

**NORTH EAST WRF  
IMPROVEMENTS PROJECT  
(PROJECT No. 19-0029-UT)**

**CONTRACT DOCUMENTS &  
SPECIFICATIONS**

**Prepared for**



**Bid Specifications  
January 2021**

**City of Clearwater, Florida  
NE WRF IMPROVEMENTS PROJECTS  
(PROJECT No. 19-0029-UT)**

**TABLE OF CONTENTS**

SECTION I	ADVERTISEMENT OF BIDS & NOTICE TO CONTRACTORS
SECTION II	INSTRUCTIONS TO BIDDERS
SECTION III	GENERAL CONDITIONS
SECTION III A	SUPPLEMENTAL GENERAL CONDITIONS
SECTION IV	TECHNICAL SPECIFICATIONS
SECTION IV A	SUPPLEMENTAL TECHNICAL SPECIFICATIONS, DIVISION 1
SECTION IV B	SUPPLEMENTAL TECHNICAL SPECIFICATIONS; GRIT REMOVAL, SALSNES FILTER AND EQUALIZATION SYSTEM IMPROVEMENTS
SECTION IV C	SUPPLEMENTAL TECHNICAL SPECIFICATIONS; SLUDGE BLEND TANK IMPROVEMENTS
APPENDIX	ODP DOCUMENTS AND OTHER PROJECT DOCUMENTATION
SECTION V	CONTRACT DOCUMENTS

Prepared in the Office of the City Engineer

# SECTION 1

## INVITATION TO BID NOTICE TO CONTRACTORS

### NE WRF Improvements RE-BID

Documents and plans for Project NE WRF Improvements RE-BID #19-0029-UT are available at <https://www.myclearwater.com/business/engineering-construction-bids>.

The work includes modifications to existing grit and primary treatment and sludge blend and storage systems, and new flow equalization system at the City's Northeast Water Reclamation Facility (WRF).

**Pre-Bid Meeting:** February 12, 2021 at 9:30AM

**Meeting Location Information:**

<https://www.myclearwater.com/business/invitation-to-bid>

**Pre-qualification Application Submittal DEADLINE:**

February 17, 2021

**Category:** Wastewater Treatment Facility

**Pre-qualification Amount:** \$19,000,000.00

**Bids DUE:** March 3, 2021 at 2:00PM (EST)

**Bid Opening:** March 3, 2021 at 2:00PM (EST)

**Meeting Location Information:**

<https://www.myclearwater.com/business/invitation-to-bid>

**FedEx or Drop off bids to:**

City of Clearwater,

Attn: Lori Vogel

Project # 19-0029-UT

Procurement Office, 3rd Floor

100 S. Myrtle Ave, Clearwater, FL 33756-5520

Issued by Lori Vogel, CPPB, Procurement Manager

For additional information contact Engineering Dept.:  
727-562-4750

# SECTION II

## INSTRUCTIONS TO BIDDERS

### Table of Contents

<b>SECTION II .....</b>	<b>i</b>
INSTRUCTIONS TO BIDDERS.....	I
1. COPIES OF BIDDING DOCUMENTS.....	1
2. QUALIFICATION OF BIDDERS .....	1
3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE .....	1
4. INTERPRETATIONS AND ADDENDA .....	2
5. BID SECURITY OR BID BOND .....	3
6. CONTRACT TIME .....	3
7. LIQUIDATED DAMAGES .....	3
8. SUBSTITUTE MATERIAL AND EQUIPMENT .....	3
9. SUBCONTRACTORS.....	3
10. BID/PROPOSAL FORM .....	4
11. SUBMISSION OF BIDS .....	4
12. MODIFICATION AND WITHDRAWAL OF BIDS .....	5
13. REJECTION OF BIDS .....	5
14. DISQUALIFICATION OF BIDDER.....	5
15. OPENING OF BIDS .....	5
16. LICENSES, PERMITS, ROYALTY FEES AND TAXES .....	5
17. IDENTICAL TIE BIDS/VENDOR DRUG FREE WORKPLACE .....	6
18. AWARD OF CONTRACT.....	7
19. BID PROTEST.....	7
20. TRENCH SAFETY ACT .....	8
21. CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MANAGEMENT MEASURES .....	9

## **1. COPIES OF BIDDING DOCUMENTS**

- 1.1. Complete sets of the Bidding Documents are accessible through the City of Clearwater website at address: [www.myclearwater.com/bid](http://www.myclearwater.com/bid). Bidding Documents may include, but are not limited to, plans, specifications, bond forms, contract form, affidavits, bid/proposal form, and addendums.
- 1.2. Complete sets of Bidding Documents must be used in preparing bids. Neither the City nor the Engineer shall be liable for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents, by Bidders, sub-bidders, or others.

## **2. QUALIFICATION OF BIDDERS**

- 2.1. Each prospective Bidder must pre-qualify to demonstrate, to the complete satisfaction of the City of Clearwater, that the Bidder has the necessary facilities, equipment, ability, financial resources and experience to perform the work in a satisfactory manner. An application package for pre-qualification may be obtained by contacting the City of Clearwater, Engineering Department, P.O. Box 4748, Clearwater, Florida 33758-4748 (mailing address); 100 South Myrtle Avenue, Clearwater, Florida 33756-5520 (street address) or by phone at (727) 562-4750. Pre-qualification requirement information is also available on the City of Clearwater Website at address:

[www.myclearwater.com/government/city-departments/engineering/construction-management](http://www.myclearwater.com/government/city-departments/engineering/construction-management).

Contractors wanting to pre-qualify to bid on a project as a General Contractor must do so two weeks (ten workdays) prior to the bid opening date. Bidders currently pre-qualified by the City do not have to make reapplication. It is the Contractor's responsibility to confirm pre-qualification status before a Bid Opening.

The Contractor shall provide copies of the current Contractor License/Registration with the State of Florida and Pinellas County in the bid response.

## **3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE**

- 3.1. It is the responsibility of each Bidder, before submitting a Bid, to (a) examine the Contract Documents thoroughly; (b) visit the site to become familiar with local conditions that may in any manner affect cost, progress, performance or furnishing of the work; (c) consider and abide by all applicable federal, state and local laws, ordinances, rules and regulations; and (d) study and carefully correlate Bidder's observations with the Contract Documents, and notify Engineer in writing of all conflicts, errors or discrepancies in the Contract Documents.
- 3.2. For the purposes of bidding or construction, bidder may rely upon the accuracy of the technical data contained in reports of explorations and tests of subsurface conditions at the site which have been utilized by the Engineer in the preparation of the Contract Documents, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof. Drawings relating to physical conditions of existing surface and subsurface conditions (except Underground Facilities) which are at or contiguous to the site and which have been utilized by the Engineer in preparation of the Contract Documents, may be relied upon by Bidder for accuracy of the technical data contained in such drawings but not upon the completeness thereof for the purposes of bidding or construction.

- 3.3. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site are based upon information and data furnished to the City and Engineer by owners of such Underground Facilities or others, and the City does not assume responsibility for the accuracy or completeness thereof unless expressly provided in the Contract Documents.
- 3.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Facilities, other physical conditions, possible conditions, and possible changes in the Contract Documents due to differing conditions appear in the General Conditions.
- 3.5. Before submitting a Bid, each Bidder shall, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing the work in accordance with the time, price and other terms and conditions of the Contract Documents.
- 3.6. On request in advance, City will provide each Bidder access to the site to conduct such explorations and tests at Bidder's own expense as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations and tests.
- 3.7. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the City unless otherwise provided in the Contract Documents.
- 3.8. The submission of a Bid will constitute an unequivocal representation by the Bidder that the Bidder has complied with every requirement of these Instructions to Bidders and that, without exception, the Bid is premised upon performing and furnishing the Work required by the Contract Documents by such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions of performance and furnishing of the work.

## **4. INTERPRETATIONS AND ADDENDA**

- 4.1. All questions as to the meaning or intent of the Contract Documents are to be directed in writing to the Engineer. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by Addenda, via the Jiffy Reprographics Plan Room to all parties recorded by the Plan Room as plan holders having received the Bidding Documents. Questions received after the time frame specified on the pre-bid meeting agenda, prior to the date for opening of Bids, may not be answered. Only information provided by formal written Addenda will be binding. Oral and other interpretations of clarifications will be without legal effect.
- 4.2. Addenda may also be issued to modify the Bidding Documents as deemed advisable by the City or Engineer.

## **5. BID SECURITY OR BID BOND**

- 5.1. Each Bid must be accompanied by Bid Security made payable to the City of Clearwater in an amount equal to ten percent (10%) of the Bidder's maximum Bid price and in the form of a certified or cashier's check or a Proposal/Bid Bond (on form provided in Section V) issued by a surety meeting the requirements of the General Conditions.
- 5.2. The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Payment and Performance bonds, whereupon the Bid Security will be returned. If the Successful Bidder fails to execute, deliver the Agreement and furnish the required Bonds within ten (10) days after the award of contract by the City Council, the City may annul the bid and the Bid Security of the Bidder will be forfeited. The Bid Security of any Bidder whom the City believes to have a reasonable chance of receiving the award may be retained by the City until the successful execution of the agreement with the successful Bidder or for a period up to ninety (90) days following bid opening. Security of other Bidders will be returned approximately fourteen (14) days after the Bid Opening.
- 5.3. The Bid Bond shall be issued in the favor of the City of Clearwater by a surety company qualified to do business in, and having a registered agent in, the State of Florida.

## **6. CONTRACT TIME**

- 6.1. The number of consecutive calendar days within which the work is to be completed is set forth in the Technical Specifications.

## **7. LIQUIDATED DAMAGES**

- 7.1. Provisions for liquidated damages are set forth in the Contract Agreement, Section V.

## **8. SUBSTITUTE MATERIAL AND EQUIPMENT**

- 8.1. The contract, if awarded, will be on the basis of material and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item may be furnished or used, application for its acceptance will not be considered by the Engineer until after the effective date of the Contract Agreement. The procedure for submittal of any such application is described in the General Conditions and as supplemented in the Technical Specifications.

## **9. SUBCONTRACTORS**

- 9.1. If requested by the City or Engineer, the Successful Bidder, and any other Bidder so requested, shall, within seven (7) days after the date of the request, submit to the Engineer an experience statement with pertinent information as to similar projects and other evidence of qualification for each Subcontractor, supplier, person and organization to be used by the Contractor in the completion of the Work. The amount of subcontract work shall not exceed fifty percent (50%) of the Work except as may be specifically approved by the Engineer. If the Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, supplier, other person or organization, he may, before recommending award of the Contract to the City Council, request the Successful Bidder to submit an acceptable substitute without an increase in Contract Price or Contract Time. If the Successful Bidder declines to make any such substitution, the City may award the contract to the next lowest and most responsive Bidder

that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security to the City of any Bidder. Any Subcontractor, supplier, other person or organization listed by the Contractor and to whom the Engineer does not make written objection prior to the recommendation of award to the City Council will be deemed acceptable to the City subject to revocation of such acceptance after the Effective Date of the Contract Agreement as provided in the General Conditions.

- 9.2. No Contractor shall be required to employ any Subcontractor, supplier, person, or organization against whom he has reasonable objection.

## **10. BID/PROPOSAL FORM**

- 10.1. The Bid/Proposal Form is included with the Contract Documents and shall be printed in ink or typewritten. All blanks on the Bid/Proposal Forms must be completed. Unit Prices shall be to no more than two decimal points in dollars and cents. The Bidder must state in the Bid/Proposal Form in words and numerals without delineation's, alterations or erasures, the price for which they will perform the work as required by the Contract Documents. Bidders are required to bid on all items in the Bid/Proposal form. The lump sum for each section or item shall be for furnishing all equipment, materials, and labor for completing the section or item as per the plans and contract specifications. Should it be found that quantities or amounts shown on the plans or in the proposal, for any part of the work, are exceeded or should they be found to be less after the actual construction of the work, the amount bid for each section or item will be increased or decreased in direct proportion to the unit prices bid for the listed individual items.
- 10.2. Bids by corporations shall be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal shall be affixed. The corporate address and state of incorporation shall be shown below the Signature. If requested, the person signing a Bid for a corporation or partnership shall produce evidence satisfactory to the City of the person's authority to bind the corporation or partnership.
- 10.3. Bids by partnerships shall be executed in the partnership name and signed by a general partner, whose title shall appear under the signature and the official address of the partnership shall be shown below the signature.
- 10.4. All names shall be typed or printed below the signature.

## **11. SUBMISSION OF BIDS**

- 11.1. Sealed Bids shall be submitted at or before the time and at the place indicated in the Advertisement for Bids and shall be submitted in a sealed envelope with the project name and number on the bottom left hand corner. If forwarded by mail, the Bid shall be enclosed in another envelope with the notation "Bid Enclosed" on the face thereof and addressed to the City of Clearwater, attention Purchasing Manager. Bids will be received at the office indicated in the Advertisement until the time and date specified. Bids in any other form will not be accepted.
- 11.2. The sealed bid envelope shall contain, but not be limited to, the Proposal/Bid Bond and corresponding Power of Attorney, Affidavit, Non Collusion Affidavit, Proposal (pages one

and two), Addendum Sheet, Bidder's Proposal, and Scrutinized Companies and Business Operations with Cuba and Syria Certification Form.

## **12. MODIFICATION AND WITHDRAWAL OF BIDS**

- 12.1. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered as described in the Advertisement of Bids. A request for withdrawal or a modification shall be in writing and signed by a person duly authorized to do so. Withdrawal of a Bid will not prejudice the rights of a Bidder to submit a new Bid prior to the Bid Date and Time. After expiration of the period for receiving Bids, no Bid may be withdrawn or modified.
- 12.2. After a bid is received by the City, the bidder may request to modify the bid for typographical or scrivener's errors only. The bidder must state in writing to the City that a typographical or scrivener's error has been made by the bidder, the nature of the error, the requested correction of the error, and what the adjusted bid amount will be if the correction is accepted by the City. The City reserves the right at its sole discretion to accept, reject, or modify any bid.

## **13. REJECTION OF BIDS**

- 13.1. To the extent permitted by applicable State and Federal laws and regulations, the City reserves the right to reject any, and all Bids, and to waive any, and all informalities. Grounds for the rejection of a bid include but are not limited to a material omission, unauthorized alteration of form, unauthorized alternate bids, incomplete or unbalanced unit prices, or irregularities of any kind. Also, the City reserves the right to reject any Bid if the City believes that it would not be in the best interest of the public to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the City. The City reserves the right to decide which bid is deemed to be the lowest and best in the interest of the public.

## **14. DISQUALIFICATION OF BIDDER**

- 14.1. Any or all bids will be rejected if there is any reason for believing that collusion exists among the bidders, the participants in such collusion will not be considered in future proposals for the same work. Each bidder shall execute the Non-Collusion Affidavit contained in the Contract Documents.

## **15. OPENING OF BIDS**

- 15.1. Bids will be opened and read publicly at the location and time stated in the Advertisement for Bids. Bidders are invited to be present at the opening of bids.

## **16. LICENSES, PERMITS, ROYALTY FEES AND TAXES**

- 16.1. The Contractor shall secure all licenses and permits (and shall pay all permit fees) except as specifically stated otherwise in the Technical Specifications. The Contractor shall comply with all Federal and State Laws, County and Municipal Ordinances and regulations, which in any manner effect the prosecution of the work. City of Clearwater building permit fees and impact fees will be waived except as specifically stated otherwise in the Technical Specifications.

- 16.2. The Contractor shall assume all liability for the payment of royalty fees due to the use of any construction or operation process, which is protected by patent rights except as specifically stated otherwise in the Technical Specifications. The amount of royalty fee, if any, shall be stated by the Contractor.
- 16.3. The Contractor shall pay all applicable sales, consumer, use, and other taxes required by law. The Contractor is responsible for reviewing the pertinent State Statutes involving the sales tax and sales tax exemptions and complying with all requirements.
- 16.4. The City of Clearwater is exempt from state sales tax on materials purchased by the City and incorporated into the WORK. The City of Clearwater reserves the right to implement the Owner Direct Purchase (ODP) Option, as may be indicated in the Scope of Work Description in Section IV – Technical Specifications and as defined in Section III – General Conditions.

## **17. IDENTICAL TIE BIDS/VENDOR DRUG FREE WORKPLACE**

- 17.1. In accordance with the requirements of Section 287.087 Florida Statutes regarding a Vendor Drug Free Workplace, in the event of identical tie bids, preference shall be given to bidders with drug-free workplace programs. Whenever two or more bids which are equal with respect to price, quality, and service are received by the City for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none or all of the tied bidders have a drug-free workplace program. In order to have a drug-free workplace program, a contractor shall supply the City with a certificate containing the following six statements and the accompanying certification statement:
  - (1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.
  - (2) Inform employees as to the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.
  - (3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).
  - (4) In the statement specified in subsection (1), notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of chapter 893, or of any controlled substance law, of the United States, or of any state, for a violation occurring in the workplace no later than five (5) days after such conviction.
  - (5) Impose a sanction on or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.
  - (6) Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

I certify that this firm does/does not (select only one) fully comply with the above requirements.

## **18. AWARD OF CONTRACT**

- 18.1. Discrepancies between words and figures will be resolved in favor of words. Discrepancies in the multiplication of units of work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- 18.2. In evaluating the Bids, the City will consider the qualifications of the Bidders, whether the Bids comply or not with the prescribed requirements, unit prices, and other data as may be requested in the Bid/Proposal form. The City may consider the qualifications and experience of Subcontractors, suppliers and other persons and organizations proposed by the Contractor for the Work. The City may conduct such investigations as the City deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons, and organizations to perform and furnish the Work in accordance with the Contract Documents to the City's satisfaction within the prescribed time.
- 18.3. If the Contract is to be awarded, it will be awarded to the lowest responsible, responsive Bidder whose evaluation by the City indicates to the City that the award will be in the best interest of the City.
- 18.4. Award of contract will be made for that combination of base bid and alternate bid items in the best interest of the City, however, unless otherwise specified all work awarded will be awarded to only one Contractor.
- 18.5. The successful bidder/contractor will be required to comply with Section 119.0701, Florida Statutes (2014), specifically to:
  - (a) Keep and maintain public records that ordinarily and necessarily would be required by the City of Clearwater in order to perform the service;
  - (b) Provide the public with access to public records on the same terms and conditions that the City of Clearwater would provide the records and at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law;
  - (c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and
  - (d) Meet all requirements for retaining public records and transfer, at no cost, to the City of Clearwater all public records in possession of the contractor upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the public agency in a format that is compatible with the information technology systems of the City of Clearwater.

## **19. BID PROTEST**

### **19.1. RIGHT TO PROTEST:**

Any actual bidder who is aggrieved in connection with the solicitation or award of a contract may seek resolution of his/her complaints initially with the Purchasing Manager, and if not satisfied, with the City Manager, in accordance with protest procedures set forth in this section.

### **19.2. PROTEST PROCEDURE:**

- A. A protest with respect to the specifications of an invitation for bid or request for proposal shall be submitted in writing a minimum of five (5) work days prior to the opening of the bid or due date of the request for proposals, unless the aggrieved person could not have been reasonably expected to have knowledge of the facts giving rise to such protest prior to the bid opening or the closing date for proposals. Opening dates for bids or due dates for requests for proposal will be printed on the bid/request document itself.
- B. Protests in respect to award of contract shall be submitted in writing a maximum of five (5) workdays after notice of intent to award is posted, or is mailed to each bidder, whichever is earlier. Notice of intent to award will be forwarded to bidders upon telephonic or written request. Protests of recommended award should cite specific portions of the City of Clearwater Code of Ordinances that have allegedly been violated.
- C. Exceptions to the five (5) day requirements noted in both A and B above may be granted if the aggrieved person could have not been reasonably expected to have knowledge of the facts giving rise to such protest prior to the bid opening, posting of intent to award, or due date for requests for proposals. Request for exceptions should be made in writing, stating reasons for the exception.
- D. The Purchasing Manager shall respond to the formal written protest within five (5) workdays of receipt. The Purchasing Manager's response will be fully coordinated with the appropriate Department Director and the Assistant City Manager.
- E. If the protestor is not satisfied with the response from the Purchasing Manager, he/she may then submit in writing within five (5) work days of receipt of that response his/her reason for dissatisfaction, along with copies of his/her original formal protest letter and the response from the Purchasing Manager, to the City Manager.
- F. The City Manager as Purchasing Agent for the City has the final authority in the matter of protests. The City Manager will respond to the protestor within ten (10) workdays of receipt of the appeal.

19.3. PROTEST FEE:

When filing a formal protest, the protesting vendor must include a fee in the amount of 5% of the selected vendor's total bid to offset the City's additional expenses related to the protest. This fee shall not exceed \$2,500 nor be less than \$50. If either the Purchasing Manager or the City Manager upholds the protest, the City will refund 100% of the fee paid.

19.4. STAY OF PROCUREMENT DURING PROTEST:

In the event of a timely protest, the Purchasing Manager shall not proceed with the solicitation or award of contract until all administrative remedies have been exhausted or until the City Manager makes written determination that the award of contract without delay is necessary to protect the best interest of the City.

## 20. TRENCH SAFETY ACT

- 20.1. The Bidder shall comply with the provisions of the City of Clearwater's Ordinance related to trench digging (Ordinance No. 7918-08) along with the Florida Trench Safety Act (Sections 553.60-553.64, Florida Statutes) and the provisions of the Occupational Safety and Health Administration's (OSHA) excavation safety standards, 29 C.F.R.s 1926.650 Subparagraph P, or current revisions of these laws.

## **21. CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MANAGEMENT MEASURES**

- 21.1. The Bidder shall comply with the provisions of the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) stormwater permit and implement stormwater pollution prevention plans (SWPPP's) or stormwater management programs (both using best management practices (BMPs) that effectively reduce or prevent the discharge of pollutants into receiving waters.
- A. The control of construction-related sediment loadings is critical to maintaining water quality. The implementation of proper erosion and sediment control practices during the construction stage can significantly reduce sediment loadings to surface waters.
  - B. Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

NPDES Management Measures available at City of Clearwater Engineering Environmental Division and EPA websites to help address construction-related Best Management Practices.

# SECTION III

## GENERAL CONDITIONS

### **Table of Contents:**

<b>1.</b>	<b>DEFINITIONS .....</b>	<b>1</b>
<b>2.</b>	<b>PRELIMINARY MATTERS.....</b>	<b>5</b>
2.1.	DELIVERY OF BONDS AND CERTIFICATES OF INSURANCE .....	5
2.2.	COPIES OF DOCUMENTS.....	5
2.3.	COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED; STARTING THE PROJECT .....	5
2.4.	BEFORE STARTING CONSTRUCTION .....	6
2.5.	PRECONSTRUCTION CONFERENCE .....	6
2.6.	PROGRESS MEETINGS .....	6
<b>3.</b>	<b>CONTRACT DOCUMENTS, INTENT .....</b>	<b>6</b>
3.1.	INTENT .....	6
3.2.	REPORTING AND RESOLVING DISCREPANCIES .....	7
<b>4.</b>	<b>AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS .....</b>	<b>7</b>
4.1.	AVAILABILITY OF LANDS.....	7
4.2.	INVESTIGATIONS AND REPORTS .....	8
4.3.	PHYSICAL CONDITIONS, UNDERGROUND FACILITIES .....	8
4.4.	REFERENCE POINTS.....	8
<b>5.</b>	<b>BONDS AND INSURANCE .....</b>	<b>9</b>
5.1.	PERFORMANCE AND PAYMENT BOND/CONTRACT BOND.....	9
5.2.	INSURANCE REQUIREMENTS .....	9
5.2.1.	COMMERCIAL GENERAL LIABILITY INSURANCE .....	9
5.2.2.	COMMERCIAL AUTOMOBILE LIABILITY INSURANCE .....	10
5.2.3.	WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE..	10
5.2.4.	PROFESSIONAL LIABILITY/MALPRACTICE/ERRORS OR OMISSIONS INSURANCE.....	10
5.2.5.	CONTRACTOR'S EQUIPMENT/INLAND MARINE/PROPERTY INSURANCE ..	10
5.2.6.	BUILDER'S RISK INSURANCE.....	10
5.3.	OTHER INSURANCE PROVISIONS.....	10
5.4.	WAIVER OF RIGHTS .....	11
<b>6.</b>	<b>CONTRACTORS RESPONSIBILITIES.....</b>	<b>12</b>
6.1.	SUPERVISION AND SUPERINTENDENCE .....	12
6.2.	LABOR, MATERIALS AND EQUIPMENT .....	12
6.3.	SUBSTITUTES AND "OR EQUAL" ITEMS .....	13
6.4.	SUBCONTRACTORS, SUPPLIERS AND OTHERS.....	14

6.5. USE OF PREMISES.....	14
6.5.1. STAGING AREAS.....	15
6.5.2. RESTORATION TIME LIMITS.....	15
6.6. LICENSE AND PATENT FEES, ROYALTIES AND TAXES .....	15
6.7. LAWS AND REGULATIONS.....	16
6.7.1. E-VERIFY .....	16
6.8. PERMITS.....	17
6.9. SAFETY AND PROTECTION.....	17
6.10. EMERGENCIES.....	18
6.11. DRAWINGS .....	18
6.11.1. SHOP DRAWINGS, SAMPLES, RFIs, AND SUBMITTAL REVIEW.....	18
6.11.2. AS-BUILT DRAWINGS.....	19
6.11.3. CAD STANDARDS .....	21
6.11.4. DELIVERABLES.....	23
6.12. CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE.....	23
6.13. CONTINUING THE WORK .....	24
6.14. INDEMNIFICATION.....	24
6.15. CHANGES IN COMPANY CONTACT INFORMATION .....	24
6.16. PUBLIC RECORDS.....	24
<b>7. OTHER WORK .....</b>	<b>26</b>
7.1. RELATED WORK AT SITE .....	26
7.2. COORDINATION.....	26
<b>8. OWNERS RESPONSIBILITY .....</b>	<b>26</b>
<b>9. OWNER REPRESENTATIVE'S STATUS DURING CONSTRUCTION .....</b>	<b>27</b>
9.1. OWNERS REPRESENTATIVE .....	27
9.2. CLARIFICATIONS AND INTERPRETATIONS .....	27
9.3. REJECTING OF DEFECTIVE WORK .....	27
9.4. SHOP DRAWINGS, CHANGE ORDERS, AND PAYMENTS .....	27
9.5. DECISIONS ON DISPUTES .....	27
9.6. LIMITATIONS ON OWNER REPRESENTATIVE'S RESPONSIBILITIES .....	28
<b>10. CHANGES IN THE WORK.....</b>	<b>29</b>
<b>11. CHANGES IN THE CONTRACT PRICE.....</b>	<b>30</b>
11.1. CHANGES IN THE CONTRACT PRICE.....	30
11.2. ALLOWANCES AND FINAL CONTRACT PRICE ADJUSTMENT .....	31
11.3. UNIT PRICE WORK .....	31
<b>12. CHANGES IN THE CONTRACT TIME .....</b>	<b>32</b>
<b>13. TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK.....</b>	<b>33</b>

SECTION III – General Conditions

13.1.	TESTS AND INSPECTION.....	33
13.2.	UNCOVERING THE WORK.....	33
13.3.	OWNER'S REPRESENTATIVE MAY STOP THE WORK.....	34
13.4.	CORRECTION OR REMOVAL OF DEFECTIVE WORK .....	34
13.5.	WARRANTY/CORRECTION PERIOD .....	34
13.6.	ACCEPTANCE OF DEFECTIVE WORK .....	35
13.7.	OWNER MAY CORRECT DEFECTIVE WORK .....	35
<b>14.</b>	<b>PAYMENTS TO CONTRACTOR AND COMPLETION.....</b>	<b>35</b>
14.1.	APPLICATION FOR PROGRESS PAYMENT .....	36
14.2.	CONTRACTOR'S WARRANTY OF TITLE .....	36
14.3.	REVIEW OF APPLICATIONS FOR PROGRESS PAYMENTS .....	37
14.4.	PARTIAL UTILIZATION .....	37
14.5.	FINAL INSPECTION .....	38
14.6.	FINAL APPLICATION FOR PAYMENT .....	38
14.7.	FINAL PAYMENT AND ACCEPTANCE.....	38
14.8.	WAIVER OF CLAIMS .....	39
<b>15.</b>	<b>SUSPENSION OF WORK AND TERMINATION .....</b>	<b>39</b>
15.1.	OWNER MAY SUSPEND THE WORK.....	39
15.2.	OWNER MAY TERMINATE .....	39
15.3.	CONTRACTOR MAY STOP WORK OR TERMINATE .....	41
<b>16.</b>	<b>DISPUTE RESOLUTION.....</b>	<b>41</b>
<b>17.</b>	<b>MISCELLANEOUS.....</b>	<b>41</b>
17.1.	SUBMITTAL AND DOCUMENT FORMS .....	41
17.2.	GIVING NOTICE.....	41
17.3.	NOTICE OF CLAIM.....	42
17.4.	PROFESSIONAL FEES AND COURT COSTS INCLUDED.....	42
17.5.	ASSIGNMENT OF CONTRACT .....	42
17.6.	RENEWAL OPTION .....	42
17.7.	ROLL-OFF CONTAINERS AND/OR DUMPSTERS .....	42
<b>18.</b>	<b>ORDER AND LOCATION OF THE WORK.....</b>	<b>42</b>
<b>19.</b>	<b>MATERIAL USED .....</b>	<b>42</b>
<b>20.</b>	<b>CONFLICT BETWEEN PLANS AND SPECIFICATIONS .....</b>	<b>43</b>
<b>21.</b>	<b>OWNER DIRECT PURCHASE (ODP) .....</b>	<b>43</b>
21.1.	SALES TAX SAVINGS.....	43
21.2.	TITLE AND OWNER RISK .....	43
21.3.	CONTRACTOR'S RECEIPT OF MATERIALS.....	43
21.4.	ODP RECORDS, WARRANTIES AND INDEMNIFICATION .....	44

SECTION III – General Conditions

<b>22. RESIDENT NOTIFICATION OF START OF CONSTRUCTION.....</b>	<b>45</b>
22.1. GENERAL.....	45
22.2. EXAMPLE.....	46
<b>23. PROJECT INFORMATION SIGNS .....</b>	<b>46</b>
23.1. SCOPE AND PURPOSE.....	46
23.2. PROJECT SIGN, FIXED OR PORTABLE .....	47
23.3. FIXED SIGN .....	47
23.4. PORTABLE SIGNS .....	47
23.5. SIGN COLORING.....	47
23.6. SIGN PLACEMENT .....	47
23.7. SIGN MAINTENANCE.....	47
23.8. TYPICAL PROJECT SIGN .....	48
<b>24. AWARD OF CONTRACT, WORK SCHEDULE AND GUARANTEE.</b>	<b>48</b>
<b>25. SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM AND ISRAEL CERTIFICATION FORM.....</b>	<b>49</b>

# 1. DEFINITIONS

## *Addenda*

Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the contract documents.

## *Agent*

Architect, engineer or other outside agency, consultant or person acting on behalf of the City.

## *Agreement*

The written contract between Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

## *Application for Payment*

The form accepted by Engineer which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

## *Approve*

The word approve is defined to mean satisfactory review of the material, equipment or methods for general compliance with the design concepts and with the information given in the Contract Documents. It does not imply a responsibility on the part of the Engineer to verify in every detail conformance with the Drawings and Specifications.

## *Bid*

The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

## *Bidding Documents*

The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

## *Bonds*

Performance and payment bonds and other instruments of security.

## *Change Order*

A written order to Contractor signed by Owner and Contractor authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued on or after the effective date of the Agreement.

## *City*

The City of Clearwater, Pinellas County, Florida.

## *Construction Inspector*

A person who is the authorized representative of the Construction Manager and inspects City construction projects in order to insure the Contractor's work complies with the intent of the Contract Documents.

## *Construction Manager*

The person who is typically in responsible charge of City construction projects. The Construction Manager assumes responsibility for the management of construction contracts at the Preconstruction Conference. The Construction Manager chairs the

### SECTION III – General Conditions

Preconstruction Conference and is the authority on any disputes or decisions regarding contract administration and performance. The Construction Manager typically acts as the Owner's Representative during construction.

#### *Contract Documents*

The Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the bid and any post-Bid documentation submitted prior to the execution of the Agreement) when attached as an exhibit to the Agreement, the Bonds, Instructions to Bidders, these General Conditions, any Supplementary Conditions, the Specifications and the Drawings, any other exhibits identified in the Agreement, together with all Modifications issued after the execution of the Agreement.

#### *Contract Price*

The Contract price constitutes the total compensation (subject to authorized adjustments) payable by Owner to Contractor for performing the Work.

#### *Contract Time*

The number of days or the date stated in the Agreement for the completion of the Work.

#### *Contractor*

The Person with whom the Owner has entered into the Agreement. For the purposes of this contract, the person, firm or corporation with whom this contract or agreement has been made by the City of Clearwater or its duly authorized representative.

#### *Critical Path Method Construction Schedule—CPM*

A graphic format construction schedule that displays construction activities as they relate to one another for the purpose of identifying the most efficient way to perform the work in a timely manner. The critical path identifies which activity is critical to the execution of the schedule.

#### *Day*

A calendar day of twenty-four (24) hours measured from midnight to the next midnight.

#### *Defective*

An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Engineers recommendation of final payment.

#### *Drawings*

The drawings, which will be identified in Technical Specifications or the Agreement, which show the character and scope of the Work to be performed and which have been prepared or approved by Engineer and are referred to in the contract documents. Shop drawings are not Drawings as so defined.

#### *Engineer*

The duly appointed representative of the City Manager of the City of Clearwater. For the purposes of this contract, the City Engineer of the City of Clearwater, Pinellas County, Florida, or his authorized representative. For certain projects, the Engineer may serve as the Owner's Representative during construction.

*Engineer's Consultant*

A Person having a contract with Engineer to furnish services as Engineer's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

*F.D.O.T Specifications*

The Standard Specifications for Road and Bridge Construction as issued by the Florida Department of Transportation (latest English edition).

*Furnish*

The words "furnish", "furnish and install", "install", and "provide" or words of similar meaning shall be interpreted, unless otherwise specifically stated, to mean "furnish and install complete in place and ready for service".

*Inspection*

The term "inspection" and the act of inspecting means examination of construction to ensure that it conforms to the design concept expressed in the Drawings and Specifications. These terms shall not be construed to mean supervision, superintending or overseeing.

*Laws and Regulations*

Any and all applicable laws, rules, regulations, ordinances, codes and orders of any kind of governmental bodies, agencies, authorities and courts having jurisdiction.

*Liens*

Liens, charges, security interests or encumbrances upon real property or personal property.

*Milestone*

A principal event specified in the contract Documents relating to an intermediate completion date or time prior to the final completion date.

*Notice to Proceed (NTP)*

A written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform his obligations under the Contract Documents.

*Owner*

The City of Clearwater, Florida. For the purposes of this contract, the person who is the City's authorized representative from the City's Department with whom will be responsible for the maintenance and operation of the Work once the Work is completed. For certain projects, a designee of the Owner may serve as the Owner's Representative during construction.

*Owner's Representative*

Designee of the Owner with authority to act on behalf of the Owner during construction.

*Person*

A natural person, or a corporation, partnership, firm, organization, or other artificial entity.

*Project*

The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

*Partial Utilization*

Use by Owner of a substantially completed part of the Work for the purpose for which is intended (or a related purpose) prior to Final Completion of all the Work.

*Representative of Contractor*

The Contractor shall assign a responsible person or persons, one of whom shall be at the construction site at all times that work is progressing. The names and positions of these persons shall be submitted to the City Engineer at the time of the pre-construction conference. This person or persons shall not be changed without written approval of City Engineer.

*Request for Information (RFI)*

An official written request for clarification of the intent of the contract documents from the Contractor to the Engineer.

*Shop Drawing*

All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier and submitted by Contractor to illustrate material or equipment for some portion of the Work.

*Specifications*

Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

*Subcontractor*

A person having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

*Substantial Completion*

The Work (or a specified part thereof) which has progressed to the point where, in the opinion of Engineer, as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by the Engineer's recommendation of final payment. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

*Supplementary Conditions*

The part of the Contract which amends or supplements these General Conditions.

*Supplier*

A manufacturer, fabricator, supplier, distributor, material man or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by the Contractor.

*Surety*

Any person, firm or corporation which is bound with Contractor and which engages to be responsible for Contractor and his acceptable performance of the Work by a Bid, Performance or Payment Bond.

*Underground Facilities*

All pipelines, conduits, ducts, cables, wires manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been

### SECTION III – General Conditions

installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal or treatment, traffic or other control systems or water.

#### *Unit Price Work*

Work to be paid for on the basis of unit prices.

#### *Work*

The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

#### *Work Change Directive*

A written directive to Contractor, issued on or after the Effective Date of the Agreement and signed by the Engineer, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or emergencies. Work Change Directive will not change the Contract Price or Contract Time but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

## **2. PRELIMINARY MATTERS**

### **2.1. DELIVERY OF BONDS AND CERTIFICATES OF INSURANCE**

When Contractor delivers the executed Agreements to the Owner, Contractor shall also deliver to the Owner such Bonds and Certificates of Insurance as Contractor may be required to furnish by this contract.

### **2.2. COPIES OF DOCUMENTS**

Engineer shall furnish to Contractor one (1) copy of Contract Documents for execution. Additional copies will be furnished, upon request, at the cost of reproduction.

### **2.3. COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED; STARTING THE PROJECT**

The Contract Time will commence on the day indicated in the Notice to Proceed. Contractor shall start to perform the work on the date the Contract Time commences to run. No work shall be done at the site prior to the date that the Contract Time commences to run. Pursuant to Section 255.05(1)(b), Florida Statutes, the Notice to Proceed cannot be issued until Contractor provides City with a certified copy of the recorded bond issued by the Pinellas County Clerk of Court.

## **2.4. BEFORE STARTING CONSTRUCTION**

Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error or discrepancy which Contractor may discover; and shall obtain a written interpretation or clarification from Engineer before proceeding with any work effected thereby; however, Contractor shall not be liable to the Owner for failure to report any conflict, error or discrepancy in the Drawings or Specifications, unless Contractor had actual knowledge thereof or should reasonably have known thereof.

No verbal agreement or conversation with any officer, Agent or employee of the Owner or Engineer's Consultant, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained. Contractor shall not commence any work at any time without approved insurance required by these General Conditions. Failure to obtain this insurance will be the sole responsibility of the Contractor.

## **2.5. PRECONSTRUCTION CONFERENCE**

After Contract has been fully executed and before the start of the Work, the Owner's Representative shall schedule a preconstruction conference to be attended by Contractor, Engineer, Owner and others as appropriate to establish a working understanding among the parties as to the Work and to discuss the schedule of the Work and general Contract procedures.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a color Critical Path Method (CPM) Construction Schedule. This is to be a sequence of events including submittal review and procurement. Notice to Proceed is usually established at the preconstruction conference and such date can be inserted into the schedule at that time. The Contractor shall also submit a Submittal Schedule for review by the Engineer. This is to make sure that the list is complete, and this schedule shall be the basis of a Submittal Log.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a completed Emergency Call List, a completed Authorized Signature List, and Verification of Illegal Discharge Construction Site Training.

## **2.6. PROGRESS MEETINGS**

The Contractor is required to attend Progress Meetings. These meetings will be scheduled on a weekly, bi-weekly, or monthly basis depending on the needs of the project. The Contractor shall bring to each meeting an updated submittal log, an updated request for information (RFI) log, a look-ahead schedule to cover the project activity from the current meeting to the next meeting, and all material test reports generated in the same time period.

# **3. CONTRACT DOCUMENTS, INTENT**

## **3.1. INTENT**

The Contract Documents comprise the entire Agreement between Owner and the Contractor concerning the Work. They may be altered only by written agreement. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be

constructed in accordance with the Contract Documents. Any Work, materials or equipment which may reasonably be inferred from the Contract Documents or from prevailing custom or from trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases, which have a well-known technical or construction industry or trade meaning, are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations of the Contract Documents shall be issued by the Owner's Representative. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the code, Laws or Regulation of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual or code, or Laws or Regulations in effect at the time of opening of Bids except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard specification, manual or code, whether or not specially incorporated by reference in the responsibilities of Owner or Contractor as set forth in the Contract Documents, shall change the duties and responsibilities of Owner, Contractor, Engineer or Owner's Representative, or any of their Agents or employees from those set forth in the Contract Documents. Clarifications and interpretations of the Contract shall be issued by the Owner's Representative. Each and every provision of law and clause required by law to be inserted in these Contract documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.

### **3.2. REPORTING AND RESOLVING DISCREPANCIES**

If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier, Contractor shall report it to the Owner's Representative in writing at once, and Contractor shall not proceed with the Work affected thereby (except in an emergency) until an amendment or supplement to Contract Documents has been issued by one of the methods provided in these General Specifications, provided however, that Contractor shall not be liable to Owner, or Owner's Representative for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

## **4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS**

### **4.1. AVAILABILITY OF LANDS**

The Owner shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be Performed, rights-of-way, easements, rights of entry for access thereto, and such other lands which are designated for the use of contractor. The Owner shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which contractor will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Owner, unless otherwise provided in the Contract Documents.

## **4.2. INVESTIGATIONS AND REPORTS**

Reference is made to the Supplementary Conditions and Technical Specifications for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by Engineer in preparation of the Drawings and Specifications. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents. Contractor shall promptly notify the Owner's Representative in writing of any subsurface or latent physical conditions at the site, or in an existing structure, differing materially from those indicated or referred to in the Contract Documents. Engineer will promptly review those conditions and advise if further investigation or tests are necessary. Owner or Engineer shall obtain the necessary additional investigations and tests and furnish copies to the Engineer and Contractor. If Engineer finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions, which differ materially from those, indicated in the contract Documents, and which could not reasonably have been anticipated by Contractor, a work change, or Change Order will be issued incorporating the necessary revisions.

## **4.3. PHYSICAL CONDITIONS, UNDERGROUND FACILITIES**

The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities or by others. Unless otherwise expressly provided in the Contract Documents, Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and the cost of all the following will be included in the Contract Price and contractor shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work. The Contractor is required to call the Sunshine State One Call of Florida prior to any excavation per State regulations and to notify any utility owners who are not a member of the Sunshine State One Call of Florida prior to any excavation. The Sunshine State One Call of Florida is an agency for the protection and location of utilities prior to any excavation and contact number is available in local telephone directory.

## **4.4. REFERENCE POINTS**

Engineer shall provide engineering surveys to establish reference points for construction, which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, unless otherwise noted in the Contract, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Owner and Engineer. Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points by a surveyor licensed in the State of Florida. The Contractor is referred to the Technical Specifications for more specific information regarding the provision of construction surveys. If a City survey crew is assigned to the project and there is excessive stake replacement caused by negligence of Contractor's forces after initial line and grade have been set, as determined by the Engineer, the Contractor will be charged at the rate of \$100.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments with a minimum charge of one hour.

## 5. BONDS AND INSURANCE

### 5.1. PERFORMANCE AND PAYMENT BOND/CONTRACT BOND

Contractor shall furnish a Performance and Payment Bond pursuant to Section 255.05, Florida Statutes in an amount equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. This bond shall remain in effect at least one year after the date when final payment becomes due, unless a longer period of time is prescribed by laws and regulations or by the Contract Documents. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents in Section V and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of such agents' authority to act. All bonds shall be deemed to contain all of the Conditions of Section 255.05, Florida Statutes, even if such language is not directly contained within the bond and the Surety shall be licensed and qualified to do business in the State of Florida. Owner reserves the right to reject any surety. If the Surety on any Bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of these Contract Documents, the Contractor shall within five days after notice thereof substitute another Bond and surety, both of which must be acceptable to Owner.

### 5.2. INSURANCE REQUIREMENTS

The Contractor shall, at its own cost and expense, acquire and maintain (and cause any subcontractors, representatives or agents to acquire and maintain) during the term with the City, sufficient insurance to adequately protect the respective interest of the parties. Coverage shall be obtained with a carrier having an AM Best Rating of A-VII or better. In addition, the City has the right to review the Contractor's deductible or self-insured retention and to require that it be reduced or eliminated.

Specifically, the Contractor must carry the following minimum types and amounts of insurance on an occurrence basis or in the case of coverage that cannot be obtained on an occurrence basis, then coverage can be obtained on a claims-made basis with a minimum four (4) year tail following the termination or expiration of this Agreement:

The following insurance limits may be achieved by a combination of primary and umbrella/excess liability policies.

#### 5.2.1. COMMERCIAL GENERAL LIABILITY INSURANCE

Commercial General Liability Insurance coverage, including but not limited to, premises operations, products/completed operations, products liability, contractual liability, advertising injury, personal injury, death, and property damage in the minimum amount of \$1,000,000 (one million dollars) per occurrence and \$2,000,000 (two million dollars) general aggregate.

## **5.2.2. COMMERCIAL AUTOMOBILE LIABILITY INSURANCE**

Commercial Automobile Liability Insurance coverage for any owned, non-owned, hired or borrowed automobile is required in the minimum amount of \$1,000,000 (one million dollars) combined single limit.

## **5.2.3. WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE**

Statutory Workers' Compensation Insurance coverage in accordance with the laws of the State of Florida, and Employer's Liability Insurance in the minimum amount of \$100,000 (one hundred thousand dollars) each employee each accident, \$100,000 (one hundred thousand dollars) each employee by disease and \$500,000 (five hundred thousand dollars) aggregate by disease with benefits afforded under the laws of the State of Florida. Coverage should include Voluntary Compensation, Jones Act, and U.S. Longshoremen's and Harbor Worker's Act coverage where applicable. Coverage must be applicable to employees, contractors, subcontractors, and volunteers, if any.

## **5.2.4. PROFESSIONAL LIABILITY/MALPRACTICE/ERRORS OR OMISSIONS INSURANCE**

Professional Liability/Malpractice/Errors or Omissions Insurance coverage appropriate for the type of business engaged in by the Contractor with minimum limits of \$1,000,000 (one million dollars) per occurrence. If a claims-made form of coverage is provided, the retroactive date of coverage shall be no later than the inception date of claims-made coverage, unless prior policy was extended indefinitely to cover prior acts. Coverage shall be extended beyond the policy year either by a supplemental extended reporting period (ERP) of as great a duration as available, and with no less coverage and with reinstated aggregate limits, or by requiring that any new policy provide a retroactive date no later than the inception date of claims-made coverage.

## **5.2.5. CONTRACTOR'S EQUIPMENT/INLAND MARINE/PROPERTY INSURANCE**

If Contractor is using its own property in connection with the performance of its obligations under this Agreement, then Contractor's Equipment–Inland Marine Insurance and/or Property Insurance on an "All Risks" basis with replacement cost coverage for property and equipment in the care, custody and control of others is recommended. City is not responsible for Contractor's (or any sub-contractors, representatives, or agents) equipment or property.

## **5.2.6. BUILDER'S RISK INSURANCE**

The City will provide at its expense, Builder's Risk Insurance for the project to cover all risks of loss in the complete and full value of the project. Contractor agrees to cooperate in a timely manner with providing any information or documentation required for the application and by the carrier as the project proceeds.

## **5.3. OTHER INSURANCE PROVISIONS**

Upon approval of this Agreement by City Council, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this Agreement remains in effect, the Contractor will furnish the City with a Certificate of Insurance(s) (using appropriate ACORD

certificate, SIGNED by the Issuer, and with applicable endorsements) evidencing all of the coverage set forth above and naming the City as an “Additional Insured.” In addition when requested in writing from the City, Contractor will provide the City with certified copies of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

City of Clearwater  
Engineering Department  
Attn: Construction Office Specialist  
P.O. Box 4748  
Clearwater, FL 33758-4748

1. The **Description** (of Operations/Locations/Vehicles) should specify Project Name and Project Number.
2. Contractor shall provide thirty (30) days written notice of any cancellation, non-renewal, termination, material change or reduction in coverage.
3. Contractor’s insurance as outlined above shall be primary and non-contributory coverage for Contractor’s negligence.
4. Contractor reserves the right to appoint legal counsel to provide for the Contractor’s defense, for any and all claims that may arise related to Agreement, work performed under this Agreement, or to Contractor’s design, equipment, or service. Contractor agrees that the City shall not be liable to reimburse Contractor for any legal fees or costs as a result of Contractor providing its defense as contemplated herein.

The stipulated limits of coverage above shall not be construed as a limitation of any potential liability to the City, and the City’s failure to request evidence of this insurance shall not be construed as a waiver of Contractor’s (or sub-contractors, representatives, or agents) obligation to provide the insurance coverage specified.

## **5.4. WAIVER OF RIGHTS**

The Owner and Contractor intend that all policies purchased in accordance with Article on Insurance will protect the Owner, Contractor, Subcontractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insured or additional insured thereunder, the Owner and Contractor waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the work; and, in addition, waive all such rights against Sub-contractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance otherwise payable under any policy so issued. In addition, the Owner waives all rights against Contractor, Subcontractors, Engineer, Engineer's Consultant and the officers, directors, employees and agents of any of them for: (i) loss due to business interruption, loss of use or other consequential loss extending beyond direct physical loss or damage to the Owner property or the Work caused by, arising out of or resulting from fire or other peril, whether or not insured by the Owner and; (ii) loss or damage to the completed Project or part thereof caused by, arising out of or resulting from fire or other insured

peril covered by any property insurance maintained on the completed Project or part thereof by the Owner during partial utilization, after substantial completion or after final payment.

## **6. CONTRACTORS RESPONSIBILITIES**

### **6.1. SUPERVISION AND SUPERINTENDENCE**

Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. Contractor shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

Contractor shall be responsible to see that the completed work complies accurately with the Contract Documents. Contractor shall keep on the work at all times during its progress a competent resident superintendent, who shall not be replaced without notice to the Owner's Representative except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications to the superintendent shall be as binding as if given to Contractor. The Contractor's superintendent shall keep a mobile cell phone on his person, so he can be contacted whenever necessary.

Contractor shall employ only competent persons to do the work and whenever the Owner's Representative shall notify Contractor, in writing, that any person on the work appears to be incompetent, unfaithful, disorderly, disrespectful or otherwise unsatisfactory, such person shall be removed from the project and shall not again be employed on it except with the written consent of the Owner's Representative. Contractor represents the City of Clearwater and shall conduct themselves in a professional manner to the public at all times.

Contractor shall reimburse Owner for additional engineering and inspection costs incurred as a result of overtime work in excess of the regular working hours or on the Owner normally approved holidays. At such times when Inspector overtime is required, the Contractor shall sign an overtime slip documenting such hours and the Contractor shall be provided a copy for his records. At the end of the project and prior to payment of withheld retainage funds, the Contractor shall deliver to the Owner a check made out to the Owner of Clearwater for full reimbursement of all Inspector overtime hours. Withheld retainage shall not be released until the Owner has received this check. Minimum number of chargeable hours for inspection costs on weekends or holidays shall be four hours. The cost of overtime inspection per hour shall be \$80.00 per hour.

Contractor shall provide and maintain in a neat and sanitary condition, such sanitary accommodations for the use of Contractor's employees as may be necessary to comply with the requirements of Laws and Regulations and the Engineer.

### **6.2. LABOR, MATERIALS AND EQUIPMENT**

Contractor shall provide competent, suitably qualified personnel to survey, lay out and construct the work as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all work at the site shall be performed during regular working hours.

Contractor shall adhere to the Community Development Code, Section 3-1508 regarding noise restrictions from 6:00 p.m. to 7:00 a.m. any day and all day Sunday. Contractor will not permit overtime work or the performance of work on Saturday, Sunday, or any legal holiday without Owner consent given after prior notice to Engineer.

Unless otherwise specified in the General Requirements, Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

All materials and equipment installed in the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Engineer, Contractors shall furnish satisfactory evidence (including reports of required tests) as to the quality of materials and equipment. The Contractor shall provide suitable and secure storage for all materials to be used in the Work so that their quality shall not be impaired or injured. Materials that are improperly stored, may be rejected by the Engineer without testing.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor, except as otherwise provided in the Contract Documents.

The City of Clearwater, at its sole discretion, reserves the right to purchase major equipment or materials to be incorporated into the Work under the Owner Direct Purchase (ODP) Option, per Section III, Article 21. In such event, the Contractor shall cooperate and assist the Owner of Clearwater, at no additional cost, to implement the ODP documents and procedures.

### **6.3. SUBSTITUTES AND "OR EQUAL" ITEMS**

Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by Engineer. If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer for approval. If in the Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or equal" item, it may be considered as a proposed substitute item. Contractor shall submit sufficient information as required by the Engineer to allow the Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and is an acceptable substitute therefore. Request for review of proposed substitute and "or equal" will be not be accepted by Engineer from anyone other than Contractor.

Request for substitute and "or equal" items by Contractor must be submitted in writing to Owner's Representative and will contain all information as Engineer deems necessary to make a determination. Request for substitute shall identify why a substitute is submitted and include advantages to the Owner. All data provided by Contractor in support of any proposed substitute or "or equal" item will be at Contractor's expense. Engineer will be allowed a reasonable time to evaluate each proposal or submittal made per this paragraph. Engineer will be sole judge of acceptability.

## 6.4. SUBCONTRACTORS, SUPPLIERS AND OTHERS

The Contractor shall deliver to the Owner's Representative before or at the preconstruction conference a list of all Subcontractors, suppliers and other persons and organizations proposed by the Contractor for Work to be performed on the Project. The Contractor shall include with this list the qualifications and references for each Subcontractor, supplier or other person and organization for review and approval. Any changes to this list must be submitted to the Owner's Representative for approval prior to the substitution of any Subcontractors, suppliers or other persons and organizations before performing any Work on the Project for the Contractor.

Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person any contractual relationship between Owner or Engineer and any Subcontractor, Supplier or other person, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons performing or furnishing any of the work to communicate with the Engineer through Contractor.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the work among Subcontractors or Suppliers or delineating the work to be performed by any specific trade.

All work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

Contractor shall not pay or employ any Subcontractor, Supplier or other person or organization whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the work against whom Contractor has reasonable objection.

Owner or Engineer will not undertake to settle any differences between Contractor and his Subcontractors or between Subcontractors.

## 6.5. USE OF PREMISES

Contractor shall confine construction equipment, the storage of materials and equipment and the operations of works to the site and land areas identified in and permitted by the Contract Documents on other land areas permitted by Laws and Regulations, right-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceed in or

at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Engineer's Consultant and their officials, directors, employees and agents from and against all claims, costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

During the progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work or at intervals established by the Engineer, Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

### **6.5.1. STAGING AREAS**

The Contactor shall obtain and deliver to the City written permission for the use of all staging and storage areas outside of the Limits of Construction. Use of right of way within the limits of construction must be approved by the City. All applicable erosion control, tree barricade and restoration, including time limits, specifications, etc., must be followed.

### **6.5.2. RESTORATION TIME LIMITS**

The timely restoration of all impacted areas, especially right-of-ways, is very important to the Citizens of Clearwater therefore, these time limits are imposed:

- Debris piles shall be removed within five (5) consecutive calendar days.
- Concrete driveways and sidewalks shall be replaced within ten (10) consecutive calendar days of removal. Resident access shall be maintained at all times.
- All arterial and collector roadways shall be restored ASAP.
- Local streets and asphalt driveways shall be restored as soon as a sufficient quantity is generated, however, this is never to exceed fifteen (15) consecutive calendar days. Local and resident access shall be maintained at all times.
- Any irrigation systems or components damaged or impacted by construction activities shall be repaired or replaced “in-kind” within forty-eight (48) hours to minimize the loss of turfgrass or landscape plantings, particularly during periods of drought.
- Sod must be restored “in-kind” within fourteen (14) consecutive calendar days of a successful pipe pressure test, removal of concrete forms, backfill of excavations, replacement of driveways or sidewalks or another project specific milestone. It must be watered for a period of thirty (30) days after it is placed. Erosion control and dust control of denuded areas must be maintained at all times.

If the project or a portion of it does not involve right-of ways, then a different schedule of sod restoration may be considered.

## **6.6. LICENSE AND PATENT FEES, ROYALTIES AND TAXES**

Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the

performance of the work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner or Engineer in the Contract Documents.

To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Contractor shall pay all sales, consumer, use and other taxes required to be paid by Contractor in accordance with the Laws and Regulations of the State of Florida and other governmental agencies, which are applicable during the performance of the work.

## **6.7. LAWS AND REGULATIONS**

Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Owner's Representative shall be responsible for monitoring Contractor's compliance with any Laws or Regulations. If Contractor performs any work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses and damages caused by or arising out of such work; however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations to the Owner to report and resolve discrepancies as described above.

### **6.7.1. E-VERIFY**

When City projects include Federal or State funding, the requirements of Executive Order 11-02 shall be adhered to utilizing the Homeland Security E-Verify System to verify employment eligibility.

Contractor and its Subcontractors shall register with and use the E-Verify system to verify the work authorization status of all newly hired employees. Contractor will not enter into a contract with any Subcontractor unless each party to the contract registers with and uses the E-Verify system. Subcontractor must provide Contractor with an affidavit stating that Subcontractor does not employ, contract with, or subcontract with an unauthorized alien. Contractor shall maintain a copy of such affidavit.

The City may terminate this Contract on the good faith belief that Contractor or its Subcontractors knowingly violated Florida Statutes 448.09(1) or 448.095(2)(c). If this Contract is terminated pursuant to Florida Statute 448.095(2)(c), Contractor may not be awarded a public contract for at least 1 year after the date of which this Contract was terminated. Contractor is liable for any additional costs incurred by the City as a result of the termination of this Contract.

See Section 448.095, Florida Statutes (2020).

See "VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM" in Appendix.

## 6.8. PERMITS

Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. The Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids. Contractor shall pay all charges of utility owners for connections to the work, and the Owner shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

Unless otherwise stated in the Contract Documents, Clearwater Building Permit Fees will be waived.

## 6.9. SAFETY AND PROTECTION

Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to: (i) all persons on the work site or who may be affected by the work, (ii) all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and (iii) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction. In the event of temporary suspension of the work, or during inclement weather, or whenever Owner's Representative may direct; Contractor shall, and shall cause Subcontractors, to protect carefully the Work and materials against damage or injury from the weather. If, in the opinion of the Owner's Representative, any portion of Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any Subcontractors to so protect the Work, such Work and materials shall be removed and replaced at the expense of Contractor. The Contractor shall initiate and maintain an accident prevention program which shall include but shall not be limited to the establishment and supervision of programs for the education and training of employees in the recognition, avoidance and prevention of unsafe conditions and acts. Contractor shall provide first aid services and medical care to his employees. The Contractor shall develop and maintain an effective fire protection and prevention program and good housekeeping practices at the site of contract performance throughout all phases of construction, repair, alteration or demolition. Contractor shall require appropriate personal protective equipment in all operations where there is exposure to hazardous conditions. The Engineer may order that the work stop if a condition of immediate danger to the Owner's employees, equipment or if property damage exists. This provision shall not shift responsibility or risk of loss for injuries or damage sustained from the Contractor to Owner, and the Contractor shall remain solely responsible for compliance with all safety requirements and for the safety of all persons and property at the site of Contract performance. The Contractor shall instruct his employees required to handle or use toxic materials or other harmful substances regarding their safe handling and use. The Contractor shall take the necessary precautions to protect pedestrians and motorists from harm, and to prevent disruptions of such traffic due to construction activity.

Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property and to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when execution of the work may affect them, and shall cooperate with them in the protection, removal,

relocation and replacement of their property. All damage, injury or loss to any property caused, directly or indirectly, in whole or part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, shall be remedied by Contractor. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor that the Work is acceptable.

## **6.10. EMERGENCIES**

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, with or without special instruction or authorization from Owner or the Owner's Representative, is obligated to act to prevent damage, injury or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Owner's Representative determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

## **6.11. DRAWINGS**

### **6.11.1. SHOP DRAWINGS, SAMPLES, RFIs, AND SUBMITTAL REVIEW**

Contractor shall submit Shop Drawings to Engineer for review and approval as called for in the Technical Specifications or required by the Engineer. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show Engineer the materials and equipment Contractor proposes to provide and to enable Engineer to review the information. Contractor shall also submit Samples to Engineer for review and approval. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified: (i) all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto, (ii) all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and (iii) all information relative to Contractor's sole responsibilities in respect to means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto. Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples with the requirements of the Work and the Contract Documents. Each submittal will have a transmittal cover sheet identifying the shop drawing name, number, and technical specification reference; will bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal. At the time of submission, Contractor shall give Engineer specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Engineer for review and approval of each such variation.

The Contractor shall maintain a submittal log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each submittal

within fourteen (14) consecutive calendar days. The Contractor shall maintain a request for information (RFI) log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each RFI within fourteen (14) consecutive calendar days. The untimely submission of Submittal or RFIs shall not be grounds for a delay claim from the Contractor.

Engineer's review and approval of Shop Drawings and Samples will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated the Contract Documents. Engineer's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

Engineer's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by the Engineer relieve the Contractor from responsibility for complying with the requirements of paragraph above discussing field measurements by the Contractor.

Contractor shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within two (2) submittals. Owner's Representative reserves the right to backcharge Contractor, for Engineer's costs for resubmittals that account for a number greater than twenty percent (20%) of the total number of first time submittals, per the approved initial submittal log. Owner's Representative reserves the right to backcharge Contractor for all third submittals. The number of first-time submittals shall be equal to the number of submittals agreed to by Engineer and Contractor. All costs to Engineer involved with subsequent submittal of Shop Drawings, Samples or other items requiring approval will be backcharged to Contractor at the rate of 3.0 times direct technical labor cost by deducting such costs from payments due Contractor for Work completed. In the event that Contractor requests a substitution for a previously approved item, all of Engineer's costs in the reviewing and approval of the substitution will be backcharged to Contractor, unless the need for such substitution is beyond the control of Contractor.

### **6.11.2. AS-BUILT DRAWINGS**

The Contractor shall keep and maintain one set of blueprints, As-Built Drawings, in good order and legible condition to be continuously marked-up at the job site. The Contractor shall mark and annotate neatly and clearly all project conditions, locations, configurations and any other changes or deviations which may vary from the details represented on the original Contract Plans, including revisions made necessary by Addenda, Shop Drawings, and Change Orders during the construction process. The Contractor shall record the horizontal and vertical locations, in the plan and profile, of all buried utilities that differ from the locations indicated or which were not indicated on the

### SECTION III – General Conditions

Contract Plans and buried (or concealed), construction and utility features which are revealed during the construction period.

The As-Built Drawings shall be available for inspection by the Engineer, Engineer's Consultant, and the Owner's Representative at all times during the progress of the Project.

The As-Built Drawings shall be reviewed by the Owner's Representative, or his designee, for accuracy and compliance with the requirements of "As-Built Drawings" prior to submittal of the monthly pay requests. The pay requests shall be rejected if the marked-up redline prints do not conform to the "As-Built Drawings" requirements. As-Built Drawings shall be submitted to the Owner Inspector for approval upon completion of the project and prior to acceptance of final pay request. Final pay request shall not be processed until As-Built Drawings have been reviewed by the Engineer or the Engineer's Consultant for accuracy and completeness.

Prior to placing new potable water mains in service, the Contractor shall provide the Engineer intersection drawings, as specified for the water mains.

The Owner's acceptance of the "As-Built Drawings" does not relieve the Contractor of the sole responsibility for the accuracy and completeness of the As-Built Drawings.

#### **6.11.2.1. General**

The Contractor shall prepare an "AS-BUILT SURVEY" per chapter 5J-17.052, Florida Administrative Code (see definition below), signed and sealed by a Florida registered land surveyor. The contractor will deliver to the Owner two hard copies of signed and sealed As-Built Drawings and an AutoCAD file.

**5J-17.050 Definition:** (10)(a) *As-Built Survey: a survey performed to obtain horizontal and/or vertical dimensional data so that constructed improvements may be located and delineated: also known as Record Survey.*

This survey shall be clearly titled "As-Built Survey" and shall be signed and sealed by a Florida registered land surveyor. The survey must be delivered to the Owner of Clearwater Construction Division upon substantial completion of the project. If this condition is not met, the Owner will procure the services of a Professional Surveyor and Mapper registered in the State of Florida and will back charge the contractor a fee of \$1,800 per day or any portion thereof to provide the Owner with the required As-Built Survey.

#### **6.11.2.2. Sanitary and Storm Sewer Piping Systems**

1. Manholes and inlets shall be located by survey coordinates (northing, easting and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. New and replaced service connections shall be dimensioned to the nearest downstream manhole. All manholes, cleanouts and catch basin invert and rim elevations, manhole and catch basin dimensions, pipe sizes, and pipe material shall also be noted on the plan view and also on the profile if one exists. The terminal ends of all subdrains, inverts of all pipe in structures, and the flow line of inlets shall also be noted on the plan view and also on the profile if one exists.
2. Pipe materials and areas of special construction shall be noted.

### **6.11.2.3. Pressure Pipe construction (Water, Reclaimed Water, Force main)**

All pipes shall be located by survey coordinates (northing, easting and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. Coordinates shall be at all pipe bends, tees, valves, reducers, and deflections. Also, all new and replaced service connections for potable and reclaimed water will be located as described above. Additionally, there must be survey coordinates no further than 100 feet apart on linear type construction and shall denote top of pipe elevation at those points.

### **6.11.2.4. Electrical and Control Wiring**

The as-built drawings shall include all changes to the original Contract Plans. The as-built drawings shall also include the size, color, and number of wires and conduit. For projects where this information is too voluminous to be contained on the blueline prints, the Contractor shall prepare supplemental drawings, on same size sheets as the blueline prints, showing the additional conduit runs, 1-line diagrams, ladder diagrams, and other information. The wiring schematic diagrams shall show termination location and wiring identification at each point on the ladder diagram.

### **6.11.2.5. Horizontal and Vertical Control**

The As-Built survey shall be based on the original datum used for the construction design plans or if required by the Owner the datum shall be referenced to the North American Datum of 1983/90 (horizontal) and the North American Vertical Datum of 1988. The unit of measurement shall be the United States Foot. Any deviation or use of any other datum, (horizontal and or vertical), must be approved by the Owner of Clearwater Engineering Department.

### **6.11.2.6. Standards**

The As-Built survey shall meet the Minimum Technical Standards per Chapter 5J-17 and the Clearwater CAD STANDARDS set forth below. In addition to locating all improvements that pertain to the as-built survey it is the requirement of the Owner to have minimum location points at every change in direction and no more than 100 feet apart on all pressure pipes.

### **6.11.2.7. Other**

The As-Built drawings shall reflect any differences from the original Contract Plans, in the same level of detail and units of dimensions as the Plans.

## **6.11.3. CAD STANDARDS**

### **6.11.3.1. Layer Naming**

#### **6.11.3.1.1. Prefixes and Suffixes**

DI	prefix denotes digitized or scanned entities
EP	prefix denotes existing points - field collected
EX	prefix denotes existing entities - line work and symbols
PR	prefix denotes proposed entities - line work and symbols

FU	prefix denotes future entities (proposed but not part of this contract) - line work and symbols
TX	suffix denotes text – use for all text, no matter the prefix

**6.11.3.1.2. Layer Naming Definitions:**

GAS	gas lines and appurtenances
ELEC	power lines and appurtenances
PHONE	telephone lines and appurtenances
CABLE	cable TV lines and appurtenances
BOC	curbs
WALK	sidewalk
WATER	water lines and appurtenances, sprinklers
STORM	storm lines and appurtenances
TREES	trees, bushes, planters
SANITARY	sanitary lines and appurtenances
FENCE	all fences
BLDG	buildings, sheds, finished floor elevation
DRIVE	driveways
EOP	edge of pavement without curbs
TRAFFIC	signal poles, control boxes
TOPBANK	top of bank
TOESLOPE	toe of slope
TOPBERM	top of berm
TOEBERM	toe of berm
SEAWALL	seawall
CONCSLAB	concrete slabs
WALL	walls, except seawall
SHORE	shoreline, water elevation
CL	centerline of road
CLD	centerline of ditch
CLS	centerline of swale
CORNER	property corners, monumentation
BENCH	benchmark, temporary benchmarks

Other layers may be created as required, using above format.

### **6.11.3.2. Layer Properties**

All layers will use standard AutoCAD linetypes, bylayer.

All layers will use standard AutoCAD colors, bylayer.

All text will use standard AutoCAD fonts.

### **6.11.3.3. Text Styles**

Text style for EX layers will use the simplex font, oblique angle of 0°, and a text height of .008 times the plot scale.

Text style for PR and FU layers will use the simplex font, oblique angle of 22.5°, and a text height of .010 times the plot scale.

## **6.11.4. DELIVERABLES**

The as-built survey shall be produced on bond material, 24" x 36" at a scale of 1"=20' unless approved otherwise. The consultant shall deliver two hard copies and one digital copy of all drawings. Requested file formats are: Autodesk DWG and Adobe PDF files.

Please address any questions regarding format to Mr. Tom Mahony, at (727) 562-4762 or e-mail address [Thomas.Mahony@myClearwater.com](mailto:Thomas.Mahony@myClearwater.com).

## **6.12. CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE**

Contractor warrants and guarantees to Owner, Engineer and Engineer's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. Contractor's warranty and guarantee hereunder includes defects or damage caused by abuse, vandalism, modification or operation by persons other than Contractor, Subcontractors or Suppliers. Until the acceptance of the Work by the Owner, the Work shall be under the charge and care of the Contractor, and he shall take every necessary precaution against injury or damage to any part thereof by action of the elements, or from any other cause whatsoever, arising from the execution or non-execution of the Work. The Contractor shall rebuild, repair and make good, at his own expense, all injuries or damages to any portion of the Work occasioned by any cause before its completion and final acceptance by the Owner. In addition, "the Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one year from the date of final acceptance".

Contractor's warranty and guarantee hereunder excludes improper maintenance and operation by Owner's employees and normal wear and tear under normal usage for any portion of the Work, which has been partially accepted by the Owner for operation prior to final acceptance by the Owner. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents: (i) observations by Owner's Representative, (ii) recommendation of any progress or final payment by Owner's Representative, (iii) the issuance of a certificate of Substantial Completion or any payment by the Owner to contractor under the Contract Documents, (iv) use or occupancy of the Work or any part thereof by Owner, (v) any acceptance by Owner or any failure to do so, (vi) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of Acceptance by the Engineer.

## **6.13. CONTINUING THE WORK**

Contractor shall carry on the work and adhere to the progress schedule during all disputes or disagreements with the Owner. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Owner or Contractor may otherwise agree in writing.

## **6.14. INDEMNIFICATION**

To the fullest extent permitted by law, Contractor agrees to defend, indemnify, and hold the City, its officers, agents, and employees, harmless from and against any and all liabilities, demands, claims, suits, losses, damages, causes of action, fines or judgments, including costs, attorneys', witnesses', and expert witnesses' fees, and expenses incident thereto, relating to, arising out of, or resulting from: (i) the services provided by Contractor personnel under this Agreement; (ii) any negligent acts, errors, mistakes or omissions by Contractor or Contractor personnel; and (iii) Contractor or Contractor personnel's failure to comply with or fulfill the obligations established by this Agreement.

Contractor will update the City during the course of the litigation to timely notify the City of any issues that may involve the independent negligence of the City that is not covered by this indemnification.

The City assumes no liability for actions of Contractor and will not indemnify or hold Contractor or any third party harmless for claims based on this Agreement or use of Contractor-provided supplies or services.

Notwithstanding anything contained herein to the contrary, this indemnification provision shall not be construed as a waiver of any immunity to which Owner is entitled or the extent of any limitation of liability pursuant to § 768.28, Florida Statutes. Furthermore, this provision is not intended to nor shall be interpreted as limiting or in any way affecting any defense Owner may have under § 768.28, Florida Statutes or as consent to be sued by third parties.

## **6.15. CHANGES IN COMPANY CONTACT INFORMATION**

Contractor shall notify Owner by US mail addressed to the City Engineer of any changes in company contact information. This includes contact phone, address, project manager, email addresses, etc.

## **6.16. PUBLIC RECORDS**

The CONTRACTOR will be required to comply with Section 119.0701, Florida Statutes.

**IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS, Rosemarie Call, phone: 727-562-4092 or [Rosemarie.Call@mclearwater.com](mailto:Rosemarie.Call@mclearwater.com), 600 Cleveland Street, Suite 600, Clearwater, FL 33755.**

The Contractor's duty to comply with public records law applies specifically to:

### SECTION III – General Conditions

- a) Keep and maintain public records required by the City of Clearwater (hereinafter “public agency”) to perform the service being provided by the contractor hereunder.
- b) Upon request from the public agency’s custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.
- c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the public agency.
- d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the contractor or keep and maintain public records required by the public agency to perform the service. If the contractor transfers all public records to the public agency upon completion of the contract, the contractor shall destroy any public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for the retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency’s custodian of public records in a format that is compatible with the information technology systems of the public agency.
- e) A request to inspect or copy public records relating to a public agency’s contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the contractor of the request and the contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.
- f) The Contractor hereby acknowledges and agrees that if the Contractor does not comply with the public agency’s request for records, the public agency shall enforce the contract provisions in accordance with the contract.
- g) A contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.
- h) If a civil action is filed against a contractor to compel production of public records relating to a public agency’s contract for services, the court shall assess and award against the contractor the reasonable costs of enforcement, including reasonable attorney fees, if:
  - 1. The court determines that the contractor unlawfully refused to comply with the public records request within a reasonable time; and
  - 2. At least 8 business days before filing the action, the plaintiff provided written notice of the public request, including a statement that the contractor has not complied with the request, to the public agency and to the contractor.
- i) A notice complies with subparagraph (h)2. if it is sent to the public agency’s custodian of public records and to the contractor at the contractor’s address listed on its contract with the public agency or to the contractor’s registered agent. Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.
- j) A contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.

## 7. OTHER WORK

### 7.1. RELATED WORK AT SITE

The City reserves the right to have its own forces enter the construction site at any time and perform work as necessary in order to perform infrastructure repair or maintenance, whether related to the project or not. The Contractor will allow complete access to all utility owners for these purposes.

The City may have its own forces perform new work related to the project, however, this work will be identified in the Contract Scope of Work and coordination will be such that this activity is denoted in the Contractor's CPM Schedule so as not to cause any delays or interference with the Contractor's work or schedule.

### 7.2. COORDINATION

If the Owner contracts with others for the performance of other work on the Project at the site, the following will be set forth in the Scope of Work: (i) the person who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified; (ii) the specific matters to be covered by such authority and responsibility will be itemized; and (iii) the extent of such authority and responsibilities will be provided. Unless otherwise provided in the Supplementary Conditions, the Owner shall have sole authority and responsibility in respect of such coordination.

## 8. OWNERS RESPONSIBILITY

Except as otherwise provided in these General Conditions, the Owner shall issue all communications from the Owner to the Contractor through Owner's Representative.

The Owner shall furnish the data required of the Owner under the Contract Documents promptly and shall make payments to Contractor promptly when they are due as provided in these General Conditions.

The Owner is obligated to execute Change Orders as indicated in the Article on Changes In The Work.

The Owner's responsibility in respect of certain inspections, tests, and approvals is set forth in the Article on Tests and Inspections.

In connection with the Owner's right to stop work or suspend work, see the Article on Engineer may Stop the Work. The Article on Suspension of Work and Termination deals with the Owner's right to terminate services of Contractor under certain circumstances.

Owner shall not supervise, direct or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. The Owner will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

## **9. OWNER REPRESENTATIVE'S STATUS DURING CONSTRUCTION**

### **9.1. OWNERS REPRESENTATIVE**

Dependent of the project type, the Owner's Representative during the construction period will either be the Construction Manager, the Engineer, or a designee of the Project's Owner. The duties, responsibilities and the limitations of authority of Owner's Representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

### **9.2. CLARIFICATIONS AND INTERPRETATIONS**

Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents regarding design issues only, in the form of Submittal responses, RFI responses, Drawings or otherwise, as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. All other clarifications and interpretations of the Contract Documents shall be issued form the Owner's Representative. Such written clarifications and interpretations will be binding on the Owner and Contractor. If Contractor believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Time and the parties are unable to agree to the amount or extent thereof, if any, Contractor may make a written claim therefore as provided in the Articles for Change of Work and Change of Contract Time.

### **9.3. REJECTING OF DEFECTIVE WORK**

The Owner's Representative or the Engineer will have authority to disapprove or reject Work which Owner's Representative or the Engineer believes to be defective, or that Owner's Representative or the Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. The Owner's Representative or the Engineer will also have authority to require special inspection or testing of the Work whether or not the Work is fabricated, installed or completed.

### **9.4. SHOP DRAWINGS, CHANGE ORDERS, AND PAYMENTS**

In connection with Engineer's authority as to Shop Drawings and Samples, see articles on Shop Drawings and Samples. In connection with Owner's Representative authority as to Change Orders, see the articles on Changes of Work, Contract Price and Contract Time. In connection with Owner's Representative authority as to Applications for Payment, see the articles on Payments to Contractor and Completion.

### **9.5. DECISIONS ON DISPUTES**

The Owner's Representative will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the work thereunder. Claims, disputes and other matters relating to the acceptability of the work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the work and Claims under the Articles for Changes of Work, Changes of Contract Time and Changes of Contract Price will be referred initially to Owner's Representative in writing with a request for a formal decision in

accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to Owner's Representative and the other party to the Agreement promptly, but in no event later than thirty (30) days, after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to Owner's Representative and the other party within sixty (60) days after the start of such occurrence or event unless Owner's Representative allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Owner's Representative and the claimant within thirty (30) days after receipt of the claimant's last submittal, unless Owner's Representative allows additional time. Owner's Representative will render a formal decision in writing within thirty (30) days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Owner Representative's written decision on such claim, dispute or other matter will be final and binding upon the Owner and Contractor unless (i) an appeal from Owner Representative's decision is taken within thirty (30) days of the Owner Representative's decision, or the appeal time which may be stated in a Dispute Resolution Agreement between Owner and Contractor for the settlement of disputes or (ii) if no such Dispute Resolution Agreement has been entered into, a written notice of intention to appeal from Owner Representative's written decision is delivered by the Owner or Contractor to the other and to Owner's Representative within thirty (30) days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty (60) days of the date of such decision, unless otherwise agreed in writing by the Owner and Contractor.

When functioning as interpreter and judge, Owner's Representative will not show partiality to the Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Owner's Representative with respect to any such claim, dispute or other matter will be a condition precedent to any exercise by the Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter pursuant the Article on Dispute Resolution.

## **9.6. LIMITATIONS ON OWNER REPRESENTATIVE'S RESPONSIBILITIES**

Neither Owner Representative's authority or responsibility under this paragraph or under any other provision of the Contract Documents nor any decision made by Owner's Representative in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by Owner's Representative shall create, impose or give rise to any duty owed by Owner's Representative to Contractor, any Subcontractor, any Supplier, any other person or organization or to any surety for or employee or agent of any of them.

Owner's Representative will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the work. Owner's Representative will not be responsible for Contractor's failure to perform or furnish the work in accordance with the Contract Documents.

Owner's Representative will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the work.

Owner Representative's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by the Contractor will only be to determine generally that their content complies with the requirements of the Contract Documents and, in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with the Contract Documents.

The limitations upon authority and responsibility set forth in this paragraph shall also apply to Owner Representative's CEI, the Engineer's Consultants, and assistants.

## **10. CHANGES IN THE WORK**

Without invalidating the Agreement and without notice to any surety, the Owner may, at any time or from time to time, order additions, deletions or revisions in the Work. Such additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as may otherwise be specifically provided).

If the Owner and Contractor are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Time that should be allowed as a result of a Work Change Directive, a claim may be made therefore as provided in these General Conditions.

Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in these General Conditions except in the case of an emergency as provided or in the case of uncovering work as provided in article for Uncovering Work.

The Owner and Contractor shall execute appropriate Change Orders or Written Amendments recommended by Owner's Representative covering:

- changes in the work which are (i) ordered by the Owner (ii) required because of acceptance of defective work under the article for Acceptance of Defective Work or correcting defective Work under the article for Owner May Correct Defective Work or (iii) agreed to by the parties;
- changes in the Contract Price or Contract Time which are agreed to by the parties; and
- changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by Owner's Representative pursuant to the article for Decisions on Disputes;
- provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the progress schedule as provided in the article for Continuing the Work.

If notice of any change affecting the general scope of the work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the

provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

## 11. CHANGES IN THE CONTRACT PRICE

### 11.1. CHANGES IN THE CONTRACT PRICE

The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Price. The Contract Price may only be adjusted by a Change Order or by a Written Amendment. Any claim for an adjustment in the Contract Price shall be based on a written notice of claim stating the general nature of the claim, to be delivered by the party making the claim to the other party and to Owner's Representative or promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty (60) days after the start of such occurrence or event, unless Owner's Representative allows additional time for claimant to submit additional or more accurate data in support of the claim, and shall be accompanied by claimant's written statement that the claimed adjustment covers all known amounts to which the claimant is entitled as a result of said occurrence or event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows: (i) where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (ii) where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit), (iii) where the Work is not covered by unit prices contained in the Contract Documents and agreement is reached to establish unit prices for the Work.

Where the work involved is not covered by unit prices contained in the Contract Documents and where the Owner's Representative, the Owner, the Engineer, the Engineer's Consultant, and Contractor cannot mutually agree on a lump sum price, the City of Clearwater shall pay for directed changes in the Work, on "COST REIMBURSEMENT" basis. The Contractor shall apply for compensation, detailing Contractors forces, materials, equipment, subcontractors, and other items of direct costs required for the directed work.

The application for Cost Reimbursement shall be limited to the following items:

1. Labor, including foremen, for those hours associated with the direct work (actual payroll cost, including wages, fringe benefits, labor insurance and labor taxes established by law). Expressly excluded from this item are all costs associated with negotiating the subject change.
2. Materials associated with the change, including sales tax. The costs of materials shall be substantiated through vendors' invoices.
3. Rental or equivalent rental costs of equipment, including necessary transportation costs if specifically used for the Work. The rental rates shall not exceed the current rental rates prevailing in the locality or as defined in the rental Rate Blue Book for Construction Equipment (a.k.a. DataQuest Blue Book). The rental rate is defined as the full-unadjusted base rental rate for the appropriate item of construction equipment and

shall cover the costs of all fuel, supplies, repairs, insurance, and other costs associated with supplying the equipment for work ordered. Contractor-owned equipment will be paid for the duration of time required to complete the work. Utilize lowest cost combination of hourly, daily, weekly, or monthly rates. Do not exceed estimated operating costs given in Blue Book. Operating costs will not be allowed for equipment on stand-by.

4. Additional costs for Bonds, Insurance if required by the City of Clearwater.

The following fixed fees shall be added to the costs of the directed work performed by the Contractor or Subcontractor.

- A. A fixed fee of fifteen percent (15%) shall be added to the costs of Item 1 above. If work is performed by a subcontractor, the Contractor's fee shall not exceed five percent (5%), and the subcontractor's fee shall not exceed ten percent (10%).
- B. A fixed fee of ten percent (10%) shall be added to the costs of Item 2 above.
- C. No markup shall be added to the costs of Items 3 and 4.

The fixed fees shall be considered the full compensation for all cost of general supervision, overhead, profit, and other general expense.

## **11.2. ALLOWANCES AND FINAL CONTRACT PRICE ADJUSTMENT**

It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to Owner and Engineer. Contractor agrees that: (i) the allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and (ii) Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by Owner's Representative to reflect actual amounts due Contractor on account of Work covered by allowances and all the Work actually performed by the Contractor, and the Contract Price shall be correspondingly adjusted.

## **11.3. UNIT PRICE WORK**

Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of unit price work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Owner's Representative. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item. The Owner or Contractor may make a claim for an adjustment in the Contract Price if: (i) the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from

the estimated quantity of such item indicated in the Contract Documents; and (ii) there is no corresponding adjustment with respect to any other item of Work; and (iii) if Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or the Owner believes that the Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease. On unit price contracts, Owner endeavors to provide adequate unit quantities to satisfactorily complete the construction of the project. It is expected that in the normal course of project construction and completion that not all unit quantities will be used in their entirety and that a finalizing change order which adjusts contract unit quantities to those unit quantities actually used in the construction of the project will result in a net decrease from the original Contract Price. Such reasonable deduction of final Contract Price should be anticipated by the Contractor in his original bid.

## 12. CHANGES IN THE CONTRACT TIME

The Contract Time (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Time (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to Owner's Representative promptly, but in no event later than thirty (30) days, after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty (60) days after such occurrence, unless Owner's Representative allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time (or Milestones) shall be determined by Owner's Representative. No claim for an adjustment in the Contract Time (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

All time limits stated in the Contract Documents are of the essence of the Agreement.

Where Contractor is prevented from completing any part of the work within the Contract Time (or Milestones) due to delay beyond the control of Contractor, the Contract Time (or Milestones) may be extended in an amount equal to the time lost due to such delay if a claim is made therefore as provided in the article for Changes in the

Work. Delays beyond the control of Contractor shall include, but not be limited to, acts by the Owner, acts of utility owners or other contractors performing other work as contemplated by the article for Other Work, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both the Owner and Contractor, an extension of the Contract Time (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay. In no event shall the Owner be liable to Contractor, any Subcontractor, any Supplier, any other person, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of Contractor, or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts by utility owners or other contractors performing other work as contemplated by paragraph for Other Work.

## **13. TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

### **13.1. TESTS AND INSPECTION**

Contractor shall give Owner's Representative and Engineer timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The costs for these inspections, tests or approvals shall be borne by the Contractor except as otherwise provided in the Contract Documents.

If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body including all Owner Building Departments and Owner Utility Departments, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish Owner's Representative the required certificates of inspection or approval. Unless otherwise stated in the Contract Documents, Owner permit and impact fees will be waived. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation of the Work.

If any Work (or the work of others) that is to be inspected tested or approved is covered by Contractor without written concurrence of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for observation. Uncovering Work as provided in this paragraph shall be at Contractor's expense unless Contractor has given Owner's Representative and Engineer timely notice of Contractor's intention to cover the same and Owner's Representative has not acted with reasonable promptness in response to such notice.

### **13.2. UNCOVERING THE WORK**

If any Work is covered contrary to the written request of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for Owner Representative's observation and replaced at Contractor's expense.

If Owner's Representative considers it necessary or advisable that covered Work be observed by Owner's Representative or inspected or tested by others, Contractor, at Owner Representative's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer or Owner's Representative may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and the Owner shall be entitled to an appropriate decrease in the Contract Price for the costs of the investigation, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in the article for Change in Contract Price. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract

Price or an extension of the Contract Time (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefore as provided the article for Change in Contract Price and Change of Contract Time.

### **13.3. OWNER'S REPRESENTATIVE MAY STOP THE WORK**

If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Engineer or Owner's Representative may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner's Representative to stop the Work shall not give rise to any duty on the part of Owner's Representative or Owner to exercise this right for the benefit of Contractor or any surety or other party. If the Owner's Representative stops Work under this paragraph, Contractor shall be entitled to no extension of Contract Time or increase in Contract Price.

### **13.4. CORRECTION OR REMOVAL OF DEFECTIVE WORK**

If required by Engineer or Owner's Representative, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer or Owner's Representative, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

### **13.5. WARRANTY/CORRECTION PERIOD**

If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to the Owner and in accordance with the Owner's written instructions; (i) correct such defective Work, or, if it has been rejected by the Owner, remove it from the site and replace it with Work that is not defective and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the Owner may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

In special circumstances where a particular item of equipment is placed in continuous service before Final Completion of all the Work, the correction period for that item may start to run from an earlier date if specifically, and expressly so provided in the Specifications or by Written Amendment.

Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

## **13.6. ACCEPTANCE OF DEFECTIVE WORK**

If, instead of requiring correction or removal and replacement of defective Work, the Owner prefers to accept it, the Owner may do so.

Contractor shall pay all claims, costs, losses and damages attributable to the Owner's evaluation of and determination to accept such defective Work such costs to be approved by Owner's Representative as to reasonableness. If any such acceptance occurs prior to Owner Representative's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in article for Change of Contract Price. If the acceptance occurs after the Owner Representative's recommendation for final payment an appropriate amount will be paid by Contractor to the Owner.

## **13.7. OWNER MAY CORRECT DEFECTIVE WORK**

If Contractor fails within a reasonable time after written notice from Owner's Representative to correct defective Work or to remove and replace rejected Work as required by Owner's Representative in accordance with the article for Correction and Removal of Defective Work or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, the Owner may, after seven days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph the Owner shall proceed expeditiously. In connection with such corrective and remedial action, the Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's Representatives, Agents and employees, the Owner's other contractors, and Owner's Representative, Engineer, and Engineer's Consultants access to the site to enable the Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by the Owner in exercising such rights and remedies will be charged against Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in the article for Change of Contract Price. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Time (or Milestones) because of any delay in the performance of the Work attributable to the exercise by the Owner of the Owner's rights and remedies hereunder.

## **14. PAYMENTS TO CONTRACTOR AND COMPLETION**

Requests for payment shall be processed in accordance with F.S. 218.735 and as described herein. Progress payments on account of Unit Price Work will be based on the number of units completed.

## 14.1. APPLICATION FOR PROGRESS PAYMENT

Contractor shall submit (not more often than once a month) to Owner's Representative for review an Application for Payment filled out and signed by Contractor covering the Work completed once each month and accompanied by such supporting documentation as is required by the Owner's Representative and the Contract Documents. Unless otherwise stated in the Contract Documents, payment will not be made for materials and equipment not incorporated in the Work. Payment will only be made for that portion of the Work, which is fully installed including all materials, labor and equipment. A retainage of not less than five (5%) of the amount of each Application for Payment for the total of all Work, including as-built survey and Inspector overtime reimbursement, completed to date will be held until final completion and acceptance of the Work covered in the Contract Documents. No progress payment shall be construed to be acceptance of any portion of the Work under contract.

The Contractor shall review with the Engineer or the Construction Inspector all quantities and work for which payment is being applied for and reach agreement prior to submittal of an Official Pay Request. The Engineer or the Construction Inspector will verify that the on-site marked up as-built drawings are up to date with the work and are in compliance with the Contract Documents.

In addition to all other payment provisions set out in this contract, the Owner's Representative may require the Contractor to produce for Owner, within fifteen (15) days of the approval of any progress payment, evidence and/or payment affidavit that all subcontractors and suppliers have been paid any sum or sums then due. A failure on the part of the contractor to provide the report as required herein shall result in further progress or partial payments being withheld until the report is provided.

## 14.2. CONTRACTOR'S WARRANTY OF TITLE

Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to the Owner no later than the time of payment, free and clear of liens. No materials or supplies for the Work shall be purchased by Contractor or Subcontractor subject to any chattel mortgage or under a conditional sale contact or other agreement by which an interest is retained by the seller. Contractor warrants that he has good title to all materials and supplies used by him in the Work, free from all liens, claims or encumbrances. Contractor shall indemnify and save the Owner harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies incurred in the furtherance of the performance of this Contract. Contractor shall at the Owner's request, furnish satisfactory evidence that all obligations of nature hereinabove designated have been paid, discharged, or waived. If Contractor fails to do so, then the Owner may, after having served written notice on said Contractor either pay unpaid bills, of which the Owner has written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to Contractor shall be resumed in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to the Contractor or the Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of Contractor and any payment so made by the Owner shall be considered as payment made under the Contract by the Owner to Contractor, and the Owner shall not be liable to Contractor for any such payment made in good faith.

## **14.3. REVIEW OF APPLICATIONS FOR PROGRESS PAYMENTS**

The Owner's Representative will within twenty (20) business days after receipt authorize and process payment by the Owner a properly submitted and documented Application for payment, unless the application requires review by an Agent. If the Application for payment requires review and approval by an Agent, properly submitted and documented Applications for payment will be paid by the Owner within twenty-five (25) business days. If an Application for payment is rejected, notice shall be given within twenty (20) business days of receipt indicating the reasons for refusing payment. The reasons for rejecting an Application will be submitted in writing, specifying deficiencies and identifying actions that would make the Application proper. In the latter case, Contractor may make the necessary corrections and resubmit the Application. The Owner's Representative or Agent may refuse to recommend the whole or any part of any payment to Owner. Owner's Representative or Agent may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously recommended, to such extent as may be necessary in Owner Representative's or Agent's opinion to protect the Owner from loss because: (i) the Work is defective, or completed Work has been damaged requiring correction or replacement, (ii) the Contract Price has been reduced by amendment or Change Order, (iii) the Owner has been required to correct defective Work or complete Work, or (iv) Owner's Representative or Agent has actual knowledge of the occurrence of any of the events enumerated in the article on Suspension of Work and Termination.

The Owner may refuse to make payment of the full amount recommended by the Owner's Representative or Agent because: (i) claims have been made against the Owner on account of Contractor's performance or furnishing of the Work, (ii) Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to the Owner to secure the satisfaction and discharge of such Liens, (iii) there are other items entitling the Owner to a set-off against the amount recommended, or (iv) the Owner has actual knowledge of any of the events described in this paragraph. The Owner shall give Contractor notice of refusal to pay in accordance with the time constraints of this section with a copy to the Owner's Representative or Agent, stating the reasons for such actions, and Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by the Owner and Contractor, when Contractor corrects to the Owner's satisfaction the reasons for such action.

## **14.4. PARTIAL UTILIZATION**

Use by the Owner at the Owner's option of any substantially completed part of the Work which (i) has specifically been identified in the Contract Documents, or (ii) Owner, Engineer, Owner's Representative, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by the Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Final Completion of all the Work subject to the following:

The Owner at any time may request Contractor in writing to permit the Owner to use any such part of the Work which the Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner, Owner's Representative, and Engineer that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner, Owner's Representative, and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and

substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor, Owner's Representative, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner, Owner's Representative, and Contractor in writing giving the reasons therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of the articles for Substantial Completion and Partial Utilization will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

## **14.5. FINAL INSPECTION**

Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Owner's Representative will make a final inspection with Engineer, Owner and Contractor and will within thirty (30) days notify Contractor in writing of particulars in which this inspection reveals that the Work is incomplete or defective. The Owner's Representative will produce a final punch list, deliver it to the Contractor within five (5) days of completion and assign a date for this work to be completed not less than thirty (30) days from delivery of the list. Failure to include any corrective work or pending items does not alter the responsibility of the contractor to complete all the construction services purchased pursuant to the contract. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

## **14.6. FINAL APPLICATION FOR PAYMENT**

After Contractor has completed all such corrections to the satisfaction of Owner's Representative and has delivered in accordance with the Contract Documents all maintenance and operating instructions, As-built/Record Drawings, schedules, guarantees, Bonds, certificates or other evidence of insurance required by the paragraph for Bonds and Insurance, certificates of inspection, Inspector overtime reimbursement as required in the Contract Documents and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by paragraph for Bonds and Insurance, and (ii) executed consent of the surety to final payment using the form contained in Section V of the Contract Documents.

Prior to application for final payment, Contractor shall clean and remove from the premises all surplus and discarded materials, rubbish, and temporary structures, and shall restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the Work and shall leave the Work in a neat and presentable condition.

## **14.7. FINAL PAYMENT AND ACCEPTANCE**

If through no fault of Contractor, final completion of the Work is significantly delayed and if Owner's Representative so confirms, the Owner shall, upon receipt of Contractor's final Application for payment and recommendation of Owner's Representative, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by the Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph for Bonds and Insurance, the written consent of the surety to the payment

of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Owner's Representative with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that such payment shall not constitute a waiver of claims.

If on the basis of Owner Representative's observation of the Work during construction and final inspection, and Owner Representative's review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Owner's Representative will indicate in writing his recommendation of payment and present the Application to Owner for payment. Thereupon, Owner's Representative will give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of this article. Otherwise, Owner's Representative will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the Owner shall, within twenty (20) days after receipt thereof pay contractor the amount recommended by Owner's Representative.

## **14.8. WAIVER OF CLAIMS**

The making and acceptance of final payment will constitute: a waiver of all claims by the Owner against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and a waiver of all claims by Contractor against the Owner other than those previously made in writing and still unsettled.

## **15. SUSPENSION OF WORK AND TERMINATION**

### **15.1. OWNER MAY SUSPEND THE WORK**

At any time and without cause, Owner's Representative may suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to Contractor, which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved claim therefore as provided in the articles for Change of Contract Price and Change of Contract Time.

### **15.2. OWNER MAY TERMINATE**

Upon the occurrence of any one or more of the following events:

Contractor persistently fails to perform the work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule as adjusted from time to time);

Contractor disregards Laws and Regulations of any public body having jurisdiction;

Contractor violates Article 6.7.1 of this Section III;

### SECTION III – General Conditions

Contractor disregards the authority of Owner's Representative;

Contractor otherwise violates in any substantial way any provisions of the Contract Documents; or if the Work to be done under this Contract is abandoned, or if this Contract or any part thereof is sublet, without the previous written consent of the Owner, or if the Contract or any claim thereunder is assigned by Contractor otherwise than as herein specified, or at any time Owner's Representative certifies in writing to the Owner that the rate of progress of the Work or any part thereof is unsatisfactory or that the work or any part thereof is unnecessarily or unreasonably delayed;

Lack of funding. The City's performance and obligation to pay under this Contract is contingent upon an annual appropriation by the Clearwater City Council.

The Owner may, after giving Contractor (and the surety, if any), seven days' written notice and, to the extent permitted by Laws and Regulations, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere, and finish the Work as the Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by the Owner arising out of or resulting from completing the Work such excess will be paid to Contractor.

If such claims, costs, losses and damages exceed such unpaid balance, Contractor shall pay the difference to the Owner. Such claims, costs, losses and damages incurred by the Owner will be reviewed by Owner's Representative as to their reasonableness and when so approved by Owner's Representative incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph the Owner shall not be required to obtain the lowest price for the Work performed.

Where Contractor's services have been so terminated by the Owner, the termination will not affect any rights or remedies of the Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by the Owner will not release Contractor from liability.

Upon seven (7) days' written notice to Contractor and Owner's Representative, the Owner may, without cause and without prejudice to any other right or remedy of the Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items):

for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

### **15.3. CONTRACTOR MAY STOP WORK OR TERMINATE**

If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Owner's Representative fails to act on any Application for Payment within thirty (30) days after it is submitted or the Owner fails for thirty (30) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven (7) days' written notice to the Owner and Owner's Representative, and provided the Owner or Owner's Representative does not remedy such suspension or failure within that time, terminate the Agreement and recover from the Owner payment on the same terms as provided in the article for the Owner May Terminate. However, if the Work is suspended under an order of court through no fault of Owner, the Contractor shall not be entitled to payment except as the Court may direct. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if Owner's Representative has failed to act on an Application for Payment within thirty (30) days after it is submitted, or the Owner has failed for thirty (30) days to pay Contractor any sum finally determined to be due, Contractor may upon seven (7) days' written notice to the Owner and Owner's Representative stop the Work until payment of all such amounts due Contractor. The provisions of this article are not intended to preclude Contractor from making claim under paragraphs for Change of Contract Price or Change of Contract Time or otherwise for expenses or damage directly attributable to Contractor's stopping Work as permitted by this article.

## **16. DISPUTE RESOLUTION**

If and to the extent that the Owner and Contractor have agreed on the method and procedure for resolving disputes between them that may arise under this Agreement, such dispute resolution method and procedure will proceed. If no such agreement on the method and procedure for resolving such disputes has been reached, subject to the provisions of the article for Decisions on Disputes, the Owner and Contractor may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute provided, however, that nothing herein shall require a dispute to be submitted to binding arbitration.

## **17. MISCELLANEOUS**

### **17.1. SUBMITTAL AND DOCUMENT FORMS**

The form of all submittals, notices, change orders, pay applications, logs, schedules and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner's Representative subject to the approval of Owner.

### **17.2. GIVING NOTICE**

Whenever any provision of the Contract Documents requires the giving of written notice, notice will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

### **17.3. NOTICE OF CLAIM**

Should the Owner or Contractor suffer injury or damage to person or property because of any error, omission or any act of the other party or of any of the other party's officers, employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

### **17.4. PROFESSIONAL FEES AND COURT COSTS INCLUDED**

Whenever reference is made to "claims, costs, losses and damages," the phrase shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

### **17.5. ASSIGNMENT OF CONTRACT**

The Contractor shall not assign this contract or any part thereof or any rights thereunder without the approval of Owner, nor without the consent of surety unless the surety has waived its rights to notice of assignment.

### **17.6. RENEWAL OPTION**

Annual Contracts issued through the Engineering Department may be renewed for up to three (3) years, upon mutual consent of both the Owner and the Contractor/Vendor. All terms, conditions and unit prices shall remain constant unless otherwise specified in the contract specifications or in the Invitation to bid. Renewals shall be made at the sole discretion of the Owner and must be agreed to in writing by both parties. All renewals are contingent upon the availability of funds, and the satisfactory performance of the Contractor as determined by the Construction Department.

### **17.7. ROLL-OFF CONTAINERS AND/OR DUMPSTERS**

All City construction projects shall utilize City of Clearwater Solid Waste roll-off containers and/or dumpsters for their disposal and hauling needs. For availability or pricing contact William Buzzell, at the City of Clearwater, Solid Waste Department, by phone: (727) 562-4929 or email: [William.Buzzell@myClearwater.com](mailto:William.Buzzell@myClearwater.com).

## **18. ORDER AND LOCATION OF THE WORK**

The City reserves the right to accept and use any portion of the work whenever it is considered to the public interest to do so. The Engineer shall have the power to direct on what line or street the Contractor shall work and order thereof.

## **19. MATERIAL USED**

All material incorporated into the final work shall be new material unless otherwise approved by the Engineer. If requested by the Engineer, the Contractor shall furnish purchase receipts of all materials.

## **20. CONFLICT BETWEEN PLANS AND SPECIFICATIONS**

The various Contract Documents shall be given precedence, in case of conflict, error or discrepancy, as follows: Modifications, Contract Agreement, Addenda, Supplementary General Conditions, General Conditions, Supplementary Technical Specifications and Technical Specifications. In a series of Modifications or Addenda the latest will govern. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality, more stringent or greater quantity of Work shall be provided in accordance with the Engineer/Architect's interpretation.

## **21. OWNER DIRECT PURCHASE (ODP)**

### **21.1. SALES TAX SAVINGS**

The Owner reserves the right to purchase certain portions of the materials or equipment for the Project directly in order to save applicable sales tax in compliance with Florida Law since owner is exempt from the payment of sales tax. The contract price includes Florida sales and other applicable taxes for materials, supplies, and equipment which will be a part of the Contractor's Work. Owner-purchasing of construction materials or equipment, if selected, will be administered on a deductive Change Order basis. The contract price shall be reduced by the actual cost of the materials or equipment purchased by owner plus the normally applicable sales tax, even if the actual cost is in excess of the cost for the materials or equipment as-bid by the Contractor. For purposes of calculating engineering fees, contractor fees, architects' fees, and any other amounts that are based on the contract amount, however, the original, as-bid contract amount shall be used.

Direct purchase shall be considered for single items or materials that exceed \$10,000 in value and/or items identified in Section V, Bidders Proposal. The Contractor shall provide the Owner an ODP Summary of all intended suppliers, vendors, equipment and materials for consideration as ODP materials or equipment (refer to ODP Instructions in Contract Appendix).

### **21.2. TITLE AND OWNER RISK**

Owner will issue Purchase Orders and provide a copy of Owner's Florida Consumer Certification of Tax Exemption and Certificate of Entitlement directly to the Vendor for ODP materials or equipment. Invoices for ODP materials or equipment shall be issued to the Owner, and a copy sent to the Contractor.

Notwithstanding the transfer of ODP materials or equipment by the Owner to the Contractor's possession, the Owner shall retain legal and equitable title to any and all ODP materials or equipment; therefore, the owner assumes the risk of damage or loss at the time of purchase or delivery of items, unless material is damaged as the result of negligence by the Contractor.

### **21.3. CONTRACTOR'S RECEIPT OF MATERIALS**

The Contractor shall be fully responsible for all matters relating to the receipt of materials or equipment furnished to the Owner including, but not limited to, verifying correct quantities, verifying documents of orders in a timely manner, coordinating purchases, providing and obtaining all warranties and guarantees required by the Contract Documents, and inspection and acceptance of the goods at the time of delivery. The Owner shall coordinate with Contractor and Vendor delivery schedules, sequence of delivery, loading orientation, and other arrangements normally

required by the Contractor for the particular materials or equipment furnished. The Contractor shall provide all services required for the unloading and handling of materials or equipment. The Contractor agrees to indemnify and hold harmless the Owner from any and all claims of whatever nature resulting from non-payment of goods to suppliers arising from the action of the Contractor.

As ODP materials or equipment are delivered to the job site, the Contractor shall visually inspect all shipments from the suppliers and approve the vendor's invoice for items delivered. The Contractor shall assure that each delivery of ODP materials or equipment is accompanied by documentation adequate to identify the Purchase Order against which the purchase is made. This documentation may consist of a delivery ticket and/or an invoice from the supplier conforming to the Purchase Order together with such additional information as the Owner may require. The Contractor will then forward an electronic copy of the invoice and supporting documentation to the Owner for payment within fourteen (14) calendar days of receipt of said goods or materials. Such payment shall be directly from public funds, from Owner to Vendor.

The Contractor shall insure that ODP materials or equipment conform to the Specifications and determine prior to acceptance of goods at time of delivery if such materials or equipment are patently defective, and whether such materials or equipment are identical to the materials or equipment ordered and match the description on the bill of lading. If the Contractor discovers defective or non-conformities in ODP materials or equipment upon such visual inspection, the Contractor shall not utilize such nonconforming or defective materials or equipment in the Contractor's Work and instead shall properly notify the Owner of the defective or nonconforming condition so that repair or replacement of those materials or equipment can occur without undue delay or interruption to the Project. If the Contractor fails to perform such inspection and otherwise incorporates into the Contractor's Work such defective or nonconforming ODP materials or equipment, the condition of which it either knew or should have known by performance of an inspection, Contractor shall be responsible for all damages to the Owner, resulting from Contractor's incorporation of such materials or equipment into the Project, including liquidated damages.

## **21.4. ODP RECORDS, WARRANTIES AND INDEMNIFICATION**

The Contractor shall maintain records of all ODP materials or equipment it incorporates into Contractor's Work from the stock of ODP materials or equipment in its possession. The Contractor shall account monthly to the Owner for any ODP materials or equipment delivered into the Contractor's possession, indicating portions of all such materials or equipment which have been incorporated in the Contractor's Work.

The Contractor shall be responsible for obtaining and managing all warranties and guarantees for all materials, equipment and products as required by the Contract Documents. All repair, maintenance, or damage-repair calls shall be forwarded to the Contractor for resolution with the appropriate supplier, vendor, or subcontractor.

The Owner shall indemnify and hold Contractor harmless from any sales tax (and interest and penalties incurred in connection therewith) in the event there is a final determination that purchases made by Owner, which Owner treats as being exempt from sales tax, are subject to sales tax. "Final determination" shall mean an assessment by the Department of Revenue that is no longer subject to protest, or a determination of a court having jurisdiction over such matters that is final and not subject to appeal. Contractor agrees to promptly notify owner of any audit, assessment, proposed assessment or notice of deficiency issued with regard to the Project and relating to ODP materials or equipment. ODP Purchase Orders must be closed out prior to closing out the contract/Contractor

Purchase Order. If material costs needed for project exceed the ODP Purchase Order amount, the ODP Purchase Order will not be increased. Amounts in excess of the ODP Purchase Order will be paid for by the Contractor.

## **22. RESIDENT NOTIFICATION OF START OF CONSTRUCTION**

### **22.1. GENERAL**

The Contractor shall notify all residents along the construction route or within a 500-foot radius, unless stated otherwise in the Contract Documents, with a printed door hanger notice indicating the following information about the proposed construction work and the Contractor performing the work: City seal or logo; the scheduled date for the start of construction; the type of construction; general sequence and scheduling of construction events; possibility of water service disruption and/or colored water due to construction efforts; Contractor's name, the Superintendent's name, Contractor address and telephone number; Contractor's company logo (optional); requirement for residents to remove landscaping and/or other private appurtenances which are in conflict with the proposed construction; and other language as appropriate to the scope of Contract work. Sample door hanger including proposed language shall be approved by the City prior to the start of construction. Notification shall be printed on brightly colored and durable card stock and shall be a minimum of 4-1/4 by 11 inches in size. Notification (door hanger) shall be posted to residences and businesses directly affected by the Contractor's activities no later than seven (7) days prior to the start of construction activity. Directly affected by the Contractor's activities shall mean all Contractor operations including staging areas, equipment and material storage, principal access routes across private property, etc. Contractor cannot start without proper seven (7) day notice period to residents. Contractor is required to maintain sufficient staff to answer citizen inquiries during normal business hours and to maintain appropriate message recording equipment to receive citizen inquires after business hours.

Resident notification by the Contractor is a non-specific pay item to be included in the bid items provided in the contract proposal.

## 22.2. EXAMPLE



**CLEARWATER**  
BRIGHT AND BEAUTIFUL • BAY TO BEACH

**NOTICE OF CONSTRUCTION**

TODAY'S DATE: \_\_\_\_/\_\_\_\_/\_\_\_\_

**PLEASE EXCUSE US FOR ANY INCONVENIENCE**

We are the construction contractor performing the (*state project name*) for the City of Clearwater in your area. The work will be performed in the public right-of-way adjacent to your property. This notice is placed a minimum of seven (7) days in advance of construction to notify property owners of the pending start of construction.

(*Brief description of the construction process to be expected by the property owners*)

The construction process may necessitate the removal of certain items from the right-of-way. Typical items such as sprinklers, grass, and postal approved mailboxes will be replaced by the contractor within a reasonably short period of time. The replacement of driveways and sidewalks will be made using standard asphalt or concrete materials. The property owner is responsible for the expense and coordination to replace driveways and sidewalks which have customized colors, textures and/or materials. Small trees, shrubs, landscaping materials, unauthorized mailboxes or structures within the right-of-way which must be removed due to the construction process will not be replaced. The property owner is responsible to relocate any such items which the property owner wishes to save prior to the start of construction. Vehicles parked on the streets or within the right-of-way may be required to be placed elsewhere.

We are available to answer any questions you may have regarding the construction process or any particular item that must be relocated. Please contact our Construction Manager \_\_\_\_\_ at (727) \_\_\_\_\_. We will be more than happy to assist you.

Construction is anticipated to begin on: \_\_\_\_\_.

**Company Name**  
**Company Address**  
**Contractor Phone Number**

## 23. PROJECT INFORMATION SIGNS

### 23.1. SCOPE AND PURPOSE

The Owner desires to inform the general public on the Owner's use and expenditure of public funding for general capital improvement and maintenance projects. To help accomplish this purpose, the Contractor is required to prepare and display public project information signs during the full course of the contract period. These signs will be displayed at all location(s) of active work. Payment to Contractor for the preparation, installation and management of project sign(s) shall be

included in the cost of the work. The number of and type of signs will be stated in SECTION IV, SCOPE OF WORK.

## **23.2. PROJECT SIGN, FIXED OR PORTABLE**

Sign type shall be "fixed" on stationary projects and "portable" on projects which have extended locations or various locations. The particular wording to be used on the signs will be determined after contract award has been approved. Contractor will be provided the wording to be used on sign at the preconstruction conference.

### **23.3. FIXED SIGN**

Fixed sign shall be 4-foot by 6-foot (4'x6') in size and painted on a sheet of exterior grade plywood of the same size and a minimum thickness of 1/2-inches. Sign shall be attached to a minimum of two (2) 4-inch by 4-inch (4"x4") below grade pressure treated (P.T.) wooden posts and braced as necessary for high winds. Posts shall be long enough to provide secure anchoring in the ground. Bottom of sign must be a minimum of 24-inches above the ground. Alternate mounting system or attachment to fencing or other fixed structure can be considered for approval. Sign shall be painted white on both sides with exterior rated paint.

### **23.4. PORTABLE SIGNS**

Portable sign shall be a minimum of 24-inches by 30-inches (24"x30") in size and will be attached to a standard sized portable traffic barricade. Sign material shall be aluminum, 0.080-inches or thicker, background of white reflective sheeting, and shall be silkscreen or vinyl lettering. Portable sign shall be two signs located and attached to each side of the traffic barricade.

### **23.5. SIGN COLORING**

Background shall be white. Project Descriptive Name shall be in blue lettering. All other lettering shall be black. Basic lettering on sign shall be in all capital letters, of size proportional to the sign itself. Each sign shall depict the City's logo. The Project Manager/City Representative shall provide the appropriate electronic logo file(s) to the Contractor.

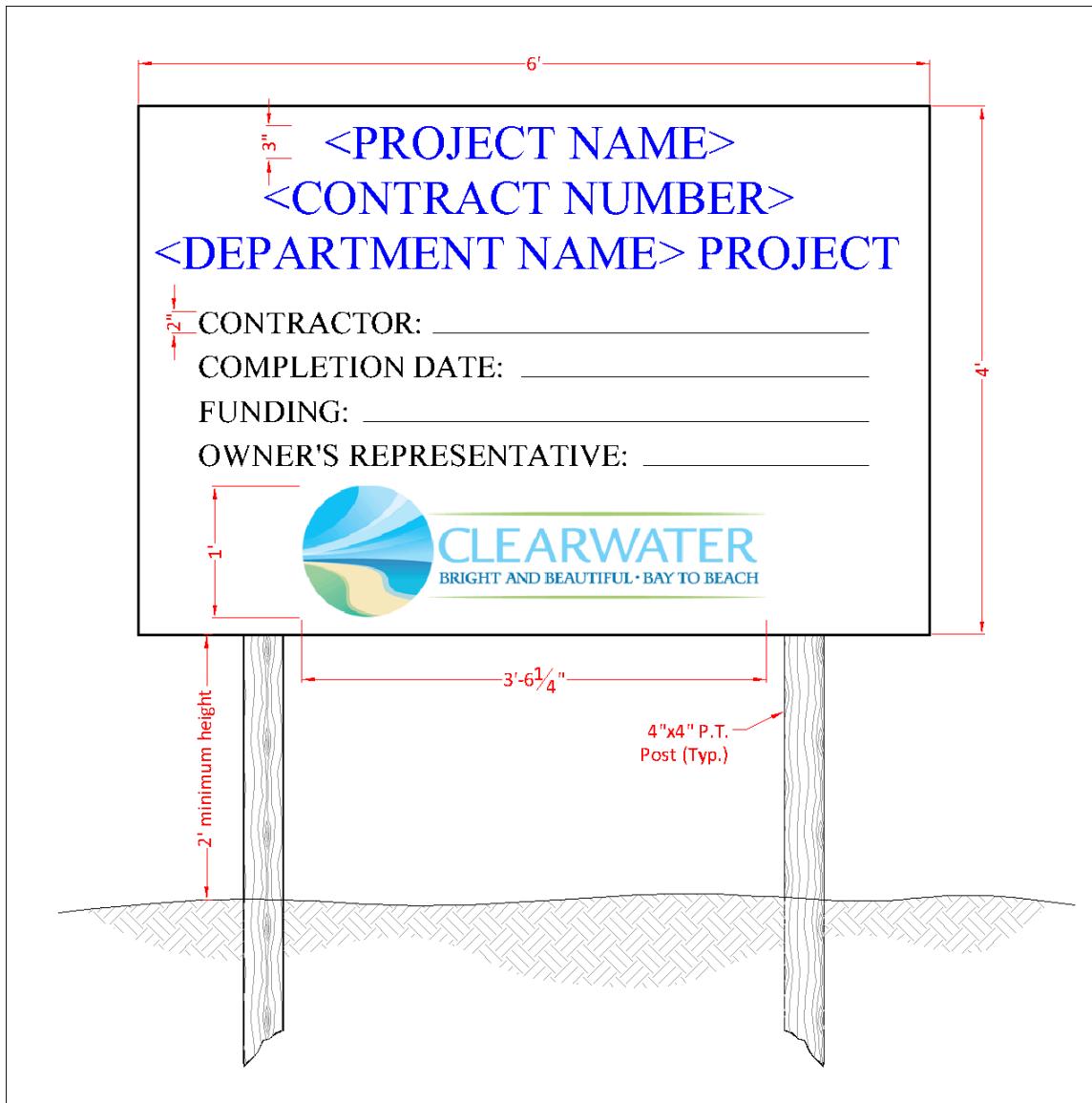
### **23.6. SIGN PLACEMENT**

Signs shall be placed where they are readily visible by the general public which pass by the project site. Signs are not to be placed where they may become a hazard or impediment to either pedestrian or vehicular traffic. For construction projects outside of the Owner's right-of-way, the signs will be placed on the project site. For projects constructed inside of the Owner's right-of-way, the signs will be placed in the right-of-way. Portable signs are to be moved to the locations of active work on the project. Multiple portable signs will be necessary where work is ongoing in several locations at the same time. Fixed signs are to be placed at the start of construction and will remain in place until the request for final payment.

### **23.7. SIGN MAINTENANCE**

The Contractor is responsible for preparation, installation, movement, maintenance, replacement, removal and disposal of all project signs during the full course of the contract period. The Contractor will place and secure portable signs from dislocation by wind or other actions. Signs are to be cleaned as necessary to maintain legibility and immediately replaced if defaced.

## 23.8. TYPICAL PROJECT SIGN



## 24. AWARD OF CONTRACT, WORK SCHEDULE AND GUARANTEE

It will be required that the work will commence not later than five (5) calendar days after the Engineer gives written Notice to Proceed (NTP), which notice shall be given as outlined in Article 2 of these General Conditions.

It is further required that all work within this contract be completed within the indicated number of consecutive calendar days as determined in Section IV, Scope of Work. Contract Time to commence at start date noted on the Notice to Proceed. If the Contractor fails to complete the work within the stipulated time, the City will retain the amount stated in the Contract, per calendar day, for each day that the contract remains incomplete. The work shall be discontinued on Saturdays, Sundays, and approved Holidays. If it becomes necessary for the Contractor to perform work on Saturdays, Sundays, and approved City of Clearwater Employee Holidays, that in the opinion of the Engineer, will require the presence of Inspectors, the Contractor shall pay the City of

### SECTION III – General Conditions

Clearwater, Florida, the amount of Four Hundred Eighty Dollars (\$480.00) per each eight-hour (8) day for each Inspector given such assignment.

The Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one (1) year from the date of final acceptance.

## **25. SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM AND ISRAEL CERTIFICATION FORM**

Pursuant to Section 287.135, Florida Statutes, any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or is engaged in business operations in Cuba or Syria, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for an amount equal to or greater than one million (\$1,000,000.00) dollars. Any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies that Boycott Israel List, or is engaged in a boycott of Israel, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for ANY amount.

Each entity submitting a bid, proposal, or response to a solicitation must certify to the City of Clearwater that it is not on the aforementioned lists, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel at the time of submitting a bid, proposal or response, in accordance with Section 287.135, Florida Statutes. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce. Boycott Israel or boycott of Israel means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel.

The certification forms (the Certification) are attached hereto, and must be submitted, along with all other relevant contract documents, at the time of submitting a bid, proposal, or response. Failure to provide the Certification may deem the entity's submittal non-responsive. If the City of Clearwater determines that an entity has submitted a false certification form, been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel, then the contract may be terminated at the option of the City of Clearwater. Other than the submission of a false certification, the City of Clearwater, on a case-by-case basis and in its sole discretion, may allow a company to bid on, submit a proposal for, or enter into or renew a contract for goods or services, if the conditions set forth in Section 287.135, Florida Statutes, apply.

The City retains the right to pursue civil penalties and any other applicable rights and remedies as provided by law for the false submission of the attached certification forms.

**SECTION III – General Conditions**

See Section V of the Contract for Certification Forms to be executed and submitted with the Bid/Proposal Form.

## **SECTION IIIA**

### **SUPPLEMENTAL GENERAL CONDITIONS**

These Supplemental General Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplementary remain in full force and effect. The terms used in these Supplemental General Conditions have the meanings stated in the General Conditions.

**1. In Paragraph 1 Definitions, delete the definition for Contract Time in its entirety and insert the following in its place:**

*Contract Time* - The number of days or the dates stated in the Contract to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) achieve Final Completion.

**2. In Paragraph 1 Definitions, add the following new paragraph:**

*Final Completion* – The time at which the Work has progressed to the point where, in the opinion of the Engineer, the Work, including all “punch list” items, is fully and finally completed in a good and workmanlike manner, in accordance with the Contract Documents; is free of all defects and deficiencies; all required final governmental inspections and approvals have been obtained; and all final paperwork, including that necessary to prepare a Final Change Order (if required), has been submitted and approved.

**3. Delete Paragraph 2.3 in its entirety and insert the following in its place:**

#### COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED; STARTING THE PROJECT

The Contract Times will commence to run on the day indicated in the Notice to Proceed. The Contractor shall start to perform the Work on the date the Contract Time commences to run. No Work shall be done at the site prior to the date that the Contract Time commences to run. A Notice to Proceed may be issued at any time within 60 days after the Effective Date of the Agreement. A Notice to Proceed will not be issued prior to the Contractor providing the City a certified copy of the recorded payment and performance bond, pursuant to §255.05(1)(b), Florida Statutes.

**4. In Paragraph 6.1, delete the last sentence in the 4<sup>th</sup> paragraph and insert the following in its place:**

The cost of overtime inspection per hour shall be the City's actual cost per hour, not to exceed \$120 per hour. When inspection is being provided by the Engineer or a consultant to the City, the cost of overtime inspection per hour shall be 3.2 times the Engineer's or consultant's direct technical labor cost.

**5. In Paragraph 6.11.1, delete the first full sentence of the first paragraph and insert the following in its place:**

Contractor shall submit Shop Drawings and Samples as called for in the Technical Specifications, and all other items specified to be submitted in the Division 1 specifications, to Engineer for review as called for in the Technical Specifications or required by the Engineer. Items required to be submitted in accordance with Division 1 shall be submitted in accordance with the requirements for Shop Drawings as specified in the General Requirements.

**6. Delete the last paragraph in Paragraph 6.11.1 in its entirety and insert the following in its place:**

Contractor shall furnish required submittals with complete information and accuracy. Owner reserves the right to backcharge Contractor for Engineer's actual direct technical labor cost times a 3.2 multiplier for the review of any first-time submittals that account for a number greater than two hundred and fifty (250), not to exceed \$600 each. Contractor may combine or group similar items into a single submittal, such as valves or valve O&M manuals, or may group submittals pertaining to a single item into a single submittal, such as a valve shop drawing and the corresponding O&M manual. Contractor shall not combine unrelated items into a single submittal, such as valves and concrete mix. Owner reserves the right to backcharge Contractor for Engineer's actual direct technical labor cost times a 3.2 multiplier for the review of any re-submittals, or submittals requiring confirmation, that account for a number greater than seventy-five (75), not to exceed a cost of \$250 each. In the event that Contractor requests a substitution for a previously approved item, all of Engineer's costs in the reviewing and approval of the substitution will be back charged to Contractor, unless the need for such substitution is beyond the control of Contractor. Said costs shall be Engineer's actual direct technical labor cost times a 3.2 multiplier, not to exceed \$600 each.

**7. Delete Paragraph 24 in its entirety and insert the following in its place:**

## **24 CONTRACT TIMES AND LIQUIDATED DAMAGES**

### **24.1 Time is of the Essence**

24.1.1 It is mutually agreed between the parties that time is of the essence. All Contract Time(s) for Milestones, if any, Substantial Completion, Final Completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

### **24.2 Substantial Completion**

24.2.1 Contractor shall achieve Substantial Completion of the Work within five hundred ten (510) days from the date on which Owner issues Contractor a Notice to Proceed.

24.2.2 The term Substantial Completion means the time at which the Work has progressed to the point where, in the opinion of Engineer, the Work is otherwise sufficiently complete in accordance with the Contract Documents, so that the Work can be utilized for the purposes for which it is

intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

#### 24.3 Final Completion

24.3.1 Contractor shall achieve Final Completion of the Work within five hundred forty (540) days from the date on which Owner issues Contractor a Notice to Proceed.

#### 24.4 Liquidated Damages

24.4.1 Contractor and Owner recognize that time is of the essence of this Contract and that Owner will suffer financial loss if the Work is not completed within the times specified herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay as follows:

24.4.2 In the event Contractor fails to achieve Substantial Completion of the Work within the time specified above, Contractor shall be required to pay Owner the sum as specified in the Contract per day for each and every calendar day elapsing after the time specified above, until the Contractor has achieved Substantial Completion.

24.4.3 In the event Contractor fails to achieve Final Completion of the Work within the time specified above, the Owner shall also have the right to:

- A. Terminate the Contractor without further notice;
- B. Complete any of the remaining items and backcharge Contractor for all costs incurred and exercise all other rights and remedies available at law or in equity.

#### 24.5 Work Schedule

24.5.1 If the Contractor fails to complete the work within the stipulated time, the City will retain the amount stated in the Contract, per calendar day, for each day that the contract remains incomplete. The work shall be discontinued on Saturdays, Sundays, and approved Holidays. If it becomes necessary for the Contractor to perform work on Saturdays, Sundays, and approved City of Clearwater Employee Holidays, that in the opinion of the Engineer will require the presence of Inspectors, the Contractor shall reimburse the City of Clearwater, Florida, the costs for each Inspector given such assignment in accordance with the City's agreement with the Engineer to provide such services.

#### 24.6 Guarantee

24.6.1 The Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one (1) year from the date of final completion.

# **SECTION IV**

## **TECHNICAL SPECIFICATIONS**

### **Table of Content:**

<b>100 SERIES: GENERAL .....</b>	<b>1</b>
101. SCOPE OF WORK .....	1
101-1. GRIT REMOVAL, SALSNES FILTER AND EQUALIZATION SYSTEM IMPROVEMENTS .....	1
101-2. SLUDGE BLEND TANK IMPROVEMENTS .....	2
102. FIELD ENGINEERING.....	3
101-3. LINE AND GRADE PERFORMED BY THE CONTRACTOR .....	3
101-4. LINE AND GRADE PERFORMED BY THE CITY .....	4
103. DEFINITION OF TERMS .....	4
101-5. REFERENCE STANDARDS .....	4
104. STREET CROSSINGS, ETC. ....	4
105. AUDIO/VIDEO RECORDING OF WORK AREAS .....	5
101-6. CONTRACTOR TO PREPARE AUDIO/VIDEO RECORDING.....	5
101-7. SCHEDULING OF AUDIO/VIDEO RECORDING .....	5
101-8. PROFESSIONAL VIDEOGRAPHERS .....	5
101-9. EQUIPMENT .....	5
101-10. RECORDED AUDIO INFORMATION.....	5
101-11. RECORDED VIDEO INFORMATION .....	5
101-12. VIEWER ORIENTATION.....	6
101-13. LIGHTING .....	6
101-14. SPEED OF TRAVEL .....	6
101-15. VIDEO LOG/INDEX .....	6
101-16. AREA OF COVERAGE.....	6
101-17. COSTS OF VIDEO SERVICES .....	7
106. STREET SIGNS .....	7
107. WORK ZONE TRAFFIC CONTROL .....	7
101-18. CONTRACTOR RESPONSIBLE FOR WORK ZONE TRAFFIC CONTROL .....	7
101-19. WORK ZONE TRAFFIC CONTROL PLAN .....	7
101-20. ROADWAY CLOSURE GUIDELINES.....	8
101-21. APPROVAL OF WORK ZONE TRAFFIC CONTROL PLAN.....	9
101-22. INSPECTION OF WORK ZONE TRAFFIC CONTROL OPERATION .....	9
101-23. PAYMENT FOR WORK ZONE TRAFFIC CONTROL .....	9
101-24. CERTIFICATION OF WORK ZONE TRAFFIC CONTROL SUPERVISOR.....	9
108. OVERHEAD ELECTRIC LINE CLEARANCE.....	10
101-25. CLEARANCE OPTIONS.....	10
101-26. REQUIRED MINIMUM CLEARANCE DISTANCES.....	10
109. PROJECT WEB PAGES .....	11

101-27.	WEB PAGES DESIGN.....	11
101-28.	WEB ACCESSIBILITY GUIDELINES.....	11
101-29.	THE “BRIGHT & BEAUTIFUL” LOGO AND ITS USE.....	11
101-30.	MAPS AND GRAPHICS .....	11
101-31.	INTERACTIVE FORMS .....	11
101-32.	POSTING.....	12
101-33.	WEB PAGES UPDATES.....	12
<b>200 SERIES: SITEWORK.....</b>	<b>13</b>	
201.	EXCAVATION FOR UNDERGROUND WORK .....	13
202.	OBSTRUCTIONS .....	14
203.	DEWATERING .....	14
101-34.	GENERAL .....	14
101-35.	PERMIT REQUIREMENTS .....	14
204.	UNSUITABLE MATERIAL REMOVAL.....	15
101-36.	BASIS OF MEASUREMENT.....	15
101-37.	BASIS OF PAYMENT .....	15
205.	UTILITY TIE IN LOCATION MARKING .....	15
206.	CLEARING AND GRUBBING.....	16
101-38.	BASIS OF MEASUREMENT.....	16
101-39.	BASIS OF PAYMENT .....	16
207.	EROSION AND SEDIMENT CONTROL .....	16
101-40.	GENERAL .....	16
101-41.	TRAINING OF PERSONNEL .....	16
101-42.	STABILIZATION OF DENUDED AREAS .....	17
101-43.	PROTECTION AND STABILIZATION OF SOIL STOCKPILES .....	17
101-44.	PROTECTION OF EXISTING STORM SEWER SYSTEMS.....	17
101-45.	SWALES, DITCHES AND CHANNELS .....	17
101-46.	UNDERGROUND UTILITY CONSTRUCTION .....	17
101-47.	MAINTENANCE .....	17
101-48.	COMPLIANCE.....	18
208.	CONSTRUCTION AND REPAIR OF SEAWALLS AND OTHER BEACH EROSION CONTROL STRUCTURES. ....	18
101-49.	EXISTING SEAWALLS AND REVETMENTS.....	18
101-50.	TOP OF CAP ELEVATION.....	18
101-51.	SEAWALLS AND REVETMENTS LOCATED SEAWARD OF THE CCL .....	18
101-52.	PLACEMENT OF NEW SEAWALL .....	18
101-53.	POST CONSTRUCTION SURVEY .....	19
101-54.	RIP-RAP .....	19
101-55.	RETAINING WALL IN LIEU OF VERTICAL SEAWALL .....	19
<b>300 SERIES: MATERIALS.....</b>	<b>20</b>	
301.	CONCRETE .....	20
302.	EXCAVATION AND FORMS FOR CONCRETE WORK .....	20

101-56.	EXCAVATION.....	20
101-57.	FORMS .....	20
303.	REINFORCEMENT.....	20
101-58.	BASIS OF PAYMENT .....	21
304.	BACKFILL.....	21
101-59.	MATERIALS AND GENERAL .....	21
101-60.	TESTING AND INSPECTION .....	21
305.	RIPRAP .....	22
101-61.	BASIS OF MEASUREMENT.....	22
101-62.	BASIS OF PAYMENT .....	23
<b>400 SERIES:</b>	<b>SANITARY SEWER.....</b>	<b>24</b>
401.	SANITARY MANHOLES .....	24
101-63.	BUILT UP TYPE .....	24
101-64.	PRECAST TYPE .....	24
101-65.	DROP MANHOLES .....	25
101-66.	FRAMES AND COVERS .....	25
101-67.	MANHOLE COATINGS .....	25
101-68.	CONNECTIONS TO MANHOLES .....	25
402.	RAISING OR LOWERING OF SANITARY SEWER STRUCTURES .....	25
101-69.	BASIS OF PAYMENT .....	25
403.	SANITARY SEWERS AND FORCE MAINS.....	26
101-70.	MATERIALS .....	26
101-71.	INSTALLATION .....	26
101-72.	TESTING .....	27
101-73.	BASIS OF PAYMENT .....	28
404.	HDPE DEFORMED - REFORMED PIPE LINING .....	28
101-74.	INTENT .....	28
101-75.	PRODUCT AND CONTRACTOR/INSTALLER ACCEPTABILITY .....	28
101-76.	MATERIALS .....	28
101-77.	CLEANING/SURFACE PREPARATION .....	29
101-78.	TELEVISION INSPECTION .....	30
101-79.	LINER INSTALLATION .....	31
101-80.	LATERAL RECONNECTION .....	31
101-81.	TIME OF CONSTRUCTION.....	31
101-82.	PAYMENT .....	31
405.	SANITARY MANHOLE LINER RESTORATION .....	32
101-83.	SCOPE AND INTENT .....	32
101-84.	PAYMENT .....	32
101-85.	FIBERGLASS LINER PRODUCTS .....	32
101-86.	STRONG SEAL MS-2 LINER PRODUCT SYSTEM .....	33
101-87.	INFILTRATION CONTROL.....	34
101-88.	GROUTING MIX .....	34
101-89.	LINER MIX .....	34

101-90.	WATER .....	35
101-91.	OTHER MATERIALS .....	35
101-92.	EQUIPMENT .....	35
101-93.	INSTALLATION AND EXECUTION .....	36
101-94.	INNERLINE ENVIRONMENTAL SERVICES LINER PRODUCT SYSTEM .....	37

**500 SERIES: POTABLE AND RECLAIMED WATER MAINS, FIRE LINES AND APPURTEANCES .....43**

501.	SCOPE.....	43
502.	MATERIALS .....	43
101-95.	GENERAL .....	43
101-96.	PIPE MATERIALS AND FITTINGS .....	43
101-97.	GATE VALVES .....	45
101-98.	VALVE BOXES .....	46
101-99.	HYDRANTS .....	46
101-100.	SERVICE SADDLES .....	47
101-101.	TESTS, INSPECTION AND REPAIRS .....	47
101-102.	BACKFLOW PREVENTERS .....	48
101-103.	TAPPING SLEEVES .....	48
101-104.	BLOW OFF HYDRANTS.....	48
503.	CONSTRUCTION .....	48
101-105.	MATERIAL HANDLING .....	48
101-106.	PIPE LAYING .....	49
101-107.	SETTING OF VALVES, HYDRANTS AND FITTINGS .....	50
101-108.	CONNECTIONS TO EXISTING LINES .....	51
504.	TESTS .....	51
101-109.	HYDROSTATIC TESTS .....	51
101-110.	NOTICE OF TEST .....	52
505.	STERILIZATION.....	52
101-111.	STERILIZING AGENT.....	52
101-112.	FLUSHING SYSTEM .....	52
101-113.	STERILIZATION PROCEDURE .....	52
101-114.	RESIDUAL CHLORINE TESTS .....	52
101-115.	BACTERIAL TESTS.....	52
506.	MEASUREMENT AND PAYMENT.....	53
101-116.	GENERAL .....	53
101-117.	FURNISH AND INSTALL WATER MAINS .....	53
101-118.	FURNISH AND INSTALL FITTINGS .....	54
101-119.	FURNISH AND INSTALL GATE VALVES COMPLETE WITH BOXES AND COVERS .....	54
101-120.	FURNISH AND INSTALL FIRE HYDRANTS .....	54

**600 SERIES: STORMWATER.....55**

601.	RAISING OR LOWERING OF STORM DRAINAGE STRUCTURES.....	55
101-121.	BASIS OF PAYMENT .....	55

602. UNDERDRAINS.....	55
101-122. BASIS OF MEASUREMENT.....	55
101-123. BASIS OF PAYMENT .....	56
603. STORM SEWERS.....	56
101-124. TESTING AND INSPECTION .....	56
101-125. BASIS OF PAYMENT .....	57
604. STORM MANHOLES, INLETS, CATCH BASINS OR OTHER STORM STRUCTURES.....	57
101-126. BUILT UP TYPE STRUCTURES.....	57
101-127. PRECAST TYPE.....	58
101-128. BASIS OF PAYMENT .....	58
605. GABIONS AND MATTRESSES.....	58
101-129. MATERIAL .....	58
101-130. PERFORMANCE.....	59
<b>700 SERIES: STREETS AND SIDEWALKS .....</b>	<b>61</b>
701. RESTORATION OR REPLACEMENT OF DRIVEWAYS, CURBS, SIDEWALKS AND STREET PAVEMENT .....	61
702. ROADWAY BASE AND SUBGRADE.....	61
101-131. BASE .....	61
101-132. SUBGRADE .....	63
703. ASPHALTIC CONCRETE MATERIALS .....	64
101-133. ASPHALTIC CONCRETE.....	64
101-134. HOT BITUMINOUS MIXTURES – PLANT, METHODS, EQUIPMENT & QUALITY ASSURANCE .....	64
101-135. ASPHALT MIX DESIGNS AND TYPES.....	65
101-136. ASPHALT PAVEMENT DESIGNS AND LAYER THICKNESS .....	65
101-137. GENERAL CONSTRUCTION REQUIREMENTS .....	65
101-138. CRACKS AND POTHOLE PREPARATION .....	65
101-139. ADJUSTMENT OF MANHOLES .....	66
101-140. ADDITIONAL ASPHALT REQUIREMENTS.....	66
101-141. BASIS OF MEASUREMENT .....	67
101-142. BASIS OF PAYMENT .....	67
704. ADJUSTMENT TO THE UNIT BID PRICE FOR ASPHALT .....	67
705. ASPHALT DRIVEWAYS .....	68
101-143. BASIS OF MEASUREMENT .....	68
101-144. BASIS OF PAYMENT .....	68
706. CONCRETE CURBS .....	68
101-145. BASIS OF MEASUREMENT.....	68
101-146. BASIS OF PAYMENT .....	68
707. CONCRETE SIDEWALKS AND DRIVEWAYS.....	69
101-147. CONCRETE SIDEWALKS.....	69
101-148. CONCRETE DRIVEWAYS .....	69
101-149. CONCRETE CURB RAMPS .....	69

101-150. BASIS OF MEASUREMENT.....	69
101-151. BASIS OF PAYMENT .....	69
708. MILLING OPERATIONS.....	70
101-152. EQUIPMENT, CONSTRUCTION & MILLED SURFACE.....	70
101-153. ADDITIONAL MILLING REQUIREMENTS .....	70
101-154. SALVAGEABLE MATERIALS .....	71
101-155. DISPOSABLE MATERIALS .....	71
101-156. ADJUSTMENT AND LOCATION OF UNDERGROUND UTILITIES .....	71
101-157. ADJUSTMENT OF UTILITY MANHOLES .....	71
101-158. TYPES OF MILLING .....	71
101-159. MILLING OF INTERSECTIONS.....	71
101-160. BASIS OF MEASUREMENT.....	72
101-161. BASIS OF PAYMENT .....	72
<b>800 SERIES: TRAFFIC SIGNALS, SIGNS AND MARKINGS .....</b>	<b>73</b>
801. TRAFFIC SIGNAL EQUIPMENT AND MATERIALS .....	73
101-162. BASIS OF MEASUREMENT AND PAYMENT.....	73
802. SIGNING AND MARKING .....	73
101-163. BASIS OF MEASUREMENT AND PAYMENT.....	74
803. ROADWAY LIGHTING .....	74
101-164. BASIS OF MEASUREMENT AND PAYMENT.....	74
<b>900 SERIES: LANDSCAPING/RESTORATION.....</b>	<b>75</b>
901. WORK IN EASEMENTS OR PARKWAYS .....	75
902. GENERAL PLANTING SPECIFICATIONS .....	75
101-165. IRRIGATION.....	75
101-166. LANDSCAPE .....	85
903. SODDING .....	99
904. SEEDING .....	100
905. LAWN MAINTENANCE SPECIFICATIONS.....	100
101-167. SCOPE.....	100
101-168. SCHEDULING OF WORK.....	101
101-169. WORK METHODS .....	101
906. LEVEL OF SERVICE .....	103
907. COMPLETION OF WORK .....	103
908. INSPECTION AND APPROVAL .....	103
909. SPECIAL CONDITIONS.....	104
910. TREE PROTECTION .....	104
101-170. TREE BARRICADES .....	104
101-171. ROOT PRUNING .....	105
101-172. PROPER TREE PRUNING.....	106

# **100 SERIES: GENERAL**

## **101. SCOPE OF WORK**

Project Name: NE WRF Improvements

Project Number: 19-0029-UT

### **Scope of Work:**

This project is the combination of two projects that were designed separately by two different consultants. Prior to bidding, the two projects were combined into a single project for bidding and construction purposes. The scope of each project is described in this section. Technical specifications (Divisions 2 through 16) have been developed for each project and are applicable to each project only.

### **101-1. GRIT REMOVAL, SALSNES FILTER AND EQUALIZATION SYSTEM IMPROVEMENTS**

This work includes the modifications and improvements to the grit removal and primary treatment systems, installation of a new equalization basin and pumping system, and inspection and rehabilitation of existing concrete other flow channels as required.

The Work consists of, but is not limited to, the tasks described hereinafter.

1. Pretreatment System Improvements
  - a. Demolition and removal of the existing primary sludge thickener equipment and grit pumps. Modifications to the existing primary sludge thickener structure.
  - b. Installation of four stacked-tray grit removal units with four recessed impeller pumps. Installation of one new grit cyclone and new grit classifier, rehabilitation of two existing cyclones and one existing classifier. All related and associated site piping, electrical, SCADA, structural work, etc.
  - c. Demolition of and modifications to the existing odor control equipment and ductwork as shown on the drawings.
  - d. Installation of water control gates into existing flow channels and inspection and rehabilitation of those channels as warranted by the inspection.
  - e. Repair of existing concrete flow channels
2. Primary Treatment System Improvements
  - a. Demolition of two existing primary clarifiers and primary sludge pumping equipment.
  - b. Installation of three (3) Salsnes filters, three (3) filter feed pumps, three filter sludge pumps and associated site piping, electrical, SCADA, structural work, etc.
  - c. Inspection of an existing below grade box channel that conveys flow from the primary clarifiers and rehabilitation of that channel as warranted by the inspection, if required by the Owner.
3. Equalization system improvements
  - a. Demolition of and removal of an existing irrigation tank and associated structures and equipment.

- b. Installation of one (1) new glass fused-to-steel equalization tank.
  - c. Installation of two (2) return and two (2) feed pumps, and associated site piping, electrical, SCADA, structural work, etc.
  - d. Installation of a compressed gas mixing system for the equalization tank.
4. Rehabilitation and upgrade of an existing in-plant submersible duplex lift station.
  5. Design furnish and install temporary bypass pumping, screening, and grit removal equipment systems to maintain plant flow and treatment during construction of the permanent improvements. The plant must remain in service during the construction of the project. Refer to the Construction Phasing Plan for details on the order of the project construction.

## 101-2. SLUDGE BLEND TANK IMPROVEMENTS

1. Demolish the Following within the Existing Sludge Storage and Blend Tanks: FRP Covers, Agitators, Aeration Piping and Diffusers, Existing Piping (as shown in the Contract Drawings).
2. Remove Grit, Sludge, and Rags Remaining in Existing Sludge Storage and Blend Tanks and Dispose Off-Site in accordance with FDEP Regulations.
3. Temporarily remove, store, and protect FRP Odor Control Ducts for reconnection to new Storage and Blend Tank Covers.
4. Repair and Refurbish the Existing Sludge Storage and Blend Tanks and Stairs.
5. Drain, Clean, and Coat the Interior and Exterior of the Existing Sludge Storage and Blend Tanks.
6. Concrete Repair and Recoating of the Existing Pipe Trench between the North and South Blend Tanks and addition of new grating.
7. Demolition of Existing Truck Off-Loading Pump Station North of the Sludge Storage and Blend Tanks, preserving concrete for the stair column footer (as shown in the Contract Drawings).
8. Install two In-Line Grinder systems as specified on the Drawings near the Blend Tanks.
9. Install New Mixers in the Sludge Storage and Blend Tanks.
10. Install New Aluminum Covers with Access Ladders and Harness Tie-Off Points from Walkway on the Sludge Storage and Blend Tanks.
11. Install New Truck Off-Loading Pump Station east of the Sludge Storage and Blend Tanks.
12. Install Anaerobic Digester Feed Pump Station and Associated Yard Piping at the Sludge Storage and Blend Tanks.
13. Install New Canopy over New Truck Off-Loading Pump Station and Anaerobic Digester Feed Pump Station.
14. Remove and Replace Dewatering Feed Pump Station Pumps and Piping located at Sludge Storage and Blend Tanks.

15. Remove and Replace Dewatering Feed Pump Station Canopy and Concrete Foundation (as shown in the Contract Drawings).
16. Install #57 stone and geotextile fabric in the existing grassed areas (as shown in the Contract Drawings).
17. Remove concrete sidewalk and pad (as shown in the Contract Drawings), preserving the pipe trench and leaving appropriate base and support for stair landing and stair columns supports.
18. Remove and Replace process and drain piping between Storage and Blend Tanks (as shown in the Contract Drawings).
19. Modify Yard Piping of the Thickened Primary Sludge (TPSL) and Thickened Waste-Activated Sludge (TWAS) and install valve concrete pad.
20. Incorporate Electrical, Arc Flash Requirements, Instrumentation & Controls (I&C) and SCADA Integration for Proposed Improvements.

**Contract Period: 730 Consecutive Calendar Days**

## **102. FIELD ENGINEERING**

### **101-3. LINE AND GRADE PERFORMED BY THE CONTRACTOR**

Unless otherwise specified, the Contractor shall provide and pay for field engineering service required for the project. Such work shall include survey work to establish lines and levels and to locate and lay out site improvements, structures, and controlling lines and levels required for the construction of the work. Also included are such Engineering services as are specified or required to execute the Contractor's construction methods. Engineers and Surveyors shall be licensed professionals under the laws of the State of Florida. The Contractor shall provide three (3) complete sets of As-built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Article 6.11.2 of these Contract Documents.

#### **102-2.1. GRADES, LINES AND LEVELS**

Existing basic horizontal and vertical control points for the project are those designated on the Drawings or provided by the City. Control points (for alignment only) shall be established by the Engineer. The Contractor shall locate and protect control points prior to starting site work and shall preserve all permanent reference points during construction. In working near any permanent property corners or reference markers, the Contractor shall use care not to remove or disturb any such markers. In the event that markers must be removed or are disturbed due to the proximity of construction work, the Contractor shall have them referenced and reset by a Professional Land Surveyor licensed in the State of Florida.

#### **102-2.2. LAYOUT DATA**

The Contractor shall layout the work at the location and to the lines and grades shown on the Drawings. Survey notes indicating the information and measurements used in establishing locations and grades shall be kept in notebooks and furnished to the Engineer with the record drawings for the project.

## **101-4. LINE AND GRADE PERFORMED BY THE CITY**

If line and grade is supplied by the City, at the completion of all work the Contractor shall be responsible to have furnished to the project inspector a replacement of the wooden lath and stakes used in the construction of this project. Excessive stake replacement caused by negligence of Contractor's forces, after initial line and grade have been set, as determined by the City Engineer, will be charged to the Contractor at the rate of \$100.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments. Minimum charge is \$100.00. The Contractor shall provide three (3) complete sets of As-built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Article 6.11.2 of these Contract Documents.

## **103. DEFINITION OF TERMS**

For the Purpose of these Technical Specifications, the Definition of Terms from Section III, Article 1 - Definitions of these Contract Documents shall apply.

For the purpose of the Estimated Quantities, the Contractor's attention is called to the fact that the estimate of quantities as shown on the Proposal is approximate and is given only as a basis of calculation upon which the award of the contract is to be made. The City does not assume any responsibility that the final quantities will remain in strict accordance with estimated quantities nor shall the Contractor plead misunderstandings or deception because of such estimate of quantities or of the character or location of the work or of other conditions or situations pertaining thereto.

## **101-5.REFERENCE STANDARDS**

Reference to the standards of any technical society, organization, or associate, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published at the date of receipt of bids, unless specifically stated otherwise.

The most stringent specification prevails in the case where more than one specification is referenced for the same task.

Contractor shall utilize applicable FDOT Standards and Specifications for tasks that are not covered by City's Standards and Specifications.

## **104. STREET CROSSINGS, ETC.**

At such crossings, and other points as may be directed by the Engineer, trenches shall be bridged in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalk, and also to afford necessary access to public or private premises. The material used, and the mode of constructing said bridges, and the approaches, thereto, must be satisfactory to the Engineer.

The cost of all such work must be included in the cost of the trench excavation.

## **105. AUDIO/VIDEO RECORDING OF WORK AREAS**

### **101-6.CONTRACTOR TO PREPARE AUDIO/VIDEO RECORDING**

Prior to commencing work, the Contractor shall have a continuous color audio/video recording taken along the entire length of the Project including all affected project areas. Streets, easements, rights-of-way, lots or construction sites within the Project must be recorded to serve as a record of pre-construction conditions.

### **101-7.SCHEDULING OF AUDIO/VIDEO RECORDING**

The video recordings shall not be made more than twenty-one (21) days prior to construction in any area.

### **101-8.PROFESSIONAL VIDEOGRAPHERS**

The Contractor shall engage the services of a professional videographer. The color audio/video recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio/video recording documentation.

### **101-9.EQUIPMENT**

All equipment, accessories, materials and labor to perform this service shall be furnished by the Contractor. The total audio/video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions. In some instances, audio/video coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking.

### **101-10. RECORDED AUDIO INFORMATION**

Each recording shall begin with the current date, project name and be followed by the general location, i.e., viewing side and direction of progress. Accompanying the video recording of each video shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator or aide, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversations.

### **101-11. RECORDED VIDEO INFORMATION**

All video recordings must continuously display transparent digital information to include the date and time of recording. The date information shall contain the month, day and year. The time information shall contain the hour, minutes and seconds. Additional information shall be displayed periodically. Such information shall include, but not be limited to, project name, contract number, direction of travel and the viewing side. This transparent information shall appear on the extreme upper left hand third of the screen. Camera pan, tilt, zoom-in and zoom out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video playback. In

addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chrome, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

## **101-12. VIEWER ORIENTATION**

The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the video viewer, highly visible yellow flags shall be placed by the Contractor in such a fashion as to clearly indicate the proposed centerline of construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed ten feet (10'). The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.

## **101-13. LIGHTING**

All recording shall be done during time of good visibility. No videoing shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

## **101-14. SPEED OF TRAVEL**

The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within the construction area's zone of influence. The rate of speed in the general direction of travel of the vehicle used during videoing shall not exceed forty-four (44) feet per minute.

## **101-15. VIDEO LOG/INDEX**

All videos shall be permanently labeled and shall be properly identified by video number and project title. Each video shall have a log of that video's contents. The log shall describe the various segments of coverage contained on the video in terms of the names of the streets or location of easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering survey or coordinate values (if reasonably available) and the date.

## **101-16. AREA OF COVERAGE**

Video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, drainage system features, mailboxes, landscaping, culverts, fences, signs, Contractor staging areas, adjacent structures, etc., within the area covered by the project. Of particular concern shall be the existence of any faults, fractures, or defects. Taped coverage shall be limited to one side of the Site, street, easement or right of way at any one time.

## **101-17. COSTS OF VIDEO SERVICES**

The cost to complete the requirements under this section shall be included in the contract items provided in the proposal sheet. There is no separate pay item for this work.

## **106. STREET SIGNS**

The removal, covering or relocation of street signs by the Contractor is prohibited.

All street signs shall be removed, covered or relocated by the City's Traffic Engineering Division in accordance with Sections 700, 994, 995, and 996 of FDOT's Standard Specifications.

The Contractor shall notify the City's Traffic Engineering Division a minimum of twenty-four (24) hours in advance of the proposed sign relocation, covering or removal.

## **107. WORK ZONE TRAFFIC CONTROL**

### **101-18. CONTRACTOR RESPONSIBLE FOR WORK ZONE TRAFFIC CONTROL**

The Contractor shall be responsible to furnish, operate, maintain and remove all work zone traffic control associated with the Project, including detours, advance warnings, channelization, hazard warnings and any other necessary features, both at the immediate work site and as may be necessary at outlying points.

### **101-19. WORK ZONE TRAFFIC CONTROL PLAN**

The Contractor shall prepare a detailed traffic control plan designed to accomplish the level of performance outlined in the Scope of the Work and/or as may be required by construction permits issued by Pinellas County and/or the Florida Department of Transportation for the Project, incorporating the methods and criteria contained in Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations in the Manual on Uniform Traffic Control Devices published by the U.S. Department of Transportation and adopted as amended by the Florida Department of Transportation, or most recent addition. This plan shall be reviewed and approved by City Traffic Operations personnel regardless if MOT plan details are included in the contract plans.

#### **107-2.1. WORK ZONE SAFETY**

The general objectives of a program of work zone safety are to protect workers, pedestrians, bicyclists and motorists during construction and maintenance operations. This general objective may be achieved by meeting the following specific objectives:

- Provide adequate advance warning and information regarding upcoming work zones.
- Provide the driver clear directions to understanding the situation they will be facing as the driver proceeds through or around the work zone.
- Reduce the consequences of an out of control vehicle.
- Provide safe access and storage for equipment and material.
- Promote speedy completion of projects (including thorough cleanup of the site).

- Promote use of the appropriate traffic control and protection devices.
- Provide safe passageways for pedestrians through, in, and/or around construction or maintenance work zones.

Per the 2014 Design Standards (DS), Index 600 or latest revision:

“When an existing pedestrian way or bicycle way is located within a traffic control work zone, accommodation must be maintained and provision for the disabled must be provided. Only approved pedestrian longitudinal channelizing devices may be used to delineate a temporary traffic control zone pedestrian walkway. Advanced notification of sidewalk closures and marked detours shall be provided by appropriate signs.”

Per the 2014 Standard Specifications for Road and Bridge Construction or latest revision

FDOT Design Standards (DS): 102-5 Traffic Control, 102-5.1 Standards, are the minimum standards for the use in the development of all traffic control plans.

## **101-20. ROADWAY CLOSURE GUIDELINES**

Roadway types: Major Arterials, Minor Arterials, Local Collectors, and Local

Following are typical requirements to be accomplished prior to closure. The number of requirements increases with traffic volume and the importance of access. Road closures affecting business or sole access routes will increase in process requirements as appropriate. For all but local streets, no road or lane closures are allowed during the Christmas holiday season and the designated “Spring Break” season without prior approval by the City Engineer.

### **107-2.2. ALL ROADWAYS**

Obtain permits for Pinellas County or Florida Department of Transportation roadways.

Traffic control devices conform to national and state standards.

#### **107-2.2.1. PUBLIC NOTIFICATION**

Standard property owner notification prior to start of construction for properties directly affected by the construction process.

### **107-2.3. MAJOR ARTERIALS, MINOR ARTERIALS, LOCAL COLLECTORS**

Consult with City Traffic Division staff for preliminary traffic control options.

Develop Formal Traffic Control Plan for Permit Submittal to Regulatory Agency as necessary.

#### **107-2.3.1. PUBLIC NOTIFICATION**

Message Board Display, Minimum of seven (7) day notice period prior to road closure and potentially longer for larger highway. The message board is to be provided by the Contractor.

## **107-2.4. MAJOR ARTERIALS, MINOR ARTERIALS**

### **107-2.4.1. PUBLIC NOTIFICATION**

C-View Release

## **107-2.5. MAJOR ARTERIALS**

### **107-2.5.1. PUBLIC NOTIFICATION**

News Release

The Message Board may need to be displayed for a period longer than seven (7) days.

## **101-21. APPROVAL OF WORK ZONE TRAFFIC CONTROL PLAN**

The Contractor is invited and encouraged to confer in advance of bidding, and is required, as a specification of the work, to confer in advance of beginning any work on the Project, with the Traffic Operations Division, Municipal Services Building, 100 South Myrtle Avenue, telephone (727) 562-4747, for the purpose of approval of the Contractor's proposed detailed traffic control plan. All maintenance of traffic (MOT) plans shall be signed and sealed by a Professional Engineer or an individual who is certified in the preparation of MOT plans in the State of Florida.

## **101-22. INSPECTION OF WORK ZONE TRAFFIC CONTROL OPERATION**

The Traffic Operations Division may inspect and monitor the traffic control plan and traffic control devices of the Contractor. The City's Construction Inspector assigned to the project, may make known requirements for any alterations or adjustments to the traffic control devices. The Contractor shall take direction from the Project Engineer or Project Inspector.

## **101-23. PAYMENT FOR WORK ZONE TRAFFIC CONTROL**

Payment for work zone traffic control is a non-specific pay item to be included in the construction costs associated with other specific pay items unless specifically stated otherwise.

## **101-24. CERTIFICATION OF WORK ZONE TRAFFIC CONTROL SUPERVISOR**

The City may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current International Municipal Signal Association, Work Zone Traffic Control Safety Certification or Worksite Traffic Supervisor Certification from the American Traffic Safety Association with additional current Certification from the Florida Department of Transportation. This requirement for Certification will be noted in the Scope of Work and/or sections of these Technical Specifications. When the certified supervisor is required for the Project, the supervisor will be on the Project site at all times while work is being conducted.

The Worksite Traffic Supervisor shall be available on a twenty-four (24) hour per day basis and shall review the project on a day-to-day basis as well as being involved in all changes to traffic control. The Worksite Traffic Supervisor shall have access to all equipment and materials needed

to maintain traffic control and handle traffic related situations. The Worksite Traffic Supervisor shall ensure that routine deficiencies are corrected within a twenty-four (24) hour period.

The Worksite Traffic Supervisor shall be available on the site within 45 minutes after notification of an emergency situation, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

Failure of the Worksite Traffic Supervisor to comply with the provisions of this Subarticle may be grounds for decertification or removal from the project or both. Failure to maintain a designated Worksite Traffic Supervisor or failure to comply with these provisions will result in temporary suspension of all activities except traffic and erosion control and such other activities deemed to be necessary for project maintenance and safety.

## **108. OVERHEAD ELECTRIC LINE CLEARANCE**

### **101-25. CLEARANCE OPTIONS**

When working in the vicinity of overhead power lines, the Contractor shall utilize one of the following options:

Option 1 - Having the power lines de-energized and visibly grounded.

Option 2 - Maintaining a minimum distance of twenty feet (20') of clearance for voltages up to 350 kV and fifty feet (50') of clearance for voltages more than 350 kV.

Option 3 - Determine the line voltage and provide clearance in accordance with the following table.

### **101-26. REQUIRED MINIMUM CLEARANCE DISTANCES**

VOLTAGE (nominal, kV, alternating current)	MINIMUM CLEARANCE DISTANCE (feet)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45
Over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electric power transmission and distribution)

Note: The value that follows “to” is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

## **109. PROJECT WEB PAGES**

### **101-27. WEB PAGES DESIGN**

If requested by the City, Engineer shall design the Project Web Site in accordance with the current City Web Site standards and styles. Project Web Site should include general project information as: Project Name & Number, Scope description, Location, Schedule, and Project Contacts.

**Note:** Occasionally City modifies the general design of the City’s Web Site, and the Engineer shall consult the City Webmaster for the current requirements, before designing or updating the Project Web Pages.

### **101-28. WEB ACCESSIBILITY GUIDELINES**

Project Web Pages should conform to the W3C Web Accessibility Guidelines and US Section 508 guidelines whenever possible:

<http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/>

<http://www.section508.gov/>

In particular, use of variable-width tables, user-adjustable/relative font sizes, ALT text for images, CSS whenever possible, etc. Accessibility should be a priority over design/aesthetics.

### **101-29. THE “BRIGHT & BEAUTIFUL” LOGO AND ITS USE**

The City’s “Bright & Beautiful” logo should be used for everyday business, on all print and electronic material. It should be used on all internal correspondence, brochures, advertising, vehicles, apparel and signage. It should be used only in the manner presented here, in the proportion shown here, with no alterations. It should not be condensed, lengthened, or otherwise distorted to fit a space. The logo is approved for use by City departments and is not to be used by outside vendors without the permission of the City Manager, Assistant City Manager or Public Communications office. Electronic versions of the logo should be obtained from Public Communications.

### **101-30. MAPS AND GRAPHICS**

Use of maps and graphics is recommended to illustrate the project; only approved graphics should be posted to the Project Web Pages.

### **101-31. INTERACTIVE FORMS**

The site should also include an interactive form or other options to allow the Public’s input sent back to the City regarding the Project.

## **101-32. POSTING**

The site should be presented to the City’s Webmaster for review and posting to the City’s Web Server. Posting of the Project Web Pages to a different server than City’s Web server, if approved, should be coordinated with the City’s Webmaster for resolving all accessibility and conformity issues.

## **101-33. WEB PAGES UPDATES**

Unless otherwise specified and agreed, Engineer is responsible for keeping the posted Web Pages up-to-date, by sending revisions and updates through the City Project Manager to the City’s Webmaster for posting.

## **200 SERIES: SITEWORK**

### **201. EXCAVATION FOR UNDERGROUND WORK**

The Contractor is responsible to take all necessary steps to conduct all excavation in a manner which provides for the successful completion of the proposed work while at all times maintaining the safety of the workmen, the general public and both public and private property. The Contractor's methods of work will be consistent with the standard practices and requirements of all appropriate Safety Regulatory Agencies, particularly the Occupational Safety and Health Administration (OSHA) requirements for excavation. Unless otherwise specifically stated in these plans and specifications, the methods of safety control and compliance with regulatory agency safety requirements are the full and complete responsibility of the Contractor.

For the purposes of the Contractor's safety planning in the bidding process, the contractor is to consider all excavation to be done in the performance of this contract to be in soil classified as OSHA "Type C". The Contractor's attention is called to specific requirements of OSHA for excavation shoring, employee entry, location of excavated material adjacent to excavation, the removal of water from the excavation, surface encumbrances and in particular the requirement of a "Competent Person" to control safety operations. The Contractor will identify their Competent Person to City staff at the start of construction.

City staff is required from time to time to perform inspections, tests, survey location work, or other similar activity in an excavation prepared by the Contractor. City staff, in conformance with the OSHA Excavation Safety Requirements, is to only enter an excavation in compliance with these OSHA standards. The City's staff reserve the option to refuse entry into the Contractor's excavation if, in the opinion of the City's staff, the entry into the Contractor's excavation is unsafe or does not conform to OSHA requirements. If this circumstance occurs, the Contractor must either provide the necessary safety requirements or provide alternate means for the accomplishment of the City's work at the Contractor's expense.

The construction quantities, if any, contained in the bid proposal for this contract do not contain sufficient quantities to allow the Contractor to perform excavation work using strictly the "open cut" method whereby no shoring systems are used and trench side slopes are cut to conform to OSHA safety requirements without a shoring system. In addition to safety reasons, the Contractor is required to use excavation and trench-shoring methods in compliance with all safety requirements which allow the Contractor to control the amount of restoration work necessary to complete the project.

Not more than four hundred feet (400') of trench shall be opened at one time in advance of the completed work unless written permission is received from the Engineer for the distance specified. For pipe installation projects, the trench shall be a minimum of six inches (6") wider on each side than the greatest external horizontal width of the pipe or conduit, including hubs, intended to be laid in them. The bottom of the trench under each pipe joint shall be slightly hollowed, to allow the body of the pipe to rest throughout its length. In case a trench is excavated at any place, excepting at joints, below the grade of its bottom as given, or directed by the Engineer, the filling and compaction to grade shall be done in such manner as the Engineer shall direct, without compensation.

## **202. OBSTRUCTIONS**

Any pipes, conduits, wires, mains, footings, driveways, or other structures encountered shall be carefully protected from injury or displacement. Any damage thereto shall be fully, promptly, and properly repaired by the Contractor to the satisfaction of the Engineer and the owner thereof. Any survey monument or benchmark which must be disturbed shall be carefully referenced before removal, and unless otherwise provided for, shall be replaced upon completion of the work by a registered land surveyor. Any concrete removed due to construction requirements shall be removed to the nearest expansion joint or by saw cut. Contractor shall consult Inspector for the approved means.

## **203. DEWATERING**

### **101-34. GENERAL**

Unless specifically authorized by the Engineer, all pipe, except subdrains, shall be laid "in the dry". The Contractor shall dewater trench excavation as required for the proper execution of the work, using one or more of the following approved methods: well point system, trenched gravity underdrain system, or sumps with pumps.

Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining a high vacuum, and at the same time, of handling large volumes of air as well as of water.

The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. Contractor shall not dam, divert, or cause water to flow in excess in existing gutters, pavements or other structures: and to do this Contractor may be required to divert the water to a suitable place of discharge as may be determined by the Engineer. Where possible, Contractor may contain produced groundwater on the project site, a dewatering plan must be submitted to the City for approval if a discharge permit is not obtained or required.

The cost of dewatering shall be included in the unit price bid per linear foot of pipe, or, in the case of other underground structures, in the cost of such structures.

### **101-35. PERMIT REQUIREMENTS**

#### **203-2.1. DEWATERING DISCHARGE**

The Contractor shall be responsible for submitting the Notice of Intent to use the Generic Permit for the Discharge of Groundwater from Dewatering Operations and associated fee in accordance with Florida DEP Requirements, F.A.C. 62-621.300(2)(b) prior to discharging of produced groundwater into the City's streets, storm sewers or waterways.

Prior to construction, a dewatering plan must be prepared and submitted to the City for review. It shall include site-specific notes and details presenting the Contractor's proposed dewatering and disposal methods. The City will field-inspect the dewatering operation throughout construction.

## **204. UNSUITABLE MATERIAL REMOVAL**

All unsuitable material, such as muck, clay, rock, etc., shall be excavated from under pipes, structures and roadways and removed from the site. All material removed is property of the Contractor, who shall dispose of said material off-site at their expense. The limits and depths of the excavation shall be determined in the field by the Engineer.

### **101-36. BASIS OF MEASUREMENT**

The basis of measurement shall be the number of cubic yards of clean fill placed as determined by either cross sections of the excavation, truck measure, or lump sum as specified in the Scope of Work and Contract Proposal. Included in the cost of cubic yards of suitable material placed is the removal, hauling and disposal of unsuitable material.

### **101-37. BASIS OF PAYMENT**

The unit price for the removal of unsuitable material shall include: all materials, equipment, tools, labor, disposal, hauling, excavating, dredging, placing, compaction, dressing surface and incidentals necessary to complete the work. If no pay item is given, the removal of unsuitable material shall be included in the most appropriate bid item.

## **205. UTILITY TIE IN LOCATION MARKING**

The tie in locations for utility laterals of water, sanitary sewer, and gas shall be plainly marked on the back of the curb. Marking placed on the curb shall be perpendicular with respect to the curb of the tie in location on the utility lateral. Marks shall not be placed on the curb where laterals cross diagonally under the curb. The tie in location shall be the end of the utility lateral prior to service connection.

Markings shall be uniform in size and shape and colors in conformance with the code adopted by the American Public Works Association as follows:

SAFETY RED	Electric power, distribution & transmission Municipal Electric Systems
HIGH VISIBILITY SAFETY YELLOW	Gas Distribution and Transmission Oil Distribution and Transmission Dangerous Materials, Produce Lines, Steam Lines
SAFETY ALERT ORANGE	Telephone and Telegraph Systems Police and Fire Communications Cable Television
SAFETY PRECAUTION BLUE	Water Systems, Slurry Pipe Lines and Potable Water
SAFETY GREEN	Sewer Systems
LAVENDER	Reclaimed Water, Irrigation and Slurry Lines

WHITE	Proposed Excavation
PINK	Temporary Survey Markings

Marks placed on curbs shall be rectangular in shape and placed with the long dimension perpendicular to the flow line of the curb. Marks placed on valley gutter and modified curb shall be six inch (6") x three inch (3") and placed at the back of the curb. Marks placed on State Road and vertical curb shall be four inch (4") x two inch (2") and be placed on the curb face.

## **206. CLEARING AND GRUBBING**

The work included in this specification includes the removal and disposal of all structures, appurtenances, asphalt, concrete, curbs, walls, trees, roots, vegetation, boulders, conduits, poles, posts, pipes, inlets, brush, stumps, debris and other obstructions resting on or protruding through the ground surface necessary to prepare the area for construction.

Clearing and grubbing shall be performed in accordance with Section 110 of FDOT's Standard Specifications. Unless otherwise specified in the contract documents, the Contractor shall take ownership of all removed material and dispose of them off-site in accordance with all Local, State and Federal Requirements.

### **101-38. BASIS OF MEASUREMENT**

The basis of measurement shall be either a lump sum quantity or the number of acres cleared and grubbed as specified on the plans or directed by the Engineer.

### **101-39. BASIS OF PAYMENT**

The pay item for clearing and grubbing shall include: all removal and disposal of materials and structures as well as all materials, hauling, equipment, tools, labor, leveling of terrain, landscape trimming and all incidentals necessary to complete the work.

## **207. EROSION AND SEDIMENT CONTROL**

### **101-40. GENERAL**

Erosion and sediment control shall conform to the requirements of the FDOT Standard Specifications for Prevention, Control, and Abatement of Erosion and Water Pollution. Contractor shall use temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the City of Clearwater Standard Indices.

### **101-41. TRAINING OF PERSONNEL**

The City may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current Florida Department of Environmental Protection (FDEP) Florida Stormwater, Erosion, and Sedimentation Control Inspector Training & Certification. All personnel working on the Project shall complete illicit discharge training once per calendar year. Contractor shall provide documentation to the City prior to Notice To Proceed. Example of training and

training sign-in sheet will be provided by the City to the Contractor at the Pre-Construction Meeting.

## **101-42. STABILIZATION OF DENUDED AREAS**

No disturbed area may be denuded for more than thirty (30) calendar days unless otherwise authorized by the City Engineer. During construction, denuded areas shall be covered by mulches such as straw, hay, filter fabric, seed and mulch, sod, or some other temporary vegetation. Within sixty (60) calendar days after final grade is established on any portion of a project site, that portion of the site shall be provided with established permanent soil stabilization measures per the original site plan, whether by impervious surface or landscaping.

## **101-43. PROTECTION AND STABILIZATION OF SOIL STOCKPILES**

Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present. In no case shall an unstabilized stockpile remain after thirty (30) calendar days.

## **101-44. PROTECTION OF EXISTING STORM SEWER SYSTEMS**

During construction, all storm sewer inlets in the vicinity of the project shall be protected by temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the City of Clearwater Standard Indices, or equals approved by the City Engineer before installation.

## **101-45. SWALES, DITCHES AND CHANNELS**

All swales, ditches and channels leading from the site shall be sodded within three (3) days of excavation. All other interior swales, etc., including detention areas will be sodded prior to issuance of a Certificate of Occupancy.

## **101-46. UNDERGROUND UTILITY CONSTRUCTION**

The construction of underground utility lines and other structures shall be done in accordance with the following standards: no more than 400 linear feet of trench shall be open at any one time; and, wherever consistent with safety and space consideration, excavated material shall be cast to the uphill side of trenches. Trench material shall not be cast into or onto the slope of any stream, channel, road ditch or waterway.

## **101-47. MAINTENANCE**

All erosion and siltation control devices shall be checked regularly, especially after each rainfall and will be cleaned out and/or repaired as required.

## **101-48. COMPLIANCE**

Failure to comply with the aforementioned requirements may result in a fine and/or more stringent enforcement procedures such as (but not limited to) issuance of a "Stop Work Order".

## **208. CONSTRUCTION AND REPAIR OF SEAWALLS AND OTHER BEACH EROSION CONTROL STRUCTURES.**

Other beach erosion control structures, accompanied by a certified survey showing the location of the groin or other beach erosion control structure and adjoining groins or other beach erosion control structures, shall be presented to the city council for final approval. Where steps are necessary to provide access along the beach to the public, then such steps shall be shown as part of the plan for groin construction prior to issuance of the permit, and such steps shall be constructed and maintained in a safe condition at all times.

## **101-49. EXISTING SEAWALLS AND REVETMENTS**

Existing seawalls and revetments on natural waterbodies may be replaced with a revetment or with a vertical seawall with the provision of rip rap placed at the base of the wall up to the mean high water line for the entire length of the seawall. Revetments and seawalls may be replaced with a vertical seawall in manmade waterbodies, provided that the seawall is within the property line and maintains the established shoreline.

## **101-50. TOP OF CAP ELEVATION**

The top of cap elevation for all replacement and new seawalls and seawall caps shall not exceed 4.8 feet N.A.V.D. If the top of a seawall cap is constructed at an elevation differing from the adjacent property owner top of cap elevation by greater than one foot, then a return wall is required to sufficiently provide for the break in grade at the property line. Seawalls exceeding 4.8 feet N.A.V.D. in height prior to the effective date of this article may be maintained, repaired and replaced to their current height.

## **101-51. SEAWALLS AND REVETMENTS LOCATED SEAWARD OF THE CCL**

Seawalls and revetments located seaward of the coastal construction setback line are controlled by regulations of the Division of Beaches and Shores of the Florida Department of Environmental Protection. Replacement of a seawall or revetment that is located seaward of the coastal construction setback line necessitates submission of a permit application to the state department of environmental protection.

## **101-52. PLACEMENT OF NEW SEAWALL**

The placement of a new seawall waterward of an existing seawall is permitted, subject to the following conditions:

- (a) A Florida registered professional engineer must certify the new seawall design.
- (b) The new seawall shall not extend more than 18 inches from the waterward face of the original alignment of the existing vertical seawall location.

- (c) The new seawall shall be placed vertically plumb.
- (d) Placing a seawall in front of an existing seawall shall only be permitted once unless the seawall behind the new seawall is removed.
- (e) Existing seawall sections that interfere with new seawall location shall be removed.
- (f) The new seawall shall include an adequate closure of gaps at each property line.
- (g) For zoning purposes, the setbacks for the property will be measured from either the property line or the waterside of the original seawall slab, whichever is more restrictive, and will not be adjusted to accommodate the new seawall addition. For purposes of pier construction, the shore normal dimensions will be measured from the waterside of the original seawall slab.

## **101-53. POST CONSTRUCTION SURVEY**

Prior to final inspection and approval of a new or replacement seawall or seawall cap, a post-construction survey shall be required. Repairs of existing seawalls and seawall caps which do not alter the height or location shall not be subject to this requirement.

## **101-54. RIP-RAP**

On all-natural waterways, an apron of rip-rap shall be placed at the base of all new and repaired seawalls up to the mean high water line for the entire length of the seawall to absorb the wave energy and protect the underlying soft earth or sand from being carried away, as well as to provide habitat for desirable marine species. This rip-rap shall be required at the base of all new seawalls and at the time that an existing seawall is repaired where the replacement constitutes greater than 50 percent of the entire length of the seawall or includes the replacement of a panel.

## **101-55. RETAINING WALL IN LIEU OF VERTICAL SEAWALL**

A retaining wall may be built as an alternative to a vertical seawall, provided that all activities, including dredging, filling, slope grading, or equipment access and similar activities and all portions of the wall are located landward of the mean high water line.

## **300 SERIES: MATERIALS**

### **301. CONCRETE**

The Contractor shall notify the Construction Inspector or City a minimum of twenty-four (24) hours in advance of all concrete placement.

Unless otherwise noted elsewhere or directed, the following requirements shall be adhered to:

All concrete work shall be performed in accordance with the latest editions of the Design and Control of Concrete Mixtures by the Portland Cement Association, the American Concrete Institute, and FDOT's Standard Specifications. Unless otherwise specified, all concrete shall have fiber mesh reinforcing and have a minimum compressive strength of 3000 psi at twenty-eight (28) days. The cement type shall be Type I and shall conform to AASHTO M-85. The aggregate shall conform to ASTM C-33. All ready-mix concrete shall conform to ASTM C-94. The slump for all concrete shall be in the range of three inches (3") to five inches (5"), except when admixtures or special placement considerations are required.

All concrete shall be tested in the following manner:

Placement of less than five cubic yards (5 cy) shall be tested at the Engineer's discretion. Otherwise, for each class, for each day, for every 50 cy or part thereof exceeding five cubic yards (5 cy), one set of three (3) compressive strength cylinders will be required (1 at 7 days and 2 at 28 days). At the discretion of the Engineer, unacceptable test results may require the Contractor to provide further tests, as determined by the Engineer, to determine product acceptability, or need for removal, and compensation or denial thereof.

### **302. EXCAVATION AND FORMS FOR CONCRETE WORK**

#### **101-56. EXCAVATION**

Excavating for concrete work shall be made to the required depth of the subgrade or base upon which the concrete is to be placed. The base or subgrade shall be thoroughly compacted to a point six inches (6") outside said concrete work before the forms are placed.

#### **101-57. FORMS**

Forms for concrete work shall be either wood or metal, except curbs. Curb forms shall be metal only, unless at radius, intermittent sections less than ten (10) linear feet or by written permission from Engineer. They shall be free from warps or bends, shall have a depth equal to the dimensions required for the depth of the concrete deposited against them and shall be of sufficient strength when staked to resist the pressure of concrete without moving or springing.

### **303. REINFORCEMENT**

When required, reinforcement shall be placed in the concrete work. Bar reinforcement shall be deformed: ASTMA-A 615, steel shall be billet Intermediate or Hard Grade: Rail Steel A.A.S.H.T.O. M42. Twisted Bars shall not be used, Fabric Reinforcement shall conform to the requirements of AASHTO M55 (ASTM A185). Welded deformed steel wire fabric for Concrete reinforcement shall meet the requirements of AASHTO M 221 (ASTM A497). Welded wires shall

be elevated by the use of chairs. Epoxy coated reinforcing Steel Bars shall meet ASTM A775/A77 requirements.

## **101-58. BASIS OF PAYMENT**

Reinforcement shall not be paid for separately. The cost of such work shall be included in the contract unit price for the item of work specified.

## **304. BACKFILL**

### **101-59. MATERIALS AND GENERAL**

Material for backfill other than under Gabion mattress shall be carefully selected from the excavated material or from other sources as may be required by the Engineer. Such material shall be granular, free from clay, muck, organic matter or debris, contain no rocks or other hard fragments greater than three inches (3") in the largest dimension and all fill shall be similar material.

Material for backfill under Gabion mattress shall be an A-1 soil meeting AASHTO M145.

Backfill shall be carried up evenly in layer not exceeding eight inches (8") in thickness and shall be compacted into place by mechanical tamping before the next layer is applied. A hydro-hammer shall not be used for compaction. Backfill placed around pipes shall be carefully placed around the sides and top of pipe by hand shovels and thoroughly compacted to twelve inches (12") above the pipe by tamping or other suitable means.

For backfill in small areas that do not permit any type of tamping, Contractor may use flowable fill to achieve required density. Flowable fill shall adhere to Section 121 of FDOT specifications.

Where wet conditions are such that dewatering by normal pumping methods would not be effective, as determined by the Engineer, Contractor may use #57 stone (meeting FDOT's specifications) and hand tamping until backfill has reached an elevation and condition such as to make the use of the mechanical tampers practical. Fully wrap the stones with a layer of Type D filter fabric of FDOT Index 199. Do not place stones within four feet (4') of the ends of trench or ditch; use normally accepted backfill material at the ends.

Where new cast-in-place concrete work is performed, do not place backfill until the specified twenty-eight (28) days compressive strength occurs.

Do not allow heavy construction equipment to cross over pipes or culverts until placing and compacting backfill material to the finished earthwork grade or to an elevation of at least four feet (4') above the top of the pipe or culvert.

The cost of backfill, flowable fill, alternative approved material for wet conditions, and extra dewatering effort to achieve required density, etc., shall be included in the contract unit price or lump sum price for the item of the work specified.

## **101-60. TESTING AND INSPECTION**

Contractor shall employ and pay for the services of an independent testing laboratory, approved by the Owner, to perform density testing on backfilled material. All testing shall be witnessed by

the Owner's Representative. The test shall be repeated until satisfactory results are obtained. The Contractor shall be charged for all retests and re-inspection services.

Backfill under all type of impervious areas and around structures: Backfill in these areas shall be compacted to a minimum of 98% Modified Proctor Test in accordance with ASTM D 1557 or ASSHTO T 180. Tests shall be performed up to the proposed bottom of pavement elevation.

Backfill outside of impervious areas: Backfill in these areas shall be compacted to a minimum of 95% Standard Proctor Test in accordance with ASTM D-698 or AASHTO T-99. Tests shall be performed up to the proposed finished grade.

**Backfill Testing:** The Contractor shall demonstrate the adequacy of backfill compaction by performing density testing. For each test location, density testing shall be performed at eight inch (8") lifts. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D 1556) or liquid displacement methods (ASTM D 2167). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The Contractor shall furnish all equipment, tools, and labor to prepare the test site for testing.

**Normal Testing Frequency:** One test shall be performed for each one hundred feet (100') of backfill or fraction thereof or for each single run of pipe/culvert connecting two (2) successive structures whichever is less. The location of the test within each section shall be selected by the Owner's Representative. Testing shall progress as each one hundred foot (100') section is completed. Four (4) tests equally spaced around each structure shall be performed on each eight inch (8") lift. Testing which indicates that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill.

**Expanded Testing Requirements:** If normal testing within a testing section indicates unacceptable backfill, the Owner's Representative may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required by the Owner's Representative shall be paid for by the Contractor and shall not exceed testing of four (4) additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the Contractor at no additional cost to the Owner. Additional testing beyond that required may be performed by the Contractor at his expense to further delineate limits of unacceptable backfill.

## **305. RIPRAP**

The work included in this specification includes the construction of riprap as shown on the plans. The riprap shall be constructed per Section 530 of FDOT's Standard Specifications.

### **101-61. BASIS OF MEASUREMENT**

The basis of measurement for riprap shall be the dry weight in tons.

## **101-62. BASIS OF PAYMENT**

The pay item for sand-cement riprap shall include: all materials, testing, labor, grout, hauling, equipment, excavation, backfill, dressing and shaping for placement of sand-cement and all incidentals necessary to complete the work.

The pay item for rubble riprap shall include: all materials, required bedding stone, dressing and shaping for placement of bedding stone, filter fabric, testing, hauling, excavating, backfill, dressing and shaping for placement of rubble, and all incidentals necessary to complete the work. No payment will be granted if concrete or stone that exists on-site is used as rubble riprap.

## **400 SERIES: SANITARY SEWER**

### **401. SANITARY MANHOLES**

#### **101-63. BUILT UP TYPE**

Manholes shall be constructed of brick with cast iron frames and covers as shown on the drawings. Invert channels shall be constructed smooth and semicircular in shape conforming to inside of adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be formed by one of the following methods: form directly into concrete manhole base, build up with brick and mortar, lay half tile in concrete, or lay full section of sewer pipe through manhole and break out top half of pipe.

The manhole floor outside of channels shall be made smooth and sloped toward channels.

Free drop in manholes from inlet pipe invert to top of floor outside the channels shall not exceed twenty four inches (24").

Standard Drop Manholes shall be constructed wherever free drop exceeds twenty four inches (24").

Manhole steps shall not be provided. Joints shall be completely filled, and the mortar shall be smoothed from inside of manholes.

The entire interior and exterior of brick manholes shall be plastered with one half inch (1/2") of mortar.

Brick used may be solid only. Brick shall be laid radially with every sixth course being a stretcher course.

#### **101-64. PRECAST TYPE**

Precast Sanitary Manholes shall conform to this specification unless otherwise approved by the City Engineer.

AASHTO M 85 Type II cement shall be used throughout with a minimum wall thickness of five inches (5"). The precast sections shall conform to ASTM C 478 latest revision. Section joints shall be a tongue and groove with "ram neck" gasket or "O" ring to provide a watertight joint. Minimum concrete strength shall be 4000 psi at 28 days.

Three sets of shop drawings and location inventory shall be submitted to the City Engineer for approval. Approval of shop drawings does not relieve Contractor of responsibility for compliance to these specifications unless letter from Contractor requesting specific variance is approved by the City Engineer.

Location inventory submitted with shop drawing shall detail parts of manhole per manhole as numbered on the construction plans. All manhole parts shall be numbered or lettered before being sent to the job site to permit proper construction placement. A plan or list of the numbering system shall be present on the job site when manhole components are delivered.

Precast manhole dimensions, drop entry, grout flow of channel, etc., shall be as shown on City of Clearwater Engineering Index #302 Sheets 1 and 2 of 2.

Manhole sections shall be rejected if abused during shipping or placement and if pipe openings are not properly aligned. The "break in" to precast manholes for pipe entry will not be allowed.

The manhole base shall be set on a pad of A 1 or A 2 Classification soil approximately five inches (5") thick to secure proper seating and bearing.

#### **401-2.1. MANHOLE ADJUSTMENT RINGS (GRADE RINGS)**

Between the top of the manhole cone and the manhole cover frame, a manhole adjustment ring shall be installed. The intent of the manhole adjustment ring is to accommodate future grade changes without disturbing the manhole. See Section IV, Article 703-7, Asphaltic Concrete – Adjustment of Manholes.

#### **101-65. DROP MANHOLES**

Standard drop inlets to manholes shall be constructed of commercial pipe, fittings and specials as detailed on the drawings.

#### **101-66. FRAMES AND COVERS**

Manhole frames and covers shall be set in a full bed of mortar with the top of the cover flush with or higher than finished grade as directed. Refer to Index 301.

#### **101-67. MANHOLE COATINGS**

The exterior and interior of all built up manholes shall be coated with two (2) coats of Type II Asphalt emulsion, moisture and damp proof (Specification ASTM D 1227 Type II Class I) as manufactured by W.R. Meadows Sealite or approved equal.

The exterior of all precast manholes shall have a 15 mil dry thickness of Sherwin Williams Targard® Coal Tar Epoxy or approved equal. The interior shall be AGRU SUREGRIP HDPE or PP-R Liner with a minimum thickness of two millimeters (2 mm).

#### **101-68. CONNECTIONS TO MANHOLES**

Connections to existing sanitary manholes using approved PVC sewer main shall be made with a manhole adapter coupling by NPC Kor-N-Seal® or approved water stop coupling.

### **402. RAISING OR LOWERING OF SANITARY SEWER STRUCTURES**

Sanitary Sewer Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

#### **101-69. BASIS OF PAYMENT**

Payment, unless covered by a bid item, shall be included in the cost of the work.

## 403. SANITARY SEWERS AND FORCE MAINS

### 101-70. MATERIALS

#### 403-2.1. GRAVITY SEWER PIPE

**GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE OR DUCTILE IRON.** Polyvinyl chloride pipe and fittings shall conform to ASTM specification D 3034 for S.D.R. 35. Sewer pipe with more than ten feet (10') of cover shall be SDR 26. The pipe shall be plainly marked with the above ASTM designation. The bell end of joints and fittings shall have a rubber sealing ring to provide a tight flexible seal in conformance with ASTM D 3212. The laying length of pipe joints shall be a maximum of twenty feet (20').

Unless otherwise noted in these specifications or construction plans, Ductile Iron pipe and fittings for gravity sewer shall conform to Article 501 of these Technical Specifications for DIP water main except pipe shall be interior Protecto 401 ceramic epoxy lined in accordance with manufacturer's recommendations. Where sanitary sewer main is to be placed between building lots in a sideline easement, the sewer main shall, insofar as possible, be constructed without manholes or lateral connections within the side easement. The pipe material in the side easement between streets shall be C 900, SDR 18 polyvinyl chloride water main pipe as described in these Technical Specifications Article 501. A two-way cleanout shall be installed on each lateral at the property line.

#### 403-2.2. FORCE MAIN PIPE

**FORCE MAIN PIPE SHALL BE POLYVINYL CHLORIDE OR DUCTILE IRON.** Unless otherwise noted in the specifications or construction plans, both polyvinyl chloride and ductile iron force main pipe and fittings shall conform to Article 501 of these Technical Specifications for water main pipe except that DIP shall be Protecto 401 ceramic epoxy lined in accordance with manufacturer's recommendations.

All polyvinyl chloride pipe which has become deteriorated due to exposure to ultra violet radiation shall be rejected.

### 101-71. INSTALLATION

#### 403-2.3. GRAVITY SEWER PIPE

Installation of Thermoplastic gravity sewer pipe shall be in conformance with recommended practices contained in ASTM D 2321.

The bottom trench width in an unsupported trench shall be limited to the minimum practicable width (typically pipe OD plus eight inches (8") to twelve inches (12") on each side) allowing working space to place and compact the haunching material. The use of trench boxes and movable sheeting shall be performed in such a manner that removal, backfill and compaction will not disturb compacted haunching material or pipe alignment.

Dewatering of the trench bottom shall be accomplished using adequate means to allow preparation of bedding, placement of the haunching material and pipe in the trench without standing water.

Dewatering shall continue until sufficient backfill is placed above the pipe to prevent flotation or misalignment.

Where pipe bedding is insufficient to adequately support pipe, the Contractor will be required to remove unsuitable material and bed pipe in Class I material (one half inch (1/2") diameter aggregate) to provide firm support of pipe.

Connections to manholes with sanitary pipe shall use a joint two (2) feet in length and shall use an approved water stop around pipe joint entry.

The laterals shown on the plans do not necessarily reflect exact locations. The Contractor is required to locate all existing laterals for reconnection and to coordinate with the construction inspector the location of all new laterals.

#### **403-2.4. FORCE MAIN PIPE**

Installation of force main pipe shall be in conformance with Article 501 of these Technical Specifications for water main pipe.

### **101-72. TESTING**

#### **403-2.5. TESTING OF GRAVITY SEWERS**

The Contractor shall take all precautions to secure a perfectly water tight sewer under all conditions. The water tightness of a sewer which has a crown lying below groundwater level may be tested by measuring infiltration. The water tightness of sewers having crowns lying above groundwater level may be tested by filling the pipe with water so as to produce a hydrostatic head of two feet or more above the crown of the sewer at the upper end of the test section or the water table outside of the sewer, whichever is higher, and then measuring the exfiltration. In no case shall the infiltration or exfiltration exceed fifty (50) gallons per inch of diameter per mile per day. The Contractor shall furnish all labor, materials and equipment to test the amount of infiltration or exfiltration under the Engineer's direction. Where the infiltration or exfiltration is excessive, the Contractor at their own expense shall take the necessary steps to remedy such conditions by uncovering the sewer, remaking the joints or by replacing the entire length of sewer as required by the Engineer. No such repaired joints may be backfilled until after they have been tested and found to be acceptable. Care shall be taken to avoid flotation. The Contractor shall TV inspect all mains to verify the true and uniform grade and the absence of bellies or dropped joints prior to acceptance. Any dips or sags of more than five percent (5%) of the inside pipe diameter dimension shall be cause for rejection. The above tests shall be performed at the discretion of the Engineer on any or all sections of the line.

#### **403-2.6. TESTING OF FORCE MAINS**

Force mains shall be tested under a hydrostatic pressure of 150 psi for two (2) hours, as described in Article 501 of these Technical Specifications for the testing of water mains.

## **101-73. BASIS OF PAYMENT**

### **403-2.7. GRAVITY SEWER PIPE**

Payment for in place sanitary sewer gravity main pipe shall be the unit price per linear foot per appropriate range of depth of cut as contained in the contract proposal. Measurement for payment shall be along the centerline of the sewer main from center to center of manholes.

Payment for laterals shall be the unit price per linear foot of pipe as measured from the centerline of the sewer main pipe to the terminal end of the lateral pipe including a two-way cleanout at the property line.

Payment for sewer pipe shall include all labor, equipment and materials necessary to complete the installation. This shall include clearing and grubbing, excavation, shoring and dewatering, backfill and grading.

### **403-2.8. FORCE MAIN PIPE**

Payment and measurement of force main pipe shall be the same as described in Article 501 of these Technical Specifications for water main pipe.

## **404. HDPE DEFORMED - REFORMED PIPE LINING**

### **101-74. INTENT**

It is the intention of this specification to provide for the trenchless restoration of eight inch (8") to twelve inch (12") sanitary sewers by the installation of a high density polyethylene, jointless, continuous, fold and form pipe liner which is watertight and chemically resistant to withstand exposure to domestic sewage including all labor, materials and equipment to provide for a complete, fully restored and functioning installation.

### **101-75. PRODUCT AND CONTRACTOR/INSTALLER ACCEPTABILITY**

The City requires that all contractors be prequalified. See General Conditions regarding contractor prequalification. In addition, the City requires a proven extensive track record for the fold and form liner system to be used in this project. All contractors submitting for prequalification approval for this project must exhibit extensive satisfactory experience in the installation of the proposed liner system and satisfactory evidence that the proposed liner system has been extensively and successfully installed in the United States and the State of Florida. The installer must be certified by the liner system manufacturer for installation of the liner system. The City reserves full and complete authority to approve the satisfactory nature of both the liner system and the installer.

## **101-76. MATERIALS**

Pipe shall be made from P. E. 3408 polyethylene resins complying with ASTM D 3350, cell classification: P.E. 345434 D for High Density. It shall be Type 3, Grade 4, Class D, according to ASTM D 1248. The Contractor shall provide certified test results for review by the Engineer, from the manufacturer, that the material conforms with the applicable requirements. Material shall have

a minimum thickness of SDR 32.5. Pipe specimens shall comply with the minimum property values shown below with the applicable ASTM requirements:

<u>Material</u>	<u>Property</u>	<u>ASTM Method</u>	<u>Value</u>
HDPE	Tensile Strength	D 638	3,300 psi
	Elasticity Modulus		E=113,000 psi
	Impact Strength	D 256 A	3.0 ft-lb/in
	Flexure Modulus		E=136,000 psi
	Expansion Coeff.		c=0.009 in/in/deg F

At the time of manufacture, each lot of liner shall be reviewed for defects and tested in accordance with ASTM D 2837 and D 1693. At the time of delivery, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults. The Contractor shall provide, as requested, certified test results for review by the Engineer, from the manufacturer, that the material conforms with the applicable requirements. The Engineer may at any time request the Contractor provide test results from field samples to the above requirements.

Liner shall be marked at five (5) foot intervals or less with a coded number, which identifies the manufacturer, SDR, size, material, date, and shift on which the liner was extruded.

Lining manufacturer shall submit to the Engineer for approval as requested, complete design calculations for the liner thickness. The criteria for liner design shall be HS-20 traffic loading, water table to the ground surface, minimum expected lifetime of fifty (50) years, and no structural strength retained from the existing pipe. Any liner system must be approved by the Engineer prior to receiving bids. Request for contractor prequalification and/or liner system approval must be received by the Engineer no later than fourteen (14) days prior to the date for receiving bids.

## **101-77. CLEANING/SURFACE PREPARATION**

It shall be the responsibility of the Contractor to clean and prepare the existing pipes for rehabilitation. The Contractor will thoroughly clean the interior of the sewers to produce a clean interior surface free of all coatings, sand, rock, roots, sludge, or other deleterious materials prior to liner insertion. Bypass pumping will be provided by the Contractor as part of the unit cost of restoration. Bypass operations are to be so arranged as to cause minimum disruptions to local traffic, residents and particularly to commercial facilities. During the cleaning and preparation operations all necessary precautions shall be taken to protect the public, all property and the sewer from damage.

All material removed from the sewers shall be the Contractor's responsibility for prompt disposal in accordance with all regulatory agency requirements. The Contractor may be required to control the rate of sewer cleaning in the sanitary system to avoid heavy pollution loads at the City's treatment plants.

## **101-78. TELEVISION INSPECTION**

After cleaning, and again after the rehabilitation work on each section of the project is completed, all pipe sections shall be visually inspected with a digital camera and recorded in DVD format as specified below.

### **404-2.1. VIDEO, PHOTO CAPTURE AND DATA COLLECTION REQUIREMENTS FOR MANHOLE AND PIPELINE INSPECTION**

This section describes the requirements of the Contractor in providing the following minimum requirements for Video, Photo Capture and Database structure to the City. The City is currently using CUES Granite XP video and data collection software. The Contractor shall provide the TV Inspections in the same Granite XP database, photo and video capture format. The Contractor-provided TV Inspections, Database, DVDs, Photos and related files shall have the ability to direct synchronize to the City's existing Granite XP database.

### **404-2.2. IMAGE (PHOTOS) CAPTURE FORMAT AND REQUIREMENTS**

The Inspection image files (pictures) shall have the ability to export to Industry Standard Formats to include JPEG, BMP, and TIFF formats and be transferable by disk, DVD and/or external hard drive to an external personal computer utilizing standard viewers and printers.

### **404-2.3. DIGITAL VIDEO FORMAT AND REQUIREMENTS**

Digital video files (Inspection Videos) shall be captured and/or recorded in the MPEG 1, 2 or 4 format or as specified by the City. The Video capture files shall be in MPEG format with data linking (Inspection Observations) to the database file(s). The “Link” of the video capture file to the database observation file is required. The inspection observation(s) shall link to the video record in real-time.

The accompanying database shall support the following code systems: WRc, PACP, CUES standard, or current code system being utilized by the City. The Database and Software program (Granite XP V2.X) shall be able to import asset data from an ArcGIS (City current version) geo-database file utilizing the network features to associate Sewer Mains with corresponding Sewer Nodes.

The database structure shall retain information on the various structures found within a sewer or storm system. It is important that the structures, nodes, manholes and pipe identifiers and related attribute information be retained as separate tables from the Inspection allowing import of existing data from multiple sources. The data structure allows different projects to reside within a single database. Information gathered in projects shall be available to view by project or by system. Data gathered during project inspection shall be available to view by the selected structure. Therefore, all inspections can be viewed on a structure even if gathered in different projects.

### **404-2.4. SYNCHRONIZATION**

The database shall have the ability to synch assets and inspections from replicated databases. The sync process should have built-in error checking for duplicates, updates and any modifications to

the data being synched. This allows for multiple sources of data to be effectively consolidated into a single unitary database for analysis and evaluation.

## **101-79. LINER INSTALLATION**

Liner shall be sized to field measurements obtained by the Contractor to provide a tight fit to the full interior circumference of the existing sanitary sewer and shall be a continuous, jointless liner product from inside of manhole to inside of manhole. Contractor shall use installation methods approved by the liner manufacturer including liner placement, reforming to fit existing pipe, pressure and heat requirements and reconnection of laterals. The Contractor shall immediately notify the Engineer of any construction delays taking place during the insertion operation. Contractor shall maintain a reasonable backup system for bypass pumping should delays or problems with pumping systems develop. Liner entries at manholes shall be smooth, free of irregularities, and watertight. No pinholes, tears, cracks, thin spots, or other defects in the liner shall be permitted. Such defects shall be removed and replaced by the Contractor at their expense. OSHA requirements for installation procedures, in particular, confined spaces are to be met.

## **101-80. LATERAL RECONNECTION**

Sanitary laterals shall be reconnected as soon as possible to renew service. Laterals are to be reconnected by means of robotics, by internally cutting out the liner to 100% of the area of the original opening. All lateral reconnections are to be grouted to prevent leakage. Grouting method and material is to be approved by the Engineer.

Any reconnections to laterals and connections to manholes which are observed to leak shall be resealed by the Contractor. All laterals discovered during the lining process are to be reconnected unless specifically directed otherwise by the City. Contractor shall notify all local system users when the sanitary system will not be available for normal usage by the delivery of door hangers with appropriate information regarding the construction project.

## **101-81. TIME OF CONSTRUCTION**

Construction schedules will be submitted by the Contractor and approved by the Engineer. At no time will any sanitary sewer service connection remain inoperative for more than an eight (8) hour period without a service bypass being operated by the Contractor. In the event that sewage backup occurs and enters buildings, the Contractor shall be responsible for cleanup, repair and property damage costs and claims.

## **101-82. PAYMENT**

Payment for sanitary sewer restoration shall be made per linear foot including all preparation, bypass pumping, equipment, labor, materials, operations, restoration, etc., to provide a fully completed and operational sewer. Payment shall be measured from center of manhole to center of manhole for the sanitary systems and from end of pipe to end of pipe for storm systems.

## **405. SANITARY MANHOLE LINER RESTORATION**

### **101-83. SCOPE AND INTENT**

It is the intent of this portion of the specification to provide for the structural rehabilitation of manhole walls and bases with solid preformed liners and made-in-place liner systems used in accordance with the manufacturer's recommendations and these specifications. In addition to these specifications, the Contractor shall comply with manufacturer's instructions and recommendations for work. Purpose of work is to eliminate infiltration, provide corrosion protection, repair voids and to restore the structural integrity of the manhole. For any particular system the Contractor will submit manufacturer's technical data and application instructions. All OSHA regulations shall be met.

### **101-84. PAYMENT**

Payment for liners shall be per vertical foot of liner installed from the base to the top of the installed liner. Liners will generally be installed to the top of existing or new corbels. No separate payment will be made for the following items: Bypass pumping; Traffic Control; Debris Disposal; Excavation, including necessary pavement removal; Shoring and/or dewatering; Structural fill; Backfill and compaction; Grout and mortar; Brick; Resetting of the manhole ring and cover; Pipe extensions and connectors necessary to the installation; Replacement of unpaved roadway and grass or shrubbery plot; Replacement of roadway base and asphalt surface; and Appurtenant work as required for a complete and operable system. The cost of such work shall be included in the pay item, per linear foot of liner.

## **101-85. FIBERGLASS LINER PRODUCTS**

### **405-2.1. MATERIALS**

#### **405-2.1.1. LINERS**

Liners shall be fiberglass engineered to meet or exceed AASHTO H 20 loading of 16,000 pound vertical wheel load. Manhole liners are to be of the integral corbel design unless otherwise stipulated. Manhole liners are to be as large in diameter as will fit into the existing manhole. The Contractor shall measure the existing manhole immediately prior to ordering materials and is solely responsible for the fitting of the liner. Contractor will be required to submit factory certification for fiberglass liners. The manhole liner shall meet all requirements of ASTM D 3753.

#### **405-2.1.2. MORTAR**

Mortar shall be composed of one part Portland Cement Type I and between two (2) and three (3) parts clean, well graded sand, 100% of which shall pass a No. 8 sieve.

#### **405-2.1.3. GROUTING**

Grouting shall be a concrete slurry of four (4) bags of Portland Cement Type II per cubic yard of clean, well graded sand.

## **405-2.2. INSTALLATION AND EXECUTION**

Excavate an area around the top of the existing manhole sufficiently wide and deep for the removal of the manhole ring and corbel section.

Remove the frame and cover and corbel section without damaging the existing manhole walls. Care is to be taken not to allow brick or soil to fall into the existing manhole.

Remove or reinsert loose brick which protrude more than one inch from the interior wall of the manhole and which could interfere with the insertion of the fiberglass liner.

If the shelf of the manhole invert is not level around the perimeter, form a flat shelf with mortar.

Cut the liner to the proper length. Cutouts in the manhole shall be made to accommodate existing inlet and outlet pipes, drops and cleanouts.

Lower the liner into the existing manhole and set the bottom of the liner into quick setting grout. Obtain a good bottom seal to prevent the loss of grout from the annular space between the outside of the liner and the inside wall of the existing manhole. Set the liner as nearly vertical as possible. Pour six inches (6") of quick setting grout above the initial bottom seal in the annular void to insure an adequate bottom seal.

Bridge the gap from drops, laterals, force mains, cleanouts and all existing piping between the existing manhole wall and the new manhole liner with P.V.C. pipe. Use quick setting mortar to seal the area around the manhole liner and piping.

Fill the annular space between the manhole liner and the existing manhole interior walls with grout. Care must be taken not to deflect the manhole liner due to head pressure.

Set the existing manhole ring and cover using brick to make elevation adjustments as needed.

Observe water tightness and repair any visible leakage.

Backfill around the new liner and compact the backfill. Sod the disturbed area. Match existing sod.

Where manholes fall in paved areas, refer to Standard Detail Index 104, "Street and Driveway Replacement for Concrete and Asphaltic Concrete Surfaces".

## **101-86. STRONG SEAL MS-2 LINER PRODUCT SYSTEM**

This specification shall govern all work to spray apply a monolithic fiber reinforced cementitious liner to the wall and bench surfaces of brick, concrete or any other construction material; Strong Seal MS 2 product.

Described are procedures for manhole preparation, cleaning, application and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the Strong Seal MS 2 product directly to the contour of the manhole to form a structural cementitious liner of a minimum one half inch (1/2") thickness using a machine specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications which includes:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.

3. The spray application of a pre blended cementitious mix to form a monolithic liner in a two (2) coat application.

### **405-2.3. MATERIALS**

#### **405-2.3.1. PATCHING MIX**

Strong Seal shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1. Compressive Strength (ASTM C-109)	15 min., 200 psi	6 hrs., 1,400 psi
2. Shrinkage (ASTM C-596)	28 days, 150 psi	
3. Bond (ASTM C-952)	28 days, 150 psi	
4. Cement	Sulfate resistant	
5. Density, when applied	105 +/- 5 pcf	

### **101-87. INFILTRATION CONTROL**

Strong Plug shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1. Compressive strength (ASTM C-109) - 600 psi, 1 hr.; 1000 psi 24 hrs.
2. Bond (ASTM C-952) - 30 psi, 1 hr.; 80 psi, 24 hrs.

### **101-88. GROUTING MIX**

Strong-Seal Grout shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and a one (1) day strength of 50 psi.

### **101-89. LINER MIX**

Strong Seal MS 2 shall be used to form the monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements at twenty-eight (28) days:

1. Compressive strength (ASTM C 109)	3,000 psi
2. Tensile strength (ASTM C 496)	300 psi
3. Flexural strength (ASTM C 78)	600 psi
4. Shrinkage (ASTM C 596)	0% at 90% R.H.
5. Bond (ASTM C 952)	130 psi
6. Density, when applied	105 + pcf

Product must be factory blended requiring only the addition of water at the Project site. Bag weight shall be 50 to 51 pounds and contents shall have dry bulk density of 54 to 56 pounds per cubic foot. Fiberglass rods which are contained in the product shall be alkaline resistant and shall be one-

half inch (1/2") to five-eighths inch (5/8") long with a diameter of 635 to 640 microns. Products shall, in the unmixed state, have a lead content not greater than two percent (2%) by weight.

Strong Seal MS 2C shall be made with Calcium Aluminate Cement and shall be used according to the manufacturer's recommendations in applications where there is evidence of severe sulfide conditions.

Product must be factory blended requiring only the addition of water at job site.

Bag weight shall be 50 to 51 pounds and contents must have a dry bulk density of 50 to 56 pounds per cubic foot.

Cement content must be 65% to 75% of total weight of bag.

One bag of product when mixed with correct amount of water must have a wet density of 95 to 108 pounds per cubic foot and must yield a minimum of 0.67 cubic foot of volume.

Fiberglass rods must be alkaline resistant with rod lengths not less than one-half inch (1/2") in length nor greater than five-eighths inch (5/8") in height.

Product shall not include any basic ingredient that exceeds maximum allowable EPA limit for any heavy metal.

Manufacturer must provide MSDS sheets for product(s) to be used in reconstruction process.

A two (2) coat application of liner material will be required (no exceptions) with the first coat rough troweled to force materials into cracks and crevices to set the bond. The second coat to be spray applied to assure a minimum of one-half inch (1/2") thickness after troweling or brush finishing to a relatively smooth finish.

## **101-90. WATER**

Shall be clean and potable.

## **101-91. OTHER MATERIALS**

No other material shall be used with the mixes previously described without prior approval or recommendation from the manufacturer.

## **101-92. EQUIPMENT**

A specially designed machine consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, contra blend mixer with twin ribbon paddles with discharge, and an air system for spray application of product. Equipment must be complete with water storage and metering system. Mixer and pump is to be hydraulically powered. Equipment is to be mounted to heavy duty construction tandem axle road worthy trailer complete with electric brakes and running lights. Internal combustion engine must be included to power the hydraulic system and air compressor.

## 101-93. INSTALLATION AND EXECUTION

### 405-2.4. PREPARATION

1. Place boards over inverts to prevent extraneous material from entering the sewer lines and to prevent up stream line from flooding the manhole.
2. All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 1,200 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick setting patching mix.
3. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application after which the weep holes shall be plugged with the quick setting mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
4. Any bench, invert or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
5. After all preparation has been completed, remove all loose material.

### 405-2.5. MIXING

For each bag of product, use the amount of water specified by the manufacturer and mix using the Spray Mate Model 35C or 35D equipment for thirty (30) seconds to one (1) minute after all materials have been placed in the mixing hopper. Place the mix into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

### 405-2.6. SPRAYING

The surface, prior to spraying, shall be damp without noticeable free water droplets or running water. Materials shall be sprayed, applied to a minimum uniform thickness to insure that all cracks, crevices and voids are filled and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond. Not before the first application has begun to take an initial set (disappearance of surface sheen which could be fifteen (15) minutes to one (1) hour depending upon ambient conditions) is the second application made to assure a minimum total finished thickness of one-half inch (1/2"). The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. A brush finish may be applied to the finished coat to remove trowel marks. Manufacturer's recommendation shall be followed whenever more than twenty-four (24) hours have elapsed between applications. The wooden bench covers shall be removed, and the bench is sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than one-half inch (1/2"). The wall bench intersection shall be rounded to a uniform radius, the full circumference of the intersection. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow.

## **405-2.7. PRODUCT TESTING**

At some point during the application, at least four (4) two inch (2") cubes may be prepared each day or from every fifty (50) bags of product used, identified and sent, in accordance with the Owner's or Manufacturer's directions, for compression strength testing as described in ASTM C 109.

## **405-2.8. CURING**

Ambient manhole conditions are adequate for curing so long as the manhole is covered. It is imperative that the manhole be covered as soon as possible after the application has been completed.

## **405-2.9. MANHOLE TESTING AND ACCEPTANCE**

Manhole may be vacuum tested from the top of manhole frame to the manhole base. All pipes entering the manhole shall be plugged, taking care to securely place the plug from being drawn into the manhole. The test head shall be placed, and the seal inflated in accordance with the manufacturers' recommendations. A vacuum pump of ten inches (10") of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9"). The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight inch (48") diameter, seventy five (75) seconds for sixty inch diameter (60"), and ninety (90) seconds for seventy-two inch (72") diameter manholes. If the manhole fails the initial test, necessary repairs shall be made. Retesting shall proceed until a satisfactory test is obtained. Tests shall be performed by the Contractor under the direction of the Project Engineer.

## **101-94. INNERLINE ENVIRONMENTAL SERVICES LINER PRODUCT SYSTEM**

### **405-2.10. SCOPE**

Materials and application procedures for manhole rehabilitation for the purpose of restoring structural integrity, providing corrosion resistance, and stopping infiltration by means of:

1. Hydraulic grouting, where required, as a preliminary measure to stop high volume infiltration.
2. Hydrophilic grouting (positive side waterproofing), where required, as follows:
  - a. Hydrophilic foam-injected through wall of manhole to fill voids, and/or
  - b. Hydrophilic gel-injected through wall of manhole to stop active leaks
3. Cementitious waterproofing with crystallization (negative side waterproofing)
4. Calcium aluminate cement lining, minimum of one-half inch (1/2")
5. Epoxy coating, minimum of thirty (30) dry mils

## 405-2.11. MATERIALS

### 405-2.11.1. REPAIRING CEMENT

A quick setting hydraulic cement compound shall be used to plug all visible minor leaks and to instantly stop major leaks, so that further waterproofing processes may proceed unhindered. The repairing cement shall be nonshrinking, nonmetallic, and noncorrosive. The compound shall have the following properties:

Set Time	1-3 minutes
Tensile Strength	1 day 510 psi
ASTM C 307	3 days 745 psi 28 days 855 psi
Compressive Strength	1 day 3,125 psi
ASTM -C 109	7 days 7,808 psi 28 days 9,543 psi
Flexural Strength ASTM C 78	1 day 410 psi 3 days 855 psi 28 days 1,245 psi

### 405-2.11.2. HYDROPHILIC GROUTING

Based on conditions found in and around the manhole, the applicator shall pressure inject either one or both of the following materials:

1. An expansive foam grout shall be used to stop major intrusion of water and fill cracks and voids behind the structure's surface. Physical properties are as follows:

Tensile Strength	380 psi	ASTM D 3574-86
Elongation	400%	ASTM D 3574-86
Bonding Strength	250-300 psi	

2. A hydrophilic gel grout shall be used for soil stabilization behind the manhole to prevent seepage, to provide a damming effect, and to place a hydrostatic barrier around exterior of manhole. Physical properties are as follows:

Density	8.75-9.17 lbs/gal	ASTM D-3574
Tensile Strength	150 psi	ASTM D- 412
Elongation	250%	ASTM D-3574
Shrinkage	Less than 4%	ASTM D-1042
Toxicity	Non Toxic	

### 405-2.11.3. WATERPROOFING

A waterproofing component based on the crystallization process shall be applied. The system combines cementitious and silicate based materials that are applied to negative side surfaces to seal and stop leakage caused by hydrostatic pressure. A combination of five coats (using three components-two powders and a special liquid) react with moisture and the constituents of the substrate to form the crystalline structure. It becomes an integral part of the structure and blocks the passage of water. With moisture present, the crystallization process will continue for

approximately six (6) months. Upon completion, the color will be light grey. Physical properties are as follows:

Slant/Shear bond Strength to Calcium Aluminate Cement ASTM C882 Modified	1,200 1,800 psi
Tensile Strength (7 day cure)	380 psi (2.62 MPa) 325 psi (2.24 MPa)
ASTM C 190	at 100% RH at 50% RH
Permeability (3 day cure) CRD 48 55	8.1x10 <sup>-10</sup> cm/sec to 7.6x10 <sup>-11</sup> cm/sec

#### 405-2.11.4. CEMENT LINING

A self-bonding calcium aluminate cement shall be applied to restore structural integrity and provide corrosion resistance qualities. The cement (before adding fibers) shall have the following properties:

Calcium Aluminate Cement		12 Hrs	24 Hrs	7 Days	28 Days
Astm C 495	Compressive Strength, Psi	7000	11000	12000	13000
Astm C 293	Flexural Strength, Psi	1000	1500	1800	2000
Astm C 596	Shrinkage At 90% Humidity	--	<0.04	<0.06	<0.08
Astm C 666	Freeze-Thaw Aft 300 Cycle		No Damage		
Astm C 990	Pull - Out Strength		200 - 230 Psi Tensile		
Astm C 457	Air Void Content (7 Days)		3%		
Astm C 497	Porosity/Adsorption Test		4 - 5%		

Modules of Elasticity: 7.10 X 10 PSI after twenty-four (24) hours moist curing at 68 degrees Fahrenheit.

The calcium aluminate cement shall be reinforced with inert fibers which comply with ASTM C 1116 and ASTM C 1018, added at the rate of one (1) pound per cubic yard of concrete. The mixture shall be applied to a thickness of at least one half inch (1/2"), but no greater than two inches (2"). It will have a dark grey color.

#### 405-2.11.5. EPOXY COATING

A high build, flexible waterproofing epoxy shall be applied to a minimum of thirty (30) dry mils. This epoxy will seal structure from moisture and provide protective qualities to the surface, including excellent resistance to chemical attack and abrasion. The epoxy shall be 100% solids, can be applied to damp surfaces, cures to a tile like finish, is easy to clean, and has no toxic fumes. Its uses include sewage treatment plants and other sewer structures. The epoxy shall have the following properties at 75 degrees Fahrenheit:

Mixing Ratio (Parts A:B), by volume	1:1
Color (other colors available on request)	Light Gray

Pot Life, hrs	1
Tensile Strength, psi, min	2,000
Tensile Elongation, %	10 –20
Water Extractable Substances, mg./sq. in., max	5
Bond Strength to Cement (ASTM 882) psi	1,800

#### 405-2.11.6. CHEMICAL RESISTANCE

The sanitary sewer liner shall be resistant to: Alcohols, Trichloroethylene, Nitric Acid (3%), Jet Fuels, Water, Sulfuric Acid (3% 10%), MEK, Wine, Butyl Acetate, Beer, Lactic Acid (3%), Gasoline, Corn Oil, Aluminum Sulfate, Paraffin Oil, Vegetable Juice, Sodium Chloride, Motor Oil, Hydrochloric Acid (3%), and many others.

#### 405-2.12. INSTALLATION AND EXECUTION

##### 405-2.12.1. PROCEDURAL OVERVIEW

Work shall proceed as follows:

1. Remove rungs (steps), if desired by client.
2. Clean manhole and remove debris.
  - a. Plug lines and/or screen out displaced debris.
  - b. Apply acid wash, if necessary, to clean and degrease.
  - c. Hydroblast and/or sand blast structure.
  - d. Remove debris from work area.
3. Repair minor defects in walls, benches, and invert, as required, with repairing cement. (Note: Major structural repairs, such as rebuilding of benches, will also be made as required by client.)
4. Inject hydrophilic grout through all surfaces, as needed, to eliminate infiltration.
5. Apply cementitious/crystallization waterproofing agents to all surfaces, repeating steps as needed.
6. Spray and/or hand apply calcium aluminate cement lining to all surfaces.
7. Spray apply epoxy coating to all surfaces.

**NOTE:** Steps 1-5 shall be executed consecutively with minimal delays; calcium aluminate (Step 6) shall require a cure time of at least twenty-four (24) hours for needed adhesion of epoxy (Step 7) to cement lining.

##### 405-2.12.2. PREPARATION

An acid wash shall be used (if needed) to clean and degrease. Then, if the client desires, the rungs shall be removed. Next, the entire structure is thoroughly water and/or sand blasted to remove any loose or deteriorated material. Care shall be taken to prevent any loose material from entering lines and other areas by either plugging the lines (where feasible) or inserting protective screens.

### **405-2.12.3. STRUCTURAL REPAIR**

Hand place or spray apply hydraulic cement material as necessary to prepared surface to fill cracks and voids in structure. Allow twenty (20) minutes before applying waterproofing/crystallization.

### **405-2.12.4. INFILTRATION CONTROL**

Pressure injection of hydrophilic gel and hydrophilic foam.

1. Drill five-eighths inch (5/8") holes through active leaking surface.
2. Install all zert fittings, as recommended by manufacturer.
3. Inject material until water flow stops.
4. Remove fittings (if necessary).

### **405-2.12.5. WATERPROOFING/CRYSTALLIZATION PROCESS**

1. Apply a slurry coat of powder #1 to moist wall using a stiff brush, forming an undercoat.
2. Apply dry powder #2 to slurry coat by hand.
3. Brush or spray on sealing liquid during the application to penetrate and initiate the crystal forming process.
4. Repeat steps 2 and 3, until there are no visible leaks.
5. Apply powder #1 as an overcoat.
6. Allow one (1) hour to cure before applying cement lining.

### **405-2.12.6. CEMENT LINING**

1. Dampen surface.
2. Mix material in mixer as recommended for spray or hand trowel application.
3. Apply cement until required build up of at least one half inch (1/2") (and no more than two inches (2")) has been achieved.
4. Trowel to smooth finish, restoring contours of manhole.
5. Texture brush surface to prepare for epoxy finish.
6. Allow for a twenty-four (24) hour cure time prior to epoxy coating.

NOTE: If conditions of heavy humidity prevail, a dry air blower shall be used to facilitate curing times.

### **405-2.12.7. EPOXY COATING**

Spray apply epoxy coating using airless spraying equipment until surface is visibly covered and a thickness of at least thirty (30) mils has been achieved. Manhole may be safely entered after six (6) hours, as epoxy will be hardened. Full cure strength will be achieved at forty eight (48) hours.

#### **405-2.12.8. CLEAN UP**

The work crew shall remove all debris and clean work area.

#### **405-2.12.9. MANHOLE TESTING AND ACCEPTANCE**

Manhole may be vacuum tested from the top of manhole frame to the manhole base. All pipes entering the manhole shall be plugged, taking care to securely place the plug from being drawn into the manhole. The test head shall be placed, and the seal inflated in accordance with the manufacturer's recommendations. A vacuum pump of ten inches (10") of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9"). The manhole shall pass if the time is greater than sixty (60) seconds for a forty eight inch (48") diameter, seventy five (75) seconds for sixty (60) inches, and ninety (90) seconds for seventy-two inch (72") diameter manholes. If the manhole fails the initial test, necessary repairs shall be made. Retesting shall proceed until a satisfactory test is obtained. Tests shall be performed by the Contractor under the direction of the Project Engineer.

#### **405-2.12.10. WARRANTY**

All materials and workmanship shall be warranted to the Owner for a period of five (5) years, provided that all the above mentioned repair steps are used.

# **500 SERIES: POTABLE AND RECLAIMED WATER MAINS, FIRE LINES AND APPURTEANCES**

## **501. SCOPE**

The Contractor shall furnish all plant, labor, materials and equipment to perform all operations in connection with the construction of potable water mains, fire lines, reclaimed water mains and appurtenances including clearing, excavation, trenching, backfilling and clean up.

## **502. MATERIALS**

### **101-95. GENERAL**

Materials, equipment and supplies furnished and permanently incorporated into the project shall be of first quality in every respect and shall be constructed and finished to high standards of workmanship. Materials shall be suitable for service intended, shall reflect modern design and engineering and shall be fabricated in a first class workmanlike manner. All materials, equipment and supplies shall be new and shall have not been in service at any time previous to installation, except as required in tests or incident to installation. Machined metal surfaces, exposed bearings and glands shall be protected against grit, dirt, chemical corrosion and other damaging effects during shipment and construction.

### **101-96. PIPE MATERIALS AND FITTINGS**

#### **502-2.1. DUCTILE IRON PIPE**

Ductile Iron Pipe shall be in accordance with ANSI/AWWA C151/A21.51 81 or latest revision. Pipe thickness class, wall thickness and working pressure shall conform to the following table:

Size	Class	Thickness (In.)	Rated Water Working Pressure (PSI)
4"	51	0.26	350
6"	50	0.25	350
8"	50	0.27	350
12"	50	0.31	350

The trench laying condition shall be Type 2, Flat bottom trench backfill lightly consolidated to centerline of pipe.

Pipe shall be manufactured in accordance with ANSI/AWWA C151/A21.51 81 or latest revision.

Pipe shall be asphalt coated on the outside and standard cement lined and sealed coated with approved bituminous seal coat in accordance with ANSI/AWWA C104/A21.4 80 or latest revision.

Ductile iron pipe shall be used for all hydrant installations and for fire line installations from the main to the backflow preventer.

## **502-2.2. POLYVINYL CHLORIDE (PVC) PIPE**

Polyvinyl Chloride (PVC) Pipe four inch (4") through eight inch (8") shall be in accordance with ANSI/AWWA C900 or latest revision and the American Society for Testing Materials (ASTM) Standard D 2241 and PVC Resin Compound conforming to ASTM Specification D 1784.

Polyvinyl Chloride Pipe shall have the same O.D. as Cast and Ductile Iron Pipe and be compatible for use without special adapters with Cast Iron Fittings.

Pipe dimension ratio, working pressure and laying length shall conform to the following table:

Size	Dimension Ratio (OD/Thick.)	Rated Water Working Pressure (PSI)	Laying Length (Ft)
4	18	150	20
6	18	150	20
8	18	150	20

Pipe larger than eight inch (8") shall be ductile iron. The City Engineer reserves the right to require the use of ductile iron in sizes four inch (4") through eight inch (8") when needed due to laying conditions or usage.

The bell of four inch (4") and larger PVC pipe shall consist of an integral wall section with a solid cross section elastomeric ring which meets the requirements of ASTM D 1869.

Each length of pipe shall bear identification that will remain legible during normal handling, storage and installation and so designate the testing agency that verified the suitability of the pipe material for potable water service.

All polyvinyl chloride pipe shall be laid with two (2) strands of insulated twelve (12) gauge A.W.G. solid strand copper wire taped to the top of each joint of pipe with about eighteen inches (18") between each piece of tape. It is to be installed at every valve box through a two inch (2") PVC pipe to twelve inches (12") minimum above the top of the concrete slab. The two inch (2") PVC pipe shall be the same length as the adjustable valve box, and the two inch (2") PVC pipe shall be plugged with a two inch (2") removable brass plug with recessed nut. This wire is to be continuous with splices made only by direct bury 3M brand splice kit approved by the Engineer. This wire is to be secured to all valves, tees and elbows.

## **502-2.3. FITTINGS AND JOINTS**

Fitting from four inch (4") through sixteen inch (16") in size will be compact ductile iron cast in accordance with ANSI/AWWA C153/A 21.53 with mechanical joint bells. Bolts, nuts and gaskets shall be in accordance with requirements of ANSI/AWWA C153/A 21.53. The working pressure rating shall be 350 psi. Ductile iron fittings shall be coated and lined in accordance with requirements of ANSI/AWWA C104/A21.4. Mechanical joint glands shall be ductile iron in accordance with ANSI/AWWA C111/A 21.11. When reference is made to ANSI/AWWA

Standards, the latest revisions apply. Only those fittings and accessories that are of domestic (USA) manufacture will be acceptable.

#### **502-2.4. RESTRAINT**

Restraint of plugs, caps, tees, bends, etc., shall be accomplished by the use of approved mechanical restraining rings or glands installed per manufacturer's recommendations. Hydrants shall be restrained by the use of swivel connecting joints. Restraining mechanical joint glands on hydrants shall be used only where hydrant runout length precludes the use of swivel joint connectors.

#### **502-2.5. PIPE WITHIN CASING**

All pipe placed within casings shall be slip joint ductile iron restrained by the use of restraining gaskets designed for use with the particular joint being installed and have properly sized casing spacers (Cascade Series) installed on the pipe so that the pipe will be centered within the casing. Each end of the casing shall be properly sealed to prevent the intrusion of soil, water, or debris within the casing itself. It shall be sealed by brick and mortar, cement or any approved method by the Engineer.

### **101-97. GATE VALVES**

Discs of valves shall be operated by methods which will allow operation in any position with respect to the vertical. Gate valves for interior piping or exposed above grade outside structures, shall be hand wheel operated with rising stems. Valves four inches (4") and larger, buried in earth shall be equipped with two inch (2") square operating nuts, valve boxes and covers. Valves shall be fitted with joints suitable for the pipe with which they are to be used. The direction of opening for all valves shall be to the left (counter clockwise).

Unless otherwise shown or specified, valves for high pressure service shall be rated at not less than 150 psi cold water, non-shock.

The manufacturer's name and pressure rating shall be cast in raised letters on the valve body.

Installation shall be in accordance with good standard practice. Exposed pipelines shall be so supported that their weight is not carried through valves.

Two Inch (2") diameter and smaller are not allowed. These should be approved ball valves.

Three Inch (3") diameter are not allowed.

Gate Valves, four inch (4") to sixteen inch (16") diameter, inclusive, shall be resilient seated gate valves encapsulated with EPDM Rubber in conformance with ANSI/A.W.W.A. Standard Specification C509-515 latest revision. These valves shall include the following features consistent with C509-515, full opening unobstructed waterway, zero leakage at 200 psi differential pressure, all internal parts removable from bonnet without removing body from pressure main, corrosion resistant bronze or stainless steel nonrising stem with O-ring bonnet seal with epoxy coated inside and outside cast iron or ductile iron valve body.

Gate valves larger than sixteen inches (16") shall be suitable for the service intended and shall be resilient seated gate valves encapsulated with EPDM rubber in conformance with ANSI/AWWA. These valves shall include the following features consistent with C509-80, full opening unobstructed waterway, zero leakage at 200 psi differential pressure. All valves shall be equipped

with steel cut bevel gears, extended type gear case and rollers, bronze or babbitt tracks and scrapers and valved by-pass.

## **101-98. VALVE BOXES**

Valve boxes shall be of standard extension design and manufacture and shall be made of cast iron. No PVC Risers or Derisers are allowed as part of a valve box assembly. They are to be three-piece valve box assemblies. The lower part of the assembly can be ordered in various heights to accommodate different depths. Suitable sizes of valve boxes and extension pieces shall be provided where shown. The valve box cover shall be of cast iron. Valve boxes and their installation shall be included in the bid price for valves. Refer to City Index No. 402; Sheet 1 of 5 & Sheet 2 of 5 for potable water valve pad detail, and City Index No. 502; Sheet 1 of 2 & Sheet 2 of 2 for reclaimed water valve boxes and pad detail.

## **101-99. HYDRANTS**

No other hydrants, other than those listed below, may be used in extension to or replacement of the City of Clearwater potable water system:

- Kennedy Guardian #K 8ID Fire Hydrant,
- Mueller Super Centurion 25 Fire Hydrant
- AVK Nostalgic 2780.
- American Darling B-84-B.

No substitutions shall be allowed without the approval of the City of Clearwater.

Above hydrants shall be in accordance with the latest revision of the AWWA Specification C 502 and include the following modifications:

1. All shipments to be palletized and tailgate delivery.
2. Hydrants shall conform to A.W.W.A. Standard C-502 latest revision and must be UL/FM listed.
3. Hydrants shall be of the compression type, closing with line pressure.
4. The operating threads will be contained in an operating chamber sealed at the top and bottom with an O-ring seal. The chamber will contain a lubricating grease or oil.
5. Hydrants shall be of the traffic model breakaway type, with the barrel made in two sections with the break flange located approximately two inches (2") above the ground line. Breakaway bolts are not allowed.
6. Operating nut shall be of one-piece bronze or ductile iron construction.
7. A dirt shield shall be provided to protect the operating mechanism from grit buildup and corrosion due to moisture.
8. A thrust washer shall be supplied between the operating nut and stem lock nut to facilitate operation.
9. Operating nut shall be a #7 one and a half inch (1-1/2") pentagon nut.

10. Nozzles shall be of the tamper resistant, one quarter (1/4) turn type with O-ring seals or threaded into upper barrel. Nozzles shall be retained with a stainless steel locking device.
11. The main valve shall be of EPDM solid rubber.
12. The seat shall be of a bronze ring threaded to a bronze insert in the hydrant shoe, with O-rings to seal the barrel from leakage of water in the shoe.
13. The main valve stem will be 304 or higher grade stainless steel and made in two sections with a breakable coupling.
14. Hydrant shall have a six inch (6") Mechanical Joint epoxy lined elbow, less accessories.
15. Hydrant shall have a five and one quarter inch (5-1/4") valve opening, and shall be a left hand operation to open.
16. Hydrant shall be without drains.
17. Hydrant shall have two (2) two and one half inch (2-1/2") hose nozzles and one (1) four and one half inch (4-1/2") pumper nozzle. Threads shall be in accordance with the National Standard Hose Coupling Thread Specifications.
18. Hydrant body shall have a factory finish of yellow paint. All paints shall comply with AWWA standard C-502-85 or latest revision.

All hydrants will be shop tested in accordance with the latest AWWA Specification C 502.

Restrained joint assemblies shall be used which have bolted mechanical and swivel joints from the hydrant tee through to the hydrant. Restrained joints shall absorb all thrust and prevent movement of the hydrant.

All hydrants shall be provided with an auxiliary gate valve so that the water to the hydrant may be shut off without the necessity of closing any other valve in the distribution system.

No hydrants shall be installed on the reclaimed water system unless approved by the City of Clearwater's Engineering Department.

## **101-100. SERVICE SADDLES**

Service saddles shall be used on all service taps to four inch (4") P.V.C. water main. The largest service connection allowable on four inch (4") main shall be one and one half inch (1-1/2"). Service saddles shall be used on all two inch (2") service connections to six inch (6") and larger mains. Service saddles (JCM 406 series or Ford FC 202 series) shall be wide bodied ductile iron with epoxy or nylon coating and shall have stainless steel straps.

## **101-101. TESTS, INSPECTION AND REPAIRS**

1. All materials shall be tested in accordance with the applicable Federal, ASTM or AWWA Specification and basis of rejection shall be as specified therein. Certified copies of the tests shall be submitted with each shipment of materials.
2. All materials will be subject to inspection and approved by the Engineer after delivery; and no broken, cracked, misshapen, imperfectly coated or otherwise damaged or unsatisfactory material shall be used.

3. All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected and promptly removed from the site.
4. If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

## **101-102. BACKFLOW PREVENTERS**

The City of Clearwater owns and maintains all backflow prevention devices that are installed within their system. Therefore, any and all devices must be purchased from the City and installed by City work forces.

Backflow prevention devices installed on customer's service lines at the point of delivery (service connection) shall be of a type in accordance with AWWA specification C506 or latest revision.

Two (2) different types of backflow prevention devices are allowed. Type of device, and when required, is determined by the degree of hazard presented to the municipal water system from possible backflow of water within the customer's private system. The types of devices allowed are:

1. Double Check Valve Assembly - a device composed of two (2) single, independently acting, approved check valves, including tightly closing shutoff valves located at each end of the assembly and suitable connections for testing the water tightness of each check valve.
2. Reduced pressure principle backflow prevention device - a device containing a minimum of two (2) independently acting, approved check valves, together with an automatically operated pressure differential relief valve located between the two check valves. The unit must include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with properly located test cocks.

## **101-103. TAPPING SLEEVES**

Steel body tapping sleeves shall be JCM Industries Inc., JCM 412 or Smith-Blair 622. All steel body tapping sleeves shall have heavy welded ASTM A 285, Grade C steel body, stainless steel bolts, manufacturer's epoxy coated body, and three-quarter inch (3/4") bronze test plug.

## **101-104. BLOW OFF HYDRANTS**

Blow offs are not allowed.

## **503. CONSTRUCTION**

## **101-105. MATERIAL HANDLING**

1. Pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

2. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at their expense in a manner satisfactory to the Engineer.
3. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

## **101-106. PIPE LAYING**

### **503-2.1. ALIGNMENT AND GRADE**

The pipe shall be laid and maintained to the required lines and grades with fittings, valves and hydrants at the required locations, spigots centered in bells; and all valves and hydrant stems plumb. All pipe installed shall be pigged and properly blown off before any pressure testing and sterilization of the pipe can be completed.

The depth of cover over the water main shall be a minimum of thirty inches (30") and a maximum of forty-two inches (42") below finished grade, except where approved by the Engineer to avoid conflicts and obstructions. Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration of the plans is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade or arrange with the Owners of the structures for the removal, relocation, or reconstruction of the obstructions.

### **503-2.2. INSTALLATION**

Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped in the trench.

If damage occurs to any pipe, fittings, valves, hydrants or accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Engineer who will prescribe corrective repairs or rejection.

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid. Pipe joints shall be made up in accordance with the manufacturer's recommendations.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into the pipe, the Engineer may require that, before lowering the pipe into the trench, a heavy, woven canvas bag of suitable size shall be placed over each end and left there until the

connection is to be made to the adjacent pipe. During laying operation, no debris, tools, clothing or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

Pipe shall be laid with bell ends facing in the direction of laying unless directed otherwise by the Engineer. Where pipe is laid on the grade of ten percent (10%) or greater, the laying shall start at bottom and shall proceed upward with the bell ends of the pipe upgrade.

Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane to avoid obstructions or to plumb stems, or where long radius curves are permitted, the amount of deflection allowed shall not exceed that allowed under the latest edition of ANSI/AWWA C600-82 and C900 81 or latest revisions.

No pipe shall be laid when, in the opinion of the Engineer, trench conditions are unsuitable.

## **101-107. SETTING OF VALVES, HYDRANTS AND FITTINGS**

### **503-2.3. GENERAL**

Valves, hydrants, fittings, plugs and caps shall be set and joined to pipe in the manner specified above for installation of pipe.

### **503-2.4. VALVES**

Valves in water mains shall, where possible, be located on the street property lines extended unless shown otherwise on the plans. All valves shall be installed at the tee in all cases, not to exceed eighteen inches (18") from the main line.

The valve box shall not transmit any shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed. Refer to City Index No. 402; Sheet 1 of 5 & Sheet 2 of 5 for potable water valve pad detail, and City Index No. 502; Sheet 1 of 2 & Sheet 2 of 2 for reclaimed water valve box and pad detail.

### **503-2.5. HYDRANTS**

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. All hydrants located ten feet (10') or more from the main shall have a gate valve at the main and another gate valve at the hydrant location. No valve can be located anywhere in the hydrant run to circumvent the use of two valves. Refer to City Index No. 402; Sheet 4 of 4 for potable water hydrants. No hydrants shall

be installed on the reclaimed water system unless approved by the City of Clearwater's Engineering Department.

All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb. Hydrants shall be set to the established grade, with nozzles as shown or as directed by the Engineer.

Each hydrant shall be connected to the main with a six inch (6") ductile iron branch controlled by an independent six inch (6") gate valve. If hydrant is placed greater than ten feet (10') from the main, an additional valve shall be installed at the hydrant and shall be included in the hydrant assembly cost.

## **503-2.6. ANCHORAGE**

Movement of all plugs, caps, tees, bends, etc., unless otherwise specified shall be prevented by attaching approved mechanical restraining rings or glands and installed per manufacturer's recommendations. Hydrants shall be held in place with restrained swivel joints. Restraining mechanical joint glands on hydrants may be used where hydrant run out length precludes the use of hydrant connecting swivel joints.

Where special anchorage is required, such anchorage shall be in accordance with details shown on the plans.

## **101-108. CONNECTIONS TO EXISTING LINES**

Where shown on the plans or directed by the Engineer, the water lines constructed under this contract shall be connected to the existing lines now in place. No such connection shall be made until all requirements of the specifications as to tests, flushing, and sterilization have been met and the plan of the cut in to the existing line has been approved by the Engineer.

Where connections are made between new work and existing work, the connections shall be made in a thorough and workmanlike manner using proper materials and fittings to suit the actual conditions. All fittings shall be properly sterilized, and pipe will be properly swabbed before connections to existing facilities. All connections to existing facilities will be completed under the supervision of the City of Clearwater.

## **504. TESTS**

### **101-109. HYDROSTATIC TESTS**

After installation of water mains, complete with all associated appurtenances including service taps, all sections of newly laid main shall be subject to a hydrostatic pressure test of 150 pounds per square inch for a period of two (2) hours and shall conform to AWWA C600 latest revision. All mains shall be pigged and flushed to remove all sand and other foreign matter before any hydrostatic test can or will be performed. The pressure test shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection and all necessary apparatus, together with operating personnel, shall be furnished by the Contractor at their expense.

The Contractor shall make all necessary taps into the pipe line. The Owner will furnish the water for the test. Before applying the test pressure, all air shall be expelled from the pipe line.

**101-110. NOTICE OF TEST**

The Contractor shall give the City of Clearwater's Owner Representative forty-eight (48) hours advance notice of the time when the installation is ready for hydrostatic testing.

**505. STERILIZATION**

Before the system is put into operation, all water mains and appurtenances and any item of new construction with which the water comes in contact, shall be thoroughly sterilized in accordance with AWWA C651.

**101-111. STERILIZING AGENT**

The sterilizing agent shall be liquid chlorine, sodium hypochlorite solution conforming to Federal Specification O-S-602B, Grade D, or dry hypochlorite, commonly known as "HTH" or "Perchloron".

**101-112. FLUSHING SYSTEM**

Prior to the application of the sterilization agent, all mains shall be thoroughly flushed. Flushing shall continue until a clean, clear stream of water flows from the hydrants. Where hydrants are not available for flushing, such flushing shall be accomplished at the installed blow off devices generally at the ends of the lines.

**101-113. STERILIZATION PROCEDURE**

All piping, valves, fittings and all other appurtenances shall be sterilized with water containing a minimum chlorine concentration of 75 ppm at any point in the system. This solution shall then remain in the distribution system for a minimum contact period of eight (8) hours and never more than twenty-four (24) hours before it is flushed out. All valves in the lines being sterilized shall be opened and closed several times during the contact period.

**101-114. RESIDUAL CHLORINE TESTS**

After the sterilization outlined above has been accomplished, flushing shall continue until free residual chlorine tests not less than 0.2 ppm nor more than 3.0 ppm. Residual chlorine test shall be in accordance with standard methods using a standard DPD test set.

**101-115. BACTERIAL TESTS**

After the water system has been sterilized and thoroughly flushed as specified herein, City of Clearwater Water Division or the Owner's Representative personnel shall take samples of water from remote points of the distribution system in suitable sterilized containers. The City shall forward the samples to a laboratory certified by the Florida State Board of Health for bacterial examination in accordance with AWWA C651. If tests of such samples indicate the presence of coliform organisms, the sterilization as outlined above shall be repeated until tests indicate the absence of such pollution. The bacterial tests shall be satisfactorily completed before the system is placed in operation and it shall be the Contractor's responsibility to perform the sterilization as outlined above.

If methods of sterilization differ materially from those outlined above, such methods shall be in accordance with directives of the Florida State Board of Health and all methods employed shall have the approval of that agency. Definite instructions as to the collection and shipment of samples shall be secured from the laboratory prior to sterilization and shall be followed in all respects. The City of Clearwater shall secure clearance of the water main from the Florida Department of Environmental Protection before the water distribution system is put into operation.

## **506. MEASUREMENT AND PAYMENT**

### **101-116. GENERAL**

Bids must include all sections and items as specified herein and as listed on the Bid Form. Payment for the work of constructing the project will be made at the unit price or lump sum payment for the items of work as set forth in the Bid, which payment will constitute full compensation for all labor, equipment, and materials required to complete the work. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work:

- Clearing and grubbing
- Excavation, including necessary pavement removal
- Shoring and/or dewatering
- Structural fill
- Backfill
- Grading
- Tracer wire
- Refill materials
- Joint materials
- Tests and sterilization
- Appurtenant work as required for a complete and operable system.

### **101-117. FURNISH AND INSTALL WATER MAINS**

#### **506-2.1. MEASUREMENT**

The quantity for payment shall be the actual number of feet of pipe of each size and type satisfactorily furnished and laid, as measured along the centerline of the completed pipe line, including the length of valves and fittings.

#### **506-2.2. PAYMENT**

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials and equipment, and constructing the water mains completely and ready for operation.

**101-118. FURNISH AND INSTALL FITTINGS****506-2.3. MEASUREMENT**

The quantity for payment will be the number of tons, or decimal part thereof, of ductile iron fittings satisfactorily furnished and installed. Fitting weights shall be based on weights stamped on the body of the fitting, provided such weights do not exceed the theoretical weights by more than the tolerances permitted in ANSI/AWWA C110/A 21.10 82, latest revision, in which case, the weight will be based upon the theoretical weight plus the maximum tolerance.

**506-2.4. PAYMENT**

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials, and equipment required to furnish and install ductile iron fittings.

**101-119. FURNISH AND INSTALL GATE VALVES  
COMPLETE WITH BOXES AND COVERS****506-2.5. MEASUREMENT**

The quantity for payment shall be the number of gate valves of each size satisfactorily furnished and installed.

**506-2.6. PAYMENT**

Payment of the applicable unit price for each size shall be full compensation for furnishing all plant, labor, material and equipment and installing the valve complete with box and cover.

**101-120. FURNISH AND INSTALL FIRE HYDRANTS****506-2.7. MEASUREMENT**

The quantity for payment shall be the number of fire hydrants satisfactorily furnished and installed. The only hydrants allowed to be installed in the City of Clearwater utilities system are listed in Article 501-2.5 of these Technical Specifications. No exceptions.

**506-2.8. PAYMENT**

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, material and equipment and installing the fire hydrant completely including necessary thrust anchorage, six inch (6") pipe between the main and the hydrant and gate valve and valve box on the hydrant lead.

## **600 SERIES: STORMWATER**

### **601. RAISING OR LOWERING OF STORM DRAINAGE STRUCTURES**

Storm Drainage Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

#### **101-121. BASIS OF PAYMENT**

Payment, unless covered by a bid item, shall be included in the cost of the work.

### **602. UNDERDRAINS**

The Contractor shall construct sub-surface drainage pipe as directed in the Scope of Work and detail drawings contained in the Project construction plans. In general, underdrain pipe shall be embedded in a bed of #6 FDOT aggregate, located behind the back of curb and aggregate surface covered with a non-degradable fibrous type filter material. A #57 aggregate may be used in lieu of #6 if it is washed and screened to remove fines. The aggregate may be stone, slag or crushed gravel. Unless otherwise noted on the plans, underdrain pipe shall be eight inches (8") in diameter, polyvinyl chloride pipe, in conformance with ASTM F-758 "Standard Specification For Smooth Wall PVC Underdrain Systems for Highways" latest revision, minimum stiffness of 46 in conformance with ASTM D2412, perforations in conformance with AASHTO M-189 described in FDOT Section 948-1.5 or latest revision and in conformance with ASTM D3034 - SDR 35.

Alternate acceptable underdrain pipe material is Contech A-2000 which is a rigid PVC pipe that exceeds ASTM Specifications D1784, minimum cell classification of 12454B or 12454C, manufactured per ASTM F949-93a, minimum pipe stiffness of 50 psi, with no evidence of splitting, cracking or breaking when pipe is tested in accordance with ASTM D2412 at 60% flattening and with a double gasket joint.

Underdrain pipe placed beneath existing driveways and roadways shall be non-perforated pipe with compacted backfill. All poly-chloride pipe which has become deteriorated due to exposure to ultra violet radiation shall be rejected. Where ductile iron pipe is specified, pipe material shall be the same as specified for potable water pipe in these technical specifications. All underdrain aggregate shall be fully encased in a polyester filter fabric "sock" (Mirafi 140-N or approved equal) per the construction detail drawings.

Filter aggregate for underdrains shall be as specified in the FDOT Standard Specifications, Section 901 – Course Aggregate, and shall be either #6 or #57. If #57 is used, it must be washed and screened to remove fines. The aggregate may be stone, slag, or crushed gravel.

#### **101-122. BASIS OF MEASUREMENT**

Measurement shall be the number of linear feet of eight inch (8") Sub-drain in place and accepted.

## **101-123. BASIS OF PAYMENT**

Payment shall be based upon the unit price per linear foot for underdrain as measured above, which shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, and labor necessary to construct the underdrain (specifically underdrain pipe, aggregate and filter fabric). Underdrain clean-outs, sod, driveway, road and sidewalk restoration shall be paid by a separate bid item.

## **603. STORM SEWERS**

All storm drain pipe installed within the City of Clearwater shall be steel reinforced concrete unless otherwise approved by the City Engineer. Said pipe shall comply with Section 430 of FDOT Standard Specifications.

All reinforced concrete pipe joints shall be wrapped with Mirafi 140N filter fabric or equivalent (as approved by the City Engineer). The cost for all pipe joint wraps shall be included in the unit price for the pipe.

All pipe, just before being lowered into a trench, is to be inspected and cleaned. If any difficulty is found in fitting the pieces together, this fitting is to be done on the surface of the street before laying the pipe, and the tops plainly marked in the order in which they are to be laid. No pipe is to be trimmed or chipped to fit. Each piece of pipe is to be solidly and evenly bedded, and not simply wedged up. Before finishing each joint, some suitable device is to be used to find that the inverts coincide and pipe is clear throughout.

## **101-124. TESTING AND INSPECTION**

The Contractor shall take all precautions to secure a watertight sewer under all conditions.

The work under this Article shall include the internal video recording of new stormwater drainage pipes and drainage structures. The Contractor shall provide the City with a video of the completed stormwater drainage system, and a written report. The Contractor shall pump down and clean the pipes and drainage structures, to the satisfaction of the City, prior to video recording. The video shall be of the standard DVD format, in color, with all the pertinent data and observations recorded as audio on the DVD. The data should include:

- 1) An accurate recorded footage of the pipe lengths.
- 2) The drainage structure number and pipe size.
- 3) The run of the pipe and direction of flow (i.e. from S-1 to S-2).
- 4) Details of structural defects, broken pipes, sags, dips, misalignments, obstructions and infiltration.

The written report shall include the four (4) items listed previously.

All visual and video recording inspections shall be completed by the Contractor and be in accordance with Section 430-4.8 of FDOT Standard Specifications. Any deficient or damaged pipe discovered during the video recording process shall be the responsibility of the Contractor to repair or replace at their own expense within the contractual duration.

As a complement to the video report, the Contractor shall also provide digital photos of areas of concern in electronic (computer CD/DVD) and hard copy form (in color).

All known pipe breaks or those breaks discovered after the video inspection shall be repaired by the Contractor regardless of the test allowances. Faulty sections of drainage pipes or drainage structures rejected by the Engineer shall be removed and re-laid by the Contractor. Sections of pipe that are repaired, re-laid or replaced shall be accompanied with a corresponding post construction video inspection at the Contractor's expense. In all cases that a leak is found, re-inspection shall be required at the Contractor's expense, to confirm that the problem has been resolved.

## **101-125. BASIS OF PAYMENT**

Payment shall be the unit price per linear foot for storm sewer pipe in place and accepted, measured along the centerline of the storm sewer pipe to the inside face of exterior walls of storm manholes or drainage structures and to the outside face of endwalls. Said unit price includes all work required to install the pipe (i.e. all materials, equipment, filter fabric wrap, gravel bedding if needed for stabilization, labor and incidentals, etc.).

## **604. STORM MANHOLES, INLETS, CATCH BASINS OR OTHER STORM STRUCTURES**

For details on specific design of a type of storm structure refer to Index Numbers 201 to 231.

When required, inlets, catch basins or other structures shall be constructed according to the plans and applicable parts of the specifications, Articles 301, 302, 303 and 202, and as approved by the Engineer. Said structures shall be protected from damage by the elements or other causes until acceptance of the work.

## **101-126. BUILT UP TYPE STRUCTURES**

Built up type manholes shall be constructed of brick with cast iron frames and covers as shown on Index Numbers 201. Invert channels shall be constructed smooth and semi circular in shape conforming to inside of adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be built up with grout.

The storm structure floor outside of channels shall be made smooth and sloped toward channels.

Manhole steps shall not be provided. Joints shall be completely filled and the mortar shall be smoothed from inside of the manholes.

The entire exterior of brick manholes shall be plastered with a skim coat of one half inch (1/2") of mortar.

Brick shall be laid radially with every sixth course being a stretcher course.

In cases where a storm pipe extends inside a structure, the excess pipe will be cut off with a concrete saw and shall not be removed with a sledge hammer.

## **101-127. PRECAST TYPE**

Precast manholes shall be constructed as shown on Index 202. The manhole base shall be set on a pad of dry native sand approximately five inches (5") thick to secure proper seating and bearing.

Precast Manholes and Junction Boxes: The Contractor may substitute precast manholes and junction boxes in lieu of cast in place units unless otherwise shown on the plans. Precast Inlets will not be acceptable. When precast units are substituted, the construction of such units must be in accordance with ASTM C 478, or the standard specifications at the manufacturer's option.

Precast structures must also meet the requirement that on the lateral faces, either inside or outside, the distance between precast openings for pipe or precast opening and top edge of precast structure be no less than wall thickness. A minimum of four courses of brick will be provided under manhole ring so that future adjustment of manhole lid can be accommodated. Manhole steps shall not be provided.

## **101-128. BASIS OF PAYMENT**

Payment for Junction Boxes, Manholes or other structures shall be on a unit basis.

# **605. GABIONS AND MATTRESSES**

## **101-129. MATERIAL**

### **605-2.1. PVC COATED WIRE MESH GABIONS & MATTRESSES**

#### **605-2.1.1. GABION & MATTRESS BASKETS**

Gabion and mattress baskets units shall conform to ASTM A975, be of non-raveling construction and fabricated from a double twist by twisting each pair of wires through three half turns developing the appearance of a triple twist. The galvanized wire core shall have a diameter of 0.106 inches.

#### **605-2.1.2. PVC (POLYVINYL CHLORIDE) COATING**

The coating shall be gray in color and shall have a nominal thickness of 0.0216 inches but not less than 0.015 inches in thickness. The protective PVC plastic shall be suitable to resist deleterious effects from exposure to light, immersion in salt or polluted water and shall not show any material difference in its initial compound properties. The PVC compound is also resistant to attack from acids and resistant to abrasion.

The PVC coating shall be extruded and adhere to the wire core prior to weaving. The PVC coated wire shall be woven into a double twisted hexagonal mesh having uniform openings of 3 1/4 inches by 4 1/2 inches. The overall diameter of the mesh wire (galvanized wire core plus PVC coating) shall be 0.146 inches. Selvedge and reinforcing wire shall be of heavily galvanized wire core, 0.134 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.174 inches. Lacing and connecting wire shall be of soft tensile strength (75,000 PSI max), heavily galvanized wire core, 0.087 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.127 inches. The use of alternate wire fasteners shall be permitted in lieu of tie wire providing the alternate fastener

produces a four (4) wire selvedge joint with a strength of 1200 lbs. per linear foot while remaining in a locked and closed condition. Properly formed interlocking fasteners shall be spaced from 4 to 6 inches and have a minimum 3/4 square inch inside area to properly confine the required selvedge wires.

#### **605-2.1.3. GABION AND MATTRESS FILLER MATERIAL:**

The filler stone shall be from a source approved by the Engineer before delivery is started. Representative preliminary samples of the stone shall be submitted by the contractor or supplier for examination and testing by the Engineer. The stone shall have a minimum specific gravity of 2.3 and be of a quality and durability sufficient to insure permanency in the structure. The individual stones shall be free of cracks, seams, and other defects that would tend to promote deterioration from natural causes, or which might reduce the stones to sizes that could not be retained in the gabion or mattress baskets.

All filler material shall be uniformly graded between 4 inch and 8 inch (equivalent spherical diameter) and shall be angular in form. Rounded stones shall not exceed 10% of the stone, by weight and 70% of the stone, by weight, shall exceed the largest dimension of the mesh opening. Crushed concrete shall not be used for filler material.

#### **605-2.1.4. GEOTEXTILE FABRIC**

Fabric shall conform to FDOT Standard Specifications, Section 985.

### **101-130. PERFORMANCE**

Gabions and Reno Mattresses shall be installed according to the manufacturer's recommendations and as shown on the Drawings. Fabrication of gabion baskets shall be in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the Drawings. Gabions and mattresses shall be of single unit construction; the base, lid ends and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that the strength and flexibility at the connecting point is at least equal to that of the mesh. Where the length of the gabion and mattress exceeds one and one-half its horizontal width, they shall be equally divided by diaphragms of the same mesh and gauge as the mattresses shall be furnished with the necessary diaphragms secured in proper position on the base so that no additional tying is required at this juncture. The wire mesh is to be fabricated so that it will not ravel. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut.

Each gabion or mattress shall be assembled by tying all untied edges with binding wire. The binding wire shall be tightly looped around every other mesh opening along seams so that single and double loops are alternated.

A line of empty gabions shall be placed into position according to the contract drawings and binding wire shall be used to securely tie each unit to the adjoining one along the vertical reinforced edges and the top selvedges. The base of the empty gabions placed on top of a filled line of gabions shall be tightly wire to the latter at front and back.

To achieve better alignment and finish in retaining walls, gabion stretching is recommended.

Connecting wires shall be inserted during the filling operation in the following manner: Gabions shall be filled to one third full and one connecting wire in each direction shall be tightly tied to opposite faces of each cell at one third height. The gabion shall then be filled to two thirds full and one connecting wire in each direction shall be tightly tied to opposite face of each cell at one two third height. The cell shall then be filled to the top.

Filler stone shall not be dropped more than twelve inches (12") into the gabions and mattresses.

Geotextile fabric shall be installed at locations shown in the Drawings. The surface to receive the cloth shall be prepared to a relatively smooth condition free of obstructions which may tear or cut the cloth. The panel shall be overlapped a minimum of 30 inches and secured against movement. Cloth damaged or displaced during installation, gabion work, or backfill shall be replaced or repaired to the satisfaction of the Engineer at the contractor's expense. The work shall be scheduled so that the fabric is not exposed to ultraviolet light more than the manufacturer's recommendations or five days, whichever is less.

In wet conditions, a base shall be established by spreading and compacting #57 stone prior to placement of geotextile fabric and gabions or mattresses.

## **700 SERIES: STREETS AND SIDEWALKS**

### **701. RESTORATION OR REPLACEMENT OF DRIVEWAYS, CURBS, SIDEWALKS AND STREET PAVEMENT**

Driveways, sidewalks, and curbs destroyed or damaged during construction shall be replaced and shall be the same type of material as destroyed or damaged, or to existing City Standards, whichever provides the stronger repair. All street pavement destroyed or damaged shall be replaced with the same type of material, to existing City Standards, unless the existing base is unsuitable as determined by the Engineer, then the base shall be replaced with City approved material. All replaced base shall be a minimum eight inches (8") compacted thickness, or same thickness as base destroyed plus two inches (2"), if over six inches (6"), and compacted to 98% of maximum density per AASHTO T-180.

Unless called for in the proposal as separate bid items, cost of the above work including labor, materials and equipment required shall be included in the bid price per linear foot of main or square yard of base.

The bid price for street pavement, restoration or replacement when called for in the proposals, shall include all materials, labor and equipment required to complete the work, and shall be paid for on a square yard basis. When replacement is over a trench for utilities, the area of replacement shall be limited to twice the depth of the cut plus twice the inside diameter of the pipe. All necessary restoration exceeding this footprint will be at the Contractor's expense.

The bid price for restoration or placement of driveways, curbs and sidewalks, when called for in the proposals, shall include all materials, labor and equipment required to complete the work and shall be paid for on the basis of the following units: Driveways, plant mix - per square yard; concrete - per square foot; curbs - per linear foot; sidewalk four inches (4") or six inches (6") thick - per square foot. Concrete walks at drives shall be a minimum of six inches (6") thick and be reinforced with 6/6 X 10/10 welded wire mesh (also see Articles 303 and 707). The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of all driveway, curb, sidewalk and street restoration and replacement work.

### **702. ROADWAY BASE AND SUBGRADE**

#### **101-131. BASE**

This specification describes the construction of roadway base and subgrade. The Contractor shall refer to Section IV, Article 101 "Scope of Work" of the City's Contract Specifications for additional roadway base and subgrade items.

Roadway base shall be eight inches (8") compacted minimum thickness unless otherwise noted on the plans or directed by the Engineer. The subgrade shall be twelve inches (12") compacted minimum thickness with a minimum Limerock Bearing Ratio (LBR) of 40 unless otherwise noted on the plans or directed by the Engineer. The Contractor shall obtain from an independent testing laboratory a Proctor and an LBR for each type material. The Contractor shall also have an independent testing laboratory perform all required density testing. Where unsuitable material is

found within the limits of the base, Section IV, Article 204 (Unsuitable Material Removal) of the City's Technical Specifications will apply.

Once the roadway base is completed, it shall be primed that same day (unless otherwise directed by the Engineer) per Section 300 of FDOT's Standard Specifications. Repairs required to the base that result from a failure to place the prime in a timely manner shall be done to the City's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the City approves the repaired base. The cost for placement of prime material shall be included in the bid item for base.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of all base and subgrade placement or reworking.

The following base materials are acceptable:

1. **Shell Base:** Shell base shall be constructed in accordance with Sections 200 and 913 of FDOT's Standard Specifications and shall have a minimum compacted thickness as shown on the plans. The shell shall be FDOT approved. The cost of the prime coat shall be included in the bid item price for base.
2. **Limerock Base:** Limerock base shall be constructed in accordance with Sections 200 and 911 of FDOT's Standard Specifications and shall have a minimum compacted thickness as shown on the plans. The limerock shall be from a FDOT approved certified pit. The cost of the prime coat shall be included in the bid item price for base.
3. **Crushed Concrete Base:** Crushed concrete base shall be constructed in accordance with Sections 204 and 901 of FDOT's Standard Specifications and shall have a minimum compacted thickness as shown on the plans. The crushed concrete material shall be FDOT approved. The Contractor shall provide certified laboratory tests on gradation to confirm that the crushed concrete base material conforms to the above specifications. The LBR shall be a minimum of 100. LBR and gradation tests shall be provided to the City by the Contractor once a week for continuous operations, or every 1000 tons of material, unless requested more frequently by the City Engineer or designee. The cost of the prime coat shall be included in the bid item price for base.
4. **Superpave Asphalt Base:** Full depth asphalt base shall be constructed in accordance with Section 234 of FDOT's Standard Specifications and shall have a minimum compacted thickness as shown on the plans. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.
5. **Reclaimed Asphalt Pavement Base:** Reclaimed asphalt pavement base shall be constructed in accordance with Section 283 of FDOT's Standard Specifications and shall have a minimum compacted thickness as shown on the plans. As per FDOT Section 283, RAP material shall be used as a base course only on non-limited access paved shoulders, shared use paths, or other non-traffic bearing applications. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.

## **702-2.1. BASIS OF MEASUREMENT FOR BASE AND REWORKED BASE**

The basis of measurement shall be the number of square yards of base in place and accepted as called for on the plans. The maximum allowable deficiency shall be a half-inch (1/2"). Areas deficient in thickness shall either be fixed by the Contractor to within acceptable tolerance, or if so approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

## **702-2.2. BASIS OF PAYMENT FOR BASE AND REWORKED BASE**

The unit price for base shall include: all materials, roadbed preparation, placement, spreading, compaction, finishing, prime, base, subgrade (unless the plans specify a separate pay item), stabilization, mixing, testing, equipment, tools, hauling, labor, and all incidentals necessary to complete the work. Payment for asphalt base shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans.

## **101-132. SUBGRADE**

All subgrade shall be stabilized and constructed in accordance with Sections 160 and 914 of FDOT's Standard Specifications unless otherwise noted herein. All subgrade shall have a minimum compacted thickness of 12" unless otherwise shown on the plans or directed by the Engineer. If limerock is used, it shall also meet the requirements of Section 911 of FDOT's Standard Specifications. Where unsuitable material is found within the limits of the subgrade, Section IV, Article 204 (Unsuitable Material Removal) of the City's Contract Specifications will apply. The extent of said removal shall be determined by the Engineer in accordance with accepted construction practices. The Contractor is responsible for clearing, grading, filling, and removing any trees or vegetation in the roadbed below the subgrade to prepare it per the plans. The cost of this work shall be included in the unit price for base or subgrade. The Contractor shall obtain from an independent testing laboratory the bearing value of the subgrade after the materials are mixed for the stabilized subgrade.

## **702-2.3. BASIS OF MEASUREMENT**

The basis of measurement shall be the number of square yards of stabilized subgrade in place and accepted as called for on the plans. The maximum allowable deficiency for mixing depth shall be per Section 161-6.4 of FDOT's Standard Specifications. Acceptable bearing values shall be per Section 160-7.2 of FDOT's Standard Specifications. Areas deficient in thickness or bearing values shall either be corrected by the Contractor to within acceptable tolerance, or if so approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

## **702-2.4. BASIS OF PAYMENT**

The unit price for subgrade shall include roadbed preparation, placement, spreading, compaction, finishing, testing, stabilizing, mixing, materials, hauling, labor, equipment and all incidentals necessary to complete the work. If no pay item is given, subgrade shall be included in the bid item for base.

## **703. ASPHALTIC CONCRETE MATERIALS**

This specification is for the preparation and application of all asphaltic concrete materials on roadway surfaces unless otherwise noted.

### **101-133. ASPHALTIC CONCRETE**

#### **703-2.1. AGGREGATE**

All aggregates shall be obtained from an approved FDOT source and shall conform to Sections 901 through 915 of FDOT's Standard Specifications.

#### **703-2.2. BITUMINOUS MATERIALS**

All bituminous materials shall conform to Section 916 of FDOT's Standard Specifications.

### **101-134. HOT BITUMINOUS MIXTURES – PLANT, METHODS, EQUIPMENT & QUALITY ASSURANCE**

The plant and methods of operation used to prepare all asphaltic concrete and bituminous materials shall conform to the requirements of Section 320 of FDOT's Standard Specifications. Unless otherwise noted, all acceptance procedures and quality control/assurance procedures shall conform to the requirements of Section 330 of FDOT's Standard Specifications.

The City shall have the right to have an independent testing laboratory select, test, and analyze, at the expense of the City, test specimens of any or all materials to be used. The results of such tests and analyses shall be considered, along with the tests or analyses made by the Contractor, to determine compliance with the applicable specifications for the materials so tested or analyzed. The Contractor hereby understands and accepts that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the City, which fails to meet the requirements of the Contract documents, all costs of such independent inspection and investigation as well as all costs of removal, correction, reconstruction, or repair of any such work shall be borne solely by the Contractor.

Payment reductions for asphalt related items shall be determined by the following:

1. Density per FDOT's Standard Specifications.
2. Final surface or friction course tolerances per FDOT's Standard Specifications.
3. Thickness will be determined from core borings. Deficiencies of  $\frac{1}{4}$ " or greater shall be corrected by the Contractor, without compensation, by either replacing the full thickness for a length extending at least twenty-five feet (25') from each end of the deficient area, or when the Engineer allows for an overlay per FDOT's Standard Specifications. In addition, for excesses of one-quarter inch ( $\frac{1}{4}$ ") or greater, the Engineer will determine if the excess area shall be removed and replaced at no compensation, or if the pavement in question can remain with payment to be made based on the thickness specified in the contract.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all asphalt.

## **101-135. ASPHALT MIX DESIGNS AND TYPES**

All asphalt mix designs, acceptance procedures and quality control/assurance procedures shall conform to the requirements of Sections 330 and 334 of FDOT Standard Specifications. All asphalt mix designs shall be approved by the Engineer prior to the commencement of the paving operation. Reclaimed asphalt pavement (RAP) material may be substituted for aggregate in the asphaltic concrete mixes up to 25% by weight.

## **101-136. ASPHALT PAVEMENT DESIGNS AND LAYER THICKNESS**

All asphalt pavement designs shall conform to the following requirements:

Type SP/Spec 334-1

Type FC/Spec 337-8

Type B/Spec 234-8

ATPB/287-8

## **101-137. GENERAL CONSTRUCTION REQUIREMENTS**

The general construction requirements for all hot bituminous pavements (including limitations of operations, preparation of mixture, preparation of surface, placement and compaction of mixture, surface requirements, correction of unacceptable pavement, Quality Control Testing, etc.) shall be in accordance with Section 330 of FDOT's Standard Specifications.

## **101-138. CRACKS AND POTHOLE PREPARATION**

### **703-2.3. CRACKS**

Cracks in roadway pavement shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris to be removed from cracks by compressed air or other suitable method.
2. Apply a multiple layered application of bituminous binder and fine aggregate, as appropriate to the depth of the crack until the void of the crack is completely filled to the level of the surrounding roadway surface.
3. If application of asphaltic concrete is not to begin immediately after crack repair, cracks are to be sanded to prevent vehicular tracking.
4. Payment for crack filling shall be included in the unit price for asphaltic concrete.

### **703-2.4. POTHOLES**

Potholes shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris is to be removed from potholes by hand, sweeping, or other suitable method.
2. A tack coat is to be applied to the interior surface of the pothole.
3. The pothole is to be completely filled with asphaltic concrete, and thoroughly compacted.

4. Payment for pothole preparation shall be included in the unit price for asphaltic concrete.

## **101-139. ADJUSTMENT OF MANHOLES**

The necessary adjustments of sanitary sewer and storm drain manholes and appurtenances shall be accomplished by the Contractor. The Contractor shall be paid on a per unit basis for each item.

The use of manhole adjustment risers is acceptable under the following conditions:

The riser shall meet or exceed all FDOT material, weld, and construction requirements. The riser shall consist of an A-36 hot rolled steel meeting or exceeding the minimum requirements of A.S.T.M. A-36. The riser shall be a single piece with a stainless steel adjustment stud and shall have a rust resistant finish. The use of cast iron, plastic, or fiberglass risers is not permitted. In addition, the installation of each riser shall be per manufacturer's specifications. Each manhole shall be individually measured, and each riser shall be physically marked to ensure that the proper riser is used. Also, the ring section shall be cleaned, and a bead of chemically resistant epoxy applied to the original casting, prior to installation of the riser. It is the Contractor's responsibility to ensure that the manholes are measured, the risers are physically marked, the ring sections are thoroughly cleaned, and that the epoxy is properly applied prior to installation of each riser.

If risers are not used, the adjustment of manholes shall be accomplished by the removal of pavement around manhole, grade adjustment of ring and cover, and acceptable replacement and compaction of roadway materials prior to paving. A full depth backfill using asphalt is acceptable. The use of Portland cement for backfill is not acceptable.

All manhole and valve adjustments shall be accomplished prior to the application of final asphaltic concrete surface. Unless otherwise noted in the specs or on the plans, the paving operation shall occur within seven (7) calendar days from the completion of the adjustment. On arterial roadways, the manholes are to be ramped with asphalt during the time period between initial adjustment and final resurfacing. Water and gas valves, sewer cleanouts, valve boxes, tree aeration vents, etc., will be adjusted by the Contractor with the cost for this work to be included in the unit cost of the asphalt. Care must be taken around said appurtenances to ensure that they are not paved over. It is the Contractor's responsibility to inform the owners of all utilities of impending work and coordinate their adjustments, so they are completed prior to the scheduled paving.

## **101-140. ADDITIONAL ASPHALT REQUIREMENTS**

1. All impacted radius returns within project limits shall be paved unless otherwise directed by the Construction Inspector or Engineer, with payment to be included in the per ton bid item for asphalt.
2. All pavement markings impacted by placement of asphalt shall be replaced prior to the road being open to traffic unless otherwise noted in the contract scope and plans.
3. All project related debris shall be hauled off the job site by the Contractor in a timely manner and at their own expense in conformance with all regulatory requirements.
4. The Contractor shall pay particular attention to sweeping when paving. Prior to paving, all construction areas shall be swept with a Municipal type sweeper (either vacuum or mechanical type) that picks up and hauls off, dust and dirt. The sweeper must be equipped

with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off of sidewalks, driveways, curbs and roadways each day before leaving the job site.

5. The application of tack and prime coats (either required or placed at the Engineer's discretion) shall be placed per Section 300 of FDOT's Standard Specifications. Tack shall also be applied to the face of all curbs and driveways. The cost (including heating, hauling and applying) shall be included in the per ton bid item for asphalt, unless otherwise noted in the project scope and plans.
6. Leveling course and spot patching shall be applied to sections of the road as noted on the plans, or as directed by the Engineer, per Section 330 of FDOT's Standard Specifications. The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.
7. If an asphalt rubber binder is required, it shall conform to the requirements of Section 336 of FDOT's Standard Specifications.
8. On all streets with curb and gutter, the final compacted asphalt shall be one-quarter inch ( $\frac{1}{4}$ ") above the lip or face of said curb per City Index 101.

## **101-141. BASIS OF MEASUREMENT**

Basis of measurement will be the number of tons of asphaltic concrete completed, in place and accepted. Truck scale weights will be required for all asphaltic concrete used.

## **101-142. BASIS OF PAYMENT**

Payment shall be made at the contract unit price for asphaltic concrete surface as specified and measured above. This price shall include all materials, preparation, hauling, placement, tack and/or prime coat either required or placed at Engineer's discretion, leveling, spot patching, filling of cracks, pothole repair, sweeping, debris removal, labor, equipment, tools, and incidentals necessary to complete the asphalt work in accordance with the plans and specifications.

## **704. ADJUSTMENT TO THE UNIT BID PRICE FOR ASPHALT**

When this Article applies to the contract, the unit bid price for asphalt will be adjusted in accordance with the following provisions:

1. Price adjustment for asphalt shall only be made when the current FDOT Asphalt Price Index varies more than ten percent (10%) from the bid price at the time of the bid opening.
2. The Bituminous Material Payment Adjustment Index published monthly by the FDOT shall be used for the adjustment of unit prices. This report is available on FDOT's internet site. The address is: <http://www.dot.state.fl.us/construction/fuel&bit/fuel&bit.shtm>. For additional information, call FDOT at (850) 414-4252.
3. The FDOT Payment Adjustment Index in effect at the time of the bid opening will be used for the initial determination of the asphalt price.
4. The FDOT Payment Adjustment Index in effect at the time of placement of the asphalt will be used for payment calculation.

5. The monthly billing period for contract payment will be the same as the monthly period for the FDOT Payment Adjustment Index.
6. No adjustment in bid prices will be made for either tack coat or prime coat.
7. No price adjustment reflecting any further increases in the cost of asphalt will be made for any month after the expiration of the allowable contract time.
8. The City reserves the right to make adjustments for decreases in the cost of asphalt.

## **705. ASPHALT DRIVEWAYS**

New driveways or existing asphalt driveways that must be altered for project construction shall be constructed or replaced in accordance with the specifications for paving the street with the exception that the base shall be six inches (6"). Remove only enough to allow adequate grade for access to the street. Use Article 703 Asphaltic Concrete, of these Technical Specifications, as specified for the street paving.

When the finished surface of the existing drive is gravel, replacement shall be of like material. Payment shall be the same as Asphalt Driveways.

### **101-143. BASIS OF MEASUREMENT**

Measurement shall be the number of square yard of Asphalt Driveways in place and accepted.

### **101-144. BASIS OF PAYMENT**

Payment shall be the unit price per square yard for Asphalt Driveways as measured above, which price shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

## **706. CONCRETE CURBS**

Concrete Curbs shall be constructed to the line, grade and dimensions as shown on the plans. Unless otherwise noted, all concrete curbs shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Expansion joints shall be placed at intervals not to exceed 100 feet, and scored joints shall be placed at intervals not to exceed ten feet (10'). In addition, all the requirements of City Articles 301, 302 and 303 shall also apply. The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete curbs.

### **101-145. BASIS OF MEASUREMENT**

The basis of measurement shall be linear feet of curb in place and accepted.

### **101-146. BASIS OF PAYMENT**

Payment shall be the unit price per linear foot of curb, which price shall be full compensation for all work described in this and other applicable parts of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

## **707. CONCRETE SIDEWALKS AND DRIVEWAYS**

### **101-147. CONCRETE SIDEWALKS**

Concrete sidewalks shall be constructed to the line, grade and dimensions as shown on the plans or herein specified. Unless otherwise noted, all concrete sidewalks shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Unless otherwise specified, all concrete sidewalks shall have a minimum width of four feet (4'). Concrete sidewalks shall have a minimum thickness of four inches (4"), except at driveway crossings where a minimum thickness of six inches (6") is required. Also, 6/6 X 10/10 welded wire mesh reinforcement is required for all sidewalk that crosses driveways. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Expansion joints shall be placed at intervals of not more than 100 hundred feet, and scoring marks shall be made every five feet (5'). Concrete shall be poured only on compacted subgrade. In addition, all the requirements of Articles 301, 302 and 303 of these Technical Specifications shall also apply.

### **101-148. CONCRETE DRIVEWAYS**

Concrete driveways, whether new construction or replacement, shall be a minimum of six inches (6') in thickness with 6/6 x 10/10 welded wire mesh reinforcement and a minimum horizontal distance between expansion joints of no less than four feet (4') measured in any direction. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Concrete shall be poured only on compacted subgrade. In addition, all the requirements of Articles 301, 302 and 303 of these Technical Specifications shall also apply.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete sidewalks and driveways.

### **101-149. CONCRETE CURB RAMPS**

The contractor is responsible for constructing ADA compliant concrete curb ramps per the plans and installing detectable warning surfaces on said ramps as called for in the plan set. Concrete curb ramps and detectable warning surfaces are to be constructed per FDOT Standards and Specifications.

### **101-150. BASIS OF MEASUREMENT**

The basis of measurement shall be the number of square feet of four inch (4") concrete sidewalk, six inch (6") concrete sidewalk, and six inch (6") concrete driveways in place and accepted.

### **101-151. BASIS OF PAYMENT**

Payment shall be the unit price per square foot for each item as measured above, which shall be full compensation for all work described in this section and other applicable parts of the specifications and shall include all materials, equipment, tools, welded wire mesh where required, labor and incidentals necessary to complete the work.

## 708. MILLING OPERATIONS

### 101-152. EQUIPMENT, CONSTRUCTION & MILLED SURFACE

Unless otherwise noted in the specs, plans or this Article, the milling operation shall be performed in accordance with Section 327 of FDOT's Standard Specifications. The Contractor shall notify the City of Clearwater Project Representative a minimum of twenty-four (24) hours in advance of all milling.

### 101-153. ADDITIONAL MILLING REQUIREMENTS

1. If the milling machine is equipped with preheating devices, the Contractor is responsible to secure any necessary permits, and for complying with all local, state and federal environmental regulations governing operation of this type of equipment.
2. All milled surfaces must be repaved within seven (7) days from the time it was milled, unless otherwise noted in the contract documents.
3. Prior to paving, all milled areas shall be swept with a Municipal type sweeper either of the vacuum or the mechanical type that picks up and hauls off, dust and dirt. The sweeper must be equipped with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off of sidewalks, driveways and curbs in addition to the roadways before leaving the job site.
4. In cases where concrete valley swales are present, the adjoining pavement shall be milled to allow for the new asphalt grade to be flush with the concrete surface.
5. The Contractor shall be responsible for removing any asphalt that remains in the curb line and/or median curbs after the milling operation of a street is complete. The cost of this removal shall be included in the bid item for milling.
6. All radius returns on streets to be milled shall also be milled unless otherwise directed by the Engineer, with payment to be included in the bid item for milling.
7. Any leveling or base replacement required after milling shall be applied to sections of the road as noted on the plans, or directed by the Engineer, per Section 330 of FDOT's Standard Specifications. The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.
8. Any roadway base material exposed as a result of the milling operation shall be primed that same day (unless otherwise directed by the Engineer) per Section 300 of FDOT's Standard Specifications. Repairs required to said base that result from a failure to place the prime in a timely manner shall be done to the City's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the City approves the repaired base. The cost of said prime shall be included in the bid item for milling.
9. Prior to the placement of asphalt, the face of all curbs and driveways shall be tacked after the milling operation is complete.

## **101-154. SALVAGEABLE MATERIALS**

Unless otherwise specified, all salvageable materials resulting from milling operations shall remain the property of the City. The transporting and stockpiling of salvageable materials shall be performed by the Contractor. The Contractor shall contact the City Project Representative to schedule delivery of material at least 48 hours prior to starting work.

## **101-155. DISPOSABLE MATERIALS**

All surplus materials not claimed by the City shall become the responsibility of the Contractor. The Contractor shall dispose of the material in a timely manner and in accordance with all regulatory requirements in areas provided by the Contractor at no additional expense to the City.

## **101-156. ADJUSTMENT AND LOCATION OF UNDERGROUND UTILITIES**

All private utilities and related structures requiring adjustment shall be located and adjusted by their owners at the owner's expense. City-owned utilities and structures shall be located by the Owner/City and adjusted by the contractor. The Contractor shall arrange their schedule to allow utility owners the time required for such adjustments (minimum 48 hours' notice per State Statute). All utility adjustments shall be completed prior to the commencement of milling and resurfacing operations.

## **101-157. ADJUSTMENT OF UTILITY MANHOLES**

The necessary adjustments of sanitary sewer and stormwater utility manholes and appurtenances shall be accomplished by the Contractor in accordance with Section IV, Article 703-7 of the City's Technical Specifications.

## **101-158. TYPES OF MILLING**

There are two types of milling used by the City:

- A. Wedge – This will consist of milling a six foot (6') wide strip along the curb line of the pavement adjacent to the curb so the new asphalt will align with the original curb height and pavement cross section.
- B. Full Width – This will consist of milling the entire roadway (i.e. curb line/edge of pavement to curb line/edge of pavement). All existing horizontal and vertical geometry shall remain unless otherwise indicated or approved by the Engineer.

## **101-159. MILLING OF INTERSECTIONS**

Intersections, as well as other areas (including radius returns) are to be milled and repaved to restore and/or improve the original drainage characteristics. Said work should extend approximately fifty (50) to one hundred (100) feet in both directions from the low point of the existing swale.

## **101-160. BASIS OF MEASUREMENT**

The quantity to be paid for will be the area milled, in square yards, completed and accepted.

## **101-161. BASIS OF PAYMENT**

The unit price for milling shall include: all materials, preparation, hauling, transporting and stockpiling of salvageable materials, disposal of all surplus material, any required milling of radius returns and intersections, prime and/or tack coat either required or placed at Engineer's discretion, removal of asphalt from curbs, sweeping, labor, equipment, and all incidentals necessary to complete the milling in accordance with the plans and specifications.

## **800 SERIES: TRAFFIC SIGNALS, SIGNS AND MARKINGS**

### **801. TRAFFIC SIGNAL EQUIPMENT AND MATERIALS**

All traffic signal work shall be performed per FDOT's Standard Specifications (Sections 603 through 699), unless otherwise specified in the contract documents and plans.

This specification includes, but is not limited to, the following items: all necessary equipment, materials, guaranties, acceptance procedures, signal timings, field tests, grounding, conduit, signal and interconnect cable, span wire assemblies, pull and junction boxes, electrical power service assemblies, poles, signal assemblies, pedestrian assemblies, inductive loop detectors, pedestrian detectors, traffic controller assemblies, controller cabinets and accessories, removal of existing traffic signal equipment, and internally illuminated signs.

All traffic signal installations shall be mast arms and conform to the requirements of FDOT's Mast Arm Assembly standard and shall be signed and sealed by a professional engineer registered in the State of Florida. All mast arm calculations, as well as the geotechnical report, shall also be signed and sealed by a professional engineer registered in the State of Florida. All mast arm colors shall be determined and approved by the City prior to ordering from the manufacturer.

All traffic signal indicators for vehicles and pedestrians shall be LEDs and, approved by both the City and FDOT. In addition to this, all pedestrian signal indicators shall utilize countdown features.

Contractor changes to the operation of an existing signal is prohibited unless directed by the City's Traffic Engineering Division.

All damaged inductive loop detectors shall be restored by the contractor per FDOT Index 17781.

### **101-162. BASIS OF MEASUREMENT AND PAYMENT**

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials, testing and incidentals required to complete the work per the plans.

### **802. SIGNING AND MARKING**

All signing and marking work shall be performed per FDOT's Standard Specifications, unless otherwise specified in the contract documents and plans.

This specification includes the following work: RPM's (Section 706), painted traffic stripes and markings (Section 710), thermoplastic stripes and markings (Section 711) and tubular delineators/flex posts (Sections 705 and 972).

The Contractor is responsible to ensure that striping is correctly placed. Errors in striping or markings shall be “blacked-out” with paint, unless otherwise directed by the Engineer. No payment will be made for these incorrect or “blacked-out” areas. Omissions in striping or markings shall be corrected to the City's satisfaction prior to any payment being made.

The Contractor is responsible for restoring all striping in paint and reflective beading per the FDOT indices mentioned above. The City's Traffic Engineering department shall follow up with thermoplastic striping at a later date unless otherwise specified.

### **101-163. BASIS OF MEASUREMENT AND PAYMENT**

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials and incidentals required to complete the work per the plans.

## **803. ROADWAY LIGHTING**

All roadway lighting shall be constructed per Sections 715 and 992 of FDOT's Standard Specifications, unless otherwise specified in the contract documents and plans.

### **101-164. BASIS OF MEASUREMENT AND PAYMENT**

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, materials, testing and incidentals required to complete the work per the plans.

## **900 SERIES: LANDSCAPING/RESTORATION**

### **901. WORK IN EASEMENTS OR PARKWAYS**

Restoration is an important phase of construction, particularly to residents affected by the construction progress.

The Contractor will be expected to complete restoration activities within a reasonable time following primary construction activity. Failure by the Contractor to accomplish restoration within a reasonable time shall be justification for a temporary stop on primary construction activity or a delay in approval of partial payment requests.

Reasonable care shall be taken for existing shrubbery. Contractor shall replace all shrubbery removed or disturbed during construction. No separate payment shall be made for this work.

The Contractor shall make provision and be responsible for the supply of all water, if needed, on any and all phases of the contract work. The Contractor shall not obtain water from local residents or businesses except as the Contractor shall obtain written permission.

Reuse water is available for the Contractor's use without charge from the City's Water Reclamation Facilities, provided the water is used on City of Clearwater contractual work. Details for Contractor to obtain and reuse water from the Water Reclamation Facilities will be coordinated at the pre-construction conference. The Contractor's use of reuse water must conform to all regulatory requirements.

### **902. GENERAL PLANTING SPECIFICATIONS**

#### **101-165. IRRIGATION**

##### **902-2.1. DESCRIPTION**

- A. The work specified in this Section consists of the installation of an automatic underground irrigation system as shown or noted in the plans. Provide all labor, materials, equipment, services and facilities required to perform all work in connection with the underground sprinkler irrigation system, complete, as indicated on the drawings and/or specified. Work noted as "NIC", "existing", or "by others" is not included in this pay item.
- B. The irrigation plans are schematic in nature. Valves and pipes shall be located in the turf/landscape areas except at road/paving crossings. All piping under paving shall be sleeved. Changes in the irrigation system layout shall be modified with the approval of the Engineer.

##### **902-2.1.1. QUALITY ASSURANCE**

- A. The irrigation work shall be installed by qualified personnel or a qualified irrigation subcontracting company that has experience in irrigation systems of similar size, scope, mainline, system pressure, controls, etc.
- B. All applicable ANSI, ASTM, FED.SPEC. Standards and Specifications, and all applicable building codes and other public agencies having jurisdiction upon the work shall apply.

- C. Workmanship: All work shall be installed in a neat, orderly and responsible manner with the recognized standards of workmanship. The Engineer reserves the right to reject material or work which does not conform to the contract documents. Rejected work shall be removed or corrected at the earliest possible time at the Contractor's expense.
- D. Operation and Maintenance Manuals: The Contractor shall prepare and deliver to the Engineer within ten (10) calendar days prior to completion of construction a minimum of three (3) hard cover binders, with three rings, containing the following information:
  1. Index sheet stating the Contractor's address and business telephone number, twenty-four (24) hour emergency phone number, person to contact, list of equipment with name(s) and address(es) of local manufacturer's representative(s) and local supplier where replacement equipment can be purchased.
  2. Catalog and part sheet on every material and equipment installed under this contract.
  3. Complete operating and maintenance instructions on all major equipment.
  4. Provide the Engineer and the City of Clearwater maintenance staff with written and "hands on" instructions for major equipment and show evidence in writing to the Engineer at the conclusion of the project that this service has been rendered.
    - a. Four-hour instruction (minimum) for the Drip Emitter equipment operation and maintenance.
    - b. Two-hour instruction (minimum) for automatic control valve operation and maintenance.

### **902-2.1.2. PROJECT CONDITIONS**

- A. The Contractor shall coordinate the work with all other trades, all underground improvements, the location and planting of trees and all other planting. Verify planting requiring excavation of twenty-four inch (24") diameter and larger with the Engineer prior to installation of main lines.
- B. Provide temporary irrigation at all times to maintain plant materials.
- C. The Contractor is responsible to maintain the work area and equipment until final acceptance by the Engineer. Repairs and replacement of equipment broken, stolen, or missing as well as regular maintenance operations shall be the obligation of the Contractor.
- D. The Contractor shall submit a traffic control plan (per FDOT specifications) to the Engineer prior to initiating construction on the site. The Contractor shall be responsible for the maintenance of traffic signs, barriers, and any additional equipment to comply with the FDOT standards and to ensure the safety of its employees and the public.

### **902-2.1.3. WARRANTY**

- A. The Manufacturer(s) shall warrant the irrigation system components to give satisfactory service for one (1) year period from the date of acceptance by the Engineer and the City of Clearwater. Should any problems develop within the warranty period due to inferior or faulty materials, they shall be corrected at no expense to the City of Clearwater.

## **902-2.2. PRODUCTS**

### **902-2.2.1. GENERAL**

- A. All materials throughout the system shall be new and in perfect condition. No deviations from the specifications shall be allowed except as noted.

### **902-2.2.2. PIPING**

- A. The irrigation system pipe shall be as stated herein and shall be furnished, installed and tested in accordance with these specifications.
- B. All pipe is herein specified to be Polyvinyl Chloride (PVC) Pipe, 1120, Schedule 40, conforming to ASTM D2665 and D1785.
- C. All nipples, pipe connections, bushings, swing joints, connecting equipment to the mainline is required to be threaded Polyvinyl Chloride (PVC) Pipe, Schedule 80.

### **902-2.2.3. PIPE FITTINGS**

- A. All pipe fittings for Schedule 40 PVC pipe shall be as follows: Fittings shall conform to the requirements of ASTM D2466, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval. The connection of mainline pipe to the automatic control valve shall be assembled with threaded Schedule 80 fittings and threaded Schedule 80 nipples.

### **902-2.2.4. PVC PIPE CEMENT AND PRIMER**

- A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the manufacturer. Pipe joints for solvent weld pipe to be belled end.
- B. Purple primer shall be applied after the pipe and fittings has been cut and cleaned. The Primer shall be of contrasting color and be easily recognizable against PVC pipe.

### **902-2.2.5. THREADED CONNECTIONS**

- A. Threaded PVC connections shall be made using Teflon tape or Teflon pipe sealant.

### **902-2.2.6. GATE VALVES**

#### **902-2.2.6.1. MANUAL GATE VALVES TWO INCHES (2") AND SMALLER**

- A. Provide the following, unless otherwise noted on Drawings:
  1. 200-250 psi Ball Valve
  2. PVC body - with Teflon Ball Seals
  3. Threaded-Dual end Union Connectors
  4. Non-Shock Safe-T-Shear Stem
  5. Safe-T-Shear True Union Ball Valve as manufactured by Spears Manufacturing Company, Sylmar, California, or approved equal.

#### **902-2.2.6.2. GATE VALVES TWO AND A HALF INCHES (2½") AND LARGER**

- A. Provide the following, unless otherwise noted on Drawings:
  - 1. AWWA-C-509
  - 2. 200 lb. O.W.G.
  - 3. Cast Iron body - ASTM A 126 Class B
  - 4. Deep socket joints
  - 5. Rising stem
  - 6. Bolted bonnet
  - 7. Double disc
  - 8. Equipped with two inch (2") square operating key with tee handle
- B. Provide two (2) operating keys for gate valve three inches (3") and larger. The "street key" shall be five feet (5') long with a two inch (2") square operating nut.

#### **902-2.2.7. SLEEVES**

- A. Sleeves: (Existing by City of Clearwater)

#### **902-2.2.8. REMOTE CONTROL VALVES**

- A. The remote control valve shall be a solenoid actuated, balance-pressure across-the diaphragm type capable of having a flow rate of 25-30 gallons per minute (GPM) with a pressure loss not to exceed 6.1 pounds per square inch (PSI). The valve pressure rating shall not be less than 150 psi.
- B. The valve body and bonnet shall be constructed of high impact weather resistant plastic, stainless steel and other chemical/UV resistant materials. The valve's one-piece diaphragm shall be of durable santoprene material with a clog resistant metering orifice.
- C. The valve body shall have a one inch (1") (FNPT) inlet and outlet or a one inch (1") slip by slip inlet and outlet for solvent weld pipe connections.
- D. The valve construction shall be as such to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
- E. The valve shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California, or approved equal.
- F. Identify all control valves using metal I.D. tags numbered to match drawings.

#### **902-2.2.9. VALVE BOXES**

- A. For remote control drip valve assembly and UNIK control timer use a Brooks #36 concrete value box with #36-T cast iron traffic bearing cover or approved equal.
- B. For flush valve assembly use an Ametek #181014 ten inch (10") circular valve box with #181015 cover comparable to Brooks, or approved equal.

- C. For air relief assembly use an Ametek #182001 (6") economy turf box with #182002 cover comparable to Brooks or approved equal.

### **902-2.2.10. DRIP IRRIGATION**

#### **902-2.2.10.1.CONSTRUCTION**

- A. Techline shall consist of nominal sized one-half inch (1/2") low-density linear polyethylene tubing with internal pressure compensating, continuously self-cleaning, integral drippers at a specified spacing (12", 18", or 24" centers). The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.67 inches and an inside diameter (I.D.) of 0.57 inches. Individual pressure compensating drippers shall be welded to the inside wall of the tubing as an integral part of the tubing assembly. These drippers shall be constructed of plastic with a hard plastic diaphragm retainer and a self-flushing/cleaning elastomer diaphragm extending the full length of the dripper.

#### **902-2.2.10.2. OPERATION**

- A. The drippers shall have the ability to independently regulate discharge rates, with an inlet pressure of seven to seventy (7-70) pounds per square inch (PSI), at a constant flow and with a manufacturer's coefficient of variability (Cv) of 0.03. Recommended operating pressure shall be between 15-45 PSI. The dripper discharge rate shall be 0.4, 0.6, or 0.9 gallons per hour (GPH) utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The drippers shall continuously clean themselves while in operation. The dripperline shall be available in 12", 18" and 24" spacing between drippers unless otherwise specified. Techline pipe depth shall be under mulch unless otherwise specified on Plans. Maximum system pressure shall be 45 PSC. Filtration shall be 120 mesh or finer. Bending radius shall be seven inch (7").
- B. For on-surface or under mulch installations, six inch (6") metal wire staples (TLS6) shall be installed three feet (3') to five feet (5') on center, and two staples installed at every change of direction.

#### **902-2.2.10.3. LINE FLUSHING VALVES**

- A. The sub-surface system shall utilize Automatic Line Flush Valves at the end of each independent zone area. This valve shall be capable of flushing one gallon at the beginning of each irrigation cycle. The valves shall match the dripline manufacturer and connect directly to the dripline.

#### **902-2.2.10.4. AIR/VACUUM RELIEF VALVE**

- A. Each independent irrigation zone shall utilize an Air/Vacuum Relief Valve at its high point(s). The air and vacuum relief valve shall seal effectively from 2 to 110 psi.

#### **902-2.2.10.5. PRESSURE REGULATORS**

- A. The pressure regulator shall be designed to handle steady inlet pressures over 150 pounds per square inch (psi) and maintain a constant outlet pressure of 25 psi. Regulating accuracy shall be within +/-6%. The pressure regulator shall be manufactured from high-impact

engineering grade thermoplastics. Regulation shall be accomplished by a fixed stainless steel compression spring which shall be enclosed in a chamber separate from the water passage.

#### **902-2.2.10.6. FILTERS**

- A. The filter shall be a multiple disc type filter with notation indicating the minimum partial size to travel through or the mesh size of the element being used. The discs shall be constructed of chemical resistant thermoplastic for corrosion resistance.

#### **902-2.2.10.7. FITTINGS**

- A. All connections shall be made with barb or compression type fitting connections. Fittings and dripline shall be as manufactured by the manufacturer of the dripline to ensure the integrity of the subsurface irrigation system.

#### **902-2.2.11. AUTOMATIC CONTROL TIMER**

- A. The irrigation controller (control module) shall be programmable by a separate transmitter device only. The program shall be communicated to the Control Module from the Field Transmitter via an infrared connection. The controller shall be of a module type which may be installed in a valve box underground. The controller shall function normally if submerged in water and the communication from the transmitter shall function if submerged in water.
- B. The control module shall be housed in an ABS plastic cabinet and shall be potted to insure waterproof operation. The control module shall have two mounting slots for screws allowing the module to be securely mounted inside a valve box.
- C. The controller shall operate on one nine volt (9V) alkaline battery for one full year regardless of the number of stations utilized. The controller shall operate 1, 2, or 4 stations either sequentially or independently.
- D. The controller shall have three (3) independent programs with eight (8) start times each, station run time capability from one (1) minute to twelve (12) hours in one (1) minute increments, and a seven (7) day calendar. The controller shall turn on stations via latching solenoids installed on the valves. Manual operations shall be initiated by attaching the Field Transmitter to the Control Module and programming a manual start. The controller shall be capable of manual single station or manual program operation.
- E. The controller shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA.

#### **902-2.2.12. FIELD TRANSMITTER**

- A. The irrigation controller shall be programmable by a separate transmitter device (Field Transmitter) only. The Field Transmitter shall communicate to the Control Module via an infrared connection. The Field Transmitter shall be water resistant and housed in ABS plastic and have a removable, reversible protective sheath. The Field Transmitter shall operate on one nine volt (9V) alkaline battery.

- B. The Field Transmitter shall have a large LCD screen and a seven-key programming pad. A beep sound shall confirm every key stroke. The screen shall automatically turn off after one minute when not in use.
- C. The Field Transmitter shall be capable of programming an unlimited number of UNIK Control Modules.
- D. The Field Transmitter shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA.

### **902-2.2.13. LATCHING SOLENOID**

- A. The Latching Solenoid shall be supplied with an installed, filtered adapter allowing installation of the solenoid onto any Rain Bird DV, PGA, PEB, PES-B, GB, or EFB series valve.
- B. The Latching Solenoid shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA.

## **902-2.3. EXECUTION**

### **902-2.3.1. GENERAL INSTALLATION REQUIREMENTS**

- A. Before work is commenced, hold a conference with the Engineer to discuss general details of the work.
- B. Verify dimensions and grades at job site before work is commenced.
- C. During the progress of the work, a competent superintendent and any assistants necessary shall be on site, all satisfactory to the Engineer. This superintendent shall not be changed, except with the consent of the Engineer. The superintendent shall represent the Contractor in Contractor's absence and all directions given to the superintendent shall be as binding as if given to the Contractor.
- D. Obtain and pay for all irrigation and plumbing permits and all inspections required by outside authorities.
- E. All work indicated or notes on the Drawings shall be provided whether or not specifically mentioned in these Technical Specifications.
- F. If there are ambiguities between the Drawings and Specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification will be made only by the Engineer, and the Contractor shall comply with the decisions. In the event the installation contradicts the directions given, the installation shall be corrected by the Contractor at no additional cost.
- G. Layout of sprinkler lines shown on the Drawing is diagrammatic only. Location of sprinkler equipment is contingent upon and subject to integration with all other underground utilities. Contractor shall employ all data contained in the contract Documents and shall verify this information at the construction site to confirm the manner by which it relates to the installation.

- H. Do not proceed with the installation of the sprinkler system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend, or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Engineer.
- I. The disturbance of existing paving will not be permitted. Install all required sleevng prior to roadway base.

### **902-2.3.2. EXCAVATING AND BACKFILLING**

#### **902-2.3.2.1. TRENCHING - GENERAL**

- A. Dig sides of trenches straight. Provide continuous support for pipe on bottom of trenches. Lay pipe to uniform grade. Trenching excavation shall follow layout indicated on Drawings.
- B. Maintain six inch (6") horizontal and minimum clearance between sprinkler lines and between all lines of other trades.
- C. Do not install sprinkler lines directly above another line of any kind.
- D. Maintain six inch (6") vertical minimum between sprinkler lines which cross at angles of 45 degrees to 90 degrees.
- E. Exercise care when excavating, trenching and working near existing utilities.

#### **902-2.3.2.2. BACKFILLING**

- A. All pressure supply lines (mainline) shall have eighteen inches (18") of fill placed over the pipe.
- B. Initial backfill on all lines shall be of a fine granular material with no foreign matter larger than one half inch ( $\frac{1}{2}$ ").
- C. Compact backfill according to Section 125 of FDOT Standard Specifications.
- D. Do not, under any circumstances, use equipment or vehicle wheels for compacting soil.
- E. Restore grades and repair damages where settling occurs.
- F. Compact each layer of fill with approved equipment to achieve a maximum density per AASHTO T 180. Under landscaped area, compaction shall not exceed 95% of maximum density.
- G. Compaction shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than six inches (6") thick. The hand tampers shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent damage to the irrigation system piping and adjacent utilities.

#### **902-2.3.2.3. ROUTING OF PIPING:**

- A. Routing of pressure and non-pressure piping lines are indicated diagrammatically on Drawings.

- B. Coordinate specimen trees and shrubs with routing of lines.
  - 1. Planting locations shall take precedence over sprinkler and piping locations.
  - 2. Report to Owner any major deviation from routing indicated.
- C. Conform to Drawings layout without offsetting the various assemblies from the pressure supply line.
- D. Layout drip tube and make any minor adjustments required due to differences between site and Drawings. Any such deviations in layout shall be within the intent of the original Drawings, and without additional cost.
- E. Layout all systems using an approved staking method and maintain the staking of approved layout.

### **902-2.3.3. INSTALLATION**

#### **902-2.3.3.1. WATER SUPPLY**

- A. Connections to the water sources shall be at the approximate locations indicated on the Drawings. Make minor changes caused by actual site conditions without additional cost to the Owner.

#### **902-2.3.3.2. ASSEMBLIES**

- A. Routing or pressure supply lines as indicated on Drawings is diagrammatic only. Install lines and required assemblies in accordance with details on Drawings.
- B. Do not install multiple assemblies on plastic lines. Provide each assembly with its own outlet. When used, the pressure relief valve shall be the last assembly.
- C. Install all assemblies in accord with the respective detail Drawings and these Technical Specifications.
- D. Plastic pipe and threaded fittings shall be assembled using Teflon tape, applied to the male threads only.

#### **902-2.3.3.3. SLEEVES: (EXISTING BY CITY OF CLEARWATER)**

- A. The Contractor shall verify the location of all existing sleeves as shown on the roadway, utility and/or irrigation plans and notify the Engineer of any discrepancies.

#### **902-2.3.3.4. PLASTIC PIPE**

- A. Install plastic pipe in accord with manufacturer's recommendations.
- B. Prepare all welded joints with manufacturer's cleaner prior to applying solvent.
  - 1. Allow welded joints at least fifteen (15) minutes setup/curing time before moving or handling.
  - 2. Partially center load pipe in trenches to prevent arching and shifting when water pressure is on.

3. Do not permit water in pipe until a period of at least four (4) hours has elapsed for solvent weld setting and curing, unless recommended otherwise by solvent manufacturer.

C. Curing

1. When the temperature is above 80 degrees F., allow soluble weld joints at least twenty-four (24) hours curing time before water is introduced under pressure.

D. Flushing the system:

1. After all sprinkler pipe lines and risers are in place and connected, open the control valves and flush out the system with a full head of water.

E. Installing piping under existing pavement:

1. Piping under existing pavement may be installed by jacking & boring.
2. Secure permission from the Engineer before cutting or breaking any existing pavement. All repairs and replacements shall be approved by Engineer and shall be accomplished at no additional cost.

**902-2.3.3.5. CONTROLLERS**

A. Install all automatic controllers as shown in the plans.

1. The location of all controllers shall be approved by the Engineer's representative prior to installation.

**902-2.3.3.6. REMOTE CONTROL VALVES**

A. Install at sufficient depth to provide not more than six inches (6"), nor less than four inches (4") cover from the top of the valve to finish grade.

B. Install valves in a plumb position with twenty-four inch (24") minimum maintenance clearance from other equipment, three feet (3') minimum from edges of sidewalks, buildings, and walls, and no closer than seven feet (7') from the back of curb or edge of pavement along roadways.

C. Contractor shall adjust the valve to provide the proper flow rate or operating pressure for each sprinkler zone.

**902-2.3.3.7. GATE VALVES**

A. Install where indicated and with sufficient clearance from other materials for proper maintenance.

B. Check and tighten valve bonnet packing before backfill.

## **101-166. LANDSCAPE**

### **902-2.4. GENERAL**

#### **902-2.4.1. REQUIREMENTS OF REGULATORY AGENCIES**

- A. Comply with Federal, State, Local, and other duly constituted authorities and regulatory agencies, without additional cost to the Owner in matters pertaining to codes, safety, and environmental matters.
- B. Any permits for the installation or construction of any of the work included under the contract, which are required by any of the legally constituted authorities having jurisdiction, shall be arranged for by the Contractor and paid for directly by the Contractor, unless otherwise agreed upon in writing.

#### **902-2.4.2. SCOPE OF WORK**

- A. All provisions of Contract, including General and Special Provisions and Plans, apply to the work specified in this Article. The Scope of Work includes everything for and incidental to executing and completing all landscape work shown on the Plans, Schedules, Notes and as specified herein.
- B. Furnish and provide all labor, plants and materials tools and equipment necessary to prepare the soil for plantings, to install and care for all plant materials (including finish grading if necessary); to remove and/or transplant existing plants if indicated; to furnish, plant, fertilize, guy and brace, water, mulch and prune all new plant materials; and to execute all other Work as described herein or indicated on the Plans.
- C. Work under this Article shall include labor and materials for final grading and raking to prepare the site for sodding, sprigging, or seeding, so finished lawn or playing field will appear even and uniform, will drain adequately, and will comply with the intent of the landscape drawings.
- D. Initial maintenance of landscape materials as specified in this document.

#### **902-2.4.3. QUALITY ASSURANCE**

- A. Landscape work shall be contracted to a single firm specializing in landscape work, who shall in turn subcontract no more than 40% of the work specified. All subcontractors under the control of the Contractor involved in the completion of the landscape work, shall be made known to the Owner and the Landscape Architect prior to their commencement of work on the project.
- B. All work of this Article shall conform to the highest standard of landscape practices.
- C. The Plant Material Schedule included with these Plans is provided only for the Contractor's convenience; it shall not be construed as to conflict or predominate over the Plans. If conflict between the Plans and Specifications exists, the Plans shall predominate and be considered the controlling document.
- D. During this work, the Contractor shall be responsible for maintaining safety among persons in their employ in accordance with the standards set by The Occupational Safety and Health

Act of 1970 (and all subsequent amendments). Owner and Landscape Architect shall be held harmless from any accident, injury or any other incident resulting from compliance or non-compliance with these standards.

- E. The Contractor shall cooperate with and coordinate with all other trades whose work is built into or affects the work in this Article.
- F. All appropriate utility companies and agencies shall be contacted 72 hours prior to excavation. Call “One Call”/“Sunshine 811” at 8-1-1; “Sunshine 811” administrative offices may be reached at (800) 638-4097.
- G. The Contractor shall carefully examine the site and all existing conditions affecting the work, such as: soil, obstructions, existing trees, utilities, etc. Report any conditions in conflict with the work to the Landscape Architect.

#### **902-2.4.4. SUBMITTALS**

- A. The Contractor is required to submit prior to the expiration of the required maintenance period, two (2) copies of typewritten instructions recommending procedures to be established by the Owner for maintenance of landscape work for a period of one (1) year.
- B. Furnish unit prices for all plant materials and inert materials, including labor for all specified work.

#### **902-2.4.5. ALTERNATES, ADDITIONS, DELETIONS, SUBSTITUTIONS**

- A. If there are additions/alternates included in these Plans and Specifications, the Contractor must propose prices to accomplish the work stated as additions/alternates at the time of bidding.
- B. The Owner, through their Project Representative, reserves the right to add or deduct any of the work stated herein without rendering the Contract void.
- C. The Contractor must have written approval by the Project Representative for any substitutions not previously agreed to in the purchase agreement: installation without approval is entirely at the Contractor’s risk.
- D. All material acquired through additions or substitutions shall be subject to all conditions and warranties stated herein.

#### **902-2.4.6. ABBREVIATIONS/DEFINITIONS**

*O.A. or HT.*: The over-all height of the plant measured from the ground to the natural, untied state of the majority of the foliage, not including extreme leaves, branches or fronds.

*C.T.*: Clear trunk is measured from the ground to the bottom of the first leaf or frond stem with no foliage from ground to specified height. For example, on Canary Island Date Palms or similar, the clear trunk measurement includes the “nut” at the base of the fronds.

*C.W.*: Clear wood is measured from the ground to the bottom of the base of the lowest leaf sheath or boot, trimmed in a natural manner. For example, on Canary Island Date Palms or similar, the clear wood measurement does not include the “nut” at the base of the fronds.

*SPR.*: Spread, branches measured in natural untied position to the average crown diameter, not including extreme leaves, branches or fronds.

*STTR.*: Straight trunk.

*MIN.*: Minimum.

*GAL.*: Gallon container size, i.e., 1 gallon, 3 gallon, 7 gallon, etc.

*O.C.*: On center, distance between plant centers.

*DIA.*: Diameter.

*LVS.*: Leaves.

*D.B.H.*: Diameter or caliper of main trunk of tree as measured at breast height at 4-1/2 feet above grade.

*CAL.*: Caliper, the outside diameter of up to a four inch tree is measured six inches above grade, larger trees are measured at 12 inches above grade.

*B&B*: Balled and burlapped in accordance with horticultural standards of the American Association of Nurserymen.

*PPP*: Plants per pot.

*FG*: Field grown.

*STD.*: Standard, single, straight trunk.

*Owner*: To be known as that entity which holds title or control to the premises on which the work is performed.

*Owner's Representative*: Owner's on-site representative shall be responsible for approval of quantity and quality of *materials specified and execution of installation*.

*Contractor*: Shall refer to that person or enterprise commonly known as the Landscape Contractor.

*Landscape Architect*: This person or firm is the responsible representative of the Owner who produces the landscape Plans and Specifications.

## **902-2.4.7. PRODUCT DELIVERY, STORAGE, AND HANDLING**

### **902-2.4.7.1. PLANT MATERIALS**

- A. Provide container-grown or, if appropriate, freshly dug trees and shrubs. Do not prune prior to delivery. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. If plant delivery is made in open vehicles, the entire load shall be suitably covered.
- B. All plants are to be handled at all times so that roots or root balls are adequately protected from sun, cold, or drying winds. No root balls for trees and container plants that have been cracked or broken shall be planted except upon special approval. Plants shall not be pulled by the tops or stems, nor handled in a rough or careless manner at any time.

- C. Balled and burlapped (“B & B”) plants shall be moved with firm, natural, balls of soil, not less than one foot (1') diameter of ball to every one inch (1") caliper of trunk; root ball depth shall not be less than two-thirds (2/3) of root ball diameter. B & B plants which cannot be planted upon delivery shall have their root balls covered with moist soil or mulch.
- D. Trees shall be dug with adequate balls, burlapped, and wire bound if needed. Root pruning to be done a minimum of four (4) weeks before removal from the field and planting at the site. Root balls may not be encased in “grow bags” or other synthetic material, except plastic shrink wrap for transport only.
- E. Remove all fronds from sabal palms prior to planting, but leave a minimum of twelve inches (12") of new frond growth above the bud. Do not damage bud. On all other palms, only a minimum of palm fronds shall be removed from crown to facilitate moving and handling. Clear trunk shall be determined after minimum fronds have been removed. Boots shall be removed from trunk unless otherwise specified. Palms shall be planted within twenty-four (24) hours of delivery.
- F. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and cover to keep the roots moist.
- G. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
- H. Time delivery so that sod will be placed within twenty-four (24) hours after stripping. Protect sod against drying and breaking by covering palettes of sod or placing in a shaded area.

#### **902-2.4.8. JOB CONDITIONS**

##### **902-2.4.8.1. ACCEPTANCE OF JOB CONDITIONS.**

- A. The Contractor shall examine the sub-grade, verify elevations, observe the conditions under which work is to be performed and notify the Landscape Architect or Project Representative in writing of unsatisfactory conditions prior to beginning work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Landscape Architect. Start of work shall indicate acceptance of conditions and full responsibility for the completed work.
- B. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work and following the approved schedule. If seasonal limitations apply, notify the Landscape Architect for adjustments to the Schedule.
- C. Determine locations of all underground utilities and review for conflicts with planting procedures.
- D. When adverse conditions to plant growth are encountered, such as rubble fill, drainage conditions or obstruction, the Contractor shall notify the Landscape Architect in writing prior to planting.

- E. Plant trees and shrubs after final grades are established and prior to sod installation or seeding lawns. Protect existing lawn, trees, and promptly repair damages from planting operations.

#### **902-2.4.8.2. SCHEDULING OF WORK**

- A. The work shall be carried out to completion with the utmost speed. Immediately upon award of contract, the Contractor shall prepare a construction schedule and furnish a copy to the Owner's Representative and/or the Landscape Architect for approval. The Contractor shall carry out the work in accordance with the approved schedule.
- B. If the Contractor incurs unforeseen costs, such as overtime hours, holidays, etc., in order to complete the work within the time stated in the Contract, and/or to maintain the progress schedule, all said costs shall be borne by the Contractor at no additional cost to the Owner.
- C. The Owner's Representatives may request work stoppage in writing. Upon written request from the Owner's Representative, the Landscape Contractor shall suspend delivery of material and stop all work for such a period as deemed necessary by the Owner, the Owner's Representative, or the General Contractor, with respect to any additional costs which may result from work stoppage.

#### **902-2.4.8.3. UTILITIES**

- A. The Contractor shall perform work in a manner which will avoid conflicts with utilities. Hand excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

### **902-2.5. PRODUCTS**

#### **902-2.5.1. MATERIALS**

##### **902-2.5.1.1. PLANT MATERIALS: NOMENCLATURE**

- A. Plant species, sizes, etc., shall be per Plans and Specifications on Plant Material Schedule. Nomenclature is per Manual of Cultivated Plant, Standard Encyclopedia of Horticulture, L.H. Bailey, or Standardized Plant Names Dictionary, American Joint Committee on Horticultural Nomenclature (latest editions) or conforms with names accepted in the nursery trade.

##### **902-2.5.1.2. PLANT MATERIALS: QUALITY ASSURANCE**

- A. Provide healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the project. Plants shall have a habit of growth that is normal for the species and be sound, healthy, vigorous and free from insects, pests or their eggs, plant diseases, defects and injuries. Plants shall be well branched and densely foliated when in leaf and shall have healthy, well-developed root systems.
- B. Trees shall be heavily branched or, in the case of palms, be heavily leafed. Some plant materials may be collected stock with the approval of the Landscape Architect. Provided

tree species that have a single main trunk (central leader), unless otherwise stated. Trees that have the main trunk forming a “Y” shape or parallel branching are not acceptable.

- C. Plant materials shall be specified and shall be Florida #1 or better as to shape and quality for the species as outlined in Grades and Standards for Nursery Plants Part I and II, Florida Department of Agriculture and Consumer Services (latest edition).
- D. The Owner or Landscape Architect reserves the right to inspect plant materials either at the place of growth or at the project site prior to planting for compliance with requirements for name, variety, size, quality, or designated area.
- E. Landscape materials shall be shipped with certificates of inspection as required by governmental authorities. The Contractor shall comply with all governing regulations that are applicable to landscape materials.
- F. Do not make substitutions. If specified landscape material is not available, submit to the Landscape Architect proof of it being non-available. In such event, if the Landscape Architect designates an available source, such shall be acquired from designated source. When authorized, a written change order for substitute material will be made by adjustment to Contract amount.
- G. Height and/or width of trees shall be measured from ground up; width measurement shall be normal crown spread of branches with plants in the normal position. This measurement shall not include immediate terminal growth. All measurements shall be taken after pruning for specified sizes. All trees and shrubs shall conform to measurements specified in the plant material schedule, except that plant material larger than specified may be used with the approval of the Owner or Landscape Architect, with no increase to the Contract price. Plant materials shall not be pruned prior to delivery.
- H. Plant Material shall be symmetrical, typical for variety and species. Plants used where symmetry is required shall be matched as nearly as possible.
- I. Balled and burlapped plants shall have firm, natural balls of earth of sufficient diameter and depth to encompass the feeding root system necessary for full development of the plant and to conform with the standards of the American Association of Nurserymen. Root balls and tree trunks shall not be damaged by improper binding and B & B procedures.
- J. Container-grown plants may be substituted for balled and burlapped plants or vice-versa provided the quality is equal or better than specified and the Landscape Architect approves the substitution.
- K. Container-grown stock shall have been grown in containers for at least four months, but not over two years. If requested, samples must be shown to prove no root bound condition exists.

#### **902-2.5.1.3. GRASSES: SOD OR SEED**

- A. Sod or seed (as/if specified) shall be a species as stated on the Plan. Solid sod shall be of even thickness and with a good root structure, 95% free of noxious weed, freshly mowed before cutting, and in healthy condition when laid. It must not be stacked more than twenty-four (24) hours before laying and it must be grown in soil compatible to that in which it will be installed. Sod must be kept moist prior to and after installation.

- B. Seed shall be delivered to the site in unopened bags with certification tags in place. Purity, germination and weed content shall be as certification requirements.

#### **902-2.5.1.4. MULCH**

- A. Mulch shall be as specified in the plans or by the project manager.
- B. Install mulch to an even depth of three inches (3") before compaction, as shown in the PLANTING DETAILS in the plans.

#### **902-2.5.1.5. FERTILIZER**

- A. Granular fertilizer shall be uniform in composition; free flowing and suitable for application with approved equipment; received at the site in full, labeled, unopened bags bearing the name, trade name or trademark and warranty of the producer; fully conforming to State of Florida fertilizer laws.
- B. All fertilizer shall bear the manufacturer's statement of analysis and shall contain the appropriate minimum amounts of elements for the type of use specified herein.
- C. Agriform 20-10-5 fertilizer tablets or approved equal, shall be placed in planting pit for all plant materials at time of installation and prior to completion of pit backfilling.
- D. Ground cover and annual areas shall receive fertilization with Osmocote Time Release Fertilizer according to product instructions and rate.
- E. For sod and seeded areas, fertilize with a complete granular fertilizer on Bahia and St. Augustine grasses at the rate of one pound (1 lb.) of nitrogen per one thousand square feet (1000 sq ft). Fertilizer shall be commercial grade, mixed granules, with 30% to 50% of the nitrogen being in slow or controlled release form. The ratio of nitrogen to potash will be 1:1 or 2:1 for complete fertilizer formulations. Phosphorus shall be no more than one-fourth ( $\frac{1}{4}$ ) the nitrogen level. They shall also contain magnesium and micronutrients (i.e. manganese, iron, zinc, copper, etc.).

#### **902-2.5.1.6. STAKES AND GUYS**

- A. For trees, approved plastic or rubber guys shall be used between the stakes and the tree trunk. Galvanized steel guy wire shall not be used.
- B. Stakes shall be cut from 2" x 4" pressure treated (p.t.) stock for trees over two inch (2") caliper. Stakes shall be 2" x 2" pressure treated (p.t.) stock for trees two inch (2") caliper and under. A minimum of two (2) stakes per tree or an optional three (3) stakes per tree shall be used.
- C. For single trunk palms, stakes shall be cut from 2" x 4" pressure treated (p.t.) stock, with a minimum of three (3) stakes per palm. Batten consisting of 5 layers of burlap and 5 - 2" x 4" by 16" wood connected with two – three-quarter inch ( $\frac{3}{4}$ ") steel bands shall be used around the palm trunk.
- D. Other tree staking systems may be acceptable if approved.

#### **902-2.5.1.7. PLANTING SOIL**

- A. Unless stated on the plans or in the specifications, install plant material in tilled and loosened native soil backfill. It is the responsibility of the Landscape Contractor to test, prior to planting and at no additional cost to the City, any soils which may be unsuitable for the vigorous growth of plants. Unsuitable conditions shall be reported to the Landscape Architect immediately in writing.
- B. When required, planting soil media shall be provided by the Contractor and shall consist of one-third (1/3) peat and two-thirds (2/3) sandy loam, with no lumps over one inch (1").
- C. Backfill and clean fill dirt provided by the Contractor shall be in a loose, friable soil. There must be slight acid reaction to the soil (about 6.0 – 6.5 pH) with no excess of calcium or carbonate, and it shall be free from excess weeds, clay lumps, stones, stumps, roots and toxic substances or any other materials that might be harmful to plant growth or a hindrance to grading, planting, and maintenance procedures and operations. No heavily organic soil, such as muck or peat shall be used as fill dirt.
- D. Bed preparation for annual beds under one (1) gallon container size shall consist of three inches (3") of Florida peat or other approved organic soil amendment spread over full length and width of planting area. Rototil organic layer six inches (6") to eight inches (8") into native soil.

#### **902-2.5.1.8. SOIL AMENDMENTS**

- A. Terra-Sorb AG or approved equal, soil amendment shall be mixed with native or planting soil for all trees, shrubs, ground cover, and annuals according to manufacturer's recommended application rates and methods, if specified on the Plans.

#### **902-2.5.1.9. TREE PROTECTION**

- A. Wood fencing shall be 2" x 4" pressure treated (p.t.) stock with flagging on horizontal members. Space vertical members six feet (6') to eight feet (8') on center. The barricade shall be placed so as to protect the critical protection zone area, which is the area surrounding a tree within a circle described by a radius of one foot (1') for each inch of the tree's diameter at breast height DBH (four and one half feet') above grade.

#### **902-2.5.1.10. ROOT BARRIER SYSTEM**

- A. Root barrier fabric shall be installed when specified in the plans and/or specifications for protection of adjacent paved surfaces according to specific product name or equal. Install as directed by the manufacturer.

#### **902-2.5.1.11. PACKAGED MATERIALS**

- A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.

#### **902-2.5.1.12. PESTICIDES**

- A. Pesticides shall be only approved, safe brands applied according to manufacturer's directions.

## **902-2.6. EXECUTION**

### **902-2.6.1. PREPARATION**

#### **902-2.6.1.1. OBSTRUCTIONS BELOW GROUND**

- A. It shall be the responsibility of the Contractor to locate and mark all underground utilities, irrigation lines and wiring prior to commencement of the work.
- B. If underground construction, utilities or other obstructions are encountered in excavation of planting areas or pits, the Landscape Architect shall be immediately notified to select a relocated position for any materials necessary.

#### **902-2.6.1.2. GRADING AND PREPARATION FOR PLANT MATERIALS**

- A. All proposed landscape areas containing existing turf grass or weeds shall be treated with Monsanto's "Round-Up" per manufacturer's specifications. All proposed landscape areas adjacent to water bodies shall be treated with "Rodeo" per the manufacturer's specifications.
- B. New plant materials will not be installed until a 98% weed/turf eradication has been achieved. More than one application may be required to produce an acceptable planting bed.
- C. Pre-emergent herbicides are not a substitute for spray treatment of "Round-Up" or "Rodeo" and may be used only with the written approval of the Landscape Architect.
- D. Should any plant material in the same or adjacent beds be damaged by these chemicals, the same size, quantity and quality of plants shall be immediately replaced by the Contractor at no cost to the Owner.
- E. Any necessary corrections or repairs to the finish grades shall be accomplished by the Contractor. All planting areas shall be carefully graded and raked to smooth, even finish grade, free from depressions, lumps, stones, sticks or other debris and such that they will conform to the required finish grades and provide uniform and satisfactory surface drainage without puddling.
- F. The Contractor shall remove debris (sticks, stones, rubbish) over one and one half inches (1½") in any dimension from individual tree, shrub and hedge pits and dispose of the excavated material off the site.

#### **902-2.6.1.3. PREPARATION FOR ANNUAL BED PLANTING**

- A. Prepare native subgrade by rototilling or loosening by hand methods. Spread three inches (3") of one-third (1/3) Florida peat and two-thirds (2/3) sandy, or other approved organic soil amendment over the full length and width of planting area for annuals. Rototill organic layer six inches (6") to eight inches (8") into the native soil. Grade the planting bed by "crowning" to ensure that surface drainage, percolation, and aeration occur at rapid rates. Add Osmocote time release fertilizer according to product instructions and rate.

#### **902-2.6.1.4. PREPARATION FOR SEEDING AND SOD AREAS**

- A. All proposed sod areas containing existing turf grass or weeds shall be treated with Monsanto's "Round-Up" per manufacturer's specifications. All proposed sod areas adjacent to water bodies shall be treated with "Rodeo" per the Manufacturer's Specifications.
- B. Limit preparation to areas which will be planted promptly after preparation. Loosen sub-grade of seed and sod areas to a minimum depth of four inches (4").
- C. Immediately prior to any turf work, the Contractor shall finish grade the soil to a smooth, even surface assuring positive drainage away from buildings and the subsequent turf flush to the tops of adjacent curbs and sidewalks. The surface shall be sloped to existing yard drains.
- D. A complete fertilizer shall be applied to St. Augustine or Bahia grass at a rate of one pound (1 lb.) of nitrogen per one thousand square feet (1000 sq ft). Fertilizer shall be commercial grade, mixed granules, with 30% to 50% of the nitrogen being in slow or controlled release form. Thoroughly work fertilizer into the top four inches (4") of soil.
- E. Moisten prepared seed and sod areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

## **902-2.6.2. INSTALLATION**

### **902-2.6.2.1. BERM CONSTRUCTION (IF SPECIFIED)**

- A. Install berms at location and design shown on Plans and at the height and slope indicated. Height stated is for finished berm with soil at natural compaction.
- B. Exact location and configuration of berms may require modification to allow proper drainage; such changes will be coordinated with the Landscape Architect.
- C. If shown on the Plan, construct berms using clean sandy loam fill dirt which is well-drained, free of rocks, roots, or other debris, with a soil pH of an acid Nature (about 6.0 - 6.5). No heavily organic soil, such as muck or peat shall be used in berm construction.

### **902-2.6.2.2. LAYOUT OF PLANT MATERIALS**

- A. Unless otherwise stipulated, plant materials shall be approximately located per the plans by scale measurements using established building, columns, curbs, screen walls, etc., as the measuring reference point. Slight shifting may be required to clear wires, prevent blockage of signage, etc.
- B. Shrubs and ground covers shall be located and spaced as noted on the plant material schedule (if provided), otherwise plants will be placed in the planting beds at the normally accepted spacing for each species.
- C. Leave an eighteen inch (18") (450 millimeters) border of mulched space between outer leaves of installed plant material and the bed line, curb, or building foundation wall for all plant sizes.
- D. Any necessary "minor" adjustments in the layout of planting shall be made by the Contractor with the approval of the Landscape Architect in order to conform as nearly as possible to the intent of the Plans.

### **902-2.6.2.3. PLANTING PROCEDURES**

- A. All shrubs, trees and ground covers or vines shall be planted in pits having vertical sides and being circular in outline. Planting pit shall be three (3) to five (5) times the width of the root ball.
- B. Plants shall be set straight or plumb, in the locations shown, at such level that after settlement normal or natural relationship of the top of the root ball with the ground surface will be established. With regards to proper nursery practices, plants under certain conditions (i.e. low and wet areas) will benefit from being planted “high” with the root ball about one inch (1”) higher than the surrounding grade.
- C. All plant materials shall be fertilized with Agriform 20-10-5 planting tablets, or approved equal, at time of installation and prior to completion of pit backfilling. Agriform planting tablets shall be placed uniformly around the root mass at a depth that is between the middle and the bottom of the root mass.

Application rate:

1 gallon	1 - 21 gram tablet
3 gallon	2 - 21 gram tablet
5 gallon	3 - 21 gram tablet
7 gallon	4 - 21 gram tablet
Trees	3 tablets each $\frac{1}{2}$ " (12 millimeters) caliper
Palms	7 - 21 gram tablets

- D. Native soil shall be used in back-filling plant pits or as specified. The Contractor shall be responsible for providing additional soil for building tree saucers.
- E. When balled and burlapped plants are set, undisturbed native soil shall be left under the base of the root ball to prevent voids. Backfill tilled and loosened native soil around the sides of the root ball. Remove the top 4 four inches (4") (100 millimeters) of burlap wire, and all tie-down material from the root ball. Do not remove these materials from the bottom of the root ball. Thoroughly water-in before bringing the back-fill up to the proper grade. Roots of bare plants shall be properly spread out, and planting soil carefully worked in among them. Failure to comply is cause for rejection.
- F. Containerized plants shall be installed with undisturbed native soil left under the base of the root ball to prevent voids. Planting pit shall be three (3) to five (5) times the width of the root ball. Backfill tilled and loosened native soil around the sides of the root ball. Thoroughly water-in before bringing the backfill up to the proper grade.
- G. Plant spacing shall be “on center” and varies with the different plant species. Space each variety of plant equally in the planting areas. Shrubs and ground covers adjacent to straight or curved edges shall be triangular - spaced in rows parallel to those edges. Plant a minimum of eighteen inches (18") from the back of the curb to the outside edge of the plant.
- H. All azaleas shall be placed into a prepared bed of amended soil containing 50% weed-free Florida peat or approved equivalent. Root balls shall be scarified vertically at 120 degree angles in a triangular pattern.
- I. Sabal palms may be planted deeper than normal if conditions warrant and if approved.

**902-2.6.2.4. SODDING**

- A. During periods of drought, sod shall be watered sufficiently at its origin to moisten the soil adequately to the depth to which it is to be cut.
- B. An application of 6-6-6, 40% organic, slow or controlled release fertilizer shall be made to all lawn areas just prior to the laying of the sod at a rate of one pound (1 lb.) of nitrogen per one thousand square feet (1000 sq ft). The ground shall be moistened before the sod is laid in place.
- C. Solid sod shall be laid tightly with closely abutting staggered joints with an even surface edge and sod edge, in a neat and clean manner to the edge of all the paving and shrub areas. Cut down soil level to one inch (1") to one and one half inches (1-1/2") below top of walks prior to laying sod.
- D. Within two (2) hours after installing sod and prior to rolling, irrigate the sod. Sufficient water shall be applied to wet the sod thoroughly and to wet the sod to a depth of two inches (2") (50 millimeters). Watering shall be done in a manner that will avoid erosion due to the application of excessive quantities, and the watering equipment shall be a type that will prevent damage to the finished sod surface. Watering shall be repeated as necessary to keep sod moist until rooted to subgrade.
- E. The sod shall be pressed firmly into contact with the sod bed using a turf roller or other approved equipment so as to eliminate air pockets, provide a true and even surface and insure knitting without any displacement of the sod or deformation of the surfaces of sodded areas. After the sodding operation has been completed, the edges of the area shall be smooth and shall conform to the grades indicated.
- F. If, in the opinion of the Landscape Architect, top dressing is necessary after rolling, clean silica sand shall be used to fill voids. Evenly apply sand over the entire surface to be leveled, filling-in dips and voids and thoroughly washing into the sod areas.
- G. On slopes 3:1 or steeper, and as required, a geotextile fabric shall be installed per manufacturer's specifications prior to placing sod. The sod shall be fastened in place with suitable wooden pins or by other approved method.

**902-2.6.2.5. SEEDING**

- A. Seed shall be installed per the specifications of the State of Florida Department of Transportation. See plan for type of seed.

**902-2.6.2.6. TREE GUYING, BRACING AND STAKING**

- A. Tree guying, staking and bracing shall be the responsibility of the Contractor per sound nursery practices, and shall be done per details shown on the Plans. For trees, a minimum of two (2) stakes per tree or an optional three (3) stakes per tree at 120 degree spacing shall be used. Stakes shall be driven in at an angle, then tightened to vertical supported by approved plastic or rubber guys. Trees shall be staked with a minimum of four feet (4') height of stake above grade and a minimum of thirty inches (30") of stake below grade.
- B. For single trunk palms, a minimum of three (3) stakes per palm at 120 degree spacing shall be used. Toenail the stakes to batten consisting of five (5) layers of burlap and five (5) - 2

inch x 4 inch x 16 inch wood connected with two (2) three-quarter inch (3/4") steel bands. Palms shall be staked with a minimum of five feet (5') of stake above grade.

- C. Contractor shall remove all tree guying, staking, and bracing from trees six (6) months after the date of final acceptance of the landscape work.
- D. Stake only trees that require support to maintain a plumb position or are in potentially hazardous areas.

#### **902-2.6.2.7. MULCHING**

- A. All planting beds shall be weed-free prior to mulching.
- B. All curb, roadway, and bed line edges will be “trenched” to help contain the applied mulch. Mulch should be below top of curb and resistant to washout from stormwater run-off.
- C. All plant beds and tree rings shall be mulched evenly with a three inch (3") layer (before compaction) of 100% Grade B recycled cypress bark mulch, or other mulch as specified on the Plans or General Notes.
- D. Mulch shall not be placed against the trunks of plant materials or foundations of buildings. Maintain a minimum three inch (3") clearance for trees and shrub trunks and a minimum six inch (6") clearance for the walls of buildings.
- E. For beds of annual flowers, a 12 inch wide x 3 inch deep band of mulch shall be installed in front of the first row of annuals. Maintain a minimum six inches (6") of non-mulched clearance from the outside edge of annuals.

#### **902-2.6.2.8. PRUNING**

- A. Pruning shall be done by an experienced certified Arborist to maintain the natural shape and form of the plant.
- B. Upon acceptance by the Owner, prune any broken branches, remove crossed branches, and branches hanging below the clear trunk of the tree.

#### **902-2.6.2.9. CLEAN-UP**

- A. During landscape work, store materials and equipment where directed by the Owner.
- B. The Contractor shall promptly remove any materials and equipment used on the job, keeping the area neat at all times. Upon completion of all planting, dispose of all excess soil and debris leaving pavements and work areas in safe and orderly condition.
- C. The clean-up of the site shall include the removal and proper disposal of the tree guying, staking, and bracing materials as described in specifications.

#### **902-2.6.2.10. PROTECTION**

- A. The Contractor shall provide safeguards for the protection of workmen and others on, about, or adjacent to the work, as required under the parameters of the Occupational Safety and Health Administration (O.S.H.A.) standards.
- B. The Contractor shall protect the Owner's and adjacent property from damage.

- C. The Contractor shall protect the landscape work and materials from damage due to landscape operations. Maintain protection during installation and maintenance periods.
- D. The Contractor shall provide protection (tree barricades) for all existing trees and palms as specified.

#### **902-2.6.2.11. REPAIR OF DAMAGES**

- E. The Contractor shall repair all damage caused by their operations to other materials, property, or trades to a level equal in quality to the existing condition prior to damage.
- F. The Contractor shall be held responsible for all damage done by their work or employees to other materials or trades' work. Patching and replacement of damaged work may be done by others, at the Owner's direction, but the cost of same shall be paid by the Contractor who is responsible for the damage.

#### **902-2.6.3. MAINTENANCE**

- A. The Contractor shall maintain all plant materials in a first class condition from the beginning of landscape construction until Final Acceptance.
- B. Operations:
  - 1. Maintenance shall include, but not be limited to, watering of turf and planting beds, mowing, fertilizing, cultivation, weeding, pruning, disease and pest control, replacement of dead materials, straightening, turf or planter settlement corrections, replacement of rejected materials, staking and guying repair and tightening, wash-out repairs and regrading, and any other procedures consistent with the good horticultural practice necessary to insure normal, vigorous and healthy growth of all work under the Contract. Mowing shall be consistent with the recommended height per the University of Florida Cooperative Extension Service.
  - 2. Within the warranty period, the Contractor shall notify the Owner of any maintenance practices being followed or omitted which would be detrimental to the healthy, vigorous growth of the landscape.
  - 3. The Contractor shall be responsible for the final watering of not less than one inch (1") of water for all planted materials before leaving the site.

#### **902-2.6.4. INSPECTION, REJECTION, AND ACCEPTANCE**

##### **902-2.6.4.1. INSPECTION**

- A. Upon completion of the installation, the Contractor will notify the Owner or the Owner's Representative that the job is ready for inspection. Within fifteen (15) days of notifications, the installation will be inspected by the Landscape Architect. A written and/or graphic inspection report will be sent to the Owner and/or Landscape Contractor.

##### **902-2.6.4.2. REJECTION AND REPLACEMENT**

- A. The Landscape Architect shall be final judge as to the suitability and acceptability of any part of the work. Plant material will be rejected if it does not meet the requirements set forth in the Plans and Specifications.

- B. Replace any rejected materials immediately or within fifteen (15) days and notify the Landscape Architect that the correction has been made.

#### **902-2.6.4.3. ACCEPTANCE**

- A. After replacement of rejected plant material, if any, have been made, and completion of all other correction items, the Owner or Project Representative will accept the project in writing.
- B. Upon Final Acceptance, the Owner assumes responsibility for maintenance within the terms of the Contract. Acceptance will in no way invalidate the Contractor's warranty period.
- C. The Contractor's warranty period will begin after final acceptance of the project by the Owner.
  1. If evidence exists of any lien or claim arising out of or in connection with default in performance of this Contract, the Owner shall have the right to retain any payment sufficient to discharge such claim and all costs in connection with discharging such claim.
  2. Where the Specifications call for any stipulated item or an "approved equivalent", or in words to that effect, the Contractor shall indicate the price of the type and species specified in the proposal, giving the price to be added or deducted from their Contract price. The final selection rests with the Owner or their representative.
  3. Where plants installed do not meet specifications, the Owner reserves the right to request plant replacement or an appropriate deduction from the Contract amount to compensate for the value not received from the under-specified plant materials. No additional compensation will be made to the Contractor for plants installed that exceed specifications.

#### **902-2.6.5. WARRANTY**

- A. The Contractor shall warranty all palms and trees furnished under this contract for a period of one (1) year and all shrubs for a period of six (6) months. Material which is either dead or in poor health during this period or at completion will be replaced at no charge to the Owner. Should any of the plant materials show 50% or more defoliation during the warranty period, due to the Contractor's use of poor quality or improper materials or workmanship, the Contractor upon notice, shall replace without delay same with no additional cost to the Owner. Should any plant require replacing, the new plant shall be given the equal amount of warranty.

### **903. SODDING**

Unless otherwise noted herein, the Contractor shall place all sod, either shown on the plans or at the direction of the Engineer, in conformance with Sections 575, 981, 982 and 983 of FDOT's Standard Specifications. The area for sod application shall be loosened and excavated to a suitable depth and finished to a grade compatible with existing grass and structures. Sod shall be placed with edges in close contact and shall be compacted to uniform finished grade with a sod roller immediately after placement. In sloped areas, the sod shall be graded and placed so as to prohibit

erosion and undermining of the adjacent sidewalk. No sod that has been cut for more than seventy-two (72) hours can be used unless authorized by the Engineer in advance. The sod shall be thoroughly watered immediately after placement. The Contractor shall continue to water sod as needed and/or directed by the Engineer as indicated by sun exposure, soil, heat and rain conditions, to establish and assure growth, until termination of the contract. Dead sod, or sod not acceptable to the Engineer, shall be removed and replaced by the Contractor at no additional compensation. Any questions concerning the type of existing sod shall be determined by the Engineer.

Unless otherwise noted on the plans, payment for sod (including labor, equipment, materials, placement, rolling, watering, etc.) shall be included in other bid items. Payment for these associated bid items may be withheld until the Contractor provides the City a healthy, properly placed stand of grass. When this work is given as a separate bid item, it shall cover all labor, equipment and materials, (including water) required for this work and shall be paid for on the basis of each square foot in place and accepted. No payment for sod shall be made until the Contractor provides the City a healthy, properly placed stand of grass.

## **904. SEEDING**

Seed, or seed and mulch, shall only be used when specified for certain demolition projects. The seed and/or mulch shall be placed as called for on the plans in the following manner. The area to be seeded shall be brought to the required line and grade, fertilized and seeded in basic conformance with FDOT's Standard Specifications Sections 570, 981, 982 and 983. However, no wildflower seed shall be used, and Argentine Bahia Seed shall be used instead of Pensacola Bahia. No sprigging will be required. Also, the addition of 20 lb. of Rye Seed (to total 60 lb. of seed per acre) will be required during the stated periods. It is also required that the Contractor maintain said seed until growth is assured.

When this work is given as a bid item, the item shall cover all labor, material, equipment (including water), required for this work, and shall be paid for on the basis of each square yard in place and accepted. If called for on the plans, but not shown as a bid item, then the cost of such work as stated above shall be included in the cost of other work.

## **905. LAWN MAINTENANCE SPECIFICATIONS**

### **101-167. SCOPE**

To remove trash and debris from landscape and paved area; maintenance and fertilization of plant beds and landscape materials; maintenance, repair, and operation of irrigation systems; ornamental pest control; palm pruning; maintenance of traffic; and the cleaning of hard surfaces at designated areas. The Contractor is to work with the City in coordinating maintenance activities and reporting irregularities in the work zone.

The Contractor(s) will provide the labor and materials required to maintain the specified landscaped street areas including:

- Traffic safety and Maintenance of Traffic;
- Trash and debris removal from the job site;
- Removal of weeds in landscaped areas and hard surfaces;
- Proper trimming and pruning of landscape plants and palms;

- Proper fertilization and pest control of landscape and palms (may be subcontracted);
- Irrigation service and repair;
- Mulch replacement;
- Cleaning of hard surfaces; and the
- Reporting of irregularities at the job site.

## **101-168. SCHEDULING OF WORK**

The Contractor(s) shall accomplish all landscape maintenance required under the contract between the hours of 7:00 a.m. and 6:00 p.m. Monday through Saturday, excluding observed holidays. The City may grant, on an individual basis, permission to perform contract maintenance at other hours.

All work shall be completed in a continuous manner, such as cleanup, weeding, trimming, etc., be completed before leaving the job site.

## **101-169. WORK METHODS**

### **905-2.1. MAINTENANCE SCHEDULING**

The Contractor(s) will adhere to a work schedule provided by the City (see Level of Service). Any variations to that schedule, requested by either party, must be approved, either verbally or in writing by an authorized representative of the other party.

### **905-2.2. DUTIES PER SERVICE VISIT**

The Contractor(s) shall provide the following service at each scheduled visit to the designated location:

#### **905-2.2.1. LITTER AND DEBRIS**

Remove trash and debris from the project site. Proper disposal of collected trash and debris is the Contractor's responsibility. Extraordinary amounts of debris caused by hurricanes, tornadoes, vandalism, etc., would be the responsibility of the City to clean up. The Contractor should report such accumulations of debris when they are encountered. Bids for the extraordinary cleanup from the Contractor would be considered. Work sites should be left in a clean and neat appearance upon completion. All debris from pruning process is to be removed from the job site and disposed of by the Contractor.

#### **905-2.2.2. VISUAL CHECK**

The site should be checked for irregularities, such as irrigation leaks, vehicle damage, dead or damaged plant material, vandalism, etc., which should be reported to the City within twenty-four (24) hours after providing the service.

#### **905-2.2.3. PLANT TRIMMING AND PALM PRUNING**

All plant material should be trimmed in a manner that promotes the natural shape and mature size of the particular species. Trimming should be performed at intervals that will maintain plants in a neat appearance. Trimming should be performed to promote fullness of the plants, while

maintaining height restrictions in Clear Sight Zones as established on the landscape plans. Plants shall be kept trimmed to the back of curb. Brown foliage shall be removed from Liriope.

Palm pruning to be performed at least once per year, preferably in late June or July following flower formation, consistent with the following specification:

#### **905-2.2.3.1. PHOENIX SPECIES (CANARY DATE, INDIA DATE, PYGMY DATE, ETC.)**

Remove all descending fronds, to the base of the frond; all parallel and ascending fronds are to remain in order to leave a full, rounded head; seed heads may remain, but remove old faded heads that are encountered in the pruning process; and remove loose frond boots; remove vegetation, such as strangler figs, Brazilian Pepper, Asparagus fern, etc., growing in the frond boots or on the trunk. Provide the rounded, classic cut on all Medjool palm boots. No climbing spikes allowed on palms.

#### **905-2.2.3.2. TRAFFIC CONTROL**

Proper and safe work zones in vehicular traffic areas are to be set up and maintained by the Contractor, according to the approved Maintenance of Traffic specifications.

#### **905-2.2.3.3. PEDESTRIAN SAFETY**

Contractor is responsible for maintaining safe work zones in areas where pedestrian and park users are present. The City reserves the right to limit the hours of operation in certain high pedestrian use areas.

#### **905-2.2.4. PLANT FERTILIZATION**

All tree and plant material should be fertilized with the appropriate amount of 20-6-12 sulfur coated, slow release, ornamental fertilizer, three times per year. Applications should be made in mid-February, early June, and mid-September, for the first two years. Fertilizer types and amounts will change with requirements of maturing landscape materials.

#### **905-2.2.5. WEED REMOVAL IN LANDSCAPED AREA**

Weeds should be removed on a regular basis in order to keep them from being visibly noticeable. Weed control with the use of appropriate herbicides is allowable, given they are properly applied by a certified applicator. Herbicide damage to landscape material will be remedied by Contractor at their expense.

#### **905-2.2.6. MULCH CONDITION**

Should be maintained at a thickness that will discourage weed growth as well as help retain soil moisture, usually three inches (3").

#### **905-2.2.7. IRRIGATION SERVICE AND REPAIR**

Should be performed at each visit to assure the system's proper operation and timing. Drip tubing should be kept covered with mulch. Timer should be checked for proper time of day and operating schedule. Leaks or breaks in the system should be repaired before the next scheduled system running time.

### **905-2.2.8. LAWN AND ORNAMENTAL PEST CONTROL**

Should be performed by a properly licensed and certified applicator to keep pest populations at a less than damaging level. Landscape materials lost to or extensively damaged by pests will be replaced by the Contractor at the Contractor's expense. Diazinon products are not to be used on City properties.

### **905-2.2.9. PALM FERTILIZATION**

Apply three (3) pounds of Magnesium sulfate and one pound of Potassium evenly, per tree, across the root zone (typically within the dripline), annually in early February.

### **905-2.2.10. FREEZE PROTECTION**

The City will provide a freeze/frost protection fabric for the Contractor to install over freeze/frost sensitive plants (Lantana and Pentas). The covering material will be stored at a City facility. Contractor will remove the covering material from storage and install over the sensitive plants, securely fastening edges of the material to the ground per manufacturer's directions. The City will furnish metal pins needed for securing fabric to the ground. The City will notify the Contractor one (1) day or twenty-four (24) hours minimum prior to the need to protect plant material. After uses, the Contractor will prepare the fabric for storage and return it to the designated City facility. Protective covering shall be removed the following afternoon or remain in place as directed by the City. The City shall notify the Contractor by 11:00 a.m. about removing the cover or keeping it in place due to continued freezing temperatures. The City may cancel the freeze protection event at any time prior to the end of the scheduled installation day (5:00 p.m.) The Contractor will be compensated for the number of hours mobilization or on-site work at the contracted rate per man-hour unit price. The Contractor shall provide a unit price for the installation and removal of the covering fabric on a per event basis, as well as an hourly rate per employee required. The City and Contractor will coordinate appropriate irrigation operations with weather conditions. Should freeze/frost damage occur, the Contractor shall perform remedial work as per unit basis, as directed by the City.

## **906. LEVEL OF SERVICE**

The Project Site is to be serviced weekly. Repairs to damage or vandalism to be made within seven (7) working days of reported irregularity. Weekly visits should occur no closer than six (6) and no further than ten (10) calendar days apart.

## **907. COMPLETION OF WORK**

Within twenty-four (24) hours of completing work the City either in person or by phone of said completion. It is acceptable to leave a phone message.

## **908. INSPECTION AND APPROVAL**

Upon receiving notification from the Contractor, the City shall inspect the serviced location the following business day. If, upon inspection, the work specified has not been completed, the City shall contact the Contractor to indicate the necessary corrective measures. The Contractor will be

given forty-eight (48) hours from this notification to make appropriate corrections. If the work has been completed successfully then the City will pay for services billed.

## **909. SPECIAL CONDITIONS**

1. This location will be newly installed and under warranty by the installer for a twelve (12) month period on plants, trees and palms. Landscape installer will coordinate irrigation operation with the Maintenance contractor to assure adequate irrigation to the landscape materials. Installer will also be responsible for the untying of palm heads/fronds as they feel appropriate.
2. All listed acreage or square footage figures are estimates.
3. All work shall be performed in a good and workmanlike manner, consistent with trade practices and standards which prevail in the industry.
4. The Contractor shall be responsible for damage to any plant material or site feature caused by the Contractor or their employees. The Contractor shall be notified in writing of the specific nature of the damage and cost of repair. The City shall, at its option, invoice the Contractor for the payment, or reduce by the amount of the repairs on the next regular payment to the Contractor.
5. Occasionally circumstances (standing water, prolonged inclement weather, parked vehicles, etc.) may make all or portions of a location unserviceable during the regular schedule. The Contractor shall notify the City Supervisor of such occurrences and shall schedule to perform the required work to the location as soon as the pertaining circumstances are relieved.

## **910. TREE PROTECTION**

### **101-170. TREE BARRICADES**

- A. A protective barrier shall be placed around all protected trees and palms prior to land preparation or construction activities within or adjacent to the work zone, including all staging and/or lay down areas. Protective barriers shall be installed as follows:
  1. At or greater than the full dripline of all species of Mangroves and Cabbage Palms.
  2. At or greater than the full dripline of all protected native pine trees and other conifer species.
  3. At or greater than two-thirds (2/3) of the dripline of all other protected species
  4. At or greater than the full dripline of trees within a specimen tree stand.
- B. Protective barriers are to be constructed using no less than two inch (2") lumber for upright posts. Upright posts are to be at least four feet (4') in length with a minimum of one foot (1') anchored in the ground. Upright posts are to be placed at a maximum distance of eight feet (8') apart. Horizontal rails are to be constructed using no less than one inch (1") by four-inch (4") lumber and shall be securely attached to the top of the upright post. The City's representative must approve any variation from the above requirements.

- C. Whenever a protective barrier is required, it shall be in place until all construction activity is terminated. The area within the barrier limits shall remain undisturbed by any activity during construction. Native ground cover and understory vegetation existing within the barriers shall remain throughout construction. Exotic plant species may only be removed by manual labor utilizing hand tools or by other means if authorized in writing by the City's representative.
- D. Prior to the erection of any required protective barrier, all surface foreign material, trash or debris shall be removed from the area enclosed by the barrier, and after erection of the barrier no such material or litter shall be permitted to remain within the protected area. No equipment, chemicals, soil deposits or construction materials shall be placed within such protective barriers.
- E. No signs, building permits, wires, or other attachments of any kind shall be attached to any protected tree or palm.
- F. At all times, due care shall be taken to protect the critical root zone of trees protected by this section, and root pruning requirements shall apply to such trees.

## **101-171. ROOT PRUNING**

- A. Where proposed construction improvements involve excavation and/or impacts to the critical root zone of protected trees, the Contractor shall be required to have an International Society of Arboriculture (ISA) certified arborist perform, or directly supervise root pruning to reduce the impacts of construction. The critical root zone is equivalent to the tree's dripline. Prior to any clearing, grubbing or excavation activities, the affected roots must be severed by clean pruning cuts at the point where grubbing or excavation impacts the root system. Roots can be pruned utilizing specified root pruning equipment designed for that purpose or by hand digging a trench and pruning roots with a pruning saw, chain saw or other equipment designed for tree pruning. Root pruning by trenching equipment or excavation equipment is strictly prohibited. Roots located in the critical root zone that will be impacted by construction activities shall be pruned to a minimum depth of eighteen inches (18") below existing grade or to the depth of the proposed impact if less than eighteen inches (18") from existing grade. The City's Representative on Engineering Department projects for Root Pruning issues is the Senior Landscape Architect and can be reached at (727) 562-4747, or through the construction inspector assigned to the project.
- B. Root pruning shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist.
- C. Any proposed root pruning trenches shall be identified on site (i.e. staked or painted) inspected and approved by the City's representative prior to actual root pruning.
- D. Root pruning shall be performed as far in advance of other construction activities as is feasible, but at a minimum shall be performed prior to ANY impacts to the soil. Associated tree protection measures should be implemented upon completion of said root pruning.
- E. If there is a likelihood of excessive wind and/or rain exceptional care shall be taken on any root pruning activities.

- F. Root pruning shall be limited to a minimum of ten inches (10") per one inch (1") of the trunk diameter from the tree base. Any exception must be approved by the City's representative prior to said root pruning.
- G. Roots shall be cut cleanly, as far from the trunk of the tree as possible. Root pruning shall be done to a minimum depth of eighteen inches (18") from existing grade, or to the depth of the disturbance if less than eighteen inches (18").
- H. Root pruning shall be performed using a root cutting machine specifically designed for this purpose. Alternate equipment or techniques must be approved by the City's representative, prior to any work adjacent to trees to be preserved.
- I. Root pruning shall be completed, inspected and accepted prior to the commencement of any excavation or other impacts to the critical root zones of trees to be protected.
- J. Excavations in an area where root are present shall not cause the tearing or ripping of tree roots. Roots must first be cleanly severed prior to continuing with the excavation, or tunneled around to prevent damage to the root.
- K. Tree roots shall not be exposed to drying out. Root ends shall be covered with native soil or burlap and kept moist until final backfill or final grades has been established.
- L. When deemed appropriate (e.g., during periods of drought) the City representative may require a temporary irrigation system be utilized in the remaining critical root zones of root pruned trees.
- M. When underground utility lines are to be installed within the critical root zone, the root pruning requirement may be waived if the lines are installed via tunneling or directional boring as opposed to open trenching.

## **101-172. PROPER TREE PRUNING**

- A. All tree pruning and/or root pruning on existing trees to remain shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist. Furthermore, all tree work shall conform to the American National Standards Institute (ANSI) 2001, American National Standard for tree care operations – Tree, Shrub and other Woody Plant Maintenance – Standard practices (pruning) ANSI A-300.
- B. Proper pruning techniques for all lateral branches of protected trees are required. Flush cuts (pruning cuts that remove the branch collar) and stub cuts (cuts that leave a stub on the tree) are improper techniques. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition, and will require replacement consistent with the current City Code of Ordinances and Community Development Code.
- C. No protected tree shall have more than thirty percent (30%) of its foliage removed.
- D. No protected tree shall be topped, hat racked or lion-tailed. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition, and will require replacement consistent with the current City Code of Ordinances and Community Development Code.

#### SECTION IV – Technical Specifications

E. Tree Trunks and limbs shall be protected. The use of tree spikes or other devices that damage trunk and bark tissue on protected trees shall be prohibited. Any protected tree that has been damaged in such a manner will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.

**SECTION IVA**

**NORTHEAST WRF IMPROVEMENTS PROJECT**

**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

**(PROJECT No. 19-0029-UT)**

PREPARED FOR:



CITY OF CLEARWATER  
ENGINEERING DEPARTMENT  
100 SOUTH MYRTLE AVENUE  
CLEARWATER, FL 33756

PREPARED BY:



KING ENGINEERING ASSOCIATES, INC.  
4921 MEMORIAL HIGHWAY  
ONE MEMORIAL CENTER, SUITE 300  
TAMPA, FL 33634

**Bid Specifications**

**January 2021**

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## TABLE OF CONTENTS

### **DIVISION 01            GENERAL REQUIREMENTS**

01005	GENERAL REQUIREMENTS
01014	SUMMARY OF WORK
01015	CONTROL OF WORK
01016	CONSTRUCTION PHASING PLAN
01030	SPECIAL PROJECT PROCEDURES
01040	COORDINATION
01050	FIELD ENGINEERING AND SURVEYING
01065	PERMITS AND EASEMENTS
01090	REFERENCE STANDARDS
01150	MEASUREMENT AND PAYMENT
01152	APPLICATIONS FOR PAYMENT
01153	CHANGE ORDER PROCEDURES
01200	MEETINGS AND CONFERENCES
01300	SUBMITTALS
01310	CONSTRUCTION SCHEDULES
01340	SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES
01385	COLOR AUDIO-VIDEO CONSTRUCTION RECORDS
01410	TESTING AND TESTING LABORATORY SERVICES
01500	TEMPORARY FACILITIES
01505	MOBILIZATION
01510	TEMPORARY UTILITIES

- 01580 PROJECT IDENTIFICATION AND SIGNS
- 01600 MATERIAL AND EQUIPMENT
- 01610 WATER TIGHTNESS TEST FOR HYDRAULIC STRUCTURES
- 01625 START-UP SYSTEMS TESTING
- 01640 QUALITY CONTROL
- 01670 SUBSTITUTIONS AND PRODUCT OPTIONS
- 01700 CONTRACT CLOSEOUT
- 01710 CLEANING
- 01720 PROJECT RECORD DOCUMENTS
- 01730 OPERATING AND MAINTENANCE DATA
- 01740 WARRANTIES AND BONDS
- 01820 TRAINING

Index of Technical Specifications  
Sign and Seal Sheet  
for

**CITY OF CLEARWATER  
NE WRF IMPROVEMENTS PROJECT  
PROJECT No. 19-0029-UT**

**SPECIFICATIONS**

**KING ENGINEERING ASSOCIATES, INC.**

**SECTION IVA**

Division 01 – General Requirements

01005, 01014, 01015, 01016, 01030, 01040, 01050, 01065, 01090, 01150, 01152, 01153, 01200, 01300, 01310, 01340, 01385, 01410, 01500, 01505, 01510, 01580, 01600, 01610, 01625, 01640, 01670, 01700, 01710, 01720, 01730, 01740, 01820

**SECTION IVB**

Division 02 - Sitework

02050, 02062, 02063, 02064, 02080, 02083, 02085, 02100, 02125, 02140, 02220, 02221, 02276, 02485, 02525, 02575, 02720, 02730

Division 6 – Wood and Plastics

06600

Division 09 – Finishes

09865, 09900

Division 11 – Equipment

11203, 11306, 11310, 11317, 11320, 11321, 11323, 11324, 11335, 11350, 11560

Division 13 – Special Construction

13210, 13300, 13525, 13567, 13600, 13615, 13630, 13640, 13650

Division 15 – Mechanical

15010, 15062, 15064, 15065, 15080, 15094, 15100, 15480

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Index of Technical Specifications  
Sign and Seal Sheet  
for

**CITY OF CLEARWATER  
NE WRF IMPROVEMENTS PROJECT  
PROJECT No. 19-0029-UT**

**SPECIFICATIONS**

**JONES EDMUNDS & ASSOCIATES, INC.**

**SECTION IVC**

Division 02 – Site Construction

02220, 02225, 02230, 02240, 02305, 02370, 02700, 02920

Division 03 – Concrete

03100, 03180, 03200, 03250, 03300, 03360, 03600, 03930

Division 05 – Metals

05500

Division 09 – Finishes

09900

Division 11 – Equipment

11000, 11228, 11330, 11356

Division 13 – Special Construction

13232, 13316, 13401

Division 15 – Mechanical

15055, 15060, 15075, 15110, 15120, 15121, 15122, 15125, 15144, 15155, 15290, 15860

Division 16 – Electrical

16050, 16060, 16110, 16120, 16130, 16140, 16150, 16160, 16170, 16370, 16402, 16450, 16460,  
16500, 16601, 16921

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Index of Technical Specifications  
Sign and Seal Sheet  
for

**CITY OF CLEARWATER  
NE WRF IMPROVEMENTS PROJECT  
PROJECT No. 19-0029-UT**

**SPECIFICATIONS**

**WEKIVA ENGINEERING, LLC**

**SECTION IVB**

Division 03 – Concrete

03100, 03200, 03250, 03300, 03350, 03600, 03740, 03750, 03800

Division 05 – Metals

05500

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Index of Technical Specifications  
Sign and Seal Sheet  
for

**CITY OF CLEARWATER  
NE WRF IMPROVEMENTS PROJECT  
PROJECT No. 19-0029-UT**

**SPECIFICATIONS**

**CARASTRO & ASSOCIATES, INC.**

**SECTION IVB**

**Division 16 - Electrical**

16010, 16050, 16110, 16120, 16135, 16142, 16143, 16170, 16190, 16195, 16452, 16460, 16470,  
16480, 16481, 16482, 16620, 16670, 16775

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1 SECTION 01005  
2

3 GENERAL REQUIREMENTS  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. Description  
10

11 The design and permitting for the Work of this project was performed by two  
12 independent consulting engineering firms: Ardurra Group (Ardurra) (fka King  
13 Engineering Associates) and Jones Edmunds and Associates (JEA). The two  
14 designs (plans and specification) have been merged into a single construction  
15 project for the convenience of the Owner.  
16

17 In performing the Work, the particular attention of the Contractor is called to the  
18 fact that the Work shall conform in all respects to the design (Drawings and  
19 Specifications) pertinent to that portion of the Work. The Work associated with  
20 the design provided by Ardurra is as shown on the Drawings labeled Northeast  
21 WRF Grit, Salsnes and Equalization System Improvements and the technical  
22 specifications titled Section IVB. The Work associated with the design provided  
23 by JEA is as shown on the Drawings labeled Northeast Water Reclamation  
24 Facility (NEWRF) Sludge Blend Tank Improvements and the technical  
25 specifications titled Section IVC. The work described in Sections I, II, IIA, III,  
26 IIIA, IV, IVA (Division 1 General Requirements specifications) and V is  
27 applicable to all the Work.  
28

29 The work to be completed consists of the furnishing of all labor, materials and  
30 equipment, and the performance of all Work included in this Contract. At all  
31 times during construction of the project, the Water Reclamation Facility (WRF)  
32 shall remain in service. Throughout the project, the Contractor shall cooperate  
33 fully with operations staff in order to minimize disruption to facility operations.  
34 No facility or structure shall be taken out of service, except those specifically  
35 scheduled to be demolished, without the prior written approval of the Owner or  
36 Engineer. Plant operations and regulatory compliance will take priority over and  
37 may impact the construction schedule.  
38

39 B. Work Included  
40

41 The Contractor shall furnish all labor, superintendence, materials, plant, power,  
42 light, heat, fuel, water, tools, appliances, equipment, supplies and other means  
43 of construction necessary or proper for performing and completing the Work.  
44 Perform and complete the Work in the manner best calculated to promote rapid  
45 construction consistent with safety of life and property and to the satisfaction of  
46 the Engineer, and in strict accordance with the Contract Documents. The  
47 Contractor shall clean up the Work and maintain it during and after construction,

1 until accepted, and shall do all work and pay all costs incidental thereto. He  
2 shall repair or restore all structures and property that may be damaged or  
3 disturbed during performance of the Work.

4  
5 The cost of incidental work described in these General Requirements, for which  
6 there are no specific Bid Items, shall be considered as part of the general cost  
7 of doing the work and shall be included in the prices for the various Contract Bid  
8 Items. No additional payment will be made therefore.  
9

10 The Contractor shall provide and maintain such modern plant, tools, and  
11 equipment as may be necessary, in the opinion of the Engineer, to perform in a  
12 satisfactory and acceptable manner all the work required by this Contract. Only  
13 equipment of established reputation and proven efficiency shall be used. The  
14 Contractor shall be solely responsible for the adequacy of his workmanship,  
15 materials and equipment, prior review of the Engineer notwithstanding.  
16

17 C. Public Utility Installation and Structures  
18

19 Public utility installations and structures shall be understood to include all poles,  
20 tracks, pipes, wires, conduits, house service connections, vaults, manholes and  
21 all other appurtenances and facilities pertaining thereto whether owned or  
22 controlled by the Owner, other governmental bodies or privately owned by  
23 individuals, firms or corporations, used to serve the public with transportation,  
24 traffic control, gas, electricity, telephone, sewerage, drainage, water or other  
25 public or private property which may be affected by the work shall be deemed  
26 included hereunder.  
27

28 The Contractor shall protect all public utility installations and structures from  
29 damage during the work. Access across any buried public utility installation, or  
30 structure, shall be made only in such locations and by means reviewed by the  
31 Engineer. The Contractor shall so arrange his operations as to avoid any  
32 damage to these facilities. All required protective devices and construction shall  
33 be provided by the Contractor at his expense. All existing public utilities  
34 damaged by the Contractor shall be repaired by the Contractor, at his expense.  
35 No separate payment will be made for such protection or repairs to public utility  
36 installations or structures.  
37

38 Public utility installations or structures owned or controlled by the Owner or other  
39 governmental body, which are shown on the Plans to be removed, relocated,  
40 replaced or rebuilt by the Contractor, shall be considered as a part of the general  
41 cost of doing the Work and shall be included in the prices bid for the various  
42 contract items. No separate payment shall be made therefore.  
43

44 Where public utility installations or structures owned or controlled by the Owner  
45 or other governmental body are encountered during the course of the Work, and  
46 are not indicated on the Plans or in the Specifications, and when, in the opinion  
47 of the Engineer, removal, relocation, replacement or rebuilding is necessary to

1 complete the work under this Contract, such work shall be accomplished by the  
2 utility having jurisdiction, or such work may be ordered, in writing by the  
3 Engineer, for the Contractor to accomplish. If such work is accomplished by the  
4 utility having jurisdiction it will be carried out expeditiously and the Contractor  
5 shall give full cooperation to permit the utility to complete the removal,  
6 relocation, replacement or rebuilding as required. If such work is accomplished  
7 by the Contractor, it will be in accordance with the General and Supplemental  
8 General Conditions.  
9

10 The Contractor shall give written notice to Owner and other governmental utility  
11 departments and other owners of public utilities of the locations of his proposed  
12 construction operations, at least forty-eight hours in advance of breaking ground  
13 in any area or on any unit of the work.

14 The maintenance, repair, removal, relocation or rebuilding of public utility  
15 installations and structures, when accomplished by the Contractor as herein  
16 provided, shall be done by methods reviewed by the Engineer.  
17

## 19 1.02 DRAWINGS AND SPECIFICATIONS

### 21 A. Drawings

23 When obtaining data and information from the Drawings, figures shall be used  
24 in preference to scaled dimensions, and large-scale drawings in preference to  
25 small-scale drawings.

### 27 B. Copies Furnished to Contractor

29 The Engineer may incorporate the addenda into a set of "conformed" drawings  
30 and specifications and may provide one electronic copy of each to the  
31 Contractor. The conformed drawings and specifications shall not supersede the  
32 Contract Documents and addenda provided to the Contractor. It shall be the  
33 responsibility of the Contractor to check that the conformed drawings and  
34 specifications properly include all revisions/addenda to the Contract  
35 Documents. The Contractor shall furnish each of the subcontractors,  
36 manufacturers, and suppliers such copies of the Contract Documents as may  
37 be required for their work. Additional copies of the Drawings and Specifications,  
38 when requested, may be furnished to the Contractor at cost of reproduction.

### 40 C. Supplementary Drawings

42 When, in the opinion of the Engineer, it becomes necessary to explain more  
43 fully the work to be done or to illustrate the work further or to show any changes  
44 that may be required, Drawings known as Supplementary Drawings, with  
45 Specifications pertaining thereto, will be prepared by the Engineer and copies  
46 thereof will be given to the Contractor and the Owner.  
47

1           D. Contractor to Check Drawings and Data

2  
3         The Contractor shall verify all dimensions, quantities and details shown on the  
4         Drawings, Supplementary Drawings, Schedules, Specifications or other data  
5         received from the Engineer and shall notify him of any errors, omissions,  
6         conflicts and discrepancies found therein. The Contractor shall submit to the  
7         Engineer a Request for Information (RFI), consecutively numbered and on a  
8         form provided by the Engineer, detailing all conflicts and discrepancies.  
9         Engineer shall promptly provide a response to all RFIs submitted by the  
10      Contractor. Contractor will not be allowed to take advantage of any conflicts  
11      and discrepancies, as full instructions will be furnished by the Engineer, should  
12      such conflicts and discrepancies be discovered.

13           E. Specifications

14  
15         The Technical Specifications generally consist of three parts: General,  
16         Products, and Execution. The General Section contains General Requirements  
17         that govern the work. Products and Execution modify and supplement these by  
18         detailed requirements for the work and shall always govern whenever there  
19         appears to be a conflict.

20           F. Intent

21  
22         All Work called for in the Specifications applicable to this Contract, but not  
23         shown on the Drawings in their present form, or vice-verse, shall be of like effect  
24         as if shown or mentioned in both. Work not specified in either the Drawings or  
25         in the Specifications, but involved in carrying out their intent or in the complete  
26         and proper execution of the work, is required and shall be performed by the  
27         Contractor as though it were specifically delineated or described.

28  
29         The apparent silence of the Specifications as to any detail, or the apparent  
30         omission from them of a detailed description concerning any work to be done  
31         and materials to be furnished, shall be regarded as meaning that only the best  
32         general practice is to prevail and that only material and workmanship of the best  
33         quality is to be used, and interpretation of these Specifications shall be made  
34         upon that basis.

35  
36         The inclusion of the Related Requirements (or work specified elsewhere) in the  
37         General part of the specifications is only for the convenience of the Contractor,  
38         and shall not be interpreted as a complete list of related Specification Sections.

39           **1.03 MATERIALS AND EQUIPMENT**

40           A. Manufacturer

41  
42         The names of proposed manufacturers, suppliers and dealers who are to furnish  
43         materials, fixtures, equipment, appliances or other fittings shall be submitted to

1 the Engineer for review. Such review must be obtained before shop drawings  
2 will be checked. No manufacturer will be approved for any materials to be  
3 furnished under this Contract unless he shall be of good reputation and have a  
4 plant of ample capacity. He shall, upon the request of the Engineer, be required  
5 to submit evidence that he has manufactured a similar product to the one  
6 specified and that it has been previously used for a like purpose for a sufficient  
7 length of time to demonstrate its satisfactory performance. All transactions with  
8 the manufacturers or subcontractors shall be through the Contractor, unless the  
9 Contractor shall request, in writing to the Engineer, that the manufacturer or  
10 subcontractor deal directly with the Engineer. Any such transactions shall not  
11 in any way release the Contractor from his full responsibility under this Contract.  
12

13 Any two or more pieces of material or equipment of the same kind, type or  
14 classification, and being used for identical types of service, shall be made by  
15 the same manufacturer.

16           B. Delivery

17           The Contractor shall deliver materials in ample quantities to insure the most  
18 speedy and uninterrupted progress of the work so as to complete the work within  
19 the allotted time. The Contractor shall also coordinate deliveries in order to  
20 avoid delay in, or impediment of, the progress of the work of any related  
21 Contractor.

22           C. Tools and Accessories

23           The Contractor shall, unless otherwise stated in the Contract Documents,  
24 furnish with each type, kind or size of equipment, one complete set of suitably  
25 marked high grade special tools and appliances that are needed to adjust,  
26 operate, maintain or repair the equipment. Such tools and appliances shall be  
27 furnished in approved painted steel cases, properly labeled and equipped with  
28 good grade cylinder locks and duplicate keys.

29           Spare parts shall be furnished as specified. Where spare parts are specified to  
30 be "manufacturer's recommended" or "as recommended by the manufacturer",  
31 the Contractor shall furnish those spare parts that are normally or commonly  
32 recommended by the manufacturer as shown on the manufacturer's readily  
33 available literature.

34           Each piece of equipment shall be provided with a substantial nameplate,  
35 securely fastened in place and clearly inscribed with the manufacturer's name,  
36 year of manufacture, serial number, weight and principal rating data.

37           D. Installation of Equipment

1           The Contractor shall have on hand sufficient proper equipment and machinery  
2           of ample capacity to facilitate the work and to handle all emergencies normally  
3           encountered in work of this character.

4  
5           Equipment shall be erected in a neat and workmanlike manner on the  
6           foundations at the locations and elevations shown on the Drawings, unless  
7           directed otherwise by the Engineer during installation. All equipment shall be  
8           correctly aligned, leveled and adjusted for satisfactory operation and shall be  
9           installed so that proper and necessary connections can be made readily  
10          between the various units.

11  
12          The Contractor shall furnish, install and protect all necessary anchor and  
13          attachment bolts and all other appurtenances needed for the installation of the  
14          devices included in the equipment specified. Anchor bolts shall be as reviewed  
15          by the Engineer and made of ample size and strength for the purpose intended.  
16          Substantial templates and working drawings for installation shall be furnished.

17  
18          The Contractor shall, at his own expense, furnish all materials and labor for, and  
19          shall properly bed in non-shrink grout, each piece of equipment on its supporting  
20          base that rests on masonry foundations. Grout shall completely fill the space  
21          between the equipment base and the foundation. All metal surfaces coming in  
22          contact with concrete or grout shall receive a coat of coal tar epoxy equal to  
23          Kop-Coat 300M.

24  
25          E. Service of Manufacturer's Representative

26  
27          The prices for equipment shall include the cost of furnishing a competent and  
28          experienced engineer or superintendent who shall represent the manufacturer  
29          and shall assist the Contractor, when required, to install, adjust, test and place  
30          in operation the equipment in conformity with the Contract Documents.

31  
32          Prior to placing the equipment in permanent operation, the manufacturer shall  
33          furnish to the Engineer and Contractor a written Certificate of Proper Installation  
34          stating that the equipment has been installed properly in strict accordance with  
35          the manufacturer's recommendations.

36  
37          After the equipment is placed in operation by the Contractor, such engineer or  
38          superintendent shall make all adjustments and tests required by the Engineer  
39          to prove that such equipment is proper and in satisfactory operating condition,  
40          and shall instruct/train such personnel as may be designated by the Owner in  
41          the proper operation and maintenance of such equipment.

42  
43          1.04 INSPECTION AND TESTING

44  
45          A. General

1 For tests specified to be made by the Contractor, the testing personnel shall  
2 make the necessary inspections and tests and the reports thereof shall be in  
3 such form as will facilitate checking to determine compliance with the Contract  
4 Documents. Five copies of the reports shall be submitted and the authorities'  
5 certification thereof must be furnished to the Engineer as a prerequisite for the  
6 acceptance of any material or equipment. Testing for the Blend and Storage  
7 Tank portion of the project shall be in accordance with Technical Specification  
8 IVC, Section 11000 and as described herein.  
9

10 If in the making of any test of any material or equipment it is ascertained by the  
11 Engineer that the material or equipment does not comply with the Contract, the  
12 Contractor will be notified thereof and he will be directed to refrain from  
13 delivering said material or equipment, or to remove it promptly from the site or  
14 from the work and replace it with acceptable material, without cost to the Owner.  
15

16 Tests of electrical and mechanical equipment and appliances shall be  
17 conducted in accordance with recognized test codes of the ANSI, ASME, or the  
18 IEEE, except as may otherwise be stated herein.  
19

20 The Contractor shall be fully responsible for the proper operation of equipment  
21 during tests and instruction periods and shall neither have nor make any claim  
22 for damage that may occur to equipment prior to the time when the Owner  
23 formally takes over the operation thereof.  
24

25       B. Costs  
26

27 All inspection of materials furnished under this Contract will be performed by the  
28 Owner or duly authorized inspections engineers or inspection bureaus without  
29 cost to the Contractor, unless otherwise expressly specified. The cost of shop  
30 and field tests of equipment and of certain other tests specifically called for in  
31 the Contract Documents shall be borne by the Contractor and such costs shall  
32 be deemed to be included in the Contract price.  
33

34 Materials and equipment submitted by the Contractor as equivalent to those  
35 specified may be tested by the Owner for compliance with the specifications.  
36 The Contractor shall reimburse the Owner for the expenditures incurred in  
37 making such tests on materials and equipment that are rejected for non-  
38 compliance.  
39

40       C. Inspection of Materials  
41

42 The Contractor shall give notice in writing to the Engineer, sufficiently in  
43 advance of his intention to commence the manufacture or preparation of  
44 materials especially manufactured or prepared for use in or as part of the  
45 permanent construction. Such notice shall contain a request for inspection, the  
46 date of commencement and the expected date of completion of the manufacture  
47 or preparation of materials. Upon receipt of such notice, the Engineer will

1 arrange to have a representative present at such times during the manufacture  
2 as may be necessary to inspect the materials or he will notify the Contractor that  
3 the inspection will be made at a point other than the point of manufacture, or he  
4 will notify the Contractor that inspection will be waived. The Contractor must  
5 comply with these provisions before shipping any material. Such inspection  
6 shall not release the Contractor from its responsibility for furnishing materials  
7 meeting the requirements of the Contract Documents.

8

9     D. Certificate of Manufacture

10

11 When inspection is waived or when the Engineer so requires, the Contractor  
12 shall furnish authoritative evidence in the form of Certificates of Manufacture  
13 that the materials to be used in the work have been manufactured and tested in  
14 conformity with the Contract Documents. These certificates shall be notarized  
15 and shall include copies of the results of physical tests and chemical analyses,  
16 where necessary, that have been made directly on the product or on similar  
17 products of the manufacturer. Submit Certificates of Manufacture in accordance  
18 with Section 01300.

19

20     E. Shop Tests of Operating Equipment

21

22 Each piece of equipment for which pressure, duty, capacity, rating, efficiency,  
23 performance, function or special requirements are specified shall be tested in  
24 the shop of the maker in a manner that shall conclusively prove that its  
25 characteristics comply fully with the requirements of the Contract Documents.  
26 No such equipment shall be shipped to the work until the Engineer notifies the  
27 Contractor, in writing, that the results of such tests are acceptable.

28

29 Five copies of the manufacturer's actual test data and interpreted results  
30 thereof, accompanied by a certificate of authenticity sworn to by a responsible  
31 official of the manufacturing company, shall be forwarded to the Engineer for  
32 review in accordance with Section 01300.

33

34 The cost of shop tests and of furnishing manufacturer's preliminary and shop  
35 test data of operating equipment shall be borne by the Contractor.

36

37     F. Preliminary Field Tests

38

39 As soon as conditions permit, the Contractor shall furnish all labor, materials,  
40 and instruments and shall make preliminary field tests of equipment. If the  
41 preliminary field tests disclose any equipment furnished under this Contract that  
42 does not comply with the requirements of the Contract Documents, the  
43 Contractor shall, prior to the acceptance tests, make all changes, adjustments  
44 and replacement required. The Contractor shall assist in the preliminary field  
45 tests as applicable.

46

47     G. Final Field Tests

1  
2 Upon completion of the work and prior to final payment, all equipment and  
3 systems installed under this Contract shall be subjected to acceptance tests as  
4 specified or required to prove compliance with the Contract Documents.  
5

6 The Contractor shall furnish labor, fuel, energy, water and all other materials,  
7 equipment and instruments necessary for all acceptance tests, at no additional  
8 cost to the Owner. The equipment suppliers and subcontractors shall assist in  
9 the final field tests, as applicable.  
10

11 H. Failure of Tests  
12

13 Any defects in the materials and equipment or their failure to meet the tests,  
14 guarantee or requirements of the Contract Documents shall be promptly  
15 corrected by the Contractor by replacement or otherwise as directed by the  
16 Engineer. The decision of the Engineer as to whether or not the Contractor has  
17 fulfilled his obligations under the Contract shall be final and conclusive. If the  
18 Contractor fails to make these corrections or if the improved materials and  
19 equipment, when tested, shall again fail to meet the guarantees or specified  
20 requirements, the Owner, notwithstanding its partial payment for work, materials  
21 and equipment, may reject the work, materials and equipment and may order  
22 the Contractor to remove them from the site at his own expense.  
23

24 I. Final Inspection  
25

26 During such final inspections, the work shall be clean and free from water. In  
27 no case will the final change order be prepared until the Contractor has complied  
28 with all requirements set forth and the Engineer has made his final inspection of  
29 the entire work and is satisfied that the entire work is properly and satisfactorily  
30 constructed in accordance with the requirements of the Contract Documents.  
31

32 1.05 TEMPORARY STRUCTURES  
33

34 A. Temporary Fences  
35

36 If, during the course of the work, it is necessary to remove or disturb any fence  
37 or part thereof, the Contractor shall, at his own expense, if so ordered by the  
38 Engineer, provide a suitable temporary fence, which shall be maintained until  
39 the permanent fence is replaced. The Engineer shall be solely responsible for  
40 the determination of the necessity for providing a temporary fence and the type  
41 of temporary fence to be used.  
42

43 B. Temporary Driveways  
44

45 At its own expense, the Contractor shall furnish, install, maintain and remove all  
46 temporary driveways and access roads required to provide access to the work  
47 and through the site of the work to maintain existing operations and to allow  
48

1 construction of other projects in the area. The Contractor shall fully cooperate  
2 with the Owner in providing this access.

3

4 C. Temporary Structures and Facilities

5

6 The Contractor shall construct any temporary piping and facilities as required in  
7 order to maintain existing treatment capacity and operations during  
8 construction.

9

10 1.06 TEMPORARY SERVICES

11

12 A. First Aid

13

14 The Contractor shall keep upon the site, at each location where work is in  
15 progress, a completely equipped first aid kit and shall provide ready access  
16 thereto at all times when people are employed on the work.

17

18 1.07 LINE AND GRADE

19

20 A. Line and Grade

21

22 All work under this Contract shall be constructed in accordance with the lines  
23 and grades shown on the Drawings, or as given by the Engineer. The full  
24 responsibility for maintaining alignment and grade rests upon the Contractor.

25

26 The Contractor, prior to commencing of construction, shall have established  
27 benchmarks and base line controlling points. The Contractor shall so place  
28 excavation and other materials as to cause no inconvenience in the use of the  
29 reference marks provided. He shall remove any obstructions placed by him  
30 contrary to this provision.

31

32 B. Surveys

33

34 The Contractor shall furnish and maintain, at his own expense, stakes and other  
35 such materials to establish all working or construction lines and grades, as  
36 required, and shall be solely responsible for the accuracy thereof.

37

38 All surveying shall be performed in accordance with Specification 01050.

39

40 C. Safeguarding Marks

41

42 The Contractor shall safeguard all points, stakes, grade marks, monuments and  
43 bench marks made or established on the work, bear the cost of re-establishing  
44 them if disturbed, and bear the entire expense of rectifying work improperly  
45 installed due to not maintaining or protecting or to removing without  
46 authorization such established points, stakes and marks.

1           The Contractor shall safeguard all existing and known property corners,  
2           monuments and marks adjacent to but not related to the work and, if required,  
3           shall bear the cost of re-establishing them if disturbed or destroyed.  
4

5           **1.08 ADJACENT STRUCTURES AND LANDSCAPING**  
6

7           A.       The Contractor shall also be entirely responsible and liable for all damage or  
8           injury as a result of his operations to all other adjacent public and private  
9           property, structures of any kind and appurtenances thereto met with during the  
10          progress of the work. The cost of protection, replacement in their original  
11          locations and conditions or payment of damages for injuries to such adjacent  
12          public and private property and structures affected by the work, whether or not  
13          shown on the Drawings or specified shall be included in the various Contract  
14          Items and no separate payments will be made therefore. Where such public  
15          and private property, structures of any kind and appurtenances thereto are not  
16          shown on the Drawings and when, in the opinion to avoid interference with the  
17          work, payment therefore will be made as provided for in the General Conditions.  
18

19          Contractor is expressly advised that the protection of buildings structures,  
20          tunnels, tanks, pipelines, etc. and related work adjacent to and in the vicinity of  
21          his operations, wherever they may be, is solely his responsibility. Conditional  
22          inspection of buildings or structures in the immediate vicinity of the project which  
23          may reasonably be expected to be affected by the Work shall be performed by  
24          and be the responsibility of the Contractor.  
25

26          Contractor shall, before starting operations, make an examination of the interior  
27          and exterior of the adjacent structures, buildings, facilities, etc., and record by  
28          notes, measurements, photographs, etc., conditions that might be aggravated  
29          by open excavation and construction. Repairs or replacement of all conditions  
30          disturbed by the construction shall be made to the satisfaction of the Owner and  
31          to the satisfaction of the Engineer. This does not preclude conforming to the  
32          requirements of the insurance underwriters. Copies of surveys, photographs,  
33          reports, etc., shall be given to the Engineer.  
34

35          Prior to the beginning of any excavations, the Contractor shall advise the  
36          Engineer of all buildings or structures discovered which may impact their work.  
37          The Contractor shall receive approval from the Owner or Owner's  
38          representative before performing work on those buildings and structures. They  
39          shall Document in the Record Drawings the work on these buildings or  
40          structures which the project work affect.  
41

42           B.       Protection of Trees  
43

44           1.       The Contractor shall adequately protect all trees and shrubs with boxes  
45           or otherwise in accordance with ordinances governing the protection of  
46           trees. No excavated materials shall be placed so placed as to injure such  
47           trees or shrubs. Trees or shrubs destroyed through negligence of the

1 Contractor or his employees shall be replaced with new stock of similar  
2 size and age, in the proper season and at the sole expense of the  
3 Contractor.

4

5 2. Beneath trees or other surface structures, where possible, pipelines may  
6 be built in short tunnels, backfilled with excavated materials, except as  
7 otherwise specified, or the trees or structures carefully supported and  
8 protected from damage.

9

10 3. The Owner may order the Contractor, for the convenience of the Owner,  
11 to remove trees along the line or trench excavation. If so ordered, the  
12 Owner will obtain any permits required for removal of trees.

13

14 C. Lawn Areas

15

16 Lawn areas shall be left in as good condition as before the starting of the work.  
17 Where sod is to be removed, it shall be carefully removed, and later replaced,  
18 or the area where sod has been removed shall be restored with new sod.

19

20 D. Restoration of Fences

21

22 Any fence, or part thereof, that is damaged or removed during construction shall  
23 be replaced or repaired by the Contractor and shall be left in as good or better  
24 a condition as existed before starting the work. The manner in which the fence  
25 is repaired or replaced and the materials used in such work shall be subject to  
26 the review of the Engineer. No additional payment will be made for the  
27 replacement or repair of any fence.

28

29 1.09 PROTECTION OF WORK AND PUBLIC

30

31 A. Barriers and Lights

32

33 During the prosecution of the work, the Contractor shall install and maintain at  
34 all times such barriers and lights as will effectively prevent accidents. The  
35 Contractor shall provide suitable barricades, red lights, "danger" or "caution" or  
36 "street closed" signs and watchmen at all places where the work causes  
37 obstructions to the normal traffic or constitutes in any way a hazard to the public.

38

39 B. Smoke Prevention

40

41 The Contractor shall use hard coal, coke, oil or gas as fuel for equipment  
42 generating steam. A strict compliance with ordinances regulating the production  
43 of emission of smoke will be required. No open fires will be permitted.

44

45 C. Noise

1           The Contractor shall eliminate noise to as great an extent practicable at all  
2           times. Air compressing plants shall be equipped with silencers and the exhaust  
3           of all gasoline motors or other power equipment shall be provided with mufflers.  
4           In the vicinity of hospitals and schools and where directed by the Engineer,  
5           special care shall be used to avoid noise or other nuisances. The Contractor  
6           shall strictly observe all local regulations and ordinances covering noise control.  
7

8           Except in the event of an emergency, no work shall be done between the hours  
9           of 7:00 P.M. and 7:00 A.M., or on Sundays, or as otherwise stated in the General  
10          Conditions. If the proper and efficient prosecution of the work requires  
11          operations during the night, the written permission of the Engineer shall be  
12          obtained before starting such items of the work.

13           D. Access to Public Services

14           Neither the excavated materials nor the materials or plant used in the  
15          construction of the work shall be so placed as to prevent free access to all fire  
16          hydrants, valves or manholes.

17           E. Dust Prevention

18           The Contractor shall minimize dust nuisance from all construction operations  
19          and from traffic by keeping the roads and/or construction areas sprinkled with  
20          water at all times or when directed by the Owner and/or Engineer.

21           1.10 CUTTING AND PATCHING

22           A. The Contractor shall do all cutting, fitting or patching of his portion of the work  
23          that may be required to make the several parts thereof join and coordinate in a  
24          manner satisfactory to the Engineer and in accordance with the Drawings and  
25          Specifications. The work shall be performed by competent workmen skilled in  
26          the trade required by the restoration.

27           1.11 CLEANING

28           A. During construction of the work, the Contractor shall, at all times, keep the site  
29          of the work and adjacent premises as free from material, debris and rubbish as  
30          is practicable and shall remove the same from any portion of the site if, in the  
31          opinion of the Owner or Engineer, such material, debris, or rubbish constitutes  
32          a nuisance or is objectionable.

33           The Contractor shall remove from the site all of his surplus materials and  
34          temporary structures when no further need therefore develops.

35           B. Final Cleaning

1 At the conclusion of the work, all erection plant, tools, temporary structures and  
2 materials belonging to the Contractor shall be promptly taken away, and he shall  
3 remove and promptly dispose of all water, dirt, rubbish or any other foreign  
4 substances.

5  
6 The Contractor shall thoroughly clean all equipment and materials installed by  
7 him and shall deliver such materials and equipment undamaged in a bright,  
8 clean, polished and new operating condition.  
9

10 1.12 MISCELLANEOUS

11 A. Protection against Siltation and Bank Erosion

- 12 1. The Contractor shall arrange his operations to minimize siltation and  
13 bank erosion on construction sites and on existing or proposed water  
14 courses, drainage ditches, wetlands and other areas of concern.  
15  
16 2. The Contractor, at his own expense, shall remove any siltation deposits  
17 and correct any erosion problems as directed by the Engineer that results  
18 from his construction operations.  
19  
20 3. The Contractor shall be solely responsible for any fines resulting from the  
21 encroachment of any environmentally protected areas.  
22

23 B. Protection of Wetland Areas

24 The Contractor shall properly dispose of all surplus material, including soil, in  
25 accordance with Local, State and Federal regulations and the permits issued  
26 for this project. Under no circumstances shall surplus material be disposed of  
27 in wetland areas as defined by the Florida Department of Environmental  
28 Protection, Southwest Florida Water Management District, U.S. Army Corps of  
29 Engineers, etc.

30 C. Existing Facilities

31 The work shall be so conducted to maintain existing facilities in operation insofar  
32 as is possible. Requirements and schedules of operations for maintaining  
33 existing facilities in service during construction shall be as described in these  
34 Specifications.

35 D. Use of Chemicals

36 All chemicals used during project construction or furnished for project operation,  
37 whether herbicide, pesticide, disinfectant, polymer, reactant, or of other  
38 classification, must show approval of either EPA or USDA. Use of all such  
39 chemicals and disposal of residues shall be in strict conformance with  
40 manufacturers' instructions.  
41

1  
2       E. Tree Removal  
3

4           The Contractor shall notify the Engineer and any regulatory authorities forty-  
5           eight (48) hours in advance of any removal of trees on the project. No clearing  
6           shall occur and no earth moving equipment shall be placed on-site until after  
7           the notice has been issued. The Contractor shall provide maintenance of the  
8           tree barricades and other preventive measures to protect the trees that are to  
9           remain. Failure to notify the Engineer before removing trees shall result in the  
10          in-kind replacement of the tree at no additional cost to the Owner.

11  
12       F. Sanitary and Storm Sewer Systems  
13

14           The Contractor shall be entirely responsible for the satisfactory installation of  
15           storm sewer and sanitary sewer systems to be in substantial conformance to  
16           the approved Drawings. No roadway base or paving shall be constructed until  
17           the Contractor has performed lamping of these lines to his and the Engineer's  
18           satisfaction, and all storm sewer and sanitary sewer invert grades are verified  
19           in the field by the Owner. The lamping of lines and verification of elevations in  
20          no way absolves the Contractor from any of contractual obligations.

21  
22       G. Related Permits  
23

24           The Contractor recognizes that the Owner has applied for, and may have  
25           received, certain permits pertaining to the work. At the sole discretion of the  
26           Owner, the Owner may assign said permits to the Contractor and the Contractor  
27           shall accept said assignments upon such request from the Owner.

28  
29       H. All work in the vicinity of open waters, wetlands or any jurisdictional area is to  
30           be performed in strict accordance with applicable environmental permits and  
31           their conditions. Erosion barriers, when shown on the construction Drawings,  
32           are the minimum required. If the Contractor's construction methods require that  
33           additional erosion control is necessary to satisfy these permits, such controls  
34           shall be supplied, installed and maintained throughout the construction process  
35           by the Contractor at no additional cost to the Owner or Engineer.

36  
37           It is the sole responsibility of the Contractor to submit, in a timely manner, any  
38           information, data, etc. that is required as a condition of a permit. Required  
39           information, data, etc. shall be submitted directly to the permitting agency by the  
40           Contractor with copies to the permittee and the Engineer. The Contractor will  
41           be held responsible for any fine(s) or other action resulting from a violation of  
42           permit conditions.

43  
44       1.13 DISPOSAL  
45

46       A. The Contractor shall directly pay all tipping fees associated with disposal of  
47           construction demolition debris. The Contractor shall include in its bid all costs

associated with disposal of construction debris including collection, storage, hauling and tipping fees.

## 1.14 RESTORATION OF PROPERTY

- A. Responsibility. All damage resulting from construction work on existing structures, wetland areas, roadway pavement, driveways, other paved areas, fences, utilities, traffic control devices and any other obstruction not specifically named herein, shall be repaired, restored or replaced by the Contractor, at their own expense, unless otherwise specified.
  - B. Temporary Repairs. All damage named in Paragraph A above shall be at least temporarily repaired, restored or replaced immediately following construction efforts at that location. Temporary restoration shall mean putting the affected area back into a safe, usable condition. In no case shall trenches remain open overnight within a street right-of-way unless the governing Traffic Control Division grants specific approval.
  - C. Permanent Repairs. All damage shall be permanently repaired, restored, or replaced not later than the 30th calendar day following the completion of construction at that location unless otherwise stipulated. Permanent repairs shall be accomplished in a professional workmanship-like manner in accordance with Specifications contained herein, or contract documents, if addressed. The Contractor may be relieved of the 30-day time limit above only by specific written agreement with the Engineer.
  - D. Owner Retribution. In the event that the Contractor fails to make the permanent repairs within the time specified, the Owner, at its option, will, with its own resources or by contract with others, cause the repair, restoration, or replacement of the affected area to be accomplished. The costs of such work will be deducted either from the next pay request or from any other monies owed the Contractor.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01014  
2

3 SUMMARY OF WORK  
4

5 PART 1 – GENERAL  
6

7 1.01 LOCATION OF WORK  
8

9 A. All Work of this Contract is located in rights-of-way, easements, or on property  
10 owned by the City of Clearwater, Florida.

11 1.02 WORK TO BE DONE  
12

13 A. The Contractor shall furnish all labor, materials, equipment, tools, services and  
14 incidentals to complete all work required by these Specifications and as shown  
15 on the Drawings.

16 B. The Contractor shall perform the work complete, in place and ready for  
17 continuous service, and shall include repairs, testing, permits, clean up,  
18 replacements, and restoration required as a result of damages caused during  
19 this construction.

20 C. All materials, equipment, skills, tools, and labor which is reasonably and properly  
21 inferable and necessary for the proper completion of the work in a substantial  
22 manner and in compliance with the requirements stated or implied by these  
23 Specifications or Drawings shall be furnished and installed by the Contractor  
24 without additional compensation, whether specifically indicated in the Contract  
25 Documents or not.

26 D. The Contractor shall comply with all Municipal, County, State, Federal, and other  
27 codes applicable to the proposed construction work.

28 1.03 GENERAL DESCRIPTION OF WORK TO BE PERFORMED  
29

30 A. The work of this Contract comprises the general rehabilitation of the following  
31 facilities, as shown on the Contract Drawings and as specified herein.

32 1. Mobilization, demobilization, insurances, permits and bonds.

33 2. Rehabilitation and modifications of existing facilities as shown on the  
34 Drawings and described in Specification Sections I through V.

35 1.04 CONSTRUCTION ACTIVITIES  
36

37 A. General  
38

- 1           1. Upon successful construction completion of each new component, and  
2           pre-operational testing, Contractor shall conduct testing as required by  
3           the Contract Documents.  
4
- 5           2. Contractor shall ensure that, prior to start-up of any component, all  
6           handrails, walkways, lighting and associated safety-related facilities are  
7           in place.  
8
- 9           3. Contractor shall provide Engineer a minimum of 14-calendar days  
10          advance written notice of any requested change in operation to the  
11          existing facility, bypass requirements or connections to existing facilities,  
12          and shall obtain the Engineer's written review before scheduling this  
13          work.

14

15         B. Restrictions

16

- 17           1. In planning its work, the Contractor shall consider the following  
18          requirements.  
19
- 20           a. As noted elsewhere in these Specifications and on the Drawings,  
21           existing equipment and pipelines that can be taken out of service  
22           will be limited.  
23
- 24           b. The Contractor shall not take any existing facilities out of service  
25           without first obtaining the Owner's or Engineer's written approval.  
26
- 27           c. All new facilities shall be tested in accordance with Specification  
28           01625 to demonstrate to the Engineer and Owner that the new  
29           facility and associated equipment properly operates prior to taking  
30           any other existing facilities or equipment out of service.  
31
- 32           d. All manipulation of valves shall be performed by the Owner's  
33           personnel. The Contractor shall not be allowed to manipulate any  
34           valves. If there is an emergency, the Contractor shall notify the  
35           Owner immediately.

36

37         PART 2 – PRODUCTS (NOT USED)

38

39         PART 3 – EXECUTION (NOT USED)

40

41

42           END OF SECTION

1 SECTION 01015  
2

3 CONTROL OF WORK  
4

5 PART 1 – GENERAL  
6

7 1.01 WORK PROGRESS  
8

9       A. The Contractor shall provide equipment that will be efficient, safe, appropriate  
10      and large enough to secure a satisfactory quality of work and a rate of progress  
11      that will ensure the completion of the work within the Contract Time(s). If, at  
12      any time, such facilities appear to the Engineer to be inefficient, inappropriate,  
13      insufficient or unsafe for securing the quality of work required or for producing  
14      the rate of progress aforesaid, he may order the Contractor to increase the  
15      facilities equipment, and the Contractor shall conform to such order. Failure of  
16      the Engineer to give such order shall in no way relieve the Contractor of his  
17      obligations to secure the quality of the work and rate of progress required to  
18      meet the Contract Time(s).  
19

20 1.02 PRIVATE LAND  
21

22       A. The Contractor shall not enter or occupy private land outside of easements,  
23      except by permission of the Owner.  
24

25 1.03 WORK LOCATIONS  
26

27       A. Work shall be located substantially as indicated on the Drawings, but the  
28      Engineer reserves the right to make such modifications in locations as may be  
29      found desirable to avoid interference with existing structures or for other  
30      reasons. Where fittings are noted on the Drawings, such notation is for the  
31      Contractor's convenience and does not relieve him from laying and jointing  
32      different or additional items where required.  
33

34 1.04 OPEN EXCAVATIONS  
35

36       A. All open excavations shall be adequately safeguarded by providing temporary  
37      barricades, caution signs, lights and other means to prevent accidents to  
38      persons, and damage to property. The Contractor shall, at his own expense,  
39      provide suitable and safe bridges and other crossings for accommodating travel  
40      by Owner's personnel, pedestrians and workmen. Bridges provided for access  
41      to private property during construction shall be removed when no longer  
42      required. The length of open trench will be controlled by the particular  
43      surrounding conditions and does not endanger existing facilities. If the  
44      excavation becomes a hazard, or if it excessively restricts traffic, construction  
45      procedures such as limiting the length of open trench, prohibiting stacking  
46      excavated material in the street, and requiring that the trench shall not remain  
47      open overnight.

- 1  
2       B. The Contractor shall take precautions to prevent injury to the public due to open  
3           trenches. All trenches, excavated material, equipment, or other obstacles,  
4           which could be dangerous to the public, shall be well lighted at night.  
5

6       **1.05 TEST PITS**  
7

- 8       A. The Contractor shall excavate test pits (pot-hole) for locating underground  
9           pipelines or structures in advance of construction to verify that the work can be  
10          constructed as intended. Test pits shall be excavated and backfilled by the  
11          Contractor so as not to create a hazardous area. Test pits shall be backfilled  
12          immediately after their purpose has been satisfied and the surface restored and  
13          maintained in a manner satisfactory to the Engineer.  
14

15       **1.06 MAINTENANCE OF TRAFFIC**  
16

- 17       A. Unless permission to close a street or plant roadway is received in writing from  
18           the proper authority, all excavated material shall be placed so that vehicular and  
19           pedestrian traffic may be maintained at all times. If the Contractor's operations  
20          cause traffic hazards, he shall repair the road surface, provide temporary ways,  
21          erect wheel guards or fences, or take other measures for safety satisfactory to  
22          the Engineer.  
23

- 24       B. Maintenance of traffic shall be in accordance with the latest edition of the Florida  
25           Department of Transportation (FDOT) Standards. Detours around construction  
26          will be subject to the review of the Owner and the Engineer. Where detours are  
27          permitted, the Contractor shall provide all necessary barricades and signs as  
28          required to divert the flow of traffic. While traffic is detoured the Contractor shall  
29          expedite construction operations and those periods when traffic is being  
30          detoured will be strictly controlled by the Owner.  
31

- 32       C. The Contractor shall take precautions to prevent injury to the public due to open  
33           trenches. Night watchmen may be required where special hazards exist, or  
34           police protection provided for traffic while work is in progress. The Contractor  
35          shall be fully responsible for damage or injuries whether or not police protection  
36          has been provided.  
37

38       **1.07 CARE AND PROTECTION OF PROPERTY**  
39

- 40       A. The Contractor shall be responsible for the preservation of all public and private  
41           property and shall use every precaution necessary to prevent damage thereto.  
42           If any direct or indirect damage is done to public or private property by or on  
43           account of any act, omission, neglect, or misconduct in the execution of the work  
44           on the part of the Contractor, such property shall be restored by the Contractor,  
45           at his expense, to a condition similar or equal to that existing before the damage  
46           was done, or he shall make good the damage in other manner acceptable to  
47           the Engineer.

- 1
- 2       B. All sidewalks that are disturbed by the Contractor's operations shall be restored
- 3           to their original condition with the use of similar or comparable materials. All
- 4           curbing shall be restored in a condition equal to the original construction and in
- 5           accordance with the best modern practice.
- 6
- 7       C. Along the location of the work all fences, walks, bushes, trees, shrubbery, and
- 8           other physical features shall be protected and restored in a thoroughly
- 9           workmanlike manner. Fences and other features removed by the Contractor
- 10          shall be replaced in the location indicated by the Engineer as soon as conditions
- 11          permit. All grass areas beyond the limits of construction that have been
- 12          damaged by the Contractor shall be restored to original conditions.
- 13
- 14      D. Trees close to the work shall be boxed or otherwise protected against injury.
- 15           The Contractor shall trim all branches that are susceptible to damage because
- 16           of his operations, but in no case shall any tree be cut or removed without prior
- 17           notification of the appropriate tree authority. All injuries to bark, trunk, limbs,
- 18           and roots of trees shall be repaired by dressing, cutting, and painting in
- 19           accordance with approved methods, using only approved tools and materials.
- 20
- 21      E. The protection, removal, and replacement of existing physical features shall be
- 22           part of the work under the Contract and all costs in connection therewith shall
- 23           be included in the unit and/or lump sum prices established.
- 24

25     1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

26

- 27       A. The Contractor shall assume full responsibility for the protection of all buildings,
- 28           structures, and utilities, public or private, including poles, signs, services to
- 29           buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains,
- 30           and electric and telephone cables, whether or not they are shown on the
- 31           Drawings. The Contractor shall carefully support and protect all such structures
- 32           and utilities from injury of any kind. Any damage resulting from the Contractor's
- 33           operations shall be repaired at no additional cost.
- 34
- 35       B. The Contractor shall bear full responsibility for obtaining all locations of
- 36           underground structures and utilities (including existing water services, drain
- 37           lines, and sewers). Services shall be maintained and all costs or charges
- 38           resulting from damage thereto shall be paid by the Contractor.
- 39
- 40       C. If, in the opinion of the Engineer, permanent relocation of a utility owned by the
- 41           Owner is required, the Engineer may direct the Contractor in writing, to perform
- 42           the work. Work so ordered will be paid for at the unit prices bid in the Proposal,
- 43           if applicable, or as extra work as provided for in the General Conditions. If
- 44           relocation of a privately owned utility is required, the Owner will notify the Utility
- 45           to perform the work as expeditiously as possible. The Contractor shall fully
- 46           cooperate with the Owner and Utility and shall have no claim for delay due to
- 47           such relocation.

1  
2       D. Underground and above ground utilities/facilities are identified on the Drawings  
3       based on best information available at the time for the preparation of the plans.  
4       It is the responsibility of the Contractor to locate all utilities prior to any  
5       excavation. The Contractor shall be responsible for any damage to existing  
6       underground utilities and facilities and shall coordinate the protection of these  
7       utilities with the Owner.

8  
9       **1.09 DISTRIBUTION SYSTEMS AND SERVICES**

- 10  
11      A. The Contractor shall interrupt water, telephone, cable TV, internet service,  
12       sewer, gas, or other related utility services and disrupt the normal functioning of  
13       the system as little as possible, and shall notify the Owner, Engineer and public  
14       well in advance of any requirement for dewatering, isolating, or relocating a  
15       section of a utility, so that necessary arrangements may be made with the  
16       appropriate agency.
- 17  
18      B. If it appears that utility service will be interrupted for an extended period, the  
19       Engineer may order the Contractor to provide temporary service lines.  
20       Inconvenience of the users shall be the minimum, consistent with the existing  
21       conditions. The safety and integrity of the system is of prime importance in  
22       scheduling work.

23  
24       **1.10 PROTECTION OF CONSTRUCTION AND EQUIPMENT**

- 25  
26      A. All newly constructed work shall be carefully protected from injury or damage in  
27       every way. No wheeling or walking or placing of heavy loads shall be allowed  
28       and any portion injured or damaged shall be reconstructed by the Contractor at  
29       his own expense.

30  
31       **1.11 WATER FOR CONSTRUCTION PURPOSES**

- 32  
33      A. The Contractor shall be responsible for providing and paying for all water  
34       required for construction purposes. The Contractor shall make all connections  
35       and other provisions, including backflow prevention and metering provisions,  
36       necessary to obtain said water from the local utility's potable and/or reclaimed  
37       water system, as required. The Contractor shall pay the appropriate party for  
38       all water used for construction purposes. Bid prices shall include the costs  
39       incurred for water usage.

40  
41       **1.12 MAINTENANCE OF FLOW**

- 42  
43      A. The Contractor shall, at his own cost, provide for the flow of sewers, drains, and  
44       water courses interrupted during the progress of the work, and shall immediately  
45       remove all offensive matter. The entire procedure for maintaining existing flows  
46       shall be reviewed by the Engineer in advance of the interruption of any flow.

1      1.13 COOPERATION WITHIN THIS CONTRACT

- 2
- 3      A. All firms or persons authorized to perform any work under this Contract shall  
4           cooperate with the General Contractor and his subcontractors or trades, and  
5           shall assist in incorporating the work of other trades where necessary or  
6           required.
- 7
- 8      B. Cutting and patching, drilling and fitting shall be carried out where required by  
9           the trade or subcontractor having jurisdiction, unless otherwise indicated herein  
10          or directed by the Engineer.

11     1.14 COOPERATION OUTSIDE THIS CONTRACT

- 12
- 13      A. As part of normal and/or emergency system operations and maintenance, the  
14           Owner may employ the services of contractors outside this contract. As such,  
15           the Contractor of this Work shall coordinate their schedule with and  
16           accommodate said contractor as necessary for the execution of their work. This  
17           coordination shall be provided at no additional cost to the Owner.
- 18
- 19      B. As part of normal and/or emergency system operations and maintenance, the  
20           Owner has normal delivery and maintenance suppliers that will be on-site on a  
21           regular basis. Contractor shall allow continuous access to all equipment and  
22           facilities, so as not to impede the operation and maintenance of said facility.  
23           This coordination shall be provided at no additional cost to the Owner.
- 24

25     1.15 CLEAN-UP

- 26
- 27      A. During the course of the work, the Contractor shall keep the site of his  
28           operations in a clean and neat condition. He shall remove, transport and  
29           properly dispose of all surplus broken pavement, crushed concrete, lumber,  
30           excess steel, equipment, temporary structures, and any other refuse from the  
31           construction operation, on a weekly basis or as directed by the Owner and/or  
32           Engineer. At the conclusion of the work, remove, transport and properly dispose  
33           of any surplus excavation, and refuse remaining from the construction  
34           operation, and leave the entire site of his work in a neat and orderly condition.
- 35
- 36      B. The Contractor shall provide for disposal of excavated material removed from  
37           the site.
- 38

39     1.16 COORDINATION WITH ELECTRICAL UTILITY

- 40
- 41      A. The Contractor shall be responsible for coordinating with the power company to  
42           have electrical service supplied to the site.
- 43
- 44

## 1 1.17 WORK SEQUENCE

A. The Owner may incur penalties for failure to maintain service/operations. Therefore, the Contractor will schedule and complete the work in a manner that assures that the facility maintains service including redundancy throughout the duration of the project. Prior to taking any service or operation off-line, Contractor shall prepare a work sequence plan and coordinate all shutdowns with the Owner and/or Engineer. All temporary measures and materials required to meet this condition during construction shall be provided, installed, maintained and removed by the Contractor. All costs associated with this effort shall be borne by the Contractor. All fines imposed by failure to meet this operating condition, due to the Contractor's Work Sequence, shall be borne by the Contractor.

## 16 1.18 CHARACTER OF THE CONTRACTOR'S SUPERINTENDENT AND WORKERS

A. The Contractor's superintendent and project manager shall conduct themselves in a professional manner. If, in the opinion of the Owner and the Engineer, the superintendent and project manager do not conduct themselves in a professional and courteous manner, the Engineer can recommend to the Owner that the superintendent and/or the project manager be relieved of their responsibilities and removed from the project. Upon written notice from the Owner, the Contractor shall immediately remove the superintendent and/or the project manager of their responsibilities and removed from the project. The work of this project must be conducted under the supervision of a full-time superintendent.

B. Any person employed by the Contractor or by any subcontractor who in the opinion of the Engineer does not conduct him/herself in a professional and courteous manner or is intemperate or disorderly, shall, at written request of the Owner be replaced by the Contractor.

## PART 2 – PRODUCTS (NOT USED)

36 PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01016  
2  
3 CONSTRUCTION PHASING PLAN  
4

5 PART 1 – GENERAL  
6

7 1.01 DESCRIPTION  
8

- 9 A. At all times during construction of the project, the City of Clearwater's Northeast  
10 Water Reclamation Facility shall remain in service, except for temporary  
11 shutdowns described herein. Throughout construction, the Contractor shall  
12 cooperate fully with the City's operations and maintenance staff in order to  
13 minimize disruption to the facility's operation.  
14
- 15 B. The Owner will continue to operate the existing and new or rehabilitated  
16 treatment facilities during construction and will be responsible for maintaining  
17 effluent quality. The Contractor will operate all temporary treatment systems in  
18 cooperation with the City. This includes the requirement to schedule  
19 construction operations such as to not impact any treatment that might affect  
20 the performance of the plant during the City's quarterly chronic toxicity testing  
21 associated with its FDEP operating permit.  
22
- 23 C. The Contractor shall schedule and conduct the work in such a way that it will  
24 not impede any treatment process, create potential hazards to operating  
25 equipment or to personnel, will not reduce the quality of plant effluent and  
26 residuals, and not cause odor or other nuisance.  
27
- 28 D. The general intent of this project is to rehabilitate the existing facilities while  
29 continuously treating wastewater and sludge using existing, new, temporary, or  
30 rehabilitated equipment and facilities. The Contractor shall design, furnish,  
31 install, test, operate and maintain all temporary bypass pumping, treatment and  
32 piping system(s) required to complete the work as shown.  
33
- 34 E. No facility or structure shall be taken out of service until a temporary  
35 utilities/facility or the new replacement utility/facility or structure is constructed,  
36 tested and accepted by the Owner. Vehicle and personnel access to all  
37 operating treatment units shall be maintained at all times.  
38
- 39 F. The phasing plans described herein are representative only. It is the  
40 Contractor's responsibility to devise its own phasing plan, which will meet the  
41 requirements specified herein. The Contractor shall submit to the Engineer a  
42 construction phasing plan for review for conformance with these specifications  
43 prior to beginning any construction onsite.  
44
- 45 G. Brief shutdowns of equipment may be allowed during critical phases, but only  
46 with the Owner's prior written approval. The Contractor shall request the  
47 Owner's approval a minimum two (2) weeks prior to any temporary shutdowns.

- 1                   H. The Contractor shall maintain in service all existing facilities until the  
2 rehabilitated or replacement facilities are constructed, tested and accepted by  
3 the Owner. All materials, piping, equipment, power, labor, etc. associated with  
4 temporary utilities/facilities or temporary pumping or piping shall be the  
5 responsibility of the Contractor. The Contractor shall coordinate and provide a  
6 new temporary service drop from the power company and pay for all electrical  
7 power usage for power to all temporary facilities, temporary treatment process  
8 equipment, temporary bypass pumping equipment, and all other temporary  
9 power needs during construction.
- 10
- 11                  I. Prior to taking any structure or facility out of service, the Contractor shall furnish,  
12 install and test all temporary bypass pumping, treatment and piping systems  
13 and other temporary piping connections and equipment as required or directed.  
14 All power, labor, equipment, and materials for any temporary pumping and  
15 piping shall be the responsibility of the Contractor. Temporary bypass pumping  
16 and treatment systems, if any, shall meet the requirements of Specification  
17 Sections IVB 13567, Section IVC and as shown on the Contract Drawings.

18

19                 **PART 2 – PRODUCTS**  
20                 (**NOT USED**)

21

22                 **PART 3 – EXECUTION**

23

24                 **3.01 HEADWORKS AND PRIMARY TREATMENT PHASING PLAN**

- 25
- 26                  A. The phasing plan for the headworks and primary treatment portion of project  
27 shall observe the following priorities with respect to plant operations.
- 28
- 29                      • Maintain plant flow  
30                      • Maintain grit removal  
31                      • Maintain primary sludge removal  
32                      • Maintain primary sludge thickening  
33                      • Maintain headworks odor control system

- 34
- 35                  B. The following describes a phased approach to constructing the project while  
36 observing the priorities listed in 3.01 A.

37

38                 **Phase 1** – Install temporary LS No. 2 pump station, establish its reliability and  
39 re-route the discharge piping LS 2 to upstream of the existing bar screens as  
40 shown on the drawings before any other work associated with the Headworks  
41 and Primary Treatment Systems is performed. Coordinate the work associated  
42 with in-plant Pump Station No. 2 with the Sludge Blend Tank Improvements  
43 work such that construction of these two systems is not occurring concurrently.

44

45

1           **Phase 2** – In this phase, the existing north primary clarifier is demolished, the  
2 continuous moving belt filter facility is constructed, and a temporary bypass  
3 pumping, screenings/grit removal and yard piping are installed, tested and  
4 placed in service. The temporary bypass pumping system, screenings/grit  
5 removal system, and continuous moving belt filter system will be operated so  
6 as to maintain flow, screenings/grit removal, and primary sludge removal while  
7 the work associated with the headworks building, the north primary clarifier, and  
8 the primary effluent box channel is completed. The City will operate the  
9 continuous belt moving filters and the Contractor will operate the temporary  
10 bypass pumping and temporary screenings/grit removal systems. Other items  
11 of work associated with this phase include:  
12

- 13           • Construct scab wall on inside face of the north primary clarifier wall  
14 before demolishing the clarifier. Plug the existing primary clarifier influent  
15 and sludge withdrawal pipes.
- 16           • Temporarily relocate the 4-inch force main from the influent channel  
17 upstream of the existing Parshall flume to a point upstream of the bar  
18 screens or into the temporary grit removal system.
- 19           • Temporarily relocate the common force main serving in-plant pump  
20 stations No. 2 and No. 3 from the existing primary clarifier splitter box to  
21 a point upstream of the existing bar screens or into the temporary grit  
22 removal system.
- 23           • Make two (2) 48" x 30" wet taps on the existing 48" pipe carrying flow to  
24 the secondary treatment system.
- 25           • Install all temporary and permanent yard piping required to maintain full  
26 plant flow and to operate the continuous belt moving filters, including the  
27 temporary piping between the temporary grit removal facility and the inlet  
28 to the moving belt filters.
- 29           • Install, test and bring on-line all electrical power, controls, and SCADA  
30 systems for the continuous moving belt filters.
- 31           • Furnish and install a temporary flowmeter with totalizer on the discharge  
32 of the temporary bypass pump system, with connection to the existing  
33 SCADA system.
- 34           • Place the temporary bypass pumping system, the temporary  
35 screenings/grit removal system and the moving belt filter system in  
36 service. Close the influent gates to the existing bar screens and install  
37 the slide gate in the Diversion Chamber to isolate the existing headworks  
38 building, the primary clarifier and sludge pump building and the primary  
39 effluent box channel.

40           **Phase 3** – In this phase, all remaining work upstream of the effluent Diversion  
41 Chamber is performed, tested and made ready for operation while the  
42 temporary bypass pumping system, the temporary screenings/grit removal  
43 system, and the continuous moving belt filters are in operation.  
44

45           **Phase 4** – In this phase, the temporary bypass pumping system, temporary  
46 screenings/grit removal system, and all temporary yard piping are removed and  
47

1 flow is re-established to the permanent configuration as those systems are  
2 brought on-line.  
3

4 **3.02 FLOW EQUALIZATION SYSTEM PHASING PLAN**  
5

6 **Phase 5** – During this phase, the existing irrigation tank is removed and the new  
7 flow equalization facility is constructed. The completion of this phase should  
8 coincide with the completion of the Headworks and Primary Treatment Phasing  
9 Plan so that the permanent connections to the existing 48" pipe carrying flow to  
10 the secondary treatment system can be made.  
11

- 12 • Demolish existing irrigation tank, with associated control building and  
13 piping.
- 14 • Construct the foundation and floor of the new flow equalization tank
- 15 • Construct glass-fused-to-steel tank.
- 16 • Install tank platform and internal equipment including pulsed air mixing  
17 system piping.
- 18 • Construct equalization basin supply and return pump stations,  
19 compressed air system and all associated piping and electrical systems.
- 20 • When the temporary pumping and screenings/grit removal treatment  
21 systems are no longer required for construction of the Headworks and  
22 Primary Treatment Improvements, startup the flow equalization tank and  
23 associated equipment.

24 **3.03 DESCRIPTION OF SLUDGE BLEND TANK IMPROVEMENTS WORK**  
25

26     A. Specific Constraints and Sequencing  
27

28     The following constraints shall be applied to the sequencing of  
29 construction on the project. These constraints and sequencing do not  
30 purport to include all constraints for sequencing required for the  
31 construction of the project.  
32

33     1. The daily scheduled deliveries of the East WRF thickened WAS  
34 (TWAS) shall not be interrupted during construction. Typical  
35 deliveries are in 6,000 gallon tanker trucks with 2-3 deliveries each  
36 day. The existing Truck Off-Loading Pump Station shall be used  
37 during construction of the new facilities until such time that startup  
38 and testing of the new Truck Off-Loading Pump Station is  
39 completed and can be placed into service and operated by the  
40 Owner. The daily transfer of TWAS and thickened Primary Sludge  
41 (TPSL) to the Anaerobic Digesters shall not be interrupted during  
42 construction.  
43

44     2. The daily dewatering of the anaerobic sludge from the Storage  
45 and Blend Tanks shall not be interrupted during construction. The  
46 Owner typically deters from 5:00 p.m. to 1:00 a.m. for single  
47

1 loads and from 1:00 p.m. to 5:00 a.m. for double loads Monday  
2 through Saturday. Saturday evening through Sunday evening is  
3 the only time the Owner does not typically dewater. The  
4 Contractor is responsible for verifying this schedule with the  
5 Owner. One of the Sludge Storage and Blending Tanks shall  
6 remain in service at all times to store and dewater anaerobic  
7 digested sludge and maintain a dewatering unit in operation. The  
8 Dewatering Pumps shall be temporarily relocated as shown in the  
9 Contract Drawings and will act as a temporary bypass during the  
10 construction and installation of the new dewatering equipment and  
11 associated piping, valves, concrete, and electrical. The  
12 Contractor shall provide all temporary valves and piping to  
13 perform the required work. Temporary bypass piping shall be  
14 constructed and installed in a method similar to the bypass piping  
15 plan shown in the Contract Drawings. The Contract Drawings  
16 show a feasible bypass option, but the Contractor may submit  
17 another bypass plan for Owner and Engineer approval. The  
18 Contractor is responsible for the actual means and methods  
19 employed.

- 20
- 21     3. The Contractor shall be responsible for operating and maintaining  
22       all temporary systems during construction.
  - 23     4. The Contractor shall coordinate with the Engineer and Owner  
24       before taking any pumps, pipes, or other equipment out of service.  
25       All temporary systems shall be installed and operational, all flow  
26       diversion valves shall be checked and operable, and the  
27       appropriate flow channel shall be cleaned.
  - 28     5. Coordinate the Sludge Blend Tank Improvement Work with the  
29       work associated with in-plant Pump Station No. 2 such that  
30       construction of these two systems is not occurring at the same  
31       time.

32     B. Storage and Blend Tank Sequencing:

- 33
- 34     1. All tank processes shall be operated out of the South Dewatering  
35       Storage Tank while improvements are made to the North Biosolids  
36       Blend Tank. Improvements on the North Biosolids Blend tanks  
37       shall be up to and including the riser piping so that the tank can  
38       be fully operational with electrical, instrumentation, and SCADA  
39       elements in place. The existing below grade piping to the South  
40       Dewatering Storage Tank shall remain protected and undisturbed  
41       until the North Biosolids Blend Tank construction is complete and  
42       is prepared to begin operation.

1           2. When construction on the North Biosolids Blend Tank is complete,  
2           the riser piping will be tied into the existing plant feed piping where  
3           the south isolation valve will be closed and plugged and the riser  
4           isolation valve will remain open to receive plant sludge.  
5           Construction shall commence on the South Dewatering Storage  
6           Tank and demolition and replacement of the concrete and piping  
7           between the tanks, east of the pipe trench, during this period.  
8

9           C. Dewatering Feed Pumps:

- 10           1. While the North Biosolids Blend Tank is being upgraded, the  
11           Dewatering Feed Pumps will be relocated while maintaining  
12           dewatering feed from the South Dewatering Storage Tank using  
13           the relocated existing active Dewatering Feed Pumps (one  
14           designated for the Centrifuge, one for the Belt Filter Press, and  
15           the other as a Standby Feed Pump as shown in the Contract  
16           Drawings).
- 17           2. The Contractor shall have a minimum of one operating dewatering  
18           pump relocated to the bypass area with all electrical, piping, and  
19           appurtenances required for operation. The Contractor shall  
20           connect the dewatering bypass system to the South Dewatering  
21           Storage Tank during the schedule provided by the Owner when  
22           the Dewatering Operation is not occurring. The remaining  
23           dewatering pumps will then be connected to the dewatering  
24           bypass no less than 3 days after initial connection and bypass  
25           startup.
- 26           3. Once the North Biosolids Blend Tank work has been completed  
27           and the tank can be put into service and operated by the Owner,  
28           the South Dewatering Storage Tank shall be taken offline and the  
29           Digested Sludge from the Anaerobic Digester shall be diverted to  
30           the North Biosolids Blend Tank.
- 31           4. During the work sequence above, the Dewatering Feed header  
32           piping between the two tanks in the open trench shall be replaced  
33           as shown in the Contract Documents. The relocated Dewatering  
34           Feed Pumps shall maintain all capacity for this duration.
- 35           5. At least three Dewatering Feed Pumps shall remain in service  
36           during construction at all times. The Contractor shall provide  
37           temporary power and perform any work required to maintain  
38           operation of the relocated Anaerobically Digested Sludge  
39           Dewatering System.

40           D. TWAS and TPSL:

- 1           1. The Contractor shall construct the components of the new sludge  
2           valve station piping, flow meter, and motor operated valves  
3           without interrupting the existing TWAS and TPSL lines (to the  
4           maximum extent possible) that feed sludge to the anaerobic  
5           digester.  
6
- 7           2. The Contractor shall coordinate with the Owner to schedule a  
8           temporary shutdown and bypass piping (as required) of the TPSL  
9           and TWAS flows to connect the newly constructed piping to the  
10          existing sludge lines in order to keep the processes in service. In  
11          addition, construct the connection of the 4-inch blended sludge  
12          line to the existing anaerobic digester feed line at the anaerobic  
13          digester during the shut-down or schedule a separate bypass  
14          shut-down event.  
15
- 16          3. The TWAS and TPSL shall maintain flow to the Anaerobic  
17          Digesters uninterrupted during construction of the piping from the  
18          Sludge Storage and Blend Tanks to the connection point at the  
19          existing digester feed piping.

21          E. Electric Duct Bank:

- 22          1. Contractor shall coordinate construction of the Duct Bank shown  
23          on the Electrical Contract Drawings so that access shall be  
24          permitted from either the South or West direction. Access shall be  
25          defined as a complete constructed asphalt surface for roll-off  
26          trucks to remove and replace the dumpster for emptying.  
27
- 28          2. The Contractor shall complete all pavement restoration over one  
29          section of the duct bank before beginning excavation on the other  
30          section.  
31
- 32          3. The Contractor shall be responsible for coordinating with the  
33          Owner on the Grit Dumpster Removal schedule in order to ensure  
34          the Work of this project will not interrupt Dumpster Pad Access.  
35
- 36          4. Access to the Dumpster Pad west of the South Dewatering  
37          Storage Tank shall be maintained at all times to allow plant  
38          operation related to the removal of the grit dumpster on a regular  
39          basis.  
40

41          F. Odor Control Reconnection:

- 42          1. Contractor to ensure the Odor Control Piping is stored and  
43          protected during the Work describe herein. When the construction  
44          on the North Blend Tank is completed, the Contractor may  
45          reconnect the Odor Control Piping to the North Biosolids Blending

1                   Tank and modify to plug the portion that would go to the South  
2                   Dewatering Storage Tank at the discretion of the Owner.  
3

- 4                   2. Modifications may be needed to reconnect the existing Odor  
5                   Control Piping to the penetration provided by the selected cover  
6                   manufacturer. The Contractor shall coordinate this with the cover  
7                   manufacturer and shall be responsible for the material and labor  
8                   associated with the Odor Control piping modifications during  
9                   reconnection.

10                  11                   END OF SECTION  
12  
13  
14  
15

1 SECTION 01030  
2

3 SPECIAL PROJECT PROCEDURES  
4

5 PART 1 – GENERAL  
6

7 1.01 WORKMANSHIP, MATERIAL AND EQUIPMENT  
8

- 9       A. When a specific product is specified or called for, it is intended and shall be  
10      understood by the Contractor that the Contractor's proposal includes those  
11      products in its bid. Should the Contractor desire to incorporate products equal  
12      to those specified, the Contractor shall furnish information as described in the  
13      General Conditions. The alternate product or products submitted by the  
14      Contractor shall meet the requirements of the Specifications and shall, in all  
15      respects, be equal to the products specified by name herein.  
16
- 17       B. All apparatus, mechanism, equipment, machinery and manufactured articles for  
18      incorporation into the Work shall be the new and unused standard products of  
19      recognized reputable manufacturers unless specifically noted otherwise.  
20
- 21       C. Contractor shall properly dispose of all excess materials from the site.  
22

23 1.02 CONNECTIONS TO EXISTING SYSTEMS  
24

- 25       A. The Contractor shall perform all work necessary to locate, excavate and prepare  
26      for connections to the existing systems, as shown on the Drawings. All  
27      connections to existing systems shall be coordinated with the Owner and/or  
28      Engineer prior to commencing the work. All connections to existing systems  
29      shall be attended by the Owner and/or Owner's Representative. The costs for  
30      this work and for the actual connection to the existing systems shall be included  
31      in the various prices bid and shall not result in any additional cost to the Owner.  
32
- 33       B. During the initial phases of the work, the Contractor is responsible to do  
34      reconnaissance of the site and verify the correct location and sizing of the  
35      facilities at all connection points before purchasing the necessary materials.  
36

37 1.03 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES  
38

- 39       A. The attention of the Contractor is directed to the fact that during excavation, the  
40      possibility exists that the Contractor may encounter water, gas, telephone,  
41      electrical, internet, and/or other utilities not shown on the Drawings. The  
42      Contractor shall exercise extreme care before and during excavation to locate  
43      and flag these lines so as to avoid damage thereto. Should damage occur to  
44      an existing line, the Contractor shall immediately contact the utility and the  
45      Owner. If the repair is to be completed by the Contractor it shall be carried out  
46      in a timely and quality manner. Costs associated with such damage shall be  
47      borne by the Contractor at no additional cost to the Owner.

- 1
- 2       B. It is the responsibility of the Contractor to ensure that all utility or other poles,  
3           the stability of which may be endangered by the close proximity of excavation,  
4           are temporarily supported in position while work proceeds in the vicinity of the  
5           pole and that utility or other companies concerned be given reasonable advance  
6           notice of any such excavation by the Contractor.
- 7
- 8       C. The locations of existing utilities are shown without express or implied  
9           representation, assurance, or guarantee that they are complete or correct or  
10          that they represent a true picture of underground piping to be encountered.  
11          Encountering existing utilities at different depths or locations than shown on the  
12          Drawings shall not be cause for additional costs to the Owner.
- 13
- 14      D. The existing piping and utilities that interfere with new construction shall be  
15          rerouted as shown, specified or required. The Contractor shall excavate test  
16          pits sufficiently ahead of the proposed work to predict potential conflicts. Before  
17          any piping and utilities not shown on the Drawings are disturbed, the Contractor  
18          shall immediately notify the Engineer of the location of the pipeline or utility and  
19          shall reroute or relocate the pipeline or utility as directed.
- 20
- 21      E. The Contractor shall exercise care in any excavation to locate all existing piping  
22          and utilities. All utilities that do not interfere with completed work shall be  
23          carefully protected against damage. Any existing utilities damaged in any way  
24          by the Contractor shall be restored or replaced by the Contractor at his expense,  
25          as directed by the Engineer.
- 26
- 27      F. It is intended that wherever existing utilities such as water, gas, telephone,  
28          electrical, or other service lines must be crossed, deflection of the pipe within  
29          recommended limits and cover shall be used to satisfactorily clear the  
30          obstruction unless otherwise indicated on the Drawings. However, when in the  
31          opinion of the Owner or Engineer this procedure is not feasible, he may direct  
32          the use of fittings for the utility crossing. The Contractor shall verify utility  
33          crossings with test pits prior to construction as required by the Engineer.
- 34

35     1.04 SERVICES OF MANUFACTURER'S FIELD SERVICE TECHNICIAN

36

- 37       A. Bid prices for equipment furnished shall include the cost of a competent field  
38           service technician of the manufacturers of all equipment to assist in the  
39           installation, adjustment and testing of the equipment, and to instruct the Owner's  
40           operating personnel on operation and maintenance. The approved  
41           manufacturer's operation and maintenance data shall be delivered to the  
42           Engineer prior to instructing the Owner's personnel. This supervision may be  
43           divided into two or more time periods, as required by the installation program or  
44           as directed by the Engineer.
- 45
- 46       B. After installation of the equipment has been completed and the equipment is  
47           presumably ready for operation, but before it is operated by others, the

1 manufacturer's field service technician shall inspect, operate, test and adjust the  
2 equipment. The inspection shall include at least the following points where  
3 applicable:

- 4 1. Soundness (without damaged parts).
- 5 2. Completeness in all details, as specified and required.
- 6 3. Correctness of setting, alignment, and relative arrangement of various
- 7 parts.
- 8 4. Adequacy and correctness of packing, sealing and lubricants.
- 9 5. Calibration and adjustment of all related instrumentation and controls.
- 10 6. Energize equipment.
- 11 7. Deficiency correction.
- 12 8. Demonstration of compliance with applicable performance specification.

13 C. The operation, testing and adjustment shall be as required to prove that the  
14 equipment has been left in proper condition for satisfactory operation under the  
15 conditions specified.

16 D. Upon completion of this work, the manufacturer's field service technician shall  
17 submit to the Engineer, a complete, signed report of the results of his inspection,  
18 operation, adjustments and tests in accordance with Section 01300 Submittals.  
19 The report shall include detailed descriptions of the points inspected, tests and  
20 adjustments made, quantitative results obtained if such are specified, and  
21 suggestions for precautions to be taken to ensure proper maintenance.

22 E. Each equipment manufacturer shall provide instruction to the Owner's operating  
23 personnel. Training shall be in accordance with Section IVB, Specification  
24 11000 and as described herein. Training shall not be performed until the  
25 requirements of Paragraphs B, C and D above have been fully satisfied and any  
26 specified performance testing completed. Training shall be provided for the  
27 number of days specified in each equipment section of these specifications.  
28 Training shall be provided on an 8-hour per day basis. Partial days of less than  
29 eight (8) full working hours shall not be credited toward the specified duration.  
30 Training shall not be concurrent with on-going testing, debugging or installation  
31 activities; but shall be on a separate activity devoted exclusively to the  
32 instruction of the Owner's personnel in the operation and maintenance of the  
33 manufacturer's equipment. Qualified representatives of each equipment  
34 manufacturer specifically skilled in providing instruction to operations personnel  
35 shall perform training. Training shall provide an overview of operations and  
36

1 maintenance requirements and shall include as a minimum, but not be limited  
2 to:  
3

- 4 1. Description of unit and component parts.
- 5 2. Operating capabilities and performance criteria.
- 6 3. Operating procedures.
- 7 4. Maintenance procedures.
- 8 5. Servicing and lubrication schedules.
- 9 6. Troubleshooting.
- 10 7. Electrical instrumentation and control requirements and interface.

11 The operating and maintenance data to be provided shall be used as a basis  
12 for training. Additional requirements for Training are provided in Section 01820  
13 and Section IVB, Specification 11000.

- 14
- 15 F. A written "Certificate of Proper Installation" executed by the manufacturer  
16 stating that the installation of the equipment is satisfactory, that the equipment  
17 has been satisfactorily tested and is ready for operation, and that the Owner's  
18 personnel have been instructed in the proper operation and maintenance of the  
19 equipment shall be submitted before start-up by the Contractor. The Certificate  
20 shall indicate date and time instruction was given and names of Owner's  
21 personnel in attendance. This certification shall be submitted on a certification  
22 form reviewed by the Engineer.
- 23
- 24 G. See the Technical Specifications for additional requirements for furnishing the  
25 services of the manufacturer's field service technician.
- 26
- 27 H. For other equipment furnished, the Contractor, unless otherwise specified, shall  
28 furnish the services of accredited field services technicians of the manufacturer  
29 only when some evident malfunction or over-heating makes such services  
30 necessary in the opinion of the Engineer.

31 1.05 OPERATING AND MAINTENANCE DATA

- 32
- 33 A. Operating and Maintenance information shall be in accordance with Section  
34 01730 and as described herein.
- 35
- 36 B. Operating and maintenance data for each piece of equipment furnished shall  
37 be delivered directly to the Engineer for review within 60 days of shop drawing  
38 review completion. No payment shall be made for equipment installed or stored  
39 on-site until the Engineer has reviewed the adequacy and completeness of

1 operating and maintenance data. Final copies of operating and maintenance  
2 data shall have been delivered to the Engineer prior to scheduling the  
3 training/instruction period with the Owner.

4

5 **1.06 EQUIPMENT DATA LIST**

6

- 7       A. Obtain, prepare and submit a complete, detailed listing of equipment and motor  
8 data for all electrical items furnished under this Contract. This listing shall be  
9 submitted with the preliminary draft of Operations and Maintenance Data  
10 Manuals on Equipment Data Sheets.

11

12 **1.07 SPARE PARTS**

13

- 14       A. Spare parts to be provided for certain equipment are specified in the pertinent  
15 sections of the Technical Specifications. The Contractor shall collect and store  
16 all spare parts in a manner approved by the manufacturer. In addition, the  
17 Contractor shall furnish to the Engineer an inventory listing all spare parts, the  
18 equipment they are associated with, the name and address of the supplier, and  
19 the delivered cost of each item. Copies of actual invoices for each item shall be  
20 furnished with the inventory to substantiate the delivered cost. The Contractor  
21 shall deliver the spare parts to the Engineer ten (10) days prior to start-up of the  
22 equipment.
- 23
- 24       B. All spare parts shall be furnished in containers clearly identified in indelible  
25 markings as to contents. Each container shall be packed for prolonged storage.
- 26
- 27       C. No start-up activities shall take place until the specified spare parts have been  
28 furnished.

29

30 **1.08 INSTALLATION OF EQUIPMENT**

31

- 32       A. Special care shall be taken to ensure proper alignment of all equipment, with  
33 particular attention to mechanical equipment such as pumps and electric drives.  
34 The units shall be carefully aligned on their foundations by qualified millwrights  
35 after their sole plates have been shimmed to true alignment at the anchor bolts.  
36 The anchor bolts shall be set in place and the nuts tightened against the shims.  
37 After the foundation alignments have been approved by the manufacturer, the  
38 bedplates or wing feet of the equipment shall be securely bolted in place. The  
39 alignment of equipment shall be further checked after securing to the  
40 foundations, and after confirmation of all alignments, the sole plates shall be  
41 finally grouted in place. The Contractor shall be responsible for the exact  
42 alignment of equipment with associated piping and, under no circumstances,  
43 will "pipe springing" be allowed.
- 44
- 45       B. All wedges, shims, filling pieces, keys, packing, or other materials necessary to  
46 properly align, level and secure apparatus in place shall be furnished by the  
47 Contractor. All parts intended to be plumb or level must be proven exactly so.

1 Any grinding necessary to bring parts to proper bearing after erection shall be  
2 done at the expense of the Contractor.  
3

4 **1.09 MAINTENANCE AND LUBRICATION SCHEDULES**

5 A. For all mechanical and electrical equipment furnished, the Contractor shall  
6 provide a list including the equipment name; address and telephone number of  
7 the manufacturer's representative and service company so that service and/or  
8 spare parts can be readily obtained. Submit in accordance with Section 01300.  
9

10 **1.10 INSTALLATION LISTS**

11 A. All manufacturers or equipment suppliers who propose to furnish equipment or  
12 products shall submit an installation list to the Engineer along with the required  
13 Shop Drawings.

14 B. The installation list shall include all installations (minimum of two) where  
15 identical equipment has been installed and has been in operation for a period  
16 of at least one (1) year.

17 **1.11 SLEEVES AND OPENINGS**

18 A. The Contractor shall provide all openings, channels, chases, etc., and install  
19 anchor bolts and other items to be embedded in concrete, as required to  
20 complete the work under this Contract, together with those required by  
21 subcontractors, and shall do all cutting and patching, excepting cutting and  
22 patching of materials of a specified trade and as stated otherwise in the following  
23 paragraph.

24 B. The Contractor shall coordinate with the subcontractors to provide all sleeves,  
25 inserts, hangers, anchor bolts, etc., of the proper size and material for the  
26 execution of the work. The Contractor shall be responsible for any corrective  
27 cutting and refinishing required to make the necessary openings, chases, etc.  
28 In no case shall beams, lintels or other structural members be cut without the  
29 written acceptance of the Engineer.

30 **1.12 PROVISIONS FOR CONTROL OF EROSION**

31 A. Sufficient precautions shall be taken during construction to minimize the run-off  
32 of polluting substances such as silt, clay, fuels, oils, bitumen, calcium chloride,  
33 or other polluting materials harmful to humans, fish, or other life, into the  
34 supplies and surface waters of the state. Control measures must be adequate  
35 to assure that turbidity in the receiving water will not be increased more than 10  
36 nephelometric turbidity units (NTU), or as otherwise required by the state or  
37 other controlling body, in water used for public water supply or fish unless limits  
38 have been established for the particular water. In surface water used for other  
39 purposes, the turbidity must not exceed 25 NTU unless otherwise permitted.

1           Special precautions shall be taken in the use of construction equipment to  
2           prevent operations that promote erosion.  
3

- 4           B. The Contractor shall comply with the requirements of the EPA-NPDES generic  
5           permit for storm water discharges and the storm water pollution prevention plan  
6           developed for the project. See Section 01065.  
7

8           **1.13 VALVE INDICES**  
9

- 10          A. The Contractor shall be responsible for furnishing tags for all valves required on  
11          the work and installing the tags required for his own work. Tags on above  
12          ground valves shall be non-corrosive metal or plastic, 2 inches in diameter, 19-  
13          gauge thickness. Tags for buried valves shall be secured to a concrete base  
14          as shown on the Drawings. Submit to the Engineer for review, two (2) samples  
15          of each type of tag proposed and manufacturer's standard color chart and letter  
16          styles. Tags shall have stamped on them the information shown on the  
17          Drawings and the data described herein. The Contractor shall submit to the  
18          Engineer for review, not less than 120 days before start-up, a valve schedule  
19          containing all valves required for the work. The schedule shall contain for each  
20          valve, the location, type, a number, words to identify the valve's function, and  
21          the normal operating position. The information contained in the valve schedules  
22          shall be coded on the tags in a system provided by the Owner. Above ground  
23          valve tags shall be furnished with non-corrosive metal wire for attachment  
24          thereof.  
25

26           **1.14 HURRICANE PREPAREDNESS PLAN**  
27

- 28          A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to  
29          the Engineer and Owner a Hurricane Preparedness Plan. The Plan should  
30          outline the necessary measures that the Contractor proposes to perform at no  
31          additional cost to the Owner in case of a hurricane warning.  
32
- 33          B. In the event of inclement weather, or whenever Engineer shall direct; the  
34          Contractor shall carefully protect the Work and materials against damage or  
35          injury from the weather. If, in the opinion of Engineer, any portion of Work or  
36          material has been damaged or injured by reason of failure on the part of the  
37          Contractor or subcontractors to set protect the Work, such Work and materials  
38          shall be removed and replaced at the expense of the Contractor.  
39

40           **1.15 WARRANTIES**  
41

- 42          A. The Contractor and the equipment manufacturers shall warranty all equipment  
43          supplied under these Specifications for a minimum period of one (1) year unless  
44          otherwise specified. Warranty period shall commence on the date that the Work  
45          is accepted by the Owner as substantially complete.  
46

- 1           B. The equipment shall be warranted to be free from defects in workmanship,  
2           design and materials. If any part of the equipment should fail during the  
3           warranty period, it shall be replaced and returned to service at no expense to  
4           the Owner.
- 5           C. If, within the warranty period, repairs or changes are required in connection with  
6           work that in the opinion of the Engineer is rendered necessary as the result of  
7           the use of materials, equipment or workmanship that is inferior, defective, or not  
8           in accordance with the terms of the Contract, the Contractor shall promptly upon  
9           receipt of notice from the Owner and without expense to the Owner:
- 10           1. Place in satisfactory condition in every particular all of such work and  
11           correct all defects herein.
- 12           2. Repair or replace all damage to buildings, the site, or equipment or  
13           contents thereof, which, in the opinion of the Engineer, is the result of the  
14           use of materials, equipment or workmanship that are inferior, defective,  
15           or not in accordance with the terms of the Contract.
- 16           3. Repair or replace any work or material or equipment disturbed in fulfilling  
17           any such guarantee.
- 18           D. If within ten (10) days after receiving notice, the Contractor fails to proceed to  
19           comply with the terms of the warranty, the Owner may have the defects  
20           corrected, and the Contractor and his surety shall be liable for all expenses  
21           incurred, provided, however, that in case of an emergency where, in the opinion  
22           of the Owner, delay would cause loss or damage, repairs may be started without  
23           notice being given to the Contractor and the Contractor shall pay the cost  
24           thereof.
- 25           E. All special guarantees or warranties applicable to specific parts of the work, as  
26           may be stipulated in the Contract Documents, shall be subject to the terms of  
27           this paragraph during the first year following acceptance. All special guarantees  
28           and manufacturers' warranties shall be assembled by the Contractor and  
29           delivered to the Engineer, along with a summary list thereof, before the  
30           acceptance of the Work.
- 31           F. The manufacturer's warranty period shall run concurrently with the Contractor's  
32           warranty or guarantee period. No exception to this provision shall be allowed.  
33           The Contractor shall be responsible for obtaining equipment warranties from  
34           each of the respective suppliers or manufacturers for all the equipment  
35           specified. The form of warranty may be included in the Contract Documents, or  
36           shall otherwise be acceptable to the Owner.
- 37           G. In the event that the manufacturer is unwilling to provide a one-year warranty  
38           commencing at the time of Substantial Completion, the Contractor shall obtain  
39           from the manufacturer a multi-year warranty as specified in Section 01740

1 starting at the time that the manufacturer certified proper installation. This  
2 warranty shall not relieve the Contractor of the one-year warranty commencing  
3 upon Substantial Completion.

4  
5 H. The Contractor's one-year warranty or guarantee period shall be part of the  
6 project's Performance Bond.  
7

8 I. Additional warranty requirements are specified in Section 01740.  
9

10 1.16 WATER TIGHTNESS  
11

12 A. Special precautions shall be taken in the curing of concrete to reduce concrete  
13 cracking. All water-retaining structures (those that are intended to hold a liquid)  
14 shall be filled and tested for leaks by the Contractor, with water acceptable to  
15 the Engineer, prior to surface coating or painting. Procedure and manner in  
16 which any leaks are repaired must be reviewed by the Engineer. All costs  
17 associated with the testing and repair of leaks shall be at the expense of the  
18 Contractor.  
19

20 1.17 CONSTRUCTION CONDITIONS  
21

22 A. The Contractor shall strictly adhere to the specific requirements of the  
23 governmental unit or agencies having jurisdiction over the work. Wherever  
24 there is a difference in the requirements of a jurisdictional body and these  
25 Specifications, the more stringent shall apply.  
26

27 1.18 PUBLIC NUISANCE  
28

29 A. The Contractor shall not create a public nuisance including, but not limited to,  
30 encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.  
31

32 B. Sound levels measured by the Engineer personnel shall not exceed 45 dBA 7  
33 PM to 7 AM or 55 dBA 7 AM to 7 PM. This sound level shall be measured at  
34 the exterior of the exterior wall of the nearest residence. Levels at the equip-  
35 ment shall not exceed 85 dBA measured five (5) feet from the equipment at any  
36 time. Sound levels in excess of these values are sufficient cause to have the  
37 work suspended. Work stoppage by the Engineer or Owner for excessive noise  
38 shall not relieve the Contractor of completing the Work in accordance with the  
39 Contract Time(s), at no additional cost to the Owner.  
40

41 C. No extra charge may be made for time lost due to work stoppage resulting from  
42 the creation of a public nuisance.  
43

44 1.19 HAZARDOUS LOCATIONS  
45

46 A. Contractor shall perform work in accordance with OSHA, state and local safety  
47 requirements.  
48

1  
2   1.20 SUSPENSION OF WORK DUE TO WEATHER  
3

- 4       A. During inclement weather, all work that could be damaged or rendered inferior  
5       by such weather conditions shall be suspended. The orders and decisions of  
6       the Engineer as to suspensions shall be final and binding. The ability to issue  
7       such an order shall not be interpreted as a requirement to do so. During  
8       suspension of the work for any cause, the work shall be suitably covered and  
9       protected so as to preserve it from injury by the weather or otherwise; and, if the  
10      Engineer shall so direct, rubbish and surplus materials shall be removed.  
11  
12       B. The Contractor shall be responsible for documenting all inclement weather  
13       conditions.  
14

15   1.21 RELOCATIONS  
16

- 17       A. The Contractor shall be responsible for the relocation of structures, including  
18       but not limited to light poles, signs, sign poles, fences, piping, conduits and  
19       drains that interfere with the positioning of the work as set out on the Drawings.  
20       The cost of all such relocations shall be borne by the Contractor at no additional  
21       cost to the Owner.  
22

23   1.22 SALVAGE  
24

- 25       A. Any existing equipment or material including, but not limited to, valves, pipes,  
26       fittings, couplings, etc., which is removed or replaced as a result of construction  
27       under this project may be designated by the Owner to be salvaged. Any existing  
28       equipment or material to be salvaged shall remain onsite and the Contractor  
29       shall be responsible for delivering the salvage equipment/materials to the exact  
30       location onsite as directed by the Engineer.  
31

32   1.23 PERMITS  
33

- 34       A. Upon notice of award, the Contractor shall immediately apply for all applicable  
35       permits, not previously obtained by the Owner, from the appropriate  
36       governmental agency or agencies. No work shall commence until all applicable  
37       permits have been obtained and copies delivered to the Engineer. The costs  
38       for obtaining all permits shall be borne by the Contractor.  
39

40   1.24 PUMPING  
41

- 42       A. The Contractor with his own equipment shall perform all pumping necessary to  
43       prevent flotation of any part of the structures during construction operations. All  
44       water collected during pumping operations shall be properly disposed of in  
45       accordance with these specifications and/or regulatory requirements, whichever  
46       is more stringent.  
47

B. The Contractor shall, with his own equipment, pump out water that may seep or leak into the excavations or structures. All water collected during pumping operations shall be properly disposed of in accordance with these specifications and/or regulatory requirements, whichever is more stringent. Below grade galleries and other operating areas shall be kept dry at all times. The extent of pumping required in tanks, channels and other non-operating areas will be determined by the Owner/Engineer.

## 1.25 NOTIFICATION OF WORK ON EXISTING FACILITIES

A. Before commencing work on any of the existing structures or equipment, the Contractor shall notify the Owner/Engineer, in writing, at least 10 calendar days in advance of the date he proposed to commence such work.

## 1.26 OWNER OCCUPANCY AND OPERATION OF COMPLETED FACILITIES

A. It is assumed that portions of the work will be completed prior to completion of the entire work. Upon completion of construction of each individual facility, including testing, if the Owner, at his sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the one-year guaranty period shall commence on that date. The Owner has the option of not accepting any individual completed facility, but accepting the entire work as a whole when it is completed and tested.

## 1.27 POTENTIAL IMPACTS ON THE SCHEDULE

A. The Owner may incur penalties for failure to maintain service/operations. Therefore, the Bidders are noticed that this work is at an active and operating Water Reclamation Facility and that plant operations, regulatory compliance and required testing will take priority over and may impact the construction schedule.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

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1 SECTION 01040  
2  
3 COORDINATION  
4

5 PART 1 – GENERAL  
6

7 1.01 PROJECT COORDINATION  
8

- 9       A. The Contractor shall provide for the complete coordination of all construction  
10      efforts. This shall include but not necessarily be limited to coordination of the  
11      following:
- 12           1. The work of subcontractors.  
13           2. The flow of material and equipment from suppliers.  
14           3. The effort of equipment manufacturers during testing and start-up.  
15           4. The interrelated work with public and private utility companies.  
16           5. The interrelated work with the Owner where tie-ins to existing facilities  
17      are required.  
18           5. The effort of independent testing agencies.  
19           6. The work to be provided under allowances.
- 20       B. Notify the Engineer immediately in writing if any conditions exist which will prevent  
21      satisfactory results in the installation of the System. Should the Contractor or  
22      subcontractor start work without such notification, it shall be construed as an  
23      acceptance of all claims or questions as to the suitability of the work of others to  
24      receive its Work.
- 25       C. The Contractor shall make all submittals to the single designated Construction  
26      Manager with copy to the City's Project Manager. The Construction Manager will  
27      disseminate the submittals to the proper engineering firm for action and response.
- 28       D. The Section IVA Northeast WRF Improvements Project Supplemental Technical  
29      Specifications – Division 1 General Requirements specifications – apply to both the  
30      King Engineering Section IVB Northeast WRF Grit Removal, Salsnes Filter and  
31      Equalization System Improvements Project and the Jones Edmunds Section IVC  
32      Northeast WRF Blend Tank Improvements; and may not be listed in the Table of  
33      Contents for each of the respective Technical Specifications.
- 34       E. All references to O&M Data in the Jones Edmunds Section IVC Northeast WRF  
35      Blend Tank Improvements shall be to Specification Section 01830 – O&M Manuals  
36      of the Section IVA Northeast WRF Improvements Project Supplemental Technical

## Specifications – Division 1 General Requirements specifications.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

## END OF SECTION

1 SECTION 01050  
2

3 FIELD ENGINEERING AND SURVEYING  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. The Contractor shall provide and pay for all field engineering and survey  
10 services required. Such work shall include survey work to establish existing  
11 and/or proposed lines and grades and to locate and lay out site boundaries and  
12 easements, project control, site improvements, structures, controlling lines and  
13 levels and all other survey required for the construction of the work. Also  
14 included are such engineering services as are specified or required to execute  
15 the Contractor's construction methods. Engineers and surveyors shall be  
16 licensed professionals registered in the State of Florida.  
17
- 18 B. The accuracy of any method of staking shall be the responsibility of the  
19 Contractor. All surveying for vertical and horizontal control shall be the  
20 responsibility of the Contractor.  
21
- 22 C. The Contractor shall be held responsible for the preservation of all stakes and  
23 marks. If any stakes or marks are carelessly or willfully disturbed by the  
24 Contractor, the Contractor shall not proceed with any work until he has  
25 established such points, marks, lines and elevations as may be necessary for  
26 the prosecution of the work.  
27

28 1.02 SURVEY REFERENCE POINTS  
29

- 30 A. Existing basic horizontal and vertical control points for the project are those  
31 designated on the Drawings, where applicable. The Contractor shall locate and  
32 protect control points prior to starting site work and shall preserve all permanent  
33 reference points during construction. In working near any permanent property  
34 corners or reference markers, the Contractor shall use care not to remove or  
35 disturb any such markers. In the event that markers must be removed or are  
36 disturbed due to the proximity of construction work, the Contractor shall have  
37 them referenced and reset by a Registered Land Surveyor.  
38

39 1.03 PROJECT SURVEY REQUIREMENTS  
40

- 41 A. The Contractor shall engage the services of a Florida Registered Land Surveyor  
42 to establish all lines and grades on the Drawings necessary to fully construct  
43 the work in accordance with Chapter 5J-17 of the Florida Administrative Code  
44
- 45 B. The Registered Land Surveyor shall establish and stake all pipeline and  
46 roadway right-of-way adjacent to construction at 100' intervals on tangents, 50'  
47 intervals on curves and at all changes in direction. The surveyor shall place lath

1 and hub at such points with stations indicated. Tack in hub shall not be  
2 permitted.  
3

- 4 1. The Registered Land Surveyor shall utilize current right-of-way maps,  
5 plats and property deeds, all being of public record, in conjunction with  
6 existing monumentation to establish the existing right-of-way lines and  
7 utility easement boundaries.  
8
- 9 C. The Registered Land Surveyor shall establish a temporary benchmark system  
10 in accordance with Chapter 5J-17 FAC and shall provide a written list to the  
11 Contractor for his use.  
12
- 13 D. The Contractor shall provide an as-built survey of all pipes and structures  
14 constructed under the project that shall be signed and sealed by a Florida  
15 Registered Surveyor and Mapper. At minimum, the As-Built Survey shall  
16 include:  
17
- 18 1. Top of concrete elevations and northings and eastings for all basins and  
19 structures;  
20 2. Weir elevations for all basins and structures;  
21 3. Pipe inverts for gravity pipelines and top of pipe elevations for pressure  
22 pipelines for all yard piping, electrical duct banks and fiber optic cable  
23 conduits, and northings and eastings of all changes in pipe direction.  
24 4. Concrete pads for pumps, grinders, and other mechanical  
25 appurtenances.  
26 5. Top of mixers, blend tank covers, and stairways and walkway between  
27 tanks. Invert elevation of blend tank pipe trench, corners of finished  
28 concrete pads, and new asphalt construction.  
29

30 1.04 RECORDS  
31

- 32 A. Contractor shall maintain a complete, accurate log of all control and survey work  
33 as construction progresses. Survey notes indicating the information and  
34 measurements used in establishing locations and grades shall be kept in  
35 notebooks and furnished to the Engineer with the Record Drawings.  
36

37 1.05 SUBMITTALS  
38

- 39 A. Submit name and address of surveyor to the Engineer.  
40
- 41 B. On request of the Engineer, submit documentation to verify accuracy of field  
42 engineering work.  
43

44 PART 2 – PRODUCTS (NOT USED)  
45

46 PART 3 – EXECUTION (NOT USED)

47 END OF SECTION

1 SECTION 01065  
2

3 PERMITS AND EASEMENTS  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. The Contractor shall be responsible to ensure that the construction of the project  
10 adheres to City, County, State, and Federal standards and regulations, and to  
11 all permits and easements acquired for the project.  
12
- 13 B. The Contractor shall coordinate all work within rights-of-way with the agency  
14 having jurisdiction, including all road/lane closures, road/lane narrowing and  
15 detours.  
16
- 17 C. Copies of any Permits, Deeds, Easement Agreements or License Agreements  
18 that the Owner has obtained will be available for review by prospective bidders  
19 at the City of Clearwater's Plan Room – website address:  
20 [www.myclearwater.com/cityprojects](http://www.myclearwater.com/cityprojects). The Contractor shall conduct all operations  
21 in accordance with the requirements of all Permits, Easements and License  
22 Agreements.  
23
- 24 D. Specific requirements for erosion and sedimentation controls are specified in  
25 Part 207 of Section IV, City of Clearwater Standard Technical Specifications.  
26
- 27 E. Where Permits, Deeds, Easement Agreements, or License Agreements require  
28 that certain Work is to be performed only in the presence of a representative of  
29 the permitting entity, the Contractor shall provide all coordination and  
30 notification required to assure full compliance with the permit conditions.  
31
- 32 F. The Owner has obtained or will obtain certain Permits, Deeds, Easement  
33 Agreements, or License Agreements required for construction of the project. A  
34 listing of those Permits, Deeds, Easement Agreements, or License Agreements  
35 that the Owner has obtained or applied for is listed below. The Contractor shall  
36 be responsible for obtaining all other Permits, Easement Agreements, or  
37 License Agreements necessary for the proper execution of the Work not  
38 specifically noted to be obtained by the Owner.  
39
- 40 G. The Contractor shall comply with all terms, conditions, provisions and  
41 requirements of all permits issued or to be issued for the Project. Should the  
42 Contractor's failure to comply with said permits lead to enforcement action  
43 by any of the permitting or jurisdictional agencies, any resultant costs in  
44 the forms of repairs, fines, penalties, administrative costs, attorney's fees or  
45 consultant fees shall be deducted from the Contract Price or shall be otherwise  
46 collectible from the Contractor and its Surety, jointly and severally.

- 1  
2       H. The Contractor shall notify the Owner a minimum of 30 days prior to the  
3 expiration of a permit if said expiration occurs prior to completion of the Work.  
4  
5       I. Prior to any land clearing or tree removal, the Contractor shall construct a soil  
6 tracking device in accordance with current Florida Department of Transportation  
7 design standards.

8  
9       1.02 PERMITS  
10

- 11       A. Permits by, or applied for by, the Owner are as follows:  
12

Permit Title	Agency	Permit/File Number
Building Permit	City of Clearwater	TBD
Revision to Domestic WW Permit (Northeast)	Florida Department of Environmental Protection	FL0128937
ERP	SWFWMD	43005372.007

- 13  
14  
15       B. Each bidder shall be familiar with the requirements of the permit conditions that  
16 relate to construction activities and shall include the cost of satisfying these  
17 permit conditions in developing a bid for the project.  
18  
19       C. At a minimum, the Contractor shall register with appropriate authorities, obtain  
20 the following permits, comply with their respective conditions, and submit copies  
21 of all applications and final permits to Engineer and Owner:  
22  
23           1. City of Clearwater building permit(s)  
24           2. Generic Permit for the Production of Groundwater (if required)  
25           3. Storm Water NPDES  
26  
27       D. The Contractor shall obtain and pay for all construction permits required  
28 including those necessary for clearing, grubbing, and tree removal. No clearing  
29 shall occur and no earth-moving equipment shall be placed on-site until after  
30 the permits have been issued.  
31  
32       E. The Contractor shall obtain, implement and comply with all local and state  
33 permits required for dewatering, including consumptive or water use permitting,  
34 if required for construction from the Southwest Florida Water Management  
35 District.  
36  
37       F. The Contractor shall be responsible for obtaining, and complying with, all  
38 required permits relating to discharges from dewatering shall obtain a State of  
39 Florida Department of Environmental Protection Generic Permit for the

1 Discharge of Produced Ground Water From Any Non-Contaminated Site  
2 Activity in accordance with 62-621.300(2) FAC. See specification Section  
3 02140 Temporary Dewatering.

- 4
- 5 G. The Contractor shall obtain, implement and comply with the requirements of a  
6 Generic Permit for Storm Water Discharge from Large and Small Construction  
7 Activities (CGP), in accordance with 62-621.300(4) FAC. The Contractor shall  
8 submit a CGP Notice of Intent (NOI) to the Florida Department of Environmental  
9 Protection (FDEP) and develop and submit a Storm Water Pollution Prevention  
10 Plan (SWPPP) as part of the CGP. The Contractor shall:
- 11
- 12 1. Obtain the CGP form and NOI Application Form from the FDEP or its  
13 website, DEP Documents 62-621.300(4)(a) and 62-621.300(4)(b),  
14 respectively.
- 15
- 16 2. Develop an SWPPP in compliance with FDEP storm water permitting  
17 rules that shall include, at a minimum, the following:
- 18
- 19 a. A site evaluation of how and where pollutants may be mobilized  
20 by storm water.
- 21 b. A site plan for managing storm water runoff.
- 22 c. Identification of appropriate erosion and sediment controls  
23 including Best Management Practices to reduce erosion,  
24 sedimentation, and storm water pollution.
- 25 d. A maintenance and inspection schedule.
- 26 e. Plan and procedures for record keeping.
- 27 f. A map depicting storm water exit areas.
- 28
- 29 3. Complete and submit the NOI Application, including all attachments, to  
30 the local FDEP office along with the appropriate application fee.
- 31
- 32 4. The Contractor shall furnish a copy of the FDEP Notice of Permit, along  
33 with a copy of the SWPPP, to the Engineer.
- 34

35 1.03 EASEMENTS

- 36
- 37 A. The Contractor shall comply with all provisions of the various easements for the  
38 following parcels:
- 39

Easement Number	Owner	County Parcel ID

1  
2 PART 2 – PRODUCTS (NOT USED)  
3

4 PART 3 – EXECUTION (NOT USED)  
5  
6

7 END OF SECTION  
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1 SECTION 01090  
2

3 REFERENCE STANDARDS  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

9 A. Abbreviations and acronyms are used in the Contract Documents to identify  
10 reference standards.  
11

12 1.02 QUALITY ASSURANCE  
13

14 A. Application: When a standard is specified by reference, comply with  
15 requirements and recommendations stated in that standard, except when  
16 requirements are modified by the Contract Documents or applicable codes  
17 establish stricter standards.  
18

19 B. Publication Date: The publication in effect on the date of issue of Contract  
20 Documents, except when a specific publication date is specified.  
21

22 1.03 ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS  
23

24 Obtain copies of referenced standards direct from publication source, when needed for  
25 proper performance of Work, or when required for submittal by Contract Documents.  
26

27 AA Aluminum Association  
28 900 19<sup>th</sup> Street NW  
29 Washington, DC 20006  
30

31 AASHTO American Association of State Highway  
32 and Transportation Officials  
33 444 North Capitol Street, NW Suite 249  
34 Washington, DC 20001  
35

36 ACI American Concrete Institute  
37 38800 Country Club Drive  
38 Farmington Hills, MI 48331  
39

40 AI Asphalt Institute  
41 2696 Research Park Drive  
42 Lexington KY 40511  
43

44 AISC American Institute of Steel Construction  
45 One East Wacker Drive  
46 Suite 3100  
47 Chicago, IL 60601-2001  
48

1	AISI	American Iron and Steel Institute 1140 Connecticut Avenue Suite 705 Washington DC 20036
2	ANSI	American National Standards Institute 1819 L Street, NW Washington, DC 20036
3	ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990
4	ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA, 19428
5	AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
6	AWS	American Welding Society 550 N.W. LeJeune Road Miami, FL 33126
7	CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, IL 60173-4758
8	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) 470 L'enfant Plaza – Suite 8100 Washington, DC 20407
9	NEMA	National Electrical Manufacturers' Association 1300 North 17 <sup>th</sup> Street Suite 1847 Rosslyn, VA 22209
10	PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
11	PCI	Prestressed Concrete Institute 209 W. Jackson Blvd. Chicago, IL 60606

1           SSPC           Society for Protective Coatings  
2                          40 24<sup>th</sup> Street, 6<sup>th</sup> floor  
3                          Pittsburgh, PA 15222  
4  
5           UL           Underwriters' Laboratories, Inc.  
6                          333 Pfingston Road  
7                          Northbrook, IL 60062  
8  
9           ABMA          American Bearing Manufacturer's Association  
10  
11          BOCA          Building Officials and Code Administrators International Inc.  
12  
13          CSI           Construction Specifications Institute  
14  
15          FDOT          Florida Department of Transportation  
16  
17          NIST          National Institute of Standards and Technology  
18  
19          NFPA          National Fire Protection Association  
20  
21          OSHA          Occupational Safety and Health Act  
22  
23          SSBC          Southern Standard Building Code  
24  
25                          All Local, State, and County Municipal Building Code requirement of the Owner's  
26                          Insurance.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

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## SECTION 01150

2

### MEASUREMENT AND PAYMENT

4

#### PART 1 – GENERAL

6

##### 1.01 SCOPE OF WORK

8

- 9       A. This section defines the Work included in each bid item in the Bid / Proposal  
10      section of the Contract Documents. Payment will be made based on the  
11      specified items included in the description in this section for each pay item  
12      number.
- 13       B. All prices included in the Bid Form / Schedule of Prices shall be full  
14      compensation for all labor, supervision, materials, tools, equipment, and  
15      incidentals necessary to complete the Work as shown on the Drawings and/or  
16      as specified in the Contract Documents. Actual quantities of each item bid on  
17      a unit price basis will be determined upon completion of the construction in the  
18      manner established for each item in this section. Payment for all items listed in  
19      the Bid Form / Schedule of Prices shall constitute full compensation for all work  
20      shown and/or specified to be performed under the Contract.
- 21       C. Measurement and Payment items A through M are applicable to the work  
22      contained in Specification Section IVC and as shown on the Drawings produced  
23      by Jones Edmonds and Associates, Inc. Measurement and Payment items O  
24      through T are applicable to the work contained in Specification Section IVB and  
25      as shown on the Drawings produced by Ardurra/King.
- 26       D. Restoration is considered to be an integral part of the Work, and all bid prices  
27      shall include the cost of restoration necessitated by the Work related to that bid  
28      item. All existing structures and property including, but not limited to, paving,  
29      stabilized roads, drainage piping and ditches, catch basins, head walls, yard  
30      culverts, lawns, fences, trees, shrubs, ground areas, walkways, sidewalks,  
31      driveways, alleys, curbs, gutters, irrigation systems, buildings, structures and  
32      equipment that are altered, removed or damaged during construction shall be  
33      restored to the same or better condition than existed prior to construction at no  
34      additional cost to the Owner. Cleanup is an integral part of restoration process.
- 35       E. The Contractor shall exercise care to preserve and protect existing facilities  
36      during all periods for the construction phase. All existing structures, equipment,  
37      and private property, including, but not limited to paving, stabilized roads,  
38      drainage piping and ditches, latch basins, head walls, yard culverts, lawns,  
39      fences, trees, shrubs, ground areas, walkways, driveways, alleys, curbs, gutters  
40      and irrigations systems that are altered, removed or damaged during  
41      construction and are not included in the proposed alterations of the new work  
42      shall be restored to the same or better condition than existed prior to  
43      construction.

1  
2       F. The Contractor shall be responsible for all traffic maintenance requirements  
3 necessitated by the construction/installation of those specific bid items requiring  
4 traffic maintenance. The cost for this work shall be included in the specific unit  
5 price submitted for that particular bid item.  
6

7       **PART 2 – PRODUCTS (NOT USED)**  
8

9       **PART 3 – EXECUTION**  
10

11      **3.01 MEASUREMENT AND PAYMENT**  
12

13       Bid Items 1 through 13 will pertain to all work shown on the Drawings and specified in  
14 Section IVC of the Technical Specifications for the Northeast WRF Blend Tank  
15 Improvements and all associated work as specified in Divisions 0 and 1. Bid Items 14  
16 through 19 will pertain to all work shown on the Drawings and specified in Section IVB  
17 of the Technical Specifications for the Northeast WRF Grit Removal, Salsnes Filter and  
18 Equalization System Improvements.  
19

20       A. Remove Contents of Existing Sludge Storage and Blend Tanks (Bid Item 1)  
21

22           1. Measurement: Measurement for removal of the contents of the existing  
23 sludge storage and blend tanks shall be made on a per cubic yard basis  
24 of the actual volume of contents removed from the existing sludge  
25 storage and blend tanks and disposed of in accordance with the  
26 contract documents and to the satisfaction the City.  
27

28           2. Payment: Payment for Bid Item 1 shall be made in accordance with the  
29 Schedule of Values and shall be full compensation for the furnishing of  
30 all labor, materials, equipment, and services necessary to remove the  
31 settled grit, sludge, scum, rags, solids, and trash in the tanks and wash  
32 down tank walls and floor to remove accumulations. The item includes  
33 but is not limited to removing, loading, transporting, and properly  
34 disposing of the tank contents including liquid, sludge, scum, rags, grit,  
35 hair, grease, solids, and semi-solids off site in accordance with applicable  
36 federal, state, and local regulations. The Contractor should expect  
37 manways may be required to access tanks, confined space conditions  
38 apply, and air ventilation and monitoring will be required to complete the  
39 work.  
40

41       B. Existing Sludge Storage and Blend Tank Concrete Crack Repair (Bid Item 2)  
42

43           1. Measurement: Measurement for concrete crack repair of the existing  
44 sludge storage and blend tanks shall be made on a per lineal foot basis  
45 of the actual length of the crack repair made in accordance with the  
46 contract documents and to the satisfaction the City.  
47

1           2. Payment: Payment for Bid Item 2 shall be for furnishing all labor,  
2 material, equipment, and services for the repair and refurbishment of the  
3 Sludge Storage and Blend Tanks' concrete and pipe trench concrete.  
4 This work includes, but is not limited to, concrete crack repair in  
5 accordance with the concrete documents and to the satisfaction of the  
6 City. The Contractor shall furnish all other labor, materials, equipment,  
7 and services required to perform all requested work and shall coordinate  
8 with the manufacturers to verify the understanding of the requested work  
9 before submitting his Bid.

10           C. Existing Sludge Storage and Blend Tank Spalled Concrete Repair (Bid Item 3)

11           1. Measurement: Measurement for spalled concrete crack repair of the  
12 existing sludge storage and blend tanks shall be made on a per square  
13 foot basis of the actual quantity of spalled concrete repaired in  
14 accordance with the contract documents and to the satisfaction the  
15 City.

16           2. Payment: Payment for Bid Item 3 shall be for furnishing all labor,  
17 material, equipment, and services for the repair and refurbishment of the  
18 Sludge Storage and Blend Tanks' concrete and pipe trench concrete.  
19 This work includes, but is not limited to, spalled concrete repair in  
20 accordance with the concrete documents and to the satisfaction of the  
21 City. The Contractor shall furnish all other labor, materials, equipment,  
22 and services required to perform all requested work and shall coordinate  
23 with the manufacturers to verify the understanding of the requested work  
24 before submitting his Bid.

25           D. Demolition of Existing Aeration Equipment, Mixing Equipment, and Associated  
26 Appurtenances (Bid Item 4)

27           1. Measurement: Measurement for payment of the lump sum price bid for  
28 Item 4 shall not be made and all items shall be included in the lump sum  
29 price bid.

30           2. Payment: Payment for Bid Item 4 shall be made in accordance with the  
31 Schedule of Values and shall be full compensation for the furnishing all  
32 labor, materials, equipment, and services necessary to demolish,  
33 remove, and dispose of non-salvageable materials in accordance with  
34 the Contract Drawings. This item includes the removal of tank aeration  
35 equipment including aeration grid piping, diffusers, and associated  
36 supports. The aeration piping penetrating the tank wall shall be cut and  
37 capped inside the tank. This item includes the removal of tank mixing  
38 including stirring pickets, center guide shaft and bracket, and associated  
39 supports. All electrical wiring related to the mixers shall be removed  
40 along with the conduit. The bridge must remain in place for the duration  
41 of the Work. Photographs should be taken to document the existing and

final conditions of the Work. The items also include but are not limited to: dewatering, loading, hauling, excavation, disposal, filling, backfilling, compaction, grouting, and sodding all area disturbed by the Contractor's operations. Salvage of items shall be as directed in the Contract Documents. Loading and disposal of the construction debris shall be in accordance with applicable local, state, and federal regulations

E. Existing Odor Control Piping, Stair Treads, and Tank Walkway Repair and Refurbishment (Bid Item 5)

1. Measurement: Measurement for payment of the lump sum price bid for Item 5 shall not be made and all items shall be included in the lump sum price bid.
2. Payment: Payment for Bid Item 5 shall be made in accordance with the Schedule of Values and shall be full compensation for furnishing all labor, materials, equipment, and services for the repair and refurbishment of the odor control piping (including, but not limited to the painting, coating, and restoration of all FRP piping from the tank covers to the Odor Control Tower), stair treads, and tank walkway in accordance with the Contract Documents. The Contractor shall furnish all other labor, materials, equipment, and services required to perform all requested work and shall coordinate with the manufacturers to verify the understanding of the requested work before submitting his Bid.

F. Clean and Coat the Interior and Exterior of the Existing Sludge Storage and Blend Tanks (Bid Item 6)

1. Measurement: Measurement for payment of the lump sum price bid for Item 6 shall not be made and all items shall be included in the lump sum price bid.
2. Payment: Payment for Bid Item 6 shall be made in accordance with the Schedule of Values and shall be for furnishing all labor, materials, equipment, and services for the cleaning and coating of both existing sludge storage and blend tanks and the pipe trench connecting the tanks to the satisfaction of the City. This item includes pressure washing to remove debris and all hardened deposits on the interior surface of the tanks. This may require the tanks to be manually scraped to remove muck or scale that is not removed from pressure washing. The tank shall be rinsed and dried to remove any excess material or liquid from the tank and otherwise prepare the tank for structural inspection. The Contractor shall notify the City 48 hours before the completion of the final rinse. The Contractor is responsible for dewatering the materials removed from the tank and adding chemicals, as necessary, for odor control of the tank contents to meet all federal, state, and local regulatory requirements. Water from the dewatering process can be conveyed to the head of the

1 WRF provided it does not contain chemicals harmful to the biological  
2 process. Water required for dilution, wash down and related purposes  
3 will be available from the City's water reclaimed system. Following  
4 cleaning the interior and exterior of both tanks and trench, the existing  
5 interior and exterior coatings shall be removed and shall be painted and  
6 coated in accordance with the Contract Documents. The Contractor shall  
7 furnish all other labor, materials, equipment, and services required to  
8 perform all requested work and shall coordinate with the painting and  
9 coating manufacturers to verify the understanding of the requested work  
10 before submitting his Bid.  
11

12 G. Sludge Storage and Blend Tanks, Pump Stations, and Yard Piping Equipment  
13 and Rehabilitation (Bid Item 7)

- 15 1. Measurement: Measurement for payment of the lump sum price bid for  
16 Item 7 shall not be made and all items shall be included in the lump sum  
17 price bid  
18
- 19 2. Payment: Payment for Bid Item 7 shall be made in accordance with the  
20 Schedule of Values and shall be for furnishing all labor, materials,  
21 equipment, and services required including, but not limited to, the  
22 installation of one mixer each in the North Biosolids Blend Tank and  
23 South Dewatering Storage Tank; new aluminum covers, access ladders,  
24 and harness tie-off points on both tanks; refurbishment of the existing  
25 Truck Off-Loading Pump Station, located north of the Sludge Storage  
26 and Blend Tanks as shown in the Drawings; installation of the new Truck  
27 Off-Loading Pump Station, piping, and associated appurtenances  
28 located east of the Sludge Storage and Blend Tanks as shown in the  
29 Drawings; installation of the new Anaerobic Digester Feed Pump Station,  
30 piping, associated appurtenances, and associated yard piping to the  
31 existing anaerobic digesters as shown in the Drawings; installation of two  
32 inline grinder systems as shown on the Drawings; removal of the existing  
33 Dewatering Feed Pump Station, piping, and associated appurtenances  
34 as shown in the Drawings; and installation of the new Dewatering Feed  
35 Pump Station, piping, and associated appurtenances; and in accordance  
36 with the Contract Documents. The Contractor shall furnish all other labor,  
37 materials, equipment, and services required to perform all requested  
38 work and shall coordinate with the manufacturers to verify the  
39 understanding of the requested work before submitting his Bid.

40 H. New Truck Off-Loading and Anaerobic Digester Feed Pump Station Canopy  
41 (Bid Item 8)

- 44 1. Measurement: Measurement for payment of the lump sum price bid for  
45 Item 8 shall not be made and all items shall be included in the lump sum  
46 price bid.

1           3. Payment: Payment for Bid Item 8 shall be made in accordance with the  
2           Schedule of Values and shall be for furnishing all labor, materials,  
3           equipment, and services for the installation of a new Truck Off-Loading  
4           and Anaerobic Digester Feed Pump Station Canopy in accordance with  
5           the Contract Documents. The Contractor shall furnish all other labor,  
6           materials, equipment, and services required to perform all requested  
7           work and shall coordinate with the manufacturers to verify the  
8           understanding of the requested work before submitting his Bid.  
9

10          I. Dewatering Feed Pump Station Canopy Removal and Replacement (Bid Item  
11           9)

13          1. Measurement: Measurement for payment of the lump sum price bid for  
14           Item 9 shall not be made and all items shall be included in the lump sum  
15           price bid.

17          2. Payment: Payment for Bid Item 9 shall be made in accordance with the  
18           Schedule of Values and shall be for furnishing all labor, materials,  
19           equipment, and services for the removal of the existing canopy over the  
20           Dewatering Feed Pumps and replacement with a new Dewatering Feed  
21           Pump Station Canopy in accordance with the Contract Documents. The  
22           Contractor shall furnish all other labor, materials, equipment, and  
23           services required to perform all requested work and shall coordinate with  
24           the manufacturers to verify the understanding of the requested work  
25           before submitting his Bid.

27          J. Thickened Primary Sludge and Thickened WAS Yard Piping Modification (Bid  
28           Item 10)

30          1. Measurement: Measurement for payment of the lump sum price bid for  
31           Item 10 shall not be made and all items shall be included in the lump sum  
32           price bid.

34          2. Payment: Payment for Bid Item 10 shall be made in accordance with the  
35           Schedule of Values and shall be for furnishing all labor, materials,  
36           equipment, and services for the modifications to the existing thickened  
37           primary sludge and thickened WAS yard piping to route to the North and  
38           South Sludge Blend Tanks in accordance with the Contract Documents.  
39           The Contractor shall include Electrical, Arc Flash Requirements,  
40           Instrumentation & Controls (I&C) and SCADA Integration for the  
41           Proposed Improvements. The Contractor shall furnish all other labor,  
42           materials, equipment, and services required to perform all requested  
43           work and shall coordinate with the manufacturers to verify the  
44           understanding of the requested work before submitting his Bid.

45          K. Mobilization (Bid Item 11)

1. **Measurement:** Measurement for payment of the lump sum price bid for Mobilization shall be on a lump sum basis, but the cost shall not exceed four percent (4%) of the proposed Subtotal for Items 1-10.
  2. **Payment:** Payment for Bid Item 11 shall be full compensation for all costs associated with initiating the project as limited by other sections of the agreement including the Contractor's Performance and Payment Bonds. Payment for these performances shall be based on the terms of Section 01505 and in accordance with the Schedule of Values.

L. Indemnification (Bid Item 12)

1. Measurement: Measurement for payment of the amount stipulated under Bid Item 12 Indemnification shall not be made and all items shall be included in the lump sum.
  2. Payment: Payment of One Hundred Dollars (\$100.00) for Bid Item 12 shall be full compensation for Indemnification of the Owner and the Owner's Engineer as specified in the General Conditions and shall be included in the first payment request.

#### M. Owner's Contingency (Bid Item 13)

1. **Measurement:** Measurement for payment shall be as agreed upon by the Owner and Contractor.
  2. **Payment:** Payment shall be made in accordance with the terms of the Contingency Request and, if applicable, in accordance with the Schedule of Values.

N. Northeast WRF Pretreatment and Primary Treatment Improvements (Bid Item 14).

1. Measurement: Measurement for payment of the lump sum price bid for Item 14 Pretreatment and Primary Treatment Improvements shall not be made and all items shall be included in the lump sum price bid.
  2. Payment: Payment for Bid Item 14 shall be made in accordance with the Schedule of Values and shall be full compensation for the furnishing of all labor, materials, tools, equipment, and supervision required to perform the work as shown on the Drawings and Specifications as indicated herein including, but not limited to:
    - All work shown on the Drawings and specified in Sections IVB of the Technical Specification for the Northeast WRF Grit Removal, Salsnes Filter and Equalization System Improvements
    - Associated work as specified Divisions 0 and 1;

## MEASUREMENT AND PAYMENT

01150-7

12/18/20

- All demolition work, as specified, shown or required;
- All paving grading and drainage work, as specified, shown or required;
- All yard piping work, as specified, shown or required;
- All work associated with converting the existing picket thickener facilities to stacked tray removal systems, including grit pumping, grit concentrators and grit classifiers, including temporary pumping, screening/grit removal and bypass piping, as specified, shown or required;
- All work associated with installation of the continuous loop moving belt filtration systems, including foundations, stairs and platforms, feed pumps and sludge pumps, blowers, water systems, and piping as specified, shown or required;
- All work associated with the equalization basin, including foundations, tank, stairs and platforms, pumping systems, air compressors, air receiver, solenoid valves, control panels, monitors, and piping and nozzles as specified, shown or required; and
- All electrical, control systems, new SCADA work and programming, work and programming on the existing SCADA system, including pre-fabricated electrical enclosures with motor control centers, power distribution systems, and instrumentation and controls systems, as specified, shown or required.
- Demolition of obsolete existing odor control equipment and modifications to existing odor control equipment.
- Rehabilitation of the in-plant submersible lift station

O. Removal and Replacement of the Top Portion of the Existing Primary Clarifier Effluent Box Channel (Bid Item 15).

1. Measurement: Measurement for payment of the lump sum price bid for Item 15 shall not be made and all items shall be included in the lump sum price bid. Upon the Engineer's inspection of the Primary Effluent Box Channel, this work may not be performed.
2. Payment: Payment for Bid Item 15 shall be in accordance with the Schedule of Values and shall be full compensation for the furnishing of all labor, materials, tools, equipment, and supervision required to remove and replace the top portion of the existing Primary Clarifier Effluent Box Channel as shown on the Drawings and Specifications.

P. Rehabilitation of the walls and floors of the flow channels in the headworks building, the flow channel to the primary clarifier splitter box, the primary clarifier splitter box, the scum box, and the primary clarifier effluent box channel in accordance with Section 01150, 3.01P. (Bid Item 16).

1. Measurement: Measurement for payment of the unit price bid for Item 16 shall be made on a per square foot basis using an average ½" MEASUREMENT AND PAYMENT

1 thickness. The limits of the work shall be as directed by the Engineer  
2 following inspection. The Contractor shall assist the Engineer in  
3 inspecting the concrete surfaces. Upon Engineer's inspection of the  
4 Primary Effluent Box Channel, this work may not be performed.  
5

- 6 2. Payment: Payment for Bid Item 16 shall be made in accordance with the  
7 Schedule of Values and shall be full compensation for the furnishing of  
8 all labor, materials, tools, equipment, and supervision required to perform  
9 the work as shown on the Drawings and Specifications including, but not  
10 limited to the removal and repair of damaged concrete.

11 Q. Mobilization (Bid Item 17)

- 12 1. Measurement: Measurement for payment of the lump sum price bid for  
13 Mobilization shall be on a lump sum basis, but the cost shall not exceed  
14 four percent (4%) of the proposed Subtotal for Items 14-16.  
15  
16 2. Payment: Payment for Bid Item 17 shall be full compensation for all costs  
17 associated with initiating the project as limited by other sections of the  
18 agreement including the Contractor's Performance and Payment Bonds.  
19 Payment for these performances shall be based on the terms of Section  
20 01505 and in accordance with the Schedule of Values.  
21  
22

23 R. Indemnification (Bid Item 18)

- 24 3. Measurement: Measurement for payment of the amount stipulated under  
25 Bid Item 18 Indemnification shall not be made and all items shall be  
26 included in the lump sum.  
27  
28 4. Payment: Payment of One Hundred Dollars (\$100.00) for Bid Item 18  
29 shall be full compensation for Indemnification of the Owner and the  
30 Owner's Engineer as specified in the General Conditions and shall be  
31 included in the first payment request.  
32  
33

34 S. Owner's Contingency (Bid Item 19)

- 35 1. Measurement: Measurement for payment shall be as agreed upon by  
36 the Owner and Contractor.  
37  
38 2. Payment: Payment shall be made in accordance with the terms of the  
39 Contingency Request and, if applicable, in accordance with the Schedule  
40 of Values.  
41  
42

43 END OF SECTION  
44  
45

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MEASUREMENT AND PAYMENT  
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12/18/20

1 SECTION 01152

2  
3 APPLICATIONS FOR PAYMENT

4  
5 PART 1 – GENERAL

6  
7 1.01 REQUIREMENTS INCLUDED

- 8  
9 A. Submit Applications for Payment to the Engineer in accordance with the  
10 approved payment schedule, and in the format established by the Owner.  
11  
12 B. Contractor shall submit to the Engineer for review, the proposed Application for  
13 Payment form, prior to the first payment request. Format shall be MS Excel.

14  
15 1.02 FORMAT AND DATA REQUIRED

- 16  
17 A. Submit applications typed on forms either provided in these Specifications,  
18 furnished by the Owner, or as approved by the Owner, with itemized data typed  
19 on 8-1/2 inch x 11 inch or 8-1/2 inch x 14-inch white paper continuation sheets.  
20  
21 B. Provide itemized data on continuation sheet:  
22  
23 1. Format, schedules, line items and values: those of the Schedule of  
24 Values accepted by the Engineer.

25  
26 1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

27  
28 A. Application Form:

- 29  
30 1. Fill in required information, including that for Change Orders executed  
31 prior to date of submittal of application.  
32  
33 2. Fill in summary of dollar values to agree with respective totals indicated  
34 on continuation sheets.  
35  
36 3. Execute certification with signature of a responsible officer of the  
37 Contractor.

38  
39 B. Continuation Sheets:

- 40  
41 1. Fill in total list of all scheduled component items of work, with item  
42 number and scheduled dollar value for each item.  
43  
44 2. Fill in dollar value in each column for each scheduled line item when work  
45 has been performed or products stored.  
46 3. List each Change Order executed prior to date of submission, at the end  
47 of the continuation sheets.

- 1  
2       a. List by Change Order Number, and description, as for an original  
3           component item of work.  
4  
5       4. To receive approval for payment on component material stored on site,  
6           submit copies of the original invoices with the Application for Payment.  
7           The application for payment must also include a table summarizing the  
8           amount of each invoice and the schedule of values line item to which the  
9           stored materials apply.

10  
11     1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS  
12

- 13       A. Provide substantiating data, containing suitable information for review of costs  
14           requested with a cover letter identifying:  
15  
16           1. Project.  
17  
18           2. Application number and date.  
19  
20           3. Detailed list of enclosures.  
21  
22           4. For stored products:  
23  
24              a. Item number and identification as shown on application.  
25  
26              b. Description of specific material.  
27  
28              c. Supplier invoices.  
29  
30              d. A table identifying stored material, amount stored, amount  
31                installed, and schedule of values item, which the material applies.  
32  
33       B. Submit one copy of data and cover letter for each copy of application.  
34  
35       C. The Contractor is to maintain an updated set of drawings to be used as record  
36           drawings. As a prerequisite for monthly progress payments, the Contractor is  
37           to exhibit the updated record drawings for review by the Owner and the  
38           Engineer.  
39  
40       D. Contractor shall maintain an updated construction schedule in accordance with  
41           these Specifications. As a prerequisite for monthly progress payments,  
42           Contractor shall submit the updated construction schedule with the applications  
43           for progress payments. If the Contractor fails to submit the required updated  
44           schedule within the time prescribed, the Engineer may withhold progress  
45           payment estimates until such a time as the Contractor submits the required  
46           updated schedule.  
47

1           E. Contractor shall maintain an updated set of As-Built Drawings in accordance  
2           with these Specifications. As a prerequisite for monthly progress payments,  
3           Contractor shall submit the updated As-Built Drawings with the applications for  
4           progress payments. If the Contractor fails to submit the updated As-Built  
5           Drawings, the Engineer may withhold progress payment estimates until such a  
6           time as the Contractor submits same.

7

8        1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

9

- 10          A. Fill in application form as specified for progress payments.
- 11          B. Use continuation sheet for presenting the final statement of accounting as  
12           specified in the Specification.
- 13          C. All appropriate information must be entered on the application form.
- 14
- 15           1. The line title, "Application Period", must indicate the dates between which  
16           all work was completed during the pay period. These dates must be  
17           consecutive with the dates of the previous Payment Request and they  
18           must not overlap.
- 19
- 20           2. All blank lines within the "Contract Data" and "Summary of Project  
21           Status" section of the application must be completed. Also, if any  
22           Change Orders have been approved, the "Change Orders" section must  
23           include that information.
- 24
- 25           3. All calculations and arithmetic must be precise to the penny.
- 26
- 27           4. The application must be signed and dated by an authorized  
28           representative of the Contractor.
- 29

30

31        1.06 SUBMITTAL PROCEDURE

32

- 33          A. Prior to submitting a completed Application for Payment request, the Contractor  
34           shall arrange a field meeting with the Owner and/or Engineer to review and  
35           verify all installed quantities and/or stored materials. Only when the  
36           Owner/Engineer and Contractor agree on installed quantities and percentages,  
37           should the Application for Payment be submitted.
- 38
- 39          B. Submit six (6) copies of Applications for Payment to the Engineer at the times  
40           stipulated in the General Conditions.
- 41
- 42          C. When the Engineer finds Application properly completed and correct, he will  
43           transmit certificate for payment to Owner, with copy to Contractor.
- 44

45

46        PART 2 – PRODUCTS (NOT USED)

47

1 PART 3 – EXECUTION (NOT USED)

2

3

4 END OF SECTION

1 SECTION 01153  
2

3 CHANGE ORDER PROCEDURES  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- A. Promptly implement Change Order procedures.
  - 1. Provide full written data required to evaluate changes.
  - 2. Maintain detailed records of work done on a time and material/force account basis.
  - 3. Provide full documentation to Engineer on request.
- B. Designate in writing the member of Contractor's organization:
  - 1. Who is authorized to accept changes in the work.
  - 2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the work.

25 1.02 DEFINITIONS  
26

- A. Change Order: See General Conditions.
- B. Work Directive Change: A written order to the Contractor, signed by Owner and Engineer, which amends the Contract Documents as described, authorizes Contractor to proceed with a change that affects the Contract Sum or the Contract Time, and that will be included in a subsequent Change Order.
- C. Engineer's Supplemental Instructions: A written order, instructions, or interpretations, signed by Engineer making minor changes in the Work not involving a change in Contract Sum or Contract Time.
- D. Field Order: A written order to the Contractor, signed by the Engineer and the Contractor, which is issued to interpret/clarify the Contract Documents, order minor changes in the work. The work described by a Field Order is to be accomplished without change to the Contract Sum, Contract Time, and/or claims for other costs.

43 1.03 PRELIMINARY PROCEDURES  
44

- A. Owner and Engineer may initiate changes by submitting a Work Directive Change to the Contractor. Request will include:

CHANGE ORDER PROCEDURES

01153-1

04/26/2019

- 1           1. Detailed description of the change, products, and location of the change  
2           in the Project.  
3  
4           2. Supplementary or revised Drawings and Specifications.  
5  
6           3. The projected time span for making the change, and a specific statement  
7           as to whether overtime work is or is not authorized.  
8  
9           4. A specific period of time during which the requested price will be  
10          considered valid.  
11  
12          B. Contractor may initiate changes by submitting a written notice to the Engineer,  
13          containing:  
14  
15           1. Description of the proposed changes.  
16  
17           2. Statement of the reason for making the changes.  
18  
19           3. Statement of the effect on the Contract Sum and the Contract Time.  
20  
21           4. Statement of the effect on the work of separate contractors.  
22  
23           5. Documentation supporting any change in Contract Sum or Contract  
24          Time, as appropriate.  
25  
26

27         **1.04 CONSTRUCTION CHANGE AUTHORIZATION**

- 28  
29          A. Work Directive Change will describe changes in the Work, both additions and  
30          deletions, with attachments of revised Contract Documents to define details of  
31          the change and will designate the method of determining any change in the  
32          Contract Sum and any change in Contract Time.  
33  
34          B. Owner and Engineer will sign and date the Work Directive Change as  
35          authorization for the Contractor to proceed with the changes.  
36

37         **1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS**

- 38  
39          A. Support each quotation for a lump sum proposal, and for each unit price, which  
40          has not previously been established, with sufficient substantiating data to allow  
41          the Engineer to evaluate the quotation.  
42  
43          B. On request, provide additional data to support time and cost computations:  
44  
45           1. Labor required.  
46  
47           2. Equipment required.

- 1                   3. Products required.
- 2                    a. Recommended source of purchase and unit cost.
- 3                    b. Quantities required.
- 4                   4. Taxes, insurance, and bonds.
- 5                   5. Credit for work deleted from Contract, similarly documented.
- 6                   6. Overhead and profit.
- 7                   7. Justification for any change in Contract Time.
- 8                   C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a Lump Sum proposal, plus additional information:
- 9                   1. Name of the Owner's authorized agent who ordered the work and date of the order.
- 10                  2. Dates and times work was performed and by whom.
- 11                  3. Time record, summary of hours worked, and hourly rates paid.
- 12                  4. Receipts and invoices for:
- 13                    a. Equipment used, listing dates, and times of use.
- 14                    b. Products used, listing of quantities.
- 15                    c. Subcontracts.

35                 1.06 PREPARATION OF CHANGE ORDERS AND FIELD ORDERS

- 36                  A. Engineer will prepare each Change Order and Field Order.
- 37                  B. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.
- 38                  C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.
- 39                  D. Field Order will describe interpretations or clarifications of Contract Documents, order minor changes in the Work, and/ or memorialize trade-off agreements.

1           E. Field Order work will be accomplished without change in the Contract Sum,  
2           Contract Time, and/or claims for other costs.  
3

4       **1.07 LUMP SUM/FIXED PRICE CHANGE ORDER**  
5

6           A. Engineer initiates the form, including a description of the changes involved and  
7           attachments based upon documents and proposals submitted by Contractor, or  
8           requests from Owner, or both.  
9

10          B. Once Engineer has completed and signed the form, all copies should be sent to  
11           Contractor for review. After review by Contractor, all copies should be sent to  
12           Owner for review. Engineer should make distribution of executed copies.  
13

14       **1.08 UNIT PRICE CHANGE ORDER**  
15

16          A. Content of Change Orders will be based on either:  
17

1. Engineer's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as recommended by Engineer.
3. Survey of complete work.

24          B. The amounts of the unit prices to be:  
25

1. Those stated in the Agreement.
2. Those mutually agreed upon between Owner and Contractor.

30          C. When quantities of each of the items affected by the Change Order can be  
31           determined prior to start of the work:  
32

1. Owner and Engineer will sign and date a Work Directive Change as  
   authorization for Contractor to proceed with the changes.

36          D. When quantities of the items cannot be determined prior to start of the work:  
37

1. Engineer or Owner will issue a Work Directive change directing the  
   Contractor to proceed with the change on the basis of unit prices, and  
   the Engineer will cite the applicable unit prices.
2. Upon completion of the change, the Engineer will determine the cost of  
   such work based on the unit prices and quantities used. Contractor shall  
   submit documentation to establish the number of units of each item and  
   any claims for a change in Contract Time.

3. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
4. Contractor will sign and date the Change Order to indicate their agreement with the terms therein.
5. Owner will then sign the change order.

109 1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION  
110 CHANGE AUTHORIZATION

- A. Engineer and Owner will issue a Work Directive Change directing Contractor to proceed with the changes.
- B. Upon completion of the change, the Contractor shall submit itemized accounting and supporting data.
- C. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.
- D. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
- E. Contractor will sign and date the Change Order to indicate agreement therewith.
- F. Owner will then sign the Change Order.

28 1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- A. Not greater than monthly revise Schedule of Values and Application for Payment forms to record each change as a separate item of work and to record the adjusted Contract Amount.
- B. Not greater than monthly revise the Progress Schedule to reflect each change in Contract Time. Revise sub-schedules to show changes for other items of work affected by the Change Order.
- C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

41 PART 2 – PRODUCTS (NOT USED)

43 PART 3 – EXECUTION (NOT USED)

45 END OF SECTION

1  
2  
3

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CHANGE ORDER PROCEDURES  
01153-6

04/26/2019

1 SECTION 01200  
2

3 MEETINGS AND CONFERENCES  
4

5 PART 1 – GENERAL  
6

7 1.01 PRE-CONSTRUCTION CONFERENCE  
8

- 9       A. In accordance with the Contract Documents, prior to the commencement of  
10      Work, a preconstruction conference shall be held at a mutually agreed time and  
11      place.
- 12       B. The purpose of the conference shall be to designate responsible personnel and  
13      establish a working relationship. Matters requiring coordination shall be  
14      discussed and procedures for handling such matters established. The agenda  
15      shall include as a minimum:
- 16           1. Contractor's Initial Construction Schedule  
17           2. Procedures for Transmittal, Review and Distribution of Shop Drawings  
18           3. Procedures for Submittal and Review of Monthly Applications for  
19           Payment  
20           4. Maintaining As-Built Drawings  
21           5. Critical Work Sequencing and Construction Restrictions  
22           6. Field Decisions and Change Orders  
23           7. Field Office, Storage Areas and Security  
24           8. Equipment and Material Deliveries  
25           9. Safety Meetings and Program  
26           10. Traffic Control Plan  
27           11. Pre-construction Video

- 28       C. The Engineer shall preside at the conference, and shall arrange for preparation  
29      and distribution of the minutes.

30 1.02 PROGRESS MEETINGS  
31

- 32       A. The Owner shall schedule and conduct regular project meetings at least  
33      biweekly and at other times as deemed necessary by the progress of the work.

1           The Contractor and the Engineer shall be represented at each meeting. The  
2           Contractor and/or Engineer may request attendance by representatives of  
3           material Supplier(s) and Subcontractor(s).

- 4
- 5       B. The Engineer shall preside at the conference and shall arrange for keeping the  
6           minutes and distributing them to all persons in attendance. The purpose of the  
7           meetings shall include but not be limited to reviewing the progress of the Work,  
8           maintaining coordination of efforts, discussing changes in scheduling and  
9           resolving problems that may develop; claims review; and future scheduling.

10

11      PART 2 – PRODUCT (NOT USED)

12

13      PART 3 – EXECUTION (NOT USED)

14

15

16           END OF SECTION

1 SECTION 01300  
2

3 SUBMITTALS  
4

5 PART 1 – GENERAL  
6

7 1.01 GENERAL SUBMITTAL REQUIREMENTS  
8

- 9 A. All submittals, regardless of origin, shall be transmitted in the format provided  
10 to the Contractor by the Engineer, certified and signed by the Contractor  
11 indicating the submittal to be correct and in accordance with the Contract  
12 Documents, and noting any special instructions regarding the submittal. Each  
13 submittal shall identify the submittal number in the format required by the  
14 Engineer, with the name and number of this contract, the Contractor's name,  
15 and references to applicable specification paragraphs and Contract Drawings.  
16 Each submittal shall indicate the intended use of the item in the Work. When  
17 catalog pages are submitted, applicable items shall be clearly identified. The  
18 current revision, issue number, and date shall be indicated on all drawings and  
19 descriptive data.
- 20 B. Contractor shall stamp each submittal and said stamp shall be Contractor's  
21 representation to Owner and Engineer that Contractor accepts full responsibility  
22 for determining and verifying all quantities, dimensions, field construction  
23 criteria, materials, catalog numbers, and similar data, and that he has reviewed  
24 or coordinated each submittal with the requirements of the Work and the  
25 Contract Documents.
- 26 C. All deviations from the Contract Documents shall be identified on each submittal  
27 and shall be tabulated in Contractor's letter of transmittal. Such submittals shall  
28 indicate, as pertinent to the deviation, essential details of all changes proposed  
29 by Contractor (including modifications to other facilities that may be a result of  
30 the deviation) and all required piping and wiring diagrams.
- 31 D. Contractor shall accept full responsibility for the completeness of each  
32 submission, and, in the case of a resubmission, shall verify that all exceptions  
33 previously noted by Engineer have been taken into account. In the event that  
34 more than one resubmission is required because of the Contractor's failure to  
35 account for exceptions previously noted, Contractor shall reimburse Owner for  
36 the charges of Engineer for review of the additional resubmissions.
- 37 E. Resubmittals shall be made within seven (7) days of the date of the letter  
38 returning the material to be modified or corrected, unless within seven (7) days  
39 the Contractor submits an acceptable request for an extension of the stipulated  
40 time period, listing the reasons the resubmittal cannot be completed within that  
41 time.
- 42 F. Any need for more than one resubmission, or any other delay in obtaining

1 Engineer's review of submittals, will not entitle Contractor to extension of the  
2 Contract Time unless delay of the Work is directly caused by a change in the  
3 work authorized by a Change Order.

- 4
- 5 G. Contractor's letter of resubmittal shall list the date of his original submittal, the  
6 date of the Engineer's letter returning the submittal, and the dates of submission  
7 and return of any previous resubmittals.
- 8
- 9 H. Engineer's review of drawings and data submitted by Contractor will cover only  
10 general conformity to the drawings and specifications, external connections,  
11 and dimensions which affect the layout. Engineer's review does not indicate a  
12 thorough review of all dimensions, quantities, and details of the material,  
13 equipment, device or item shown. Engineer's review of submittals shall not  
14 relieve Contractor from responsibility for errors, omissions, or deviations, or  
15 responsibility for compliance with the Contract Documents.
- 16
- 17 I. It is intended that submittals be handled electronically whenever possible,  
18 however, when necessary to employ paper copies, five copies of each drawing  
19 and necessary data, plus the number of copies that the Contractor wants  
20 returned, shall be submitted to Engineer. Engineer will not accept submittals  
21 from anyone but Contractor. Submittals shall be consecutively numbered in  
22 direct sequence of submittal and without division by subcontracts or trades.  
23 Resubmittals shall bear the number of the first submittal followed by a letter (A,  
24 B, etc.), to indicate the sequence of the resubmittal. If applicable, the Engineer  
25 will provide the Contractor with an electronic file of the submittal format to be  
26 followed.
- 27
- 28 J. When submittals are returned marked CONFIRM or REJECTED - RESUBMIT,  
29 the corrections shall be made as noted thereon and as instructed by Engineer  
30 and corrected copies shall resubmitted.
- 31
- 32 K. When corrected copies are resubmitted, Contractor shall in writing direct  
33 specific attention to all revisions and shall list separately any revisions made  
34 other than those called for by Engineer on previous submissions.
- 35
- 36 L. When the submittals are returned marked APPROVED, NO EXCEPTIONS  
37 TAKEN or MAKE CORRECTIONS NOTED resubmittal is not required.
- 38

39 1.02 SCHEDULE OF SUBMITTALS

- 40
- 41 A. The Contractor shall prepare and submit for approval a Schedule of Submittals  
42 identifying the date of the initial submission, the beginning of manufacture as  
43 applicable, and the delivery to the site. This Schedule shall be submitted as a  
44 separate submittal and be approved as a prerequisite to the submission of any  
45 other submittal. No other shop drawing or submittal will be reviewed until the  
46 Schedule of Submittals is approved.
- 47

- 1           B. The Schedule of Submittals shall include all submittals specified to be submitted  
2           including shop drawings, schedules, permits, warranties, reports, and other  
3           items specified to be submitted.
- 4           C. The Schedule of Submittals shall show the submittal of each shop drawing  
5           and/or submittal sufficiently in advance of performing the related work or other  
6           applicable activities, or within the time specified in the individual work sections  
7           of the Specifications, so that the installation will not be delayed by processing  
8           times, including disapproval and resubmittal (if required), coordination with other  
9           submittals, testing, purchasing, fabrication, delivery, and similar sequenced  
10          activities.
- 11          D. The Schedule of Submittals shall indicate those submittals that are critical to the  
12          progress schedule. The Schedule shall show other, non-critical shop drawing  
13          submittals spread out over the contract time as required to minimize the number  
14          of concurrent reviews being performed, or as directed by the Engineer. All  
15          equipment testing certifications, certifications of proper installation, warranties,  
16          O&M manuals, spare parts and Owner training materials specified to be  
17          provided shall be submitted in accordance with this specification, and shall  
18          either be submitted with the shop drawing submittal for the equipment, or  
19          submitted separately.
- 20          E. The Contractor shall so develop the Schedule of Submittals such that ***the total***  
21          ***number of submittals does not exceed one hundred and twenty (120) for***  
22          ***the headworks, grit removal, primary treatment, and equalization basin***  
23          ***portion of the project.*** In developing the Schedule of Submittals, the  
24          Contractor shall identify separate submittals for:
- 25           1. Each item of equipment specified in Divisions 11 through 16.  
26           2. Each pipe material of construction (ductile iron, steel, PVC, HDPE, etc.).  
27           3. Demolition Plan per Section 02050.  
28           4. Construction Phasing Plan per Section 01016.  
29           5. Temporary Bypass Pump and Piping Plan per Section 13567.  
30           6. Construction and start-up schedules.  
31           7. Field testing and equipment start-up reports specified to be performed and  
32           prepared by equipment suppliers.  
33           8. Miscellaneous submittals such as the Construction Phasing Plan, Demolition  
34           / Alteration Plan, and Start-Up Plan as specified throughout the  
35           specifications.

36          In developing the Schedule of Submittals, the Contractor may identify a single  
37          submittal for a given Division, such as Division 5 Miscellaneous Metals, or a  
38          given Section, such as 15100 Valves, incorporating all items into a single  
39          submittal. However, no submittal shall include items from two (or more)  
40          different Divisions.

41          In developing the Schedule of Submittals, the Contractor may identify

1 equipment-related submittals for warranties, spare parts, O&M manuals, and  
2 training plans separately, or with the specific equipment submittal, or in groups  
3 of common items (i.e., O&M manuals, warranties, etc.).  
4

5 As specified elsewhere, the Contractor will be required to submit certificates of  
6 proper installation, sign-in sheets for equipment/systems training sessions,  
7 and proof of delivery receipts for O&M manuals and spare parts, however,  
8 such submittals will not count against the total number of submittals specified  
9 above. Similarly, monthly schedule and narrative updates that are submitted  
10 with Applications for Payment will not count against the total number of  
11 submittals specified above.  
12

- 13 F. In accordance with Section IIIA, the Contractor shall reimburse the Owner for  
14 Engineer's cost to review excess submittals and re-submittals and/or  
15 confirmations.

16 1.03 CONSTRUCTION SCHEDULE  
17

- 18 A. Before Work is started, Contractor shall submit to Engineer for review a  
19 schedule of the proposed construction operations. The construction schedule  
20 shall indicate the sequence of the Work, the time of starting and completion of  
21 each part, the installation date for each major item of equipment, and the time  
22 for making connections to existing piping, structures, or facilities. The  
23 construction schedule shall include the Construction Phasing Plan and  
24 Demolition submittals as specified in Sections 01016 and Technical Section  
25 IVC, Specification 02050, and other requirements specified in Section IVC.  
26
- 27 B. The schedule shall be revised At least every 30 days or as necessary to reflect  
28 changes in the progress of the Work.  
29
- 30 C. Owner may require Contractor to add to his equipment, or construction forces,  
31 as well as increase the working hours, if operations fall behind schedule at any  
32 time during the construction period.  
33

34 1.04 PROGRESS REPORTS  
35

- 36 A. A progress report shall be furnished to Engineer with each application for  
37 progress payment. If the Work falls behind schedule, Contractor shall submit  
38 additional progress reports at such intervals as Engineer may request.  
39
- 40 B. Each progress report shall include sufficient narrative to describe current and  
41 anticipated delaying factors, their effect on the construction schedule, and  
42 proposed corrective actions. Any Work reported complete, but which is not  
43 readily apparent to Engineer, must be substantiated with satisfactory evidence.  
44
- 45 C. Each progress report shall also include three (3) prints of the accepted graphic  
46 schedule marked to indicate actual progress.  
47

1

2   1.05 SCHEDULE OF VALUES

3

- 4           A. The Contractor shall submit to the Engineer for review a Schedule of Values  
5           after review of the tentative schedule and before submission of the first  
6           application for payment. The schedule of values, showing the value of each  
7           major unit of work, significant pieces of mechanical and rotating equipment, and  
8           significant electrical and instrumentation components in sufficient detail as  
9           requested by the Engineer, shall be acceptable to the Engineer before any  
10          application for payment is prepared or approved.
- 11
- 12           B. The sum of the items listed in the Schedule of Values shall equal the Contract  
13          Price. Such items as Bond premium, temporary construction facilities, may be  
14          listed separately in the schedule of values, provided the amounts can be  
15          substantiated. Overhead and profit shall not be listed as separate items. The  
16          Schedule of Values shall contain at a minimum a complete listing of the various  
17          project milestones that are "critical path" items according to the approved  
18          construction schedule.
- 19
- 20           C. In addition to those items listed in Paragraph B, the O&M manuals, as-built  
21          drawings, start-up, training, warranty, and any other individualized component  
22          that the Contractor or Engineer wants separately itemized for payment shall also  
23          be included on the Schedule of Values.
- 24
- 25           D. An unbalanced Schedule of Values providing for overpayment of Contractor on  
26          items of Work that would be performed first will not be accepted. The Schedule  
27          of Values shall be revised and resubmitted until acceptable to Engineer. Final  
28          acceptance by Engineer shall indicate only consent to the Schedule of Values  
29          as a basis for preparation of applications for progress payments and shall not  
30          constitute an agreement as to the value of each indicated item.

31

32   1.06 SCHEDULE OF PAYMENTS

33

- 34           A. Within thirty (30) days after Notice to Proceed, the Contractor shall furnish to  
35          the Engineer a schedule of estimated monthly payments. The schedule shall  
36          be revised and resubmitted each time an application for payment varies more  
37          than 10 percent from the estimated payment schedule.

38

39   1.07 SURVEY DATA

40

- 41           A. All field books, notes, and other data developed by Contractor in performing  
42          surveys required as part of the Work shall be available to Engineer for  
43          examination throughout the construction period. All such data shall be  
44          submitted to Engineer with the other documentation required for final  
45          acceptance of the Work.

46

47   1.08 SHOP DRAWING SUBMITTALS, WORKING DRAWINGS AND ENGINEERING

SUBMITTALS

01300-5

03/20/2020

1           DATA

- 2
- 3       A. Shop drawings, working drawings, and engineering data shall be included in the
- 4           Schedule of Submittals identifying the dates for the initial submission of shop
- 5           and working drawings, the beginning of manufacture, testing and installation of
- 6           materials, supplies and equipment.
- 7
- 8       B. The Schedule of Submittals shall show the submittal of each shop drawing
- 9           sufficiently in advance of performing the related work or other applicable activities,
- 10          or within the time specified in the individual work sections of the
- 11          Specifications, so that the installation will not be delayed by processing times
- 12          including re-review and resubmittal (if required), coordination with other
- 13          submittals, testing, purchasing, fabrication, delivery, and similar sequenced
- 14          activities.
- 15
- 16       C. The Schedule of Submittals shall indicate those submittals that are critical to the
- 17          progress schedule and shall show other shop drawing submittals spread out
- 18          over the contract time as required to minimize the number of concurrent reviews
- 19          or as directed by the Engineer.
- 20
- 21       D. Engineering data covering all equipment and fabricated materials that will
- 22          become a permanent part of the Work shall be submitted to Engineer, for
- 23          review. These data shall include drawings and descriptive information in
- 24          sufficient detail to show the kind, size, arrangement, and operation of
- 25          component materials and devices; the external connections, anchorages, and
- 26          supports required; performance characteristics; and dimensions needed for
- 27          installation and correlation with other materials and equipment.
- 28

29       1.09 OPERATION AND MAINTENANCE DATA

- 30
- 31       A. Operation and maintenance data submittals are specified in Section 01730.

32

33       1.10 LAYOUT DATA

- 34
- 35       A. Contractor shall keep neat and legible notes of measurements and calculations
- 36          made by him in connection with the layout of the Work. Copies of such data
- 37          shall be furnished to the Engineer for use in checking
- 38
- 39       B. Contractor's layout as provided under Lines and Grades. All such data
- 40          considered of value to Owner will be transmitted to Owner by Engineer with
- 41          other records upon completion of the Work.

42

43       1.11 SUBMITTALS FOR COLOR SELECTION

- 44
- 45       A. The following is a list of items that must be submitted together for color selection.
- 46          No single item on this list will be approved without the submittal of all other
- 47          items.

1. Paint for piping, valves, valve box covers, meter box covers, etc.
  2. Paint for equipment.
  3. Additional submittal requirements as indicated in Section IV.B Specification 09900, Painting and Coating.

## 1.12 HEALTH AND SAFETY PLAN

- A. The Contractor shall submit a written job specific Health and Safety Plan prior to beginning work on the site. The Health and Safety Plan shall have the following written components at minimum:

  - Project Specific Team Members and Contact Information
  - Health, Safety and Environmental Policy Statement
  - Location, Phone Numbers and Maps with Directions to the 4 nearest Urgent Care Centers and Hospitals
  - First Aid, Medical Response, and Transportation Procedures with Delegated Responsibilities
  - Personal Protection Equipment Policies and Procedures

## PART 2 – PRODUCT (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

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1 SECTION 01310  
2

3 CONSTRUCTION SCHEDULES  
4

5  
6 PART 1 – GENERAL  
7

8 1.01 GENERAL  
9

- 10 A. Construction under this contract must be coordinated to assure that construction  
11 is completed within the time allowed by the Contract Documents. The Contractor  
12 will also coordinate his activities with the other contractors to allow orderly and  
13 timely completion of all the work.  
14
- 15 B. All construction schedules shall be of the critical path method, bar chart type, and  
16 shall be prepared using MS Project, SURETRACK, PRIMAVERA P6, or equal.  
17
- 18 C. The Contractor is advised that the construction schedule must reflect that no new  
19 or existing major pieces of treatment equipment or systems may be shut down or  
20 started up within one week prior to the toxicity screening and compliance testing  
21 events on the Owner's TRE Schedule. Compliance with this requirement shall at  
22 all times be subject to the Owner's approval.  
23

24 1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS  
25

- 26 A. Within 15 calendar days after the issuance of the Notice of Award, the Contractor  
27 shall prepare and submit to the Engineer a preliminary construction progress  
28 schedule. The schedule shall contain a sufficient number of tasks such that no  
29 single task has a value that exceeds 2.0% of the total Contract Price. Partial  
30 payments will not be approved until an acceptable construction progress schedule  
31 has been accepted by the Engineer.  
32
- 33 B. The schedule shall be updated monthly reflecting the baseline schedule and the  
34 Contractor's progress on each activity. No progress payment will be approved  
35 until the updated schedule is submitted and accepted by the Engineer.  
36
- 37 C. Night work may be established by the Contractor as regular procedure only with  
38 the prior written permission of the Owner. Such permission, however, may be  
39 revoked at any time by the Owner if the Contractor fails to maintain adequate  
40 equipment and supervision for the proper execution and control of the work at  
41 night.  
42
- 43 D. The Contractor shall designate an authorized representative who shall be  
44 responsible for development and maintenance of the schedule and of progress  
45 and payment reports. This representative of the Contractor shall have direct  
46 project control and complete authority to act on behalf of the Contractor in fulfilling  
47 the commitments of the Contractor's schedule.

1  
2   1.03 PROGRESS OF THE WORK  
3

- 4           A. The work shall be executed with such progress as may be required to prevent any  
5           delay to the general completion of the work. The work shall be executed at such  
6           times and in or on such parts of the project, and with such forces, materials and  
7           equipment to assure completion of the work in the time established by the  
8           Contract.  
9
- 10          B. If the Contractor, for his convenience and at his own expense, should desire to  
11          carry on his work at night or outside regular hours, he shall submit written notice  
12          to the Engineer and he shall allow ample time for satisfactory arrangements to be  
13          made for inspecting the work in progress. The Contractor shall reimburse the  
14          Owner for extra inspection required for work outside regular hours. The Contractor  
15          shall light the different parts of the project as required to comply with all applicable  
16          Federal and State regulations and with all applicable requirements of the  
17          municipality in which the work is being done.

18  
19   PART 2 – PROGRESS SCHEDULE SUBMITTALS  
20

21   2.01 GENERAL REQUIREMENTS  
22

- 23           A. As required within the General Conditions, the Contractor shall submit a critical  
24           path progress schedule as described herein. The schedule shall take into  
25           considerations all work phasing and restrictions as specified elsewhere in the  
26           Contract Documents. The schedule shall show no work taking place on any locally  
27           recognized holiday.  
28
- 29           B. The critical path progress schedule requirement shall consist of a detailed  
30           schedule, monthly status reports (Monthly Reports), a start-up schedule, and  
31           revisions to the schedules and analyses as described. The planning, scheduling,  
32           management and execution of the work are the sole responsibilities of the  
33           Contractor. The progress schedule shall allow the Engineer to review Contractor's  
34           planning, scheduling, management and execution of the work; to assist Engineer  
35           in evaluating work progress and make progress payments; to allow other  
36           contractors to cooperate and coordinate their activities with those of the  
37           Contractor; and to provide Owner with information about "construction schedule"  
38           and "cumulative outlay schedule."  
39
- 40           C. Engineer's review of the schedule submittals shall not relieve Contractor from the  
41           responsibility for any deviations from the Contract Documents unless Contractor  
42           has in writing called Engineer's attention to such deviations at the time of  
43           submission and Engineer has given written concurrence to the specific deviations,  
44           nor shall any concurrence by Engineer relieve Contractor from responsibility for  
45           errors and omissions in the submittals.  
46

- 1           D. Float or slack time is not for the exclusive benefit of the Owner, the Engineer or  
2           the Contractor. Extensions of time for performance, as specified in the General  
3           and Supplementary Conditions, will be granted only to the extent that equitable  
4           time adjustments for the network activity, or activities affected, exceed the total  
5           float or slack time along the affected network paths, as shown in the precedence  
6           diagram and report in effect at the instant of either (a) a notice to proceed with a  
7           change, or (b) a notice of suspension of work or possession, or (c) detection of a  
8           subsequently acknowledged differing site condition, or (d) occurrence of cause for  
9           an excusable delay. Further, use of float time in the schedule, or the allocation of  
10          float time to activities by means of special logic restraints or imposed dates, shall  
11          be shared to the benefit of Owner, Engineer, Contractor, and his subcontractors  
12          and suppliers in proportion of their scope of responsibilities. Excessive use of float  
13          time to the detriment of succeeding activities may be cause for denying an  
14          extension of time if it can be demonstrated that the float along the network paths  
15          affected at the instant of the delaying condition would have been larger than the  
16          delay had it not been for the excessive and unreasonable float usage in violation  
17          of the sharing concept required by this Specification.
- 18           E. Engineer's review of the schedule submittals shall be only for conformance with  
19           the information given in the Contract Documents and shall not extend to the  
20           means, methods, sequences and techniques or procedures of construction or to  
21           safety precautions or programs incident thereto. Engineer's review of the  
22           schedule submittals will be predicated on a Contractor's stamp of approval signed  
23           off by Contractor. Contractor's stamp of approval on any schedule submittals shall  
24           constitute a representation to Owner and Engineer that Contractor, has either  
25           determined or verified all data on the submittal, or assumes full responsibility for  
26           doing so, and that Contractor and his subcontractors and suppliers have reviewed  
27           and coordinated the sequences shown in the submittal with the requirements of  
28           the work under the Contract Documents.

30           **2.02 SUPPLEMENTARY REQUIREMENTS**

- 31           A. Graphic network diagrams shall be on a time-scaled precedence network format.  
32           The graphic network diagram shall include the following format:
- 33           1. Description of each activity, or restraint, shall be brief but convey the scope  
34           of work described.
- 35           2. Activities shall identify all items of work that must be accomplished to  
36           achieve Substantial Completion, or any interim substantial completion,  
37           such as the major disciplines of work; items pertaining to the approval of  
38           regulatory agencies; contractor's time required for submittals, fabrication  
39           and deliveries; the time required by Engineer to review all submittals as set  
40           forth in the Contract Documents; items of work required of Owner to  
41           support pre-operational and start-up testing; time required for the relocation  
42           of utilities. Activities shall also identify interface milestones with the work  
43           of other contract work under separate contracts with Owner.

1  
2       3. Any activities not shown on the graphic network diagram shall be  
3       4. considered to have no effect on the Contractor's ability to achieve  
4       5. Substantial Completion, or any interim substantial completion, within the  
5       6. Contract Time. Any delays to activities that do not appear in the concurred  
6       7. detailed schedule shall give rise only to non-prejudicial delays. Attempts  
7       8. to impose after-the-fact logic constraints where none existed previously to  
8       9. justify time extensions will not be permitted.  
9

10      4. Activity durations shall be in whole working days.  
11

12      5. Graphic diagrams shall be time-scaled and sequenced by work areas. The  
13       Diagram of Activities shall show numerical values for total float and be  
14       shown on their early schedules. The diagram shall be neat and legible and  
15       submitted on sheets no larger than 24 inches by 36 inches on a medium  
16       suitable for reproduction.  
17

18      B. Printout reports shall contain the following data for each activity or restraint:  
19

20       1. Activity identification, activity description, activity duration, activity  
21       man-days, computed or specified early start date, computed early finish  
22       date, computed late start date, computed or specified late finish date, and  
23       total float and free float.  
24

25       2. Separate reports shall be provided, including all activities and restraints,  
26       and shall be submitted monthly as follows:  
27

- 28           a. Activity, sort by early start dates in order of ascending numbers.  
29           b. Activity, sort by area/facility.  
30           c. Float report, in order of ascending total float values.  
31           d. Successor/predecessor report.  
32

### 33 PART 3 – EXECUTION 34

#### 35 3.01 DETAILED SCHEDULE SUBMITTAL 36

37      A. Submittal shall include a time-scaled graphic diagram showing all Contract  
38       activities, computer printout reports, and a supporting narrative. The initial  
39       Detailed Schedule submittal shall be delivered within 10 calendar days after the  
40       Notice to Proceed and shall use the Notice to Proceed as the "data date". Upon  
41       receipt of Engineer's comments, Contractor shall meet with Engineer and discuss  
42       an appraisal and evaluation of the proposed work plan. Necessary revisions  
43       resulting from this review shall be made by Contractor and the detailed schedule  
44       resubmitted within 15 calendar days after the meeting. The re-submittal, if agreed  
45       to by the Owner, and unless subsequently changed with the concurrence of or at  
46       the direction of Owner, shall be the work plan to be used by the Contractor for  
47       planning, scheduling, managing and executing the work. If Contractor fails to

1 provide an acceptable Detailed Schedule submittal, he will be deemed not to have  
2 provided a basis upon which progress may be evaluated, which will further  
3 constitute reasons for refusing to recommend payment.

- 4
- 5     B. The graphic diagram shall be formatted in accordance with Article 2.02(A) above.  
6         The diagram shall include all detailed activities grouped by major areas of work.  
7         The critical path activities shall be identified, including critical paths for interim  
8         dates, if applicable, by clearly highlighting the path on the graphics diagram.
- 9
- 10     C. This submittal shall include five copies of the graphic diagram, the printout reports  
11         and the narrative, in accordance with Article 2.02 of these scheduling  
12         requirements.
- 13
- 14     D. The narrative shall include sufficient data to explain the basis of Contractor's  
15         determination of durations, describe the contract conditions and restraints  
16         incorporated into the schedule, and provide a "what-if" analysis pertaining to  
17         potential problems and practical steps to mitigate them. Should Engineer require  
18         additional data, this information shall be supplied by Contractor within ten calendar  
19         days.
- 20
- 21     E. Once approved, the Detailed Schedule shall be set as the baseline for the project,  
22         which shall not be changed without the Owner's and Engineer's approval.
- 23

24     3.02 MONTHLY STATUS REPORTS

25

- 26     A. Beginning with the first month, and every month thereafter, Contractor shall submit  
27         to Engineer, with each Application for Payment, a Monthly Status Report (based  
28         on the Detailed Schedule) with data as of the last day of the pay period. The  
29         monthly Status Report shall include a revised copy of the currently accepted  
30         graphic diagram, computer printouts and a narrative. The Monthly Status Report  
31         will be reviewed by the Engineer. The Contractor shall address the Engineer's  
32         comments in the subsequent Monthly Status Report. If Contractor fails to provide  
33         acceptable Monthly Status Reports, he will be deemed not to have provided a  
34         basis upon which progress may be evaluated, which will be reason for refusing to  
35         recommend progress payments.
- 36
- 37     B. The revised diagram shall show, for the currently accepted detailed diagram,  
38         percentages of completion for all activities, actual start and finish dates, and  
39         remaining durations, as appropriate. Activities not previously included in the  
40         currently accepted detailed schedule shall be added, except that contractual dates  
41         will not be changed except by Change Order. Review of a revised diagram by the  
42         Engineer will not be construed to constitute concurrence with the time frames,  
43         duration, or sequencing for such added activities; instead the corresponding data  
44         as ultimately incorporated into an appropriate change order shall govern.
- 45
- 46     C. The narrative shall include the information shown in the following outline in a  
47         narrative form:

- 1           1. Construction progress (refer to activity number in the Detailed Schedule) including:
- 2               a. Activities completed this reporting period;
- 3               b. Activities in progress this reporting period;
- 4               c. Activities scheduled to commence next reporting period.
- 5           2. Description of problem areas.
- 6           3. Current and anticipated delays, including:
- 7               a. Cause of the delay;
- 8               b. Corrective action and schedule adjustments to correct the delay;
- 9               c. Impact of the delay on other activities, on milestones, and on completion dates.
- 10          4. Changes in construction sequence.
- 11          5. Pending items and status thereof, including:
- 12               a. Permits;
- 13               b. Change Orders;
- 14               c. Time extensions;
- 15               d. Other.
- 16          6. Contract completion date status
- 17               a. Ahead of schedule and number of days;
- 18               b. Behind schedule and number of days.

32      3.03 REVISIONS

- 33      A. All revised Detailed Schedule submittals shall be in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the submittal may be reviewed at monthly meetings. Changes to activities having adequate float shall be considered a minor change.
- 34      B. A revised detailed work plan submittal shall be submitted for review, when required by Engineer, for one of the following reasons:
- 35           1. Owner or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.

1           2. Contractor elects to change any sequence of activities in order to affect a  
2           critical path of the currently accepted detailed schedule documents.

3  
4           C. If, prior to agreement on an equitable adjustment to the Contract Time, Engineer  
5           requires revisions to the Detailed Schedule in order to evaluate planned progress,  
6           Contractor shall provide an interim revised submittal for review with change  
7           effect(s) incorporated as directed. Interim revisions to the documents will be  
8           incorporated during the first subsequent Monthly Status Report.

9

#### 10       3.04 START-UP SCHEDULE SUBMITTALS

11

- 12       A. At least 90 calendar days prior to the date of Substantial Completion, Contractor  
13           shall submit a Start-Up Schedule with a time-scaled (days after notice to proceed)  
14           graphic diagram detailing the work to take place in the period between 60 days  
15           prior to Substantial Completion, together with a supporting narrative. The Start-  
16           Up Schedule shall be identified on the Detailed Schedule. Engineer shall respond  
17           within 10 calendar days after receipt of the submittal. Upon receipt of Engineer's  
18           comments, Contractor shall make the necessary revisions and submit the revised  
19           schedule within ten calendar days. If Contractor fails to provide acceptable  
20           Start-up Schedule submittals, he will be deemed not to have provided a basis  
21           upon which progress may be evaluated, which will be reason for refusing to  
22           recommend payment.
- 23
- 24       B. The Start-up Schedule may not be combined with the Detailed Schedule. The  
25           Start-up Schedule is intended to show much greater detail than the Detailed  
26           Schedule for start-up activities. Typical information required includes, but is not  
27           limited to, the timing of vendor representatives site visits, pre-op testing, individual  
28           equipment start-ups, Owner's training, and performance certification testing.
- 29
- 30       C. The graphic diagram shall use the currently accepted Detailed Schedule for those  
31           activities completed ahead of the last 60 calendar days prior to Substantial  
32           Completion, and detailed activities for the remaining 60-day period within the time  
33           frames outlined in the currently accepted Detailed Schedule.
- 34
- 35       D. Contractor will be required to continue the requirement for monthly reports, as  
36           outlined in Articles 3.03 and 3.04 above. In preparing these reports, Contractor  
37           must assure that the Detailed Schedule is consistent with the progress noted in  
38           the Start-up Schedule.
- 39
- 40       E. In addition, Contractor will be required to submit a revised copy of the start-up  
41           graphic diagram on a monthly basis with a start-up narrative. This revised diagram  
42           shall highlight percentages of completion, actual start and finish dates, and  
43           remaining durations as applicable. Activities not previously included in the  
44           accepted detailed work plan shall be added in these submittals, except that  
45           contractual dates shall not be changed except by Change Order. Reviews of  
46           these submittals by Engineer will not be construed to constitute concurrence with  
47           the time frames, durations or sequence of work for each added activity.

### **3.05 CONSTRUCTION PERIOD**

A. Whenever it becomes apparent from the current monthly progress evaluation and updated schedule data that any milestone and/or Contract completion date will not be met, the Contractor shall take appropriate action to bring the work back on schedule. Actions could include:

1. Increase construction manpower in such quantities and crafts as to substantially eliminate the backlog of work;
  2. Increase the number of working hours per shift, shifts per work day, work days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work; and
  3. Reschedule work items to achieve concurrency of accomplishment.

The addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the current Detailed Schedule shall be at the Contractor's own cost and shall not be considered justification for a Change Order or treated as an acceleration order.

END SECTION

1 SECTION 01340  
2

3 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9       A. The Contractor shall submit to the Engineer for review such working drawings,  
10      shop drawings, test reports and data on materials and equipment (hereinafter  
11     in this Section called data), and material samples (hereinafter in this Section  
12     called samples) as are required for the proper control of work, including but not  
13     limited to those working drawings, shop drawings, data and samples for  
14     materials and equipment specified elsewhere in the Specifications and in the  
15     Contract Drawings.  
16
- 17       B. The Contractor shall note that there are specific submittal requirements in other  
18     sections of these Specifications, including the requirement to submit and have  
19     reviewed a Schedule of Shop Drawing Submittals prior to the submittal of any  
20     other shop drawing, as described in Section 01300.

21 1.02 SHOP DRAWINGS  
22

- 23       A. When used in the Contract Documents, the term "shop drawings" shall be  
24     considered to mean Contractor's Drawings for material and equipment that will  
25     become an integral part of the Project. These drawings shall be complete and  
26     detailed. Shop drawings shall consist of fabrication, erection and setting  
27     drawings and schedule drawings, manufacturer's scale drawings, bills of  
28     material, wiring and control diagrams, and inspection and test reports including  
29     performance curves and certifications as applicable to the Work.  
30
- 31       B. All details on shop drawings submitted for review shall show clearly the  
32     elevations of the various parts to the main members and lines of the structure  
33     and/or equipment, and where correct fabrication of the work depends upon field  
34     measurements, such measurements shall be made and noted on the shop  
35     drawings before being submitted for review.  
36

37 1.03 PRODUCT DATA  
38

- 39       A. Product data as specified in individual sections, include, but are not necessarily  
40     limited to, standard prepared data for manufactured products (sometimes  
41     referred to as catalog data), such as the manufacturers product specification  
42     and installation instructions, availability of colors and patterns, manufacturer's  
43     printed statements of compliances and applicability, roughing-in diagrams and  
44     templates, catalog cuts, product photographs, standard wiring diagrams, printed  
45     performance curves and operational-range diagrams, production or quality  
46     control inspection and test reports and certifications, mill reports, product  
47

1 operating and maintenance instructions and recommended spare-parts listing  
2 storage instructions, and printed product warranties, as applicable to the work.  
3

4 **1.04 WORKING DRAWINGS**

- 5
- 6 A. When used in the Contract Documents, the term "working drawings" shall be  
7 considered to mean the Contractor's Drawings for temporary structures such as  
8 temporary bulkheads, support of open cut excavation, support of utilities,  
9 ground water control systems, forming and falsework; for underpinning; and for  
10 such other work as may be required for construction but does not become an  
11 integral part of the Project.
- 12
- 13 B. Working drawings shall be signed and sealed by a registered Professional  
14 Engineer, currently licensed to practice in the State and shall convey, or be  
15 accompanied by, calculations or other sufficient information to completely  
16 explain the structure, machine, or system described and its intended manner of  
17 use. Prior to commencing such work, working drawings must have been  
18 reviewed without specific exceptions by the Engineer. Such review will be for  
19 general conformance and will not relieve the Contractor in any way from his  
20 responsibility with regard to the fulfillment of the terms of the Contract. All risks  
21 of error are assumed by the Contractor. The Owner and Engineer shall have  
22 no responsibility for errors on the working drawings or the finished work.
- 23

24 **1.05 SAMPLES**

- 25
- 26 A. The Contractor shall furnish, for review of the Engineer, samples required by  
27 the Contract Documents or requested by the Engineer. Samples shall be  
28 delivered to the Engineer as specified or directed and in quantities and sizes as  
29 specified. A minimum of two samples of each item shall be submitted unless  
30 otherwise specified. The Contractor shall prepay all shipping charges on  
31 samples. Materials or equipment for which samples are required shall not be  
32 used in work until reviewed by the Engineer.
- 33
- 34 B. Samples specified in individual sections, include, but are not necessarily limited  
35 to, physical examples of the work such as sections of manufactured or  
36 fabricated work, small cuts or containers of materials, complete units of  
37 repetitively-used products, color/textured/pattern swatches and range sets,  
38 specimens for coordination of visual effect, graphic symbols, and units of work  
39 to be used by the Engineer or Owner for independent inspection and testing, as  
40 applicable to the Work.
- 41
- 42 C. The Contractor shall prepare a transmittal letter for each shipment of sample,  
43 shall enclose a copy of this letter with the shipment, and shall send a copy of  
44 this letter to the Engineer. Review of a sample shall be only for the characteris-  
45 tics or use named in such review and shall not be construed to change or modify  
46 any Contract requirements.
- 47

1      1.06 SUBMITTAL REQUIREMENTS

- 2
- 3      A.     The Contractor shall review, approve, and submit, with reasonable promptness  
4            and in such sequence, so as to cause no delay in the Contract Work or in the  
5            Work of the Owner or any separate contractor, all shop drawings, product data,  
6            working drawings and samples required by the Contract Documents.
- 7
- 8      B.     It is intended that all shop drawing be submitted electronically by email,  
9            however, when electronic submittals cannot be made, the Contractor shall  
10            submit to the Engineer five (5) copies of the shop drawing, plus the number of  
11            copies he wants returned. The Engineer will review the submittal and  
12            electronically return to the Contractor appropriate review comments and/or  
13            marked-up copies of the shop drawings if applicable.
- 14
- 15     C.     Shop drawings, product data, working drawings and samples shall be  
16            transmitted using a form provided by the Engineer and furnished with the  
17            following information:
- 18
- 19        1.     Number and title of the drawing.
- 20
- 21        2.     Date of drawing or revision.
- 22
- 23        3.     Name of project building, facility or system.
- 24
- 25        4.     Name of contractor, subcontractor, and manufacturer submitting  
26            drawing.
- 27
- 28        5.     Clear identification of contents, location of the work, and the sheet  
29            numbers where the product is found in the contract drawings.
- 30
- 31        6.     Contractor Certification Statement.
- 32
- 33        7.     Submittal Identification Number.
- 34
- 35        8.     Contract Drawing Number Reference.
- 36
- 37        9.     Statement indicating any deviations from the Contract Documents.
- 38
- 39     D.     All items specified are not necessarily intended to be a manufacturer's standard  
40            product. Variations from specified items will be considered on an "or equal"  
41            basis. If submittals show variations from Contract requirements because of  
42            standard shop practice or for other reasons, the Contractor shall describe such  
43            variations in his letter of transmittal and on the shop drawings along with  
44            notification of his intent to seek contract adjustment. If acceptable, proper  
45            adjustment in the Contract shall be implemented where appropriate. If the  
46            Contractor fails to describe such variations he shall not be relieved of the  
47            responsibility for executing the work in accordance with the Contract, even

1           though such drawings have been reviewed. Variations submitted but not  
2           described may be cause for rejection. Any variations initiated by the Contractor  
3           will not be considered as an addition to the scope of work unless specifically  
4           noted and then accepted as such in writing by the Engineer.  
5

- 6           E. Data on materials and equipment shall include materials and equipment lists  
7           giving, for each item thereon, the name and location of the supplier or  
8           manufacturer, trade name, catalog reference, material, size, finish and all other  
9           pertinent data.  
10          F. For all mechanical and electrical equipment, the Contractor shall provide a  
11           single list that includes the equipment name, and address and telephone  
12           number of the manufacturer's representative and service company, so that  
13           service and/or spare parts can be readily obtained. In addition, a maintenance  
14           and lubrication schedule for each piece of equipment shall be submitted as  
15           specified in Section 01730.  
16          G. The Contractor shall use the color "green" to make his remarks on the  
17           Submittals. Only the Engineer will utilize the color "red" in marking submittals.  
18

21        1.07 CONTRACTOR'S RESPONSIBILITY  
22

- 23          A. It is the duty of the Contractor to check, and coordinate with the work of all  
24           trades, all drawings, data, schedules and samples prepared by or for him before  
25           submitting them to the Engineer for review. Each copy of every drawing or data  
26           sheet 11"x17" and larger shall bear Contractor's stamp showing that they have  
27           been so checked and approved. Drawings or data sheets 11"x17" and smaller  
28           shall be bound together in an orderly fashion and bear the Contractor's stamp  
29           on the cover sheet. The cover sheet shall fully describe the packaged data and  
30           include a list of all sheet numbers within the package. Shop drawings submitted  
31           to the Engineer without the Contractor's stamp will be returned to the Contractor,  
32           without review at the Engineer's option.  
33
- 34          B. The Contractor shall review shop drawings, product data, and samples prior to  
35           submission to determine and verify the following:  
36
- 37           1. Field measurements.
  - 38           2. Field construction criteria.
  - 39           3. Manufacturer's catalog numbers and similar data.
  - 40           4. Conformance with Specifications.
- 41          C. Shop drawings shall indicate any deviations in the submittal from the  
42           requirements of the Contract Documents.  
43

- 1           D. No extension of time will be authorized because of the Contractor's failure to  
2           transmit complete and acceptable submittals sufficiently in advance of the Work.  
3
- 4           E. The Contractor shall not begin any work affected by a submittal that is returned  
5           indicating: "Confirm", "Amend and Resubmit", or "Rejected- Resubmit". Before  
6           starting this work, all revisions must be corrected by the Contractor. After  
7           resubmittal they will be reviewed and returned by the Engineer. If returned  
8           marked, "No Exceptions Taken" or "Make Corrections Noted", the Contractor  
9           may begin this work. Any corrections made to these shop drawings shall be  
10          followed without exception.
- 11
- 12          F. The Contractor shall submit to the Engineer all shop drawings and data  
13          sufficiently in advance of construction requirements to provide not less than  
14          twenty-one (21) calendar days for Engineer's review from the time the Engineer  
15          receives them.
- 16
- 17          G. The Contractor shall be responsible for and bear all cost that may result from  
18          the ordering of any material or from proceeding with any part of work prior to  
19          review by the Engineer of the necessary shop drawings.
- 20
- 21          H. All shop drawings, product data, working drawings and samples submitted by  
22          subcontractors for review shall be sent directly to the Contractor for checking.  
23          The Contractor shall be responsible for their submission according to the shop  
24          drawing schedule in order to prevent delays in delivery of materials and project  
25          completion.
- 26
- 27          I. The Contractor shall check all subcontractor's shop drawings, product data,  
28          working drawings and samples regarding measurements, size of members,  
29          materials, and details to satisfy him that they are in conformance to the Contract  
30          Documents. Shop drawings found to be inaccurate or otherwise in error shall  
31          be returned to the subcontractors for correction before submission to the  
32          Engineer.

33

34        **1.08 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING  
35           DRAWINGS AND SAMPLES**

36

- 37          A. The Engineer's review is for general conformance with the design concept and  
38          contract drawings. Markings or comments shall not be construed as relieving  
39          the Contractor from compliance with the Contract Drawings and Specifications  
40          or departures thereof. The Contractor remains responsible for details and  
41          accuracy, for coordinating the work with all other associated work and trades,  
42          for selecting fabrication processes, for techniques of assembly, and for  
43          performing work in a safe manner.
- 44
- 45          B. The review of shop drawings, data, and samples will be general. The review  
46          shall not be construed as:
- 47

- 1        1. Permitting any departure from the Contract requirements;
- 2
- 3        2. Relieving the Contractor of responsibility for any errors, including details,
- 4                  dimensions, and materials;
- 5
- 6        3. Approving departures from details furnished by the Engineer, except as
- 7                  otherwise provided herein.
- 8
- 9        C. If the shop drawings, data or samples as submitted describe variations and
- 10                 show a departure from the Contract Documents, which Engineer finds to be in
- 11                 the interest of the Owner and to be so minor as not to involve a change in
- 12                 Contract Price or Time, the Engineer may return the reviewed drawings without
- 13                 noting an exception.
- 14
- 15        D. Submittals pertaining to the Headworks and Equalization Basin components will
- 16                 be returned to the Contractor under one of the following:
- 17
- 18                 "NO EXCEPTIONS TAKEN" is assigned when there are no notations or
- 19                 comments on the submittal. When returned under this code the Contractor may
- 20                 release the equipment and/or material for manufacture.
- 21
- 22                 "MAKE CORRECTIONS NOTED" is assigned when notations or comments
- 23                 have been made on the submittal pointing out minor discrepancies as compared
- 24                 with the Contract Documents. Resubmittal or confirmation is not necessary
- 25                 prior to release for manufacturing.
- 26
- 27                 "EXCEPTIONS AS NOTED" or "CONFIRM" is assigned when a confirmation of
- 28                 the notations and comments is required from the Contractor. The Contractor
- 29                 may release the equipment or material for manufacture; however, all notations
- 30                 and comments must be incorporated into the final product addressing the
- 31                 omissions and/or nonconforming items that were noted. Only the items to be
- 32                 "confirmed" need to be resubmitted.
- 33
- 34                 "REJECTED - RESUBMIT" is assigned when the submittal is in noncompliance
- 35                 with the Contract Documents and must be corrected and the entire package
- 36                 resubmitted. This code generally means that the equipment or material cannot
- 37                 be released for manufacture unless the Contractor takes full responsibility for
- 38                 providing the submitted items in accordance with Contract Documents.
- 39
- 40                 "FOR YOUR INFORMATION" is assigned when the package provides
- 41                 information of a general nature that may or may not require a response.
- 42
- 43        E. Submittals pertaining to the Blend Tanks components will be returned to the
- 44                 Contractor under one of the following:
- 45
- 46                 "NO EXCEPTIONS NOTED" is assigned when specifications and the Work
- 47                 may proceed.

1  
2 "MAKE CORRECTIONS NOTED" is assigned when the reviewer has added a  
3 correction to the submission that allows the Work (modified in accordance with  
4 the correction comment) to proceed. The Contractor shall accept the  
5 responsibility of the modified document and the resulting Work with no  
6 additional compensation.  
7

8 "AMEND AND RESUBMIT" is assigned when the submittal will require  
9 Contractor modifications based on the reviewer's comments that accompanied  
10 the returned submittal. The Contractor will be cautioned that work may not  
11 proceed under this review status.  
12

13 "REJECTED" is assigned when the submittal is not in conformance with the  
14 requirements of the performance Specifications and cannot be modified to gain  
15 compliance. A new submittal will be required in the instance of a "REJECTED"  
16 status and the Contractor will be cautioned that work may not proceed under  
17 this condition.  
18

- 19 F. Resubmittals will be handled in the same manner as first submittals. On  
20 resubmittals the Contractor shall direct specific attention, in writing, on the  
21 transmittal and on resubmitted shop drawings by use of revision triangles or  
22 other similar methods, to revisions other than the corrections requested by the  
23 Engineer on previous submissions. Any such revisions that are not clearly  
24 identified shall be made at the risk of the Contractor. The Contractor shall make  
25 corrections to any work done because of this type revision that is not in  
26 accordance to the Contract Documents as may be required by the Engineer.  
27
- 28 G. If the Contractor considers any correction indicated on the shop drawings to  
29 constitute a change to the Contract Documents, the Contractor shall deliver  
30 written notice thereof to the Engineer at least seven (7) working days prior to  
31 release for manufacture.  
32
- 33 H. The number of shop drawings the Engineer will review is limited as described  
34 in the General Condition or Supplemental General Conditions, and the  
35 Contractor will be back charged for costs incurred by the Engineer due to  
36 excessive shop drawing submittals or resubmittals as described therein. This  
37 limitation is intended to reduce the number of submittals to be reviewed but shall  
38 not be construed to limit the number of shop drawings required and the  
39 Contractor shall submit all shop drawings required as directed by the Engineer.  
40
- 41 I. When the shop drawings have been completed to the satisfaction of the  
42 Engineer, the Contractor shall carry out the construction in accordance  
43 therewith and shall make no further changes therein except upon written  
44 instruction from the Engineer.  
45
- 46 J. Partial submittals may not be reviewed. The Engineer will be the only judge as  
47 to the completeness of a submittal. Submittals not complete will be returned to

1           the Contractor. The Engineer may at his option provide a list or mark the  
2           submittal directing the Contractor to the areas that are incomplete.  
3

4           **PART 2 – PRODUCTS**

5  
6           **2.01 SHOP DRAWINGS**

7  
8           Final shop drawings shall be submitted in electronic format, organized by submittal  
9           number, on electronic media.

10           **PART 3 – EXECUTION (NOT USED)**

11  
12  
13  
14           **END OF SECTION**  
15

1 SECTION 01385  
2

3 COLOR AUDIO-VIDEO AND PHOTOGRAPHIC CONSTRUCTION RECORDS  
4

5 PART 1 – GENERAL  
6

7 1.01 DESCRIPTION  
8

9 A. Scope  
10

11 The Contractor shall have digital pictures/photographs, stored on the most  
12 recent type of electronic storage device of the Work from views and at such  
13 times as directed by the Engineer. These photographs shall represent a visual  
14 history of the Project, from Notice to Proceed through Final Completion.  
15

16 The Contractor shall also use electronic “snap-shot” photography as necessary  
17 to record and facilitate resolution of on-site issues through the transmission of  
18 electronic photographs by e-mail from the site to the Engineer’s and Owner’s  
19 offices.  
20

21 The Contractor shall prepare color audio/video electronic storage devices of all  
22 work areas within 20 days of the Notice to Proceed. These specifications shall  
23 supplement the Owner’s color audio-video construction records requirements,  
24 if any, and the more stringent shall apply.  
25

26 B. Requirements Included  
27

28 Prior to commencing work, the Contractor shall have a continuous color  
29 audio/video recording and pictures taken of the entire Project, including access  
30 to the site of the work. Streets, easements, rights-of way, lots or construction  
31 sites within the Project must be recorded to serve as a record of pre-construction  
32 conditions. One copy of the electronic files and logs shall be submitted to the  
33 on the most recent type of electronic storage device. All photographs will be  
34 logged and re-named reflecting the orientation and subject. The Engineer will  
35 designate those areas, if any, to be omitted from or added to the audio-visual  
36 coverage. All electronic storage devices and written records shall become the  
37 property of the Owner.  
38

39 C. Scheduling  
40

41 No construction shall begin prior to review by the Owner of the electronic files  
42 covering the Project construction area(s). The Owner will have the authority to  
43 reject all or any portion not conforming to specifications and order that it be  
44 redone at no additional charge. The Contractor shall reschedule unacceptable  
45 coverage within seven days after being notified.  
46

47 D. Videographer Qualifications

1  
2 The Contractor shall engage the services of a professional photographer and  
3 videographer known to be skilled and regularly engaged in the business of  
4 preconstruction color photographs and audio-video documentation. The  
5 professional, through the Contractor, shall furnish to the Engineer a list of all  
6 equipment to be used for the recording, i.e., manufacturer's name, model  
7 number, specifications and other pertinent information.  
8

9 Additional information to be furnished by the professional is the names and  
10 addresses of two references for work completed by the professional of a similar  
11 nature within the last 12 months. Engineer's review of the selected professional  
12 is required prior to taking first audio-video recording.  
13

14 E. Equipment  
15

16 The Contractor shall finish all equipment, accessories, materials and labor to  
17 perform this service. The equipment shall reproduce bright, sharp, clear  
18 pictures with accurate colors and shall be free from distortion, tearing, rolls or  
19 any other form of imperfection. The audio portion of the recording shall  
20 reproduce the commentary of the camera operator with proper volume, clarity  
21 and be free from distortion and interruptions. In some instances, audio-video  
22 coverage may be required in areas not accessible by conventional wheeled  
23 vehicles. Such coverage shall be obtained by walking. The color video camera  
24 used in the recording shall be of Industrial Grade and shall have EIA Standard  
25 NTSC type color - 1.0V 75 OHMS. Video output from camera shall be capable  
26 of horizontal resolution of 350 lines at center and utilize a minimum of 8:1 zoom  
27 with a 2/3 Newvicon tube or CCD pick-up element for optimum color imagery  
28 plus minimum lag through of one-foot candle. The recording shall be made with  
29 Industrial Grade recorder. The recordings shall be high resolution, extended  
30 still frame capable, in color. The recorded video files shall be compatible for  
31 playback with on any American PC based Computer.  
32

33 F. Recorded Information, Audio  
34

35 Each recording shall begin with the current date, project name and be followed  
36 by the general location, i.e., viewing side and direction of progress.  
37 Accompanying each the video recording shall be a corresponding and  
38 simultaneously recorded audio recording. This audio recording, exclusively  
39 containing the commentary of the camera operator or aide, shall assist in viewer  
40 orientation and in any needed identification, differentiation, clarification, or  
41 objective description of the features being shown in the video portion of the  
42 recording. The audio recording shall also be free from any conversations.  
43

44 G. Recorded Information, Video  
45

46 All video recordings must continuously display transparent digital information to  
47 include the date and time of recording. The date information shall contain the

1 month, day and year. The time information shall contain the actual hour,  
2 minutes and seconds of the day. Additional information shall be displayed  
3 periodically. Such information shall include, but not be limited to, project name,  
4 contract number, direction of travel and the viewing side. This transparent  
5 information shall appear on the extreme upper left hand third of the screen.  
6 Camera pan, tilt, zoom-in and zoom-out rates shall be sufficiently controlled  
7 such that recorded objects are clearly viewed during video playback. In  
8 addition, all other camera and recording system controls, such as lens focus  
9 and aperture, video level, pedestal, chrome, white balance, and electrical focus  
10 shall be properly controlled or adjusted to maximize picture quality. The  
11 construction documentation shall be recorded in SP mode.

12

13 H. Recorded Information, Photographs

14

15 Photographs shall be digital and in color. Provide one copy of each digital  
16 picture on each of three of the most recent electronic storage devices. Each  
17 photograph shall be re-named to reflect to orientation and the subject.

18

19 Provide photographs taken of each of the major items during construction.

20

21 View and Quantities Required: A minimum of 30 photographs per month clearly  
22 showing project status and key elements of construction. All video and pictures  
23 shall be submitted as read only devices.

24

25 Deliver electronic images to the Engineer with every pay request.

26

27 Photographs shall be from locations to illustrate the condition of construction  
28 and the state of progress adequately.

29

30 The Contractor shall provide before and after photographs of each portion of  
31 the site. The below-ground facilities shall include all equipment, walls, floor,  
32 piping, supports, and entrance. At major location photographs shall include  
33 before, during, and after photographs and all photographs shall be placed in  
34 ascending date order when submitted to show the Work as it progresses.

35

36 Each digital photograph shall be date and time stamped.

37

38 The Contractor shall provide the Engineer with a written description of each  
39 photograph. The Field Engineer or inspector shall approve the description.

40

41

42 Catalog and manage Electronic "snap-shots" and images of photographs in a  
43 secure digital photograph management system capable of being linked to the  
44 project schedule and document management database. Add captions,  
45 descriptions, and key words. Transfer a copy of all "snap-shots" and  
46 photographs with their related notes, keywords, captions, and activity IDs to the  
47 Engineer weekly.

1  
2 All photographs shall be clear, sharp, and free of distortion after enlargement.  
3

4 All photographs (pictures) must display transparent digital information to include  
5 the date and time of recording. The date information shall contain the month,  
6 day and year. The time information shall contain the actual hour, minutes and  
7 seconds of the day. Camera pan, tilt, zoom-in and zoom-out rates shall be  
8 sufficiently controlled such that recorded objects are clearly viewable. In  
9 addition, all other camera and recording system controls, such as lens focus  
10 and aperture, video level, pedestal, chrome, white balance, and electrical focus  
11 shall be properly controlled or adjusted to maximize picture quality. Pictures  
12 shall be a minimum of 72 dpi resolution and jpg or similar format. The minimum  
13 picture width shall be 4000 pixels with a minimum width: height aspect ratio of  
14 1.77.

15  
16 I. Viewer Orientation  
17

18 The audio, video, and photograph portions of the recording shall maintain  
19 viewer orientation. In areas where the proposed construction location is not  
20 readily apparent to the viewer, highly visible yellow flags shall be placed, by the  
21 Contractor, in such a fashion as to clearly indicate the proposed centerline of  
22 construction. When conventional wheeled vehicles are used as conveyances  
23 for the recording system, the vertical distance between the camera lens and the  
24 ground shall not exceed 10 feet. The camera shall be firmly mounted such that  
25 transport of the camera during the recording process will not cause an unsteady  
26 picture.

27  
28 J. Lighting  
29

30 All recording shall be done during time of good visibility. No recording shall be  
31 done during precipitation, mist or fog. The recording shall only be done when  
32 sufficient sunlight is present to properly illuminate the subjects of recording and  
33 to produce bright, sharp video recordings of those subjects.

34  
35 K. Speed of Travel  
36

37 The average rate of travel during a particular segment of coverage shall be  
38 directly proportional to the number, size and value of the surface features within  
39 that construction areas zone of influence. The rate of speed in the general  
40 direction of travel of any vehicle used during recording of a linear project site  
41 shall not exceed 44 feet per minute.

42  
43 L. Video and photograph Log/Index  
44

45 All video and photographs shall be permanently labeled and shall be properly  
46 identified by location and project title. Each storage devices shall have a log of  
47 that storage devices' contents. The log shall describe the various segments of

coverage in terms of the location, orientation and equipment and the date.

## M. Area of Coverage

Coverage shall include all surface features located within 100 feet of the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, drainage system features, mailboxes, landscaping, culverts, fences, signs, Contractor staging areas, adjacent structures, etc., within the area covered by the project. Of particular concern shall be the existence of any faults, fractures, or defects. Coverage shall be limited to one side of the site, street, easement or right-of-way at any one time.

## PART 2 – PRODUCTS (NOT USED)

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. Prior to requesting Substantial Completion, the Contractor shall review the pre-construction video with the Owner/Engineer and identify any work needed to restore the site to pre-construction conditions.

END OF SECTION

1  
2  
3

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COLOR AUDI-VIDEO CONSTRUCTION RECORDS  
01385-6

05/04/2020

1 SECTION 01410  
2

3 TESTING AND TESTING LABORATORY SERVICES  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9       A. Contractor shall employ and pay for the services of an Independent Testing  
10      Laboratory to perform that geotechnical testing (concrete, compaction,  
11      pavement, etc.) specifically indicated on the Contract Documents or specified  
12      in the Specifications or at any other time Contractor elects to have materials and  
13      equipment tested for conformity with the Contract Documents.  
14
- 15       1. Contractor shall coordinate with the laboratory to facilitate the execution  
16      of its required services.  
17
- 18       2. Employment of the laboratory shall in no way relieve Contractor's  
19      obligations to perform the Work of the Contract.  
20
- 21       B. Contractor shall perform and pay for all other testing (pressure, torque, etc.)  
22      required in the specifications.  
23

24 1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY  
25

- 26       A. Laboratory is not authorized to:  
27
- 28        1. Release, revoke, alter or enlarge on requirements of Contract  
29      Documents.  
30
- 31        2. Approve or accept any portion of the Work.  
32
- 33        3. Perform any duties of the Contractor.  
34

35 1.03 CONTRACTOR'S RESPONSIBILITIES  
36

- 37       A. Coordinate with laboratory personnel, provide access to Work, to  
38      Manufacturer's operations.  
39
- 40       B. Secure and deliver to the laboratory adequate quantities of representational  
41      samples of materials proposed to be used and which require testing.  
42
- 43       C. Provide to the laboratory the preliminary design mix proposed to be used for  
44      concrete, and other materials mixes, which require control by the testing  
45      laboratory.  
46

1           D. Materials and equipment used in the performance of work under this Contract  
2           are subject to inspection and testing at the point of manufacture or fabrication.  
3           Standard specifications for quality and workmanship are indicated in the  
4           Contract Documents. The Engineer may require the Contractor to provide  
5           statements or certificates from the manufacturers and fabricators that the  
6           materials and equipment provided by them are manufactured or fabricated in  
7           full accordance with the standard specifications for quality and workmanship  
8           indicated in the Contract Documents. All costs of this testing and providing  
9           statements and certificates shall be a subsidiary obligation of the Contractor,  
10          and no extra charge to the Owner shall be allowed on account of such testing  
11          and certification.

12         E. Furnish incidental labor and facilities:

- 15           1. To provide access to work to be tested.
- 16           2. To obtain and handle samples at the Project site or at the source of the  
17           product to be tested.
- 19           3. To facilitate inspections and tests.
- 20           4. For storage and curing of test samples.

24         F. The Contractor shall be responsible for notifying the laboratory sufficiently in  
25           advance (minimum 48 hours) of operations to allow for laboratory assignment  
26           of personnel and scheduling of tests.

28         G. Employ and pay for the services of the same or a separate, equally qualified  
29           independent testing laboratory to perform additional inspections, sampling and  
30           testing required for the Contractor's convenience and as reviewed by the  
31           Engineer.

33         PART 2 – PRODUCTS      (NOT USED)

35         PART 3 – EXECUTION      (NOT USED)

38                                   END OF SECTION

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## SECTION 01500

### TEMPORARY FACILITIES

#### PART 1 – GENERAL

##### 1.01 WORK INCLUDED

- A. The Contractor shall furnish, install and maintain all of the temporary facilities required for the proper execution of the work. This temporary work shall include:
1. Sanitary Facilities
  2. Maintenance of Traffic
  3. Barricades, Lights and the Protection of Public and Private Property
  4. Parking
  5. Provisions for Control of Dust, Pollution and Stormwater
  6. Contractor's Field Office
  7. Engineer's Field Office
  8. Storage of Combustibles

##### 1.02 SANITARY FACILITIES

- A. Contractor shall furnish temporary separate male and female sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.
- B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

##### 1.03 MAINTENANCE OF TRAFFIC

- A. Contractor shall conduct his work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Driveway access to commercial properties shall be maintained at all times. Such maintenance of traffic shall not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point. At all times, the Contractor shall perform the Work in accordance with the permits and easement agreements.

- 1           B. Traffic control shall be in accordance with Pinellas County and the City of  
2           Clearwater Roadway and Traffic Design Standards for Traffic Control Through  
3           Work Zones and as shown on the Drawings. The Contractor shall follow all  
4           traffic rules regulated by the local governments.  
5
- 6           C. In making open-cut street crossings, the Contractor shall not block more than  
7           one-half of the street at a time. Whenever possible, Contractor shall widen the  
8           shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall  
9           be provided as necessary on shoulders.

10          1.04 BARRICADES AND LIGHTS

- 11
- 12          A. All streets, roads, highways, and other public thoroughfares which are closed to  
13           traffic shall be protected by effective barricades on which shall be placed  
14           acceptable warning signs. Barricades shall be located at the nearest  
15           intersecting public highway or street on each side of the blocked section.  
16
- 17          B. All open trenches and other excavations shall have suitable barricades, signs,  
18           and lights to provide adequate protection to the public. Obstructions such as  
19           material piles and equipment shall be provided with similar warning signs and  
20           lights. Contractor shall be responsible for public safety within the construction  
21           area.  
22
- 23          C. All barricades and obstructions shall be illuminated with warning lights from  
24           sunset to sunrise. Material storage and conduct of the Work on or alongside  
25           public streets and highways shall cause the minimum obstruction and  
26           inconvenience to the traveling public. All barricades, signs, lights and other  
27           protective devices shall be installed and maintained in conformity with  
28           applicable statutory requirements and, where within railroad and highway rights-  
29           of-way, as required by the authority having jurisdiction thereof.  
30
- 31          D. Open trenches and other excavations shall not be left open overnight, over  
32           weekends and holidays, or greater than one calendar day, except during  
33           adverse weather conditions.  
34

35          1.05 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- 36
- 37          A. Contractor shall protect, shore, brace, support, and maintain all underground  
38           pipes, conduits, drains, and other underground construction uncovered or  
39           otherwise affected by his construction operations. All pavement, surfacing,  
40           driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other  
41           surface structures affected by construction operations, together with all sod and  
42           shrubs in yards and parking areas, shall be restored to their original condition,  
43           whether within or outside the easement. All replacements shall be made with  
44           new materials.  
45

46          1.06 PARKING

- 1  
2       A. Contractor shall provide and maintain suitable parking areas for the use of all  
3 construction workers and others performing work or furnishing services in  
4 connection with the Project, as required to avoid any need for parking personal  
5 vehicles where they may interfere with public traffic, Owner's operations, or  
6 construction activities.  
7

8       **1.07 DUST CONTROL**  
9

- 10      A. Contractor shall take reasonable measures to prevent unnecessary dust. Earth  
11 surfaces subject to dusting shall be kept moist with water or by application of an  
12 approved chemical dust suppressant. Dusty materials in piles or in transit shall  
13 be covered when practicable to prevent blowing.  
14
- 15      B. Buildings or operating facilities that may be adversely affected by dust shall be  
16 adequately protected from dust. Existing or new machinery, motors, instrument  
17 panels or similar equipment, shall be protected by suitable dust screens. Proper  
18 ventilation shall be included with dust screens.  
19

20      **1.08 SWEEPING**  
21

- 22      A. The Contractor shall sweep loose material from all pavements at the end of  
23 each workday.  
24

25      **1.09 POLLUTION CONTROL**  
26

- 27      A. Contractor shall prevent the pollution of drains and watercourses by sanitary  
28 wastes, sediment, debris and other substances resulting from construction  
29 activities. No sanitary wastes will be permitted to enter any drain or watercourse  
30 other than sanitary sewers. No sediment, debris or other substance will be  
31 permitted to enter sanitary sewers and reasonable measures will be taken to  
32 prevent such materials from entering any drain or watercourse.  
33

34      **1.10 STORMWATER CONTROL**  
35

- 36      A. The Contractor shall be responsible for maintaining stormwater flow and  
37 drainage of the construction area. In cases where existing stormwater  
38 structures and culverts are to be removed as part of construction, temporary  
39 flow paths or bypass pumping shall be provided until the new stormwater system  
40 is accepted and placed into service.  
41

42      **1.11 FIELD OFFICES**  
43

- 44      A. The Contractor shall furnish, install and maintain temporary field offices for the  
45 Engineer and the Contractor during the entire construction period; and shall  
46 furnish, install and maintain storage and work sheds needed for construction.

1           The Contractor shall remove field offices, sheds or contents no sooner than two  
2           (2) weeks prior to achieving Substantial Completion of the Work.  
3

4           B. Prior to installation of offices, the Contractor shall consult with the Owner on  
5           location, access and related facilities.  
6

7           C. Construction of field offices shall:  
8

- 9           1. Be structurally sound, weather tight, with floors raised above ground.  
10          2. Have temperature transmission resistance: compatible with occupancy  
11           and storage requirements.  
12          3. At Contractor's option, portable or mobile buildings may be used. Mobile  
13           trailers, when used, shall be modified for office use. Mobile trailers shall  
14           not be used for living quarters.  
15

16          D. The Contractor shall furnish and install field offices as required for the  
17           Contractor's superintendent and other needs, properly furnished. The  
18           Contractor's field office(s) shall be separate from the Engineer's offices and the  
19           conference room.  
20

21          E. The Contractor shall furnish and install on-site one (1) conference room suitable  
22           for meetings with 16 attendees, two (2) offices for the Engineer, one (1) office  
23           for the Owner and one (1) gender-neutral restroom. The conference room,  
24           restroom and the three (3) offices shall be under the same roof. All offices shall  
25           be a minimum area of 150 ft<sup>2</sup> and the conference room shall be a minimum area  
26           of 500 ft<sup>2</sup>. The field office area shall be furnished with six (6) graveled parking  
27           spaces and stairs. The temporary field offices shall be air conditioned, equipped  
28           with standard office furniture, and potable water in addition to the following  
29           equipment:  
30

- 31           1. One (1) standard office desk (5'x3'), rolling chair with adjustable height  
32           and armrest; and two (2) "visitors" standard chairs for each office.  
33           2. One (1) plan table (6'x3') for full size (24"x36") drawings for each office.  
34           3. One (1) five-drawer lateral file cabinets, legal size for each office.  
35           4. One (1) laptop personal computer (PC), one for each office and the  
36           conference room, meeting the following specifications:  
37            a. Intel® Core™ i5-2520M (Dual Core 2.50GHz, 3M cache);  
38            b. Windows 10 Professional (latest version);  
39            c. 4.0GB, DDR3-1333MHz SDRAM;  
40            d. 17.3" (1600x900) Anti-Glare LCD screen display;  
41            e. 500 GB Hardrive;  
42            f. DVD/CD/CD-RW Drive;  
43            g. 10/100T Ethernet Port and Wireless LAN Card;  
44            h. External USB mouse;  
45            i. Microsoft Office Professional (latest version with Word, Excel,  
46           Access, and PowerPoint);  
47            j. MS Internet Explorer;

- k. Adobe Acrobat X Standard (or latest version);
  - l. Adobe Reader X (or latest version);
  - m. Autodesk Design Review (latest version).
  - n. Scheduling software compatible with the Contractor's scheduling software as specified in Section 01310.

5. A minimum of two (2) exit doors from the conference room area; and, separate keying for each office.

6. High speed (cable, DSL or equal) internet service connection for each PCs.

7. All ancillary wiring and cables to connect each PC in each office and the conference room to a common Printer/Copier/Scanner device to be located in the conference room area.

8. One (1) Hewlett-Packard Laserjet (black/white) printer/copier/scanner compatible with PCs furnished. Printer shall be able to print/scan both sides (during the same event) of letter and 11"x17" sized documents and shall be network compatible. Contractor shall configure the network to print or scan from each temporary PC. The printer shall be capable of scanning up to 11"x17" documents and automatically converting the document to a "PDF" format file and uploading the document to the PC. The printer shall also be capable of copying "letter" size up to 11"x17" documents.

F. All temporary offices and the conference room shall be air conditioned.

G. The conference room shall be equipped with the following:

1. A minimum of six (6) 3' x 8' tables pushed together to form a large table and 16 padded folding or rolling chairs for the table.
  2. One (1) 72-inch flat screen monitor/TV mounted on one of the walls and in clear view of everyone seated at the table, wired to the temporary office network.
  3. One (1) direct telephone line and combination phone/fax machine with speaker phone capability;
  4. One (1) minimum 1.5 cu. ft. microwave;
  5. One (1) minimum 10 cu. ft. combination refrigerator/freezer.

H. All equipment and furniture specified herein shall be new and unused. Contractor shall setup and configure all PC/printer/scanner equipment on one single local area network (LAN). All other hardware/software shall be configured for a complete operational PC system. Contractor shall bear all monthly costs for the high-speed internet service and phone connection including installation costs. The Contractor shall arrange for and provide bi-weekly cleaning services for the field offices, restroom and conference room.

I. All items listed in paragraph 1.10 E shall become the property of the Owner immediately following final completion. All software and hardware shall be licensed to the Owner prior to final completion. Prior to final completion, the

1 Contractor shall deliver the items listed in paragraph 1.10 E to the Owner."

2

3 J. The Contractor shall be responsible for regularly (at minimum bi-weekly) maintain, clean, and service the Engineer's and Owner's Field Office, restroom and conference room, including daily disposal of garbage (trash), replacing ink toner printer cartridges, supplying sufficient quantities of letter sized and 11" x 17" printing paper and replacement of any office furniture, equipment or PC components defective for the duration of the Contract time. Contractor shall be responsible for maintaining the graveled parking area for the duration of the Contract time.

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12 K. The Contractor shall make all provisions and pay all installations and other costs including maintenance and supplies for the Engineer's field office in order to provide internet service, power service, water/sewer service and all other costs as required for the Engineer's field office for the duration of construction.

13

14

15

16

17 **1.12 COMBUSTIBLES STORAGE**

- 18
- 19 A. The Contractor shall protect all combustible products and materials placed on site from vehicular damage and vandalism.
- 20
- 21 B. Contractor shall submit a plan for all locations of fuel and vehicle storage through the duration of the project, updated as necessary to address specific phases or locations of the work.
- 22
- 23
- 24 C. There shall be no fuel storage in wetland areas.
- 25
- 26 D. Fuel storage containers shall be limited to 549 gallons or less. The Contractor is solely responsible for maintaining fuel containers and ensuring that all measures for protection and containment are provided as required by law.
- 27
- 28
- 29
- 30
- 31

32 PART II – PRODUCT

33 (Not Used)

34

35 PART III – EXECUTION

36 (Not Used)

37

38 END OF SECTION

39

1 SECTION 01505

2  
3 MOBILIZATION  
4

5 PART 1 – GENERAL  
6

7 1.01 DEFINITION AND SCOPE  
8

9       A. Mobilization shall include the obtaining of all permits, insurance, and bonds;  
10      moving onto the site of all plant and equipment; furnishing and erecting plants,  
11      temporary facilities, and other construction facilities; all as required for the  
12      proper performance and completion of the Work. Mobilization shall include, but  
13      not be limited to, the following principal items:

- 14
- 15       1. Move onto the site all plant and equipment required for first month's  
16       operations.
  - 17       2. Install temporary construction power, wiring, and lighting facilities.
  - 18       3. Establish fire protection plan and Health and Safety program.
  - 19       4. Secure construction water supply.
  - 20       5. Provide on-site sanitary facilities and potable water facilities.
  - 21       6. Arrange for and erect Contractor's work and storage yard and  
22       employees' parking facilities.
  - 23       7. Submit all required insurance certificates and bonds.
  - 24       8. Obtain all required permits.
  - 25       9. Post all OSHA, Environmental Protection Agency, Department of Labor,  
26       and all other required notices.
  - 27       10. Have superintendent at the job site full time.
  - 28       11. Submit a detailed construction schedule acceptable to the Engineer.
  - 29       12. If required, erect project construction sign(s).
  - 30       13. Submit a finalized schedule of values and schedule of payments  
31       acceptable to the Owner.
  - 32       14. Submit a finalized schedule of submittals.
  - 33       15. Construct, maintain, and restore temporary access and haul roads.

16. Provide a continuous color audio-videotape recording of existing conditions.

## PART 2 – PRODUCT (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01510  
2

3 TEMPORARY UTILITIES  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. Furnish, install and maintain temporary utilities required for construction,  
10 remove on completion of Work.  
11

12 1.02 REQUIREMENTS OF REGULATORY AGENCIES  
13

- 14 A. Comply with National Electric Code.  
15  
16 B. Comply with Federal, State and local codes and regulations and with utility  
17 company requirements.  
18  
19 C. Comply with Local City and County Health Department Regulations.  
20

21 PART 2 – PRODUCTS  
22

23 2.01 MATERIALS, GENERAL  
24

- 25 A. Materials may be new or used but must be adequate in capacity for the required  
26 usage, must not create unsafe conditions, and must not violate requirements of  
27 applicable codes and standards.  
28

29 2.02 TEMPORARY ELECTRICITY AND LIGHTING  
30

- 31 A. Arrange with utility company and Owner to provide service required for power  
32 and lighting and pay all costs for service and for power used in the construction,  
33 testing and trial operation prior to final acceptance of the work by the Owner.  
34 All cost associated with obtaining temporary and permanent power shall be at  
35 Contractor expense.  
36  
37 B. Provide adequate artificial lighting for all areas of work when natural light is not  
38 adequate for work, and for areas accessible to the public.  
39

40 2.03 TEMPORARY TELEPHONE SERVICE  
41

- 42 A. Arrange with local telephone service-company to provide direct line telephone  
43 service or mobile phone service at the construction site for the use by personnel  
44 and employees.  
45  
46 B. Pay all costs for installation, maintenance and removal, and service charges.  
47

1           C.     Provide cellular phone service for site superintendent(s).  
2

3       **2.04 TEMPORARY WATER**

4           A.     The Contractor shall install at each connection to the local water supply system  
5                   a backflow preventer and meter meeting local utility requirements.  
6

7           B.     The Contractor shall pay for all temporary water facilities, including the backflow  
8                   preventers and meters, and the actual amount of water used during  
9                   construction.  
10

11           C.     Provide connections to on-site reclaimed water for use in washdown and other  
12                   non-potable water needs. Clearly mark each hose and/or other hydrant as  
13                   required.  
14

15       **2.05 TEMPORARY SANITARY FACILITIES**

16           A.     Provide sanitary facilities in compliance with laws and regulations.  
17

18           B.     Service, clean and maintain facilities and enclosures.  
19

20       **PART 3 – EXECUTION**

21       **3.01 GENERAL**

22           A.     Maintain and operate systems to assure continuous service.  
23

24           B.     Modify and extend systems as work progress requires.  
25

26           C.     Allow the Owner and Engineer reasonable use of all temporary utilities.  
27

28       **3.02 REMOVAL**

29           A.     Completely remove temporary materials and equipment when their use is no  
30                   longer required as determined by the Engineer.  
31

32           B.     Clean and repair damage caused by temporary installations or use of temporary  
33                   facilities.  
34

35                   **END OF SECTION**  
36  
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38  
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41

1 SECTION 01580  
2

3 PROJECT IDENTIFICATION AND SIGNS  
4

5 PART 1 - GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. Contractor shall furnish and install one (1) construction sign at a City-approved  
10 location at the site.
- 12 B. Erect sign meeting all City standards.
- 14 C. Remove sign on completion of construction.
- 16 D. Allow no other signs to be displayed.

18 1.02 INFORMATIONAL SIGN(S)  
19

- 20 A. Painted signs with painted lettering, or standard products.
  - 22 1. Size of signs and lettering: as required by the Owner, or as appropriate  
23 to usage.
  - 25 2. Colors: as required by the Owner, otherwise of uniform colors throughout  
26 Project.
- 28 B. Erect at appropriate location(s), as directed by the Owner or Engineer, to  
29 provide required information.

31 1.03 QUALITY ASSURANCE  
32

- 33 A. Sign Painter: Professional experienced in type of work required.
- 35 B. Finishes, Painting: Adequate to resist weathering and fading for scheduled  
36 construction period.

38 PART 2 - PRODUCTS  
39

40 2.01 SIGN MATERIALS  
41

- 42 A. Structure and Framing: Minimum 8-feet wide by 4-feet high mounted on 4"x4"  
43 pressure-treated lumber and braced as required, in accordance with the City of  
44 Clearwater Standards.
- 45 B. Sign Surfaces: Exterior softwood plywood with medium density overlay,  
46 standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.
  - C. Rough Hardware: Galvanized.
  - D. Paint: Exterior quality.
    1. Use Bulletin colors for graphics.
    2. Colors for structures, framing, sign surface and graphics:
  - E. The project sign shall be painted in accordance with the attached detail.
  - F. Owner will provide the standard decal.

## PART 3 - EXECUTION

### 3.01 PROJECT IDENTIFICATION SIGN(S)

- A. Paint exposed surface of supports, framing and surface material; one coat of primer and one coat of exterior paint.

### 3.02 MAINTENANCE

- A. Maintain sign(s) and supports in a neat, clean condition; repair damages to structures, framing or sign.

### 3.03 REMOVAL

- A. Remove sign(s), framing, supports and foundations at completion of project.

END OF SECTION

1 SECTION 01600  
2

3 MATERIAL AND EQUIPMENT  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9       A. Material and equipment incorporated into the Work shall:  
10           1. Conform to applicable specifications and standards.  
11           2. Comply with size, make, type and quality specified, or as specifically  
12           identified in writing by the Engineer.  
13  
14       B. Manufactured and Fabricated Products:  
15           1. Design, fabricate and assemble in accord with the best engineering  
16           and shop practices.  
17           2. Manufacture like parts of duplicate units to standard sizes and  
18           gauges, to be interchangeable.  
19           3. Two or more items of the same kind shall be identical, by the same  
20           manufacturer.  
21           4. Products shall be suitable for service conditions.  
22           5. Equipment capacities, sizes and dimensions shown or specified shall  
23           be adhered to unless variations are specifically identified in writing.  
24           6. Materials and equipment furnished by the Contractor shall be new  
25           and shall not have been in service at any other installation unless  
26           otherwise approved. They shall conform to applicable specifications  
27           approved in writing by the Engineer.  
28           7. Rotating machinery shall be designed and fabricated to provide  
29           satisfactory operation without excessive wear and without excessive  
30           maintenance during its operating life. Rotating parts shall be  
31           statically and dynamically balanced and shall operate without  
32           excessive vibration.  
33  
34       C. Do not use material or equipment for any purpose other than that for which  
35           it is designed or is specified.

36  
37 1.02 REVIEW OF MATERIALS  
38

- A. All materials and equipment furnished by the Contractor shall be subject to the inspection and review of the Engineer. No material shall be delivered to the work without prior review of the Engineer.
  - B. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
  - C. The Contractor shall submit data and samples sufficiently early to permit consideration and review before materials are necessary for incorporation in the work. Any delay resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claims against the Owner or the Engineer.
  - D. The materials and equipment used on the work shall correspond to the accepted samples or other data previously submitted to the Engineer for review. If requested, the Contractor shall be required to submit to the Engineer ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Engineer or Owner will not allow any experimental or untried type of material or machinery to be installed.
  - E. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Engineer, all field and operating tests shall be made in the presence of the Engineer or the Engineer's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Engineer.

## 1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including four copies to the Engineer.

- 1           1. Maintain one set of complete instructions at the job site during  
2            installation and until completion.  
3  
4           B. Handle, install, connect, clean, condition and adjust products in strict accord  
5            with such instructions and in conformity with specified requirements.  
6  
7           1. Should job conditions or specified requirements conflict with  
8            manufacturer's instructions, consult with Engineer for further  
9            instructions.  
10  
11          2. Do not proceed with work without clear instructions.  
12  
13          C. Perform work in accord with manufacturer's instructions. Do not omit any  
14            preparatory step or installation procedure unless specifically modified or  
15            exempted by Contract Documents.

18        1.04 TRANSPORTATION AND HANDLING

- 20          A. Arrange deliveries of Products in accordance with construction schedules,  
21            coordinate to avoid conflict with work and conditions at the site.  
22  
23          1. Deliver Products in undamaged condition, in manufacturer's original  
24            containers or packaging, with identifying labels intact and legible.  
25  
26          2. Immediately on delivery, inspect shipments to assure compliance  
27            with requirements of Contract Documents and submittals, and that  
28            Products are properly protected and undamaged.  
29  
30          B. Provide equipment and personnel to handle Products by methods to  
31            prevent soiling or damage to Products or packaging.  
32  
33          C. Where materials or equipment are specifically shown or specified to be  
34            reused in the Work, special care shall be used in removing, handling,  
35            storing, and reinstalling to ensure their proper function in the completed  
36            Work.

39        1.05 STORAGE AND PROTECTION

- 41          A. The Contractor shall furnish a covered, weather-protected storage structure  
42            providing a clean, dry, non-corrosive environment for all mechanical  
43            equipment, valves, architectural items, electrical and instrumentation  
44            equipment, and special equipment to be incorporated into this project.  
45            Storage of equipment shall be in strict accordance with the "instructions for  
46            storage" of each equipment supplier and manufacturer including connection

1 of heaters, placing of storage lubricants in equipment, etc. The Contractor  
2 shall furnish a copy of the manufacturer's instructions for storage to the  
3 Engineer prior to storage of all equipment and materials. Corroded,  
4 damaged or deteriorated equipment and parts shall be replaced before  
5 acceptance of the project. Equipment and materials not properly stored will  
6 not be included in a payment estimate.

- 7
- 8     B. Store Products in accord with manufacturer's instructions, with seals and  
9         labels intact and legible.
- 10         1. Store products subject to damage by the elements in weather tight  
11             enclosures.
- 12         2. Maintain temperature and humidity within the ranges required by  
13             manufacturer's instructions.
- 14         3. Store fabricated products above the ground, on blocking or skids,  
15             prevent soiling or staining. Cover products which are subject to  
16             deterioration with impervious sheet coverings, provide adequate  
17             ventilation to avoid condensation.
- 18         4. Store loose granular materials in a well-drained area on solid  
19             surfaces to prevent mixing with foreign matter.
- 20
- 21         C. All materials and equipment to be incorporated in the work shall be handled  
22             and stored by the Contractor before, during, and after shipment in a manner  
23             to prevent warping, twisting, bending, breaking, chipping, rusting, and any  
24             injury, theft or damage of any kind whatsoever to the material or equipment.
- 25
- 26         D. Cement, sand and lime shall be stored under a roof and off the ground and  
27             shall be kept completely dry at all times. All miscellaneous steel and  
28             reinforcing steel shall be stored off the ground or otherwise to prevent  
29             accumulations of dirt or grease, and in a position to prevent accumulations  
30             of standing water and to minimize rusting. Precast concrete sections shall  
31             be handled and stored in a manner to prevent accumulations of dirt,  
32             standing water, staining, chipping or cracking. Brick, block and similar  
33             masonry products shall be handled and stored in a manner to reduce  
34             breakage, chipping, cracking, and spilling to a minimum.
- 35
- 36         E. All materials that, in the opinion of the Engineer, have become so damaged  
37             as to be unfit for the use intended or specified shall be promptly removed  
38             from the site of the work, and the Contractor shall receive no compensation  
39             for the damaged material or its removal.
- 40
- 41         F. Arrange storage in a manner to provide easy access for inspection. Make  
42             periodic inspections of stored Products to assure that Products are

maintained under specified conditions, and free from damage or deterioration.

#### G. Protection After Installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

- H. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

- I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary corrections.

## 1.06 SUBSTITUTIONS AND PRODUCT OPTIONS

#### A. Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.
  2. For products specified by naming several products or manufacturers, submit the products or manufacturers named, which complies with the specifications.
  3. For products specified by naming one or more products or manufacturers and "or equal", Contractor shall submit a request as for substitutions for any product or manufacturer not specifically named

## B Substitutions:

1. After the Effective Date of the Agreement, the Engineer will consider written requests from Contractor for substitution of products.

- 1           2. Submit a separate request for each product, supported with  
2           complete data, with drawings and samples as appropriate, including:  
3  
4           a. Comparison of the qualities of the proposed substitution with  
5           that specified.  
6  
7           b. Changes required in other elements of the work because of  
8           the substitution.  
9  
10          c. Effect on the construction schedule.  
11  
12          d. Cost data comparing the proposed substitution with the  
13          product specified.  
14  
15          e. Any required license fees or royalties.  
16  
17          f. Availability of maintenance service, and source of  
18          replacement materials.  
19  
20          3. The Engineer will be the judge of the acceptability of the proposed  
21          substitution.

22          C. Contractor's Representation:

- 23           1. A request for a substitution constitutes a representation that  
24           Contractor:  
25  
26           a. Has investigated the proposed Product and determined that it  
27           is equal to or superior in all respects to that specified.  
28  
29           b. Shall provide the same warranties or bonds for the  
30           substitution as for the product specified.  
31  
32           c. Will coordinate the installation of an accepted substitution into  
33           the Work and make such other changes as may be required  
34           to make the Work complete in all respects.  
35  
36           d. Waives all claims for additional costs, under his responsibility,  
37           which may subsequently become apparent.

38          1.07 LUBRICATION SYSTEM

- 39          A. The minimum design criteria for lubricating moving parts of the equipment  
40          shall include 1 week of continuous operation during which no lubricants  
41          shall be added to the system.

- 1           B. The system shall be designed to receive lubricants whether in operation or  
2           shut down and shall not leak or waste lubricants under either condition. The  
3           manufacturer's recommendations of grade and quality and a supply of the  
4           lubricants so recommended in quantities sufficient to conduct start-up and  
5           testing operations shall be furnished with the equipment.

6

7        1.08 SPECIAL TOOLS

- 8
- 9           A. Manufacturers of equipment and machinery shall furnish any special tools  
10          (including grease guns or other lubricating devices) required for normal  
11          adjustment, operations and maintenance, together with instructions for their  
12          use. The Contractor shall preserve and deliver to the Owner these tools  
13          and instructions in good order no later than upon completion of the Contract.

14

15        1.09 WARRANTY

- 16
- 17           A. For all major pieces of equipment, submit a warranty from the equipment  
18          manufacturer as specified in Section 01740. The manufacturer's warranty  
19          period shall be concurrent with the Contractor's warranty.

20

21        1.10 SPARE PARTS

- 22
- 23           A. Spare parts for certain equipment have been specified in the pertinent  
24          sections of the Specifications. The Contractor shall collect and store all  
25          spare parts so required in an area to be designated by the Engineer. In  
26          addition, the Contractor shall furnish to the Engineer an inventory listing all  
27          spare parts, the equipment they are associated with, the name and address  
28          of the supplier, and the delivered cost of each item. Copies of actual  
29          invoices for each item shall be furnished with the inventory to substantiate  
30          the delivered cost.

31

32        1.11 GREASE, OIL, AND FUEL

- 33
- 34           A. All grease, oil, and fuel required for testing of equipment shall be furnished  
35          with the respective equipment. The Owner shall be furnished with a year's  
36          supply of required lubricants including grease and oil of the type  
37          recommended by the manufacturer with each item of equipment supplied.

- 38
- 39           B. The Contractor shall be responsible for changing the oil in all drives and  
40          intermediate drives of each mechanical equipment after initial break-in of  
41          the equipment, which in no event shall be any longer than three weeks of  
42          operation.

43

44        1.12 ELECTRICAL EQUIPMENT ENCLOSURES

45

1           A. All items of electrical equipment that are furnished with process, heating,  
2           ventilating, or other equipment shall conform to the requirements specified  
3           under the appropriate electrical Sections of the Specifications. Enclosures  
4           for electrical equipment, such as switches and starters, shall conform to the  
5           requirements specified under the appropriate electrical Sections of the  
6           Specifications.

7

8        **1.13 EQUIPMENT DRIVE GUARDS**

9

10          A. Screens, guards, or cages shall be provided for all exposed rotating or  
11          moving parts in accordance with accepted practices of applicable  
12          governmental agencies. Unless specified otherwise in the Technical  
13          Specification Sections, guards shall be constructed of galvanized sheet  
14          steel or galvanized woven wires or expanded metal set in a frame of  
15          galvanized steel members. Guards shall be secured in position by steel  
16          braces or straps, which will permit easy removal for servicing the  
17          equipment.

18

19        **1.14 PROTECTION AGAINST ELECTROLYSIS**

20

21          A. Where dissimilar metals are used in conjunction with each other, suitable  
22          insulation shall be provided between adjoining surfaces so as to eliminate  
23          direct contact and any resultant electrolysis. The insulation shall be  
24          bituminous-impregnated felt, heavy -bituminous coatings, nonmetallic  
25          separators or washers, or other acceptable materials.

26

27        **1.15 CONCRETE INSERTS**

28

29          A. Concrete inserts for hangers shall be designed to support safely, in the  
30          concrete that is used, the maximum load that can be imposed by the  
31          hangers used in the inserts. Inserts for hangers shall be of a type which will  
32          permit adjustment of the hangers both horizontally (in one plane) and  
33          vertically and locking of the hanger head or nut. All inserts shall be  
34          galvanized.

35

36        **1.16 SLEEVES**

37

38          A. Unless otherwise indicated on the Drawings or specified, openings for the  
39          passage of pipes through floors and walls shall be formed of sleeves of  
40          standard-weight, galvanized-steel pipe. Each sleeve shall be of ample  
41          diameter to pass the pipe and its insulation, if any, and to permit such  
42          expansion as may occur. Sleeves shall be of sufficient length to be flush at  
43          the walls and the bottom of the slabs and to project 2 inches above the  
44          finished floor surface. Threaded nipples shall not be used as sleeves.

- B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.
  - C. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

## END OF SECTION

1  
2

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MATERIAL AND EQUIPMENT  
01600-10

03/20/2020

1 SECTION 01610  
2

3 WATER TIGHTNESS TEST FOR HYDRAULIC STRUCTURES  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The Contractor shall furnish all labor, materials, and incidentals required  
10      and perform tightness testing of water-containing structures as listed in this  
11      Section and all retesting until the structures meet the requirements as  
12      specified in this Section.  
13

14 1.02 RELATED WORK  
15

- 16       Section 01600, Materials and Equipment  
17       Section 01740, Warranties and Bonds.  
18       Division 3, Concrete.

19 1.03 SUBMITTALS  
20

- 21       A. Submit shop drawings in accordance with Section 01300, Submittals.  
22  
23       B. Submit to the Engineer the results of each water tightness test of each  
24      structure. The submittal format shall be similar to that shown in Figure A  
25      attached to the end of this Section.  
26

27 1.04 WORK SEQUENCE (not used)  
28

29 1.05 REFERENCE STANDARDS  
30

- 31       A. Reference standards and recommended practices referred to in this Section  
32      shall be the latest revision of any such document in effect at the bid  
33      time. The following documents are a part of this Section. Where this Section  
34      differs from these documents, the requirements of this Section shall apply.  
35  
36       B. The testing reinforced concrete tanks or water containment structures shall  
37      conform to the following standards and as modified in this Section:  
38  
39       C. American Concrete Institute (ACI) 350—Reinforced concrete water-  
40      retaining structures, 1R and as specified.  
41

42 1.06 QUALITY ASSURANCE  
43

- 44       A. Coordinate timing and procedures for obtaining testing water and structure  
45      testing with the Owner well in advance of the actual testing.  
46

1  
2       B. Water Source and Disposal:

3  
4       Water for testing shall be provided by the Owner. Water shall be plant  
5       reuse/reclaimed water. The Contractor shall supply all labor, equipment, and  
6       materials. Test water shall be disposed of by the Contractor in an approved  
7       manner. Water shall not be disposed of by discharging it onto the ground surface  
8       of public or private land.

9  
10      1.07 WARRANTIES

11  
12       A.      Warranties shall be in accordance with General Conditions, Supplementary  
13        Conditions, and Section 01740, Warranties and Bonds.

14  
15      1.08 DELIVERY, STORAGE, AND HANDLING

16  
17       A.      The Contractor shall adhere to the requirements specified in Section 01600,  
18        Materials and Equipment, for storing and protecting the items specified in  
19        this Section.

20  
21      1.09 QUALIFICATIONS (not used)

22  
23      PART 2 – PRODUCTS (Not Used)

24  
25      PART 3 - EXECUTION

26  
27      3.01 GENERAL

28  
29       A.      The Contractor shall prepare structures for testing as follows:

30  
31       Inspect the structure to be tested for potential leakage paths such as cracks,  
32       voids, etc. and repair any leakage paths in compliance with the provisions  
33       specified in this Section or as approved by the Engineer.

34  
35       Thoroughly clean the structure to be tested of dirt, mud, and construction  
36       debris before beginning watertightness tests. The floor and sumps shall be  
37       flushed with water to provide a clean surface ready for testing.

38  
39       Inlet and outlet pipes not required to be operational for the tests may be  
40       temporarily sealed or bulkheaded before testing.

41  
42       Confirm the adequacy of seals around valves and reset or seal as approved  
43       by the Engineer. Estimates of valve leakage will not be allowed as  
44       adjustments to the measured tank or structure leakage.

1   3.02 TESTING PROCEDURES

2  
3   A.   Conditions of Testing

4  
5   The Contractor shall not begin initial filling of concrete structures until all  
6   concrete elements of the structure have been repaired and rehabilitated  
7   and the designed compressive strength of the concrete used in the repairs  
8   nor less than 14 days after the tank repair and rehabilitation or when the  
9   coating systems have been fully cured per the manufacturer's  
10   recommendations.

11  
12   The Contractor shall fill unlined or partially lined concrete structures to the  
13   maximum operating water surface level and maintain the water at that level  
14   for at least 72 hours before beginning water tightness tests to minimize  
15   water absorption into the concrete during testing. The testing of fully lined  
16   concrete structures may be started as soon as the structure is filled.

17  
18   B.   Testing Procedures

19  
20   The duration of the test shall not be less than that required for a drop in the  
21   water surface of 1/2-inch based on the calculated maximum allowable  
22   leakage rate for 3 days.

23  
24   Loss-of-volume measurements shall be taken at 24-hour intervals. The loss  
25   of volume is usually determined by measuring the drop in water surface  
26   elevation and computing the change in volume of the contained water.  
27   Measure water surface elevation at not less than two locations at 180° apart  
28   and preferably at four locations 90 degrees apart. Record water  
29   temperature 18 inches below the water surface when taking the first and  
30   last sets of measurements.

31  
32   C.   Reports

33  
34   Submit to the Engineer water tightness test results for each structure tested  
35   on the form shown in Figure A or a form with a similar format.

36  
37   Notify the Owner and Engineer of the scheduling of tests 3 working days  
38   before the tests. The Engineer and Owner may monitor any water tightness  
39   testing performed on the structures.

40  
41   3.03 ACCEPTANCE

42  
43   A.   The following conditions shall be considered as NOT meeting the criteria  
44   for acceptance regardless of the actual loss of water volume from the  
45   structure:

- Groundwater leakage into the structure through floors, walls, or wall-floor joints.
- Structures which exhibit flowing water from joints, cracks, or from beneath the foundation (except for underdrain systems).
- Lined concrete structures on which moisture can be picked up by a dry hand from the exterior surface of the walls.

B. The water tightness of concrete tanks and structures shall be considered acceptable when loss of water volume is within the criteria listed below:

For unlined tanks with a sidewater depth of 25 feet or less, loss of volume not exceeding 0.1 percent in 24 hours.

For tanks with lined walls and a sidewater depth of 30 feet or less, loss of volume not exceeding 0.06 percent in 24 hours. Steel diaphragms in concrete walls shall be considered the same as a wall liner.

For completely lined tanks, loss of volume not exceeding 0.025 percent in 24 hours.

### 3.04 REPAIRS AND RETESTING

- A. The Contractor may retest structures failing the water tightness test and not exhibiting visible leakage after an additional stabilization period of 7 days. Tanks failing this second test shall be repaired before further testing.
- B. The Contractor shall repair structures which fail the water tightness test and structures showing visible leakage in compliance with the provisions specified in this Section or as approved by the Engineer.
- C. Repairs and retesting of tanks shall be accomplished at no additional cost to the Owner.
- D. The following structures, where applicable, shall be tested for water tightness:
  - Equalization Basin
  - North Sludge Blending Tank
  - South Sludge Dewatering Storage Tank

## FIGURE A WATER TIGHTNESS TEST REPORT

# PROJECT

**SUBMITTED BY**

## STRUCTURE\*

## TEST DATES \_\_\_\_\_

Allowable loss of water volume \_\_\_\_\_ percent in 24 hr.

Measured loss of water volume \_\_\_\_\_ percent in 24 hr.

## TEST READINGS

Water temperature at start \_\_\_\_\_ degrees F    Water temperature at end  
\_\_\_\_\_ degrees F

<u>Date</u>	<u>Time</u>	Location 1	Location 2	Location 3	Location 4	Initials
1.	_____	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____	_____

## Change in level

#### Average change in level

#### Correction for precipitation/evaporation

Corrected change in level = CI =

(CD x (surface area) x (100)) – measured percent

(initial water volume) x (number of test days)

## Notes and field observations\*\*

---

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\* Attach a sketch showing a plan of the structure and m  
\*\* Place date and initials at the beginning of each entry.

1  
2  
3

END OF SECTION

1 SECTION 01625  
2

3 START-UP SYSTEMS TESTING  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. Prior to requesting issuance of the Certificate of Substantial Completion, the  
10 Contractor shall perform start-up testing services as specified herein.
- 12 B. Start-up of the facilities and appurtenances will require completion of all  
13 structures, installation of all equipment, and all connections to existing systems.  
14 All components of the new system shall be installed as if each were ready for  
15 use by the Owner for their intended purposes. The Contractor shall provide a  
16 written startup plan, for review by the Engineer, for individual facilities and  
17 systems. As applicable, the startup plan shall be in accordance with the  
18 construction phasing plan described in the Contractor's Schedule described in  
19 Section 01310.
- 21 C. All equipment will be tested and accepted by the Engineer prior to placement of  
22 the new facilities into operation.
- 24 D. All lubricants, water, air, fuel and power necessary for initial operation and tests  
25 shall be furnished by the Contractor at no additional cost to the Owner.
- 27 E. In addition to furnishing, delivering, installing, and testing each piece of  
28 equipment, the Contractor shall provide the services of competent factory  
29 certified representatives for the periods indicated in other sections of these  
30 Specifications. Such representatives shall assist the Engineer by instructing the  
31 operating personnel of the Owner in the maintenance and operation of the  
32 equipment, conducting tests, and making recommendations for producing the  
33 most efficient results. These services shall be made during the initial operation  
34 of the completed facilities and be in addition to services necessary during  
35 erection or to correct defective materials or workmanship during the guarantee  
36 period. These representatives shall be specially trained and qualified to provide  
37 installation services, adjustment, start-up, and testing work and shall not be  
38 sales representatives only. The cost of such representation, including  
39 subsistence and travel, shall be provided by the Contractor at no additional cost  
40 to the Owner.

41  
42 PART 2 – PRODUCTS (NOT USED)  
43

44 PART 3 – EXECUTION  
45

46 3.01 PRELIMINARY MATTERS  
47

- 48 A. General Requirements:

- 1           1. Successfully execute the start-up of the system and demonstrate  
2           satisfactory performance of the intended use thereof. The start-up and  
3           performance demonstration shall be successfully executed prior to the  
4           Engineer's issuance of Substantial Completion.  
5  
6           2. Field acceptance tests shall be witnessed by the Engineer. At least thirty  
7           (30) calendar days prior to initiating any testing, the Contractor shall  
8           submit details of all test procedures to the Engineer for review and  
9           comment. Test procedures shall be submitted to the Engineer in  
10          accordance with Specification Section 01340. This notification shall be  
11          shown on the Progress Schedule.  
12  
13          3. All performance tests and inspections shall be scheduled at least ten (10)  
14          working days in advance with the Engineer. All performance tests and  
15          inspections shall be conducted during the normal work week of Monday  
16          through Friday, unless otherwise authorized, in writing, by the Engineer.  
17  
18          4. The Contractor shall be fully responsible for the proper operation of  
19          equipment during start-up systems testing and shall neither have nor  
20          make any claim for damage that may occur to equipment prior to the time  
21          when the Owner takes over the operation thereof.  
22  
23          5. The Contractor shall be responsible for furnishing and installing all  
24          necessary valves, whether shown on the Drawings or not, in order to  
25          facilitate testing of pumping systems, tanks, and all other system start-  
26          up testing, at no additional cost to the Owner.  
27

28           B. Preparation for Systems Start-Up:

- 29  
30          1. All mechanical and electrical equipment shall be checked to ensure that  
31          each component is in good working order and properly installed and  
32          connected. All systems shall be purged as required. All sumps, tanks,  
33          basins, chambers, wet wells, and pipelines that are hydraulically checked  
34          shall be drained and returned to their original condition once the water  
35          testing is complete. All pipelines that have been filled and flushed shall  
36          be drained clean.  
37  
38          2. All instruments and controls shall be calibrated through their full  
39          operational distribution range. Any other adjustments required for proper  
40          operation of all instrumentation and control equipment shall be made and  
41          confirmed by the specific factory authorized service representative.  
42  
43          3. The Contractor shall work with each factory certified technician to  
44          complete any remaining tasks, connections, adjustments, and

1            preparations needed to ensure proper equipment and/or system  
2            operation.  
3

- 4            4. No testing or equipment operation shall occur until the Engineer has  
5            confirmed that all specified safety equipment has been installed and is in  
6            good working order.  
7
- 8            5. No testing or equipment operation shall occur until the Engineer has  
9            verified that all maintenance equipment, spare parts, and equipment  
10          Operation and Maintenance manuals have been furnished as specified.  
11
- 12          6. No testing or equipment operation shall occur until the factory certified  
13          technician for that particular component has confirmed that all lubricants,  
14          electrical connections, drains, fuel and exhaust systems have been  
15          provided and installed in accordance with the manufacturer's  
16          recommendations.  
17
- 18          7. No testing or equipment operation shall occur until the Contractor has  
19          submitted and the Engineer has reviewed the Certificate of Proper  
20          Installation.  
21

## 22        3.02 PRESSURE TESTS 23

- 24          A. Field pressure tests shall be made to confirm compliance with the Contract  
25          Documents. The Contractor shall perform field tests as herein specified. All  
26          tanks, water mains, piping and equipment shall be tested in the field in the  
27          presence of the Engineer or his authorized agent.  
28
- 29          B. Hydrostatic and leakage tests shall be performed in accordance with the  
30          applicable sections of the American Water Works Association Standard for  
31          Installation of Cast Iron/Ductile Iron Water Mains, AWWA C-600, Concrete  
32          Pressure Pipe, AWWA M9, and Underground Installation of Polyvinyl Chloride  
33          (PVC) Pressure Pipe and Fittings for Water Mains, AWWA C-605, except as  
34          herein modified.  
35
- 36          C. The Contractor shall submit his plan for pressure testing to the Engineer for  
37          review at least ten (10) days before starting the work. The Contractor shall  
38          remove and adequately dispose of all blocking material and equipment after  
39          completion and acceptance of the field hydrostatic test, unless otherwise  
40          directed by the Engineer. Any damage to the pipe shall be repaired by the  
41          Contractor.  
42
- 43          D. After completion of all work and before final acceptance, a hydrostatic and  
44          leakage test shall be conducted. Water required for testing new pipelines will  
45          be provided by the Contractor at the Contractor's expense. Water mains shall  
46          be tested with potable water and force mains and storm water lines shall be

1 tested with reclaimed water, if available. Where applicable, the Contractor shall  
2 coordinate the development of the water supply with the pipeline work in order  
3 that water will be available to meet these requirements. At no time are valves  
4 on the water supply system to be operated without the prior authorization of the  
5 Engineer.

- 6
- 7 E. Each newly installed pressure main shall be tested at a pressure equal 1.5 times  
8 the pipeline design pressure or 150 psi; whichever is greater. The duration of  
9 each test shall be a minimum of two (2) hours.
- 10
- 11 F. Any test pump(s), piping connections, taps, fittings, pressure gauges,  
12 compressors, and all necessary components thereof which might be required  
13 for the hydrostatic tests, shall be furnished by the Contractor at no additional  
14 cost to the Owner.
- 15
- 16 G. All exposed pipe, fittings, valves, air valves, blow-offs and joints shall be  
17 carefully examined during the test, and all joints showing a visible leakage shall  
18 be made tight. All defective pipe, fittings, valves, hydrants and accessories shall  
19 be removed from the line and replaced by the Contractor with new components  
20 at no additional cost to the Owner.
- 21
- 22 H. The Contractor may backfill the trench before testing the line, but he shall open  
23 up the trench at his own expense to repair any leaks.
- 24
- 25 I. All visible leaks shall be corrected regardless of the total leakage revealed by  
26 the test as compared to the allowable calculated losses. All lines that fail to  
27 meet the test shall be repaired and retested as necessary, until test  
28 requirements are complied with. All repairs and retests shall be performed at  
29 the Contractor's own expense with no additional cost to the Owner.
- 30
- 31 J. The installation will not be accepted until the leakage is equal to or less than the  
32 allowable leakage as determined by the formula below:

33

34 
$$L = \frac{SD(P)^{0.5}}{133,200}$$

35

36 in which "L" equals the allowable leakage, in gallons per hour; "S" is the length  
37 of the pipe tested, in feet; "D" is the nominal pipe diameter, in inches; and "P" is  
38 the average test pressure during the leakage test, in pounds per square inch,  
39 gauge.

- 40
- 41 K. All tests shall be made under the supervision of the Engineer or authorized  
42 agents thereof. No additional compensation will be paid to the Contractor for  
43 performing the above required tests; the cost of all labor, materials, lubricants,  
44 fuels, power, necessary appliances, and the coordination for testing purposes  
45 shall be included in the unit price or prices bid for the various items of work.
- 46

- 1           L. The Contractor shall provide the Engineer a minimum of 72 hours advance  
2           notice for scheduling hydrostatic and leakage tests.

3

4        **3.03 DISINFECTION OF POTABLE WATER LINES**

5

- 6           A. Prior to disinfection, the lines shall be cleaned and flushed. Flushing and  
7           cleaning shall occur after all hydrostatic and leak tests have been performed  
8           and passed. Lines shall be disinfected in accordance with the applicable  
9           requirements of AWWA C651 and as described hereinafter.
- 10          B. Before being placed in service, all potable water pipelines installed under this  
11           Contract shall be disinfected by chlorination in accordance with AWWA  
12           Standards. Either of the following disinfectants may be allowed upon written  
13           authorization from the Engineer.
- 14           1. Liquid Chlorine: A chlorine gas-water mixture shall be applied by means  
15           of a solution-feed chlorination device. The device must provide a means  
16           to prevent the backflow of water into the chlorine cylinder.
- 17           2. Calcium Hypochlorite Solution: A solution consisting of 5 percent  
18           calcium hypochlorite powder and 95 percent water by weight shall be  
19           prepared and this solution will be injected or pumped into the line.
- 20          C. The point of application of the chlorinating agent shall be at the beginning of the  
21           pipeline extension and through a corporation stop inserted in the top of the  
22           newly installed pipe. The water injector for delivering the chlorine-bearing water  
23           into the pipe may be supplied from a tap on the pressure side of the valve  
24           controlling the flow into the pipeline extension.
- 25          D. Water from the existing distribution system or other source of supply shall be  
26           controlled so as to flow slowly into the newly installed pipeline during the  
27           application of chlorine. The Contractor shall not allow the chlorine solution in  
28           the line being treated to flow back into the line supplying the water.
- 29          E. Treated water shall be retained in the new pipeline at least 24 hours, after which  
30           the chlorine residual in the line shall be at least 50 mg/l. Should the initial  
31           procedure fail to result in the conditions specified, the chlorination procedure  
32           shall be repeated until acceptable results are obtained, at the Contractor's  
33           expense.
- 34          F. The Contractor shall tap the lines at points designated by the Engineer and  
35           provide necessary piping to discharge water from the line to a designated  
36           location as directed by the Engineer.
- 37
- 38
- 39
- 40
- 41
- 42
- 43
- 44

- 1           G. Following chlorination, all treated water shall be thoroughly flushed from the line,  
2           at its extremities, until the replacement water throughout its length, upon testing,  
3           is proved comparable to the quality of water in the existing distribution system.  
4
- 5           H. Water for flushing will be provided through connections to the Owner's piping  
6           systems. The Contractor shall pay for all water used in flushing the pipelines.  
7           At no time are valves on the distribution system to be operated without the  
8           presence of a duly qualified representative of the Engineer.  
9
- 10          I. After the water lines have been disinfected and flushed, samples of water shall  
11        be taken from several points in sterilized containers, and samples forwarded to  
12        the Engineer, or its designated representative, for bacterial examination. If  
13        repeated tests of such samples show the presence of coliform organisms, the  
14        disinfection shall be repeated or continued until tests indicate absence of  
15        contamination. Final acceptance of the bacterial samples shall be received prior  
16        to placing the system into operation.  
17
- 18          J. The Contractor shall submit his plan for disinfection of the potable water  
19        pipelines to the Engineer for review at least ten (10) days before starting the  
20        work. Lines shall be totally free and clean prior to final acceptance.  
21

22        **3.04 LEAKAGE TEST – GRAVITY SEWERS AND OTHER GRAVITY PIPELINES**  
23

- 24          A. All gravity sewer will be tested by the Contractor prior to final acceptance of the  
25        work. All tests will be conducted in a manner to minimize any interference with  
26        the Contractor's work or progress. The Contractor shall notify the Engineer 72  
27        hours in advance of such tests and, at his option, the Engineer shall witness  
28        such tests.  
29
- 30          B. The Contractor shall notify the Engineer when the work is ready for testing, and  
31        tests shall be made as soon thereafter as practicable, under the observation of  
32        the Engineer. Reading meters, gauges or other measuring devices shall be  
33        new and furnished by the Contractor. The Contractor shall furnish all other  
34        labor, materials, services and equipment including power, fuel, meters and  
35        gauges; water and other items and apparatus necessary for making leakage  
36        tests, preparing guidelines for testing, assembling, placing, and removing  
37        testing equipment and placing in service.  
38
- 39          C. Air Leakage Test  
40
- 41           1. Tests by this method shall be limited to sewers 36 inches in diameter and  
42        smaller. The maximum allowable air leakage is based on pre-wetted  
43        pipe walls. The Contractor may therefore fill the pipe with clear water  
44        and then empty the pipe prior to air testing. When pipe walls are pre-  
45        wetted, air leakage tests shall be completed within 24 hours after filling  
46        the sewer section to be tested.

- 1
2. Air pressure tests shall be made by placing the sewer under 3.0 psig air  
3 pressure and measuring the volume of air required to maintain this  
4 pressure. The rate of air leakage shall be determined when the system  
5 reaches an equilibrium state and air flow shall be read by means of an  
6 approved rotameter.
- 7
8. 3. The maximum rate of air loss shall be 0.003 cfm per square foot of interior  
9 pipe surface and the maximum air flow shall not exceed 2.0 cfm when  
10 the total pressure on the sewer is maintained at 3.0 psig. When the  
11 groundwater level is above the invert of the sewer, but below a level  
12 adequate for infiltration testing, the maximum air loss shall be reduced 6  
13 percent for each foot of groundwater above the sewer invert.
- 14
15. 4. Air testing equipment shall be arranged so that compressors, valving,  
16 gauges, and other test devices are located at the ground surface. Air  
17 testing equipment shall have an approved air relief arrangement to  
18 prevent the sewer from being pressurized to greater than 10.0 psig.
- 19
- D. Manhole Vacuum Tests: Each manhole shall be visually inspected for leakage  
20 or evidence thereof after assembly, installation, and backfilling activities have  
21 been completed. This inspection shall occur by the Engineer or the Engineer's  
22 authorized agent. The Contractor shall demonstrate the integrity of the installed  
23 materials and construction procedures by conducting a vacuum test in  
24 accordance with ASTM C1244-93. If the manhole shows signs of leakage, it  
25 shall be repaired to the satisfaction of the Engineer at no additional cost to the  
26 Owner.
- 27
- E. Repairing Leaks: When leakage occurs in excess of the specified amount,  
28 defective manholes, pipe, pipe joints, or other appurtenances shall be located  
29 and repaired at the expense of the Contractor. If the defective portions cannot  
30 be located, the Contractor shall remove, reconstruct, and retest as much of the  
31 original work as necessary to obtain satisfactory test results.

35 3.05 SYSTEM START-UP

36 A. Contractor Responsibilities

- 39 1. The Contractor shall provide the Engineer ten (10) days' notice in writing  
40 of his intent to perform systems start-up.
- 41 2. The Contractor shall provide sufficient personnel to test equipment,  
42 monitor and record data, as directed by the Engineer.
- 43

- 1           3. The Contractor shall obtain, install, calibrate and operate all test  
2           equipment, gauges, pressure recorders, communications systems, etc.,  
3           as directed by the Engineer.  
4
- 5           4. The Contractor shall cooperate with the Engineer, provide access to the  
6           work, provide all incidental labor and facilities, and provide any temporary  
7           utilities or construction aids required.  
8
- 9           5. The Contractor shall ensure that all equipment, subsystems, and other  
10          separable parts of the Work have been adjusted and balanced and that  
11          any and all field tests have been conducted and demonstrated to be in  
12          proper operating condition to the satisfaction of the Engineer.  
13

14          B. Start-Up Tests  
15

- 16          1. Start-Up Systems Testing shall include, but not be limited to the  
17          following:  
18
- 19           a. The Contractor shall verify that all valves (new and existing,  
20           manual and automatic) are in their proper operating position in  
21           accordance with the specific operating scenario being tested.  
22
- 23           b. The Contractor shall fill the pipes with water, in an approved  
24           manner, taking care to allow the gradual release of air from all  
25           high points.  
26
- 27           c. In the presence of the Engineer, the Contractor shall demonstrate  
28           the operation of all equipment and facilities including all  
29           instrumentation and controls and all manual and automatic control  
30           systems. The Contractor shall be responsible for calibrating and  
31           verifying the accuracy of all new instruments. The Contractor shall  
32           demonstrate the proper operation of all auto-shutdown features  
33           and standby power systems or devices.  
34
- 35           d. The Contractor shall demonstrate proper operation of all aspects  
36           of the control systems, including PLC's, Operator Interface  
37           Terminals, and all hardware and software furnished. The  
38           Contractor shall demonstrate the full integration of the SCADA  
39           System with the Owner's existing network. The Contractor shall  
40           make modifications to the existing HMI screens as required or as  
41           directed by the Engineer for a fully functional system.  
42
- 43           e. Following the successful completion of these tests, the Contractor  
44           shall demonstrate automatic controlled operation of the  
45           equipment and facilities over a period of not less than 72 hours of  
46           continuous successful operation.

END OF SECTION

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- 1 SECTION 01640  
2  
3 QUALITY CONTROL  
4  
5 PART 1 – GENERAL  
6  
7 1.01 SECTION INCLUDES  
8  
9 A. Quality assurance and control of installation  
10 B. References  
11 C. Field samples  
12 D. Mock-up  
13 E. Inspection and testing laboratory services  
14 F. Manufacturers' field services and reports  
15  
16 1.02 RELATED SECTIONS  
17  
18 A. Section 01090 - Reference Standards  
19 B. Section 01300 - Submittals: Submission of Manufacturers' Instructions and  
20 Certificates  
21 C. Section 01410 - Testing- Laboratory Services  
22  
23 1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION  
24  
25 A. Monitor quality control over suppliers, manufacturers, products, services, site  
26 conditions, and workmanship, to produce Work of specified quality.  
27  
28 B. Comply fully with manufacturers' instructions, including each step in sequence.  
29  
30 C. Should manufacturers' instructions conflict with Contract Documents, request  
31 clarification from Engineer before proceeding.  
32  
33 D. Comply with specified standards as a minimum quality for the Work except when  
34 more stringent tolerances, codes, or specified requirements indicate higher  
35 standards or more precise workmanship.  
36  
37 E. Perform work by persons qualified to produce workmanship of specified quality.  
38  
39 F. Secure Products in place with positive anchorage devices designed and sized

1 to withstand stresses, vibration, physical distortion or disfigurement.  
2

3       **1.04 REFERENCES**

- 4
- 5       A. Conform to reference standard by date of issue current on date of Owner Bids.  
6
- 7       B. Should specified reference standards conflict with Contract Documents, request  
8           clarification for Engineer before proceeding.
- 9
- 10      C. The contractual relationship of the parties to the Contract shall not be altered  
11           from the Contract Documents by mention or inference otherwise in any  
12           reference document.
- 13

14       **1.05 FIELD SAMPLES**

- 15
- 16      A. Install field samples at the site as required by individual specifications Sections  
17           for review.
- 18
- 19      B. Acceptable samples represent a quality level for the Work.
- 20
- 21      C. Where field sample is specified in individual Sections to be removed, clear area  
22           after field sample has been accepted by Engineer.
- 23

24       **1.06 MOCK-UP**

- 25
- 26      A. Tests will be performed under provisions identified in this section.
- 27
- 28      B. Assemble and erect specified items, with specified attachment and anchorage  
29           devices, flashings, seals, and finishes.
- 30
- 31      C. Where mock-up is specified in individual Sections to be removed, clear area  
32           after mock-up has been accepted by Engineer.
- 33

34       **1.07 INSPECTION AND TESTING LABORATORY SERVICES**

- 35
- 36      A. Contractor shall employ and pay for services of an independent firm to perform  
37           inspection and testing.
- 38
- 39      B. The independent firm will perform inspections, tests, and other services  
40           specified in individual specification Sections and as required by the Engineer.
- 41
- 42      C. Reports will be submitted by the independent firm to the Engineer, in duplicate,  
43           indicating observations and results of tests and indicating compliance or  
44           non-compliance with Contract Documents.
- 45
- 46      D. Cooperate with independent firm; furnish samples of materials, design mix,

equipment, tools, storage and assistance as requested.

1. Notify Engineer and independent firm 48 hours prior to expected time for operations requiring services.
  2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Price.

## 1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer shall be subject to review of Engineer and Owner.
  - B. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.
  - C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
  - D. Submit report in duplicate within 30 days of observation to Engineer for review.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

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1 SECTION 01670  
2

3 SUBSTITUTIONS AND PRODUCT OPTIONS  
4

5 PART 1 – GENERAL  
6

7 1.01 DESCRIPTION  
8

9 A. General:

- 10
- 11 1. This Section describes the submission, processing and handling of  
12 requests for substitution and product options. See items as indicated on  
13 Drawings and as specified. Any substitution or option shall be in accord  
14 with provisions of Contract Documents, and completely coordinated with  
15 work of other trades.
- 16
- 17 2. Although such work is not specifically indicated, furnish all  
18 supplementary or miscellaneous items, appurtenances and devices  
19 incidental to or necessary for a sound, secure and complete installation.
- 20
- 21 3. See appropriate sections for specific items specified. See General  
22 Conditions for additional information.

23 B. Procedure:

- 24
- 25 1. For products, equipment, and materials that are named on drawings or  
26 in specifications for which a request for substitution is made, observe  
27 procedures outlined in these specifications.
- 28
- 29 C. Costs: Cost incurred by requester in providing information, catalogs, and  
30 samples - including but not limited to labor, materials, freight postage, and  
31 transportation - are sole cost of "Requestor" with no cost assessed Owner or  
32 Engineer.

33

34 1.02 REQUESTS FOR SUBSTITUTION - GENERAL  
35

- 36
- 37 A. Base all bids on materials, equipment and procedures specified.
- 38
- 39 B. Certain types of equipment and kinds of material are described in specifications  
40 by means of trade names and catalog numbers and/or manufacturer's names.  
41 Where this occurs, it was not intended to exclude from consideration such types  
42 of equipment and kinds of material bearing other trade names, catalog numbers  
43 and/or manufacturer's names, capable of accomplishing purpose of types of  
44 equipment or kinds of material specifically indicated.
- 45
- 46 C. Other types of equipment and kinds of material may be acceptable to Owner

1 and Engineer.  
2

- 3 D. Types of equipment, kinds of material and methods of construction, if not  
4 specifically indicated must be accepted in writing by Engineer and be agreed  
5 upon by Owner.
- 6 E. Conditional bids will not be accepted.
- 7

8 1.03 SUBMISSION OF REQUESTS FOR SUBSTITUTION

9

- 10 A. Within no more than 30 days after award of the Contract, the Engineer will  
11 consider requests for substitutions of products, materials, systems or other  
12 items. Requests must be received by Engineer within 30 calendar days after  
13 the date of Contract award. All requests for substitution shall be completed as  
14 specified below.
- 15 B. Substitute items must comply with color and pattern of base specified items  
16 unless specifically approved otherwise.
- 17 C. Submit two (2) copies of request for substitution. Include in request:
- 18 1. Name of product located by Drawing No. or Specification No., followed  
19 by a detail or line number the particular item(s) for which request for  
20 substitution is initiated.
- 21 2. Complete data substantiating compliance of proposed substitution with  
22 Contract Documents.
- 23 3. For Products:
- 24 a. Product identification by schedule or tag no., including  
25 manufacturer's name.
- 26 b. Manufacturer's literature, marked to indicate specific model, type,  
27 size, and options to be considered:
- 28 1) Product Description  
29 2) Performance and test data  
30 3) Reference standards  
31 4) Difference in power demand  
32 5) Dimensional differences for specified unit
- 33 c. Submit samples, full size if so required. Engineer reserves right  
34 to impound sample until physical units are installed on project for  
35 comparison purposes. All costs of furnishing and return of  
36 samples shall be paid by requester. Engineer is not responsible

for loss of or damage to samples.

- d. Name and address of similar projects where product was used, date of installation, and field performance data on installation.

- #### 4. For construction methods:

- a. Detailed description of proposed method

- b. Drawings illustrating methods

5. Itemized comparison of proposed substitution with product or method specified.

6. Data relating to changes in construction schedule.

7. Accurate cost data on proposed substitution in comparison with product or method specified.

8. Include with any request a specific statement defining changes in contract time or amount.

- D. In making request for substitution, or in using an approved substitute item, Supplier/Manufacturer represents:

1. He has personally investigated proposed product or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform function for which it is intended.

2. Will provide same or better warranty for substitute item as for product or method specified.

3. Will coordinate installation of accepted substitution into work, to include but not be limited to the following:

- a. Building and structure modifications as necessary:

- b. Additional ancillary equipment to accommodate change:

- c. Piping, valving, mechanical, electrical, or instrumentation changes and

- d. All other changes required for work to be complete in all respects to permit incorporation of substitution into project.

4. Waives all claims for additional costs related to substitution which

## SUBSTITUTIONS AND PRODUCT OPTIONS

subsequently become apparent.

- E. Written acceptance or rejection of items presented for alternative consideration will be given within two weeks after request is received.
  - F. In the event the acceptance of an alternate results in a change in contract price or time, or is a deviation from the Contract Documents, a work change directive or change order will be issued to reflect such change. In the event the acceptance of an alternate does not result in a change in Contract price or time, a field order shall be issued.
  - G. Alternates may be rejected for the following reasons:
    - 1. Acceptance will require substantial revision of Contract Documents or building spaces.
    - 2. If they are, in Engineer's opinion, not equal to base product specified, or will not adequately perform function for which intended.
    - 3. If request is not initiated by the Contractor in accordance with this specification section.
    - 4. If request will require will, in the opinion of the Engineer, excessive time and/or engineering resources to evaluate.

#### 1.04 SUBSTITUTION DUE TO UNAVAILABILITY

- A. Unavailability of specified item due to strikes, lockouts, bankruptcy, discontinuance of production, proven shortage, or similar occurrences are reasons for substitution after Contract award.
  - B. Notify Engineer in writing, as soon as condition of unavailability becomes apparent; include substantiating data. Submit request for substitution sufficiently in advance to avoid delays.
  - C. Submit data as required in paragraph 1.03 above.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01700  
2

3 CONTRACT CLOSEOUT  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9 A. Comply with requirements stated in General Conditions and in Specifications  
10 for administrative procedures in closing out the Work.
- 12 B. Electronic Shop Drawings and O&M Manuals  
13
- 14 1. The Contractor shall furnish final Shop Drawings and Operations and  
15 Maintenance Data in electronic ".pdf" format for all equipment furnished  
16 under all Specification Sections in Divisions 11, 12, 13, 14, 15 and 16.  
17
- 18 2. The Contractor shall organize all electronic Shop Drawings and  
19 Operations and Maintenance Data by specification division and section  
20 number and submit two (2) copies on compact disk media (CD-ROM) or  
21 other approved electronic media.  
22

23 1.02 SUBSTANTIAL COMPLETION  
24

- 25 A. When Contractor considers the Work, or portion thereof, to be substantially  
26 complete, he shall submit to the Engineer:
  - 28 1. A written notice that the Work, or designated portion thereof, is  
29 substantially complete.
  - 31 2. A list of items to be completed or corrected.
- 33 B. Within a reasonable time after receipt of such notice, the Engineer will inspect  
34 to determine the status of completion.
- 36 C. Should the Engineer determine that the Work is not substantially complete:
  - 38 1. The Engineer will promptly notify the Contractor, in writing, giving the  
39 reasons therefore.
  - 41 2. Contractor shall remedy the deficiencies in the Work and send a second  
42 written notice of substantial completion to the Engineer.
  - 44 3. The Engineer will re-inspect the Work.
- 46 D. When the Engineer finds that the Work is substantially complete, he will:

CONTRACT CLOSEOUT

01700-1

03/20/2020

1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with a tentative list of items to be completed or corrected.
  2. After consideration of any objections made by the Owner as provided in General Conditions, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

## 1.03 FINAL INSPECTION

- A. When Contractor considers all the Work to be complete, he shall submit written certification that:
    - 1. Contract Documents have been reviewed.
    - 2. Work has been inspected for compliance with Contract Documents.
    - 3. Work has been completed in accordance with Contract Documents.
    - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
    - 5. Work is completed and ready for final inspection.
  - B. The Engineer will inspect to verify the status of completion with reasonable promptness after receipt of such certification.
  - C. Should the Engineer consider that the Work is incomplete or defective:
    - 1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
    - 2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the Engineer that the Work is complete.
    - 3. The Engineer will re-inspect the Work.
  - D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

## 1.04 PARTIAL SUBSTANTIAL COMPLETION ACCEPTANCE

- A. For the purpose of construction phasing and for the commencement of the warranty period for equipment, the Owner may accept portions of process systems. Partial Substantial Completion shall be allowed for a complete process system only, or combination of process systems working together, and the Owner shall only consider for partial Substantial Completion those systems as specified herein.
  - B. The following general requirements must be completed prior to the Owner accepting partial Substantial Completion of a system. Owner shall accept stand-alone ancillary systems for consideration of partial substantial acceptance.
    - 1. An equipment manufacturer representative shall be present for all initial start-up and testing as specified in Section 01625 and all other start-up and testing as required in the equipment specifications in Division 11.
    - 2. The Contractor shall provide training of Owner personnel in the operation of new equipment, according to the equipment specifications outlined in Division 11 and Section 01820.
    - 3. Contractor shall provide Operating and Maintenance Data to the Owner as required by Section 01730.
    - 4. All electrical equipment including controls, conduit, wiring and safety interlocks for each piece of equipment as shown on the Drawings must be completed as outlined in Divisions 13 and 16.
    - 5. All Control System equipment must be installed and operational for the system that is being tested for partial substantial completion as outlined in Divisions 13 and 16.
    - 6. All inlet and discharge piping must be connected and tested for each system that is being tested for partial substantial completion in compliance with Division 01.
    - 7. Certifications of Proper Installation shall be furnished, along with spare parts, calibration certificates, and the results of all tests.

## 1.05 RE-INSPECTION FEES

- A. Should the Engineer perform re-inspections, due to failure of the Work, to comply with the claims of status of completion made by the Contractor:

  1. Owner will compensate the Engineer for such additional services.

- 1           2. Owner will deduct the amount of such compensation from the final  
2           payment to the Contractor.

3

4   **1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER**

- 5
- 6       A. Evidence of compliance with requirements of governing authorities.
- 7       B. Project Record Documents.
- 8
- 9       C. Operating and Maintenance Data, Instructions to Owner's Personnel.
- 10
- 11      D. Warranties and Bonds.
- 12
- 13      E. Keys and Keying Schedule.
- 14
- 15      F. Spare Parts and Maintenance Materials.
- 16
- 17      G. Evidence of Payment and Release of Liens.
- 18
- 19      H. Certificate of Insurance for Products and Completed Operations.
- 20
- 21      I. Contractor's Final Affidavit.
- 22
- 23      J. Lien Waivers from Subcontractors and Suppliers.
- 24
- 25      K. Consent of Surety from the bonding company.
- 26
- 27      L. Contractor's Guarantee.
- 28

29

30   **1.07 FINAL ADJUSTMENT OF ACCOUNTS**

- 31
- 32       A. Submit a final statement of accounting to the Engineer.
- 33
- 34       B. Statement shall reflect all adjustments to the Contract Sum:
- 35
- 36          1. The original Contract Sum.
- 37
- 38          2. Additions and deductions resulting from:
- 39
- 40            a. Previous Change Orders.
- 41
- 42            b. Unit Prices.
- 43
- 44            c. Deductions for uncorrected Work.
- 45
- 46            d. Penalties and Bonuses.

- e. Deductions for liquidated damages.
  - f. Deductions for re-inspection payments.
  - g. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Payments.

5. Sum remaining due.

## 1.08 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the General Conditions.

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

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CONTRACT CLOSEOUT  
01700-6

03/20/2020

1 SECTION 01710  
2

3 CLEANING  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. The Contractor shall execute cleaning during progress of Work and at  
10 completion of the Work as required by the General Conditions.  
11

12 1.02 DISPOSAL REQUIREMENTS  
13

14 A. The Contractor shall conduct cleaning and disposal operations to comply with  
15 all applicable Laws and Regulations.  
16

17 B. Disposal of waste materials shall be in accordance with the Section III,  
18 Paragraph 17.7 and local ordinances.  
19

20 PART 2 – MATERIALS  
21

22 2.01 MATERIALS  
23

24 A. The Contractor shall use only those cleaning materials that do not create  
25 hazards to health or property and that do not damage surfaces.  
26

27 B. The Contractor shall use only those cleaning materials and methods  
28 recommended by the Manufacturer of the surface material to be cleaned.  
29

30 C. The Contractor shall use cleaning materials only on surfaces so recommended  
31 by cleaning material Manufacturer.  
32

33 D. Disposal of cleaning materials shall not cause disruptions in the operation of the  
34 facility or otherwise cause the plant to violate its operating permit. The  
35 Contractor shall be solely responsible for all costs attributable to the improper  
36 disposal of such cleaning materials in the plant.  
37

38 PART 3 – EXECUTION  
39

40 3.01 CLEANING DURING CONSTRUCTION  
41

42 A. The Contractor shall execute daily cleaning to keep the Work, the site and  
43 adjacent properties free from accumulations of waste materials, water, eroded  
44 material, rubbish and windblown debris resulting from construction operations.  
45

46 B. The Contractor shall provide suitable on-site containers for the daily collection  
47

1                   of all waste materials, debris and rubbish.  
2

- 3                   C. The Contractor shall remove waste materials, debris and rubbish from site  
4                   containers periodically and dispose of in accordance with Section 1.02.
- 5                   D. The Contractor shall schedule operations so that dust and other contaminants  
6                   resulting from the cleaning process do not fall on wet or newly coated surfaces.
- 7                   E. The Contractor shall remove from the site all surplus materials and temporary  
8                   structures when no further need therefore develops and as approved by the  
9                   Engineer. The Contractor shall be responsible and liable for all spillage and  
10                  shall incur all associated costs including, but not limited to, costs related to  
11                  repair and maintenance resulting from any such damage.
- 12

13                  3.02 FINAL CLEANING

14

- 15                  A. The Contractor shall employ skilled workmen for final cleaning.
- 16
- 17                  B. The Contractor shall remove all grease, mastic, adhesives, dust, dirt, stains,  
18                   fingerprints, labels and all other foreign materials from sight-exposed interior  
19                  and exterior surfaces.
- 20
- 21                  C. Prior to Final Completion, the Contractor shall conduct an inspection of sight-  
22                   exposed interior and exterior surfaces and all Work areas, to verify that the  
23                  entire Work and the entire construction area of the Work are clean.
- 24
- 25

26                  END OF SECTION

27

28

1 SECTION 01720  
2

3 PROJECT RECORD DOCUMENTS  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9       A.     Maintain at the site for the Owner one record copy of:  
10           1.     Drawings  
11           2.     Specifications  
12           3.     Addenda  
13           4.     Change Orders and other Modifications to the Contract  
14           5.     Engineer's Field Orders or written instructions  
15           6.     Accepted Shop Drawings, Working Drawings and Samples  
16           7.     Field Test Records  
17           8.     Construction Photographs, if provided  
18           9.     Detailed progress schedule  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28

29 1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES  
30

- 31       A.     Store documents and samples in Contractor's field office apart from documents  
32           used for construction.  
33           1.     Provide files and racks for storage of documents.  
34           2.     Provide locked cabinet of secure storage space for storage of samples.  
35  
36  
37       B.     File documents and samples in accordance with Construction Specifications  
38           Institute (CSI) format.  
39  
40       C.     Maintain documents in a clean, dry, legible condition and in good order. Do not  
41           use record documents for construction purposes.  
42  
43       D.     Make documents and samples available at all times for inspection by the  
44           Engineer.  
45  
46

1           E. As a pre-requisite for monthly progress payments, the Contractor shall exhibit  
2           the updated "record documents" for review by the Engineer and Owner.  
3

4        1.03 MARKING DEVICES  
5

6           A. Provide felt tip marking pens for recording information in the color code  
7           designated by the Engineer.  
8

9        1.04 RECORDING  
10

11           A. Label each document "PROJECT RECORD" in neat large printed letters.  
12

13           B. Record information concurrently with construction progress.  
14

15           1. Do not conceal any work until required information is recorded.  
16

17           C. Drawings: Legibly mark to record actual construction:  
18

19           1. Depths of various elements of foundation in relation to finish first floor  
20           datum.  
21

22           2. Denote all underground piping elevations and dimensions; all changes to  
23           piping location; horizontal and vertical locations of underground utilities  
24           and appurtenances, all referenced to permanent surface improvements.  
25           Actual installed pipe material, class, etc.  
26

27           3. Locations of internal utilities and appurtenances concealed in the  
28           construction, referenced to visible and accessible features of the  
29           structure.  
30

31           4. Field changes of dimension and detail.  
32

33           5. Changes made by Field Order or by Change Order.  
34

35           6. Details not on original Contract Documents.  
36

37           7. Equipment and piping relocations.  
38

39           8. Major architectural and structural changes including relocation of doors,  
40           windows, etc.  
41

42           9. Architectural schedule changes according to Contractor's records and  
43           shop drawings.  
44

45           D. Specifications and Addenda; legibly mark each Section to record:  
46

1       1. Manufacturer, trade name, catalog number, and supplier of each product  
2       and item of equipment actually installed.

3       2. Changes made by Field Order or by Change Order.

4       E. Shop Drawings (after final review):

5       1. Five (5) sets of shop drawings for each piece of process equipment, piping,  
6       electrical and instrumentation system.

7       F. CAD Requirements for Record Drawings: The Contractor shall provide the  
8       Engineer with a complete set of Record Drawings in the latest version of  
9       AutoCAD format upon completion of the Work. No additional compensation will  
10      be allowed for the Contractor to provide the Record Drawings. The Contractor  
11      shall use the AutoCAD Drawings furnished by the Engineer for this purpose.  
12      Record Drawings must be submitted in the AutoCAD format of the Contract  
13      Drawings. No other CAD software or format will be accepted. It is Contractor's  
14      sole responsibility to ensure that the Record Drawings conform to the following  
15      CAD requirements:

16      1. Drawings shall be submitted to the Engineer on CD-ROM. Each CD shall be  
17      clearly labeled with the appropriate project number, client name, date, and  
18      file names included on each CD. If files are compressed, a description of the  
19      compression software must be included along with a copy of the appropriate  
20      uncompressing software. All changes to Drawings must be done in  
21      accordance with the appropriate scale of the Drawing revised and shall be  
22      delineated by placing a "cloud" around the areas revised and adding a  
23      revision triangle indicating the appropriate revision number.

24      2. Each Drawing must have the revision block completed to indicate the  
25      revision number, date, and initials of the person revising the Drawing. The  
26      description of the revision must say "Record Drawing." This procedure must  
27      be followed for every Drawing even when no changes are made to the  
28      Drawing.

29      3. All revisions to Drawings must be put on separate layers with the layer  
30      names prefixed Record followed by the appropriate existing layer name. The  
31      colors and line types of the appropriate existing layers shall be adhered to  
32      when creating new layers.

33      4. The Contractor shall supply one full set of Record Drawings on reproducible  
34      black line prints and five full sets of opaque copies.

35      1.05 SUBMITTAL

36      A. At contract close-out, deliver Record Documents to the Engineer for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

## 1. Date

## 2. Project title and number

3. Contractor's name and address

4. Title and number of each Record Document

5. Signature of Contractor or his authorized representative

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01730  
2

3 OPERATING AND MAINTENANCE DATA  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Compile product data and related information appropriate for Owner's operation  
10      and maintenance (O&M) of new equipment and processes furnished and or  
11      installed by the Contractor.  
12  
13       1. Prepare operating and maintenance data as specified in this Section and  
14      as referenced in other pertinent sections of Specifications.  
15  
16       2. Incorporate O&M data and information in an O&M Manual that is specific  
17      and targeted for the equipment and processes supplied for this project.  
18  
19       3. Incorporate O&M data furnished by the Owner, if previously defined in  
20      the scope of work.  
21  
22       B. Furnish all labor, equipment, materials, and all other items required to supply  
23      and deliver to the Engineer, O&M Manuals for the work, mechanical equipment,  
24      instrumentation equipment, electrical equipment, process control equipment,  
25      and software on a facility wide, system by system, and individual equipment  
26      basis as pertinent to the project.  
27  
28       C. Five (5) draft O&M Manuals for each piece of equipment shall be submitted to  
29      the Engineer upon delivery of the equipment. The draft O&M Manuals shall  
30      include the manufacturer's test results and specification and may be used as a  
31      training aid.  
32  
33       D. Furnish the Owner five (5) complete hardcopy sets of O&M data and two (2)  
34      complete set of operation and maintenance data in electronic "pdf" format on a  
35      CD as specified herein for the project.  
36  
37       1. Any modifications required after final O&M submission shall be made to  
38      the manuals by issuance of all new manuals with the revised or additional  
39      information included and clearly identified.

40  
41 1.02 QUALITY ASSURANCE  
42

- 43       A. Preparation of data shall be done by personnel:  
44  
45       1. Trained and experienced in maintenance and operation of described  
46      products.

2. Familiar with requirements of this Section.
3. Skilled and technical writer to the extent required to communicate  
essential data.
4. Skilled as draftspersons competent to prepare required Drawings.

#### 1.03 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by Owner's personnel.
- B. Format:
  1. Size: 8-1/2 inches x 11-inches.
  2. Paper: 20 pound minimum white, for typed pages.
  3. Text: Manufacturer's printed data, or neatly typewritten.
  4. Drawings:
    - a. Provide reinforced punched binder tabs, bind in with text.
    - b. Reduce larger Drawings to 11-inches x 17-inches and fold to size of text pages and printed only on one side.
  5. Provide tabbed fly-leaf for each separate product, or each piece of operating equipment.
    - a. Provide typed description of the product, and of each major component part of equipment.
    - b. Provide indexed tabs.
  6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
    - a. Title of Project
    - b. Identity of separate structure as applicable.
    - c. Identity of general subject matter covered in the manual.
- C. Binders:
  1. Commercial quality three post- binders with durable and cleanable plastic covers.

1           2. Maximum post width: 2-inches. Each binder filled to not more than 75%  
2           capacity.

3           4. When multiple binders are used, correlate the data into related consistent  
4           groupings.

5           6. D. Refer to Specification Section 01300 for additional submittal requirements.  
7

8           9. **1.04 GENERAL CONTENT OF MANUAL**

10          11. A. Neatly typewritten table of contents for each volume, arranged in systematic  
11          order. If more than one volume is required, the table of contents of each volume  
12          shall be included with all volumes.

13          14. B. The contact information, address, and phone number for the Contractor and the  
14          responsible principal shall be included.

15          16. C. A list of each product included, indexed to content of the volume.

16          17. D. A list, with each product, name, address, and telephone number of:

18          19. a. Manufacturer

20          21. b. Subcontractor or installer.

21          22. c. Maintenance contractor, as appropriate.

22          23. d. Local source of supply for parts and replacement.

23          24. E. Identify each product by product name and other identifying symbols as set forth  
24          in Contract Documents.

25          26. F. Product Data:

26          27. 1. Include only those sheets which are pertinent to the specific product.

27          28. 2. Annotate each sheet to:

28          29. a. Clearly identify specific product or part installed.

29          30. b. Clearly identify data applicable to installation.

30          31. c. Delete references to inapplicable information.

31          32. G. Drawings:

32          33. 1. Supplement product data with Drawings as necessary to clearly illustrate:

33          34. a. Relations of component parts of equipment and systems.

34          35. b. Control and flow diagrams.

35          36. c. Owner Tag Numbers.

- d. Exploded views with part numbers listed and identified.
  - 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

H. Written text, as required to supplement product data for the particular installation:

  - 1. Organized in consistent format under separate headings for different procedures.
  - 2. Provide logical sequence of instructions of each procedure.
  - 3. Provide an overview of how the complete system should operate.

I. Provide a copy of each warranty, bond, and service contract issued.

  - 1. Provide information sheet for Owner's personnel with the following information:
    - a. Proper procedures in event of failure.
    - b. Circumstances and events that may affect validity of warranties or bonds.

#### 1.05 CONTENT OF MANUAL FOR ARCHITECTURAL PRODUCTS, MOISTURE-PROTECTED, WEATHER-EXPOSED, AND APPLIED MATERIALS, AND FINISHES

- A. Manufacturer's data, giving full information on products.
    - 1. Catalog number, size, and composition.
    - 2. Applicable Standards
    - 3. Chemical Composition
    - 4. Details of Installation or Application
    - 5. Color and texture designations.
    - 6. Information required for re-ordering special-manufactured products.
    - 7. Storage instructions and shelf life information.
  
  - B. Instructions for care and maintenance.
    - 1. Manufacturer's recommendation for types of cleaning agents and methods.
    - 2. Cautions against cleaning agents and methods that are detrimental to product.
    - 3. Recommended schedule for cleaning and maintenance.

- 1  
2       4. Instructions for inspection, maintenance, and repair.  
3

4     **1.06 CONTENT OF MANUAL FOR EQUIPMENT AND SYSTEMS**  
5

6       A. Content, for each electrical, mechanical, instrumentation, and communication  
7       system, as appropriate:  
8

- 9       1. A table identifying each piece of equipment, each associated control or  
10      instrument, the location of the control or instrument, and the function of  
11      the control or instrument.  
12  
13       2. A description of the system and its component parts.  
14  
15       3. Function, normal operating characteristics, and limiting conditions for the  
16      system, the sub-system, and the component parts.  
17  
18       4. Performance curves, engineering data, and tests.  
19  
20       5. Complete nomenclature and commercial numbers of replaceable parts.  
21  
22       6. Assembly drawings.  
23  
24       7. The manufacturer's parts list, illustrations, assembly drawings, and  
25      diagrams, and exploded views required for operations and maintenance.  
26  
27       8. Manufacturer's model and serial number.  
28  
29       9. List of all special tools required to service equipment and/or systems  
30      including where the tools are stored.  
31  
32       10. Circuit directories of panel boards.  
33  
34           a. Electrical service.  
35           b. Controls.  
36           c. Communications.  
37  
38       11. As-installed color-coded wiring diagrams and control diagrams.  
39  
40       12. Instrument loop diagrams showing the path that a control or  
41      instrumentation signal takes from its origin to the action it takes.  
42  
43       13. An electrical schematic for each item.  
44  
45       14. A chart listing the controls/instruments in a loop identifying the  
46      equipment's abbreviated symbol, a description of the symbol, design

1 criteria, process flow, quantity supplied, and manufacturer's model and  
2 serial number.

3

4 15. Operating procedures.

- 5
- 6 a. Routine and normal operating instructions.  
7 b. Sequences required.  
8 c. Special operating instructions.  
9 d. Start-up, break-in, routine, and normal operating instructions.  
10 e. Regulation, control, stopping, shut-down, and emergency  
11 instructions.  
12 f. Special operating instructions.  
13 g. Control settings and ranges.

14

15 16. Maintenance procedures.

- 16
- 17 a. Routine maintenance.  
18 b. Guide to "trouble-shooting."  
19 c. Disassembly, repair, and re-assembly.  
20 d. Alignment, adjustment, tolerances, and checking.  
21 e. Type and frequency of preventive maintenance activities required  
22 for each piece of equipment.  
23 f. List of lubricants required.  
24 g. Period between lubrications.  
25 h. Servicing and lubrication schedule.

26

27 17. The manufacturer's printed operating and maintenance instructions.

28

29 18. Abnormal and emergency operations.

- 30
- 31 a. Potential overloads.  
32 b. Procedures for equipment breakdown.  
33 c. Action to be taken in a power outage.  
34 d. Identity of alarms by equipment location and action to correct.  
35 e. Equipment safety features, requirements, and potential hazards.

36

37 19. Programming manuals for programmable devices including list of  
38 standard programming.

39

40 20. Other data as required under pertinent Sections of the Specifications.

41

42 21. A list of the manufacturer's recommended spare parts, manufacturer's  
43 current prices, recommended quantities to be maintained in storage, and  
44 predicted life of parts subject to wear.

22. The final manual shall include the startup report for each piece of equipment and documentation that the Owner's designated personnel attended a formal training session as applicable for each piece of equipment.
  23. Charts of equipment, instrument, and valve tag numbers with location, function, sheet number, model number, serial number, and actuator type identified.

## 1.07 INSTRUCTION OF OWNER'S PERSONNEL

A. Refer to Specification 01820 for Training and Instruction of Owner's personnel.

## PART 2 – PRODUCTS (Not Used)

### PART 3 – EXECUTION (Not Used)

END OF SECTION

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1 SECTION 01740  
2

3 WARRANTIES AND BONDS  
4

5 PART 1 – GENERAL  
6

7 1.01 REQUIREMENTS INCLUDED  
8

- 9       A.    Compile warranties and bonds, as specified in the General Conditions.  
10      B.    Co-execute submittals when so specified.  
11      C.    Review submittals to verify compliance with Contract Documents.  
12      D.    Submit to the Engineer for review and transmittal to Owner.

13 1.02 SUBMITTAL REQUIREMENTS  
14

- 15       A.    Assemble warranties, bonds, and service and maintenance contracts, executed  
16        by each of the respective manufacturers, suppliers and subcontractors.  
17       B.    Number of original signed copies required. Two each.  
18       C.    Table of Contents. Neatly typed in orderly sequence. Provide complete  
19        information for each item.  
20  
21           1.    Product or work item.  
22           2.    Firm, with name of principal, address and telephone number.  
23           3.    Scope.  
24           4.    Date of beginning warranty, bond or service and maintenance contract.  
25           5.    Duration of warranty, bond or service maintenance contract.  
26           6.    Provide information for Owner's personnel:  
27  
28              a.    Proper procedure in case of failure.  
29              b.    Instances which might affect the validity of warranty or bond.  
30  
31           7.    Contractor, name of responsible principal, address and telephone  
32        number.  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

## 1.03 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of substantial completion and/or final acceptance by the Owner, whichever is later.
  - B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment that has a 1 HP motor or that has a list price of more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.
  - C. In the event that the equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a three (3) year warranty commencing at the time of equipment delivery to the job site. The manufacturer's warranty shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.
  - D. The Contractor shall replace and install each piece of equipment, device, or component that fails within the warranty period term specified above with reasonable promptness and without increase in the Contract Price. If the Contractor fails to provide timely repairs as specified, the Owner shall issue a claim against the Contractor's Bond. The Contractor may be allowed to repair the defective equipment in some cases as required by the Owner.

## 1.04 WARRANTY START DATE

- A. No warranty shall start until the Engineer has issued a "Notice of Substantial Completion".

## PART 2 – PRODUCTS (NOT USED)

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01820  
2

3 TRAINING  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9       The Contractor shall be responsible for performing and/or coordinating the following  
10      work relating to training the Owners designated personnel for this project:

- 12       A.     Instruct and train the Owner's personnel in the operation and maintenance of  
13        the equipment and systems supplied and/or installed under this Contract.
- 15       B.     Incorporate operation and maintenance data and training services furnished by  
16        the suppliers into the training program such as shop drawings, equipment  
17        manuals, and start-up, engineering, and training assistance.
- 19       C.     Ensure that system suppliers provide qualified training instructors experienced  
20        in the proper operation and maintenance of all applicable equipment and  
21        systems.
- 23       D.     Prepare instructors and training materials required for complete factory, field,  
24        classroom, and hands-on training.
- 26       E.     Furnish training videos and training manuals during the training program. The  
27        training manual shall be a separate document from the O&M Manual.
- 29       F.     Include in the Contract Price the cost for training equipment; preparing training  
30        manuals in addition to O&M manuals; conducting and videotaping two (2)  
31        classroom instructional sessions (AM and PM) for each piece of equipment and  
32        treatment process; performing field, factory, and hands-on training; and  
33        coordinating and incorporating training service provided by suppliers, and all  
34        other activities required to provide a comprehensive training program of  
35        sufficient length, as determined by the Owner.
- 37       G.     Notify the City two (2) weeks prior to scheduling the training sessions.

39  
40 1.02 SUBMITTALS  
41

42       A.     TRAINING PLAN  
43

44       In conjunction with submittal of draft O&M Manuals, and at least 30 days before  
45       equipment or systems startup, the Contractor shall submit to the Engineer a  
46       proposed training manual and detailed training plan with specific information as

1                   identified in PART 2 of this specification.  
2

3        **1.03 QUALITY ASSURANCE**

- 4
- 5           A. Preparation of training materials and instructions to be provided shall be  
6           performed by personnel:
- 7
- 8              1. Trained and experienced in operation and maintenance of equipment  
9              and systems installed under this Contract.
- 10
- 11             2. Familiar with the training requirements of the Owner.
- 12
- 13           B. The Contractor shall furnish the resumes and references for each instructor to  
14           be used in the training program.
- 15
- 16           C. The Engineer and Owner may review the resumes. Based on the review of the  
17           resumes and contacts with references, the Engineer shall accept, request  
18           additional information, or reject proposed instructors for the training program. If  
19           a proposed instructor is rejected, the Contractor shall submit the resume and  
20           references of another candidate within a reasonable time.

21

22       **PART 2 – PRODUCTS**

23

24       **2.01 TRAINING PLAN**

- 25
- 26           A. The Contractor shall submit for review by the Owner and Engineer a detailed  
27           training plan specific to the project or equipment with specific information as  
28           follows:
- 29
- 30              1. Title and objectives.  
31              2. Training schedule.  
32              3. Prerequisite training and experience of attendees.  
33              4. Recommended types of attendees (e.g., managers, engineers,  
34              operators, maintenance staff).  
35              5. Course description and outline of course content.  
36              6. Duration.  
37              7. Location (e.g., training center or site).  
38              8. Format (e.g., lecture, self-study, demonstration, hands-on).  
39              9. Instruction materials and equipment requirements.  
40              10. Training manual.
- 41
- 42           B. The training program shall be prepared in the manufacturer's facility and  
43           completed before start-up of the Owner's system and shall use equipment  
44           similar to the Owner's equipment.
- 45
- 46           C. The training program shall be conducted in the field in accordance with the

approved schedule.

- D. In conjunction with start-up of the equipment or system, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for two (2) 8-hour periods to instruct the Owner's designated personnel in the operation, maintenance, and control of the equipment or systems.
  - E. The Contractor shall coordinate and submit a training schedule to the Engineer 30 days before the first training event.

## 2.02 VIDEOTAPED TRAINING MATERIAL

- A. The Contractor shall produce or provide video training material subject to review of the Owner.
  - B. Provide four copies of each videotape in DVD format in plastic case with title, the Owner's name, and date on a label in a clear plastic sleeve.
  - C. Bear all costs associated with production and provision of the DVDs.

### PART 3 – EXECUTION (NOT USED)

END OF SECTION

**SECTION IVB**

**NORTHEAST WRF GRIT REMOVAL, SALNES FILTER AND  
EQUALIZATION SYSTEM IMPROVEMENTS**

**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

**(PROJECT No. 19-0029-UT)**

PREPARED FOR:



CITY OF CLEARWATER  
ENGINEERING DEPARTMENT  
100 SOUTH MYRTLE AVENUE  
CLEARWATER, FL 33756

PREPARED BY:



KING ENGINEERING ASSOCIATES, INC.  
4921 MEMORIAL HIGHWAY  
MEMORIAL CENTER, SUITE 300  
TAMPA, FL 33634

**Bid Documents**

**January 2021**

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## TABLE OF CONTENTS

### **DIVISION 02 SITEWORK**

02050	DEMOLITION
02062	REMOVAL OF EXISTING EQUIPMENT
02063	HIGH DENSITY POLYETHYLENE PIPE
02064	MODIFICATIONS TO EXISTING STRUCTURES, PIPING, AND EQUIPMENT
02080	ASBESTOS PRE-DEMOLITION ABATEMENT
02083	LEAD-BASED PAINT ABATEMENT
02085	OTHER HAZARDOUS MATERIALS REMOVAL AND DISPOSAL
02100	SITE PREPARATION
02125	SILT BARRIERS
02140	TEMPORARY DEWATERING
02220	EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES
02221	EXCAVATION, BACKFILL, FILL AND GRADING FOR PIPES
02276	TEMPORARY EROSION AND SEDIMENTATION CONTROL
02485	SURFACE RESTORATION AND SIDEWALKS
02525	CONCRETE CURB
02575	PAVEMENT CONSTRUCTION AND RESTORATION
02720	STORM DRAINAGE SYSTEM
02730	PRECAST CONCRETE STRUCTURES

### **DIVISION 03 CONCRETE**

03100	CONCRETE FORMWORK
-------	-------------------

- 03200 CONCRETE REINFORCEMENT
- 03250 CONCRETE JOINTS AND JOINTS ACCESSORIES
- 03300 CAST IN PLACE CONCRETE
- 03350 CONCRETE FINISHES
- 03600 GROUT
- 03740 MODIFICATIONS AND REPAIR TO CONCRETE
- 03750 FLOW CHANNEL COATING SYSTEM
- 03800 LEAKAGE TESTING OF WATER RETAINING STRUCTURES

**DIVISION 05 METALS**

- 05500 MISCELLANEOUS METAL

**DIVISION 06 WOOD AND PLASTICS**

- 06600 FIBERGLASS REINFORCED PLASTIC FABRICATIONS

**DIVISION 09 FINISHES**

- 09865 SURFACE PREPARATION AND SHOP PRIME PAINTING
- 09900 PAINTING

**DIVISION 11 EQUIPMENT**

- 11203 WATER CONTROL GATES
- 11306 SUMP PUMP
- 11310 END SUCTION PUMPS
- 11317 PROGRESSING CAVITY PUMPS
- 11320 RECESSED IMPELLER PUMPS
- 11321 STACKED TRAY GRIT CONCENTRATOR
- 11323 GRIT SEPARATION EQUIPMENT

- 11324 MACERATOR
- 11335 FIBERGLASS REINFORCED PLASTIC TANK
- 11350 CONTINUOUS LOOP MOVING BELT FILTER
- 11560 COMPRESSED GAS MIXING SYSTEM

**DIVISION 13 SPECIAL CONSTRUCTION**

- 13210 BOLTED STEEL WATER STORAGE TANK
- 13300 FRP COVER SYSTEM
- 13525 WET TAP SYSTEM
- 13567 TEMPORARY BYPASS PUMPING, TREATMENT AND PIPING SYSTEM
- 13600 INSTRUMENTATION GENERAL PROVISIONS
- 13615 PROCESS INSTRUMENTATION AND EQUIPMENT
- 13630 LOCAL CONTROL PANELS AND CONTROL SYSTEMS
- 13640 CONTROL STRATEGY
- 13650 FIBER OPTIC CABLE

**DIVISION 15 MECHANICAL**

- 15010 BASIC MECHANICAL REQUIREMENTS
- 15062 DUCTILE IRON PIPE AND FITTINGS
- 15064 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
- 15065 STAINLESS STEEL PIPE AND FITTINGS
- 15080 SMALL DIAMETER METAL PIPE AND FITTINGS
- 15094 PIPE HANGERS AND SUPPORTS
- 15100 VALVES AND APPURTENANCES
- 15480 ELECTRIC WATER HEATER

**DIVISION 16            ELECTRICAL**

- 16010        BASIC ELECTRICAL REQUIREMENTS
- 16050        ELECTRICAL EQUIPMENT ENCLOSURE
- 16110        RACEWAYS
- 16120        WIRES AND CABLES
- 16135        ELECTRICAL BOXES & FITTINGS
- 16142        ELECTRICAL CONNECTIONS FOR EQUIPMENT
- 16143        WIRING DEVICES
- 16170        CIRCUIT AND MOTOR DISCONNECTS
- 16190        SUPPORTING DEVICES
- 16195        ELECTRICAL IDENTIFICATION
- 16452        GROUNDING
- 16460        TRANSFORMERS
- 16470        PANELBOARDS
- 16480        MOTORS
- 16481        MOTOR CONTROL CENTER
- 16482        MOTOR STARTERS
- 16620        SURGE SUPPRESSION
- 16670        LIGHTNING PROTECTION SYSTEM
- 16775        VARIABLE FREQUENCY DRIVES

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## SECTION 02050

### DEMOLITION

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. The Contractor shall remove and dispose of or salvage existing structures, piping, conduits, electrical equipment, mechanical equipment, and appurtenances or portions thereof, as shown on the Drawings and specified herein or required to complete the project.
- B. All materials designated for disposal shall, when released by the Engineer, become the Contractor's property and shall be removed from the site and lawfully disposed of by the Contractor in accordance with Section III Paragraph 17.7, this Section 02050, and all laws.
- C. All materials designated to be salvaged shall be carefully removed and stored in a designated location on site.
- D. The following surveys and reports were performed for this project and are attached in the Appendix to these specifications.
  - 1 Pre-Demolition NESHAP Asbestos Survey, Lead Based Paint and Hazardous Materials Survey Report, prepared by Terracon Consultants, Inc., January 19, 2017.
  - 2 Report of Geotechnical Investigation Proposed Equalization Tank Northeast WWTP prepared by Driggers Engineering Services, dated March 23, 2017.
- E. The report listed in Paragraph 1.01D indicates that, at a minimum, some of the structures to be demolished as part of this project are composed of asbestos containing materials and are regulated. As such, the site is considered a Regulated Asbestos Containing Materials Site (RACM). RACM sites require that the asbestos material be abated prior to all other work on the project. Requirements regarding asbestos abatement are provided in Section 02080 Asbestos Pre-Demolition Abatement.
- F. The report listed in Paragraph 1.01D indicates that, at a minimum, some of the coatings on equipment and structures that are to be demolished as part of this project contain lead materials and are regulated. Requirements regarding lead-based paint abatement are provided in Section 02083 Lead-Based Paint Abatement.

- 1           G. The report listed in Paragraph 1.01D indicates that, at a minimum, some of the  
2           equipment to be demolished and removed as part of this project contain  
3           hazardous materials that are regulated. Requirements regarding the removal  
4           and disposal of this equipment is provided in Section 02062.
- 5           H. It is not known whether the existing structures to be demolished are supported  
6           on foundation piles. The foundation piles, if found to be existing, are to remain  
7           and no additional payment will be made for demolishing the structures  
8           supported by or connected to these piles. The foundation piles, if found, are  
9           to be located and surveyed.
- 10          I. Existing conditions are as shown on the drawings and described in Section  
11           01014 based on best available information. All bidders shall visit the site and  
12           become familiar with existing conditions not shown on the drawings or  
13           described in Section 01014.

14

15         1.02 SUBMITTALS

16

- 17
- 18           A. The Contractor shall submit for review, in accordance with Section 01300, a  
19           proposed Demolition Plan describing the proposed methods, equipment and  
20           operational sequence for demolition. Include coordination for shut-off,  
21           temporary services, continuation of service and other applicable items to  
22           ensure no interruption of operations except as herein before specified.
- 23
- 24           B. The Demolition Plan shall be fully coordinated as described in Sections 01040  
25           and with the Construction Phasing Plan restrictions specified in Section 01016.
- 26
- 27           1. The Contractor shall identify the proposed disposal site(s) for all  
28           asbestos containing materials and other regulated materials in the  
29           Demolition Plan submittal.
- 30
- 31           2. The Contractor shall identify the proposed disposal site(s) for all for  
32           treated and untreated wood materials in the Demolition Plan submittal.
- 33
- 34           3. Submit shipping receipts or bills of lading for all containers that are  
35           hauled away and have Asbestos Containing Materials (ACM) or other  
36           regulated materials.
- 37
- 38           4. Contractor's statement of proposed removal and recycling of steel  
39           demolition materials. Statement to include name of proposed recycling  
40           subcontractor and financial benefits.
- 41
- 42           5. The sequence of work shall be detailed in Demolition Plan and  
43           submitted as a shop drawing in accordance with Sections 01016,  
44           01300, and 01310.

1  
2       6. The Demolition Plan should address the Contractor's response in the  
3           event the tank fails before the liquids have been removed.

4       C. The Contractor shall submit copies of the asbestos surveys listed in Paragraph  
5           1.01D to Pinellas County Solid Waste Management and Pinellas County Air  
6           Quality to obtain authorizations and permits and shall perform the Work in  
7           accordance with said authorizations and permits.  
8

9       1.03 JOB CONDITIONS  
10

- 11      A. The Contractor shall execute the demolition and removal work to prevent  
12           damage or injury to structures, occupants thereof and adjacent features which  
13           might result from falling debris or other causes, and so as not to interfere with  
14           the use, and free and safe passage to and from adjacent structures.  
15
- 16      B. Closing or obstructing of roadways adjacent to the work by the placement or  
17           storage of materials will not be permitted. All operations shall be conducted  
18           with a minimum interference to traffic on these ways.  
19
- 20      C. The Contractor shall repair damage done to facilities to remain, or any  
21           property belonging to the Owner.  
22
- 23      D. The Contractor shall carry out his operations so as to avoid interference with  
24           operations and work in the existing facilities.  
25
- 26      E. At least seven (7) calendar days prior to commencement of a demolition or  
27           removal, the Contractor shall notify the Owner in writing of his proposed  
28           removal schedule. No removals shall be started until the schedule is  
29           acceptable to the Owner.  
30

31       1.04 REGULATORY AND SAFETY REQUIREMENTS  
32

- 33      A. Demolition Work shall be accomplished in strict accordance with 29 CFR  
34           1926-Subpart T and all other applicable local, state, and federal requirements.  
35
- 36      B. Comply with federal, state, and local hauling and disposal regulations. In  
37           addition to the requirements of the General Conditions, Contractor's safety  
38           requirements shall conform to all applicable local, state, and federal  
39           requirements.  
40
- 41      C. Furnish timely notification of this demolition/alteration project to applicable  
42           federal, state, regional, and local authorities in accordance with 40 CFR 61-  
43           Subpart M.  
44

1    1.05 SEQUENCING AND SCHEDULING

- 3            A. The Work of this Specification shall not commence until Contractor's  
4            Demolition Plan has been reviewed by Engineer.
- 6            B. Include the Work of this Specification in the progress schedule, as specified in  
7            Section 01310, Construction Schedules.
- 9            C. Work areas are shown on the Contract Drawings.

11    1.06 USE OF EXPLOSIVES

- 13           A. Use of explosives for demolition is prohibited.

15    1.07 DUST CONTROL

- 17           A. The Contractor shall use temporary enclosures and other suitable methods to  
18           limit the amount of dust and dirt rising and scattering in the air to the lowest  
19           practical level. Existing electrical and mechanical equipment to remain shall  
20           be protected from damage, dust, and debris.

22    1.08 REFERENCES

- 24           A. The following is a list of standards that may be referenced in this Section:
- 26              1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Guideline  
27              K, Containers for Recovered Non-flammable Fluorocarbon  
28              Refrigerants.
- 29              2. American National Standards Institute (ANSI): A10.6, Safety  
30              Requirements for Demolition Operations.
- 31              3. Occupational Safety and Health Administration (OSHA), U.S. Code of  
32              Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety  
33              and Health Regulations for Construction.
- 34              4. Environmental Protection Agency (EPA), U.S. Code of Federal  
35              Regulations (CFR), Title 40:  
36                 a. Part 61—National Emission Standards for Hazardous Air  
37                 Pollutants.  
38                 b. Part 82—Protection of Stratospheric Ozone.  
39                 c. Part 273—Standards for Universal Waste Management.

41    1.09 DEFINITIONS

- 43           A. ACM: Asbestos-containing material.

- 1           B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building  
2           or structure or any part thereof.
- 3           C. Modify: Provide all necessary material and labor to modify an existing item to  
4           the condition indicated or specified.
- 5           D. Relocate: Remove, protect, clean and reinstall equipment, including electrical,  
6           instrumentation, and all ancillary components required to make the equipment  
7           fully functional, to the new location identified on the Drawings.
- 8           E. Renovation/Alteration: Modifying/changing an existing building by changing  
9           systems, layout, or appurtenances.
- 10          F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the  
11           equipment, building materials, or other items so identified to be saved from  
12           destruction, damage, or waste; such property to remain that of Owner. Unless  
13           otherwise specified, title to items identified for demolition shall revert to  
14           Contractor.
- 15          G. Steel Building: Steel building envelope consisting of rigid frame primary steel,  
16           steel girts, purlins, corrugated steel panels, and steel columns.
- 17          H. Recycle: Remove, protect, and handle demolished items for recycling by a  
18           third party entity, as approved by Owner.
- 19          I. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube  
20           portion of an electric lighting device, examples of which include, but are not  
21           limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high  
22           pressure sodium, and metal halide lamps.

31        **PART 2 - PRODUCTS      (NOT USED)**

32        **PART 3 - EXECUTION**

33        **3.01 GENERAL**

- 34          A. Prior to commencing work, the Contractor shall check all underground and  
35           exposed existing utility and process piping and all equipment in any way  
36           associated or in the proximity to the items to be removed and shall verify that  
37           the piping is inactive (abandoned) and that electric power to equipment,  
38           lighting, controls, etc., has been permanently disconnected. Active services  
39           shall be brought to the attention of the Owner for proper action.
- 40          B. The Contractor shall collect and analyze samples of the digester cover and the  
41           digester liquid contents in accordance with Sections 01014 and 01016.

- 1
- 2       C. The Contractor shall remove and dispose of the foliage growing in the tank  
3       and on the digester tank cover.
- 4
- 5       D. Asbestos must be surveyed and abated by an Abatement Contractor that is  
6       licensed through the Florida Department of Business and Professional  
7       Regulation. The Contractor shall obtain the services of a licensed Abatement  
8       Contractor for all asbestos testing and abatement for the project as required.
- 9

10      3.06 UNAUTHORIZED REMOVAL

- 11
- 12       A. Any equipment, piping, and appurtenances removed without proper  
13       authorization, shall be replaced to the satisfaction of the Engineer at no cost to  
14       the Owner.

15

16      3.07 SALVAGED ITEMS

- 17
- 18       A. Items to be salvaged shall be tagged and shall remain the property of the  
19       Owner. The Contractor shall carefully move salvaged equipment to an Owner  
20       designated location.

21

22      3.08 DEMOLITION

- 23
- 24       A. All materials and equipment shown on the Drawings to be removed or  
25       demolished shall become the property of the Contractor, with the exception of  
26       items tagged by the Owner to be salvaged. Prior to removal of any existing  
27       equipment or piping from the site of work, the Contractor shall ascertain from  
28       the Engineer whether or not the particular item or items are to be salvaged.  
29       The Contractor shall dispose of all demolition materials, equipment, debris and  
30       all other items off the project site and in conformance with all existing  
31       applicable laws and regulations.

32

33      3.09 STRUCTURAL REMOVALS

- 34
- 35       A. The Contractor shall remove structures to the lines and grades shown, unless  
36       otherwise indicated by the Engineer.
- 37
- 38       B. All wood, concrete, brick, tile, concrete block, roofing materials, reinforcement,  
39       structural or miscellaneous metals, plaster, wire mesh and other items  
40       contained in or upon the structure shall be removed and taken from the project  
41       site. These items shall not be used in backfill.

42

43      3.10 MECHANICAL REMOVALS

- A. Mechanical removals shall consist of dismantling and removing of existing piping, equipment and other appurtenances as shown or required for the completion of the work. It shall include cutting, capping and plugging as required.
  - B. Wherever piping is to be removed, adjacent pipe headers that are to remain in service shall be blanked off or plugged and then anchored in an acceptable manner.

### **3.11 ELECTRICAL REMOVALS**

- A. Electrical removals shall consist of the removal of conduits and wires, and miscellaneous electrical equipment all as shown, specified or required to perform the work.

### **3.12 REPAIR WORK**

- A. Certain areas of existing structures, piping, conduits, and the like will be affected by work necessary to complete modifications under this Contract. The Contractor shall be responsible to rehabilitate those areas affected by its construction activities.
  - B. All debris, materials, piping, and miscellaneous waste products from the work described in this section shall be removed from the project as soon as possible. They shall be disposed of in accordance with applicable federal, state, and local regulations. The Contractor is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

### **3.13 CLEANUP**

- A. The Contractor shall remove from the project site all debris resulting from the demolition and removal operations as it accumulates. Upon completion of the demolition work, all materials, equipment, waste and debris of every sort shall be removed and the premises shall be left clean, neat and orderly.

END OF SECTION

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DEMOLITION  
02050-8

03/22/2019

1 SECTION 02062  
2

3 REMOVAL OF EXISTING EQUIPMENT  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9       A. Furnish all labor, tools, equipment, materials, and incidentals required to  
10      remove all existing structures, equipment, pipe, fittings, valves, electrical,  
11      instrumentation and controls, and all appurtenances as noted on the Contract  
12      Drawings, as reasonably inferred and as required in order to perform the work  
13      as described in the Contract Documents.  
14

15 PART 2 – PRODUCTS (NOT USED)  
16

17 PART 3 – EXECUTION  
18

19 3.01 GENERAL  
20

- 21       A. The Contractor shall not proceed with the removal of any equipment without  
22      specific approval from the Owner. Any facilities removed without proper  
23      authorization shall be replaced to the satisfaction of the Owner at the  
24      Contractor's expense.  
25
- 26       B. All existing equipment, valves, hardware, tubing, insulation, hangers, and  
27      supports not required to be reused and not designated as being turned over to  
28      the Owner, shall become the property of the Contractor immediately upon  
29      removal from their present locations. The Contractor shall remove such  
30      material from the plant site at his own expense and it shall not be reused.  
31
- 32       C. All existing equipment, valves, hardware, tubing, insulation, hangers, and  
33      supports designated as being turned over to the Owner, shall be identified,  
34      cleaned, protected, crated or boxed and stored at the plant site where directed.  
35
- 36       D. Pieces of equipment weighing 150 lbs or more shall be provided with suitable  
37      skids before storing.  
38
- 39       E. Wherever piping is removed for disposition, adjacent pipe, and headers that are  
40      to remain in service shall be blanked off or plugged and supported and/or  
41      properly anchored against thrust loads.  
42
- 43       F. The Contractor shall take all necessary precautions against damaging the  
44      material and equipment to be stored and reused. The Contractor shall repair  
45      any damage resulting from his operations, as directed by and to the satisfaction  
46      of the Engineer. Itemized lists of materials removed and stored shall be given

1 to the Resident Project Representative daily. A final typed itemized list shall be  
2 furnished to the Engineer in 6 copies at the completion of construction. The list  
3 shall include items, method of packaging, and place of storage.  
4

5 **3.02 EQUIPMENT TO BE RETAINED**  
6

- 7     A. All equipment removed shall remain the property of the Owner unless  
8         designated otherwise by the Owner.  
9  
10    B. If the Owner elects not to retain ownership of a certain item, the item shall  
11         become the property of the Contractor and shall be removed from the plant site  
12         at the Contractor's expense.  
13  
14    C. If the Owner requests that the Contractor utilize a specific hauling service for  
15         the removal of existing equipment or facilities, the Contractor shall utilize that  
16         service at no additional cost to the Owner.  
17  
18  
19

END OF SECTION

1 SECTION 02063  
2

3 HIGH DENSITY POLYETHYLENE (HDPE) PIPE  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The Contractor shall furnish all the materials, tools, labor, supervision and  
10      appliances for and properly install, connect, adjust, test and place in  
11      continuous satisfactory service all high density polyethylene pipe and fittings at  
12      the locations specified or required for the proper completion of all work.  
13
- 14       B. Wherever Construction activities disturb existing conditions or work already  
15      completed, Contractor shall restore the same to its original condition in every  
16      detail. All such replacement and repair shall meet with the approval of the  
17      Engineer and the Owner.  
18
- 19       C. High density polyethylene pipe and fittings are not necessarily completely  
20      indicated or detailed on the Construction Drawings. The Drawings are  
21      schematic only and indicate pipe and fittings in a general way. It is the  
22      Contractor's responsibility to furnish all materials, pipe and fittings required.  
23
- 24       D. It is the intent of these Contract Documents to require an installation, complete  
25      in every detail, whether or not indicated on the Construction Drawings, or  
26      specified herein. Consequently, the Contractor shall be responsible for all  
27      details, devices, accessories, and special construction necessary to properly  
28      furnish, install, adjust, test, place into continuous satisfactory service, and  
29      complete the Work in an acceptable manner.  
30
- 31       E. Full responsibility for designing, fabricating, and installing the high density  
32      polyethylene pipe and fittings, for selecting materials of construction, and for  
33      demonstrating compliance with specified performance requirements shall rest  
34      with the Contractor, and through the Contractor, the Manufacturer and the  
35      Material Supplier. The Engineer's approval of 1) the manufacture and  
36      installation of the high density polyethylene and fittings 2) the use of materials  
37      included in this Specification, and 3) alternative materials offered by the  
38      Contractor, shall not relieve the Contractor and Supplier of full responsibility for  
39      meeting all performance requirements and guarantees.  
40

41 1.02 DESCRIPTION OF SYSTEM  
42

- 43       A. This Section includes materials and methods of installation of HDPE. Pipe is  
44      intended for use only as suction pipe for the Internal Recycle pump stations.  
45
- 46       B. Piping shall be installed in the locations as shown on the Drawings and as  
47      specified herein.  
48

1           C. All pipe, fittings, valves, solvents and flue used for potable water piping shall  
2           be NSF-61 certified for continuous contact with potable water.  
3

4       **1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS**  
5

6           A. All Work specified herein shall be in accordance with the standards of the  
7           below listed organizations, except as otherwise shown or specified. Where  
8           reference is made to a standard of one of these, or other organizations the  
9           version of the standard in effect at the time of bid opening shall apply.  
10

11          B. American Water Works Association (AWWA).  
12

- 13            1. C651 - Standard for Disinfecting Water Mains.  
14            2. C906 - Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 in.  
15            through 63 in., for Water Distribution and Transmission.  
16

17          C. American Society for Testing Materials (ASTM)  
18

- 19            1. D618 – Practice for Conditioning Plastics and Electrical Insulating  
20            Materials for Testing.  
21  
22            2. D638 – Test Method for Tensile Properties of Plastics  
23  
24            3. D1248-84 - Polyethylene Plastics Molding and Extrusion Materials.  
25  
26            4. D2122 – Test Method for Determining Dimensions of Thermoplastic  
27            Pipe and Fittings.  
28  
29            5. D2837 – Test Method for Obtaining Hydrostatic Design Basis for  
30            Thermoplastic Pipe Materials.  
31  
32            6. D3035 – Polyethylene Plastics Pipe Based on Controlled Outside  
33            Diameter.  
34  
35            7. D3350-84 - Polyethylene Plastic Pipe and Fittings Material.  
36  
37            8. F714-85 - Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside  
38            Diameter.  
39

40          D. NSF International, The Public Health and Safety Company  
41

- 42            1. No. 14 – Plastic Piping Components and Related Materials.  
43            2. No. 60 - Drinking Water Treatment Chemicals - Health Effects.  
44            3. No. 61 -Drinking Water System Components - Health Effects.  
45  
46  
47  
48

1           E. Plastic Pipe Institute (PPI)

- 2
- 3           1. TR-3 – Policies and Procedures for Developing Recommended
- 4           Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

5

6        1.04 SUBMITTALS

7

8           A. The Contractor shall submit Shop Drawings to the Engineer of pipe, fittings

9           and all appurtenances in accordance with these Contract Documents and

10          Sections 01300 and 01340. The requirements of AWWA C906 and the

11          following supplemental requirements are applicable:

- 12
- 13          1. Certified dimensional drawings of all of pipe, joints, and fittings.
- 14
- 15          2. Joint and pipe/fitting wall construction details, which indicate the type
- 16           and thickness of the wall; manufacturing tolerances; performance
- 17           history; and all other pertinent information required for the manufacture
- 18           of the product.
- 19
- 20          3. Details of fittings and specials such as elbows, wyes, tees, outlets,
- 21           connections, test bulkheads, bosses and nozzles or other specials
- 22           where shown on the Construction Drawings, which indicate amount and
- 23           position of reinforcement. All fittings and specials shall be properly
- 24           reinforced to withstand the internal pressure both circumferential and
- 25           longitudinal, and the external loading conditions as indicated in the
- 26           Contract Documents. Shop Drawings shall clearly detail special
- 27           castings indicating all pertinent dimensions.
- 28
- 29          4. Detail Drawings of restrained and flexible joints, including test reports to
- 30           confirm thrust restraint capacities and restraining mechanism
- 31           application.
- 32
- 33          5. Pipeline laying schedule tabulated and referenced to construction line
- 34           and grade controls shown on plans, with station, offset and elevations.
- 35           References shall be provided for pipe fittings, valves, service
- 36           connections and other important features of the pipeline. In addition,
- 37           the laying schedule shall include: the pipe station and invert elevation at
- 38           all changes in grade or horizontal alignment; all elements of curves and
- 39           bends, both in horizontal and vertical alignment; and the limits of each
- 40           reach of restrained joints.
- 41
- 42          6. Drawings of special details such as reinforcement, testing stations, joint
- 43           bonding, etc., shall be at a scale that clearly depicts the item being
- 44           detailed and, in general, shall not be at a scale less than 1/8-inch equal
- 45           to 1-foot.
- 46
- 47          7. Detail drawings of all Drilling Pits, service connections, valves and valve
- 48           boxes.

- 1           8. Detailed and certified calculations of required joint restraint length  
2           computed as indicated in these Contract Documents. In addition, the  
3           Contractor shall submit calculations, drawings, and/or other  
4           documentation to prove to the Engineer's satisfaction that the pipe and  
5           unrestrained joints downstream of in-line valves can withstand the  
6           compressive forces generated by the field test pressure without  
7           affecting the pipeline system. Failure to provide adequate proof shall  
8           result in the Contractor being required to provide restrained joints  
9           downstream of in-line valves designed to withstand the full field test  
10          pressure.
- 11
- 12          9. The Supplier of the pipe shall submit, through the Contractor, an  
13           affidavit that the pipe, fittings and other products or materials furnished  
14           for this Project comply with all applicable provisions of these  
15           Specifications.
- 16
- 17          10. A complete field pressure testing, flushing, and disinfection plan for  
18           review and approval prior to the performance of any of these activities.  
19           Pressure testing shall be performed in compliance with the  
20           manufacturers recommended procedures.
- 21
- 22          B. Certification and test reports for the materials, manufacturing, and testing of  
23           the types of pipe supplied shall be performed and furnished by the pipe  
24           manufacturer in accordance with the latest standards of the industry as  
25           described in AWWA C906.
- 26
- 27          C. Provide a statement in writing from the HDPE pipe manufacturer that it is listed  
28           with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin  
29           being used to manufacture the pipe for this project.
- 30
- 31          D. The Contractor shall furnish a certified affidavit of compliance for all pipe and  
32           other products or materials furnished under this Section of the Specifications,  
33           as specified in AWWA C906; respectively, and certified copies of the following  
34           supplemental data for all pipe, fittings, and specials:
- 35
- 36          1. The Supplier shall provide, through the Contractor, a statement that the  
37           inspection and all specified tests have been made and all results  
38           thereof comply with the requirements of these Specifications.
- 39
- 40          E. All expenses incurred in making samples for certification of tests and in the  
41           preparation of any design reports shall be borne by the Contractor.
- 42
- 43          F. Approval of the Shop Drawings and the design report and acceptance of the  
44           certifications by the Engineer shall not relieve the Contractor of the  
45           responsibility to ensure that the pipe is designed and installed in strict  
46           accordance with the Contract Documents.
- 47
- 48

1    1.05 QUALITY ASSURANCE

- 2
- 3       A. The Contractor shall furnish materials under this Section that are new, unused  
4           and as specified, or if not particularized herein, which are the best of their  
5           respective kind, free of defects and imperfections, and suitable for the service  
6           intended, subject to the approval of the Engineer.
- 7
- 8       B. The Contractor shall provide workmanship that is first class in every respect,  
9           and have the installation performed by workmen thoroughly experienced in  
10          such work. A neat and workmanlike appearance in the finished Work shall be  
11          required.
- 12
- 13      C. The Contractor shall perform Work in accordance with all applicable laws and  
14          regulations and in accordance with all applicable permits and easements.
- 15
- 16      D. The HDPE pipe furnished under this Specification shall comply with AWWA  
17          C906 except as it may be modified herein.
- 18
- 19      E. All test equipment used in activities affecting quality control shall be calibrated  
20          and certified at not longer than annual intervals, unless otherwise specified or  
21          required.
- 22
- 23      F. All HDPE pipe and fittings shall be clean, sound, and without defects. No  
24          manner of repair will be accepted, unless otherwise specified or approved by  
25          the Engineer.
- 26
- 27      G. The Contractor, at no additional cost to the Owner, shall perform all the testing  
28          and recording that is required in these Specifications unless otherwise  
29          specified.
- 30
- 31      H. The Engineer shall have the right to determine the amount of pipe to be  
32          rejected.
- 33

34    1.06 SUPPLIER'S QUALIFICATIONS

- 35
- 36       A. All HDPE pipe, fittings and appurtenances shall be furnished by a  
37           manufacturer who is fully experienced, reputable and qualified in the  
38           manufacture of the items to be furnished. The equipment shall be designed,  
39           constructed, and installed in accordance with the best practices and methods  
40           and shall comply with these Specifications. The Manufacturer shall have at  
41           least 5 years experience in work similar in specification to that which is to be  
42           furnished on this project. The Manufacturer shall be required to show  
43           experience in supplying pipe in environments similar to those expected to exist  
44           on this project and that the pipe supplied in those environments has functioned  
45           satisfactorily.
- 46

47    1.07 SHOP TESTS

48

- 1           A. All pipe shall be tested by the Manufacturer in accordance with AWWA C906,  
2           the Manufacturer's standard procedures, and this Specification. Shop Tests  
3           shall be subject to witness by the Engineer and/or Owner, and/or the Owner's  
4           Representative and certified test reports shall be submitted to the Engineer by  
5           the Contractor for approval. No lot of pipe shall be shipped to the site of the  
6           Work until acceptable shop tests are completed and approved.  
7
- 8           1. The Contractor shall perform or have performed said material tests at  
9           no additional cost to the Owner. The Owner and/or the Owner's  
10          Representative and/or the Engineer shall have the right to witness all  
11          testing conducted by the Contractor; provided that the Contractor's  
12          schedule is not delayed for the convenience of the Owner. It shall be  
13          the responsibility of the Contractor to provide notice to the Owner and  
14          the Engineer of proposed tests in accordance with this Section and the  
15          Contract Documents.  
16
- 17          2. Tests and examinations to verify the quality of work shall be performed  
18          by persons other than those engaged in the activity being examined.  
19          Such persons shall not report directly to the production supervisor  
20          responsible for the Work. All instruments, gauges and other testing and  
21          measuring equipment used in activities affecting quality shall be of  
22          proper range, type, and accuracy to verify conformance with the  
23          Specification requirements. Procedures shall be in effect to assure that  
24          they are calibrated and certified at not longer than annual intervals.  
25          Calibration shall be against measurement standards, which have known  
26          relationship to national standards where such exist. Gauges must be  
27          calibrated and certified for the piece of equipment of which they are a  
28          part and must remain on the piece of equipment following certification.  
29          Materials and items including products previously checked or  
30          manufactured with equipment found to be out of calibration or  
31          adjustment shall be considered unacceptable until it can be determined  
32          that all applicable requirements have been met.  
33
- 34          3. The Supplier shall maintain records of all internal and required tests  
35          and inspections. These records shall include records of materials,  
36          manufacturing, examination, repairs, and test data taken before and  
37          during fabrication. The Engineer reserves the right to request that  
38          specific data be included in the records that may not otherwise be  
39          included. Whenever tests and examinations are performed on a pipe  
40          element or pipe, the appropriate pipe identification number shall be  
41          shown on the report. Copies of all records of tests conducted by the  
42          pipe Supplier, independent laboratory, or material manufacturers shall  
43          be given to the Engineer in such form as to be appropriate for  
44          permanent records.  
45
- 46          4. The Engineer shall have access to all records of tests and inspections  
47          related to pipe manufactured for use in the Work and shall also have  
48          the right to witness any tests being performed by the Supplier relative to  
49          products, materials, or the pipe being produced.

- 1           5. In addition to those tests specifically required, the Owner may request  
2           additional samples for testing by the Owner. The cost for these  
3           additional samples shall be borne by the Owner at no additional cost to  
4           the Contractor.  
5  
6           6. All tests required by AWWA C906 and as required herein, shall be  
7           performed by the Supplier and records of all such tests shall be  
8           provided to the Owner.  
9  
10          B. Dimensions shall be subject to gauging in the presence of the Engineer.  
11          Dimensions of each pipe shall be measured as specified in ASTM D2122.  
12          Representative samples from each of the molds each shift when the mold is  
13          used in manufacturing pipe for the Project shall be gauged.  
14  
15          C. If requested by the Engineer, one pipe from each diameter size and pressure  
16          class each shift each day shall be non-destructively tested. The wall thickness  
17          shall be measured for conformance to the thickness tolerance at the quarter  
18          points of the cross-section and at any other point selected by the Engineer.  
19          The measuring device shall be capable of measuring the pipe wall thickness to  
20          the nearest 0.001-inch. Any wall thickness measurement less than the  
21          nominal wall thickness minus the casting tolerance, shown in Table 1, shall be  
22          cause for pipe to be rejected. If the first pipe selected is rejected another pipe  
23          shall be tested. If the second pipe fails a third pipe made during that shift shall  
24          be tested. If the third pipe fails all pipe made during that shift shall be rejected.  
25  
26          D. Physical property tests shall be made on test specimens in accordance with  
27          the requirements of AWWA C906 and applicable ASTM standards. Samples  
28          for tests shall be taken every three hours.  
29  
30

## 31        1.08 INSPECTION 32

- 33          A. All Work under this Specification, including but not limited to proof of design  
34          testing, shop testing and the production of the pipe, fittings and specials, shall  
35          be subject to inspection by the Owner's representatives and/or the Engineer in  
36          the Supplier's plant. All travel, lodging and meal costs associated with this  
37          plant inspection shall be incurred by the Owner and/or the Engineer.  
38  
39          B. The Engineer shall have the right to order any pipe that, in the Engineer's  
40          opinion, does not meet the Specifications to be rejected and not shipped to the  
41          Project site.  
42  
43          C. The Owner and/or the Owner's Representative and/or the Engineer reserves  
44          the right to witness the testing of materials by the pipe Supplier or have it  
45          performed by an independent testing service. If the independent test results  
46          show that the pipe manufactured meets the requirements of the Specifications,  
47          the costs for such testing shall be paid by the Owner. If the independent test  
48          results show that the pipe manufactured does not meet the requirements of

1           this Specification, the Contractor shall pay for all testing and retesting costs.  
2           The Supplier shall make all plant laboratory facilities available to the Owner  
3           and/or the Engineer and shall notify the Engineer at least fourteen (14) days  
4           prior to start of production of the pipeline materials for the Project.

- 5
- 6       D. The Contractor shall furnish six (6) copies of the Supplier's sworn certificate of  
7           inspection and testing of all HDPE pipe and fittings used on the Work. All pipe  
8           and fittings will be subject to inspection and approval by the Engineer during  
9           production and after delivery of material to the Project Site. No broken,  
10          cracked, misshaped, damaged or otherwise unsatisfactory pipe or fittings shall  
11          be used. Such inspection by the Engineer shall not relieve the Contractor of  
12          full responsibility for the materials installed.
- 13
- 14      E. The Contractor shall furnish the Engineer with lists, in duplicate, of all pieces of  
15           pipe and fittings in each shipment received, and these lists shall give the  
16           identifying number, weight, class, size and description of each item received at  
17           the Project Site.

18

## PART 2 - MATERIALS AND EQUIPMENT

19

### 2.01 GENERAL

- 20
- 21       A. All HDPE pipe shall be manufactured in accordance with AWWA Specification  
22           C906. Minimum wall thickness of pipe shall be as specified herein. All HDPE  
23           Pipe and fittings shall meet PE 3408 with a cell classification of PE345464C.
- 24
- 25       B. Pipe shall be furnished in nominal lengths of a minimum of 40 feet, unless  
26           otherwise directed by the Engineer. Pipe for potable water supply and  
27           accessories shall bear the NSF mark indicating pipe size, manufacturer's  
28           name, AWWA and/or ASTM Specification number, working pressure and  
29           production code.
- 30
- 31       C. All materials that may be in contact with the water being conveyed (gaskets,  
32           lubricants, disinfecting agents, etc.) shall be in accordance with and approved  
33           by the appropriate NSF Standard 61.

34

### 2.02 DESIGN CRITERIA

- 35
- 36       A. The pipe shall be designed, manufactured, tested, inspected, and marked  
37           according to applicable requirements stated herein and except as modified  
38           shall conform to AWWA C906 and ASTM F714.
- 39
- 40
- 41       B. The HDPE pipe classifications approved for this project are as follows:
- 42
- 43           1. Class 75 DR 11; C 906
- 44
- 45       C. Where shown on the Drawings, or where required to meet the conditions

1 shown on the Drawings, the pipe, fittings and specials wall thickness shall be  
2 as required to meet the following parameters:  
3

4 **Water Main**

5 Working Pressure (PSI): 160  
6

7 **All Mains**

Pt	Surge Allowance (PSI)	64 / 128 (reoccurring / occasional surge events)
Pf	Field Test Pressure (PSI)	1.5 times Pw
F	Safety Factor	2
Wd	Dead Load	wHcBc (see note 1)
Ww	Live Load	AASHTO H-20
w	Weight of Soil (lb/ft <sup>3</sup> )	120 lb/ft <sup>3</sup>

16 Note (1): All pipe shall be designed for a single condition representing the  
17 worst possible combination of dead load (Wd) and live load (Ww). The dead  
18 load shall be computed assuming soil weight of 120lbs/ft<sup>3</sup>. The determination  
19 of live load shall be as recommended by AASHTO in "Standard Specifications  
20 for Highway Bridges."

- 21 D. Pipe supplied for this Project shall be suitable for use with neutral pH  
22 (approximately 7.0) treated chlorinated sewage effluent or chloraminated  
23 potable water.

24 2.03 PIPE DESIGN

- 25 A. All HDPE pipe shall have a minimum wall thickness as specified in AWWA  
26 C906. The DR shall not be greater than DR 11 or as shown on the drawings.  
27  
28 B. The Contractor shall provide design data on the pipe including calculations  
29 showing the separate and combined stresses in the wall of the pipe due to the  
30 design loads.

31 2.04 MATERIALS

- 32 A. High Density Polyethylene pipe 4-inches diameter and larger shall conform to  
33 material standard ASTM D3350 345464 C cell classification rated as PE 3408  
34 by the Plastics Pipe Institute. Minimum pressure rating shall be 160 psi SDR  
35 11 (Standard Dimension Ratio). Pressure ratings are at standard test  
36 conditions and temperature of 73.4°F (23°C).  
37  
38 B. All HDPE pipe shall meet the requirements of AWWA C906. The  
39 Hazen-Williams friction factor will not be less than 150. Each length of pipe  
40 shall be tested in accordance with AWWA C906.  
41  
42 C. All HDPE pipe shall have a Ductile Iron Pipe Sizing (DIPS) outside diameter  
43 unless otherwise specified in the Contract Documents.

- 1           D. Potable water pipe shall be permanently co-extruded with blue coloring on pipe  
2           outside surface. The exterior of exposed HDPE pipe and fittings shall be field  
3           coated with one prime coat of Tnemec 66, 2.5 to 3.5 mils minimum dry film  
4           thickness, a second coat of Tnemec 73, 2.0 to 3.0 mils per coat minimum dry  
5           film thickness and a final coat equal to the second. Field coatings shall be  
6           applied in strict conformance with the coating manufacturer's  
7           recommendations and Section 09900.
- 8
- 9           E. The polyethylene compound shall be suitably protected against degradation by  
10          ultraviolet light by means of carbon black, well dispersed by precompounding  
11          in a concentration of not less than 2 percent. In plant blending at the  
12          manufacturing facility will be permitted.
- 13
- 14          F. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.
- 15
- 16          G. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting  
17          the recipe and mixing requirements of the resin manufacturer for the resin  
18          used to manufacture the pipe in this project
- 19
- 20          H. The HDPE pipe shall be DripscoPlex, manufactured by Performance Pipe, a  
21          division of Chevron Phillips Chemical Co.; or approved equal.

24         2.05 JOINTS

- 25
- 26          A. HDPE pipe shall be jointed by the butt-fusion process in accordance with pipe  
27          manufacturer's directions. Contractor shall provide butt-fusion technicians who  
28          are trained and certified by the pipe manufacturer or representative, to  
29          complete the project. The date of technician certification shall not exceed 12  
30          months before commencing construction.
- 31
- 32          B. All HDPE pipe joined by butt-fusion shall be made from the same class and  
33          type of raw material made by the same raw material supplier.
- 34
- 35          C. Butt-fusion means the butt-joining of the pipe by softening the aligned faces of  
36          the pipe ends in a suitable apparatus and pressing them together under  
37          controlled pressure.
- 38
- 39          D. The internal and external beads resulting from the butt-fusion process shall be  
40          visible and examined for penetration 360 degrees around the pipe diameter.
- 41
- 42          E. Short pieces of pipe between valves and fittings shall be DIP with all joints  
43          restrained for sizes 3-inches and larger. For 2-inch, the short pieces shall be  
44          brass or Schedule 80 with IP threads and DI, HDPE or brass fittings and all  
45          joints restrained.

46         2.06 FITTINGS

- 1           A. Internal Recycle pipe fittings shall be butt fusion fabricated HDPE long radius  
2           bends as shown on the drawings. Ell fittings shall be ISCO ISFF902817IPS or  
3           equal.
- 4           B. All other fittings for HDPE pipe, 4" and larger except for D.I/HDPE Mechanical  
5           Joint Adaptors, shall be compact ductile iron mechanical joint fittings. If a  
6           fitting is unavailable as a compact ductile iron mechanical joint fitting, then use  
7           a regular ductile iron mechanical joint fitting as specified in Section 02061.  
8
- 9           C. DI/HDPE Mechanical Joint Adaptors.
- 10           1. The manufacturer of the HDPE pipe shall supply all Ductile Iron/HDPE  
11           mechanical joint adaptors and accessories required to perform the work  
12           as shown on the Drawings.
- 13           2. The DI/HDPE mechanical joint adaptor shall consist of:  
14
- 15            a. A molded or fabricated HDPE mechanical joint transition fitting.  
16            b. A standard rubber gasket for a DI mechanical joint.  
17            c. A DI mechanical joint backup drive ring.  
18            d. Stainless steel mechanical joint tee bolts.  
19
- 20            e. A stainless steel stiffener inserted in the MJ end of the HDPE  
21           transition fitting.
- 22           3. The DI/HDPE mechanical joint adaptor shall be connected to the HDPE  
23           pipe by a heat-fused joint on one end, and connected to a ductile iron  
24           pipe valve, or fitting with a mechanical joint on the other end.
- 25
- 26           4. The tee bolts and backup drive ring shall act as a joint restraint to keep  
27           the connecting pieces from pulling apart.
- 28
- 29           5. The HDPE transition fitting shall be molded or fabricated by the  
30           manufacturer of the HDPE pipe. All molded fittings shall be fully  
31           pressure rated to match the SDR pressure rating for which they are  
32           made. Fabricated fittings shall be rated for internal pressure service  
33           equivalent to the full pressure rating of the mating pipe.
- 34
- 35           6. If rework compounds are required, only those generated in the  
36           manufacturer's own plant from resin compounds of the same class and  
37           type from the same raw material supplier shall be used.
- 38
- 39           7. Solvent epoxy cementing and mechanical joining with bolt on wrap  
40           around clamps shall not be used for connections.
- 41
- 42
- 43
- 44
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1    2.07 LOCATOR WIRE  
2

- 3            A. All HDPE pipe installed underground by directional bore or by open cut shall  
4            be laid with a minimum of two (2) insulated 14 gauge solid strand copper wires  
5            for location purposes. All "long" HDPE service piping (services greater than 40  
6            feet in length) shall be laid with one (1) insulated 14 gauge solid strand copper  
7            wire.

8

9    PART 3 - EXECUTION  
10

11    3.01 HANDLING PIPE AND FITTINGS  
12

- 13            A. The Contractor shall transport, deliver and distribute along the line of the work,  
14            the pipe, specials and appurtenances. All Work shall be in strict accordance  
15            with the provisions of applicable permits and easements.  
16
- 17            B. Pipe shall be loaded for shipment upon suitable cars or trucks that shall be  
18            provided with padded bunks with nylon belt tie-down straps or padded  
19            banding. In loading and unloading the pipe, more than ordinary care shall be  
20            taken to prevent any injury to the pipe, ends, and connections. Such work  
21            shall be done slowly with the pipe at all times under control, and under no  
22            condition shall the pipe be dropped. Field repair of damaged pipe shall not be  
23            allowed. The pipe shall be protected during shipping by covering or some  
24            other means acceptable to the Engineer to prevent contamination of the pipe  
25            during transport.  
26
- 27            C. All pipe, fittings, etc., shall be carefully handled and protected against damage,  
28            impact shocks, and free fall. Under no circumstances shall materials be  
29            dropped. Pipe handling equipment shall consist of ropes, fabric, or rubber-  
30            protected slings and straps designed and constructed to prevent damage to  
31            the pipe. All pipe handling equipment shall be acceptable to the Engineer.  
32            Chains, forks, cables, hooks, or other equipment that may damage the pipe  
33            shall not be allowed. Two slings spread apart shall be used for lifting each  
34            length of pipe. Slings for handling the pipeline shall not be positioned at butt-  
35            fused joints. Pipe handled on skidways shall not be rolled or skidded against  
36            pipe on the ground. The dragging of fused HDPE pipe along asphalt and  
37            concrete paving is discouraged using rollers where possible.  
38
- 39            D. The open ends of all sections of joined and/or installed pipe (not in service)  
40            shall be plugged at night to prevent animals or foreign material from entering  
41            the pipe line or pipe section. Waterproof nightcaps of approved design may be  
42            used but they shall be so constructed that they will prevent the entrance of any  
43            type of natural precipitation into the pipe and will be fastened to the pipe in  
44            such a manner that the wind cannot blow them loose. The practice of stuffing  
45            cloth or paper in the open ends of the pipe will not be permitted.  
46
- 47            E. Where possible, the pipe shall be raised and supported at a suitable distance  
48            back from the open end such that the open end will be below the level of the

1 pipe at the point of support.  
2

- 3 F. In distributing the pipe in the field, each pipe shall be placed as nearly as  
4 possible to the point where it is to be laid, and facing in the proper direction.  
5 Pipe shall not be placed directly on rough ground but shall be supported in a  
6 manner that will protect the pipe against injury whenever stored at the trench  
7 site or elsewhere. Pipe fittings and specials which are placed in storage,  
8 streets or drives must be so arranged as not to cause undue inconvenience to  
9 traffic and must be protected sufficiently to prevent any damage. Chains,  
10 cables or other equipment likely to cause damage to the pipe or fitting shall not  
11 be used. Pipe which has been improperly distributed and which must be  
12 moved longitudinally along the trench shall be reloaded on a suitable car or  
13 truck or lifted and swung by a derrick or moved by such means as may be  
14 satisfactory to the Engineer.
- 15 G. Materials, if stored, shall be kept safe from damage. The interior as well as all  
16 sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free  
17 from dirt or foreign matter at all times. Valves shall be drained and stored in a  
18 manner that will protect them from damage or freezing.
- 19 H. Pipe stored outside and exposed to prolonged periods of sunlight shall be  
20 covered with canvas or other opaque material. Air circulation shall be provided  
21 under covering.
- 22 I. Pipe shall not be stacked higher than the limits recommended by the  
23 manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or  
24 concrete. Pipe shall not be stored close to heat sources.
- 25 J. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall  
26 not come in contact with petroleum products. Gaskets shall be used on a  
27 first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a  
28 manner that will ensure proper use with respect to types and sizes.
- 29 K. If in the process of manufacture, transportation, or handling, any HDPE pipe,  
30 fitting or special receives any deformation to the pipe wall, ends or  
31 connections, such pipe, fitting or special shall be rejected and replaced at the  
32 Contractor's expense. Sections of the pipes with cuts and gouges exceeding  
33 10 percent of the pipe wall thickness or kinked sections shall be removed and  
34 the ends rejoined.
- 35 L. In the presence of the Engineer, the Contractor shall inspect upon delivery all  
36 pipe, fittings, and specials and mark as "rejected" all pipe lengths and fittings  
37 or specials exhibiting signs of damage and the Contractor shall, at the  
38 Contractor's expense, immediately remove the same from the job site, or  
39 repair to the Engineer's satisfaction. Any pipe, fittings or specials deemed not  
40 suitable for installation shall be replaced in kind by the Contractor at the  
41 Contractor's own expense.
- 42

- 1           M. The Contractor shall inspect each pipe and fitting to insure that there are no  
2           damaged portions of the pipe. If any defective pipe is discovered after having  
3           been laid, it shall be removed and replaced with a sound pipe or fitting in a  
4           satisfactory manner, by the Contractor at the Contractor's own expense.  
5
- 6           N. The Contractor shall thoroughly clean each pipe or fitting of any foreign  
7           substance that may have collected on or in it prior to the pipe or fitting being  
8           placed in the trench. The openings of all pipes and fittings in the trench shall  
9           be closed during any interruption of the Work. As pipe laying progresses, the  
10          Contractor shall keep the pipe interior free of all debris. The Contractor shall  
11          completely clean the interior of the pipe of all sand, dirt, mortar splatter, and  
12          any other debris following completion of pipe laying, pointing of joints and any  
13          necessary interior repairs prior to testing and disinfecting the completed  
14          pipeline.

15

### 16        3.02 INSTALLATION OF PIPE

17

- 18          A. All polyethylene pipe shall be cut, fabricated, and installed in strict  
19           conformance with the pipe manufacturer's recommendations. Joining, laying,  
20           and pulling of polyethylene pipe shall be accomplished by personnel  
21           experienced in working with polyethylene pipe. The pipe supplier shall certify  
22           in writing that the Contractor is qualified to join, lay, and pull the pipe or  
23           representative of the pipe manufacturer shall be on site to oversee the pipe  
24           joining. Expenses for the representative shall be paid for by the Contractor.  
25
- 26          B. All joints shall be assembled in accordance with the Manufacturer's  
27           recommended procedures. In general, the procedure shall be as described  
28           herein.
- 29
- 30           1. All HDPE pipe shall be jointed by the heat fusion process, which  
31           produces homogeneous, seal, leak-tight joints.

32

  - 33           2. Restrained mechanical joints, shall be provided at tie-ins with  
34           underground valves and other pipe materials.

35

  - 36           3. Flanged joint connections shall be have the minimum pressure and DR  
37           of the adjoining pipe. Steel adapter plates shall be fabricated as  
38           required for connection to flanged wall pipe or appurtenances.

39
- 40          C. The pipe fusion machine will be a self-contained hydraulic fusion machine  
41           capable of butt fusing HDPE pipe in sizes required for the work. The carriage  
42           must be removable from the chassis for in-ditch use. The machine must be  
43           compatible with an electronic data recording device. Accessories will include  
44           all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for  
45           checking the surface temperature of the heater, extension cord (25' minimum),  
46           and hydraulic extension hoses (minimum of four). The butt fusion machine will  
47           be McElroy No. 412, or approved equivalent.



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1 SECTION 02064  
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3 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT  
4

5  
6 PART 1 - GENERAL  
7

8 1.01 SCOPE OF WORK  
9

- 10 A. Furnish all labor, materials, equipment, and incidentals required to modify, alter  
11 and/or convert existing structures as shown or specified and as required for the  
12 installation of new mechanical equipment, piping, and appurtenances. Existing  
13 piping and equipment shall be removed and dismantled as necessary for the  
14 performance of structural alterations in accordance with the requirements herein  
15 specified.  
16
- 17 B. The Contractor shall not operate the Owner's valves, equipment, etc. without a  
18 representative of the Owner in attendance.  
19

20 PART 2 – PRODUCTS  
21 (Not Used)  
22

23 PART 3 - EXECUTION  
24

25 3.01 GENERAL  
26

- 27 A. The Contractor shall cut, repair, reuse, excavate, demolish, or otherwise  
28 remove parts of the existing structures or appurtenances, as indicated on the  
29 Contract Drawings, herein specified, or as necessary to permit completion of  
30 the work under this Contract. The Contractor shall dispose of surplus materials  
31 resulting from the above work in an approved manner. The work shall include  
32 all necessary cutting and bending of reinforcing steel, structural steel, or  
33 miscellaneous metal work found embedded in the existing structures.  
34
- 35 B. The Contractor shall dismantle and remove all existing equipment, piping and  
36 other appurtenances required for the completion of the work. Where called for  
37 or required, the Contractor shall cut existing pipelines for the purpose of making  
38 connections thereto. Anchor bolts for equipment and structural steel removed  
39 shall be cut off one (1) inch below the concrete surface.  
40
- 41 C. At the time that a new connection is made to an existing pipeline, additional new  
42 piping, extending to and including a new valve, shall be installed.  
43
- 44 D. No existing structure, equipment, or appurtenance shall be shifted, cut,  
45 removed, or otherwise altered without the express approval of and to the extent  
46 approved by the Engineer.  
47

- 1           E. When removing materials or portions of existing structures and when making  
2           openings in walls and partitions, the Contractor shall take all precautions and  
3           use all necessary barriers and other protective devices so as not to damage the  
4           structures beyond the limits necessary for the new work, and not to damage the  
5           structures or contents by falling or flying debris. Unless otherwise permitted,  
6           line drilling will be required in cutting existing concrete.
- 7           F. Materials and equipment removed in the course of making alterations and  
8           additions shall become the property of the Contractor to be disposed of by him  
9           off the work site at his own place of disposal. Operating equipment shall be  
10          thoroughly cleaned, lubricated, and greased for protection during prolonged  
11          storage.
- 12          G. All alterations to existing structures shall be done at such time and in such manner as will comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment and materials shall be assembled and made ready so that the work can be completed without delay.
- 13          H. All workmanship and new materials involved in constructing the alterations shall conform to the specifications for the classes of work insofar as such specifications are applicable.
- 14          I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Specifications covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the Owner's Representative.
- 15          J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.
- 16          K. Non-shrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.
- 17          L. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipelines in a manner to provide an approved joint. Where required, the Contractor shall weld beads, flanges, or provide Dresser Couplings or equal, all as required.
- 18          M. The Contractor shall provide flumes, hoses, piping, and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work under this Contract.
- 19          N. Blasting will not be permitted to complete any work under this Contract. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

### 3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

A. The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection.

### 3.03 CLEANING EXISTING STRUCTURES

A. After dewatering and before commencing work on any tank, basin, conduit or other structure, the Contractor shall remove and dispose of, away from the plant site, the grit and other solids remaining in such structures.

END OF SECTION



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## SECTION 02080

2

## ASBESTOS PRE-DEMOLITION ABATEMENT

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4

## PART I - GENERAL

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## 1.01 DESCRIPTION

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- A. Perform all planning, administrative, execution, and cleaning requirements necessary to safely remove the asbestos-containing materials as indicated in the Contract Documents.

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## 1.02 SUMMARY OF WORK

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- A. Work Included, as identified in Terracon Consultants, Inc., *Pre-Demolition NESHPAs Asbestos Survey, Lead-Based Paint and Hazardous Materials Survey Report, dated January 19, 2017 (Terracon Report)*:

HA	Material Description	Material Location	Percent	NESHAP CATEGORY	Estimated Quantities <sup>(1)</sup>
MS2	Pipe Gasket on 6" Pipe – Flange (Dark Green)	Primary Pump House	35% - Chrysotile	Category I - Non-Friable	15 SF
MS4	Pipe Gasket on 10" Pipe – Valve Flange (Yellow)	Primary Pump House	35% - Chrysotile	Category I - Non-Friable	30 SF
MS6	Caulking (Off-White)	Primary Pump House – North & South Tank	3% - Chrysotile	Category II - Non-Friable	10 SF
R2	Pitch Pan Tar (Black)	Irrigation System – Roof	5% - Chrysotile	Category I - Non-Friable	20 SF

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(1) Estimated quantities are approximate and are to be confirmed prior to any such usage.

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1. Properly remove asbestos-containing materials indicated in the *Terracon Report* as specified herein.
2. Apply a compatible sealant to all surfaces from which asbestos-containing material was removed and exposed plastic sheeting in each work area.
3. Upon final clearance by the consultant, poly barriers shall be removed, bagged and disposed of as asbestos containing materials.

## B. Definitions

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1. Abatement - procedures to decrease or eliminate fiber release from pre-cast, spray- or trowel-applied asbestos-containing building materials. Includes encapsulation, enclosure and removal.
2. AHERA - Asbestos Hazard Emergency Response Act (40CFR763).
3. Airlock - system for permitting ingress and egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways at least three feet apart.
4. Amended Water – water to which a surfactant is added.
5. Air Monitoring - the process of measuring the fiber content of a specific volume of air in a stated period of time.

- 1           6. Clean Room - an uncontaminated area or room which is part of the worker  
2           decontamination enclosure system, with provisions for storage of workers'  
3           street clothes and protective equipment. Also known as the "Change  
4           Room".
- 5           7. Curtained Doorway - a device to allow ingress and egress from one room to  
6           another while minimizing air movement between the rooms. Typically  
7           constructed by placing two overlapping sheets of plastic over an existing or  
8           temporarily framed doorway and securing each along the top of the  
9           doorway, with the vertical edge of one along one vertical side of the  
10          doorway, and the vertical edge of the other along the opposite vertical side.  
11          Two curtained doorways spaced a minimum of three feet apart form an  
12          airlock.
- 13          8. Decontamination Enclosure System - a series of connected rooms, with  
14          curtained doorways between any two adjacent rooms, for the  
15          decontamination of workers or of materials and equipment. A  
16          decontamination enclosure system always contains an airlock.
- 17          9. Encapsulation - the sealing of asbestos surfaces involving application of a  
18          material (encapsulate/sealant) that will envelop or coat the fiber matrix and  
19          minimize fiber fallout and protect against contact damage.
- 20          10. Enclosure - procedures necessary to completely enclose material  
21          containing asbestos behind airtight, impermeable, permanent barriers.
- 22          11. EPA - United States Environmental Protection Agency.
- 23          12. Equipment Decontamination Enclosure System - a decontamination  
24          enclosure system for materials and equipment, typically consisting of a  
25          designated area of the work area, a washroom, and an uncontaminated  
26          area.
- 27          13. Equipment Room - a contaminated area or room which is part of the worker  
28          decontamination enclosure system, with provisions for storage of  
29          contaminated clothing and equipment.
- 30          14. Fixed Object (immovable object) - a unit of equipment or furniture in the  
31          work area which cannot be removed from the work area.
- 32          15. Glove-Bag - a relatively small, clear plastic enclosure which can completely  
33          encompass short sections of pipe. It shall be capable of allowing the  
34          removal of asbestos-containing materials without any of the materials  
35          escaping from the enclosure.
- 36          16. HEPA Filter - a High Efficiency Particulate Air (HEPA) filter capable of  
37          trapping and retaining 99.97 percent of asbestos thermally generated DOP  
38          particles 0.3 microns in diameter.
- 39          17. HEPA Vacuum Equipment - High Efficiency Particulate Air filtered  
40          vacuuming equipment with a filter system capable of collecting and retaining  
41          asbestos fibers. Filters should be 99.97 percent efficient for retaining  
42          thermally generated DOP particles 0.3 microns in diameter.
- 43          18. Holding Area - a chamber between the washroom and uncontaminated area  
44          in the equipment decontamination enclosure system. The holding area  
45          comprises an airlock.
- 46          19. Movable Object - a unit of equipment or furniture in the work area which can  
47          be removed from the work area.
- 48          20. NIOSH - National Institute for Occupational Safety and Health.
- 49          21. OSHA - Occupational Safety and Health Administration.
- 50          22. Permissible Exposure Limits (PELs) – as defined by OSHA, as the

maximum amount or concentration of a chemical that a worker may be exposed to under OSHA regulations. Under the OSHA Asbestos Construction standard, the two PELs are: (1) No employee may be exposed to an airborne concentration of asbestos in excess of 0.1 f/cc as an 8-hour TWA, and (2) No employee may be exposed to an airborne concentration of asbestos in excess of 1.0 f/cc as averaged over a sampling period of 30 minutes (Excursion Limit).

23. Plastic Sheeting - plastic sheet material used for protection of walls, floors, etc. and used to seal openings into work areas. The thickness of the material shall be as specified.

24. Removal - the act of removing asbestos-containing or contaminated materials from a structure and depositing in a suitable disposal site.

25. Scaffolding - self-supporting and load-bearing temporary structure.

26. Shower Room - A room constituting an airlock, between the clean room and the equipment room in the worker decontamination enclosure system, with hot and cold or warm running water suitably arranged for complete showering during decontamination.

27. Surfactant - a chemical wetting agent added to water to improve its penetrating ability, thus reducing the quantity of water required to saturate asbestos-containing materials.

28. Wet Cleaning - the process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning tools as asbestos-containing waste.

29. Washroom - a room between the work area and the holding area in the equipment decontamination enclosure system. The washroom comprises an airlock.

30. Work Area - area or areas of Project which undergo "abatement" or are contaminated.

31. Worker Decontamination Enclosure System - a decontamination enclosure system for workers, typically consisting of a clean room, a shower room, and an equipment room.

B. Approval of, or acceptance by, Owner or Consultant of various construction activities or methods proposed by Contractor does not constitute an assumption of liability either by the Consultant or Owner for inadequacy or adverse consequences of said activities or methods.

### 1.03 QUALITY CRITERIA

#### A. Qualification for Performance of Work

1. Contractor (or subcontractor engaged to perform the Work of this Section) shall:
  - a. Be a licensed asbestos abatement contractor in accordance with State of Florida Statutes, F.S. 469. Submit notarized documentation confirming current licensure.
  - b. Contractor shall have a record of not less than two years successful

experience in asbestos removal and related work similar in scope and magnitude to this project. Submit list of successfully completed projects with bidding documents.

- c. Maintain on site, a Superintendent and one Head Foreman, each having no less than one year of full-time experience in responsible charge of asbestos removal operations similar in scope and magnitude to this project within the three-year period preceding start of project and shall be fluent in English. Superintendent and Head Foreman must be approved by Owner prior to the start of the work and shall not be changed without prior approval of the Consultant. Head Foreman shall remain inside of the work area at all times the work is in progress. Submit notarized experience of Superintendent and Head Foreman with bidding documents.
  - d. Submit certification for each and every worker to be utilized on the project by the Contractor or subcontractor(s) documenting that each has successfully completed (including examinations and applicable refresher courses) an EPA-accredited training course approved by the State of Florida for asbestos abatement workers as specified in the Florida Statutes (F.S. 469). Contractor shall also submit documentation confirming EPA-accreditation and state approval for each training center represented in the submittals.
  - e. Submit certification for each and every supervisor to be utilized on the project by the Contractor or subcontractor(s) documenting that each has successfully completed (including examinations and applicable refresher courses) an EPA-accredited training course approved by the State of Florida for asbestos supervisors as specified in the Florida Statutes (F.S. 469). Contractor shall also submit documentation confirming EPA-accreditation and state approval for each training center represented in the submittals.

#### B. Reference Standards

1. Acknowledge, by the executing of the Contract, awareness and familiarity with the contents and requirements of the following regulations, codes, and standards, and assume responsibility for the performance of the work in strict compliance therewith and for every instance of failure to comply therewith.
  2. Make available for review at the site, one copy of EPA, OSHA, and applicable State, County, and City Regulations governing the work.
  3. The current issue of each document shall govern. Where conflict among requirements or with the Contract Documents exists, the more stringent requirements shall apply.
    - a. U.S. EPA Regulations for Asbestos (Code of Federal Regulations Title 40, Part 61, Subparts A and B).
    - b. U.S. EPA Regional National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart M.
    - c. U.S. Occupational Safety and Health Administration (OSHA)

- d. Asbestos Regulations (Code of Federal Regulations, Title 29, Part 1926, Section 1101).
  - e. U.S. EPA Office of Toxic Substances Guidance Document, "Asbestos-Containing Materials in School Buildings", Part I and Part II.
  - f. U.S. EPA Office of Pesticide and Toxic Substances Guidance Document, "Guidance for Controlling Friable Asbestos-Containing Materials in Buildings", EPA 56015-85-024, June 1985.
  - f. U.S. Department of Transportation, Hazardous Substances: Final Rule (Code of Federal Regulations, Title 49, Parts 171 and 172), Federal Register November 21, 1986, and corrected February 17, 1987.
  - g. State of Florida Statutes (F.S. 469): Licensure for Asbestos Consultants and Contractors.

#### C. Patent/Copyright Compliance

Comply with all patent and copyright laws involved with processes, equipment and materials regarding the work of the Contract Documents.

#### D. Survey Reports

1. Results of tests of asbestos-containing materials (which are specifically excluded as part of this Contract) taken from areas within the scope of this project are available for review at the office of the Owner.

However, the Contractor or subcontractor is cautioned that, should interpretations be made, opinions be formed, and conclusions be drawn as a result of examining the test results, those interpretations, opinions, and conclusions will be those made, formed, and drawn solely by the Contractor or subcontractor.

2. Inasmuch as randomly and/or arbitrarily selected areas were sampled, the Engineering and Owner make no representation, warranty, nor guarantee that the conditions indicated by the test results either are representative of those conditions existing throughout the area, or that unforeseen developments may occur, or that materials other than, or in proportions different from, those indicated may exist.

## 1.04 SUBMITTALS

Refer to Article 1.03 of this Section for the submittals required by the Contract Documents.

## 1.05 PRODUCT HANDLING

- A. Deliver all project materials as described in Part 2 in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.
  - B. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

- 1  
2       C. Remove from the premises, all damaged or deteriorating materials. Dispose of  
3            materials that become contaminated with asbestos in accordance with applicable  
4            regulatory standards.  
5

6       **PART 2 - PRODUCTS**  
7

8       **2.01 MATERIALS**  
9

- 10      A. Plastic Sheeting - shall be of the thicknesses specified, in sizes to minimize the  
11            frequency of joints. Utilize reinforced plastic sheeting in specified thicknesses on  
12            floors.  
13  
14      B. Tape - shall be glass fiber or other type capable of sealing joints of adjacent sheets  
15            of plastic and for attachment of plastic sheet to finished or unfinished surfaces of  
16            dissimilar materials under both dry and wet conditions.  
17  
18      C. Surfactant (wetting agent) - shall consist of resin materials in water base which  
19            have been tested to indicate material is non-toxic and non-irritating to skin and  
20            eyes, and non-carcinogenic. Approved materials and manufacturers:  
21  
22        1. "Penewet #6450" and its sprayer mixing head amended water generator  
23            manufactured by Fiberlock Technologies, Inc., 630 Putnam Avenue,  
24            Cambridge, MA 02139-0432, telephone (800) FIBERLK.  
25        2. Consultant will consider equivalent products by other manufacturers for  
26            approval if submitted with appropriate information to Consultant not later  
27            than five days prior to the scheduled time for the material to be used.  
28            Minimum information shall include Safety Data Sheet, OSHA Form No. 20;  
29            toxicological reports, and installation recommendations for use on  
30            asbestos-containing materials.  
31  
32      D. Sealant (encapsulant) - shall be manufactured by reputable, established  
33            manufacturer or encapsulant/sealant materials and be approved specifically for use  
34            in asbestos contaminated environments. Shall be compatible with the temperature  
35            conditions on surfaces to which sealant is to be applied. It is the responsibility of  
36            the Contractor to determine compatibility of the sealant with materials and  
37            conditions.  
38  
39      E. Impermeable containers – a minimum six mil thick impermeable polyethylene bags  
40            shall be used. Bags shall be properly labeled, for disposal of the asbestos  
41            containing waste material. Before starting removal, Contractor must have a  
42            sufficient number of waste disposal bags on site. The disposal bags shall be sealed  
43            with duct tape using the "gooseneck technique". This technique helps in minimizing  
44            any leaks that may occur from a poorly sealed disposal bag.  
45  
46      F. Warning labels and signs - shall be as required by OSHA Regulation 29 CFR  
47            1926.1101 (and U.S. DOT 49 CFR 171 and 172 for impermeable containers).  
48  
49      G. Other materials - Provide all other materials, such as lumber, nails and hardware,  
50            which may be required to construct and dismantle the decontamination area and

1                   the barriers that isolate the Work Area(s).  
2

- 3                   H. Glovebag - Provide commercially available glovebag assemblies constructed of  
4                   minimum six-mil plastic sheeting and permanent, securely attached sleeves and  
5                   gloves. For high temperature (greater than 120 degrees Fahrenheit) applications,  
6                   provide glovebags constructed of suitable materials. Onsite modifications to  
7                   glovebags or use contrary to manufacturer's instruction must be submitted in  
8                   writing to Consultant for review and approval prior to initiation of work.  
9

10                  2.02 TOOLS AND EQUIPMENT  
11

- 12                  A. Provide suitable tools for asbestos removal.  
13

- 14                  1. Water sprayer - utilize airless or other low-pressure sprayer for amended  
15                   water application.  
16  
17                  2. Transportation - as required for loading, temporary storage, transit, and  
18                   unloading of contaminated waste without exposure to persons or property.  
19  
20                  3. Communication equipment - shall be suitable for Inter-room  
21                   Communications, such as "walkie-talkies".  
22  
23                  4. Manufactured vacuum loading device - a commercially available, vacuum  
24                   loader possessing a minimum of:  
25  
26                   a. As a minimum, a 4-stage filter system consisting of water injection,  
27                   centrifugal cyclone separator, reverse pulse filter baghouse and a  
28                   HEPA filter.  
29                   b. Filter monitor equipped with an auto shutdown mechanism.  
30                   c. Direct loading of wetted material into six-mil plastic bags.  
31                   d. Minimum of 1500 CFM at 200 inches H<sub>2</sub>O suction.  
32  
33                  5. Continuous evacuation device (for use with glove-bags) - provide UL listed,  
34                   commercially available devices, which are capable of maintaining a  
35                   pressure differential between 0.05 and 0.25 inches of water within a glove-  
36                   bag. Device assembly shall include HEPA filtered exhaust.  
37  
38                  6. Glove-Bag - provide commercially available glove-bag assemblies  
39                   constructed of minimum six-mil plastic sheeting and permanent, securely  
40                   attached sleeves and gloves. For high temperature applications, provide  
41                   glove-bags constructed of suitable materials. On-site modifications to  
42                   glove-bags or use contrary to manufacturer's instruction must be submitted  
43                   in writing to Consultant for review prior to initiation of work. Glove Bags and  
44                   glove-bag operations will be overseen by the Owner.  
45  
46                  7. Air purifying equipment (for internal recirculation in the Work Area) - shall  
47                   be HEPA Filtration Systems or Electronic Precipitators. Ensure that no  
48                   internal air movement system or purification equipment exhausts  
49                   contaminated air from the Work Area(s) outside the Work Area.  
50

- 1           8. Diminished air pressure equipment - comply with ANSI Z9.2-7, local  
2           exhaust ventilation.

3

4       **PART 3 - EXECUTION**

5

6       **3.01 REMOVAL OF ASBESTOS-CONTAINING MATERIAL**

7

8       Properly remove and dispose of all asbestos-containing materials indicated to be removed  
9       as described in the Contract Documents in accordance with the methods and procedures  
10      outlined in the U.S. OSHA Regulation (Code of Regulations, Title 29, Part 1926, Section  
11      1101) or as more stringently specified herein.

12

13      **A. REMOVAL SEQUENCE 1 (Caulking)**

- 14
- 15       1. Prepare work areas as previously specified.
- 16
- 17       2. Properly remove asbestos-containing material as designated in the Pre-  
18          Demolition NESHAP survey by the Consultant.
- 19
- 20       3. Spray areas of asbestos material with amended water, using spray  
21          equipment recommended by surfactant manufacturer capable of providing a  
22          "mist" application to reduce the release of fibers. Wet the material  
23          sufficiently to saturate it to the substrate without excessive dripping. Spray  
24          the asbestos material repeatedly during removal to maintain wet condition  
25          but do not use excessive amounts of water.
- 26
- 27       4. Remove the saturated asbestos material in small sections. Do not allow  
28          material to dry out. As it is removed, place the material in sealable plastic  
29          bags of six-mil minimum thickness and place in labeled containers for  
30          transport.
- 31
- 32       5. Do not permit removed asbestos-containing material to fall more than 10  
33          feet. For greater height, provide an inclined chute apparatus or scaffolds.
- 34
- 35       6. After removal of asbestos-containing material, all surfaces shall be wet-  
36          cleaned to remove residual accumulated material. Continue wet-cleaning  
37          until surface is free of visible material.
- 38
- 39       7. Upon completion of the removal of ACM, a visual inspection shall be  
40          performed by the consultant in order to document the effectiveness of the  
41          abatement. If any noted ACM remain, the contractor shall address the  
42          concerns of the consultant.
- 43
- 44       8. Downwind "work in progress" air sampling will be performed in lieu of post  
45          abatement clearance sampling. Final clearance is dependent on successful  
46          final visual clearances and when the air fiber count is 0.01 f/cc or less by  
47          NIOSH #7400

48

49      **B. REMOVAL SEQUENCE 2 (Roofing)**

- 1           1. The competent person shall determine if the walking/working surfaces of the  
2           roof area on which the employees are to work have the strength and  
3           structural integrity to support the employees safely. Each employee on a  
4           walking/working surface (horizontal and vertical surface) with an  
5           unprotected side or edge which is 6 feet or more above a lower level shall  
6           be protected from falling by the use of guardrail systems, safety net  
7           systems, or personal fall arrest system.
- 8           2. Roofing material shall be removed in an intact state to the extent that it is  
9           feasible. Wet methods shall be used to remove roofing materials that are  
10          not intact, or that will be rendered not intact during removal, unless such wet  
11          methods are not feasible or will create safety hazards
- 12          3. Asbestos-containing material that has been removed from a roof shall not  
13          be dropped or thrown to the ground. Removed roofing ACM shall be double  
14          bagged and passed to the ground by hand or shall be lowered to the ground  
15          via a rope.
- 16          4. Upon completion of the removal of ACM, a visual inspection shall be  
17          performed by the consultant in order to document the effectiveness of the  
18          abatement. If any noted ACM remain, the contractor shall address the  
19          concerns of the consultant.
- 20          5. Downwind "work in progress" air sampling will be performed in lieu of post  
21          abatement clearance sampling. Final clearance is dependent on successful  
22          final visual clearances and when the air fiber count is 0.01 f/cc or less by  
23          NIOSH #7400
- 24          6. Alternative Roofing Removal Techniques: The contractor may elect to leave  
25          the ACM roof material in place and be removed as part of the wet demolition  
26          of the roofing structure, per Florida statutes 469. Contact Pinellas County  
27          Air Quality Division at 727-464-4422 with questions regarding local  
28          requirements for wet demolition of roofing materials.

29           C. REMOVAL SEQUENCE 3 (Gasket Material)

- 30          1. Prepare work area as previously specified.
- 31          2. Wrap the asbestos-containing thermal system insulation gasket area with a  
32          minimum of two layers of six-mil plastic sheeting and secure with tape.
- 33          3. Support the pipe runs on each side adjacent to the area containing ACM to  
34          be removed.
- 35          4. After pipe run is safely supported, cut each side of the pipe approximately 1  
36          foot from each adjacent side of the ACM materials.
- 37          5. Safely removed section of pipe containing ACM and place in 6 mill disposal  
38          bag.

- 1           6. Clean work area and dispose of any metal shavings and debris.
- 2
- 3           7. Alternative Glove-Bag Removal Techniques
- 4
- 5           a. Contractor may elect to use continuously evacuated glove-bag
- 6           techniques for the removal of asbestos-containing materials. Prior
- 7           to the use of such techniques, Contractor shall submit shop
- 8           drawings or product data for equipment to be utilized for review by
- 9           Consultant.
- 10          b. A continuous diminished air pressure of minimum 0.05 inches of
- 11           water must be maintained within the glove-bag assembly at all times
- 12           during removal and cleaning methods.
- 13
- 14          8. Upon completion of the removal of ACM, a visual inspection shall be
- 15           performed by the consultant in order to document the effectiveness of the
- 16           abatement. If any noted ACM remain, the contractor shall address the
- 17           concerns of the consultant.
- 18
- 19          7. Downwind "work in progress" air sampling will be performed in lieu of post
- 20           abatement clearance sampling. Final clearance is dependent on successful
- 21           final visual clearances and when the air fiber count is 0.01 f/cc or less by
- 22           NIOSH #7400

23

24        **3.02 CLEAN-UP AND DECONTAMINATION**

- 25
- 26          A. Provide general clean-up of work areas concurrently with the removal of asbestos-
- 27           containing materials. Do not permit accumulation of removed materials on floor or
- 28           ground.
- 29
- 30          B. **CLEAN-UP AND DECONTAMINATION**
- 31
- 32           1. Remove all visible accumulations of asbestos material and debris.
- 33
- 34           2. Wet-clean all surfaces in the work areas.
- 35
- 36           3. Notify Owner for observation of cleaning to determine completeness.
- 37
- 38           4. Clean all sealed impermeable containers and all equipment (excluding that,
- 39           which will be needed for further cleaning) used in the work areas and
- 40           remove from work areas via the equipment decontamination enclosure
- 41           system.
- 42
- 43           5. Following the successful final visual clearance and when the air fiber count
- 44           is 0.01 f/cc or less by NIOSH #7400 and prior to removing plastic sheeting,
- 45           all surfaces from which asbestos-containing materials were removed shall
- 46           receive one coat of sealant to seal existing surfaces as follows:
- 47
- 48           a. Misting, spraying, and pumping equipment, as recommended by the
- 49           encapsulant material's manufacturer, shall be used.
- 50

- 1                   b. Encapsulant, compatible with finish material and conditions specified  
2                   in other Divisions, shall be installed in procedures as recommended  
3                   by the manufacturer's written instructions if found to be compatible  
4                   with temperature conditions.

5

6

7        **3.03 COMPLETENESS TESTING AND DEMOBILIZATION**

8

9           **A. STANDARD OF COMPLETION FOR AREA DEMOBILIZATION**

10

- 11           1. Standard of Completion: Consider the removal complete when air testing  
12           performed by the consultant employed and paid for by the Owner shows  
13           0.01 or less f/cc for each sample using NIOSH #7400 for Phase Contrast  
14           Microscopy (PCM).
- 15           2. Testing Laboratory will test for completeness of the removal upon notice  
16           from contractor that work areas and all other decontaminated and cleaned  
17           areas are ready.
- 18           3. Re-clean at Contractor's expense all areas that do not comply with the  
19           standard of completion for final clearance. Continue cleaning until the  
20           specified standard of completeness is achieved by the consultant.  
21           Contractor shall bear cost of all follow-up tests necessitated by the failure  
22           of the air tests to meet the specified final clearance level. Owner will  
23           deduct the cost of such follow-up tests from whatever monies remain due  
24           to the Contractor.
- 25
- 26           a. Dismantle and remove sturdy barriers and plastic seals on all  
27           openings and wet clean immediate areas.  
28           b. Dismantle decontamination enclosure systems and thoroughly wet  
29           clean immediate areas.  
30           c. Dispose of debris, using cleaning materials, unsalvageable  
31           materials used for sturdy barriers, and any other remaining  
32           materials. Consider the materials as contaminated and dispose of  
33           accordingly.

34

35        **3.04 DISPOSAL OF CONTAMINATED WASTE**

36

- 37           A. Remove sealed and labeled containers of contaminated material and wastes and  
38           dispose of in approved sanitary landfill as follows:
- 39           1. Notify Owner not less than 48 hours prior to the proposed time of removing  
40           and delivery of contaminated waste to the landfill. The Owner may elect to  
41           observe this operation.
- 42           2. Seal asbestos waste in leak-proof, impermeable containers labeled in  
43           accordance with Title 29, Code of Federal Regulations, Section 1926.1101,  
44           and Title 49, Code of Federal Regulations, Sections 171 and 172.
- 45           3. Transport double-bagged contaminated waste from work area to truck in

fiber or steel drums.

4. Use only enclosed or covered trucks to haul impermeable containers to prevent loss or damage to containers enroute to sanitary landfill.
  5. Preclean using HEPA vacuum equipment and wet-cleaning methods and place one layer of six-mil plastic sheeting on walls and floor of truck prior to transport of contaminated waste.
  6. Allow only sealed plastic bags or impermeable containers to be deposited in landfill. Leave damaged, broken, or leaking plastic bags in the impermeable container and deposit entire container in landfill.
  7. Ensure that there are no visible emissions to the outside air from site where materials and waste are deposited.
  8. Contractor may recycle uncontaminated impermeable containers.
  9. Submit landfill receipts to the Owner after completion of the work.
  10. Following the last trip to dispose of contaminated waste, all plastic sheeting shall be removed from the walls and floor of the truck and also be disposed of as contaminated waste. Contractor shall then notify Owner to examined truck for cleanliness.
  11. Final completion may not be satisfied until approval of truck by Consultant after completion of transportation of contaminated waste.

### 3.05 FIELD QUALITY CONTROL

- A. A testing laboratory may be provided by the Owner at no cost to the Contractor, except as outlined in other sections of the Contract Documents, to periodically observe the removal process and perform the work in progress air monitoring.
  - B. Testing laboratory may conduct air monitoring throughout removal and cleaning operations.
  - C. The testing laboratory may perform prevalent and isolation air sampling according to the method prescribed by Section 1926.1101 of OSHA CFR Title 29 and analyze the samples in general accordance with the procedures outlined by NIOSH #7400 for PCM.
  - D. The testing laboratory may perform the Owner's testing and conduct both the preliminary and completeness of removal response action testing. Completeness of removal response action testing will be performed in general accordance with NIOSH #7400 and #7402. Such testing for the Owner does not relieve the Contractor of providing necessary tests required by other regulations, codes, and standards for the protection of his workers, or for any other purposes.
  - E. Air tests will be made both inside work areas and outside work areas where

1 applicable, and test results will be made available to the Contractor. The Contractor  
2 is cautioned, however, that should interpretations be made, opinions be formed,  
3 and conclusions be drawn as a result of examining the test results, those  
4 interpretations, opinions, and conclusions will be those made, formed, and drawn  
5 solely by the Contractor. The Contractor will be responsible for performing air tests  
6 required for his evaluation of the safety of his employees.  
7

- 8 F. A preliminary visual observation will be performed in the work area by the  
9 Consultant following notification by the Contractor that said areas have been  
10 properly cleaned. Areas will be observed for the presence of visible dust, dirt and  
11 debris.
- 12 G. Test results will be reported in terms of total fiber count per cubic centimeter of air  
13 (f/cc) for air samples analyzed by PCM.
- 14 I. Work in progress air sampling will be ran in performed of post abatement clearance  
15 sampling. Final clearance is dependent on successful final visual clearances and  
16 when the air fiber count is 0.01 f/cc or less by NIOSH #7400.
- 17 J. After final clean-up of an area is completed, the work areas shall satisfactorily pass  
18 the response action completeness criteria specified in Section 13280-3.03.
- 19 K. A final visual observation will be performed by the Consultant and Owner (or his  
20 representative) after final clean-up to inspect visible dust, dirt and debris and areas  
21 of damage.
- 22 L. Contractor shall perform additional cleaning of areas if, in the opinion of the Owner,  
23 based upon the final visual observation, previous clean-up operations were  
24 determined to be inadequate.
- 25 M. Any area whose air test results fail to comply with Paragraph J of this Section will be  
26 retested following re-cleaning of the areas. Contractor shall pay all costs  
27 associated with retesting.
- 28

29 END OF SECTION  
30  
31  
32  
33  
34  
35  
36

1 ASBESTOS ABATEMENT - CERTIFICATE OF COMPLETION  
2  
3

4 Date: \_\_\_\_\_ Terracon Project No. \_\_\_\_\_  
5

6 Owner: \_\_\_\_\_ Contractor: \_\_\_\_\_  
7

8 Facility: \_\_\_\_\_  
9

10 Address: \_\_\_\_\_  
11 \_\_\_\_\_  
12 \_\_\_\_\_  
13 \_\_\_\_\_  
14 \_\_\_\_\_  
15

16 CONTRACTOR'S AFFIDAVIT  
17

18 I CERTIFY: That work under the above named contract has/have been satisfactorily completed  
19 and that the work area has been inspected in general accordance with the field observation  
20 portions of the ASTM E1368 - 11 Standard Practice for Visual Inspection of Asbestos  
21 Abatement Projects.  
22

23 Name: \_\_\_\_\_ Signature/Date: \_\_\_\_\_  
24 (Printed)  
25  
26  
27  
28

29 STATEMENT OF CONSULTANT  
30

31 To the best of my knowledge and belief, the work under the above-named contract has been  
32 satisfactorily completed under the terms of the contract and that the contractor has satisfactorily  
33 completed the job in accordance with the terms of the contract.  
34

35 Name: \_\_\_\_\_ Signature/Date: \_\_\_\_\_  
36 (Printed)  
37  
38

1

## SECTION 02083

2

### LEAD-BASED PAINT ABATEMENT

4

#### PART 1 - GENERAL

6

##### 1.01 DESCRIPTION

8

9 Perform all planning, administrative, execution, and cleaning requirements necessary to  
10 safely perform specified lead-based paint abatement as described in this specification  
11 and in the drawings.

12

##### 1.02 SUMMARY OF WORK

14

15 A. Work Included, shall include as identified in Terracon Consultants, Inc., *Pre-*  
16 *Demolition NESHAP Asbestos Survey, Lead-Based Paint and Hazardous Materials*  
17 *Survey Report, dated January 19, 2017 (Terracon Report)*:

18

Sample location	Component	Color	Substrate
Primary Pump House – 1FL – Pipe, 10"	Pipe	Yellow	Metal
Primary Pump House – 1FL – Pipe, 6"	Pipe	Green	Metal
Primary Pump House – 1FL – Valve, 6"	Valve	Green	Metal
Primary Pump House – 1FL – Pump #2 – Valve	Valve	Red	Metal
Primary Pump House – 1FL – Sludge Pump #1	Pump	Light Blue	Metal
Primary Pump House – 1FL – Stairs	Step	Yellow	Concrete
Primary Pump House – North Tank – Drive Motor	Motor	Red	Metal
Headworks – Lower Level – Grit Pumps – Pipe, 6"	Pipe	Green	Metal
Headworks – Lower Level – Grit Pumps – Pipe, 6"	Pipe	Black	Metal
Headworks – Lower Level – Grit Pump – Pipe, 36"	Pipe	Gray	Metal
Irrigation System – Reclaimed Water Pump #2	Pump	Gray	Metal
Irrigation System – Reclaimed Water – Electric Panel Cabinet	Doors	Gray	Metal
Irrigation System – Reclaimed Water – Storage Box	Lid/Cover	Gray	Metal
Irrigation System – Reclaimed Water – Natural Gas Pipeline, 3"	Pipe	Orange	Metal
Irrigation System – Reclaimed Water – Pump #2	Motor	Dark Gray	Metal
Irrigation System – Reclaimed Water – Wall	Wall	Light Yellow	Concrete
Irrigation System – Reclaimed Water – Roof Support Beam	Beam	Yellow	Wood
Irrigation System – Reclaimed Water – Overhead PVC Drain Pipe, 2"	Pipe	Yellow	PVC
Irrigation System – Chlorine Feed System Room	Wall	White	CMU
Irrigation System – Chlorine Feed System Room	Wall	Gray	CMU
Irrigation System – Chlorine Feed System Room	Door Frame	Yellow	Metal

1  
2      B.      Work Not Included:  
3  
4          1.      Area air monitoring.  
5  
6  
7

1    C. Definitions:

- 2        1. Abatement - procedures to decrease or eliminate exposure to lead-based  
3           substances that may result in lead toxicity or poisoning, by the removal or  
4           demolition of lead-containing substances, by thorough cleanup procedures,  
5           and by post-cleanup treatment of surfaces.
- 6        2. Action Level - employee exposure, without regard to the use of respirators,  
7           to an airborne concentration of lead of 30 micrograms per cubic meter of air  
8           ( $\mu\text{g}/\text{m}^3$ ) calculated as an 8 hour time weighted average.
- 9        3. Air Monitoring - the process of measuring the lead content of a specific  
10          volume of air in a stated period of time.
- 11       4. ANSI - American National Standards Institute
- 12       5. ASTM - American Society for Testing and Materials
- 13       6. Clean Room - an uncontaminated area or room which is part of the worker  
14          decontamination enclosure system, with provisions for storage of workers'  
15          street clothes and protective equipment. Also known as the "Change  
16          Room".
- 17       7. Contractor - any business entity, public unit, or person performing the actual  
18          abatement for a lead abatement project.
- 19       8. Cleaning Solution - solution which contains at least one ounce of 5 percent  
20          Trisodium Phosphate (TSP) to each gallon of hot water.
- 21       9. Decontamination Enclosure System - a series of connected rooms, with  
22          curtained doorways between any two adjacent rooms, for the  
23          decontamination of workers or of materials and equipment.
- 24       10. Encapsulation - to resurface or cover surfaces and to seal or caulk seams  
25          with durable material, so as to prevent or control chalking or flaking of lead-  
26          containing substances.
- 27       11. Enclosure - procedures necessary to completely enclose material  
28          containing lead-based paint behind airtight, impermeable, permanent  
29          barriers.
- 30       12. EPA - United States Environmental Protection Agency.
- 31       13. Equipment Room - a contaminated area or room which is part of the  
32          decontamination enclosure system, with provisions for storage of  
33          contaminated clothing and equipment.
- 34       14. HEPA Filter - a High Efficiency Particulate Air (HEPA) filter capable of  
35          trapping and retaining 99.97 percent of thermally generated DOP particles  
36          0.3 microns in diameter.
- 37       15. HEPA Vacuum Equipment - High Efficiency Particulate Air filtered  
38          vacuuming equipment with a filter system capable of collecting and  
39          retaining asbestos fibers. Filters should be 99.97 percent efficient for  
40          retaining thermally generated DOP particles 0.3 microns in diameter.

- 1        16. Lead - metallic lead, all inorganic lead compounds, and organic lead soaps.
  - 2        17. Lead Abatement Project - any work performed in order to abate the  
3              presence of a lead-containing substance.
  - 4        18. Lead-Based Paint - any paint, plaster, or other surface coating material  
5              containing more than 0.50 percent lead by weight calculated as lead metal  
6              in the dried solid, or more than 1.0 milligrams per square centimeter by x-  
7              ray fluorescence.
  - 8        19. NESHAPS - National Emissions Standard for Hazardous Air Pollutants.
  - 9        20. NIOSH - National Institute for Occupational Safety and Health.
  - 10       21. OSHA - United States Occupational Safety & Health Administration.
  - 11       22. PEL - Permissible Exposure Limit. Employee exposure to an airborne  
12              concentration of lead of 50 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ )  
13              calculated as an 8 hour time weighted average. For work periods of less  
14              than 8 hours, the PEL is reduced according to the following formula:

When respirators are used, employee exposures may be considered to be at the level provided by the protection factor of the respirator for those periods where a respirator is worn. The periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily TWA.

1           30. Work Area - Area or areas of Project which undergo "abatement" or are  
2           contaminated.

3  
4       D. Approval of or acceptance by Consultant of various construction activities or  
5           methods proposed by Contractor does not constitute an assumption of liability  
6           either by the Consultant or Owner for inadequacy or adverse consequences of  
7           said activities or methods.

8  
9       **1.03 QUALITY CRITERIA**

10      A. Qualifications for Performance of Work:

11           1. Contractor (or subcontractor engaged to perform the removal of lead-based  
12           paint material) shall:

13               a. Have a record of not less than two years successful experience in  
14               lead-based paint removal and related work similar in scope and  
15               magnitude to this project.

16               b. Maintain on-site, a Superintendent and one Head Foreman, each  
17               having not less than one year of full-time experience in responsible  
18               charge of lead removal operations similar in scope and magnitude to  
19               this project within the three-year period preceding start of project.  
20               Superintendent and Head Foreman must be approved by Consultant  
21               or prior to the start of the work and shall not be changed without prior  
22               approval of the Consultant. Head Foreman shall remain inside the  
23               work area at all times the work is in progress. Submit certification of  
24               successful completion of training course for lead abatement  
25               supervisors as required by 40 CFR 745, Subpart L, (preferred) or  
26               OSHA-related equivalent.

27               c. Use only trained and experienced lead abatement removal workers  
28               to perform the work. Train in accordance with 29 CFR 1910.62.  
29               Submit documentation of each workers training in the pre-job  
30               submittal package required in Part 1.0 of this Section.

31  
32      B. Reference Standards:

33           1. The Contractor acknowledges, by the executing of the Contract, awareness  
34           and familiarity with the contents and requirements of the following  
35           regulations, codes, standards, and guidance documents, and assumes  
36           responsibility for the performance of the Work in strict compliance therewith  
37           and, for every instance of failure, to comply therewith.

38  
39           2. The current issue of each document shall govern. Where conflict among  
40           requirements or with the Contract Documents exists, the more stringent  
41           requirements shall apply.

42  
43               a. Department of Housing and Urban Development; Guidelines for the  
44               Evaluation and Control of Lead-Based Paint Hazards in Housing.

- 1           b. ANSI Publications: Z88.2-80; Practices for Respiratory Protection.
- 2
- 3           c. Environmental Protection Agency: SW-846/1311 Toxicity
- 4           Characteristic Leaching Procedure (TCLP).
- 5
- 6           d. NIOSH: 81-123; Occupational Health Guidelines for Chemical
- 7           Hazards.
- 8
- 9           e. Code of Federal Regulations (CFR) Publications:
- 10
- 11           29 CFR 1910.134      OSHA Respiratory Protection
- 12           29 CFR 1926          OSHA Standards for Construction Industry (esp.
- 13           1926.62 Lead)
- 14           29 CFR 1910          OSHA Standards for General Industry (esp.
- 15           1910.1025 Lead)
- 16           40 CFR 61            EPA NESHAP
- 17           40 CFR 261          EPA Regulations Identifying Hazardous Waste
- 18           40 CFR 262          EPA Regulations for Hazardous Waste
- 19           Generators
- 20           40 CFR 263          EPA Regulations for Hazardous Waste
- 21           Transporters
- 22           40 CFR 745          EPA Lead Based Paint Rules
- 23           49 CFR 171-179       DOT Hazardous Material Regulations
- 24           24 CFR 35.24        HUD Subpart C Inspection & Hazard
- 25           Assessment Requirements
- 26
- 27           f. ASTM Standards:
- 28
- 29           E1796-97          Standard Guide for Selection and Use of Liquid
- 30           Coating Encapsulation Products for Leaded
- 31           Paint in Buildings
- 32           E1797-03          Standard Specification for Reinforced Liquid
- 33           Coating Encapsulation Products for Leaded
- 34           Paint in Buildings
- 35
- 36           g. All state, county, and city codes and ordinances as applicable. Make
- 37           available for review at the site one copy of HUD, OSHA, and
- 38           applicable State, County, and City Regulations governing the Work.

39           **1.04 PATENT/COPYRIGHT COMPLIANCE**

40

41           Comply with all patent and copyright laws involved with processes, equipment and

42           materials regarding the work of the Contract Documents.

43           **1.05 TEST REPORTS**

44

45           A. Sampling of painted surfaces within the areas scheduled for demolition by the

46           Owner generally indicated the presence of paint containing lead. A summary is

47           provided - for awareness purposes only - in Section 1.02.

48

1      B. Results of tests of lead-based paints taken from surfaces within the scope of this  
2      Project are available for review at the office of the Owner. However, the Contractor  
3      or subcontractor is cautioned that, should interpretations be made, opinions be  
4      formed, and conclusions be drawn as a result of examining the test results, those  
5      interpretations, opinions, and conclusions will be those made, formed, and drawn  
6      solely by the Contractor or subcontractor.

7  
8      C. Inasmuch as randomly and/or arbitrarily selected areas were sampled, the  
9      Consultant and Owner make no representation, warranty, nor guarantee that the  
10     conditions indicated by the test reports either are representative of those  
11     conditions existing throughout the area, or that unforeseen developments may not  
12     occur, or that materials other than, or in proportions different from, those indicated  
13     may not exist.

14  
15     **1.06 DAILY LOG**

16  
17     A. The Contractor shall maintain at the work site, a daily log documenting the dates  
18     and time of, but not limited to, the following items:

- 19  
20        1. Meetings; purpose, attendees, brief discussion.  
21        2. Visitations; authorized and unauthorized.  
22        3. Personnel; by name, entering and leaving the work area.  
23        4. Special or unusual events; i.e. barrier breaching, equipment failures,  
24        accidents.  
25        5. Air monitoring tests and test results (included OSHA compliance  
26        monitoring).  
27        6. Evidence of the work area being maintained under diminished air pressure  
28        by means of a strip recorder chart.  
29        7. Documentation of Contractor's completion of the following:  
30  
31            a. Inspection of the work area preparation prior to start of lead removal  
32            activities and daily thereafter.  
33            b. Removal of any sheet plastic barriers.  
34            c. Contractor's inspections prior to lock-down, encapsulation, or any  
35            other operation that will conceal the condition of lead materials or the  
36            substrate from which such materials have been removed.  
37            d. Removal of waste materials from the work area.  
38            e. Contractor's final inspection/final air tests.

39  
40     B. Submit copies of this log at final closeout of project as a project closeout submittal.

41  
42     **1.07 SUBMITTALS**

43  
44     A. Submittals Prior to Beginning Work:

- 45  
46        1. Lead Paint Removal Plan - Submit a detailed job-specific plan of the work

procedures to be used in the removal of paint containing lead or removal of building components containing lead based paints. The plan shall be prepared, signed, and dated by the Contractor. Such plan shall include a sketch (or sketches) showing the location, size, and details of lead control areas. The plan shall also include interface of trades involved in the work, sequencing of lead removal work, waste disposal plan, personal air monitoring, respirators, and protective equipment will be used, and a detailed description of the method to be employed in order to control the generation of airborne lead. The plan will describe the protective measures to be taken to protect workers and the public from exposure to lead at a level greater than or equal to 30 micrograms per cubic meter of air at all times. The plan shall include cleanup procedures and specify the cleanliness requirements and airborne lead levels which must be achieved prior to the disestablishment of a lead control area, and the methods that will be used to determine these requirements have been met. The plan shall be approved by the Consultant prior to the start of lead paint removal work. Prior to beginning work, the Contractor, Consultant, and Owner's Representative shall meet to discuss in detail the lead removal plan, including work procedures and safety precautions.

2. Contractor's Testing Laboratory - Submit name, address, and telephone number of the Contractor's Testing Laboratory selected to analyze the representative samples of waste by TCLP (if required), personal air samples, and blood samples.
3. Contractor's testing laboratory will perform air testing according to the method prescribed by Section 1910.1926.62 of OSHA CFR Title 29 and analyzed in accordance with the procedures outlined by current NIOSH methods.
4. Training Certification: Submit evidence of each supervisor and foreman training.
5. Report from Medical Examination: Submit a doctor's written opinion for a medical examination conducted within the last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the Work Area, or wear a negative-pressure respirator.
6. Notarized Certifications: Submit a notarized certification, signed by an officer of the abatement contracting firm, that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.62.
7. Respiratory Protection Schedule: Submit level of respiratory protection intended for each operation required by the project. Submit this information on the "Respiratory Protection Schedule" form included in Section 1.10.
8. Respirator Fitting Documentation: Submit documentation indicating successful fit check testing of respirators for the individuals working on this project in accordance with 29 CFR 1910.134.

- 1           9. Submit to the Consultant a sample in/out log as required in Part 3 of this  
2           section.
- 3           10. Submit product data indicating compliance with the contract documents for  
4           products and equipment to be utilized on the project. Include  
5           manufacturer's instructions and SDS sheets (as applicable).

6

7       B. Submittals Following Completion of the Work

8

- 9           1. Submit to the Consultant, manifests which indicate the Contractor's  
10          delivery(s) of hazardous waste materials to TSD facility. Manifest shall  
11          include date, quantity of material delivered, and signature of authorized  
12          representative of TSD.
- 13
- 14          2. Submit to the Consultant copies of daily in/out logs and daily logs (including  
15          pressure differential monitor strip charts, if employed).
- 16
- 17          3. Submit to the Consultant evidence of compliance with the applicable OSHA  
18          regulation including, as a minimum, copies of employee air monitoring  
19          results or representative background data.

20

21       1.08 PRODUCT HANDLING

22

- 23       A. Deliver all materials as described in Part 2 in the original packages, containers, or  
24          bundles bearing the name of the manufacturer and the brand name.
- 25
- 26       B. Store all materials subject to damage off the ground, away from wet or damp  
27          surfaces, and under cover sufficient to prevent damage or contamination.
- 28
- 29       C. Remove from the premises all damaged or deteriorating materials. Dispose of  
30          materials that become contaminated with lead-based paint in accordance with  
31          applicable regulatory standards.

32

33       1.09 WORKSITE CONDITIONS

34

- 35       A. Worker and Visitor Procedures: The Contractor is hereby advised that lead-based  
36          paint has been determined by the U.S. Government to be a toxic substance and  
37          Contractor shall provide workers and authorized visitors with respirators which as a  
38          minimum shall meet the requirements of OSHA 29 CFR 1910.134 and protective  
39          clothing during work area preparation, prior to commencing, during actual lead-  
40          based paint removal, and until final cleanup is completed.

41

42       1.10 PERSONNEL PROTECTION

43

- 44       A. Prior to commencement of work, all workers shall be instructed by the Contractor  
45          and shall be knowledgeable, in the appropriate procedures of personnel protection  
46          and lead-based paint removal.

- 1  
2     B. Contractor acknowledges and agrees that he is solely responsible for enforcing  
3           worker protection requirements at least equal to those required by federal  
4           regulations.  
5  
6     C. In accordance with OSHA lead standard for the construction industry regulation  
7           (29 CFR 1926.62), the contractor shall initially assume that employee exposures  
8           area greater than the PEL, but not greater than ten times the PEL, and shall  
9           implement the following employee protective measures:  
10  
11        1. Appropriate respiratory protection  
12        2. Appropriate personal protective clothing and equipment  
13        3. Change Areas and hygiene facilities  
14        4. Biological monitoring including sampling and analysis for lead, zinc, and  
15           protoporphyrin levels  
16  
17        Regardless of the results of the assessment of employee exposures, the minimum  
18           acceptable level of personnel protection shall be the use of half-face, disposable  
19           cartridge respirators and protective clothing.  
20  
21     D. Contractor shall provide workers with personally issued and marked respiratory  
22           equipment approved by NIOSH and OSHA and as a minimum suitable for the lead  
23           exposure level in the work areas.  
24  
25        1. Type of respiratory protection required:  
26  
27           a. Provide Respiratory Protection as allowed by these specifications.  
28           For the work of all sections, the level of respiratory protection which  
29           supplies an airborne lead concentration inside the respirator below  
30           50 micrograms of lead per cubic meter ( $\text{mg}/\text{m}^3$ ) is the minimum level  
31           of protection allowed. Determine the proper level of protection by  
32           dividing the expected or actual airborne lead concentration in the  
33           Work Area by the "Protection Factors" given below:  
34

RESPIRATORY PROTECTION FACTOR		
AIRBORNE CONCENTRATION OF LEAD	REQUIRED RESPIRATOR	PROTECTION FACTOR
Not in excess of 500 $\text{ug}/\text{m}^3$	1/2 Mask Air Purifying with HEPA Filters	10
Not in excess of 1,250 $\text{ug}/\text{m}^3$	Loose Fitting Hood or Helmet Powered Air Purifying with HEPA Filters	25

RESPIRATORY PROTECTION FACTOR		
AIRBORNE CONCENTRATION OF LEAD	REQUIRED RESPIRATOR	PROTECTION FACTOR
Not in excess of 2,500 ug/m <sup>3</sup>	Full-Facepiece Air Purifying Respirator with HEPA Filters, or Tight Fitting Powered Air Purifying with HEPA Filters, or Full Facepiece supplied Air Respirator in a continuous Flow Mode, or Full Facepiece Self-Contained Breathing apparatus(SCBA) Operated in the Demand Mode	50
Not in excess of 50,000 ug/m <sup>3</sup>	1/2 Mask Supplied Air Respirator Operated in the Pressure Demand Mode	1,000
Not in excess of 100,000 ug/m <sup>3</sup>	Full Facepiece Supplied Air Respirator Operated in the Pressure Demand Mode	2,000

- 1
- 2 D. Where respirators with disposable filters are used, provide sufficient filters for
- 3 replacement as necessary by the workers, or as required by applicable
- 4 regulations.
- 5 E. Permit no visitors, except for governmental inspectors having jurisdiction, or as
- 6 authorized by Consultant or Owner, in the work areas after commencement of
- 7 lead-based paint disturbance or removal. Provide authorized visitors with suitable
- 8 respirators in accordance with 29 CFR 1926.62 and 1910.1025
- 9
- 10 F. Provide workers with sufficient sets of protective disposable clothing, consisting of
- 11 full-body coveralls, head covers, gloves, and foot covers; of sizes to properly fit
- 12 individual workers.
- 13
- 14 G. Provide authorized visitors with a set of suitable protective disposable clothing,
- 15 headgear, eye protection, and footwear of sizes to properly fit visitors whenever
- 16 they are required to enter the work area, to a maximum of six sets per day.
- 17

18 1.11 COORDINATION WITH OWNER'S CONSULTANT

19

- 1 A. The Owner will provide a testing laboratory for periodic air monitoring.
- 2
- 3 B. Owner has retained a consultant to perform periodic visual observations during
- 4 execution of the work. Allow Consultant and authorized visitors access to work
- 5 areas during all phases of the work.
- 6
- 7 C. Contractor shall coordinate with, and notify Consultant a minimum of 48 hours prior
- 8 to work on weekends or holidays to allow coordination of testing and monitoring
- 9 services.

10

#### 11 1.12 OWNER'S TESTING LABORATORY

12

- 13 A. The Owner will provide a testing laboratory analysis of final clearance wipe
- 14 samples within each work area. Final clearance wipes, if required, will be obtained
- 15 by the Consultant.
- 16
- 17 B. The wipe samples from each work area will be transmitted to the laboratory via first
- 18 available overnight courier service. The results of these samples will be available
- 19 within five working days following receipt by the laboratory.
- 20
- 21 C. The Contractor will be responsible for the costs of retesting for work areas which
- 22 fail to meet the specified level of cleanliness.

23

#### 24 PART 2 - PRODUCTS

25

#### 26 2.01 MATERIALS

- 27 A. Provide suitable materials for lead-based paint removal.
- 28
- 29 1. Impermeable containers - Shall be suitable to receive and retain lead-based
- 30 paint or contaminated materials until disposal at an approved site and shall
- 31 be labeled in accordance with U.S. DOT 49 CFR 171 and 172, and the EPA
- 32 NESHAPS regulations. Containers shall be both air and water- tight. As a
- 33 minimum, utilize one of the three following types of impermeable containers:
- 34 1) six mil plastic bags sized to fit within the drum 2) metal or fiber drums
- 35 with tightly fitting lids 3) leak-tight wrapping with plastic sheeting.
- 36
- 37 2. Warning labels and signs - Shall be as required by OSHA regulation 29
- 38 CFR 1910.1025 (and U.S. DOT 49CFR 171 - 180 for impermeable
- 39 containers).
- 40
- 41 3. Other materials - Provide all other materials, such as lumber, nails and
- 42 hardware, which may be required to construct and dismantle the
- 43 decontamination area and the barriers that isolate the work area(s).
- 44
- 45 4. Chemical Stripping Agents - Shall be commercially available products
- 46

1 intended for paint removal such as the Peel Away Series manufactured by  
2 Dumond Chemicals, or equivalent. Provide incidental products, such as  
3 neutralizers, as required by manufacturer's instructions and  
4 recommendations.

- 5
- 6 5. Plastic Sheeting - Polyethylene sheeting, minimum 6 mil thickness.
- 7
- 8 6. Duct Tape - glass fiber or other type capable of securing adjacent sheets of  
9 plastic and attachment of plastic sheeting to finished and unfinished  
10 surfaces of dissimilar materials under wet and dry conditions.
- 11
- 12 7. Cleaning Solution - mixture of at least one ounce of 5 percent TSP to each  
13 gallon of hot water, or equivalent.
- 14

## 15 2.02 TOOLS AND EQUIPMENT

### 16 A. Provide suitable tools for lead-based paint removal.

- 17
- 18 1. Air Purifying Equipment - HEPA filtration systems. Verify that no air  
19 movement system or purification exhausts contaminated air from inside the  
20 work area into uncontaminated areas.
- 21
- 22 2. Scaffolding - Shall be as required to accomplish the specified work and  
23 shall meet all applicable safety regulations.
- 24
- 25 3. Transportation - As required for loading, temporary storage, transit, and  
26 unloading of contaminated waste without exposure to persons or property.  
27 Use only enclosed or covered trucks to haul waste containers to prevent  
28 loss or damage enroute to the landfill.
- 29
- 30 4. Vacuum Equipped Pneumatic Needle Scaler - A commercially available  
31 pneumatic needle scaler such as to Corner-Cutter equipped with Vac-Pac  
32 manufactured by Pentek, Inc., or equivalent possessing a minimum of:
- 33
- 34 a. A 2-stage filter consisting of reverse pulse filter and a HEPA filter  
35 efficient to 99.97% at 0.3 microns.
- 36
- 37 b. Direct loading of waste material into 55-gallon or 21-gallon disposal  
38 drums.
- 39
- 40 c. Shrouds sized to conform to window frame contours.
- 41

## 42 PART 3 - EXECUTION

### 43 3.01 PREPARATION AND WORK AREA ENCLOSURE

- 1    A. Identify location and amount of all lead-based paint materials to be removed  
2    present in areas indicated on Drawings.
- 3
- 4    B. Establish a regulated area where lead-based paint removal will be performed.  
5    Seal openings and penetrations within the Work Area with 6 mil plastic sheeting  
6    secured with tape.
- 7
- 8    C. Coordinate sequence of work area preparation with Owner and other trades to  
9    properly segregate work areas from areas that must remain fully or partially  
10   operational or in which other construction is being performed.
- 11
- 12   D. Construct worker decontamination units adjacent to the regulated area where lead-  
13   based paint removal will take place. Construct decontamination unit in compliance  
14   with OSHA guidelines concerning number, size, and placement of chambers.  
15   Shower in decontamination unit shall be open on two sides and open to  
16   contaminated and non-contaminated areas.
- 17
- 18   E. Plastic Sheeting Enclosures (as applicable). Cover floor with a minimum of two  
19   layers of 6 mil plastic sheeting turning each layer up walls 16 inches and fastened  
20   to wall. Cover walls which are not to be demolished or receive lead paint removal,  
21   with two layers of 6 mil plastic sheeting overlapping upturned floor plastic 12  
22   inches. Glue and tape in such a manner as to prohibit the movement of air  
23   through joints in plastic sheeting.
- 24
- 25   F. As applicable, place the interior work areas under diminished air pressure utilizing  
26   HEPA equipped fan units which comply with ANSI Z9.2-79. Allow no discharge of  
27   unfiltered air outside work area. Maintain diminished air pressure continuously  
28   until completion of lead-based paint removal. Maintain a minimum of 0.02 inches  
29   of water diminished air pressure for fully enclosed work areas.
- 30
- 31   G. Maintain emergency and fire exits from the work areas, or establish alternative  
32   exits satisfactory to fire officials.
- 33
- 34   H. Maintain for the duration of the project from the first activity requiring disturbance of  
35   lead-based paint materials, a sign in/out log in the immediate area of the work  
36   area. Log shall be utilized by every person and each time upon entering and  
37   leaving the work area(s). Submit copies of this log to Consultant in accordance  
38   with Part 1 of this section for permanent file upon completion of Project.
- 39
- 40
- 41   I. Trap and filter wastewater using filters having a pore size of not larger than one  
42   micron. Drain wastewater into a sanitary sewer. Replace contaminated filters  
43   when they become clogged but not less than every third day. Dispose of filters as  
44   hazardous waste.
- 45
- 46   3.02 REMOVAL OF LEAD-BASED PAINT

- 1 A. Properly remove and dispose of all lead-based paint materials indicated to be  
2 removed as described in the Contract Documents in accordance with the methods  
3 and procedures outlined in 40 CFR 263, 40 CFR 745, 49 CFR 171-179, 29 CFR  
4 1926.62, or as more stringently specified herein;
- 5     1. Prepare Work Areas as previously specified.  
6     2. Properly remove lead-based paint from specified interior building  
7 components by use of approved chemical methods or approved mechanical  
8 stripping techniques.  
9     3. Demolish and remove specified finish assemblies with lead paint in whole  
10 sections. Conduct demolition and/or lead-paint removal in such a manner  
11 as to minimize the disturbance to lead-based paint and generation of dust.  
12     4. In lieu of lead based paint removal from the substrate, the painted  
13 component may be removed as a whole and disposed of as hazardous  
14 materials, as noted in section 3.04. Noted items shall be wrapped with 2  
15 layers of 6 mill poly prior to disposal.  
16     5. After removal of lead-based paint material and/or building components  
17 containing lead based paint, all abated and surrounding surfaces shall be  
18 wet-cleaned with a TSP solution to remove residual accumulated material.  
19 Continue wet-cleaning until surface is free of visible material.

20     3.03 WORK AREA DECONTAMINATION

- 21 A. After completion of the removal, the Contractor shall;
- 22     1. Deposit all non-hazardous waste, including sealing tape, plastic sheeting,  
23 mop heads, sponges, filters, and disposable clothing in double plastic bags  
24 of at least 4 mil thickness, or single bags of minimum 6 mil thickness, and  
25 seal the bags;  
26     2. Deposit all hazardous waste in 55-gallon drums, tanks, or other containers  
27 suitable for the type of waste generated provided by Owner;  
28     3. Before washing as required in paragraph 3.03 A.(4), vacuum clean all  
29 surfaces in the work area with a HEPA filtered vacuum;  
30     4. After vacuum cleaning as required in paragraph 3.03 A (3), wet wash all  
31 surfaces in the work area with a solution containing at least one ounce of 5  
32 percent trisodium phosphate to each gallon of hot water; and  
33     5. After washing as required in paragraph 3.03 A (4), vacuum clean all  
34 surfaces after they have dried, with a HEPA filtered vacuum until no visible

1 residue remains.

2 B. Standard of Cleaning for Final Clearance:

3 1. Consider work areas and all other decontaminated and cleaned areas clean  
4 when;

5 a. Visual Inspection - The Contractor shall perform a complete visual  
6 inspection of the entire Work Area including: all surfaces, ceilings,  
7 walls, floors, decontamination unit, all plastic sheeting, seals over  
8 ventilation openings, doorways, windows, and other openings; look  
9 for debris from any sources, residue on surfaces, dust, or other  
10 matter. If any debris, residue, dust, or other matter is found, repeat  
11 final cleaning and continue decontamination procedure from that  
12 point. When the Work Area is visually clean, and no debris, residue,  
13 dust, or other material is found, complete the certification found at  
14 the end of this Section. The visual inspection is not complete until  
15 confirmed in writing, on the statement by the Consultant.

16 b. When a thorough visual inspection by the Contractor indicates that  
17 each area is clean and ready for clearance sampling, wipe samples  
18 will be collected from representative surfaces (if present). Samples  
19 will be collected no sooner than one hour after the completion of  
20 cleaning. A minimum of one wipe sample will be collected from each  
21 surface type within the abatement area. Decontamination of each  
22 work area is complete when the lead concentration for each sample  
23 collected within the work area is below the following levels:

Component	Clearance Level
Sills or other Elevated Horizontal Surfaces	250 ug/ft <sup>2</sup>
Troughs, concrete, or other rough surfaces	400 ug/ft <sup>2</sup>

28 Wipe testing will be performed in general accordance with the HUD  
29 Guidelines for the Evaluation and Control of Lead Based Paint

30 c. Substantial Completion of Abatement Work - Lead abatement work  
31 is substantially complete upon meeting the requirements of this  
32 Section including submission of:

- 33 1. Certificate of Visual Inspection.  
34 2. Receipts and manifests documenting proper disposal as  
35 required by Part 3.04.  
36 3. Punch list detailing repairs to be made and incomplete items.

1  
2       d. Certificate of Visual Inspection - Following this section is a  
3           "Certificate of Visual Inspection". This certificate is to be completed  
4           by the Contractor and confirmed by the Consultant. Submit the  
5           completed certificate as a part of submittals following completion of  
6           the work.  
7

8       **3.04 DISPOSAL OF CONTAMINATED WASTE**  
9

10      A. Contractor shall be responsible for the testing and disposal of lead-based paint  
11           abatement waste and debris as hazardous waste/materials. Contractor shall  
12           appropriately test if the waste exhibits the characteristic of ignitability, corrosivity,  
13           reactivity, or toxicity as defined in 40 CFR Sections 261.20 to 261.24, per, as a  
14           minimum, EPA Method SW.846/1311, or equivalent.  
15

16      B. If hazardous, remove labeled containers of hazardous waste and transport to  
17           proper treatment, storage, and disposal facility (TSD) as follows:  
18

19        1. Seal hazardous waste in leak-proof impermeable containers labeled in  
20           accordance with Title 49, Code of Federal Regulations, Sections 171 - 180.  
21           Contractor may recycle uncontaminated impermeable containers.  
22

23        2. Use only enclosed or covered trucks or dumpsters to haul impermeable  
24           containers to prevent loss or damage to containers enroute to TSD facility.  
25

26        3. Ensure that there are no volatile or visible emissions to the outside air from  
27           site where materials and waste are deposited as a result of materials from  
28           this project.  
29

30        4. Submit hazardous waste manifest to the Consultant after completion of the  
31           Work in accordance with Part 1 of this section.  
32

33        5. Final Completion shall not be satisfied until receipt of hazardous waste  
34           manifest by Consultant after completion of transportation of hazardous  
35           waste.  
36

37      C. Solid waste which has been evaluated and determined not to be hazardous can be  
38           disposed of in a state-approved landfill which accepts construction debris as  
39           follows:  
40

41        1. Use only enclosed or covered trucks or dumpsters to haul impermeable  
42           containers to prevent loss or damage to containers enroute to landfill.  
43

44        2. Ensure that there are no volatile or visible emissions to the outside air from  
45           site where materials and waste are deposited as a result of materials from  
46           this project.

1  
2   3.05 FIELD QUALITY CONTROL  
3

- 4   A. A testing laboratory will be provided by the Owner at no cost to the Contractor,  
5   except as outlined in other sections of the Contract Documents, to periodically  
6   observe the removal process and perform area air monitoring.  
7
- 8   B. Testing laboratory may conduct air monitoring prior to and throughout removal and  
9   cleaning operations.  
10
- 11   C. The Consultant's testing laboratory will perform the Owner's testing and confirm  
12   the final visual inspection by the Contractor. Such testing and confirmation for the  
13   Owner does not relieve the Contractor of providing necessary tests required by  
14   other regulations, codes, and standards for the protection of his workers, or for any  
15   other purposes.  
16
- 17   D. Consultant's air tests will be made both inside the work areas and outside the work  
18   areas and test results will be made available to the Contractor. The Contractor is  
19   cautioned, however, that should interpretations be made, opinions be formed, and  
20   conclusions be drawn as a result of examining the test results, those  
21   interpretations, opinions, and conclusions will be those made, formed, and drawn  
22   solely by the Contractor. The Contractor will be responsible for performing air  
23   tests required for his evaluation of the safety of his employees.  
24
- 25   E. A preliminary visual observation will be performed in the work area by the  
26   Consultant following notification by the Contractor that said areas have been  
27   properly cleaned. Areas will be observed for the presence of visible dust, dirt, and  
28   debris.  
29
- 30   F. Wipe tests shall be performed in each work area after final clean-up.  
31
- 32   G. After final clean-up of an area is completed, the work area shall satisfactorily pass  
33   the final visual inspection criteria specified in Section 3.03.B.  
34
- 35   H. A final visual observation will be performed by the Contractor, Consultant and  
36   Owner (or his representative, as needed) after final clean-up to inspect visible  
37   dust, dirt, debris, and areas of damage.  
38
- 39   I. Contractor shall perform additional cleaning of area if, in the opinion of the  
40   Consultant based upon the final visual observation, previous clean-up operations  
41   were determined to be inadequate. All costs for recleaning required due to failure  
42   to meet the specified level of cleanliness shall borne by the Contractor.  
43
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END OF SECTION 02083

LEAD-BASED PAINT ABATEMENT  
02083-19

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2 WORK AREA: \_\_\_\_\_  
3  
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5

6 CONTRACTOR'S CERTIFICATION OF VISUAL INSPECTION  
7

8 In accordance with Section 13285, Part 3.03 (B), the Contractor hereby certifies that he  
9 has visually inspected the Work Area (all surfaces including pipes, beams, ledges, walls,  
10 ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris  
11 or residue.  
12  
13

14 by: (Signature) \_\_\_\_\_ Date \_\_\_\_\_  
15  
16 (Print Name) \_\_\_\_\_ (Print Title) \_\_\_\_\_  
17  
18

19 CONSULTANT'S STATEMENT OF VISUAL INSPECTION  
20

21 The Consultant hereby confirms that he has accompanied the Contractor on his visual  
22 inspection and verifies that this inspection has been thorough. To the best of his  
23 knowledge and belief, the Work Area has been cleaned in substantial conformance with  
24 the contract documents.  
25  
26

27 by: (Signature) \_\_\_\_\_ Date \_\_\_\_\_  
28  
29 (Print Name) \_\_\_\_\_ (Print  
30 Title) \_\_\_\_\_  
31  
32

33 WORK AREA CLEARANCE  
34  
35

36 The Consultant hereby confirms that all wipe samples collected and analyzed in  
37 accordance with Section 13285 are equal to or below the specified clearance level.  
38  
39

40 by: (Signature) \_\_\_\_\_ Date \_\_\_\_\_  
41  
42 (Print Name) \_\_\_\_\_ (Print  
43 Title) \_\_\_\_\_  
44

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## SECTION 02085

### OTHER HAZARDOUS MATERIALS REMOVAL AND DISPOSAL

#### PART 1 - GENERAL

##### 1.01 TRANSFORMERS AND BATTERIES

- A. Prior to initiating demolition activities, the Contractor shall remove and properly disposed of the electrical transformer and the two (2) acid batteries associated with the generator in the vicinity of the irrigation tank/chlorine feed system room in accordance with Federal, state, and local regulations. The acid batteries shall be recycled or sent to an EPA-certified waste disposal facility.

#### PART 2 – PRODUCTS (Not Used)

#### PART 3 – EXECUTION (Not Used)

END OF SECTION

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1 SECTION 02100  
2  
3 SITE PREPARATION  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. This Section covers clearing, grubbing, stripping, proof-rolling, and  
10      undercutting.
- 11      B. The Contractor shall clear and grub all of the area within the limits of  
12      construction, or as required, which includes, but is not limited to, utility  
13      easements. The width of the area to be cleared shall be reviewed by the  
14      Engineer prior to the beginning of any clearing.
- 15      C. Embankment and structure areas shall be proof-rolled. Proof-rolling must be  
16      observed on a full time basis by the Engineer or Owner's Representative.  
17      Undercutting of unsatisfactory materials will be as recommended by the  
18      Engineer or Owner's Representative.
- 19      D. Undercutting unsatisfactory soils will likely extend below the prevailing water  
20      table. Temporary construction dewatering may be required.
- 21      E. The Contractor's attention is directed to any and all applicable Local, State or  
22      Federal Soil Erosion and Sedimentation Control and water discharge  
23      ordinances. The Contractor shall comply with all applicable sections of these  
24      ordinances and obtain all required permits.

25 1.02 QUALITY ASSURANCE  
26

- 27       A. The Owner will select and pay for a qualified geotechnical engineering and  
28      testing laboratory (Testing Laboratory) to monitor all aspects of this section.  
29      Scheduling shall be performed by the Engineer.

30 PART 2 – PRODUCTS  
31           (Not Used)  
32

33 PART 3 – EXECUTION  
34

35 3.01 CLEARING  
36

- 37       A. The area to be cleared shall be completely cleared of all timber, brush, stumps,  
38      roots, grass, weeds, rubbish, asphalt, base material, piping, pond inlets and all  
39      other objectionable obstructions resting on or protruding through the surface of  
40      the ground. However, trees designated by the Engineer will be preserved as  
41      hereinafter specified. Clearing operations shall be conducted so as to prevent

1 damage to existing structures and installations.  
2

3 3.02 GRUBBING  
4

- 5 A. Grubbing shall consist of the complete removal of all stumps, roots, matted  
6 roots, brush, timber, logs, and any other organic or metallic debris not suitable  
7 for support purposes, resting on, under or protruding through the surface of the  
8 ground to a depth of 18 inches below the subgrade unless otherwise noted on  
9 the Drawings.

10 3.03 STRIPPING AND STOCKPILING  
11

- 12 A. The entire site shall be stripped and cleared of all surface vegetation, root-laden  
13 topsoil, and pond or wetland muck. Stripping about of unsuitable materials  
14 should be anticipated in non-pond areas. Removal of pond or wetland muck is  
15 not expected on this project.  
16
- 17 B. In areas so designated, and impacted wetlands, topsoil and pond muck shall be  
18 stockpiled for replacement as topsoil in the affected areas to promote vegetation  
19 growth. Topsoil and pond muck, so stockpiled, shall be protected until the  
20 material is placed as specified. The Contractor shall dispose at their own  
21 expense of any of these materials remaining after all work is in place.  
22

23 3.04 STOCKPILING  
24

- 25 A. Material identified by the Engineer as satisfactory structural fill shall be  
26 stockpiled in an area approved by the Engineer. This stockpile shall be  
27 protected until the material is placed as specified. The Contractor shall dispose  
28 of any of these materials remaining after all work is in place.  
29
- 30 B. Siltation and erosion control measures shall be in place in all stockpile areas to  
31 prevent turbid runoff and remain in compliance with the environmental permits  
32 and applicable regulations.  
33

34 3.05 DISPOSAL OF CLEARED AND GRUBBED MATERIAL  
35

- 36 A. The Contractor shall dispose of all material and debris from the clearing and  
37 grubbing operation by hauling such material and debris off-site.  
38

39 41 END OF SECTION

1 SECTION 02125  
2

3 SILT BARRIERS  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The work included under this section consists of furnishing all necessary labor,  
10      equipment, tools and materials, and in performing all operations in connection  
11      with the installation of a staked silt barrier, of cloth or straw bales, or a floating silt  
12      barrier for the protection of open water, wetland systems or areas intended to  
13      remain undisturbed by adjoining work.  
14
- 15       B. This work shall be performed in strict accordance with the requirements of all  
16      applicable sections of these specifications and in conformity with lines, grades,  
17      notes and typical sections as shown on the drawings, as directed by the Engineer  
18      or as directed by representatives of governmental agencies having permitting  
19      jurisdiction over areas to be protected.

21 PART 2 – PRODUCTS  
22

23 2.01 STAKED FABRIC SILT BARRIER  
24

- 25       A. The sediment control fabric is to be woven polypropylene meeting the following  
26      standards:

Mullen Burst Test	(ASTM D-3786)	200 psi (min.)
Grab Elongation	(ASTM D-1682)	30% (max.)
Slurry Flow Rate	(VTM-51)	0.3 gpm/sf (min.)
Retention Efficiency	(VTM-51)	75% (min.)

- 33       B. The fabric shall be provided in widths adequate to provide a barrier of a minimum  
34      of 24 inches in height and allow for 8 inches of fabric to be buried for restraint.

36 PART 3 – EXECUTION  
37

38 3.01 STAKED CLOTH SILT BARRIER  
39

- 40       A. The sediment control fabric shall be attached per the manufacturer's  
41      recommendations to the uphill or sediment producing side of the stakes. The  
42      stakes shall be spaced at 6 to 10 foot intervals. A 4" to 6" trench shall be dug  
43      along the fence line and backfilled with the bottom 10 inches of control fabric in  
44      place.

- 46       B. The ends of each unit of fence shall be connected to adjoining fence sections  
47      with a connector provided by the manufacturer or by intertwining the two end

posts to overlap the fabric sufficiently to prevent sediment from escaping, as shown in the Drawings.

### 3.02 STAKED STRAW/SYNTHETIC BALES

- A. Securely bound straw/synthetic bales may be used as a sediment barrier. The bales shall be securely bound with two strands of rope or wire. The bales shall be positioned in a 4 inch trench along the plan alignment and each bale is to be secured by driving two 1"x 2" stakes or #5 rebar through the bale and 6" min. into the ground. The tops of the stakes shall then be secured by a continuous wire tie.
  - B. Deteriorated bales shall be replaced as directed by the Engineer.

- B. Deteriorated bales shall be replaced as directed by the Engineer.

### **3.03 REMOVAL**

- A. Upon obtaining Substantial Completion, the Contractor shall be responsible for the complete removal of all silt barriers unless so directed by the Engineer. Following removal, all materials shall become the property of the Contractor.

END OF SECTION

1 SECTION 02140  
2

3 TEMPORARY DEWATERING  
4

5 PART 1 - GENERAL  
6

7 1.01 DESCRIPTION  
8

- 9       A. The Work to be performed includes the furnishing of all equipment, materials  
10      and labor necessary to remove surface or subsurface waters from excavation  
11      areas in accordance with the requirements set forth and as shown on the  
12      Drawings or as specified.  
13
- 14       B. Unless specifically authorized by the Engineer, all pipe and structures shall be  
15      laid "in the dry".  
16

17 1.02 QUALITY ASSURANCE  
18

- 19       A. The dewatering of any excavation areas and the disposal of the water  
20      produced shall be in strict accordance with the latest revision of all Laws and  
21      Regulations; with the local, State and Federal permits for the project; and, with  
22      the Contractor's approved Storm Water Pollution Prevention Plan (SWPPP).  
23
- 24       B. The Contractor shall comply with the FDEP Generic Permit for the Disposal of  
25      Non-contaminated Produced Groundwater per Chapter 62-621.300 F.A.C.  
26

27 PART 2 - PRODUCTS (Not Applicable)  
28

29 PART 3 - EXECUTION  
30

31 3.01 TEMPORARY DEWATERING  
32

- 33       A. Prior to commencing work, the Contractor shall submit to the Engineer for  
34      approval the Contractor's plans for dewatering. The dewatering system shall  
35      be in conformity with the overall construction plan.  
36
- 37       B. The Contractor shall provide adequate equipment for the removal of surface or  
38      subsurface waters that may accumulate in the excavation. Flotation and  
39      migration of fines shall be prevented by the Contractor by maintaining a  
40      positive and continuous operation of the dewatering system. The Contractor  
41      shall be fully responsible and liable for all damages that may result from the  
42      operation and/or failure of this system.  
43
- 44       C. If subsurface water is encountered, the Contractor shall utilize suitable  
45      equipment to adequately dewater the excavation so that it will be dry to a  
46      depth of 12-inches below the pipeline subgrade compaction level or over-  
47      excavation level, whichever is lower, but not more than 5-feet, to facilitate

TEMPORARY DEWATERING

02140-1

03/22/2019

1 effective subgrade compaction and to provide for a stable trench bottom. For  
2 concrete structures, the dewatering system shall maintain the water at such a  
3 level at least 2 feet below the subgrade of the structure. A wellpoint system,  
4 trench drain, sump pump operation, or other dewatering method shall be  
5 selected, designed and utilized by the Contractor to maintain the excavation in  
6 a dry condition for preparation of the trench bottom and thereafter until the fills,  
7 structures or pipes to be built thereon have been completed to such extent that  
8 they will not be floated or otherwise damaged by allowing water levels to  
9 return to natural levels. No water shall be allowed to contact masonry or  
10 concrete within 24 hours after being placed.

- 11
- 12 D. Dewatering shall at all times be conducted in such a manner as to preserve  
13 the undisturbed bearing capacity of the subgrade soils at proposed bottom of  
14 excavation and to preserve the integrity of adjacent structures and utilities.  
15 Well or sump installations shall be constructed and operated continuously with  
16 proper sand filters to prevent drawing of finer grained soil from the surrounding  
17 ground. Dewatering by trench pumping shall not be permitted if migration of  
18 fine grained natural material from bottom, side walls, or bedding material may  
19 occur.
- 20
- 21 E. In the event that satisfactory dewatering cannot be accomplished due to  
22 subsurface conditions, or where dewatering could damage existing structures,  
23 the Contractor shall obtain the Engineer's approval of wet trench construction  
24 or procedure before commencing construction.
- 25
- 26 F. Engine-driven dewatering pumps shall be equipped with residential type  
27 mufflers. Where practical and feasible, electrical "power drops" and electric  
28 motor-driven equipment shall be used in lieu of portable generators.
- 29
- 30 G. The Contractor shall take all additional precautions to prevent uplift of any  
31 structure during construction.
- 32
- 33 H. The Contractor shall take all precautions to preclude the accidental discharge  
34 of fuel, oil, etc. to prevent adverse effects on groundwater quality. All costs  
35 associated with any such adverse effects shall be borne by the Contractor.
- 36
- 37 I. The Contractor shall, at no expense to the Owner, be required to excavate  
38 below grade and refill with approved fill material if the Engineer determines  
39 that adequate drainage has not been provided.

40

### 41 3.02 DISPOSAL

42

- 43 A. All product water from dewatering shall be pumped from the trench or other  
44 excavation and shall be disposed of in strict accordance with the Permits. The  
45 Contractor will be allowed to discharge product water from dewatering offsite  
46 into storm sewers, or ditches having adequate capacity, canals or suitable  
47 disposal pits, or other surface waters in accordance with the Contractor's

1                   Storm Water Pollution Prevention Plan, provided that the water has been  
2                   sampled and tested by the Contractor, is in compliance with the concentration  
3                   limits specified in 62-621.300(2) FAC, the Contractor has obtained a Generic  
4                   Permit for the Production of Groundwater, and the Contractor has obtained the  
5                   permission of the Owner of the recipient storm water system. The frequency  
6                   of water sampling and testing shall be determined by the Engineer based on  
7                   existing conditions and field observations.

- 8
- 9                   B. Prior to discharging produced groundwater from any construction site, the  
10                  Contractor shall collect samples and analyze the groundwater, which must  
11                  meet acceptable discharge limits per 62-621.300(2) FAC.
- 12
- 13                  C. Permission to use any storm sewers, or drains, for water disposal purposes  
14                  shall be obtained from the authority having jurisdiction. Any requirements and  
15                  costs for such use shall be the responsibility of the Contractor. However, the  
16                  Contractor shall not cause flooding by overloading or blocking up the flow in  
17                  the drainage facilities, and shall leave the facilities unrestricted and as clean  
18                  as originally found. Any damage to existing facilities shall be repaired or  
19                  restored as directed by the Engineer or the authority having jurisdiction, at no  
20                  cost to the Owner.
- 21
- 22                  D. Contractor shall be responsible for acquiring and complying with all permits  
23                  required to discharge the product water from dewatering and shall protect  
24                  waterways from turbidity during the operation.
- 25
- 26                  E. In areas where adequate disposal sites are not available, partially backfilled  
27                  trenches may be used for water disposal only when the Contractor's plan for  
28                  trench disposal is approved in writing by the Engineer. The Contractor's plan  
29                  shall include temporary culverts, barricades and other protective measures to  
30                  prevent damage to property or injury to any person or persons.
- 31
- 32                  F. Contractor shall not dam, divert, or cause water to flow in excess in existing  
33                  gutters, pavements or other structures. To do this he will be required to  
34                  conduct the water to a suitable place of discharge determined by the Engineer.
- 35
- 36                  G. No flooding of streets, roadways, driveways or private property will be allowed.
- 37

38                  3.03           EQUIPMENT REMOVAL

39

- 40                  A. Removal of dewatering equipment shall be accomplished after the system is  
41                  no longer required. All materials and equipment constituting the system shall  
42                  be removed by the Contractor.
- 43
- 44                  B. All sock drains shall be filled with grout when no longer needed, and  
45                  abandoned in place.
- 46

47                   END OF SECTION

48

TEMPORARY DEWATERING

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TEMPORARY DEWATERING  
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1 SECTION 02220  
2

3 EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The Contractor shall furnish all labor, materials, equipment, and incidentals  
10      necessary to perform all excavation, backfill, and grading for structures  
11      required to complete the work shown on the Drawings and specified herein.  
12      The work shall include, but not necessarily be limited to, excavation for  
13      structures, footings, all backfilling and fill; embankment grading for structures;  
14      disposal of waste and surplus materials; and all related work such as sheeting,  
15      bracing and dewatering.
- 16       B. Structures and structural elements shall be installed at such places as  
17      indicated by the drawings at the elevations shown or as directed by the  
18      Engineer.
- 19       C. Excess topsoil and fill generated during construction of the project shall be  
20      stockpiled on site for the Contractor's use. All unused excess fill shall be  
21      salvaged/disposed of by the Contractor at no expense to the Owner.
- 22       D. During the process of grading, the subgrade shall be maintained in such  
23      condition that it will be well drained at all times. Temporary drains and  
24      drainage ditched shall be installed by the Contractor as required to intercept or  
25      divert surface water at no additional cost to the Owner.
- 26       E. If, during the excavation sequence, any earth material that could be used as fill  
27      is encountered that cannot be directly placed, it shall be stockpiled for later  
28      use. No extra payment will be made for stockpiling or double handling of  
29      material.
- 30       F. No grading is to be done in areas where there are existing utilities that may be  
31      uncovered or damaged until such utilities have been located. Prior to  
32      relocating lines, all service must be stopped, including closing required valves,  
33      electrical circuits, etc. Pipeline to be abandoned must be plugged and sealed  
34      according to these drawings and specifications.

35       1.02 QUALITY ASSURANCE AND PAYMENT  
36

- 37       A. Soil Testing  
38

- 39           1. Prior to the general placement of fill, and during such placement, the  
40            Engineer may select areas within the limits of the fill for testing the  
41

degree of compaction obtained. The Contractor shall cooperate fully in obtaining the information desired.

2. Payment for testing shall be made by the Contractor.

B. Reference Standards (American Society For Testing and Materials (ASTM, latest edition):

1. ASTM C136 – Sieve or Screen Analysis of Fine and Course Aggregates.
  2. ASTM D1556 (1974) – Density of Soil in Place by the Sand-Cone Method.
  3. ASTM D1557 – Moisture-Density Relations of Soils using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.
  4. ASTM D422 – Particle Size Analysis for Soils.
  5. ASTM D2216 – Laboratory Determination of Water Content of Soil & Rock.
  6. ASTM D2487 – Classification of Soils for Engineering Purposes.
  7. ASTM D2937 – Density of Soil in Place by the Drive-Cylinder Method.
  8. ASTM D2972 – Density of Soil in Place by the Nuclear Method.
  9. ASTM D4643 – Determination of Water Content of Soil & Rock by the Microwave Oven Method
  10. ASTM D4959 – Determination of Water Content of Soil by Direct Heating Method

## 1.03 SUBMITTALS

A. Testing laboratory reports that material for controlled fill meets requirements of this Section.

## 1.04 JOB CONDITIONS

#### A. Lateral Support of Excavation for Structures

Furnish, put in place, and maintain sheeting and bracing required to support the sides of the excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect structures, pipe and utilities from damage due to

1 lateral movement or settlement of ground. If the Engineer is of the opinion that  
2 at any point sufficient or proper supports have not been provided, he may  
3 order additional supports put in at the expense of the Contractor, and  
4 compliance with such order shall not relieve or release the Contractor from his  
5 responsibility for the sufficiency of such supports.

6

7     B. Dewatering for Structures

8

9     Furnish, install, maintain, operate, and remove a temporary dewatering  
10 system, as required to lower and control the groundwater level, so that the  
11 structures may be constructed in the dry. The Contractor shall, at his own  
12 expense, correct all damage resulting from inadequacy of the dewatering  
13 system or from flooding or the construction site from other causes.

14

15     C. Dewatering System

16

- 17       1. The dewatering system shall be adequate to drain any excavated area,  
18           to maintain the water at such a level at least 2 feet below the lowest  
19           subgrade within the structure, including utilities. The dewatering  
20           system must maintain the lowered water table 24 hours per day, 7 days  
21           per week until the structure has been completed to the required stages.
- 22       2. Continuously maintain excavation in a dry condition so as to prevent  
23           damage to the subsoil or fill during interruptions due to weather, labor  
24           strikes, power failures or other delays. Provide and have ready for  
25           immediate use at all times diesel or gasoline powered standby pumping  
26           units to serve the system in case of failure of the normal pumping units.
- 27       3. Piping and boiling, or any form of uncontrolled seepage, in the bottom  
28           or sides of the excavation shall be prevented at all times. If for any  
29           reason the dewatering system is found to be inadequate to meet the  
30           requirements set forth herein, the Contractor shall, at his own expense,  
31           make such additions, changes and/or replacements as necessary to  
32           provide a satisfactory dewatering system.
- 33       4. If applicable, the Contractor shall be responsible for creating and  
34           implementing a dewatering plan that shall be submitted to the Engineer  
35           as specified in the Environmental Resource Permit, if any. The plan  
36           shall be approved prior to initiating any construction activities.

37

38     D. Control of Groundwater Level

39

- 40
- 41       1. Maintain the groundwater level at or below subgrade of the structure  
42           until the concrete structures are up high enough to: (1) prevent flooding  
43           the structure, (2) support both bottom and top levels of walls, and (3)  
44           prevent flotation.

- 1           2. After the structure has been completed in its entirety, backfill as  
2           described hereinafter.
- 3
- 4           3. Flotation shall be prevented by maintaining a positive and continuous  
5           operation of the dewatering system. The Contractor shall be fully  
6           responsible and liable for all damages, which may result from failure of  
7           this system.
- 8
- 9           4. Disposal of drainage water shall be in an area approved by the  
10          Engineer. Precautions shall be taken to prevent the flow or seepage of  
11          drainage back into the drainage area. Particular care shall be taken to  
12          prevent the discharge of unsuitable drainage to a water supply or  
13          surface water body.
- 14
- 15          5. Removal of the dewatering system shall be accomplished after the  
16          dewatering system is no longer required.

17

## PART 2 - PRODUCTS

18

### 2.01 MATERIAL FOR CONTROLLED FILL

19

#### A. General

- 20
- 21
- 22
- 23
- 24          1. Materials for use as fill shall be as described below:
- 25
- 26          2. For each material, the Contractor shall notify the Owner's designated  
27          representative of the source of the material at least ten (10) calendar  
28          days prior to the date of anticipated use of such material, so that  
29          necessary laboratory classification testing can be performed.
- 30
- 31          3. Structural fill shall be used to provide support for building foundations,  
32          structure foundations and the reject pond embankments. Common fill  
33          shall be used to as backfill over pipes.
- 34
- 35          4. All structural fill and crushed stone shall be wrapped in filter fabric.

36

#### B. Structural Fill

- 37
- 38
- 39          1. Compacted granular fill, which will provide support for building or  
40          structure foundations, will be referred to as "structural fill." Backfill,  
41          which is placed against the exterior side of the building walls or  
42          structures, or as fill over pipelines, will be referred to as "common fill."
- 43
- 44          2. Materials for compacted structural granular fill shall be gravel, sandy  
45          gravel, or gravelly sand free of organic material, loam, wood, trash, wire  
46          and other objectionable material and shall be well-graded within the  
47          following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
6-in.	100
No. 4	20 - 95
No. 40	0 - 60
No. 200	0 - 8

9           C. Common Fill

- 11          1. Common fill shall consist of mineral soil, free of organic material, loam,  
 12           wood, trash and other objectionable material which may be  
 13           compressible or which cannot be compacted properly. Common fill  
 14           shall not contain stones larger than 10-in. in any dimension, broken  
 15           concrete, masonry, rubble or other such materials. It shall have physical  
 16           properties such that it can be readily spread and compacted during  
 17           filling.
- 19          2. Material falling within the above Specification, encountered during the  
 20           excavation, may be stored in segregated stockpiles for reuse. All  
 21           material which, in the opinion of the Engineer is not suitable for reuse,  
 22           shall be spoiled as specified herein for disposal of unsuitable materials.

24           D. Crushed Stone

- 26          1. Crushed stone shall be used for structure bases where indicated on the  
 27           drawings or directed by the Engineer. Crushed stone shall be used for  
 28           manhole bases, as a drainage layer below structures with underdrains  
 29           and at other locations indicated on the Drawings.
- 31          2. Crushed stone shall be size No. 57 with gradation as noted in Table 1  
 32           of Section 901 of Department of Transportation, Construction of Roads  
 33           and Bridges.

35        2.02 UNSUITABLE MATERIAL

- 37          A. Unsuitable material will be designated as highly organic soil ASTM D 2487  
 38           Group PT, topsoil, roots, vegetable matter, trash and debris. All unsuitable  
 39           material shall be removed in its entirety as to provide adequate bearing  
 40           capacity for proposed structures, buildings, manholes, pipelines, etc.

42        PART 3 - EXECUTION

44        3.01 STRUCTURE EXCAVATION AND COMPACTION PROCEDURES - GENERAL

- 46          A. Excavation shall be made to such widths as will give suitable room for  
 47           construction of the structures, for bracing and supporting, pumping and

EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

1 drainage; and the bottom of the excavations shall be rendered firm and dry  
2 and in all respects acceptable to the Engineer.  
3

- 4
- 5 B. Excavation and dewatering shall be accomplished by methods which preserve  
6 the undisturbed state of subgrade soils. Subgrade soil which becomes soft,  
7 loose, "quick," or otherwise unsatisfactory for support of structures as a result  
8 of inadequate excavation, dewatering or other construction methods shall be  
9 removed and replaced by structural fill as required by the Engineer at the  
Contractor's expense.
- 10
- 11 C. Dewatering shall be such as to prevent boiling or detrimental under-seepage  
12 at the base of the excavation as specified herein. The Contractor shall install  
13 such means as required to preserve the stability of the base of the operation.
- 14
- 15 D. Excavating equipment shall be satisfactory for carrying out the work in  
16 accordance with the Specifications. In no case shall the earth be ploughed,  
17 scraped or dug with machinery so near to the finished subgrade as to result in  
18 excavation of, or disturbance of material below grade, the last of the  
19 excavated material being removed with pick and shovel just before placing of  
20 concrete or working mat thereon.
- 21
- 22 E. During final excavation to subgrade level, take whatever precautions are  
23 required to prevent disturbance and remolding of the subgrade. Material  
24 which has become softened and mixed with water shall be removed. Hand  
25 excavation of the final 3 to 6-in. will be required as necessary to obtain a  
26 satisfactory undisturbed bottom. The Engineer will be the sole judge as to  
27 whether the work has been accomplished satisfactorily.
- 28
- 29 F. All structure areas shall be stripped, cleared and grubbed of all surface  
30 vegetation and root laden top soils.
- 31
- 32 G. After stripping, the structure areas should be leveled sufficiently to permit  
33 equipment traffic and then proof-rolled. Careful observations should be made  
34 during proof rolling of the stripped subgrade area to identify any areas of soft  
35 yielding soils that may require over excavation and replacement.
- 36
- 37 H. Compaction should continue until a minimum density of 95% of the maximum  
38 modified Proctor dry density, as established in accordance with ASTM D-1557,  
39 is achieved for a minimum depth of 2 feet below the subgrade surface.
- 40

41 3.02 BACKFILLING AND COMPACTION

- 42
- 43 A. Following satisfactory proof-rolling of the stripped subgrade, the structure  
44 areas may be brought up to finished subgrade level. Structural fill shall be  
45 placed in loose lifts not exceeding 12-inches and should be compacted to a  
46 minimum of 95% of the maximum modified Proctor dry density, as established

1           in accordance with ASTM D-1557. Density tests should be performed in each  
2           fill lift to confirm compaction before the next lift is placed.  
3

- 4           B. Common fill may be used as backfill against the exterior walls of the  
5           structures, including manholes and storm structures, or in other areas as  
6           designated by the Engineer. Common fill shall be placed in loose lifts not  
7           exceeding 12-inches and should be compacted to a minimum of 95% of the  
8           maximum modified Proctor dry density, as established in accordance with  
9           ASTM D-1557. Density tests should be performed in each fill lift to confirm  
10          compaction before the next lift is placed. Common fill material in place shall be  
11          compacted with such mechanical compaction equipment as approved by the  
12          Engineer.
- 13
- 14          C. Materials placed in fill areas shall be deposited to the lines and grades shown  
15          on the Drawings making due allowance for settlement of the material and for  
16          the placing of topsoil thereon.
- 17
- 18          D. The surfaces of filled areas shall be grades to smooth true lines, strictly  
19          conforming to grades indicated on the paving and grading Drawings, and no  
20          soft spots or uncompacted areas will be allowed in the work.
- 21
- 22          E. No compacting shall be done when the material is too wet either from rain or  
23          from excess application of water. At such times, work shall be suspended until  
24          the previously placed and new materials have dried sufficiently to permit  
25          proper compaction.

26

#### 27        3.04 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

28

- 29          A. Unsuitable excavated materials and pavement shall become the property of  
30          the Contractor and removed and disposed of by him off the project site.
- 31
- 32          B. Suitable excavated material may be used for fill or backfill if it meets the  
33          Specifications for common fill and is approved by the Engineer. Excavated  
34          materials so approved may be neatly stockpiled at the site, where there is an  
35          area available that will not interfere with the operation of the plant or  
36          inconvenience traffic or adjoining property owners. If space limitations do not  
37          permit stockpiling on the site, the Contractor will be required to make  
38          arrangements for off-site stockpiling. Transport of such material from and to  
39          the immediate site, including any stockpiling agreements, shall be entirely at  
40          the Contractor's expense and shall not constitute grounds for additional  
41          payment.
- 42
- 43          C. Surplus excavated material shall be used to fill depressions or other purposes  
44          as the Engineer may direct. All suitable surplus excavated material shall  
45          remain property of the Owner and the Contractor shall stockpile excess  
46          suitable excavated material where directed by the Engineer. All unsuitable

excavated material shall become the property of the Contractor and shall be removed and disposed of by him off the project site.

### 3.05 GRADING

- A. Grading in preparation for placing of topsoil, planting areas, paved walks and drives, and appurtenances shall be performed at all places that are indicated on the Drawings, to the lines, grades, and elevations shown and otherwise as directed by the Engineer. Such work shall be performed in a manner that the requirements for formation of slopes, lines, and grades can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the progress or condition of the work.
  - B. If, at the time of grading, it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
  - C. The right is reserved to make minor adjustments or revisions in lines or grades, if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.
  - D. Stones or rock fragments larger than 4-in. in their greatest dimensions will not be permitted in the top 6-in. of the finished subgrade of all fills or embankments.
  - E. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Engineer.
  - F. No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines have been located and it has been determined if such lines must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and remaining pipes are plugged.

FND OF SECTION

1 SECTION 02221  
2

3 EXCAVATION AND BACKFILL FOR PIPES  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. This section includes, except as elsewhere provided, all excavation for pipelines  
10 and appurtenances including drainage, filling, backfilling, grading, disposal of  
11 surplus material and restoration of trench surfaces.  
12
- 13 B. Excavation shall provide suitable room for installing pipe, structures and  
14 appurtenances. Pavement shall be cut with saws or pneumatic chisels along  
15 straight lines before excavating.  
16
- 17 C. The Contractor shall furnish and place all sheeting, bracing and supports, and  
18 shall remove from the excavation all materials that the Engineer may deem  
19 unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in  
20 all respects, acceptable. The length of open trench shall be related closely to  
21 the rate of pipe laying.  
22

23 1.02 SUBMITTALS  
24

- 25 A. All submittals shall be presented to the Engineer for review in accordance with  
26 the General Conditions.  
27
- 28 B. Testing laboratory reports that material for controlled fill meets requirements of  
29 this Section.  
30

31 1.03 CLEAN-UP  
32

- 33 A. Clean-up is an essential part of the work. As the work progresses and is  
34 completed, the Contractor shall clean the various sites of all operations and  
35 completely restore all work areas to the satisfaction of the Engineer and the  
36 Owner. This clean-up shall be done as promptly as practical and shall not be  
37 left until the end of the construction period. No part of the work shall be  
38 considered complete, and no payment will be made, until clean-up is completed.  
39
- 40 B. It is the Contractor's responsibility to assure that all construction sites and all  
41 other affected properties are restored to a condition equal to, or better than, the  
42 existing conditions prior to construction. All restoration is subject to the approval  
43 of the Engineer and/or Owner.  
44

45 1.04 DUST CONTROL  
46

- 1           A. It is the responsibility of the Contractor to control all dust problems that may  
2           occur during the construction with required watering. Dust control will be  
3           required seven days a week.

4

5       **1.05 EROSION CONTROL**

6

- 7           A. It is the Contractor's responsibility to erect suitable silt fences, hay bales or other  
8           erosion runoff control devices prior to commencement of earth moving or  
9           excavation activities. The Contractor shall be responsible for maintaining the silt  
10          fences, hay bales or other erosion runoff control devices in an effective manner,  
11          repairing or replacing damaged or ineffective section during the course of the  
12          work until a ground cover of grass is established and final environmental  
13          approval has been obtained.

14

15       **1.06 PERMITS FOR DEWATERING OPERATIONS**

16

- 17           A. The Contractor is responsible for obtaining all permits required for dewatering  
18          discharges, including a Florida Department of Environmental Protection Generic  
19          Permit for Produced Groundwater per F.A.C 62-621.300 and as specified in  
20          Section 02140.

21

22       **PART 2 - PRODUCTS**

23

24       **2.01 MATERIALS**

25

26           A. General

- 27
- 28           1. Materials for use as fill shall be described below. For each material, the  
29           Contractor shall notify the Testing Lab of the source of the material at  
30           least ten (10) calendar days prior to the date of anticipated use of such  
31           material.
- 32
- 33           2. Materials shall be furnished as required from an approved source, hauled  
34           to/on the site and placed at the locations indicated on the Drawings.
- 35
- 36           3. Disposal of unsuitable material is specified in this Section. See  
37           Paragraph 3.11.

38

39           B. Common Fill

40

- 41           1. Common fill shall consist of mineral soil, free of organic material, loam,  
42           wood, trash and other objectionable material which may be compressible  
43           or which cannot be compacted properly. Common fill shall not contain  
44           stones larger than 2.5 inches in any dimension, broken concrete,  
45           masonry, rubble, or other similar materials, and shall have physical  
46           properties such that it can be readily spread and compacted during filling.

1           2. Material falling within the above specification, encountered during the  
2           excavation, may be stored in segregated stockpiles for reuse. In the  
3           opinion of the Engineer, all material that is not suitable for reuse shall be  
4           spoiled as specified herein for disposal of unsuitable materials.  
5

6           C. Crushed Stone  
7

- 8           1. Crushed stone shall be used for manhole bases, as a drainage layer  
9           below structures with underdrains, for backfilling ductile iron pipe, and at  
10          other locations indicated on the Drawings. Crushed stone for pipe  
11          bedding shall be Class I Material. Aggregate size shall not exceed 1-1/2".  
12  
13          2. When crushed stone is used as bedding material, the crushed stone shall  
14          be wrapped in filter fabric to avoid migration of fines into the stone layers  
15          and subsequent loss of soil around the haunches of the pipe.  
16

17          D. Select Fill  
18

- 19          1. Select fill shall be non-cohesive, low-plasticity material free of all debris,  
20          lumps or clods, AASHTO A2-4 or A3 designation. Fill material shall be  
21          clean earth fill composed of sand or an approved mixture of clay and  
22          sand. Backfill material placed within one foot of piping and  
23          appurtenances shall not contain any stones or rocks larger than two  
24          inches in diameter, or three-quarter inch in diameter for PVC pipe.  
25

26          PART 3 - EXECUTION  
27

28          3.01 DISPOSAL OF MATERIALS  
29

- 30          A. Excavated material shall be stacked without excessive surcharge on the trench  
31          bank. Excavated material shall be segregated for use in backfilling as specified  
32          below.  
33  
34          B. Surplus excavated material that, in the opinion of the Engineer, is suitable for  
35          use in backfilling or for replacing rock and boulders shall be stockpiled at a satis-  
36          factory site to be obtained by the Contractor to be used as required. Unsatisfac-  
37          tory surplus material including paving, rock or boulders, muck, stumps and other  
38          material, as directed by the Engineer, shall be disposed of by the Contractor.  
39  
40          C. It is expressly understood that no excavated material shall be removed from the  
41          site of the work or disposed of by the Contractor except as directed by the  
42          Engineer. When removal of surplus material has been approved by the  
43          Engineer, the Contractor shall dispose of such surplus material.  
44  
45          D. Should conditions make it impracticable or unsafe to stack material adjacent to  
46          the trench, the material shall be hauled and stored at a location provided by the

1 Contractor. When required, it shall be re-handled and used in backfilling the  
2 trench. No extra compensation will be made for re-handling material.  
3

4 **3.02 SHEETING AND BRACING**

- 5
- 6 A. The Contractor shall do all shoring and sheeting required to perform and protect  
7 the excavation and, as required, for the safety of the employees.
- 8
- 9 B. All trenches shall be sheeted and braced as required by the Engineer and all  
10 applicable Federal, State, County and Municipal regulations. Sheet and  
11 bracing shall be used to prevent shifting of adjacent soil and to prevent damage  
12 to structures or the work. The sole responsibility for the design, methods of  
13 installation, and adequacy of the sheeting and bracing, shall be and shall remain  
14 that of the Contractor.
- 15
- 16 C. Sheet and bracing or approved laying box shall be used in all trenches unless  
17 the slopes are excavated until the natural angle of repose of the soil is  
18 encountered.
- 19
- 20 D. In general, sheeting and bracing shall be removed as the excavation is  
21 backfilled in such a manner as to avoid the caving in of the bank or disturbance  
22 of adjacent areas or structures. The voids left by withdrawal of the sheeting and  
23 bracing shall be carefully filled by jetting, ramming or other means approved by  
24 the Engineer. Permission shall be obtained from the Engineer prior to removal  
25 of any sheeting or bracing. Permission shall not relieve the Contractor of any  
26 responsibility for damage due to failure to leave such sheeting and bracing in  
27 place.
- 28
- 29 E. The Engineer may order, in writing, any or all sheeting or bracing to be left in  
30 place for the purpose of preventing injury to adjacent structures, property, etc.  
31 If left in place, such sheeting shall be cut off at the elevation ordered, but in no  
32 case less than thirty-six (36) inches below the existing grade. Bracing remaining  
33 in place shall be driven in tight. The right of the Engineer to order sheeting and  
34 bracing to remain in place shall not be construed as creating any obligation on  
35 his part to issue such orders. Payment for sheeting and bracing, unless  
36 specifically called for on the Drawings shall not be paid under separate item, but  
37 shall be included in the payment for other items of Work.

38 **3.03 TEST PITS**

- 39
- 40 A. The Contractor shall be required to excavate test pits for the purpose of locating  
41 underground utilities or structures and as an aid in establishing the precise  
42 location of new work. Test pits shall be backfilled as soon as the desired information  
43 has been obtained. Backfill shall be compacted per as specified herein.  
44 The backfilled surface shall be maintained in a satisfactory condition for travel  
45 until resurfaced as hereinafter specified.
- 46
- 47

1           B. Excavation of test pits shall be considered work incidental to the project and  
2           shall be done at the Contractor's expense.

3  
4           C. If, for any reason, a test pit is left open for any period of time, it shall be properly  
5           barricaded and lighted by the Contractor, when directed by the Engineer, in  
6           accordance with State and Local laws.

7  
8        3.04 DEWATERING AND DRAINAGE

9  
10          A. The Contractor shall provide temporary dewatering in accordance with Section  
11           02140.

12  
13          B. The Contractor shall furnish all materials and equipment and perform all  
14           incidental work required to install and maintain the drainage system proposed  
15           for handling ground water or surface water encountered. The Contractor shall  
16           assume all responsibility for the adequacy of the methods, materials, and equip-  
17           ment employed. Construction shall not begin until the Engineer is assured that  
18           the proposed method will be satisfactory. A stable subgrade is required, and  
19           the Contractor shall alter his drainage methods, if, in the opinion of the Engineer,  
20           the trench bottom is unsatisfactory.

21  
22          C. The Contractor shall provide pumping equipment and devices to properly  
23           remove and dispose of all water entering trench and excavation. The grade  
24           shall be maintained acceptably dry until structures and pipe to be constructed  
25           therein are completed. All drainage shall be performed without damage to the  
26           trench, pavements, pipes, electrical conduits, or other utilities.

27  
28          D. Pipe and masonry shall not be laid in water or submerged within 24 hours after  
29           being placed. Water shall not flow over new masonry within four days after  
30           placement.

31  
32          E. In no event shall water rise to cause unbalanced pressure on structures until  
33           the concrete or mortar has set at least 24 hours or reach 70% of its designed  
34           compressive strength. The Contractor shall prevent flotation of the pipe  
35           promptly placing backfill.

36  
37          F. If the Contractor elects to use underdrains for handling water, he shall furnish  
38           and install pipe and crushed stone graded from coarse to fine, and shall furnish  
39           and install all pumps and equipment necessary to maintain the water level  
40           continuously at the required elevation. Pipe underdrains shall be laid with open  
41           joints and bedded in crushed stone for the full width of trench, and to a depth of  
42           6-inches below the invert of underdrain.

43  
44          G. The invert of underdrain shall be 12-inches below the normal subgrade. Pipe  
45           underdrains shall have no permanent outlet and shall be sealed at the  
46           completion of the work. The length of continuous underdrain to be used shall  
47           be limited as conditions require. An impervious bulkhead of clay or concrete

1 shall be constructed in the trench bottom between 100 ft. lengths of the  
2 underdrainage system to obstruct the free flow of ground water after  
3 construction is completed. All excavation below normal grade for the purpose  
4 of installing underdrains, the crushed stone and underdrain pipe shall be  
5 considered a part of the drainage work to be done under the pipe items. The  
6 Contractor shall continuously guard against the loss of earth through subbase  
7 or the underdrain. Should loss of either take place, the Contractor shall alter  
8 the stone size to provide a satisfactory barrier or filter  
9

- 10 H. Socks for sock dewatering systems shall be removed or filled with grout if left in  
11 place. Well points shall be backfilled and rodded to ensure there are no voids.  
12 I. Where other methods of handling water prove inadequate, the Contractor shall  
13 furnish, install, operate, and remove proper well point or other dewatering  
14 facilities  
15

16 3.05 TRENCH EXCAVATION

- 17 A. Excavation shall be made for all trenches that are required for the installation of  
18 pipes, culverts, manholes and drainage structures.  
19 B. Trench width at the ground surface may vary depending on depth, type of soil,  
20 and position of surface structures. The minimum clear width of the trench,  
21 sheeted or unsheeted, measured at the springline of the pipe should be 1 foot  
22 greater than the outside diameter of the pipe. The maximum recommended  
23 clear width of the trench at the top of the pipe is equal to the pipe outside  
24 diameter plus 2 feet, for pipe diameters 12 inches and smaller, or the pipe  
25 outside diameter plus 3 feet, for pipes over 12 inches. If the maximum  
26 recommended trench width must be exceeded or if the pipe is installed in a  
27 compacted embankment, then pipe embedment should be compacted to a point  
28 of at least 2-1/2 pipe diameters from the pipe on both sides of the pipe or to the  
29 trench walls, whichever is less.  
30 C. The trench may be excavated by machinery to the limits shown on the Drawings  
31 and scarified.  
32 D. Rock shall be removed to a minimum of 8-inch clearance around the bottom  
33 and sides of the pipe being laid.  
34 E. The trench bottom should be constructed to provide a firm, stable and uniform  
35 support for the full length of the pipe. Bell holes should be provided at each joint  
36 to permit proper assembly and pipe support. Any part of the trench bottom  
37 excavated below grade should be backfilled to grade and should be compacted  
38 as required to provide firm pipe support. When an unstable subgrade condition  
39 is encountered that could provide inadequate pipe support, additional trench  
40 depth should be excavated and refilled with suitable foundation material. Ledge  
41  
42  
43  
44  
45  
46

1                   rock, boulders, and large stones should be removed to provide a minimum of 4  
2                   inches of soil cushion of all sides of the pipe and accessories.  
3

4                   **3.06 CREEK AND STREAM CROSSINGS**  
5

- 6                   A. When installing mains below creeks or streams, the Contractor shall take all  
7                   precautions to identify and restore confining hydrogeologic layers, to the  
8                   satisfaction of the Florida Department of Environmental Protection (FDEP). The  
9                   Engineer shall be notified when confining layers are identified.  
10
- 11                  B. Surface water crossings shall be carried out in accordance with details shown  
12                  on the plans. Any deviation from these details shall be agreed upon ahead of  
13                  excavation.  
14
- 15                  C. The Contractor shall separate the materials of the confining layer from common  
16                  fill, for later replacement at the depth originally encountered. Contractor shall  
17                  survey exiting conditions and ensure that final elevations of the crossing shall  
18                  match existing conditions.  
19
- 20                  D. The Contractor shall maintain a means of bypassing or allowing the free flow of  
21                  water during the construction of the crossing, to avoid upstream flooding during  
22                  heavy rains. The transport of sediment through or from the work area is  
23                  prohibited.  
24
- 25                  E. All costs associated with layer selection, complying with FDEP conditions,  
26                  temporary berms/ cofferdams, dewatering, and dealing with water flows shall be  
27                  considered part of the work to be done under the relevant pipe items.  
28

29                   **3.07 PIPE BEDDING**  
30

- 31                  A. The Contractor shall furnish and install pipe on the type of bedding shown on  
32                  the Drawings or as specified by the Engineer. Regardless of the type of bedding  
33                  used by the Contractor, holes in the trench shall be provided to receive the pipe  
34                  bell. The hole excavated shall be sufficient to relieve pipe bells of all loads and  
35                  yet provide support over the total length of the pipe barrel.  
36
- 37                  B. Pipe should be installed with proper bedding providing uniform longitudinal  
38                  support under the pipe. Backfill material should be worked under the sides of  
39                  the pipe to provide satisfactory supports around the haunches of the pipe. All  
40                  pipe bedding materials shall be select fill. Sharp stones and crushed rock  
41                  (larger than 3/4-inch), which could cause significant scratching or abrasion of  
42                  the pipe, shall be excluded from the embedment material. Proper compaction  
43                  procedures shall be exercised.  
44
- 45                  C. Where required to provide firm bedding for the pipe, and with the approval of  
46                  the Engineer, crushed stone bedding shall be provided from a depth of 12"  
47                  below the pipe up to the pipe haunches.

1  
2   3.08 BACKFILLING  
3

- 4           A. As soon as practicable after the pipe has been laid, joined and bedded,  
5           backfilling shall begin and thereafter prosecuted expeditiously.  
6
- 7           B. Select backfill material, free from stones and other foreign material, shall be  
8           placed to the limits shown on the Drawings or a minimum of 12-inches above  
9           the pipe. In all areas, backfill material shall be deposited in six -inch layers and  
10          carefully tamped until the compacted backfill depth reaches one foot above the  
11          top of pipe.  
12
- 13          C. The remainder of the trench above the compacted backfill, as described shall  
14          be filled thoroughly compacted by rolling, ramming, as the Engineer may direct,  
15          sufficiently to prevent subsequent settling.  
16
- 17          D. No mechanical equipment, or machinery other than a hand operated  
18          mechanical vibrator, shall be allowed within the trench area until the backfill has  
19          been properly tamped to one foot above the top of pipe. The remainder of the  
20          backfill shall be deposited in one foot layers and thoroughly tamped. Settling the  
21          backfill with water shall not be permitted.  
22
- 23          E. Where trenches are improperly backfilled, or where settlement occurs, the  
24          trenches shall be reopened to the depth required for proper compaction, refilled  
25          and compacted, and the surface restored to the required grade and compaction,  
26          mounded over and smoothed off.  
27

28   3.09 COMPACTION  
29

- 30          A. Gravel and crushed stone in open areas, shall be placed in layers not to exceed  
31          eight (8) inches in depth as measured before compaction. Each layer shall be  
32          compacted by a minimum of four (4) coverages. Incidental compaction due to  
33          traffic by construction equipment will not be credited toward the required  
34          minimum four (4) coverages.  
35
- 36          B. Common fill shall be placed in loose lifts not exceeding 12-inches and shall be  
37          compacted to a minimum of 98% of the maximum modified Proctor dry density,  
38          as established in accordance with ASTM D-1557. Select fill shall be placed in  
39          loose lifts not exceeding 6-inches and shall be compacted to a minimum of 95%  
40          of the maximum modified Proctor dry density, as established in accordance with  
41          ASTM D-1557. Density tests shall be performed every 250 feet of pipe length,  
42          in each fill lift, on each side of the pipe, to confirm compaction before the next  
43          lift is placed. Fill material in place shall be compacted with such mechanical  
44          compaction equipment as approved by the Engineer.  
45

- 1           C. Areas adjacent to structures and other confined inaccessible to the roller or truck  
2           shall be compacted with approved hand guided mechanical compaction  
3           equipment.
- 4           D. It is the intention that the fill materials, with respect to moisture, be used in the  
5           condition they are excavated insofar as this is practicable. Material that is too  
6           wet shall be spread on the fill area and permitted to dry, assisted by harrowing  
7           if necessary, until the moisture content is reduced enough to allow for proper  
8           compaction as determined by the Engineer. Muck, mud, or organic material  
9           shall not be utilized as trench fill. Such matter shall be removed from the trench  
10          and replaced with suitable fill material.

12           3.10 GRADING

- 13           A. Grading shall be performed at such places as are indicated on the Drawings, to  
14           the lines, grades, and elevations shown or as directed by the Engineer. Such  
15           work shall be performed in a manner that the requirements for formation of  
16           slopes, lines, and grades can be followed. All unacceptable material  
17           encountered, or whatever nature within the limits indicated, shall be removed  
18           and disposed of as directed. During the process of grading, the subgrade shall  
19           be maintained in such condition that it will be well drained at all times. When  
20           directed, temporary drains and drainage ditches shall be installed to intercept  
21           or divert surface water, which may affect the progress or condition of the work.
- 22           B. If, at the time of grading, it is not possible to place any material in its proper  
23           section of the permanent structure, it shall be stockpiled for later use. No extra  
24           payment will be made for the stockpiling or double handling of excavated  
25           material.
- 26           C. The right is reserved to make minor adjustments or revisions in lines or grades  
27           if found necessary as the work progresses, due to discrepancies on the  
28           Drawings or in order to obtain satisfactory construction.
- 29           D. Stones or rock fragments larger than 4 inches in their greatest dimensions will  
30           not be permitted in the top 6 inches of the subgrade line.
- 31           E. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or  
32           otherwise removed to line or finished grade of slope. All cut and fill slopes shall  
33           be uniformly dressed to the slope, cross section, and alignment shown on the  
34           Drawings or as directed by the Engineer.
- 35           F. No grading is to be done in areas where there are existing pipe lines that may  
36           be uncovered or damaged until such lines have been located and it has been  
37           determined if such lines must be maintained are relocated, or where lines are  
38           to be abandoned, all required valves are closed and remaining pipes are  
39           plugged.

### 1 3.11 DISPOSAL OF UNSUITABLE SURPLUS MATERIAL

- A. Unusable and surplus excavated materials and pavement shall become the property of the Contractor and removed and disposed of by him off the project site.
  - B. Suitable excavated materials may be used for fill or backfill if it meets the Specification for common fill and is approved by the Engineer. Excavated material so approved may be neatly stockpiled at the site where designated by the Engineer provided there is an area available that will not interfere with the operation of the plant or inconvenience traffic or adjoining property owners. If space limitations do not permit stockpiling on the site, the Contractor will be required to make arrangements for off-site stockpiling. Transport of such material from and to the immediate site including any stockpiling agreements shall be entirely at the Contractor's expense and shall not constitute grounds for additional payment.
  - C. Surplus excavated material shall be used to fill depressions or other purposes as the Engineer may direct.

## 3.12 DISPOSAL AND REPLACING OF ROCK

- A. The Contractor shall remove and dispose of all pieces of rock which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced and approved surplus excavation obtained elsewhere on the site, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material from outside sources.
  - B. Rock may be used in fill only with the approval of the Engineer.

END OF SECTION

1 SECTION 02276

2  
3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

4  
5 PART 1 - GENERAL

6  
7 1.01 SCOPE OF WORK

- 8  
9 A. The work specified in this Section consists of designing, providing, maintaining  
10 and removing temporary erosion and sedimentation controls as necessary.
- 11 B. Temporary erosion controls include, but are not limited to, straw, hay, filter  
12 fabric, permanent vegetation, grassing, mulching, netting, watering and  
13 reseeding on-site surfaces, spoil and borrow areas and providing interceptor  
14 ditches at those locations that will ensure that erosion during construction will  
15 be either eliminated or maintained within acceptable limits as established by the  
16 Engineer, Owner and the permitting agencies.
- 17 C. Temporary sedimentation controls include, but are not limited to, silt dams,  
18 traps, barriers and appurtenances, which ensure that sedimentation, will be  
19 either eliminated or maintained within acceptable limits as established by the  
20 Owner and the permitting agencies.
- 21 D. The Contractor shall provide routine re-establishment, daily maintenance of  
22 permanent and temporary erosion and sediment control measures features  
23 until the project is complete and all soil stabilized.
- 24 E. Contractor shall be required to comply with all permit conditions included as  
25 attachments to these Contract Documents and as required by these  
26 Specifications.
- 27 F. The Contractor shall use all methods and products that meet or exceed those  
28 set forth in the FDOT Standard Specifications.

29 1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- 30 A. Standard Building Code.
- 31 B. Environmental Resource Permit

32 PART 2 - PRODUCTS

33 2.01 EROSION CONTROL

- 34 A. Loaming, seeding, sodding, and mulching is specified herein.
- 35 B. Netting - fabricated of material acceptable to the Engineer.

1  
2   2.02 SEDIMENTATION CONTROL  
3

- 4       A.   Bales – synthetic or clean, seed-free cereal hay type.  
5  
6       B.   Netting - fabricated of material acceptable to the Engineer.  
7  
8       C.   Filter stone - crushed stone conforming to Florida Department of Transportation  
9           specifications.  
10  
11      D.   Concrete block - hollow, non-load-bearing type.  
12  
13      E.   Concrete - exterior grade not less than one inch thick.  
14  
15      F.   Drain pipe with sock (sedimentation control) shall be used to prevent and control  
16           soil erosion runoff and intrusion into stormwater drainage systems.  
17  
18        1.   Drain sock products such as "ADSSock" or approved equal.  
19  
20        2.   Sock material shall be on ultra-porous filter (synthetic wrap material)  
21           fitted snuggly over pipe. Material shall be 100 percent knitted polyester  
22           (or approved equal), equivalent opening size of 30 to 40, burst strength  
23           of 100-135 (ASTM D 3786), fiber size of 100-40 200 denier filament, 2.5  
24           to 3.5 ounces per square yard (ASTM D 3776).  
25  
26        3.   Approval of material is required by Owner prior to use.  
27  
28        4.   Drain pipe with sock shall span the entire opening of the inlet.  
29

30   PART 3 - EXECUTION  
31

32   3.01 EROSION CONTROL  
33

- 34       A.   Type of erosion control barriers used shall be governed by the nature of the  
35           construction operation, Contract Documents and all applicable permits.  
36  
37       B.   Diversion ditches or swales may be required to prevent turbid storm water  
38           runoff from being discharged to wetlands or other water bodies. It may be  
39           necessary to employ a combination of barriers, ditches and other  
40           erosion/turbidity control measures as conditions warrant.  
41  
42       C.   Fill material stockpiles shall be protected at all times by on-site drainage  
43           controls which prevent erosion of the stockpiled material. Control of dust from  
44           such stockpiles may be required, depending upon their location and the  
45           expected length of time the stockpiles will be present. In no case shall a non-  
46           stabilized stockpile remain after thirty (30) calendar days.  
47

- 1           D. No disturbed area may be denuded for more than thirty (30) calendar days  
2           unless otherwise authorized by the Engineer. Within sixty (60) calendar days  
3           after final grade is established on any portion of a project site, that portion of  
4           the site shall be provided with established permanent soil stabilization  
5           measures per the original site plan, whether by impervious surface or  
6           landscaping.
- 7
- 8           E. Minimum procedures for grassing are:
- 9
- 10          1. Scarify slopes to a depth of not less than 6 inches and remove large  
11            clods, rock, stumps and roots all larger than 1/2-inch in diameter and  
12            debris.
- 13
- 14          2. Sow seed within twenty-four (24) hours after the ground is scarified with  
15            either mechanical seed drills or rotary hand seeders.
- 16
- 17          3. Apply mulch loosely and to a thickness between 3/4-inch and 1-1/2  
18            inches.
- 19
- 20          4. Apply netting over mulched areas on all sloped surfaces.
- 21
- 22          5. Roll and water seeded areas in a manner which will encourage sprouting  
23            of seeds and growing of grass. Reseed areas that exhibit unsatisfactory  
24            growth. Backfill and seed eroded areas.

25

26        3.02 SEDIMENTATION CONTROL

27

- 28          A. Install and maintain silt dams, traps, barriers and appurtenances, as shown on  
29            the Drawings and as described herein. Hay bales that deteriorate and filter  
30            stone that is dislodged shall be replaced.
- 31
- 32          B. Existing storm water systems shall be protected at all times to prevent  
33            sedimentation of the storm water system. Sedimentation prevention shall  
34            comply with or exceed "Best Management Practices" in accordance with the  
35            Southwest Florida Water Management District.
- 36
- 37          C. Siltation accumulations greater than the lesser of 12 inches or one-half the  
38            depth of the siltation control barrier shall be immediately removed and placed  
39            in upland areas.
- 40
- 41          D. Where pumps are to be used to remove turbid waters from the construction  
42            area, the water shall be treated to reduce turbidity to state water quality  
43            standards prior to discharge to the wetlands. Treatment methods include, for  
44            example, turbid water being pumped into grassed swales or appropriate  
45            vegetated areas (other than upland preservation areas and wetland buffers),  
46            sediment basins, or confined by an appropriate enclosure such as turbidity

- 1                   barriers and kept confined until its turbidity level meets state water quality  
2                   standards.
- 3
- 4                   E. Sediment basins and traps, perimeter berms, filter fences, berms, sediment  
5                   barriers, vegetative buffers and other measures intended to trap sediment  
6                   and/or prevent the transport of sediment onto adjacent properties, or into  
7                   existing water bodies; must be installed, constructed, or, in the case of  
8                   vegetative buffers, protected from disturbance, as a first step in the land  
9                   alteration process. Such systems shall be fully operative and inspected before  
10                  any other disturbance of the site begins. Earthen structures including but not  
11                  limited to berms, earth filters, dams or dikes shall be stabilized and protected  
12                  from drainage damage or erosion within one week of installation.
- 13
- 14                  F. Areas of 3 acres or more shall be required to have temporary sedimentation  
15                  basins as a positive remedy against downstream siltation and will be shown  
16                  and detailed on construction plans. During development, permanent detention  
17                  areas may be used in place of silt basins provided they are maintained to the  
18                  satisfaction of the Owner.
- 19
- 20                  G. The Contractor shall be prohibited from discharging silt through any stormwater  
21                  outfall structure during construction. When temporary sedimentation basins are  
22                  used, they shall be capable at all times of containing at least one (1) cubic foot  
23                  of sediment for each one hundred (100) square feet of area tributary to the  
24                  basin. Such capacity shall be maintained throughout the project by regular  
25                  removal of sediment from the basin.
- 26
- 27                  H. Land alteration and construction shall be minimized in both permanent and  
28                  intermittent waterways and the immediately adjacent buffer of 25 feet from top  
29                  of bank of the waterways and the buffer area whenever possible, and barriers  
30                  shall be used to prevent access. Where in channel work cannot be avoided,  
31                  precautions must be taken to stabilize the work area during land alteration,  
32                  development and/or construction to minimize erosion. If the channel and buffer  
33                  area are disturbed during land alteration, they must be stabilized within three  
34                  (3) calendar days after the in channel work is completed.
- 35
- 36                  I. Silt curtains or other filter/siltation reduction devices must be installed on the  
37                  downstream side of the in channel alteration activity to eliminate impacts due  
38                  to increased turbidity. Wherever stream crossings are required, properly sized  
39                  temporary culverts shall be provided by the Contractor and removed when  
40                  construction is completed. The area of the crossing shall be restored to a  
41                  condition as nearly as possible equal to that which existed prior to any  
42                  construction activity.

#### TEMPORARY EROSION AND SEDIMENTATION CONTROL

1 State of Florida, the Contractor shall immediately take the necessary steps to  
2 correct the deficiency at his or her own expense.  
3

4 3.04 MAINTENANCE  
5

- 6 A. All erosion and siltation control devices shall be checked regularly, especially  
7 after each rainfall and will be cleaned out and/or repaired as required.  
8

9 3.05 COMPLIANCE  
10

- 11 A. Failure to comply with the aforementioned requirements may result in a fine  
12 and/or more stringent enforcement procedures such as (but not limited to)  
13 issuance of a "Stop Work Order".  
14  
15

16 END OF SECTION  
17

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## SECTION 02485

2

3

### SURFACE RESTORATION AND SIDEWALKS

4

#### PART 1 – GENERAL

5

##### 1.01 SCOPE OF WORK

6

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- A. Furnish all labor, materials, and equipment necessary to satisfactorily return all construction areas to their original conditions or better.
- B. Work includes furnishing and placing seed, sod, fertilizer, gravel, concrete, asphalt, planting, watering and maintenance until acceptance by the Owner.
- C. The restoration of grassed areas under this project shall be by sodding.

11

##### 1.02 QUALITY ASSURANCE

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- A. The Contractor shall provide a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and seeding or sodding at no additional cost to the Owner until a satisfactory stand is obtained.
- B. A satisfactory stand of grass is defined herein as a full lawn cover over areas to be seeded or sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 sq. yd. within a radius of 10 ft.

##### 1.03 SUBMITTALS

- A. Provide technical data as required for shop drawings on all materials or installation procedures required under this Section and in accordance with the contract documents.
- B. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

#### PART 2 – PRODUCTS

##### 2.01 MATERIALS

- A. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.

- 1       1. Percentages of nitrogen, phosphorus and potash shall be based on  
2       laboratory tests on soils outlined in Paragraph 1.03B. For purpose of  
3       bidding, assume 6% nitrogen, 6% phosphorus and 6% potash by weight.  
4       At least 50% of the total nitrogen shall contain no less than 3%  
5       water-insoluble nitrogen.
- 6
- 7       2. Fertilizer shall be delivered to the site, mixed as specified, in the original  
8       unopened standard size bags showing weight, analysis and name of  
9       manufacturer. Containers shall bear the manufacturer's guaranteed  
10      statement of analysis, or a manufacturer's certificate of compliance  
11      covering analysis shall be furnished to the Engineer. Store fertilizer in a  
12      weatherproof place and in such a manner that it will be kept dry and its  
13      effectiveness will not be impaired.
- 14
- 15      3. Superphosphate shall be composed of finely ground phosphate rock as  
16      commonly used for agricultural purposes containing not less than 20%  
17      available phosphoric acid.
- 18
- 19      B. Grass seed shall be the same as existed prior to construction and shall be 99  
20      percent minimum purity, 80 percent minimum germination and 1 percent  
21      maximum weed seed, labeled in accordance with U.S. Department of  
22      Agriculture Rules and Regulations under Federal Seed Act in effect. Seed  
23      which has become wet, moldy, or otherwise damaged in transit or storage shall  
24      not be acceptable.
- 25
- 26      C. All disturbed areas with the limits of construction shall receive vegetative  
27      treatment after final grading in accordance with these plans or landscaping  
28      plans. Disturbed areas not specifically designated with a vegetative cover shall  
29      be vegetated as follows:
- 30
- 31      Side slopes constructed at 4:1 (H to V) shall be sodded with argentine Bahia or  
32      seeded and then covered with an erosion control blanket. The blanket shall be  
33      the S75BN blanket as manufactured by North America Green or equal.
- 34
- 35      Side slopes less than 4:1 (H to V) shall be seeded and mulched.
- 36
- 37      D. Sodding
- 38
- 39       1. Sod shall be Argentine Bahia of firm texture having a compacted growth  
40       and good root development.
- 41
- 42       2. Sod shall be certified to meet Florida State Plant Board Specifications,  
43       absolutely true to varietal type, and free from weeds or other  
44       objectionable vegetation, fungus, insects and disease of any kind.
- 45

## SURFACE RESTORATION AND SIDEWALKS

02485-2

03/22/2019

- 1           3. Before being cut and lifted the sod shall have been mowed 3 times with  
2           the final mowing not more than a week before cutting into uniform  
3           dimensions.
- 4
- 5       E. Mulch shall be fresh hay. Rate of application specified herein shall correspond  
6           to depth not less than 1 inch or more than 3 inches according to texture and  
7           moisture content of mulch material.
- 8
- 9       F. It is the Contractor's responsibility to water the site, as required during seeding  
10          and sodding operations and through the maintenance period and until the work  
11          is accepted. The Contractor shall make whatever arrangements may be  
12          necessary to ensure an adequate supply of water to meet the needs for his  
13          work. The Contractor shall also furnish all necessary hose, equipment,  
14          attachments and accessories for the adequate irrigation of lawns and planted  
15          areas as may be required.
- 16

## PART 3 – EXECUTION

### 3.01 INSTALLATION

- 21       A. Following the subgrade preparation, the Contractor shall commence work on  
22          lawns and grassed areas. Areas to be seeded or sodded shall be free from soft  
23          spots and uneven grades. Apply 20 lbs. of 12-3-6 fertilizer per 1,000 sq. ft.
- 24
- 25       B. Seeded and sodded areas shall be protected from traffic or other use by placing  
26          warning signs or erecting barricades as necessary. Any areas damaged prior  
27          to actual acceptance by the Owner shall be repaired by the Contractor as  
28          directed by the Engineer.
- 29

### 3.02 LAWN BED PREPARATION

- 32       A. Areas to be sodded shall be cleared of all rough grass, weeds, and debris and  
33          the ground brought to an even grade.
- 34
- 35       B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
- 36
- 37       C. Superphosphate at a rate for bidding purposes of 5 pounds per 1,000 square  
38          foot and complete fertilizer at a rate for bidding purposes of 16 pounds per 1000  
39          square foot shall be evenly distributed over entire area and cross-disked into a  
40          depth of 4-6 inches.
- 41
- 42       D. The areas shall then be brought to proper grade, free of sticks, stones, or other  
43          foreign matter over 1-inch in diameter of dimension. The surface shall conform  
44          to finish grade, less the thickness of sod, free of water-retaining depressions,  
45          the soil friable and of uniformly fill texture.

1  
2   **3.03 SOD HANDLING AND INSTALLATION**

- 3  
4   A.   A one-foot wide strip of sod shall be provided around all structures, except  
5       fencing, along the edges of slabs and along the edge of pavement.  
6  
7   B.   During delivery, prior to planting, and during the planting of the lawn areas, the  
8       sod panels at all times be protected from excessive drying and unnecessary  
9       exposure of the roots to the sun. All sod shall be stacked during construction  
10      and planting so as not to be damaged by sweating or excessive heat and  
11      moisture.  
12  
13   C.   After completion of soil conditioning as specified above, sod panels shall be laid  
14      tightly together so as to make a solid sodded lawn area. On mounds and other  
15      slopes, the long dimension of the sod shall be laid perpendicular to the slope.  
16      Immediately following sod laying the lawn areas shall be rolled with a lawn roller  
17      customarily used for such purposes, and then thoroughly watered.  
18  
19   D.   Bring the sod edge in a neat, clean manner to the edge of all paving and shrub  
20      areas. Top dressing with clean, weed free, sand may be required at no  
21      additional cost to the Owner if deemed necessary by the Engineer.

22  
23   **3.04 CLEANUP**

- 24  
25   A.   Soil, mulch, seed, or similar materials spilled onto paved areas shall be removed  
26      promptly, keeping those areas as clean as possible at all times. Upon  
27      completion of seeding and sodding operations, all excess soil, stones, and  
28      debris remaining shall be removed from the construction areas.

29  
30   **3.05 MAINTENANCE**

- 31  
32   A.   Any existing landscape items damaged or altered during construction by the  
33      Contractor shall be restored or replaced as directed by the Engineer.  
34  
35   B.   Maintain landscape work until Owner accepts project. Watering, weeding,  
36      cultivating, restoration of grade, mowing and trimming grass, protection from  
37      insects and diseases, fertilizing and similar operations as needed to ensure  
38      normal growth and good health for live plant material shall be the responsibility  
39      of the Contractor and at no additional cost to the Owner. Sodded areas shall  
40      receive no less than 1.5 inches of water per week.

41  
42   **3.06 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS**

1           A. Lawn areas planted under this Contract and all lawn areas damaged by the  
2           Contractor's operation shall be repaired by proper soil preparation, fertilizing,  
3           and reseeding, in accordance with these Specifications.

END OF SECTION

## SURFACE RESTORATION AND SIDEWALKS

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SURFACE RESTORATION AND SIDEWALKS

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## SECTION 02525

### CONCRETE CURB

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. The work included under this section consists of furnishing all necessary labor, equipment, tools and materials, and in performing all operations in connection with the construction of concrete curb, concrete valley curb, concrete swale curb, median curb, and traffic separator.
- B. This work shall be performed in strict accordance with the requirements of all applicable sections of these specifications and in conformity with lines, grades, notes and typical cross sections shown on the drawings or as directed by the Design Engineer.

##### 1.02 ALTERNATE SPECIFICATIONS

Special attention is called to the fact that certain portions of the work for this project are described by reference to the "Standard Specifications". The term "Standard Specifications" refers to "The Standard Specifications for Road and Bridge Construction", latest edition, approved and adopted by the Florida Department of Transportation. In any case, where a specific detail regarding materials or method of construction has been omitted in the specifications, such work shall be performed in accordance with the requirements of the "Standard Specifications".

##### 1.03 TESTING STANDARDS

Shall be per the governing authorities' criteria.

#### PART 2 - PRODUCTS

##### 2.01 CONCRETE

Concrete for use in the construction of curbs and other miscellaneous items shall be Class "B" concrete that conforms to the requirements of "Section 03300 - Cast-In-Place Concrete", except that membrane curing compound may be used in lieu of the wet cure method or the initial cure may be by the wet method followed by a membrane cure. Membrane curing compound shall be applied at a uniform rate of one gallon per 200 square feet.

## 1 PART 3 - EXECUTION

### 3 3.01 GENERAL

5       Concrete items as required by these plans shall be constructed on a prepared  
6       smooth stabilized subgrade of uniform density. Large boulders and other  
7       obstructions shall be removed to a minimum depth of 6 inches below the finished  
8       subgrade elevation and the space shall be backfilled with sand or gravel or other  
9       suitable material which shall be thoroughly compacted by rolling or tamping. The  
10      Contractor shall furnish a template and shall thoroughly check the subgrade prior to  
11      depositing concrete.

## 13 3.02 JOINTS

15 One-half inch expansion joints shall be placed through curbs at all inlet structures, at  
16 all radius points, and at other locations as may be required by the plans and  
17 specifications. Contraction joints shall be formed not later than the morning after the  
18 pour, and shall be placed in all concrete items at intervals not to exceed 10-feet.  
19 Joints may be either formed or sawed and shall extend the full perimeter of the  
20 exposed portion of the curb. Contraction joints shall be a minimum of 1-inch in  
21 depth. Joints shall be constructed for pavements or other items as required by the  
22 plans or specifications.

24 3.03 BACKFILLING

After the concrete has sufficiently set (a minimum of 12 hours), the Contractor shall remove the forms and shall backfill the space on each side of the concrete. The backfill material shall be compacted and graded in a satisfactory manner.

**END OF SECTION**

1 SECTION 02575  
2

3 PAVEMENT CONSTRUCTION AND RESTORATION  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. The work covered by this Section of the Specifications consists of furnishing all labor,  
10 equipment, tools and materials, and in performing all operations in connection with the  
11 construction of all streets, parking and other paved areas.  
12
- 13 B. This work shall be performed in strict accordance with the requirements of all  
14 applicable sections of these Specifications and in conformity with lines, grades, notes  
15 and typical cross-sections shown on the Drawings or as directed by the Engineer.  
16
- 17 C. Special attention is called to the fact that certain portions of the work for this project are  
18 described by reference to the "Standard Specifications". The term "Standard  
19 Specifications" refers to "The Standard Specifications for Road and Bridge  
20 Construction" approved and adopted by the F.D.O.T. In any case, where a specific  
21 detail regarding materials or method of construction has been omitted in the  
22 specifications, such work shall be performed in accordance with the requirements of  
23 the "Standard Specifications."  
24
- 25 D. All "open cuts" shall be restored, in accordance with the details shown on the  
26 construction Drawings.  
27

28 PART 2 - PRODUCTS (Not Used)  
29

30 PART 3 - EXECUTION  
31

32 3.01 SUBGRADE CONSTRUCTION  
33

- 34 A. The construction of all subgrades shall conform to the requirements set forth  
35 hereinafter and shall consist of bringing the bottom of excavation and top of  
36 embankments of the roadways, drives and parking areas between the outer limits of  
37 the base course, to a surface conforming to the grades, lines and cross section shown  
38 on the Drawings, of uniform density, ready to receive the base course. When forms  
39 are to be used, the subgrade shall be prepared for an additional width, equal to the  
40 width of the base of the form plus 6 inches outside of each form line.  
41
- 42 B. All soft and yielding material and other portions of the subgrade, which will not readily  
43 compact, shall be removed and replaced with suitable material and the whole subgrade  
44 brought to line and grade and to a foundation of uniform compaction and supporting  
45 power. All submerged stumps, roots or other perishable matter encountered in the

1 preparation of the subgrade shall be removed to a depth of not less than 12 inches  
2 below the bottom of the base course.

- 3
- 4 C. After the subgrade has been properly shaped, it shall be brought to a firm, unyielding  
5 surface, by rolling the entire area with an approved 3 wheel power roller weighing not  
6 less than 10 tons. All areas inaccessible to the roller shall be thoroughly compacted  
7 with hand tampers weighing not less than 50 pounds, the face of which shall not  
8 exceed 100 square inches in area. Unless the subgrade material at the time of the  
9 rolling contains sufficient moisture to insure proper compaction, it shall be watered as  
10 directed and then compacted. Subgrade material containing excess moisture, as  
11 determined by the Engineer, shall be permitted to dry to the proper consistency before  
12 being compacted.
- 13
- 14 D. The subgrade surface shall have the density and bearing value or ratio specified on the  
15 construction drawings as determined by the Florida Bearing Value Test or Limerock  
16 Bearing Ratio (as appropriate).
- 17
- 18 E. After the subgrade has been prepared as specified above, the Contractor shall  
19 maintain it free from ruts and depressions and all damage resulting from the hauling or  
20 handling of any materials, equipment tools, etc. Ditches and drains shall be  
21 constructed and maintained along the completed subgrade section. A completed  
22 subgrade equal to the length of the base of pavement to be laid the next working day  
23 shall be maintained at all times.
- 24
- 25 F. After the subgrade has been prepared (and forms, if used, set true to line and grade),  
26 and immediately before any additional material is laid, the subgrade shall be tested as  
27 to crown and elevation by the use of an approved subgrade template furnished by the  
28 Contractor. If forms are used, the subgrade template shall be so constructed that its  
29 lower or testing edge will just come to the true position of the subgrade when the  
30 template is riding on the forms. Testing of the subgrade elevation shall be done by  
31 moving the template back and forth without tilting or lifting. The template shall be  
32 drawn along just ahead of the point where the materials for base course are being  
33 deposited and shall always be kept in position while materials are being placed. If the  
34 subgrade is found not to be at the proper elevation at all points, material shall be  
35 removed or added, as the condition necessitates, and compacted to bring all portions  
36 of the subgrade to the correct elevation and the specified density.

37

38 3.02 LIMEROCK STABILIZED SUBGRADE

39

- 40 A. Subgrade not meeting the above F.B.V. or L.B.R. value shall be stabilized by mixing a  
41 loose depth of crushed limerock meeting D.O.T. Standard Specifications, Section 911  
42 with a specified depth of local materials. The limerock shall be thoroughly mixed with  
43 the local material by a manner approved by the Engineer. No limerock shall be spread  
44 that cannot be mixed within five days after spreading. Before spreading of limerock,  
45 the road bed shall be completed to the lines shown on the Drawings and to a grade  
46 parallel to the finished elevation of the stabilized base.

1           B. Before placing of the stabilizing material, the elevation of the road bed shall be such  
2           that when the work is completed the requirements of the typical cross section shall  
3           have been fulfilled. As soon as the proper condition of moisture is attained, the  
4           material shall be compacted to the density required on Drawings.  
5

6        3.03 LIMEROCK BASE COURSE  
7

8           A. General: The work shall consist of furnishing all necessary limerock base material,  
9           spreading materials on the prepared subgrade, mixing, blending, finishing and  
10          compacting the materials to the required lines, grades and cross sections.  
11

12          B. Materials:

13           1. Limerock: Limerock shall conform with the requirements specified in Section  
14           911 of the D.O.T. Standard Specifications.  
15

16           At the Contractor's option, either Miami or Ocala formation may be used, but  
17           only one formation may be used on any Contract.  
18

19           2. Sampling and Testing: All samples of base course material shall be supplied by  
20           the Contractor at his expense and all materials shall be approved by the  
21           Engineer prior to use in the work. Additional samples of base course material  
22           shall be furnished during construction as required by the Engineer.  
23

24          C. Placing of Material:

25           1. The material shall be transported to the point where it is to be used, over  
26           material previously placed, if practicable, and dumped on the end of the  
27           preceding spread. Hauling over the subgrade and dumping on the subgrade will  
28           be permitted only when, in the Engineer's opinion, these operations will not be  
29           detrimental to the base or subbase.  
30

31          D. Spreading of Material:

32           1. Method of Spreading: Base course material shall be spread uniformly. All  
33           segregated areas of fine or coarse rock shall be removed and replaced with  
34           properly graded rock.  
35

36           2. Number of Courses: When the specified compacted thickness of the base is  
37           greater than 6-1/2 inches, the base shall be constructed in two courses. The  
38           thickness of the first course shall be approximately one-half the total thickness  
39           of the finished base, or enough additional to bear the weight of the construction  
40           equipment without disturbing the subgrade. At no time shall more than three  
41           days' work of the first course be spread and compacted ahead of the second  
42           course except where specifically authorized by the Engineer.  
43

1           E. Compacting and Finishing Base

- 2
- 3           1. The base shall be bladed and shaped to conform to the typical sections shown
- 4           on the Drawings. The base shall be compacted to not less than 98% of
- 5           maximum modified proctor dry density, as determined by ASTM D1557, with a
- 6           minimum LBR of 100.

7

8        3.04 SURFACE COURSE

9

10          A. Bituminous Prime and Tack Coats

- 11
- 12          1. General: When the prime or tack coat is applied adjacent to curb, gutter, or any
- 13           other concrete surface (except where they are to be covered with a bituminous
- 14           wearing course) such concrete surfaces shall be protected by heavy paper or
- 15           other protective material while the prime or tack coat is being applied. Any
- 16           bituminous material deposited on such concrete surfaces shall be removed
- 17           immediately.
- 18
- 19          2. Weather Limitations: No bituminous material shall be applied when the air
- 20           temperature is less than 50EF in the shade or when the weather conditions or
- 21           the condition of the existing surface is unsuitable.
- 22
- 23          3. Application of Prime Coat: After the base has been finished and cured, the full
- 24           width of surface shall be swept with a power broom supplemented with hand
- 25           brooms and mechanical blowers prior to the application of the prime coat. Care
- 26           shall be taken to remove all loose dust, dirt, and objectionable matter. If
- 27           deemed necessary, the base shall be slightly sprinkled with water immediately
- 28           in advance of the prime coat.

29

30           The temperature of the prime material shall be such as to insure uniform

31           distribution. The material shall be applied with a pressure distributor. The

32           amount to be applied shall be sufficient to coat the surface thoroughly and

33           uniformly without any excess to form pools or to flow off the base. The base

34           shall be primed by the application of approximately 0.10 gallons per square yard

35           RC-70. Cut-back asphalt shall conform to the requirements of 916-2 D.O.T.

36           Standard Specifications.

37

38           Following the application of the prime material, a light uniform application of

39           clean sand shall be applied and rolled for the full width of the base. The sand

40           shall be non-plastic, shall be free from silt and rock particles and shall not

41           contain any sticks, vegetation, grass, roots or organic matter. After the sand

42           covering has been applied, the surface may be opened to traffic.

- 43
- 44          4. Application of Tack Coat: In general, a tack coat will not be used on primed
- 45           bases except in areas which have become excessively dirty and cannot be
- 46           cleaned or where the prime has cured and lost all of its bonding effect. No tack

1                   coat shall be applied until the primed base or leveling course has been cleaned  
2                   and is free from sand, dust or other objectionable material.  
3

4                   The tack coat shall be applied with a pressure distributor. It shall be heated to a  
5                   suitable consistency and applied in a thin uniform layer at the rate of between  
6                   0.03 and 0.06 gallons per square yard. The tack coat shall be applied  
7                   sufficiently in advance of the laying of the wearing surface to permit drying, but  
8                   shall not be applied so far in advance or over such an area as to lose its  
9                   adhesiveness as a result of being covered with dust or other foreign material.  
10                  Suitable precautions shall be taken by the Contractor to protect the surface  
11                  while the tack coat is drying until the wearing surface is applied. Material for  
12                  tack coat shall be RS-2 or AC-20 unless otherwise approved by the Engineer  
13                  prior to use.  
14

15                 3.05 ASPHALTIC CONCRETE SURFACE  
16

17                 A. Materials:

18                 The material used shall be a plant-prepared asphalt of the type as shown on the  
19                 Drawings and conform to D.O.T. Specifications, Section 332 latest edition.  
20

21                 B. Placing the Mix  
22

23                 1. Place asphalt concrete mixture on prepared surface, spread and strike-off using  
24                 paving machine.

25                 2. Spread mixture at a minimum temperature of 225EF (107.2EC)

26                 3. Inaccessible and small areas may be placed by hand.

27                 4. Place each course of thickness so that when compacted it will conform to the  
28                 indicated grade, cross-section, finish thickness and density indicated.  
29

30                 5. Paver Placing:  
31

32                 a. Unless otherwise directed, begin placing along centerline of areas to be  
33                 paved on crowned section, and at high side of sections on one-way  
34                 slope, and in direction of traffic flow.  
35

36                 b. After first strip has been placed and rolled, place succeeding strips and  
37                 extend rolling to overlap previous strips.  
38

39                 c. Complete base courses for a section before placing surface courses.  
40

41                 d. Place mixture in continuous operation as practicable.  
42

- 1           6. Hand Placing:
- 2
- 3           a. Spread, tamp, and finish mixture using hand tools in areas where
- 4           machine spreading is not possible, as acceptable to Engineer.
- 5
- 6           b. Place mixture at a rate that will insure handling and compaction before
- 7           mixture becomes cooler than acceptable working temperature.
- 8
- 9           7. Joints:
- 10
- 11          a. Carefully make joints between old and new pavements, or between
- 12          successive days work, to ensure a continuous bond between adjoining
- 13          work.
- 14
- 15          b. Construct joints to have same texture, density and smoothness as
- 16          adjacent sections of asphalt course.
- 17
- 18          c. Clean contact surfaces free of sand, dirt, or other objectionable material
- 19          and apply tack coat.
- 20
- 21          d. Offset transverse joints in succeeding courses not less than 24-inches.
- 22
- 23          e. Cut back edge of previously placed courses not less than 6-inches.
- 24
- 25          f. Offset longitudinal joints in succeeding courses not less than 6-inches.
- 26
- 27          g. When edges of longitudinal joints are irregular, honeycombed or
- 28          inadequately compacted, cut back unsatisfactory sections to expose an
- 29          even, vertical surface for full course thickness.
- 30
- 31          C. Compacting the Mix
- 32
- 33          1. Provide sufficient rollers to obtain the required pavement density.
- 34
- 35          2. Begin rolling operations as soon after placing when the mixture will bear weight
- 36          of roller without excessive displacement.
- 37
- 38          3. Do not permit heavy equipment, including rollers to stand on finished surface
- 39          before it has thoroughly cooled or set.
- 40
- 41          4. Compact mixture with hot hand tampers or vibrating plate compactors in areas
- 42          inaccessible to rollers.
- 43
- 44          5. Start rolling longitudinally at extreme lower side of sections and proceed toward
- 45          center of pavement. Roll to slightly different lengths on alternate roller runs.
- 46

- 1           6. Do not roll centers of sections first under any circumstances.
- 2
- 3           7. Breakdown Rolling:
- 4
- 5           a. Accomplish breakdown or initial rolling immediately following rolling of
- 6           transverse and longitudinal joints and outside edge.
- 7
- 8           b. Operate rollers as close as possible to paver without causing pavement
- 9           displacement.
- 10
- 11           c. Check crown, grade, and smoothness after breakdown rolling.
- 12
- 13           d. Repair displaced areas by loosening at once with lutes or rakes and
- 14           filling, if required, with hot loose material before continuing rolling.
- 15
- 16           8. Second Rolling:
- 17
- 18           a. Follow breakdown rolling as soon as possible, while mixture is hot and in
- 19           condition for compaction.
- 20
- 21           b. Continue second rolling until mixture has been thoroughly compacted.
- 22
- 23           9. Finish Rolling:
- 24
- 25           a. Perform finish rolling while mixture is still warm enough for removal of
- 26           roller marks.
- 27
- 28           b. Continue rolling until roller marks are eliminated and course has attained
- 29           specified density.
- 30
- 31           10. Patching:
- 32
- 33           a. Remove and replace defective areas.
- 34
- 35           b. Cut-out and fill with fresh, hot asphalt concrete.
- 36
- 37           c. Compact by rolling to specified surface density and smoothness.
- 38
- 39           d. Remove deficient areas for full depth of course.
- 40
- 41           e. Cut sides perpendicular and parallel to direction of traffic with edges
- 42           vertical.
- 43
- 44           f. Apply tack coat to exposed surfaces before placing new asphalt concrete
- 45           mixture.
- 46

### 3.06 PARKING MARKING

#### A. Materials:

1. Parking marking paint with chlorinated rubber base.
  2. Factory mixed, quick drying and non-bleeding, FS TT-P-115C, Type III.
  3. Color: Parking Dividers - White

#### B. Marking Asphalt Concrete Pavement

## 1. Cleaning:

- a. Sweep surfaces with power broom supplemented by hand brooms to remove loose material and dirt.

- b. Do not begin marking asphalt concrete pavement until acceptable to the Engineer.

## 2. Apply paint with mechanical equipment:

- a. Provide uniform straight edges.

- b. Not less than 2 separate coats in accordance with manufacturer's recommended rates.

## 3.07 OVERLAYING

#### A. Overlaying:

1. Roadways shall be resurfaced in accordance with the provisions in 3.04 and 3.05 of this section.
  2. The pavement shall be resurfaced with a 1-inch overlay.
  3. Those areas as indicated on the drawings to be restored shall be overlaid.

END OF SECTION

1 SECTION 02720

2  
3 STORM DRAINAGE SYSTEM

4  
5 PART 1 - GENERAL

6  
7 1.01 SCOPE OF WORK

- 8  
9 A. Furnish all necessary labor, materials, equipment and performing all operations in  
10 connection with construction of storm sewers, inlets, manholes, end sections and other  
11 drainage structures or drainage construction as shown or indicated on the Drawings, or  
12 as specified herein.
- 13  
14 B. Special attention is called to the fact that certain portions of the work for this project are  
15 described by reference to the Standard Specifications. The term Standard  
16 Specifications refers to The Standard Specifications for Road and Bridge Construction,  
17 latest edition approved and adopted by the Florida Department of Transportation. In  
18 any case where a specific detail regarding materials or method of construction has  
19 been omitted in the specification or on the Drawings, such work shall be performed in  
20 accordance with the requirements of the Standard Specifications.

21  
22 1.02 QUALIFICATIONS

- 23  
24 A. All precast structures shall be furnished by a single manufacturer, who is fully  
25 experienced, reputable and qualified in the manufacture of items to be furnished. The  
26 structures shall be designed, constructed and installed in accordance with the best  
27 practices and methods, and shall comply with the requirements of the Standard  
28 Specifications.

29  
30 1.03 SUBMITTALS

- 31  
32 A. In general, 6 copies of the following data or shop drawings shall be submitted to the  
33 Engineer for approval prior to construction:

- 34  
35 1. Manhole frames, covers and other castings.  
36 2. Precast manholes  
37 3. Precast structures

- 38  
39 B. The quality of all materials, the process of manufacture and the finished sections, shall  
40 be subject to inspection and approval by the Engineer, or other representative of the  
41 Engineer. Such inspection may be made at the place of manufacture, or on the work  
42 site after delivery, or at both places. The sections shall be subject to rejection at any  
43 time on account of failure to meet any of the Specification requirements, even though a  
44 sample section may have been accepted as satisfactory at the place of manufacture.  
45 Sections rejected after delivery to the site shall be marked for identification and shall be  
46 removed from the site at once. All sections, which have been damaged after delivery,

1 will be rejected and, if already installed, shall be acceptably repaired, if approved by the  
2 Engineer, or removed and replaced, entirely at the Contractor's expense.  
3

- 4 C. At the time of inspection, the sections will be carefully examined for compliance with  
5 the ASTM designation specified below and these Specifications, and with the approved  
6 manufacturer's drawings. All sections shall be inspected for general appearance,  
7 dimension, "scratch-strength", blisters, crack, roughness, soundness and other  
8 features. The surface shall be dense and close-textured.  
9
- 10 D. Imperfections may be repaired, subject to the approval of the Engineer, after  
11 demonstration by the manufacturer that strong and permanent repairs result. Repairs  
12 shall be carefully inspected before final approval. Cement mortar used for repairs shall  
13 have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi  
14 at the end of 28 days, when tested in 3-in. by 6-in. cylinders stored in the standard  
15 manner. Epoxy mortar may be utilized for repairs, subject to the approval of the  
16 Engineer.  
17

18 PART 2 - PRODUCTS  
19

20 2.01 MATERIALS AND DESIGN  
21

- 22 A. Precast structures shall conform to ASTM Designation C478 and meet the following  
23 additional requirements:  
24
- 25 1. Type II cement shall be used, except as otherwise approved.
  - 26 2. Holes to accommodate pipe shall be precast into the section at the  
27 manufacturer's plant.
  - 28 3. All sections shall be cured by an approved method and shall not be shipped  
29 until the concrete compressive strength has attained 4,000 psi and not before 6  
30 days after fabrication and/or repair, whichever is longer.
  - 31 4. Precast concrete top slabs shall be designed for an AASHTO H-20 wheel  
32 loading.
  - 33 5. The date of manufacture and the name or trademark of the manufacturer shall  
34 be clearly marked on the inside of each precast unit.
  - 35 6. Minimum wall thickness shall be 6 inches.
  - 36 7. Minimum inside diameter shall be 48 inches for manholes.
  - 37 8. The precast reinforced based shall be a minimum of 8 inches thick and be cast  
38 monolithically with the bottom section of manhole walls.

- 1           9. Manholes sections shall be joined with a tongue and groove joint complete with  
2           flexible plastic gasket. The tongue and groove joint shall be sealed with a  
3           flexible plastic gasket, as manufactured by K. T. Snyder & Sons, or equal. After  
4           the manhole sections have been assembled, the gasket shall be trimmed to a  
5           depth of 1/4" and filled with hydraulic cement.  
6
- 7           10. Openings for pipes larger than 6 inches in diameter are to be precast. A  
8           minimum of 6 inches along the intercircumference is to remain between the  
9           extremities of hole for adjacent pipe in any single unit. A minimum of two (2)  
10          reinforcing bars shall remain in wall between any two (2) openings.  
11
- 12          11. The Contractor will furnish the fabricator with the angle of alignment and size of  
13          all pipes to enter manhole and the height of structure.  
14
- 15          12. Base units shall have sufficient height to allow for minimum of 6 inches of wall  
16          between top of highest opening for pipes and bottom of joint.  
17
- 18          13. Pipes are to be extended into structure wall a minimum of 4 inches, but should  
19          not extend beyond interior wall of structure.  
20
- 21          B. Concrete pipe shall be reinforced concrete culvert pipe conforming to ASTM  
22          Designation C-76, Table III, except when otherwise indicated. Reinforced concreted  
23          horizontal elliptical pipe shall conform to the requirements of ASTM Designation C-507,  
24          Class HE III. Pipe joints shall be rubber gasket joints and the pipe joint shall be  
25          manufactured to meet the requirements of the approved type of gasket to be used.  
26          Pipe joints and rubber gaskets shall meet the requirements of the Standard  
27          Specifications. Rubber gaskets for elliptical pipe (ERCP) shall conform to the  
28          requirements of ASTM C443 and ASSHTO M198.  
29
- 30          C. All bricks for drainage structures shall be first class, dense, free from cracks, true in  
31          shape, have square edges, and a clear ringing sound when struck. Clay brick shall be  
32          hard burned, sound, and burned entirely through. Brick of any one make shall not vary  
33          more than 1/16 inch in thickness, nor more than 1/8 inch in width or length. The  
34          average amount of water absorbed by the brick, after being thoroughly dried and then  
35          immersed for 24 hours, shall not exceed 8 percent. Concrete brick shall conform to the  
36          requirements the Standard Specifications.  
37
- 38          D. Mortar shall consist of one part cement and two parts clean sharp sand to which may  
39          be added lime in the amount of not over 25 percent of the volume of cement. It shall  
40          be mixed dry and then wetted to proper consistency for use. No mortars that have  
41          stood for more than one hour shall be used.  
42
- 43          E. All castings for manhole frames, covers, steps and other purposes shall conform to the  
44          ASTM Designation A48-74, Class 25. Castings shall be true to pattern in form and  
45          dimensions and free of pouring faults and other defects in positions which would impair  
46          their strength or otherwise make them unfit for the services intended. The seating

1 surfaces between frames and covers or grates shall be machined to fit true. No  
2 plugging or filling will be allowed. Lifting or "pick" holes shall be provided but shall not  
3 penetrate the manhole cover. Casting patterns shall conform to those shown or  
4 indicated on the Drawings.

5

6 F. Riprap

7

8 1. General

9

10 The work specified in this Section consists of the construction of Riprap  
11 composed of sand and cement. The Riprap shall be placed against the  
12 embankment or other work to be protected, in accordance with these  
13 specifications and in conformity with the lines, grades, dimensions and notes  
14 shown in the Drawings. Riprap materials shall conform to the Standard  
15 Specifications.

16 2. Portland Cement

17

18 The Portland cement used in sand-cement Riprap will not be subject to tests,  
19 provided it is from an approved source and is the product of an established and  
20 reputable manufacturer. The sandbag mixture shall contain at least one part  
21 cement to five parts of clean sand.

22 3. Fine Aggregate

23

24 The fine aggregate shall be graded so as to fall within the following limits:

<u>Passing</u>	<u>Percent</u>
No. 4 sieve	Minimum 97
No. 100 sieve	Maximum 20
No. 200 sieve	Maximum 5

25

26 This sand shall be subjected to the colorimetric test for impurities and if the color  
27 produced is darker than the standard solution it will be rejected.

28 4. Sacks

29

30 The sacks shall be cloth cement sacks, or any suitable cloth or jute sacks which  
31 will hold the sand-cement mixture without leakage when handled. The sacks  
32 shall be of uniform size and dimensions, in order to provide uniformity of lines in  
33 the completed work. They shall be free from holes and strong enough to stand  
34 handling without ripping or splitting. Only one type and size of sack shall be  
35 used at any one structure.

1           5. Grout  
2

3           The cement and the sand used in the grout between the sacks will not be  
4           required to be tested for specification requirements, provided the cement is the  
5           product of a reputable manufacturer and of a type and quality appropriate for  
6           this work, and that the sand is a clear commercial sand meeting the approval of  
7           the Engineer for this particular use.  
8

9           PART 3 - EXECUTION  
10

11          3.01 INSTALLATION  
12

- 13           A. Manholes shall be constructed to requirements of the Standard Specifications and as  
14           specified herein.  
15  
16           B. Precast concrete sections shall be set, so as to be vertical and with section in true  
17           alignment with a 1/4-inch maximum tolerance to be allowed. Backfilling shall be done  
18           in a careful manner, bringing the fill up evenly on all sides. The Contractor shall install  
19           the precast sections in a manner that will result in a watertight joint.  
20  
21           C. Holes in the concrete pipe sections required for handling or other purposes shall be  
22           plugged with a non-shrinking grout or by grout in combination with concrete plugs.  
23  
24           D. Where holes must be cut in the precast section to accommodate pipe, cutting shall be  
25           done prior to setting them in place.  
26  
27           E. The precast concrete base shall be placed on a bed of 3/4" rock, to provide even  
28           bearing and grade control.  
29  
30           F. A tapered hole filled with non-shrink waterproof after the pipe is inserted is acceptable,  
31           providing the grout is placed carefully to completely fill all around the pipe. If this  
32           method is used, place concrete encasement around the stub.  
33  
34           G. Cast iron frames, specified and furnished, shall be placed, shimmed and set in Portland  
35           cement mortar to the required grade.  
36  
37           H. The lines entering the manhole shall be laid to the grade shown on the Drawings.  
38  
39           I. The interior and exterior surfaces of the precast and cast-in-place manholes shall be  
40           given two (2) coats of bituminous damproofing for a total minimum thickness of 16  
41           mils DFT.  
42  
43           J. Manhole frame and cover shall be brought to (or adjusted to) grade from the top of the  
44           structure with brick.  
45

- 1           K. All manholes and cast-in-place structures shall be constructed watertight. If leaks  
2 appear, they shall be corrected to the satisfaction of the Engineer.
- 3           L. Manholes shall be provided with stubs and plugs, if indicated on the Drawings. Pipe  
4           stubs shall be as specified in the applicable section for pipe and shall be provided via  
5           suitable caps.
- 6           M. Drainage ditches shall be constructed to the configuration indicated on the  
7           Drawings--with care being taken to hold to the specified slope. Sodding or seeding of  
8           the ditch as called for on the Drawings shall be accomplished as soon as possible after  
9           the slopes are dressed.
- 10          N. Pipe Trenches
- 11           1. General
- 12           Pipe trenches shall be of necessary widths for the proper laying of the pipe, and  
13           the banks shall be as nearly vertical as practicable. The bottom of the trenches  
14           shall be excavated to a depth of 6-inches below the outside bottom of the pipe  
15           barrel. The resulting excavation shall be backfilled with pipe bedding material  
16           up to the level of the lower one-third of the proposed pipe barrel. This backfill  
17           material shall be tamped and compacted to provide proper bedding for the pipe  
18           and shall then be shaped to receive the pipe. Bell holes and depressions for  
19           joints shall be dug after the trench bottom has been graded, and in order that  
20           the pipe rest upon the prepared bottom for as nearly its full length as  
21           practicable, shall be only of such length, depth and width as required for  
22           properly making the particular type of joint.
- 23           2. Removal of Unstable Material
- 24           Soft, spongy, or otherwise unstable material (A-8 Material) encountered below  
25           the established grade of the excavation which will not provide a firm foundation  
26           for subsequent work, shall be removed and replaced as directed. Unless  
27           otherwise directed, all such unstable materials shall be removed for the full  
28           width of the excavation and replaced with approved fill material.
- 29           3. Pumping, Sheeting and Bracing
- 30           Where sheeting and bracing are necessary to prevent caving of the trench  
31           sidewalls or sidewalls of excavation for other structures and to safeguard the  
32           workmen, the trench or excavation for other structures shall be dug to such  
33           width that the proper allowance is made for the space occupied by the sheeting  
34           and bracing, and also is in compliance with the Trench Safety Act.

1           O. Pipe Laying and Jointing

2           1. General

3           The grade as shown or indicated on the Drawings is that of the invert and to  
4           which the work must conform. Any variation from this grade will be deemed  
5           sufficient reason to cause the work to be rejected and rebuilt at the Contractor's  
6           expense. Each piece of pipe, just before being lowered into the trench shall be  
7           inspected and cleaned. If any difficulty is found in fitting the pieces together,  
8           this fitting is to be done on the surface of the street before laying the pipe, and  
9           the tops plainly marked in the order in which they are to be laid. No pipe is to be  
10          trimmed or chipped to fit. Pipes having defects that have not caused their  
11          rejection are to be so laid that these defects will be in the upper half of the  
12          sewer. A bell hole is to be cut for each piece.

13          Each piece of pipe is to be solidly and evenly bedded and not simply wedged  
14          up. Before finishing each joint, some suitable device is to be used to find that  
15          the inverts coincide. Each pipe shall be laid to the line and grade shown or  
16          indicated on the Drawings. All pipes shall be laid with bells or grooves uphill.  
17          As the pipes are laid throughout the work they must be thoroughly cleaned and  
18          protected from dirt and water. No length of pipe shall be laid until the two  
19          preceding lengths have been thoroughly embedded in place so as to prevent  
20          any movement or disturbance of the finished joint. No walking on or working  
21          over the pipes after they are laid, except as may be necessary in tamping earth  
22          and refilling, will be permitted until they are covered to a depth of one foot.  
23          Whenever the pipe laying is discontinued, as at night, the unfinished end is to  
24          be securely protected from displacement by caving of the banks or from other  
25          injury and a suitable stopper is to be inserted therein.

26           2. Reinforced Concrete Pipe Joints

27          Joints for reinforced concrete pipe storm sewer or culverts shall be made using  
28          an approved performed or molded rubber gasket. The gasket and the surface  
29          of the pipe joint, including the gasket recess, shall be clean and free from grit,  
30          dirt or other foreign matter at the time the joints are made. In order to facilitate  
31          closure of the joint, application of an approved vegetable soap lubricant  
32          immediately prior to closing of the joint will be permitted.

33           3. Reinforced Concrete Elliptical Pipe

34          Joints for reinforced concrete elliptical pipe shall be made as specified above for  
35          reinforced concrete pipe joints. Elliptical pipe shall be laid with the longest  
36          dimensions placed horizontally.

1 P. Drainage Structures

- 2
- 3 1. Drainage structures shall be built at points shown on the Drawings or
- 4 designated by the Engineer and in strict accordance with the Drawings.
- 5
- 6 2. Excavation for drainage structures shall be sufficient to provide a clearance
- 7 between their surfaces and the face of the excavation or sheeting, if used, of not
- 8 less than 12-inches. Backfill shall be placed as specified herein before.
- 9 Unsuitable material uncovered at the footing elevation shall be excavated to
- 10 suitable material and the excavation backfilled with pipe bedding material to the
- 11 required elevation.
- 12
- 13 3. Brick masonry for manholes, inlets or other structures shall be built of brick and
- 14 mortar of the specified quality. Every fifth course of brick shall be laid as
- 15 stretchers, the remainder being laid as headers. Every brick shall have full
- 16 mortar joints on the bottom and sides which shall have been formed at one
- 17 operation by placing sufficient mortar on the head and forcing the brick into it.
- 18 Horizontal joints shall not exceed 1/4 of an inch. All brick shall be thoroughly
- 19 drenched with water immediately before being laid.
- 20

21 Q. Sand-Cement Riprap

22 1. Mixing Materials

23 The sand and cement shall be mixed dry, in the proportion of one part cement to

24 five parts sand, until the mixture is of uniform color.

25 2. Filling Sacks

26 The mixed material shall be accurately measured into each sack, with care

27 being taken to place the same amount of material in each sack, and at least the

28 top six inches of the sacks shall remain unfilled to allow for proper tying and

29 folding and to insure against breaking of the sack during placing.

30 3. Placing

31 The filled sacks shall be placed with their tied or folded ends all in the same

32 direction unless otherwise shown in the Drawings. The sacks shall be laid with

33 broken joints and, where so directed by the Engineer, header courses shall be

34 laid in order to tie the units together. The sacks shall be rammed or packed

35 against each other so as to form a close and molded contact after the sand and

36 cement mixture has set up. All sacks shall then be thoroughly wetted.

37 4. Grouting

1 After the wetting, all openings between sacks shall be filled with grout  
2 composed of one part Portland cement and five parts sand.  
3  
4  
5  
6

END OF SECTION

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1 SECTION 02730  
2

3 PRECAST CONCRETE STRUCTURES  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. The work included under this section consists of furnishing all necessary labor,  
10 equipment, materials, and performing all operations in connection with construction of  
11 Sanitary Manholes, ARV Structures (where applicable), Lift Station Wet Wells, and any  
12 other appurtenant structures including excavation, trenching, backfilling along with any  
13 other work as required or as directed that would be required to install a fully functional  
14 system.

15 1.02 SUBMITTALS  
16

17 A. Shop drawings shall be submitted in accordance with Specification 01340 for all  
18 materials associated with construction of the sanitary sewer collection system.  
19

20 21 PART 2 - PRODUCTS  
22

23 2.01 PRECAST CONCRETE STRUCTURES  
24

25 A. All precast concrete structures shall be new, unused and manufactured for this project.  
26 All manholes shall be precast concrete. The minimum acceptable manhole inside  
27 diameter is 4 feet. Precast, reinforced concrete manholes shall have tongue and  
28 groove interlocking joints. Inverts shall be formed as specified herein. It shall be the  
29 responsibility of the Contractor to assure that all manhole inlets are provided at the  
30 proper locations and elevations to accommodate the actual field requirements without  
31 additional compensation. Slabs for precast manholes shall be no less than 7 feet  
32 square. All slabs for precast drop manholes shall be of sufficient size to entirely  
33 support the drop structures. All manholes shall be placed on a FDOT No. 57 gravel  
34 base of a minimum of 12 inches in depth and wrapped in filter fabric.

35 B. Precast reinforced concrete manhole risers, grade rings and tops shall conform as to  
36 materials, design, and fabrication with the requirements of ASTM Designation C-478.  
37 The concrete shall consist of 4000 psi/28 day Type II Portland cement. The walls for  
38 manholes shall be no less than 8-inches thick. All precast manhole parts are to be free  
39 of fractures, honeycomb, and other defects of concrete. Cones shall be concentric.  
40 Flat top assemblies will be considered acceptable for lift station construction only.  
41

42 C. Precast manholes shall consist of a base unit with openings for the sewer pipe, riser  
43 units of various lengths to build the manhole up to the required depth and concentric  
44 cones. The minimum height of the shortest riser shall be 12-inches. The maximum

height of adjusting ring is 18 - inches. All interior and exterior surfaces and the tongue and groove ends of each unit shall be sand blasted and brushed clean and immediately thereafter the exterior shall be completely coated with a protective bituminous coating of not less than 15 mils. The coating shall be applied in strict accordance with the manufacturer's recommendations. The exterior paint shall be intact and continuous. Any chips or holidays shall be patched using two coats of approved coatings used according to manufacturer instructions and with the knowledge of the Owner's Engineer. Top and bottom ends of riser or sections shall be perfectly formed so that continuous and uniform contact is possible around the entire joint. Malformed joints shall be rejected. The interior of all manhole units shall be lined with Agru American HDPE Sure Grip® or equal.

## 2.02 MORTAR

- A. Mortar for manholes shall consist of one part Portland Type II cement, two to three parts fine sand mixed with water for proper consistency. Lime shall not be used in mortar for manholes. Commercially prepared mortar mixes or expanding grout shall not be used. Admixtures to mortar or commercial fast-setting cements shall not be used without approval of the Owner's Engineer.

## 2.03 MANHOLE FRAMES AND COVERS

- A. All frames and covers shall be U.S. Foundry and Manufacturing Corporation #170 with 165 pound cover. All mating surfaces shall be machined for proper fit. Castings are to be cleaned and tar coated. All manhole covers shall have two watertight pick holes. Waterproof sewer guards are required for manholes in drainage pathways and other areas prone to flooding as determined by the County. Manhole covers in paved areas shall be flush with the top of pavement. Manholes in non-paved areas shall be 3 - inches above finished grade. Identification lettering shall be in accordance with the details included on the project drawings.

## PART 3 - EXECUTION

### 3.01 EXCAVATION AND BACKFILL

- A. All excavation, preparation of pipe bedding, and backfill for sewers, sewer connections, manholes and other appurtenances shall be performed in accordance with the requirements of Section 02221 - "Earth Excavation, Backfill, Fill, and Grading for Pipes."

### 3.02 JOINING PIPE TO MANHOLES OR OTHER STRUCTURES

- A. A flexible rubber boot shall be used at the manhole to pipe connection. The boot shall be manufactured of neoprene or isoprene compounds formulated and tested to resist deterioration due to sewage, hydrogen sulfide, oils, fats, greases, petroleum products and by-products. The connection at the manhole wall shall be flexible and water-tight.

1 Any annular space inside the manhole at the connection shall be filled with approved  
2 caulking material or joint filler.

- 3
- 4 B. For manholes greater than or equal to 20 feet deep, all sewer connections to precast  
5 manholes shall be grouted on the interior and on the exterior in addition to the use of  
6 the rubber boot. The interior and exterior of connections to fiberglass manholes  
7 greater than or equal to 20 feet deep shall be glassed in.  
8
- 9 C. No pipe to manhole connections shall occur within 12 inches of a manhole-to-manhole  
10 section joint.

11 3.03 PRECAST MANHOLES

- 12
- 13 A. All slabs or bottom sections shall be installed at a grade that will allow clearance under  
14 the bells of the pipe. All slabs or bottom sections shall be solidly installed on 3/4-inch  
15 bedding stone that has been compacted against firm undisturbed soil. Depth of  
16 bedding stone will be as directed by the Engineer.  
17
- 18 B. The tongue and groove ends of each unit shall be primed with Ram-nek primer and  
19 allowed to dry. Immediately before placing the next unit, the joints shall receive a  
20 coating of Ram-nek. Enough plastic material shall be placed in the joint to squeeze a  
21 bead of excess material out of the joint insuring a completely sealed joint.  
22
- 23 C. The top of the cone shall be set between 2 1/2 inches and 14 1/2 inches below the  
24 bottom of the manhole cover frame. It is the intent of the Specifications to provide a  
25 minimum of 2 1/2 inches to accommodate future grade changes without disturbing the  
26 manhole. Where the distance between the bottom of the manhole cover frame and the  
27 top of the cone is greater than 14 1/2 inches, 12 inch riser units shall be used to bring  
28 the top of the cone to within the limits specified.  
29
- 30 D. On sewers 20-feet and deeper, the interior and exterior annular space between the  
31 sewer pipe and the opening in the manhole shall be grouted with Portland cement  
32 mortar and wiped or collared to insure a watertight joint. Invert channels shall be  
33 formed after the manhole is set by one of the following methods: Build up with brick  
34 and mortar, or lay a full section of sewer pipe through manhole and cut out the top half.  
35 The manhole floor outside of the channels shall be made smooth and sloped toward  
36 the channels on a slope of 2 inches per foot.  
37

38 3.04 DROP MANHOLES

- 39
- 40 A. External drops are required on all manholes where the upper invert is 2-feet or more  
41 above the lowest invert. The upper invert shall not be blocked.  
42
- 43 B. Drop manholes shall be constructed in accordance with details shown on the plans.  
44
- 45

1           C. Special drop manholes may be required at points where force mains connect to gravity  
2           sewers above the flow line of the manhole. The special drop shall be constructed of  
3           standard ductile iron pipe and fittings the same size as the force main.

4

5        3.05 MANHOLE INVERTS

6

7           A. Invert channels shall be constructed smooth and semicircular, conforming to the inside  
8           of adjacent sewer section. The mortared invert channel shall have a steel trowel finish.  
9           Changes in direction of flow shall be made in a smooth curve of as large a radius as  
10          possible. Changes in size and grade shall be made gradually and smoothly.  
11          Whenever possible, inverts shall be formed with a full section of pipe laid through the  
12          manhole and then breaking out the top half. Benches shall be built up solidly with  
13          concrete or brick and mortar and shall be sloping to the invert. All inside drops shall  
14          have a flume construction to channel flow into the invert. All pipe entering the manhole  
15          must be trimmed flush with the walls. All exposed sharp edges of pipe shall be wiped  
16          smooth with mortar.

17

18           B. Manhole inverts and benches shall be constructed at the same profile slope as the  
19          downstream pipe.

20

21           C. Manhole inverts shall be as follows:

22

23           1. Precut PVC half-pipe for flow through manhole; or

24

25           2. Manhole bench constructed of solid clay brick forming an invert the shape of a  
26          half-pipe.

27

28        3.06 ADJUSTMENT OF MANHOLE FRAMES AND COVERS

29

30           A. Existing manhole frames and covers shall be adjusted to pavement grade during road  
31          resurfacing by addition or removal of height adjustment rings. Where required by the  
32          Engineer, height adjustment inserts of continuous rings of a type as directed by the  
33          Engineer shall be installed in the existing frame/cover assembly.

34

35

36

37           END OF SECTION

1 SECTION 03100  
2

3 CONCRETE FORMWORK  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required and design,  
10 install and remove formwork for cast-in-place concrete as shown on the  
11 Drawings and as specified herein.  
12
- 13 B. Secure to forms as required or set for embedment as required, all miscellaneous  
14 metal items, sleeves, reglets, anchor bolts, inserts and other items furnished  
15 under other Sections and required to be cast into concrete.

16 1.02 RELATED WORK  
17

- 18 A. Concrete Reinforcement is included in Section 03200.  
19 B. Concrete Joints and Joint Accessories are included in Section 03250.  
20 C. Cast-in-Place Concrete is included in Section 03300.  
21 D. Concrete Finished are included in Section 03350.  
22 E. Grout is included in Section 03600.

23 1.03 SUBMITTALS  
24

- 25 A. Submit to the Engineer, in accordance with Section 01340, shop drawings and  
26 product data showing materials of construction and details of installation for:  
27
- 28 1. Form release agent  
29 2. Form ties  
30 3. Tapered Ties: Proposed method and products for sealing form tie hole  
31
- 32 B. Samples  
33
- 34 1. Demonstrate to the Engineer on a designated area of the concrete  
35 substructure exterior surface that the form release agent will not  
36 adversely affect concrete surfaces to be painted, coated or otherwise  
37 finished and will not affect the forming materials.  
38
- 39 C. Certificates  
40
- 41 1. Statement of qualification for the formwork designer retained by  
42 Contractor, Formwork designer shall be a professional engineer  
43 registered in the same state as the project site. Designer shall have at a  
44

minimum, five years of experience designing the required formwork and falsework systems.

2. Certify form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

## 1.04 REFERENCE STANDARDS

- A. American Concrete Institute (ACI)
    - 1. ACI 301 - Specifications for Structural Concrete
    - 2. ACI 117 – Specification for Tolerances for Concrete Construction and Materials
  - B. American Plywood Association (APA)
    - 1. Material grades and designations as specified
  - C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.05 QUALITY ASSURANCE

- A. The form liner manufacturer's representative shall be on-site during the initial installation of the form liner to instruct the Contractor on the proper methods of application and use of the liner.

## 1.06 SYSTEM DESCRIPTION

- A. Structural design responsibility: All forms and shoring shall be designed at the Contractor's expense by a professional engineer registered in the State of Florida. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 117 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.
  - B. Architectural Concrete is wall, slab, beam or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water containment structures from the top of walls to 2-ft below the normal water surface in open tanks and basins.

## PART 2 - PRODUCTS

201 GENERAL

- 1           A. The usage of a manufacturer's name and model or catalog number is for the  
2           purpose of establishing the standard of quality and general configurations  
3           desired.  
4

5           **2.02 MATERIALS**  
6

- 7           A. Forms for cast-in-place concrete shall be made of wood, metal, or other  
8           approved material. Construct wood forms of sound lumber or plywood of  
9           suitable dimensions and free from knotholes and loose knots. Where used for  
10          exposed surfaces, dress and match boards. Sand plywood smooth and fit  
11          adjacent panels with tight joints. Metal forms may be used when approved by  
12          the Engineer and shall be of an appropriate type for the class of work involved.  
13          All forms shall be designed and constructed to provide a flat, uniform concrete  
14          surface requiring minimal finishing or repairs.  
15

16           B. Wall Forms  
17

- 18           1. Forms for all exposed exterior and interior concrete walls shall be new  
19           and unused "Plyform" exterior grade plywood panels manufactured in  
20           compliance with the APA and bearing the trademark of that group, or  
21           equal acceptable to the Engineer. Provide B grade or better veneer on  
22           all faces to be placed against concrete during forming. The class of  
23           material and grades of interior plies shall be of sufficient strength and  
24           stiffness to provide a flat, uniform concrete surface requiring minimal  
25           finishing and grinding.  
26
- 27           2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or  
28           caulked with an approved material so that the joint will remain watertight  
29           and will withstand placing pressures without bulging outward or creating  
30           surface patterns.  
31
- 32           3. Circular Structures: Use forms conforming to the circular shape of the  
33           structure. Straight panels may be substitute for circular form provided  
34           panels to not exceed two (2) feet in horizontal width and angular  
35           deflection is no greater than 3 ½ degrees per joint.  
36

37           C. Column Forms  
38

- 39           1. Rectangular columns: as specified for walls.  
40
- 41           2. Circular columns: Fabricated steel or fiber reinforced plastic with bolted  
42           together sections or spirally wound laminated fiber form internally treated  
43           with form release agent for height of columns.  
44
- 45           D. Rustications shall be at the location and shall conform to the details shown on  
46           the Drawings. Moldings for chamfers and rustications shall be milled and planed

smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

E. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non-toxic and free of taste or odor and meet the requirements of NSF/ANSI Standard 61. Form release agent shall be Farm Fresh by Unitex or Engineer approved equal.

F. Concrete surfaces which are to be painted shall be formed with hard plastic finished plywood or a similar material which does not require a form release agent unless the Contractor can substantiate to the satisfaction of the Engineer that the form release agent will not remain on the formed surface after it is stripped.

G. Form Ties

1. Form ties encased in concrete other than those specified herein shall be designed so that after removal of the projecting part no metal shall remain within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a wood or metal cone at least 1/2-in diameter and 1-1/2-in long. Form ties in concrete exposed to view shall be the cone-washer type.
2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.
3. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1-1/2-in and sufficient dimensions to permit proper patching of the tie hole.
4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.
5. Common wire shall not be used for form ties.
6. Alternate form ties consisting of tapered through-bolts at least 1-in in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain Engineer's acceptance of system and spacing of ties prior to

1 ordering or purchase of forming. Clean, fill and seal form tie hole with  
2 non-shrink cement grout. The Contractor shall be responsible for  
3 watertightness of the form ties and any repairs needed.  
4

- 5 H. Bond breakers for precast and tilt-up construction when cast against concrete  
6 shall be a nonstaining, non-residual type, which will provide a positive bond  
7 prevention. Bond breakers shall be Williams Distributors, Inc., Seattle,  
8 WA - Williams Tilt-Up Compound; SCA Construction Supply Division, Superior  
9 Concrete Accessories, Franklin Park, IL - Silcoseal 77 or equal.  
10

11 PART 3 - EXECUTION  
12

13 3.01 GENERAL  
14

- 15 A. Forms shall be used for all cast-in-place concrete including sides of footings.  
16 Forms shall be constructed and placed so that the resulting concrete will be of  
17 the shape, lines, dimensions and appearance indicated on the drawings.  
18
- 19 B. Forms for walls shall have removable panels at the bottom for cleaning,  
20 inspection and joint surface preparation. Forms for walls of considerable height  
21 (15 feet or greater) shall have closable intermediate inspection ports. Tremies  
22 and hoppers for placing concrete shall be used to allow concrete inspection,  
23 prevent segregation and prevent the accumulation of hardened concrete on the  
24 forms above the fresh concrete.  
25
- 26 C. Molding, bevels, or other types of chamfer strips shall be placed to produce  
27 blockouts, rustications, or chamfers as shown on the Drawings or as specified  
28 herein. Chamfer strips shall be provided at horizontal and vertical projecting  
29 corners to produce a 3/4-in chamfer. Rectangular or trapezoidal moldings shall  
30 be placed in locations requiring sealants where specified or shown on the  
31 Drawings. Sizes of moldings shall conform to the sealants manufacturer's  
32 recommendations.  
33
- 34 D. Forms shall be sufficiently rigid to withstand construction loads and vibration  
35 and to prevent displacement or sagging between supports. Construct forms so  
36 that the concrete will not be damaged by their removal. The Contractor shall be  
37 entirely responsible for the adequacy of the forming system.  
38
- 39 E. Before form material is re-used, all surfaces to be in contact with concrete shall  
40 be thoroughly cleaned, all damaged places repaired, all projecting nails  
41 withdrawn and all protrusions smoothed. Reuse of wooden forms for other than  
42 rough finish will be permitted only if a "like new" condition of the form is  
43 maintained.  
44

45 3.02 FORM TOLERANCES  
46

- 1           A. Forms shall be surfaced, designed and constructed in accordance with the  
2           recommendations of ACI 117 and shall meet the following additional  
3           requirements for the specified finishes.
- 4
- 5           B. Formed Surface Exposed to View: Edges of all form panels in contact with  
6           concrete shall be flush within 1/32-in and forms for plane surfaces shall be such  
7           that the concrete will be plane within 1/16-in in 4-ft. Forms shall be tight to  
8           prevent the passage of mortar, water and grout. The maximum deviation of the  
9           finish wall surface at any point shall not exceed 1/4-in from the intended surface  
10          as shown on the Drawings. Form panels shall be arranged symmetrically and  
11          in an orderly manner to minimize the number of seams.
- 12
- 13          C. Formed surfaces not exposed to view or buried shall meet requirements of  
14          Class "C" Surface in ACI 117.
- 15
- 16          D. Formed rough surfaces including mass concrete, pipe encasement, electrical  
17          duct encasement and other similar installations shall have no minimum  
18          requirements for surface smoothness and surface deflections. The overall  
19          dimensions of the concrete shall be plus or minus 1-in.
- 20
- 21          E. Formed concrete Surfaces to Receive Paint: Surface deflections shall be  
22          limited to 1/32-in at any point and the variation in wall deflection shall not exceed  
23          1/16-in per 4-ft. The maximum deviation of the finish wall surface at any point  
24          shall not exceed 1/4-in from the intended surface as shown on the Drawings.
- 25

26          **3.03 FORM PREPARATION**

27

- 28           A. Wood forms in contact with the concrete shall be coated with an effective  
29           release agent prior to form installation.
- 30
- 31           B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous  
32           deposits shall be sandblasted or otherwise removed from the contact surface  
33           for all forms, except those utilized for surfaces receiving a rough finish. All forms  
34           shall have the contact surfaces coated with a release agent.
- 35

36          **3.04 REMOVAL OF FORMS**

37

- 38           A. The Contractor shall be responsible for all damage resulting from removal of  
39           forms. Forms and shoring for structural slabs or beams shall remain in place in  
40           accordance with ACI 301 and ACI 117. Form removal shall conform to the  
41           requirements specified in Section 03300 including curing requirements
- 42
- 43           B. Repair all damages resulting from removal of forms.
- 44

- C. Clean, fill and seal form tie hole with non-shrink cement grout. The Contractor shall be responsible for the watertightness of the form ties holes and any repair necessary to maintain watertightness of tie holes.

### **3.05 INSPECTION**

- A. The Engineer shall be notified when the forms are complete and ready for inspection at least 6 hours prior to the proposed concrete placement.
  - B. Failure of the forms to comply with the requirements specified herein or to produce concrete complying with requirements of this Section shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

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1 SECTION 03200  
2

3 CONCRETE REINFORCEMENT  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required and install all  
10 concrete reinforcement complete as shown on the Drawings and as specified  
11 herein.

12 1.02 RELATED WORK  
13

- 14 A. Concrete Formwork is included in Section 03100.  
15  
16 B. Concrete Joint and Joint Accessories are included in Section 03250.  
17  
18 C. Cast-in-place Concrete is included in Section 03300.  
19  
20 D. Grout is included in Section 03600.

21 1.03 SUBMITTALS  
22

- 23 A. Submit to the Engineer, in accordance with Sections 01300 and 01340, shop  
24 drawings and product data showing materials of construction and details of  
25 installation for all cast-in-place concrete tanks, retaining walls, building stem  
26 walls, wall sections, and slabs  
27  
28 1. Reinforcing steel: Placement drawings shall conform to the  
29 recommendations of the CRSI Manual of Standard Practice and ACI SP-  
30 66. All reinforcement in a concrete placement shall be included on a  
31 single placement drawing or cross referenced to the pertinent main  
32 placement drawing. The main drawing shall include the additional  
33 reinforcement (around openings, at corners, etc) shown on the standard  
34 detail sheets. Bars to have special coatings and/or to be of special steel  
35 or special yield strength are to be clearly identified.  
36  
37 2. All splice and joint locations shall be indicated on placement drawings.  
38 Splice lengths shall be clearly dimensioned.  
39  
40 3. Reinforcement cover shall be clearly indicated.  
41  
42 4. Submit reinforcement shop drawing for each structure as a complete  
43 package. Submittal showing portions of a structure will not be  
44 acceptable, unless acceptable by Engineer in advance.

- 1           5. Submittals consisting of schedules without accompanying placement  
2           drawings will not be acceptable, unless acceptable by Engineer in  
3           advance.  
4  
5           6. Bar bending details: The bars shall be referenced to the same  
6           identification marks shown on the placement drawings. Schedules shall  
7           be located on the same sheet where the bar mark is referenced. Bars to  
8           have special coatings and/or to be of special steel or special yield  
9           strength shall be clearly identified.  
10  
11          7. Schedule of all placements to contain synthetic reinforcing fibers. The  
12           amount of fibers per cubic yard to be used for each of the placements  
13           shall be noted on the schedule. The name of the manufacturer of the  
14           fibers and the product data shall be included with the submittal.  
15  
16

17          B. Test Reports:

- 18  
19          1. Certified copy of mill test on each steel proposed for use showing the  
20           physical properties of the steel and the chemical analysis.  
21  
22          2. Mechanical Reinforcing Bar Couplers. Current Evaluation Report  
23           prepared by ICC-ES or by other approved testing agency.

24          C. Certificates

- 25  
26          1. Welder's certification. The certification shall be in accordance with AWS  
27           D1.4 when welding of reinforcement is required.  
28  
29          2. Weld Procedures. Provide procedure for each type of welded reinforcing  
30           splice in accordance with AWS D1.4 when welding of reinforcing is  
31           required.  
32  
33

34          1.04 REFERENCE STANDARDS

35          A. American Society for Testing and Materials (ASTM)

- 36  
37          1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete  
38           Reinforcement.  
39  
40          2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar  
41           Mats for Concrete Reinforcement.  
42  
43          3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain,  
44           for Concrete Reinforcement  
45  
46

- 1           4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for  
2           Concrete Reinforcement
- 3           5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric,  
4           Deformed, for Concrete Reinforcement
- 5           6. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel  
6           Bars for Concrete Reinforcement
- 7           7. ASTM A616 - Standard Specification for Rail-Steel Deformed and Plain  
8           Bars for Concrete Reinforcement
- 9           8. ASTM A617 - Standard Specification for Axle-Steel Deformed and Plain  
10          Bars for Concrete Reinforcement
- 11          9. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and  
12          Plain Bars for Concrete Reinforcement.
- 13          10. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel  
14          Bars for Concrete Reinforcement
- 15          11. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel  
16          Bars.
- 17          12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and  
18          Welded Wire Fabric for Reinforcement.
- 19          13. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated  
20          Steel Reinforcing Bars.
- 21          B. American Concrete Institute (ACI)
- 22           1. ACI 301 - Standard Specification for Structural Concrete
- 23           2. ACI SP-66 - ACI Detailing Manual
- 24          C. Concrete Reinforcing Steel Institute (CRSI)
- 25           1. Manual of Standard Practice
- 26          D. American Welding Society (AWS)
- 27           1. AWS D1.4 - Structural Welding Code Reinforcing Steel
- 28          E. Where reference is made to one of the above standards, the revision in effect  
29          at the time of bid opening shall apply.

1   1.05 QUALITY ASSURANCE

- 2
- 3   A. Provide services of a manufacturer's representative, with at least 2 years'  
4   experience in the use of the reinforcing fibers for a preconstruction meeting and  
5   assistance during the first placement of the material.

6

7   1.06 DELIVERY, HANDLING AND STORAGE

- 8
- 9   A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or  
10   other foreign matter.
- 11
- 12   B. Reinforcing steel shall be shipped and stored with bars of the same size and  
13   shape fastened in bundles with durable tags, marked in a legible manner with  
14   waterproof markings showing the same "mark" designations as those shown on  
15   the submitted Placing Drawings.
- 16
- 17   C. Reinforcing steel shall be stored off the ground, protected from moisture and  
18   kept free from dirt, oil, or other injurious contaminants.

19

20   PART 2 - PRODUCTS

21

22   2.01 MATERIALS

- 23
- 24   A. Materials shall be new, of domestic manufacture and shall comply with the  
25   following material specifications.
- 26
- 27   B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- 28
- 29   C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM  
30   A706.
- 31
- 32   D. Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.
- 33
- 34   E. Welded Deformed Steel Wire Fabric: ASTM A497.
- 35
- 36   F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.
- 37
- 38   G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60  
39   deformed bars.
- 40
- 41   H. Reinforcing Steel Accessories
- 42
- 43   1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class  
44   1 - Maximum Protection.

1           2. Stainless Steel Protected Bar Supports: CRSI Bar Support  
2           Specifications, Class 2 - Moderate Protection.

3           4. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications,  
4           Precast Blocks. Blocks shall have equal or greater strength than the  
5           surrounding concrete.

6           7. Steel Protected Bar Supports: #4 Steel chairs with plastic or rubber tips.

8           9.  
10          I. Tie Wire

11         1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black  
12         annealed wire.

13         J. Mechanical Reinforcing Bar Couplers

14         1. General : Use only at locations indicated on the Drawings or where  
15         written approval has been obtained from the Engineer.

16         2. Mechanical reinforcing steel butt splices shall be positive connecting  
17         taper threaded type employing a hexagonal coupler such as Lenton rebar  
18         splices as manufactured by Erico Products Inc., Solon, OH or equal.  
19         They shall meet all ACI 318 Building Code requirements. Bar ends must  
20         be taper threaded with coupler manufacturer's bar threader to ensure  
21         proper taper and thread engagement.

22         3. Bar couplers shall be torqued to manufacturer's recommended value.

23         4. Unless otherwise noted on the Drawings, mechanical tension splices  
24         shall be designed to produce a splice strength in tension or compression  
25         of not less than 125 percent of the ASTM specified minimum yield  
26         strength of the rebar.

27         5. Compression type mechanical splices shall provide concentric bearing  
28         from one bar to the other bar and shall be capable of developing the  
29         ultimate strength of the rebar in compression.

30         6. Form saver type mechanical couplers shall have flanges with nailing  
31         holes to positively attach coupler to formwork.

32         K. Fiber Reinforcement

33         Synthetic reinforcing fiber for concrete shall be 100 percent polypropylene  
34         collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic  
35         Industries Inc., Chattanooga, TN - Fibermesh or equal. Fiber length and

1 quantity for the concrete mix shall be in strict compliance with the  
2 manufacturer's recommendations as approved by the Engineer.  
3

4 2.02 FABRICATION  
5

- 6 A. Fabrication of reinforcement shall be in compliance with the CRSI Manual of  
7 Standard Practice and ACI SP-66.  
8  
9 B. Bars shall be cold bent. Bars shall not be straightened or rebent.  
10  
11 C. Bars shall be bent around a revolving collar having a diameter of not less than  
12 that recommended by the ACI SP-66.  
13  
14 D. Bar ends that are to be butt spliced, placed through limited diameter holes in  
15 metal, or threaded, shall have the applicable end(s) saw-cut. Such ends shall  
16 terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the  
17 bar.  
18

19 PART 3 - EXECUTION  
20

21 3.01 INSTALLATION  
22

- 23 A. Surface condition, bending, spacing and tolerances of placement of  
24 reinforcement shall comply with the CRSI Manual of Standard Practice and ACI  
25 SP-66. The Contractor shall be solely responsible for providing an adequate  
26 number of bars and maintaining the spacing and clearances shown on the  
27 Drawings.  
28  
29 B. Except as otherwise indicated on the Drawings, the minimum concrete cover of  
30 reinforcement shall be as follows:  
31  
32 1. Concrete cast against and permanently exposed to earth: 3-in  
33  
34 2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2-inch  
35 (including bottom cover of slabs over water or sewage)  
36  
37 3. Concrete not exposed to soil, water, sewage, sludge and/or weather:  
38  
39 a. Slabs (top and bottom cover), walls, joists, shells and folded plate  
40 members - 1-inch  
41  
42 b. Beams and columns (principal reinforcement, ties, spirals and  
43 stirrups) - 1-1/2-inch  
44  
45 C. Reinforcement which will be exposed for a considerable length of time after  
46 being placed shall be coated with a heavy coat of neat cement slurry.

- 1           D. No reinforcing steel bars shall be welded either during fabrication or erection  
2           unless specifically shown on the Drawings or specified herein, or unless prior  
3           written approval has been obtained from the Engineer. All bars that have been  
4           welded, including tack welds, without such approval shall be immediately  
5           removed from the work. When welding of reinforcement is approved or called  
6           for, it shall comply with AWS D1.4.
- 7
- 8           E. Reinforcing steel interfering with the location of other reinforcing steel, conduits  
9           or embedded items, may be moved within the specified tolerances or one bar  
10          diameter, whichever is greater. Greater displacement of bars to avoid  
11          interference, shall only be made with the approval of the Engineer. Do not cut  
12          reinforcement to install inserts, conduits, mechanical openings or other items  
13          without the prior approval of the Engineer.
- 14
- 15          F. Securely support and tie reinforcing steel to prevent movement during concrete  
16          placement. Secure dowels in place before placing concrete.
- 17
- 18          G. Reinforcing steel bars shall not be field bent except where shown on the  
19          Drawings or specifically authorized in writing by the Engineer. If authorized,  
20          bars shall be cold-bent around the standard diameter spool specified in the  
21          CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the  
22          reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed  
23          by the Engineer. Do not bend reinforcement after it is embedded in concrete  
24          unless specifically shown otherwise on the Drawings.
- 25

26

### 27        3.02 REINFORCEMENT AROUND OPENINGS

28

- 29          A. Unless specific additional reinforcement around openings is shown on the  
30          Drawings, provide additional reinforcing steel on each side of the opening  
31          equivalent to one half of the cross-sectional area of the reinforcing steel  
32          interrupted by an opening. The bars shall have sufficient length to develop bond  
33          at each end beyond the opening or penetration.

34

### 35        3.03 SPLICING OF REINFORCEMENT

36

- 37          A. Splices designated as compression splices on the Drawings, unless otherwise  
38          noted, shall be 30 bar diameters, but not less than 12-in. The lap splice length  
39          for column vertical bars shall be based on the bar size in the column above.
- 40          B. Tension lap splices shall be provided at all laps in compliance with ACI SP-66.  
41          Splices in adjacent bars shall be staggered. Class A splices may be used when  
42          50 percent or less of the bars are spliced within the required lap length. Class  
43          B splices shall be used at all other locations.
- 44
- 45

- 1           C. Except as otherwise indicated on the Drawings, splices in circumferential  
2           reinforcement in circular walls shall be Class B tension splices and shall be  
3           staggered. Adjacent bars shall not be spliced within the required lap length.  
4
- 5           D. Splicing of reinforcing steel in concrete elements noted to be "tension members"  
6           on the Drawings shall be avoided whenever possible. However, if required for  
7           constructability, splices in the reinforcement subject to direct tension shall be  
8           welded to develop, in tension, at least 125 percent of the specified yield strength  
9           of the bar. Splices in adjacent bars shall be offset the distance of a Class B  
10          splice.
- 11
- 12          E. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall  
13          be rolled flat and firmly held in place. Splices in welded wire fabric shall be  
14          lapped in accordance with the requirements of ACI SP-66 but not less than  
15          12-in. The spliced fabrics shall be tied together with wire ties spaced not more  
16          than 24-in on center and laced with wire of the same diameter as the welded  
17          wire fabric. Do not position laps midway between supporting beams, or directly  
18          over beams of continuous structures. Offset splices in adjacent widths to  
19          prevent continuous splices.
- 20
- 21          F. Mechanical reinforcing steel splicers shall be used only where shown on the  
22          Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters.  
23          Mechanical reinforcing splices are only to be used for special splice and dowel  
24          conditions approved by the Engineer.

25

26         **3.04 ACCESSORIES**

27

- 28          A. Determine, provide and install accessories such as chairs, chair bars and the  
29          like in sufficient quantities and strength to adequately support the reinforcement  
30          and prevent its displacement during the erection of the reinforcement and the  
31          placement of concrete.
- 32
- 33          B. Use precast concrete blocks where the reinforcing steel is to be supported over  
34          soil.
- 35
- 36          C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used  
37          where the chairs are set on forms for a concrete surface that will be exposed to  
38          weather, high humidity, or liquid (including bottom of slabs over liquid containing  
39          areas). Use of galvanized or plastic tipped metal chairs is permissible in all  
40          other locations unless otherwise noted on the Drawings or specified herein.
- 41
- 42          D. Alternate methods of supporting top steel in slabs, such as steel channels  
43          supported on the bottom steel or vertical reinforcing steel fastened to the bottom  
44          and top mats, may be used if approved by the Engineer.
- 45
- 46

1   3.05 INSPECTION  
2

3           A. In no case shall any reinforcing steel be covered with concrete until the  
4           installation of the reinforcement, including the size, spacing and position of the  
5           reinforcement has been observed by the Engineer and the Engineer's release  
6           to proceed with the concreting has been obtained. The Engineer shall be given  
7           ample prior notice of the readiness of placed reinforcement for observation. The  
8           forms shall be kept open until the Engineer has finished his/her observations of  
9           the reinforcing steel.

10  
11  
12

END OF SECTION

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1 SECTION 03250  
2

3 CONCRETE JOINTS AND JOINT ACCESSORIES  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. Furnish all labor, materials, equipment and incidentals required and install  
10 accessories for concrete joints as shown on the Drawings and as specified  
11 herein.  
12

13 1.02 RELATED WORK  
14

- 15 A. Concrete Formwork is included in Section 03100.  
16  
17 B. Concrete Reinforcement is included in Section 03200.  
18  
19 C. Cast-In-Place Concrete is included in Section 03300.  
20  
21 D. Concrete Finishes are included in Section 03350.  
22  
23 E. Grout is included in Section 03600.  
24  
25 F. Miscellaneous Metals are included in Section 05500.  
26

27 1.03 SUBMITTALS  
28

- 29 A. Submit to the Engineer, in accordance with Section 01340, shop drawings and  
30 product data. Submittals shall include at least the following:  
31  
32 1. Standard Waterstops: Product data including catalogue cut, technical  
33 data, storage requirements, splicing methods and conformity to ASTM  
34 standards.  
35  
36 2. Special Waterstops: Product data including catalogue cut, technical  
37 data, location of use, storage requirements, splicing methods,  
38 installation instructions and conformity to ASTM standards.  
39  
40 3. Premolded joint fillers: Product data including catalogue cut, technical  
41 data, storage requirements, installation requirements, location of use  
42 and conformity to ASTM standards.  
43  
44 4. Bond breaker: Product data including catalogue cut, technical data,  
45 storage requirements, installation requirements, location of use and  
46 conformity to ASTM standards.

- 1
- 2       5. Expansion joint dowels: Product data on the complete assembly  
3           including dowels, coatings, lubricants, spacers, sleeves, expansion  
4           caps, installation requirements and conformity to ASTM standards.
- 5
- 6       6. Compressible joint filler: Product data including catalogue cut, technical  
7           data, storage requirements, installation requirements, location of use  
8           and conformity to ASTM standards.
- 9
- 10      7. Bonding agents: Product data including catalogue cut, technical data,  
11           storage requirements, product life, application requirements and  
12           conformity to ASTM standards.
- 13

14      B. Certifications

15

- 16       1. Certification that all materials used within the joint system are  
17           compatible with each other.
- 18       2. Certification that materials used in the construction of joints are suitable  
19           for use in contact with potable water 30 days after installation.
- 20

21      1.04 REFERENCE STANDARDS

22

23      A. American Society for Testing and Materials (ASTM)

24

- 25       1. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-  
26           Wrought, Special Quality, Mechanical Properties
- 27
- 28       2. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding  
29           Systems for Concrete
- 30
- 31       3. ASTM C1059 - Standard Specification for Latex Agents for Bonding  
32           Fresh to Hardened Concrete
- 33
- 34       4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
- 35
- 36       5. ASTM D624 - Standard Test Method for Tear Strength of Conventional  
37           Vulcanized Rubber and Thermoplastic Elastomers.
- 38
- 39       6. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- 40
- 41       7. ASTM D746 - Standard Test Method for Brittleness Temperature of  
42           Plastics and Elastomers by Impact.
- 43
- 44       8. ASTM D747 - Standard Test Method for Apparent Bending Modulus of  
45           Plastics by Means of a Cantilever Beam.
- 46

- 1           9. ASTM D792 - Standard Test Methods for Density and Specific Gravity  
2           (Relative Density) of Plastics by Displacement.
- 3           10. ASTM D1751 - Standard Specification for Preformed Expansion Joint  
4           Fillers for Concrete Paving and Structural Construction. (Nonextruding  
5           and Resilient Bituminous Types)
- 6           11. ASTM D1752 - Standard Specification for Preformed Sponge Rubber  
7           and Cork Expansion Joint Fillers for Concrete Paving and Structural  
8           Construction.
- 9           B. U.S. Army Corps of Engineers (CRD).
- 10           1. CRD C572 - Specification for Polyvinylchloride Waterstops
- 11           C. Federal Specifications
- 12           1. FS SS-S-210A - Sealing Compound for Expansion Joints
- 13           D. Where reference is made to one of the above standards, the revision in effect  
14           at the time of bid opening shall apply.

15           PART 2 - PRODUCTS

16           2.01 GENERAL

- 17           A. The use of manufacturer's name and model or catalog number is for the  
18           purpose of establishing the standard of quality and general configuration  
19           desired.
- 20           B. All materials used together in a given joint (bond breakers, backer rods, joint  
21           fillers, sealants, etc) shall be compatible with one another. Coordinate  
22           selection of suppliers and products to ensure compatibility. Under no  
23           circumstances shall asphaltic bond breakers or joint fillers be used in joints  
24           receiving sealant.
- 25           C. All chemical sealant type waterstops shall be products specifically  
26           manufactured for the purpose for which they will be used and the products  
27           shall have been successfully used on similar structures for more than five  
28           years.

29           2.02 MATERIALS

- 30           A. Standard Waterstops

1           1. PVC Waterstops: The waterstop shall be made by extruding  
2           elastomeric plastic compound with virgin polyvinylchloride as the basic  
3           resins. The compound shall contain no reprocessed materials.  
4           Minimum tensile strength of waterstop shall be 1750 psi. The waterstop  
5           shall conform to CRD C572. The waterstop shall be Greenstreak  
6           Group, Inc. model No. 679 or approved equal for construction joints.  
7           The waterstop shall be Greenstreak Group Inc. model No.732 or  
8           approved equal for control joints and Greenstreak Group Inc. Model No.  
9           738 for expansion joints. Provide grommets or pre-punched holes  
10          spaced at 12 inches on center along length of waterstop.

11           12         2. Factory Fabrications: Provide factory made waterstop fabrications for all  
13          changes of direction, transitions, and intersections, leaving only straight  
14          butt joints of sufficient length for splicing in the field.

15           16         B. Special Waterstops

17           18         1. Retrofit PVC Waterstop - The waterstop shall be made by extruding  
19           elastomeric plastic compound with virgin polyvinylchloride as the basic  
20           resins. The compound shall contain no reprocessed materials.  
21           Minimum tensile strength of waterstop shall be 1750 psi. The waterstop  
22           shall conform to CRD-C572. Waterstops shall be style 667 by Sika  
23           Greenstreak or equal.

24           25         2. Preformed adhesive waterstops - The waterstop shall be a rope type  
26           preformed plastic waterstop meeting the requirements of Federal  
27           Specification SS-S-210A. The rope shall have a cross-section of  
28           approximately one square inch unless otherwise specified or shown on  
29           the Drawings. The waterstop shall be Synko-Flex waterstop as  
30           manufactured by Henry Company Lockstop by Sika Greenstreak or  
31           equal. Primer for the material shall be as recommended by the  
32           waterstop manufacturer.

33           34         C. Expansion Joint Material

35           36         1. Joint Material at Structures - Self-expanding cork, premolded joint filler  
37           shall conform to ASTM D1752, Type III. The thickness shall be 3/4-in  
38           unless shown otherwise on the Drawings.

39           40         2. Joint Material at sidewalk and roadway concrete pavements or where  
41           fiber joint filler is specifically noted on the Drawings. The joint filler shall  
42           be asphalt-impregnated fiber board conforming to ASTM D1751.  
43           Thickness shall be 3/4-in unless otherwise shown on the Drawings.

44           45         D. Bond Breaker

- 1           1. Bond breaker tape shall be an adhesive-backed glazed butyl or  
2           polyethylene tape which will satisfactorily adhere to the premolded joint  
3           filler or concrete surface as required. The tape shall be the same width  
4           as the joint.  
5  
6           2. Except where tape is specifically called for on the drawings, bond  
7           breaker for concrete shall be either bond breaker tape or a nonstaining  
8           type bond prevention coating such as Maxi-Tilt with Dye by Dayton  
9           Superior, Inc.; Silcoseal 77, by SCA Construction Supply Division,  
10          Superior Concrete Accessories or equal.

11          E. Expansion Joint Dowels

- 12          1. Dowels shall be smooth steel conforming to ASTM A675, Grade 70.  
13          Dowels must be straight and clean, free of loose flaky rust and loose  
14          scale. Dowels may be sheared to length provided deformation from  
15          true shape caused by shearing does not exceed 0.04-in on the  
16          diameter of the dowel and extends no more than 0.04-in from the end.  
17          Bars shall be coated with a bond breaker on the expansion end of the  
18          dowel. Expansion caps shall be provided on the expansion end. Caps  
19          shall allow for at least 1-1/2-in of expansion.  
20  
21          2. Dowel Bar Sleeves: Provide two component Speed Dowel System by  
22          Sika, to accept 1" diameter x 12" long slip dowels. Speed Dowel  
23          System is comprised of a reusable base and a plastic sleeve. Both  
24          pieces shall be manufactured from polypropylene plastic.  
25  
26

27          F. Bonding Agent

- 28          1. Epoxy bonding agent shall be a two-component, solvent-free, moisture  
29          insensitive, epoxy resin material conforming to ASTM C881, Type II.  
30          The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of  
31          Lyndhurst, N.J.; MasterEmaco ADH 326 by BASF or equal. Acrylic  
32          may be used if approved by the Engineer.  
33  
34

35          G. Compressible Joint Filler

- 36          1. The joint filler shall be a non-extruded watertight strip material use to fill  
37          expansion joints between structures. The material shall be capable of  
38          being compressed at least 40 percent for 70 hours at 68 degrees F and  
39          subsequently recovering at least 20 percent of its original thickness in  
40          the first 1/2 hour after unloading. Compressible Joint filler shall be  
41          Wabo®Evasote by BASF, Inc., Ravana, NY or equal.  
42  
43          2. The Joint sealant shall be a 1-component, polyurethane-based non-sag  
44          elastomeric sealant. Joint sealant shall be Sikaflex-1a or equal.  
45  
46

1  
2 PART 3 - EXECUTION  
3

4 3.01 INSTALLATION  
5

6 A. Standard Waterstops  
7

- 8       1. Install waterstops for all joints where indicated on the Drawings.  
9       Waterstops shall be continuous around all corners and intersections so  
10      that a continuous seal is provided. Provide factory made waterstop  
11      fabrications for all changes in direction, intersections and transitions  
12      leaving only straight butt joints splices for the field.
- 13       2. Horizontal waterstops in slabs shall be clamped in position by the  
14      bulkhead (unless previously set in concrete).
- 15       3. Waterstops shall be installed so that half of the width will be embedded  
16      on each side of the joint. Care shall be exercised to ensure that the  
17      waterstop is completely embedded in void-free concrete. All waterstops  
18      shall be tied to reinforcement with reinforcement tie wire through the  
19      factory provided grommets.
- 20       4. Waterstops shall be terminated 3-in below the exposed top of walls.  
21      Expansion joint waterstop center bulbs shall be plugged with foam  
22      rubber, 1-in deep, at point of termination.

23 B. Special Waterstops  
24

- 25       1. Install special waterstops at joints where specifically noted on the  
26      Drawings. Waterstops shall be continuous around all corners and  
27      intersections so that a continuous seal is provided. Provide factory  
28      made waterstop fabrications for all changes in direction, intersections,  
29      and transitions leaving only straight butt joint splices for the field.
- 30       2. Each piece of the waterstop shall be of maximum practicable length to  
31      provide a minimum number of connections or splices. Connections and  
32      splices shall conform to the manufacturer's recommendations and as  
33      specified herein.
- 34       3. Waterstops shall be terminated 3-in below the exposed top of walls.
- 35       4. PVC base seal waterstops shall be spliced as specified for PVC  
36      standard waterstops. Base seals for expansion joints shall set on  
37      concrete sleeper beams, not less than 24-in wide, and the beam  
38      covered with two layers of sheet material such as vapor barrier  
39      material. The seal shall not be fastened by nails but firmly held in  
40      position by the bulkhead form. Base seals at non-expansion joints may  
41      be omitted.  
42  
43 CONCRETE JOINTS AND JOINT ACCESSORIES

1                   be set on vapor barrier material that extends at least two feet on each  
2                   side of the joint.

3  
4                   C. Construction Joints

- 5  
6                   1. Make construction joints only at locations shown on the Drawings or as  
7                   approved by the Engineer. Any additional or relocation of construction  
8                   joints proposed by the Contractor, must be submitted to the Engineer  
9                   for written approval.
- 10  
11                  2. Additional or relocated joints should be located where they least impair  
12                  strength of the member. In general, locate joints within the middle third  
13                  of spans of slabs, beams and girders. However, if a beam intersects a  
14                  girder at the joint, offset the joint a distance equal to twice the width of  
15                  the member being connected. Locate joints in walls and columns at the  
16                  underside of floors, slabs, beams or girders and at tops of footings or  
17                  floor slabs. Do not locate joints between beams, girders, column  
18                  capitals, or drop panels and the slabs above them. Do not locate joints  
19                  between brackets or haunches and walls or columns supporting them.
- 20  
21                  3. All joints shall be perpendicular to main reinforcement. Continue  
22                  reinforcing steel through the joint as indicated on the Drawings. When  
23                  joints in beams are allowed, provide a shear key and inclined dowels as  
24                  approved by the Engineer.
- 25  
26                  4. Provide sealant grooves for joint sealant where indicated on the  
27                  Drawings.
- 28  
29                  5. At all construction joints and at concrete joints designated on the  
30                  Drawings to be "roughened", uniformly roughen the surface of the  
31                  concrete to a full amplitude (distance between high and low points or  
32                  side to side) of approximately 1/4-in to expose a fresh face. Thoroughly  
33                  clean joint surfaces of loose or weakened materials by waterblasting or  
34                  sandblasting and prepare for bonding. At least 2 hours before and  
35                  again shortly before the new concrete is deposited, the joints and  
36                  adjacent concrete surfaces to at least 12-in past the joint shall be  
37                  saturated with water. After glistening water disappears, the joints shall  
38                  be given a thorough coating of neat cement slurry mixed to the  
39                  consistency of very heavy paste. The surfaces shall receive a coating  
40                  at least 1/8-in thick, well scrubbed-in by means of stiff bristle brushes  
41                  whenever possible. Horizontal wall joints with no access to the earlier  
42                  concrete placement surface shall have the roughened surface  
43                  thoroughly coated with a neat cement slurry of pouring consistency.  
44                  New concrete shall be deposited before the neat cement dries.
- 45

- 1           6. In lieu of the above method for bonding plastic concrete to hardened  
2           concrete, the following optional method may be used. Concrete must  
3           be allowed to set a minimum of 28 days. Use an epoxy bonding agent  
4           applied to roughened and cleaned surfaces of set concrete in strict  
5           accordance with manufacturer's recommendations [and as specified in  
6           Section 03740 with respect to preparation of surfaces and applications  
7           of bonding agent].  
8
- 9           7. Provide waterstops in all wall and slab construction joints in liquid  
10          containment structures and at other locations shown on the Drawings.  
11
- 12          8. Keyways shall not be used in construction joints unless specifically  
13          shown on the Drawings or approved by the Engineer.

14           D. Expansion Joints

- 15           1. Do not extend through expansion joints, reinforcement or other  
16           embedded metal items that are continuously bonded to concrete on  
17           each side of joint.  
18
- 19           2. Position premolded joint filler material accurately. Secure the joint filler  
20           against displacement during concrete placement and compaction.  
21           Place joint filler over the face of the joint, allowing for sealant grooves  
22           as detailed on the Drawings. Tape all joint filler splices to prevent  
23           intrusion of mortar. Seal expansion joints as shown on the Drawings.  
24
- 25           3. Expansion joints shall be 3/4-in in width unless otherwise noted on the  
26           Drawings.  
27
- 28           4. Where indicated on Drawings, install smooth dowels at right angles to  
29           expansion joints. Align dowels accurately with finished surface. Rigidly  
30           hold in place and support during concrete placement. Unless otherwise  
31           shown on the Drawings, apply oil or grease to one end of all dowels  
32           through expansion joints. Provide plastic expansion caps on the  
33           lubricated ends of expansion dowels.  
34
- 35           5. Provide center bulb type waterstops in all wall and slab expansion joints  
36           in liquid containment structures and at other locations shown on the  
37           Drawings.  
38

39           E. Control Joints

- 40           1. Provide sealant grooves, sealants and waterstops at control joints in  
41           slabs on grade or walls as detailed. Provide waterstops at all wall and  
42           slab control joints in water containment structures and at other locations  
43           shown on the Drawings.  
44

- 1
2. Control joints may be sawed if specifically approved by the Engineer. If  
3 control joint grooves are sawed, properly time the saw cutting with the  
4 time of the concrete set. Start cutting as soon as concrete has  
5 hardened sufficiently to prevent aggregates from being dislodged by the  
6 saw. Complete cutting before shrinkage stresses have developed  
7 sufficiently to induce cracking. No reinforcing shall be cut during  
8 sawcutting.
- 9
- 10 3. Extend every other bar of reinforcing steel through control joints or as  
11 indicated on the Drawings. Where specifically noted on the Drawings,  
12 coat the concrete surface with a bond breaker prior to placing new  
13 concrete against it. Avoid coating reinforcement or waterstops with  
14 bond breaker at these locations.

15 END OF SECTION  
16  
17

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1 SECTION 03300  
2

3 CAST-IN-PLACE CONCRETE  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor and materials required and install cast-in-place concrete  
10      complete as shown on the Drawings and as specified herein.  
11

12 1.02 RELATED WORK  
13

- 14       A. Concrete Formwork is included in Section 03100.  
15  
16       B. Concrete Reinforcement is included in Section 03200.  
17  
18       C. Concrete Joints and Joint Accessories are included in Section 03250.  
19  
20       D. Concrete Finishes are included in Section 03350.  
21  
22       E. Grout is included in Section 03600.  
23

24 1.03 SUBMITTALS  
25

- 26       A. Submit to the Engineer, in accordance with Sections 01300 and 01340, shop  
27      drawings and product data including the following:  
28  
29           1. Sources of cement, pozzolan and aggregates.  
30  
31           2. Material Safety Data Sheets (MSDS) for all concrete components and  
32      admixtures.  
33  
34           3. Air-entraining admixture. Product data including catalogue cut,  
35      technical data, storage requirements, product life, recommended  
36      dosage, temperature considerations and conformity to ASTM  
37      standards.  
38  
39           4. Water-reducing admixture. Product data including catalogue cut,  
40      technical data, storage requirements, product life, recommended  
41      dosage, temperature considerations and conformity to ASTM  
42      standards.  
43  
44           5. High-range water-reducing admixture (plasticizer). Product data  
45      including catalogue cut, technical data, storage requirements, product  
46      life, recommended dosage, temperature considerations, retarding

1 effect, slump range and conformity to ASTM standards. Identify  
2 proposed locations of use.  
3

4 6. Concrete mix for each formulation of concrete proposed for use  
5 including constituent quantities per cubic yard, water-cementitious  
6 materials ratio, concrete slump, type and manufacturer of cement.  
7 Provide either a. or b. below for each mix proposed.

8 a. Standard deviation data for each proposed concrete mix based  
9 on statistical records.  
10

11 b. The curve of water-cementitious materials ratio versus concrete  
12 cylinder strength for each formulation of concrete proposed  
13 based on laboratory tests. The cylinder strength shall be the  
14 average of the 28 day cylinder strength test results for each mix.  
15 Provide results of 7 and 14 day tests if available.  
16

17 7. Sheet curing material. Product data including catalogue cut, technical  
18 data and conformity to ASTM standard.  
19

20 8. Liquid curing compound. Product data including catalogue cut,  
21 technical data, storage requirements, product life, application rate and  
22 conformity to ASTM standards. Identify proposed locations of use.  
23

24 B. Samples  
25

26 1. Fine and coarse aggregates if requested by the Engineer.  
27

28 C. Test Reports  
29

30 1. Fine aggregates - sieve analysis, physical properties, and deleterious  
31 substance.  
32

33 2. Coarse aggregates - sieve analysis, physical properties, and  
34 deleterious substances.  
35

36 3. Cements - chemical analysis and physical properties for each type.  
37

38 4. Pozzolans - chemical analysis and physical properties.  
39

40 5. Proposed concrete mixes - compressive strength, slump and air  
41 content.  
42

43 D. Certifications  
44

45 1. Certify admixtures used in the same concrete mix are compatible with  
46 each other and the aggregates.  
47

- 1  
2       2. Certify admixtures are suitable for use in contact with potable water  
3                  after 30 days of concrete curing.  
4  
5       3. Certify curing compound is suitable for use in contact with potable water  
6                  after 30 days (non-toxic and free of taste or odor).  
7

8       1.04 REFERENCE STANDARDS  
9

10      A. American Society for Testing and Materials (ASTM)  
11

- 12       1. ASTM C31 - Standard Practice for Making and Curing Concrete Test  
13                  Specimens in the Field.  
14  
15       2. ASTM C33 - Standard Specification for Concrete Aggregates.  
16  
17       3. ASTM C39 - Standard Test Method for Compressive Strength of  
18                  Cylindrical Concrete Specimens.  
19  
20       4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled  
21                  Cores and Sawed Beams of Concrete.  
22  
23       5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.  
24  
25       6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement  
26                  Concrete  
27  
28       7. ASTM C150 - Standard Specification for Portland Cement  
29  
30       8. ASTM C171 - Standard Specification for Sheet Materials for Curing  
31                  Concrete  
32  
33       9. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed  
34                  Concrete by the Volumetric Method.  
35  
36       10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed  
37                  Concrete by the Pressure Method.  
38  
39       11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for  
40                  Concrete.  
41  
42       12. ASTM C309 - Standard Specification for Liquid Membrane-Forming  
43                  Compounds for Curing Concrete.  
44  
45       13. ASTM C494 - Standard Specification for Chemical Admixtures for  
46                  Concrete.  
47

1           14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or  
2           Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.  
3

4           15. ASTM C1017 - Standard Specification for Chemical Admixtures for use  
5           in Producing Flowing Concrete.  
6

7           B. American Concrete Institute (ACI).  
8

9           1. ACI 301- Standard Specification for Structural Concrete  
10

11           2. ACI 305.1 – Standard Specification for Hot Weather Concreting.  
12

13           3. ACI 306.1 - Standard Specification for Cold Weather Concreting.  
14

15           4. Where reference is made to one of the above standards, the revision in  
16           effect at the time of bid opening shall apply.  
17

18        1.05 QUALITY ASSURANCE  
19

20           A. Reinforced concrete shall comply with specifications and standards noted  
21           above. The most stringent requirement of the codes, standards and this  
22           Section shall apply when conflicts exist.  
23

24           B. Only one source of cement and aggregates shall be used on any one  
25           structure. Concrete shall be uniform in color and appearance.  
26

27           C. Well in advance of placing concrete, discuss with the Engineer the sources of  
28           individual materials and batched concrete proposed for use. Discuss  
29           placement methods, waterstops and curing. Propose methods of hot and cold  
30           weather concreting as required. Prior to the placement of any concrete  
31           containing a high-range water-reducing admixture (plasticizer), the Contractor,  
32           accompanied by the plasticizer manufacturer, shall discuss the properties and  
33           techniques of batching and placing plasticized concrete.  
34

35           D. If, during the progress of the work, it is impossible to secure concrete of the  
36           required workability and strength with the materials being furnished, the  
37           Engineer may order such changes in proportions or materials, or both, as may  
38           be necessary to secure the desired properties. All changes so ordered shall  
39           be made at the Contractor's expense.  
40

41           E. If, during the progress of the work, the materials from the sources originally  
42           accepted change in characteristics, the Contractor shall, at his/her expense,  
43           make new acceptance tests of aggregates and establish new design mixes.  
44

45           F. Testing of the following materials shall be furnished by Contractor to verify  
46           conformity with this Specification Section and the stated ASTM Standards.  
47

1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
  2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.
  3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.
  4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.
  5. Proposed concrete mix designs - compressive strength, slump and air content.
  6. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.

G. Field testing and inspection services will be provided by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid by the Owner. Testing of the following items shall be by the Owner to verify conformity with this Specification Section.

  1. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples.

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store in weather-tight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.
  - B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.
  - C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to uniform moisture content before using. Do not use frozen or partially frozen aggregates.
  - D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

- 1           E. Pozzolan: Store in weather-tight buildings, bins or silos to provide protection  
2           from dampness and contamination.
- 3
- 4           F. Sheet Curing Materials: Store in weather-tight buildings or off the ground and  
5           under cover.
- 6
- 7           G. Liquid Curing Compounds: Store in closed containers.
- 8

9

## 10 PART 2 – PRODUCTS

11

12

### 2.01 GENERAL

13

- 14           A. The use of manufacturer's name and model or catalog number is for the  
15           purpose of establishing the standard of quality and general configuration  
16           desired.

17

### 2.02 MATERIALS

18

- 19           A. Materials shall comply with this Section and any applicable State or local  
20           requirements.

- 21           B. Cement: Domestic portland cement complying with ASTM C150. Air  
22           entraining cements shall not be used. Cement brand shall be subject to  
23           approval by the Engineer and one brand shall be used throughout the Work.  
24           The following cement type(s) shall be used:

- 25           1. All Classes – Type I/II or Type II.

- 26           C. Fine Aggregate: Washed inert natural sand conforming to the requirements of  
27           ASTM C33.

- 28           D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming  
29           to the requirements of ASTM C33. Grading requirements shall be as listed in  
30           ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of  
31           Deleterious Substances and Physical Property Requirements shall be as listed  
32           in ASTM C33 Table 3 for severe weathering regions. Size numbers for the  
33           concrete mixes shall be as shown in Table 1 herein.

- 34           E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts,  
35           organic matter, or other deleterious substances.

- 36           F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those  
37           attributable to water). When it is required to use more than one admixture in a  
38           concrete mix, the admixtures shall be from the same manufacturer.  
39           Admixtures shall be compatible with the concrete mix including other

1 admixtures and shall be suitable for use in contact with potable water after 30  
2 days of concrete curing.

- 3
- 4 1. Air-Entraining Admixture: The admixture shall comply with ASTM  
5 C260. Proportioning and mixing shall be in accordance with  
6 manufacturer's recommendations.
- 7
- 8 2. Water-Reducing Agent: The admixture shall comply with ASTM C494,  
9 Type A. Proportioning and mixing shall be in accordance with  
10 manufacturer's recommendations.
- 11
- 12 3. High-Range Water-Reducer (Plasticizer): The admixture shall comply  
13 with ASTM C494, Type F and shall result in non-segregating plasticized  
14 concrete with little bleeding and with the physical properties of low  
15 water/cement ratio concrete. The treated concrete shall be capable of  
16 maintaining its plastic state in excess of 2 hours. Proportioning and  
17 mixing shall be in accordance with manufacturer's recommendations.  
18 Where walls are 14" thick or less and the wall height exceeds 12 ft a  
19 mix including a plasticizer must be used.
- 20
- 21 4. Admixtures causing retarded or accelerated setting of concrete shall not  
22 be used without written approval from the Engineer. When allowed, the  
23 admixtures shall be retarding or accelerating water reducing or high  
24 range water reducing admixtures.
- 25
- 26 G. Pozzolan (Fly Ash): Pozzolan shall be Class C or Class F fly ash complying  
27 with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent  
28 maximum.
- 29
- 30 H. Ground-granulated Blast Furnace Slaq. Ground-granulated blast furnace slaq  
31 shall conform to the following:
- 32
- 33 1. ASTM C989
- 34 2. Slaq activity classification: Grade 100 or 120.
- 35
- 36 I. Sheet Curing Materials. Waterproof paper, polyethylene film or white  
37 burlap-polyethylene sheeting all complying with ASTM C171.
- 38
- 39 J. Liquid Curing Compound. Liquid membrane-forming curing compound shall  
40 comply with the requirements of ASTM C309, Type 1-D (clear or translucent  
41 with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound  
42 shall be approved for use in contact with potable water after 30 days  
43 (non-toxic and free of taste or odor). Curing compound shall comply with  
44 Federal, State and local VOC limits.

45

46 2.03 MIXES

47

- 1           A. Development of mix designs and testing shall be by an independent testing  
2           laboratory acceptable to the Engineer engaged by and at the expense of the  
3           Contractor.
- 4
- 5           B. Select proportions of ingredients to meet the design strength and materials  
6           limits specified in Table 1 and to produce concrete having proper placability,  
7           durability, strength, appearance and other required properties. Proportion  
8           ingredients to produce a homogenous mixture which will readily work into  
9           corners and angles of forms and around reinforcement without permitting  
10          materials to segregate or allowing excessive free water to collect on the  
11          surface.
- 12
- 13          C. The design mix shall be based on standard deviation data of prior mixes with  
14          essentially the same proportions of the same constituents or, if such data is  
15          not available, be developed by a testing laboratory, acceptable to the  
16          Engineer, engaged by and at the expense of the Contractor. Acceptance of  
17          mixes based on standard deviation shall be based on the modification factors  
18          for standard deviation tests contained in ACI 318. The water content of the  
19          concrete mix, determined by laboratory testing, shall be based on a curve  
20          showing the relation between water cementitious ratio and 7 and 28 day  
21          compressive strengths of concrete made using the proposed materials. The  
22          curves shall be determined by four or more points, each representing an  
23          average value of at least three test specimens at each age. The curves shall  
24          have a range of values sufficient to yield the desired data, including the  
25          specified design strengths as modified below, without extrapolation. The  
26          water content of the concrete mixes to be used, as determined from the curve,  
27          shall correspond to strengths 16 percent greater than the specified design  
28          strengths. The resulting mix shall not conflict with the limiting values for  
29          maximum water cementitious ratio and net minimum cementitious content as  
30          specified in Table 1.
- 31
- 32          D. Compression Tests: Provide testing of the proposed concrete mix or mixes to  
33          demonstrate compliance with the specified design strength requirements in  
34          conformity with the above paragraph.
- 35
- 36          E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
- 37
- 38           1. If the air-entraining agent proposed for use in the mix requires testing  
39           methods other than ASTM C231 to accurately determine air content,  
40           make special note of this requirement in the admixture submittal.
- 41
- 42          F. Slump of the concrete as measured by ASTM C143, shall be as shown in  
43          Table 1. If a high-range water-reducer (plasticizer) is used, the slump  
44          indicated shall be that measured before plasticizer is added. Plasticized  
45          concrete shall have a slump ranging from 5 to 8-in.
- 46

1 G. Proportion admixtures according to the manufacturer's recommendations.  
 2 Two or more admixtures specified may be used in the same mix provided that  
 3 the admixtures in combination retain full efficiency and have no deleterious  
 4 effect on the concrete or on the properties of each other.  
 5  
 6  
 7  
 8  
 9

10 TABLE 1  
 11 CONCRETE MIX REQUIREMENTS  
 12

13 Class	14 Design Strength (1)	15 Fine Cement (2)	16 Coarse Aggregate (2)	17 Cementitious Aggregate (3)	18 Content (4)	
A	2500	C150 Type II	C33	57	440 min.	
B	3000	C150 Type II	C33	57	480 min.	
C	4000	C150 Type II	C33	57	560 min.	
D	5000	C150 Type II	C33	57	600 min.	
23 Class	24 W/Cm Ratio (5)	25 Fly Ash	26 AE Range (6)	27 WR (7)	28 HRWR (8)	29 Slump Range Inches
A	0.62 max.	--	3.5 to 5	Yes	*	1-4
B	0.54 max.	--	3.5 to 5	Yes	*	1-3
C	0.44 max.	25% max	3.5 to 5	Yes	*	3-5
D	0.40 max.	--	3.5 to 5	Yes	*	3-5

33 NOTES:  
 34 (1) Minimum compressive strength in psi at 28 days  
 35 (2) ASTM designation  
 36 (3) Size Number in ASTM C33  
 37 (4) Cementitious content in lbs/cu yd  
 38 (5) W/Cm is Water-Cementitious ratio by weight  
 39 (6) AE is percent air-entrainment  
 40 (7) WR is water-reducer admixture  
 41 (8) HRWR is high-range water-reducer admixture  
 42 \* HRWR used at contractor's option except where walls are 14" thick or less and the wall height  
 43 exceeds 12 ft a mix including a plasticizer must be used.  
 44

1      PART 3 – EXECUTION  
2

3      3.01 MEASURING MATERIALS  
4

- 5            A. Concrete shall be composed of portland cement, fine aggregate, coarse  
6            aggregate, water and admixtures as specified and shall be produced by a  
7            plant acceptable to the Engineer. All constituents, including admixtures, shall  
8            be batched at the plant except a high-range water-reducer may also be added  
9            in the field.
- 10          B. Measure materials for batching concrete by weighing in conformity with and  
11         within the tolerances given in ASTM C94 except as otherwise specified.  
12         Scales shall have been certified by the local Sealer of Weights and Measures  
13         within 1 year of use.
- 14          C. Measure the amount of free water in fine aggregates within 0.3 percent with a  
15         moisture meter. Compensate for varying moisture contents of fine  
16         aggregates. Record the number of gallons of water as-batched on printed  
17         batching tickets.
- 18          D. Admixtures shall be dispensed either manually using calibrated containers or  
19         measuring tanks, or by means of an automatic dispenser approved by the  
20         manufacturer of the specific admixture.
- 21            1. Charge air-entraining and chemical admixtures into the mixer as a  
22         solution using an automatic dispenser or similar metering device.
- 23            2. Inject multiple admixtures separately during the batching sequence.

24      3.02 MIXING AND TRANSPORTING  
25

- 26            A. Batch plants shall have a current NRMCA Certification or equal.
- 27            B. Concrete shall be ready-mixed concrete produced by equipment acceptable to  
28            the Engineer. No hand-mixing will be permitted. Clean each transit mix truck  
29            drum and reverse drum rotation before the truck proceeds under the batching  
30            plant. Equip each transit-mix truck with a continuous, nonreversible, revolution  
31            counter showing the number of revolutions at mixing speeds.
- 32            C. Ready-mix concrete shall be transported to the site in watertight agitator or  
33            mixer trucks loaded not in excess of their rated capacities as stated on the  
34            name plate.
- 35            D. Keep the water tank valve on each transit truck locked at all times. Any  
36            addition of water above the appropriate W/Cm ratio must be directed by the  
37            Engineer. Added water shall be incorporated by additional mixing of at least

1           35 revolutions. All added water shall be metered and the amount of water  
2           added shall be shown on each delivery ticket.  
3

- 4           E. All central plant and rolling stock equipment and methods shall comply with  
5           ACI 318 and ASTM C94.
- 6
- 7           F. Select equipment of size and design to ensure continuous flow of concrete at  
8           the delivery end. Metal or metal-lined non-aluminum discharge chutes shall  
9           be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not  
10          less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes  
11          not meeting slope requirements may be used if concrete is discharged into a  
12          hopper before distribution.
- 13
- 14          G. Retempering (mixing with or without additional cement, aggregate, or water) of  
15          concrete or mortar which has reached initial set will not be permitted.
- 16
- 17          H. Handle concrete from mixer to placement as quickly as practicable while  
18          providing concrete of required quality in the placement area. Dispatch trucks  
19          from the batching plant so they arrive at the work site just before the concrete  
20          is required, thus avoiding excessive mixing of concrete while waiting or delays  
21          in placing successive layers of concrete in the forms.
- 22
- 23          I. Furnish a delivery ticket for ready mixed concrete to the Engineer as each  
24          truck arrives. Each ticket shall provide a printed record of the weight of  
25          cement and each aggregate as batched individually. Use the type of indicator  
26          that returns for zero punch or returns to zero after a batch is discharged.  
27          Clearly indicate the weight of fine and coarse aggregate, cement and water in  
28          each batch, the quantity delivered, the time any water is added, and the  
29          numerical sequence of the delivery. Show the time of day batched and time of  
30          discharge from the truck. Indicate the number of revolutions of the truck  
31          mixer.
- 32
- 33          J. Temperature and Mixing Time Control
- 34
- 35           1. In cold weather, do not allow the as-mixed temperature of the concrete  
36           and concrete temperatures at the time of placement in the forms to drop  
37           below 40 degrees F.
- 38
- 39           2. If water or aggregate has been heated, combine water with aggregate  
40           in the mixer before cement is added. Do not add cement to mixtures of  
41           water and aggregate when the temperature of the mixture is greater  
42           than 90 degrees F.
- 43
- 44           3. In hot weather, cool ingredients before mixing to maintain temperature  
45           of the concrete below the maximum placing temperature of 90 degrees  
46           F. If necessary, substitute well-crushed ice for all or part of the mixing  
47           water.

- 1  
2       4. The maximum time interval between the addition of mixing water and/or  
3           cement to the batch and the placing of concrete in the forms shall not  
4           exceed the values shown in Table 2.

5           TABLE 2  
6

7           MAXIMUM TIME TO DISCHARGE OF CONCRETE  
8

<u>Air or Concrete Temperature (whichever is higher)</u>	<u>Maximum Time</u>
80 to 90 Degree F (27 to 32 Degree C).....	45 minutes
70 to 79 Degree F (21 to 26 Degree C).....	60 minutes
40 to 69 Degree F (5 to 20 Degree C).....	90 minutes

If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

20       3.03 CONCRETE APPEARANCE  
21

22       A. Concrete mix showing either poor cohesion or poor coating of the coarse  
23           aggregate with paste shall be remixed. If this does not correct the condition,  
24           the concrete shall be rejected. If the slump is within the allowable limit, but  
25           excessive bleeding, poor workability, or poor finishability are observed,  
26           changes in the concrete mix shall be obtained only by adjusting one or more of  
27           the following:

- 28           1. The gradation of aggregate.  
29  
30           2. The proportion of fine and coarse aggregate.  
31  
33           3. The percentage of entrained air, within the allowable limits.

35       B. Concrete for the work shall provide a homogeneous structure which, when  
36           hardened, will have the required strength, durability and appearance. Mixtures  
37           and workmanship shall be such that concrete surfaces, when exposed, will  
38           require no finishing. When concrete surfaces are stripped, the concrete, when  
39           viewed in good lighting from 10-ft away, shall be pleasing in appearance, and  
40           at 20-ft shall show no visible defects.

41       3.04 PLACING AND COMPACTING  
42

43       A. Placing  
45

1. Verify that all formwork completely encloses concrete to be placed and  
2 is securely braced prior to concrete placement. Remove ice, excess  
3 water, dirt and other foreign materials from forms. Confirm that  
4 reinforcement and other embedded items are securely in place. Have a  
5 competent workman at the location of the placement who can assure  
6 that reinforcing steel and embedded items remain in designated  
7 locations while concrete is being placed. Sprinkle semi-porous  
8 subgrades or forms to eliminate suction of water from the mix. Seal  
9 extremely porous subgrades in an approved manner.
- 10
11. Deposit concrete as near its final position as possible to avoid  
12 segregation due to rehandling or flowing. Place concrete continuously  
13 at a rate which ensures the concrete is being integrated with fresh  
14 plastic concrete. Do not deposit concrete which has partially hardened  
15 or has been contaminated by foreign materials or on concrete which  
16 has hardened sufficiently to cause formation of seams or planes of  
17 weakness within the section. If the section cannot be placed  
18 continuously, place construction joints as specified or as approved.
- 19
20. Pumping of concrete will be permitted. Use a mix design and  
21 aggregate sizes suitable for pumping and submit for approval.
- 22
23. Remove temporary spreaders from forms when the spreader is no  
24 longer useful. Temporary spreaders may remain embedded in concrete  
25 only when made of galvanized metal or concrete and if prior approval  
26 has been obtained.
- 27
28. Do not place concrete for supported elements until concrete previously  
29 placed in the supporting element (columns, slabs and/or walls) has  
30 reached adequate strength.
- 31
32. Where surface mortar is to form the base of a finish, especially surfaces  
33 designated to be painted, work coarse aggregate back from forms with  
34 a suitable tool to bring the full surface of the mortar against the form.  
35 Prevent the formation of excessive surface voids.
- 36
37. Slabs
  38. a. After suitable bulkheads, screeds and jointing materials have  
39 been positioned, the concrete shall be placed continuously  
40 between construction joints beginning at a bulkhead, edge form,  
41 or corner. Each batch shall be placed into the edge of the  
42 previously placed concrete to avoid stone pockets and  
43 segregation.
  - 44 b. Avoid delays in casting. If there is a delay in casting, the  
45 concrete placed after the delay shall be thoroughly spaded and
- 46
- 47

1 consolidated at the edge of that previously placed to avoid cold  
2 joints. Concrete shall then be brought to correct level and struck  
3 off with a straightedge. Bullfloats or darbies shall be used to  
4 smooth the surface, leaving it free of humps or hollows.  
5

- 6 c. Where slabs are to be placed integrally with the walls below  
7 them, place the walls and compact as specified. Allow 1 hour to  
8 pass between placement of the wall and the overlying slab to  
9 permit consolidation of the wall concrete. Keep the top surface  
10 of the wall moist so as to prevent cold joints.

11 8. Formed Concrete  
12

- 13 a. Place concrete in forms using tremie tubes and taking care to  
14 prevent segregation. Bottom of tremie tubes shall preferably be  
15 in contact with the concrete already placed. Do not permit  
16 concrete to drop freely more than 4-ft. Place concrete for walls  
17 in 12 to 24-in lifts, keeping the surface horizontal. If plasticized  
18 concrete is used, the maximum lift thickness may be increased  
19 to 7-ft and the maximum free fall of concrete shall not exceed 15-  
20 ft.

- 21 9. Underwater concreting shall be performed in conformity with the  
22 recommendations of ACI 304R. The tremie system shall be used to  
23 place underwater concrete. Tremie pipes shall be in the range of 8 to  
24 12-in in diameter and be spaced at not more than 16-ft on centers nor  
25 more than 8-ft from an end form. Where concrete is being placed  
26 around a pipe, there shall be at least one tremie pipe on each side of  
27 each pipe. Where the tremie system is not practical, direct pumped  
28 concrete for underwater placement may be used subject to approval of  
29 the system including details by the Engineer.  
30

31 B. Compacting  
32

- 33 1. Consolidate concrete by vibration, puddling, spading, rodding or forking  
34 so that concrete is thoroughly worked around reinforcement, embedded  
35 items and openings and into corners of forms. Puddling, spading, etc.,  
36 shall be continuously performed along with vibration of the placement to  
37 eliminate air or stone pockets which may cause honeycombing, pitting  
38 or planes of weakness.  
39
- 40 2. All concrete shall be placed and compacted with mechanical vibrators.  
41 The number, type and size of the units shall be approved by the  
42 Engineer in advance of placing operations. No concrete shall be  
43 ordered until sufficient approved vibrators (including standby units in  
44 working order) are on the job.  
45

- 1           3. A minimum frequency of 7000 rpm is required for mechanical vibrators.  
2           Insert vibrators and withdraw at points from 18 to 30-in apart. At each  
3           insertion, vibrate sufficiently to consolidate concrete, generally from 5 to  
4           15 seconds. Do not over vibrate so as to segregate. Keep a spare  
5           vibrator on the site during concrete placing operations.  
6
- 7           4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be  
8           consolidated with vibrating screeds; slabs 8 to 12-in thick shall be  
9           compacted with internal vibrators and (optionally) with vibrating  
10          screeds. Vibrators shall always be placed into concrete vertically and  
11          shall not be laid horizontally or laid over.  
12
- 13          5. Walls and Columns: Internal vibrators (rather than form vibrators) shall  
14          be used unless otherwise approved by the Engineer. In general, for  
15          each vibrator needed to melt down the batch at the point of discharge,  
16          one or more additional vibrators must be used to densify, homogenize  
17          and perfect the surface. The vibrators shall be inserted vertically at  
18          regular intervals, through the fresh concrete and slightly into the  
19          previous lift, if any.  
20
- 21          6. Amount of Vibration: Vibrators are to be used to consolidate properly  
22          placed concrete but shall not be used to move or transport concrete in  
23          the forms. Vibration shall continue until:  
24
- 25           a. Frequency returns to normal.  
26
- 27           b. Surface appears liquefied, flattened and glistening.  
28
- 29           c. Trapped air ceases to rise.  
30
- 31           d. Coarse aggregate has blended into surface, but has not  
32          disappeared.

33

### 34        3.05 CURING AND PROTECTION

35

- 36          A. Protect all concrete work against injury from the elements and defacements of  
37          any nature during construction operations.  
38
- 39          B. Curing Methods  
40
- 41           1. Curing Methods for Concrete Surfaces: Cure concrete to retain  
42          moisture and maintain specified temperature at the surface for a  
43          minimum of 7 days after placement. Curing methods to be used are as  
44          follows:  
45
- 46           a. Water Curing: Keep entire concrete surface wet by ponding,  
47          continuous sprinkling or covered with saturated burlap. Begin

wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

- b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
  - c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

## 2. Specified applications of curing methods.

- a. Slabs for Water Containment Structures: Water curing only.
  - b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
  - c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
  - d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
  - e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Water cure if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
  - f. Surfaces of Concrete Joints: Water cured or sheet material cured.
  - g. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.
  - h. Cold Weather Concreting:

1           C. Finished surfaces and slabs shall be protected from the direct rays of the sun  
2           to prevent checking and crazing.

3           D. Cold Weather Concreting:

4           1. "Cold weather" is defined as a period when for more than 3 successive  
5           days, the average daily outdoor temperature drops below 40 degrees F.  
6           The average daily temperature shall be calculated as the average of the  
7           highest and the lowest temperature during the period from midnight to  
8           midnight.

9           2. Cold weather concreting shall conform to ACI 306.1 and the additional  
10          requirements specified herein. Temperatures at the concrete  
11          placement shall be recorded at 12 hour intervals (minimum).

12          3. Discuss a cold weather work plan with the Engineer. The discussion  
13          shall encompass the methods and procedures proposed for use during  
14          cold weather including the production, transportation, placement,  
15          protection, curing and temperature monitoring of the concrete. The  
16          procedures to be implemented upon abrupt changes in weather  
17          conditions or equipment failures shall also be discussed. Cold weather  
18          concreting shall not begin until the work plan is acceptable to the  
19          Engineer.

20          4. During periods of cold weather, concrete shall be protected to provide  
21          continuous warm, moist curing (with supplementary heat when  
22          required) for a total of at least 350 degree-days of curing.

23           a. Degree-days are defined as the total number of 24 hour periods  
24           multiplied by the weighted average daily air temperature at the  
25           surface of the concrete (eg: 5 days at an average 70 degrees F  
26           = 350 degree-days).

27           b. To calculate the weighted average daily air temperature, sum  
28           hourly measurements of the air temperature in the shade at the  
29           surface of the concrete taking any measurement less than 50  
30           degrees F as 0 degrees F. Divide the sum thus calculated by 24  
31           to obtain the weighted average temperature for that day.

32          5. Salt, manure or other chemicals shall not be used for protection.

33          6. The protection period for concrete being water cured shall not be  
34          terminated during cold weather until at least 24 hours after water curing  
35          has been terminated.

36           E. Hot Weather Concreting

- 1  
2     1. "Hot weather" is defined as any combination of high air temperatures,  
3                 low relative humidity and wind velocity which produces a rate of  
4                 evaporation estimated in accordance with ACI 305R, approaching or  
5                 exceeding 0.2 lbs/sqft/hr).
- 6  
7     2. Concrete placed during hot weather, shall be batched, delivered,  
8                 placed, cured and protected in compliance with the recommendations  
9                 of ACI 305R and the additional requirements specified herein.
- 10  
11         a. Temperature of concrete being placed shall not exceed 90  
12                 degrees F and every effort shall be made to maintain a uniform  
13                 concrete mix temperature below this level. The temperature of  
14                 the concrete shall be such that it will cause no difficulties from  
15                 loss of slump, flash set or cold joints.
- 16  
17         b. All necessary precautions shall be taken to promptly deliver, to  
18                 promptly place the concrete upon its arrival at the job and to  
19                 provide vibration immediately after placement.
- 20  
21         c. The Engineer may direct the Contractor to immediately cover  
22                 plastic concrete with sheet material.
- 23  
24     3. Discuss with the Engineer a work plan describing the methods and  
25                 procedures proposed to use for concrete placement and curing during  
26                 hot weather periods. Hot weather concreting shall not begin until the  
27                 work plan is acceptable to the Engineer.

28  
29     3.06 REMOVAL OF FORMS

- 30  
31         A. Except as otherwise specifically authorized by the Engineer, forms shall not be  
32                 removed before the concrete has attained a strength of at least 30 percent of  
33                 its specified design strength, nor before reaching the following number of  
34                 day-degrees of curing (whichever is the longer):

35  
36                 TABLE 3

37  
38                 MINIMUM TIME TO FORM REMOVAL

<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls and vertical surfaces	100

45                 (See definition of degree-days in Paragraph 3.05D above).  
46

1           B. Shores shall not be removed until the concrete has attained at least 70  
2           percent of its specified design strength and also sufficient strength to support  
3           safely its own weight and construction live loads.  
4

5           **3.07 INSPECTION AND FIELD TESTING**  
6

7           A. The batching, mixing, transporting, placing and curing of concrete shall be  
8           subject to the inspection of the Engineer at all times. The Contractor shall  
9           advise the Engineer of his/her readiness to proceed at least 24 hours prior to  
10          each concrete placement. The Engineer will inspect the preparations for  
11          concreting including the preparation of previously placed concrete, the  
12          reinforcing steel and the alignment, cleanliness and tightness of formwork. No  
13          placement shall be made without the inspection and acceptance of the  
14          Engineer.  
15

16           B. Sets of field control cylinder specimens will be collected and tested by an  
17          independent testing company hired by the Contractor and subject to approval  
18          by the Engineer. The cylinder specimens shall be collected and tested during  
19          the progress of the work, in compliance with ASTM C31. The number of sets  
20          of concrete test cylinders taken of each class of concrete placed each day  
21          shall not be less than one set per day, nor less than one set for each 150 cu  
22          yds of concrete nor less than one set for each 5,000 sq ft of surface area for  
23          slabs or walls.  
24

25           1. A "set" of test cylinders consists of five cylinders: one to be tested at 7  
26          days and two to be tested and their strengths averaged at 28 days.  
27          The fourth may be used for a special test at 3 days or to verify strength  
28          after 28 days if 28 day test results are low. The fifth is to be used at 28  
29          days or 56 days where test results are low.  
30

31           2. When the average 28 day compressive strength of the cylinders in any  
32          set falls below the specified design strength or below proportional  
33          minimum 7 day strengths (where proper relation between seven and 28  
34          day strengths have been established by tests), proportions, water  
35          content, or temperature conditions shall be changed to achieve the  
36          required strengths.  
37

38           C. Cooperate in the making of tests by allowing free access to the work for the  
39          selection of samples, providing an insulated closed curing box for specimens,  
40          affording protection to the specimens against injury or loss through the  
41          operations and furnish material and labor required for the purpose of taking  
42          concrete cylinder samples. All shipping of specimens will be paid for by the  
43          Owner. Curing boxes shall be acceptable to the Engineer.  
44

45           D. Slump tests will be made in the field immediately prior to placing the concrete.  
46          Such tests shall be made in accordance with ASTM C143. If the slump is  
47          greater the specified range, the concrete shall be rejected.

- 1           E. Air Content: Test for air content shall be made on fresh concrete samples. Air  
2           content for concrete made of ordinary aggregates having low absorption shall  
3           be made in compliance with either the pressure method complying with ASTM  
4           C231 or by the volumetric method complying with ASTM C173.  
5  
6           F. The Engineer may have cores taken from any questionable area in the  
7           concrete work such as construction joints and other locations as required for  
8           determination of concrete quality. The results of tests on such cores shall be  
9           the basis for acceptance, rejection or determining the continuation of concrete  
10          work.  
11  
12          G. Cooperate in obtaining cores by allowing free access to the work and  
13          permitting the use of ladders, scaffolding and such incidental equipment as  
14          may be required. Repair all core holes. The work of cutting and testing the  
15          cores will be at the expense of the Owner.  
16  
17

18         3.08 FAILURE TO MEET REQUIREMENTS  
19

- 20          A. Should the strengths shown by the test specimens made and tested in  
21          compliance with the previous provisions fall below the values given in Table 1,  
22          the Engineer shall have the right to require changes in proportions outlined to  
23          apply to the remainder of the work. Furthermore, the Engineer shall have the  
24          right to require additional curing on those portions of the structure represented  
25          by the test specimens which failed. The cost of such additional curing shall be  
26          at the Contractor's expense. In the event that such additional curing does not  
27          give the strength required, as evidenced by core and/or load tests, the  
28          Engineer shall have the right to require strengthening or replacement of those  
29          portions of the structure which fail to develop the required strength. The cost  
30          of all such core borings and/or load tests and any strengthening or concrete  
31          replacement required because strengths of test specimens are below that  
32          specified, shall be entirely at the expense of the Contractor. In such cases of  
33          failure to meet strength requirements the Contractor and Engineer shall confer  
34          to determine what adjustment, if any, can be made in compliance with  
35          Sections titled "Strength" and "Failure to Meet Strength Requirements" of  
36          ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this  
37          Section.  
38  
39          B. When the tests on control specimens of concrete fall below the specified  
40          strength, the Engineer will permit check tests for strengths to be made by  
41          means of typical cores drilled from the structure in compliance with ASTM C42  
42          and C39. In the case of cores not indicating adequate strength, the Engineer,  
43          in addition to other recourses, may require, at the Contractor's expense, load  
44          tests on any one of the slabs, beams, piles, caps, and columns in which such  
45          concrete was used. Tests need not be made until concrete has aged 60 days.  
46

1           C. Should the strength of test cylinders fall below 60 percent of the required  
2           minimum 28 day strength, the concrete shall be rejected and shall be removed  
3           and replaced.

4

5        3.09 PATCHING AND REPAIRS

6

7           A. It is the intent of this Section to require quality work including adequate  
8           forming, proper mixture and placement of concrete and curing so completed  
9           concrete surfaces will require no patching.

10          B. Defective concrete and honeycombed areas as determined by the Engineer  
11          shall be repaired as specified by the Engineer.

12          C. As soon as the forms have been stripped and the concrete surfaces exposed,  
13           fins and other projections shall be removed; recesses left by the removal of  
14           form ties shall be filled; and surface defects which do not impair structural  
15           strength shall be repaired. Clean all exposed concrete surfaces and adjoining  
16           work stained by leakage of concrete, to approval of the Engineer.

17          D. Immediately after removal of forms remove plugs and break off metal ties as  
18           required by Section 03100. Promptly fill holes upon stripping as follows:  
19           Moisten the hole with water, followed by a 1/16-in brush coat of neat cement  
20           slurry mixed to the consistency of a heavy paste. Immediately plug the hole  
21           with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the  
22           touch (just short of "balling"). Hammer the grout into the hole until dense, and  
23           an excess of paste appears on the surface in the form of a spiderweb. Trowel  
24           smooth with heavy pressure. Avoid burnishing.

25          E. When patching exposed surfaces the same source of cement and sand as  
26           used in the parent concrete shall be employed. Adjust color if necessary by  
27           addition of proper amounts of white cement. Rub lightly with a fine  
28           Carborundum stone at an age of 1 to 5 days if necessary to bring the surface  
29           down with the parent concrete. Exercise care to avoid damaging or staining  
30           the virgin skin of the surrounding parent concrete. Wash thoroughly to remove  
31           all rubbed matter.

32

33        3.10 SCHEDULE

34

35          A. The following (Table 4) are the general applications for the various concrete  
36           classes and design strengths:

**TABLE 4**  
**CONCRETE SCHEDULE**

<u>Class</u>	<u>Design Strength (psi)</u>	<u>Description</u>
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams and all other structural concrete
D	5,000	Prestressed concrete

CAST-IN-PLACE CONCRETE  
03300-22

- 1 SECTION 03350  
2  
3 CONCRETE FINISHES  
4  
5 PART 1 - GENERAL  
6  
7 1.01 SCOPE OF WORK  
8  
9 A. Furnish all labor, materials, equipment and incidentals required and finish  
10 cast-in-place concrete surfaces as shown on the Drawings and as specified  
11 herein.  
12  
13 1.02 RELATED WORK  
14  
15 A. Concrete Formwork is included in Section 03100.  
16  
17 B. Cast-In-Place Concrete is included in Section 03300.  
18  
19 C. Grout is included in Section 03600.  
20  
21 D. Painting, toppings and special surfaces are included in Division 9.  
22  
23 1.03 SUBMITTALS  
24  
25 A. Submit to the Engineer, in accordance with Sections 01300 and 01340, shop  
26 drawings and product data showing materials of construction and details of  
27 installation for:  
28  
29 1. Concrete sealer. Confirmation that the sealer is compatible with  
30 additionally applied coatings shall also be submitted.  
31  
32 1.04 REFERENCE STANDARDS  
33  
34 A. American Society for Testing and Materials (ASTM)  
35  
36 1. ASTM C33 - Standard Specification for Concrete Aggregates.  
37  
38 B. Where reference is made to one of the above standards, the revision in effect  
39 at the time of bid opening shall apply.  
40  
41 1.05 QUALITY ASSURANCE  
42  
43 A. Finishes  
44  
45 1. For concrete which will receive additional applied finishes or materials,  
46 the surface finish specified is required for the proper application of the

1                   specified manufacturer's products. Where alternate products are  
2                   approved for use, determine if changes in finishes are required and  
3                   provide the proper finishes to receive these products.  
4

- 5                   2. Changes in finishes made to accommodate products different from  
6                   those specified shall be performed at no additional cost to the Owner.  
7                   Submit the proposed new finishes and their construction methods to the  
8                   Engineer for approval.  
9

10                  B. Services of Manufacturer's Representative  
11

- 12                  1. Make available at no extra cost to the Owner, upon 72 hours  
13                   notification, the services of a qualified field representative of the  
14                   manufacturer of curing compound, sealer or hardener to instruct the  
15                   user on the proper application of the product under prevailing job  
16                   conditions.  
17

18                  PART 2 - PRODUCTS  
19

20                  2.01 MATERIALS  
21

- 22                  A. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn;  
23                   Penalith by W.R. Meadows or equal fluosilicate base material.  
24
- 25                  B. Concrete sealer shall be "Kure-N-Seal", by Sonneborn, Minneapolis, MN or  
26                   equal.  
27

28                  PART 3 - EXECUTION  
29

30                  3.01 FORMED SURFACES  
31

- 32                  A. Forms shall not be removed before the requirements of Section 03300, have  
33                   been satisfied.  
34
- 35                  B. Exercise care to prevent damaging edges or obliterating the lines of chamfers,  
36                   rustications or corners when removing the forms or performing any other work  
37                   adjacent thereto.  
38
- 39                  C. Clean all exposed concrete surfaces and adjoining work stained by leakage of  
40                   concrete.  
41
- 42                  D. Rough-Form Finish  
43
- 44                  1. Immediately after stripping forms and before concrete has changed  
45                   color, carefully remove all fins and projections.  
46

1           2. Promptly fill holes left by tie cones and defects as specified in Section  
2           03300.

3           E. Rubbed Finish

- 4           1. Immediately upon stripping forms and before concrete has changed  
5           color, carefully remove all fins. While the wall is still damp apply a thin  
6           coat of medium consistency neat cement slurry by means of bristle  
7           brushes to provide a bonding coat within all pits, air holes or blemishes  
8           in the parent concrete. Avoid coating large areas with the slurry at one  
9           time.
- 10          2. Before the slurry has dried or changed color, apply a dry (almost  
11         crumbly) grout proportioned by volume and consisting of 1 part cement  
12         to 1-1/2 parts of clean masonry sand having a fineness modulus of  
13         approximately 2.3 and complying with the gradation requirements of  
14         ASTM C33 for such a material. Grout shall be uniformly applied by  
15         means of damp pads of coarse burlap approximately 6-in square used  
16         as a float. Scrub grout into the pits and air holes to provide a dense  
17         mortar in all imperfections.
- 18          3. Allow the mortar to partially harden for 1 or 2 hours depending upon the  
19         weather. If the air is hot and dry, keep the wall damp during this period  
20         using a fine, fog spray. When the grout has hardened sufficiently so it  
21         can be scraped from the surface with the edge of a steel trowel without  
22         damaging the grout in the small pits or holes, cut off all that can be  
23         removed with a trowel. (Note: Grout allowed to remain on the wall too  
24         long will harden and will be difficult to remove.)
- 25          4. Allow the surface to dry thoroughly and rub it vigorously with clean dry  
26         burlap to completely remove any dried grout. No visible film of grout  
27         shall remain after this rubbing. The entire cleaning operation for any  
28         area must be completed the day it is started. Do not leave grout on  
29         surfaces overnight. Allow sufficient time for grout to dry after it has  
30         been cutoff with the trowel so it can be wiped off clean with the burlap.
- 31          5. On the day following the repair of pits, air holes and blemishes, the  
32         walls shall again be wiped off clean with dry, used pieces of burlap  
33         containing old hardened mortar which will act as a mild abrasive. After  
34         this treatment, there shall be no built-up film remaining on the parent  
35         surface. If, however, such a film is present, a fine abrasive stone shall  
36         be used to remove all such material without breaking through the  
37         surface film of the original concrete. Such scrubbing shall be light and  
38         sufficient only to remove excess material without changing the texture  
39         of the concrete.
- 40
- 41
- 42
- 43
- 44
- 45
- 46

- 1           6. A thorough wash-down with stiff bristle brushes shall follow the final  
2           bagging or stoning operation. No extraneous materials shall remain on  
3           the surface of the wall. The wall shall be sprayed with a fine fog spray  
4           periodically to maintain a continually damp condition for at least 3 days  
5           after the application of the repair grout.
- 6           7. It is the intent of this finish to provide a surface that is uniform in  
7           appearance with no blemishes, imperfections, discolorations, etc.  
8

9           F. Abrasive Blast Finish

- 10          1. Coordinate with Rubbed Finish application. Do not begin until Rubbed  
11          Finish operation is complete or before concrete has reached minimum  
12          7-day strength. The Rubbed Finish application may be deleted by the  
13          Engineer if the unfinished concrete surface is of superior quality. Apply  
14          the abrasive blast finish only where indicated on Drawings.  
15
- 16          2. Prepare a sample area of minimum 4-ft high by 16-ft wide Blast Finish  
17          as directed by Engineer on a portion of new wall construction which will  
18          not be exposed in the final work. Sample area shall contain a variety of  
19          finishes obtained with different nozzles, nozzle pressures, grit materials  
20          and blasting techniques for selection by Engineer. Final accepted  
21          sample shall remain exposed until completion of all Blast Finish  
22          operations.  
23
- 24          3. Blast finish operation shall meet all regulatory agency requirements.  
25          Blast Finish contractor shall be responsible for obtaining all required  
26          permits and/or licenses.  
27
- 28          4. Perform abrasive blast finishing in as continuous an operation as  
29          possible, utilizing the same work crew to maintain continuity of finish on  
30          each surface or area of work. Maintain patterns or variances in depths  
31          of blast as present on the accepted sample.  
32
- 33          5. Use an abrasive grit of proper type and gradation as well as equipment  
34          and technique to expose aggregate and surrounding matrix surfaces as  
35          follows:  
36
- 37           a. Medium: Generally expose coarse aggregate - 1/4-in to 3/8-in  
38           reveal.  
39
- 40          6. Abrasive blast corners and edge of patterns carefully, using back-up  
41          boards, to maintain uniform corner or edge line. Determine type of  
42          nozzle, nozzle pressure and blasting techniques required to match  
43          Architect's samples.  
44

- 1           7. Upon completion of the Blast Finish operation, thoroughly flush finished  
2           surfaces with clean clear water to remove residual dust and grit. Allow  
3           to air dry until curing of concrete is complete.  
4
- 5           8. After the concrete has cured for a minimum of 28 days, apply a clear  
6           acrylic sealer as directed by manufacturer.  
7

8        3.02 FLOORS AND SLABS  
9

10      A. Floated Finish  
11

12       1. Machine Floating  
13

- 14           a. Screeed floors and slabs with straightedges to the established  
15           grades shown on the Drawings. Immediately after final  
16           screeding, a dry cement/sand shake in the proportion of two  
17           sacks of portland cement to 350 lbs of coarse natural concrete  
18           sand shall be sprinkled evenly over the surface at the rate of  
19           approximately 500 lbs /1,000 sq ft of floor. Do not sprinkle neat,  
20           dry cement on the surface.  
21
- 22           b. The application of the cement/sand shake may be eliminated at  
23           the discretion of the Engineer if the base slab concrete exhibits  
24           adequate fattiness and homogeneity and the need is not  
25           indicated. When the concrete has hardened sufficiently to  
26           support the weight of a power float without its digging into or  
27           disrupting the level surface, thoroughly float the shake into the  
28           surface with a heavy revolving disc type power compacting  
29           machine capable of providing a 200 lb compaction force  
30           distributed over a 24-in diameter disc.  
31
- 32           c. Start floating along walls and around columns and then move  
33           systematically across the surface leaving a matte finish.  
34
- 35           d. The compacting machine shall be the "Kelly Power Float with  
36           Compaction Control" as manufactured by Kelley Industries of  
37           SSP Construction Equipment Inc., Pomona, CA or equal.  
38           Troweling machines equipped with float (shoe) blades that are  
39           slipped over the trowel blades may be used for floating. Floating  
40           with a troweling machine equipped with normal trowel blades will  
41           not be permitted. The use of any floating or troweling machine  
42           which has a water attachment for wetting the concrete surface  
43           during finishing will not be permitted.  
44

45        2. Hand Floating  
46

1           a. In lieu of power floating, small areas may be compacted by hand  
2           floating. The dry cement/sand shake previously specified shall  
3           be used unless specifically eliminated by the Engineer. Screech  
4           the floors and slabs with straightedges to the established grades  
5           shown on the Drawings. While the concrete is still green, but  
6           sufficiently hardened to support a finisher and kneeboards with  
7           no more than 1/4-in indentation, wood float to a true, even plane  
8           with no coarse aggregate visible. Use sufficient pressure on the  
9           wood floats to bring moisture to the surface.

10           3. Finishing Tolerances

11           a. Level floors and slabs to a tolerance of plus or minus 1/8-in when  
12           checked with a 10-ft straightedge placed anywhere on the slab in  
13           any direction. Where drains occur, pitch floors to drains such  
14           that there are no low spots left undrained. Failure to meet either  
15           of the above requirements shall be cause for removal, grinding,  
16           or other correction as directed by the Engineer.

17           B. Broom Finish

18           1. Screech slabs with straightedges to the established grades indicated on  
19           the Drawings. When the concrete has stiffened sufficiently to maintain  
20           small surface indentations, draw a stiff bristle broom lightly across the  
21           surface in the direction of drainage, or, in the case of walks and stairs,  
22           perpendicular to the direction of traffic to provide a non-slip surface.

23           C. Steel Trowel Finish

24           1. Finish concrete as specified in Paragraph 3.04. Then, hand steel trowel  
25           to a perfectly smooth hard even finish free from high or low spots or  
26           other defects.

27           D. Concrete Sealer

28           1. Prepare and seal surfaces indicated on the room finish schedule to  
29           receive a sealer as follows:

30           a. Finish concrete as specified in the preceding paragraphs and in  
31           accordance with the Schedule in Paragraph 3.05 below.

32           b. Newly Placed Concrete: Surface must be sound and properly  
33           finished. Surface is application-ready when it is damp but not  
34           wet and can no longer be marred by walking workmen.

- 1                   c. Newly-Cured Bare Concrete: Level any spots gouged out by  
2 trades. Remove all dirt, dust, droppage, oil, grease, asphalt and  
3 foreign matter. Cleanse with caustics and detergents as  
4 required. Rinse thoroughly and allow to dry so that surface is no  
5 more than damp, and not wet.
- 6                   d. Aged Concrete: Restore surface soundness by patching,  
7 grouting, filling cracks and holes, etc. Surface must also be free  
8 of any dust, dirt and other foreign matter. Use power tools  
9 and/or strippers to remove any incompatible sealers or coatings.  
10 Cleanse as required, following the procedure indicated under  
11 cured concrete.
- 12
- 13                   e. Methods: Apply sealer so as to form a continuous, uniform film  
14 by spray, soft-bristle pushbroom, long-nap roller or lambswool  
15 applicator. Ordinary garden-type sprayers, using neoprene  
16 hose, are recommended for best results.
- 17
- 18                   f. Applications: For curing only, apply first coat evenly and  
19 uniformly as soon as possible after final finishing at the rate of  
20 200 to 400 sq ft per gallon. Apply second coat when all trades  
21 are completed and structure is ready for occupancy at the rate of  
22 400 to 600 sq ft per gallon.
- 23
- 24                   g. To meet guarantee and to seal and dustproof, two coats are  
25 required. For sealing new concrete, both coats shall be applied  
26 full-strength. On aged concrete, when renovating, dustproofing  
27 and sealing, the first coat should be thinned 10 to 15 percent  
28 with reducer per manufacturer's directions.

29

### 30         3.03 CONCRETE RECEIVING CHEMICAL HARDENER

31

- 32                  A. After 28 days, minimum, concrete cure, apply chemical hardener in three  
33 applications to a minimum total coverage of the undiluted chemical of 100 sq ft  
34 per gallon and in accordance with manufacturer's recommendations as  
35 reviewed.

36

### 37         3.04 APPROVAL OF FINISHES

- 38
- 39                  A. All concrete surfaces, when finished, will be inspected by the Engineer.
- 40
- 41                  B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be  
42 refinished or reworked.
- 43
- 44                  C. After finishing horizontal surfaces, regardless of the finishing procedure  
45 specified, the concrete shall be cured in compliance with Section 03300 unless  
46 otherwise directed by the Engineer.

1  
2   3.05 SCHEDULE OF FINISHES  
3

- 4           A. Concrete shall be finished as specified either to remain as natural concrete to  
5 receive an additional applied finish or material under another section.  
6
- 7           B. Concrete for the following conditions shall be finished as noted on the  
8 Drawings and as further specified herein:  
9
- 10          1. Concrete to Receive Dampproofing: Rough-form finish. See  
11 Paragraph 3.01D above.  
12
- 13          2. Concrete Not Exposed to View and Not Scheduled to Receive an  
14 Additional Applied Finish or Material: Rough-form finish. See  
15 Paragraph 3.01D above.  
16
- 17          3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed  
18 finish. See Paragraph 3.01E above.  
19
- 20          4. Interior Vertical Concrete Exposed to View Except in Water  
21 Containment Areas: Rubbed finish. See Paragraph 3.01E above.  
22
- 23          5. Vertical Concrete in Water Containment Areas. Rubbed finish on  
24 exposed surfaces and extending to two feet below normal operating  
25 water level: Rough-form finish on remainder of submerged areas. See  
26 Paragraphs 3.01E and 3.01D above.  
27
- 28          6. Interior and Exterior Underside of Concrete Exposed to View: Rubbed  
29 finish. See Paragraph 3.01E above.  
30
- 31          7. Exterior surfaces exposed to view and indicated to have an abrasive  
32 blast finish. See Paragraph 3.01F above.  
33
- 34          8. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or  
35 Sealer: Floated finish. See Paragraph 3.02A above.  
36
- 37          9. Concrete for Exterior Walks, Interior and Exterior Stairs: Broomed  
38 finish perpendicular to direction of traffic. See Paragraph 3.02B above.  
39
- 40          10. Concrete Slabs On Which Process Liquids Flow or In Contact with  
41 Sludge: Steel trowel finish. See Paragraph 3.02C above.  
42
- 43          11. Concrete to Receive Hardener: See Paragraph 3.02D above.  
44
- 45          12. Concrete to Receive Floor Sealer: See Paragraph 3.02E above.  
46

1           13. Concrete tank bottoms to be covered with grout: See Section 03600.  
2  
3  
4

END OF SECTION

1  
2

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CONCRETE FINISHES  
03350-10

03/22/2019

1 SECTION 03600  
2

3 GROUT  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required and install grout  
10 complete as shown on the Drawings and as specified herein.  
11

12 1.02 RELATED WORK  
13

- 14 A. Formwork is included in Section 03100.  
15  
16 B. Concrete Reinforcement is included in Section 03200.  
17  
18 C. Concrete Joints and Joint Accessories are included in Section 03250.  
19  
20 D. Cast-in-Place Concrete is included in Section 03300.  
21  
22 E. Miscellaneous Metals are included in Section 05500.  
23

24 1.03 SUBMITTALS  
25

- 26 A. Submit to the Engineer, in accordance with Sections 01300 and 01340, shop  
27 drawings and product data showing materials of construction and details of  
28 installation for:  
29  
30 1. Commercially manufactured nonshrink cementitious grout. The  
31 submittal shall include catalog cuts, technical data, storage  
32 requirements, product life, working time after mixing, temperature  
33 considerations, conformity to required ASTM standards and Material  
34 Safety Data Sheet.  
35  
36 2. Commercially manufactured nonshrink epoxy grout. The submittal shall  
37 include catalog cuts, technical data, storage requirements, product life,  
38 working time after mixing, temperature considerations, conformity to  
39 required ASTM standards and Material Safety Data Sheet.  
40  
41 3. Cement grout. The submittal shall include the type and brand of the  
42 cement, the gradation of the fine aggregate, product data on any  
43 proposed admixtures and the proposed mix of the grout.  
44  
45 4. Concrete grout. The submittal shall include data as required for concrete  
46 as delineated in Section 03300 and for fiber reinforcement as delineated

1                   in Section 03200. This includes the mix design, constituent quantities  
2                   per cubic yard and the water/cement ratio.  
3

4                   B. Laboratory Test Reports  
5

- 6                   1. Submit laboratory test data as required under Section 03300 for concrete  
7                   to be used as concrete grout.  
8

9                   C. Certifications  
10

- 11                   1. Certify that commercially manufactured grout products and concrete  
12                   grout admixtures are suitable for use in contact with potable water after  
13                   30 days curing.  
14

15                   D. Qualifications  
16

- 17                   1. Grout manufacturers shall submit documentation that they have at least  
18                   10 years' experience in the production and use of the proposed grouts  
19                   which they will supply.  
20

21                  1.04 REFERENCE STANDARDS  
22

23                  A. American Society for Testing and Materials (ASTM)  
24

- 25                  1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient  
26                  of Thermal Expansion of Chemical Resistant Mortars, Grouts and  
27                  Monolithic Surfacings and Polymer Concretes  
28

- 29                  2. ASTM C579 - Standard Test Method for Compressive Strength of  
30                  Chemical Resistant Mortars, Grouts and Monolithic Surfacings and  
31                  Polymer Concretes  
32

- 33                  3. ASTM C827 - Standard Test Method for Change in Height at Early Ages  
34                  of Cylindrical Specimens from Cementitious Mixtures  
35

- 36                  4. ASTM C1107 - Standard Specification for Packaged Dry,  
37                  Hydraulic-Cement Grout (Nonshrink)  
38

39                  B. U.S. Army Corps of Engineers Standard (CRD)  
40

- 41                  1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout  
42

43                  C. Where reference is made to one of the above standards, the revision in effect  
44                  at the time of bid opening shall apply.  
45

46                  1.05 QUALITY ASSURANCE

- 1           A. Qualifications
- 2
- 3           1. Grout manufacturer shall have a minimum of 10 years' experience in the
- 4            production and use of the type of grout proposed for the work.
- 5
- 6           B. Pre-installation Conference
- 7
- 8           1. Well in advance of grouting, hold a pre-installation meeting to review the
- 9            requirements for surface preparation, mixing, placing and curing
- 10           procedures for each product proposed for use. Parties concerned with
- 11           grouting shall be notified of the meeting at least 10 days prior to its
- 12           scheduled date.
- 13
- 14           C. Services of Manufacturer's Representative
- 15
- 16           1. A qualified field technician of the nonshrink grout manufacturer,
- 17            specifically trained in the installation of the products, shall attend the
- 18           pre-installation conference and shall be present for the initial installation
- 19           of each type of nonshrink grout. Additional services shall also be
- 20           provided, as required, to correct installation problems.
- 21
- 22           D. Field Testing
- 23
- 24           1. All field testing and inspection services required shall be provided by the
- 25            Owner. The Contractor shall assist in the sampling of materials and shall
- 26           provide any ladders, platforms, etc, for access to the work. The methods
- 27           of testing shall comply in detail with the applicable ASTM Standards.
- 28
- 29           2. The field testing of Concrete Grout shall be as specified for concrete in
- 30           Section 03300.

31

32        **1.06 DELIVERY, STORAGE AND HANDLING**

- 33
- 34           A. Deliver materials to the jobsite in original, unopened packages, clearly labeled
- 35            with the manufacturer's name, product identification, batch numbers and printed
- 36           instructions.
- 37
- 38           B. Store materials in full compliance with the manufacturer's recommendations.
- 39           Total storage time from date of manufacture to date of installation shall be
- 40           limited to 6 months or the manufacturer's recommended storage time,
- 41           whichever is less.
- 42
- 43           C. Material which becomes damp or otherwise unacceptable shall be immediately
- 44           removed from the site and replaced with acceptable material at no additional
- 45           expense to the Owner.
- 46

- 1           D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged  
2           mixes requiring only the addition of water.  
3  
4           E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three  
5           component systems requiring only blending as directed by the manufacturer.

6  
7        1.07 DEFINITIONS  
8

- 9           A. Nonshrink Grout: A commercially manufactured product that does not shrink in  
10          either the plastic or hardened state, is dimensionally stable in the hardened state  
11          and bonds to a clean base plate.

12  
13      PART 2 - PRODUCTS  
14

15      2.01 GENERAL  
16

- 17           A. The use of a manufacturer's name and product or catalog number is for the  
18          purpose of establishing the standard of quality desired.  
19  
20           B. Like materials shall be the products of one manufacturer or supplier in order to  
21          provide standardization of appearance.

22  
23      2.02 MATERIALS  
24

25           A. Nonshrink Cementitious Grout  
26

- 27            1. Nonshrink cementitious grouts shall meet or exceed the requirements of  
28            ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland  
29            cement based, contain a pre-proportioned blend of selected aggregates  
30            and shrinkage compensating agents and shall require only the addition  
31            of water. Nonshrink cementitious grouts shall not contain expansive  
32            cement or metallic particles. The grouts shall exhibit no shrinkage when  
33            tested in conformity with ASTM C827.

- 34  
35            a. General purpose nonshrink cementitious grout shall conform to  
36            the standards stated above and shall be SikaGrout 212 by Sika  
37            Corp.; Set Grout by Master Builders, Inc.; Gilco Construction  
38            Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.;  
39            NBEC Grout by U. S. Grout Corp. or equal.  
40            b. Flowable (Precision) nonshrink cementitious grout shall conform  
41            to the standards stated above and shall be Masterflow 928 by  
42            Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.;  
43            SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.;  
44            Five Star Grout by U. S. Grout Corp. or equal.

45  
46           B. Nonshrink Epoxy Grout

- 1
- 2       1. Nonshrink epoxy-based grout shall be a pre-proportioned, three
- 3           component, 100 percent solids system consisting of epoxy resin,
- 4           hardener, and blended aggregate. It shall have a compressive strength
- 5           of 14,000 psi in 7 days when tested in conformity with ASTM D695 and
- 6           have a maximum thermal expansion of  $30 \times 10^{-6}$  when tested in
- 7           conformity with ASTM C531. The grout shall be Masterflow 648 by
- 8           Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur
- 9           42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid
- 10          Chemical Co. or equal.

11

12       C. Cement Grout

13

- 14
- 15       1. Cement grouts shall be a mixture of one part portland cement conforming
- 16           to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to
- 17           ASTM C33 with sufficient water to place the grout. The water content
- 18           shall be sufficient to impart workability to the grout but not to the degree
- 19           that it will allow the grout to flow.

20

21       D. Concrete Grout

22

- 23
- 24       1. Concrete grout shall conform to the requirements of Section 03300
- 25           except as specified herein. It shall be proportioned with cement,
- 26           [pozzalan,] coarse and fine aggregates, water, water reducer and air
- 27           entraining agent to produce a mix having an average strength of 2900
- 28           psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall
- 29           be [3/8] [1/2]-in maximum. Slump should not exceed 5-in and should be
- 30           as low as practical yet still retain sufficient workability.
- 31
- 32       2. Synthetic reinforcing fibers as specified in Section 03200 shall be added
- 33           to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of
- 34           grout. Fibers shall be added from the manufacturer's premeasured bags
- 35           and according to the manufacturer's recommendations in a manner
- 36           which will ensure complete dispersion of the fiber bundles as single
- 37           monofilaments within the concrete grout.

38

39       E. Water

40

- 41
- 42       1. Potable water, free from injurious amounts of oil, acid, alkali, organic
- 43           matter, or other deleterious substances.

44

45       PART 3 - EXECUTION

44       3.01 PREPARATION

- A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
  - 1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.
- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.
- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.
  - 1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.
- I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and

1           blocking devices shall be prevented from bonding to the grout by appropriate  
2           bond breaking coatings and removed after grouting unless otherwise approved  
3           by the Engineer.  
4

5        3.02 INSTALLATION - GENERAL  
6

- 7           A. Mix, apply and cure products in strict compliance with the manufacturer's  
8           recommendations and this Section.  
9
- 10          B. Have sufficient manpower and equipment available for rapid and continuous  
11          mixing and placing. Keep all necessary tools and materials ready and close at  
12          hand.  
13
- 14          C. Maintain temperatures of the foundation plate, supporting concrete, and grout  
15          between 40 and 90 degrees F during grouting and for at least 24 hours  
16          thereafter or as recommended by the grout manufacturer, whichever is longer.  
17          Take precautions to minimize differential heating or cooling of baseplates and  
18          grout during the curing period.  
19
- 20          D. Take special precautions for hot weather or cold weather grouting as  
21          recommended by the manufacturer when ambient temperatures and/or the  
22          temperature of the materials in contact with the grout are outside of the 60 and  
23          90 degrees F range.  
24
- 25          E. Install grout in a manner which will preserve the isolation between the elements  
26          on either side of the joint where grout is placed in the vicinity of an expansion or  
27          control joint.  
28
- 29          F. Reflect all existing underlying expansion, control and construction joints through  
30          the grout.  
31

32        3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS  
33

- 34          A. Mix in accordance with manufacturer's recommendations. Do not add cement,  
35          sand, pea gravel or admixtures without prior approval by the Engineer.  
36
- 37          B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is  
38          recommended. Pre-wet the mixer and empty excess water. Add premeasured  
39          amount of water for mixing, followed by the grout. Begin with the minimum  
40          amount of water recommended by the manufacturer and then add the minimum  
41          additional water required to obtain workability. Do not exceed the  
42          manufacturer's maximum recommended water content.  
43
- 44          C. Placements greater than 3-inches in depth shall include the addition of clean,  
45          washed pea gravel to the grout mix when approved by the manufacturer.

- 1 Comply with the manufacturer's recommendations for the size and amount of  
2 aggregate to be added.
- 3
- 4 D. Place grout into the designated areas in a manner which will avoid segregation  
5 or entrapment of air. Do not vibrate grout to release air or to consolidate the  
6 material. Placement should proceed in a manner which will ensure the filling of  
7 all spaces and provide full contact between the grout and adjoining surfaces.  
8 Provide grout holes as necessary.
- 9
- 10 E. Place grout rapidly and continuously to avoid cold joints. Do not place cement  
11 grouts in layers. Do not add additional water to the mix (retemper) after initial  
12 stiffening.
- 13
- 14 F. Just before the grout reaches its final set, cut back the grout to the substrate at  
15 a 45 degree angle from the lower edge of bearing plate unless otherwise  
16 approved by the Engineer. Finish this surface with a wood float (brush) finish.
- 17
- 18 G. Begin curing immediately after form removal, cutback, and finishing. Keep grout  
19 moist and within its recommended placement temperature range for at least 24  
20 hours after placement or longer if recommended by the manufacturer. Saturate  
21 the grout surface by use of wet burlap, soaker hoses, ponding or other approved  
22 means. Provide sunshades as necessary. If drying winds inhibit the ability of a  
23 given curing method to keep grout moist, erect wind breaks until wind is no  
24 longer a problem or curing is finished.

25

26 **3.04 INSTALLATION - NONSHRINK EPOXY GROUTS**

27

- 28 A. Mix in accordance with the procedures recommended by the manufacturer. Do  
29 not vary the ratio of components or add solvent to change the consistency of  
30 the grout mix. Do not overmix. Mix full batches only to maintain proper  
31 proportions of resin, hardener and aggregate.
- 32
- 33 B. Monitor ambient weather conditions and contact the grout manufacturer for  
34 special placement procedures to be used for temperatures below 60 or above  
35 90 degrees F.
- 36
- 37 C. Place grout into the designated areas in a manner which will avoid trapping air.  
38 Placement methods shall ensure the filling of all spaces and provide full contact  
39 between the grout and adjoining surfaces. Provide grout holes as necessary.
- 40
- 41 D. Minimize "shoulder" length (extension of grout horizontally beyond base plate).  
42 In no case shall the shoulder length of the grout be greater than the grout  
43 thickness.
- 44

- 1           E. Finish grout by puddling to cover all aggregate and provide a smooth finish.  
2           Break bubbles and smooth the top surface of the grout in conformity with the  
3           manufacturer's recommendations.  
4  
5           F. Epoxy grouts are self-curing and do not require the application of water.  
6           Maintain the formed grout within its recommended placement temperature  
7           range for at least 24 hours after placing, or longer if recommended by the  
8           manufacturer.

9

10          3.05 INSTALLATION - CONCRETE GROUT

11

- 12           A. Screeed underlying concrete to the grade shown on the Drawings. Provide the  
13           surface with a broomed finish, aligned to drain. Protect and keep the surface  
14           clean until placement of concrete grout.
- 15  
16           B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt  
17           and other foreign materials. Wash the tank slab using a strong jet of water.  
18           Flushing of debris into tank drain lines will not be permitted.
- 19  
20           C. Saturate the concrete surface for at least 24 hours prior to placement of the  
21           concrete grout. Saturation may be maintained by ponding, by the use of soaker  
22           hoses, or by other methods acceptable to the Engineer. Remove excess water  
23           just prior to placement of the concrete grout. Place a cement slurry immediately  
24           ahead of the concrete grout so that the slurry is moist when the grout is placed.  
25           Work the slurry over the surface with a broom until it is coated with  
26           approximately 1/16 to 1/8-in thick cement paste. [(A bonding grout composed  
27           of 1 part portland cement, 1.5 parts fine sand, an approved bonding admixture  
28           and water, mixed to achieve the consistency of thick paint, may be substituted  
29           for the cement slurry.)]
- 30  
31           D. Place concrete grout to final grade using the scraper mechanism as a guide for  
32           surface elevation and to ensure high and low spots are eliminated where  
33           application is at clarifier bottom. Unless specifically approved by the equipment  
34           manufacturer, mechanical scraper mechanisms shall not be used as a finishing  
35           machine or screed.
- 36  
37           E. Provide synthetic reinforcing fibers in all applications unless steel reinforcement  
38           is indicated in the Drawings.
- 39  
40           F. Provide grout control joints as indicated on the Drawings.
- 41  
42           G. Finish and cure the concrete grout as specified for cast-in-place concrete.

43

44          3.06 SCHEDULE

45

- 46           A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
  2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
  3. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
  4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.
  5. Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade. Use at grout fillets or grout pours greater than 4" thick.

END OF SECTION

1 SECTION 03740  
2

3 MODIFICATIONS AND REPAIR TO CONCRETE  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. Furnish all labor, materials, equipment and incidentals required and cut,  
10 remove, repair or otherwise modify parts of existing concrete structures or  
11 appurtenances as shown on the Drawings and as specified herein. Work under  
12 this Section shall also include bonding new concrete to existing concrete.  
13

14 1.02 RELATED WORK  
15

- 16 A. Concrete Formwork is included in Section 03100.  
17 B. Concrete Reinforcement is included in Section 03200.  
18 C. Concrete Joints and Accessories are included in Section 03250.  
19 D. Cast-in-Place Concrete is included in Section 03300.  
20 E. Grout is included in Section 03600.  
21 F. Miscellaneous Metals are included in Section 05500.  
22

23 1.03 SUBMITTALS  
24

- 25 A. If applicable, submit to the Engineer, a Schedule of Demolition and the detailed  
26 methods of demolition to be used at each location.  
27 B. Submit manufacturer's technical literature on all product brands proposed for  
28 use, to the Engineer for review. The submittal shall include the manufacturer's  
29 installation and/or application instructions.  
30 C. When substitutions for acceptable brands of materials specified herein are  
31 proposed, submit brochures and technical data of the proposed substitutions to  
32 the Engineer for approval before delivery to the project.  
33

34 1.04 REFERENCE STANDARDS  
35

- 36 A. American Society for Testing and Materials (ASTM)  
37 1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding  
38 Systems for Concrete.  
39

40 MODIFICATIONS AND REPAIR TO CONCRETE  
41

42 03740-1

43 03/22/2019

- 1           2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin  
2           3. Systems Used with Concrete by Slant Sheer.  
3  
4           3. ASTM C883 - Standard Test Method for Effective Shrinkage of  
5           Epoxy-Resin Systems Used with Concrete.  
6  
7           4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.  
8  
9           5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.  
10  
11          6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid  
12          Plastics.  
13  
14          7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by  
15          Punch Tool.  
16  
17          8. ASTM D790 - Standard Test Methods for Flexural Properties of  
18          Unreinforced and Reinforced Plastics and Electrical Insulating Materials.  
19  
20

- 21         B. Where reference is made to one of the above standards, the revision in effect  
22         at the time of bid opening shall apply.

24         **1.05 QUALITY ASSURANCE**

- 26         A. No existing structure or concrete shall be shifted, cut, removed, or otherwise  
27         altered until authorization is given by the Engineer.  
28  
29         B. When removing materials or portions of existing structures and when making  
30         openings in existing structures, all precautions shall be taken and all necessary  
31         barriers, shoring and bracing and other protective devices shall be erected to  
32         prevent damage to the structures beyond the limits necessary for the new work,  
33         protect personnel, control dust and to prevent damage to the structures or  
34         contents by falling or flying debris. Unless otherwise permitted, shown or  
35         specified, line drilling will be required in cutting existing concrete.  
36  
37         C. Manufacturer Qualifications: The manufacturer of the specified products shall  
38         have a minimum of 10 years' experience in the manufacture of such products  
39         and shall have an ongoing program of training, certifying and technically  
40         supporting the Contractor's personnel.

42         **1.06 DELIVERY, STORAGE AND HANDLING**

- 44         A. Deliver the specified products in original, unopened containers with the  
45         manufacturer's name, labels, product identification and batch numbers.  
46

1           B. Store and condition the specified product as recommended by the  
2 manufacturer.

3

4 **PART 2 - PRODUCTS**

5

6 **2.01 MATERIALS**

7

8       A. General

9

10      1. Materials shall comply with this Section and any state or local  
11 regulations.

12

13       B. Epoxy Bonding Agent

14

15      1. General

16

17       a. The epoxy bonding agent shall be a two-component, solvent-free,  
18 asbestos-free moisture insensitive epoxy resin material used to  
19 bond plastic concrete to hardened concrete complying with the  
20 requirements of ASTM C881, Type II and the additional  
21 requirements specified herein.

22

23      2. Material

24

25       a. Properties of the cured material:

26

27        1) Compressive Strength (ASTM D695): 8500 psi minimum at  
28 days.

29

30        2) Tensile Strength (ASTM D638): 4000 psi minimum at 14  
31 days.

32

33        3) Flexural Strength (ASTM D790 - Modulus of Rupture):  
34 6,300 psi minimum at 14 days.

35

36        4) Shear Strength (ASTM D732): 5000 psi minimum at 14  
37 days.

38

39        5) Water Absorption (ASTM D570 - 2 hour boil): One percent  
40 maximum at 14 days.

41

42        6) Bond Strength (ASTM C882) Hardened to Plastic: 1500  
43 psi minimum at 14 days moist cure.

44

45        7) Effective Shrinkage (ASTM C883): Passes Test.

46

1                   8)     Color: Gray.  
2

3       3.     Approved manufacturers: Sika Corporation, Lyndhurst, NJ - Sikadur 32,  
4                   Hi-Mod; Master Builder's, Cleveland, OH - Concresive Liquid (LPL) or  
5                   equal.

6

7       C.     Epoxy Paste  
8

9

10      1.     General

11       a.    Epoxy Paste shall be a two-component, solvent-free, asbestos  
12           free, moisture insensitive epoxy resin material used to bond  
13           dissimilar materials to concrete such as setting railing posts,  
14           dowels, anchor bolts and all-threads into hardened concrete and  
15           shall comply with the requirements of ASTM C881, Type I, Grade  
16           3 and the additional requirements specified herein. It may also be  
17           used to patch existing surfaces where the glue line is 1/8-in or  
18           less.

19

20      2.     Material

21

22       a.    Properties of the cured material:

23

24       1)    Compressive Properties (ASTM D695): 10,000 psi  
25           minimum at 28 days.

26

27       2)    Tensile Strength (ASTM D638): 3,000 psi minimum at 14  
28           days. Elongation at Break - 0.3 percent minimum.

29

30       3)    Flexural Strength (ASTM D790 - Modulus of Rupture):  
31           3,700 psi minimum at 14 days.

32

33       4)    Shear Strength (ASTM D732): 2,800 psi minimum at 14  
34           days.

35

36       5)    Water Absorption (ASTM D570): 1.0 percent maximum at  
37           7 days.

38

39       6)    Bond Strength (ASTM C882): 2,000 psi at 14 days moist  
40           cure.

41

42       7)    Color: Concrete grey.

43

44      3.     Approved manufacturers:

- 1           a. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur  
2           Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concresive  
3           1438 or equal.
- 4           b. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master  
5           Builders, Inc., Cleveland, OH - Concresive 1438 or equal.
- 6
- 7           D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink  
8           Epoxy Grout and Polymer Modified mortar are included in Section 03600  
9           GROUT.
- 10
- 11          E. Adhesive Capsule type anchor system shall be equal to the HIT-HY 200  
12          adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The  
13          capsule shall consist of a sealed glass capsule containing premeasured  
14          amounts of polyester or vinylester resin, quartz sand aggregate and a hardener  
15          contained in a separate vial within the capsule. Where the adhesive anchor is  
16          under sustained tensile loading (i.e. vertically installed anchors) the anchor  
17          system shall be Hilti HIT RE-500 SD by Hilti Fastening Systems, Tulsa, OK. All  
18          steel reinforcement shall be anchored using the Hilti HIT RE-500 SD adhesive  
19          anchoring system.
- 20
- 21          F. Acrylic Latex Bonding Agent
- 22
- 23          G. Crack Repair Epoxy Adhesive
- 24
- 25           1. General
- 26
- 27           a. Crack Repair Epoxy Adhesive shall be a two-component,  
28           solvent-free, moisture insensitive epoxy resin material suitable for  
29           crack grouting by injection or gravity feed. It shall be formulated  
30           for the specific size of opening or crack being injected.
- 31
- 32           b. All concrete surfaces containing potable water or water to be  
33           treated for potable use that are repaired by the epoxy adhesive  
34           injection system shall be coated with an acceptable epoxy coating  
35           approved by the FDA for use in contact with potable water.
- 36
- 37           2. Material
- 38
- 39           a. Properties of the cured material
- 40
- 41           1) Compressive Properties (ASTM D695): 10,000 psi  
42           minimum at 28 days.
- 43
- 44           2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14  
45           days. Elongation at Break - 2 to 5 percent.
- 46

- 3) Flexural Strength (ASTM D790 - Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)
  - 4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.
  - 5) Water Absorption (ASTM D570 - 2 hour boil): 1.5 percent maximum at 7 days.
  - 6) Bond Strength (ASTM C882): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.
  - 7) Effective Shrinkage (ASTM 883): Passes Test.

### **3. Approved manufacturers:**

- a. For standard applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland, OH - Concrehesive 1380 or equal.
  - b. For very thin applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland, OH - Concrehesive 1468 or equal.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.
  - B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.
  - C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.
  - D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval

1 by the Engineer. Where possible, rebar locations shall be identified prior to  
2 drilling using "rebar locators" so that drilled hole locations may be adjusted to  
3 avoid rebar interference.  
4

5 **3.02 CONCRETE REMOVAL**  
6

- 7 A. Concrete designated to be removed to specific limits as shown on the Drawings  
8 or directed by the Engineer, shall be done by line drilling at limits followed by  
9 chipping or jack-hammering as appropriate in areas where concrete is to be  
10 taken out. Remove concrete in such a manner that surrounding concrete or  
11 existing reinforcing to be left in place and existing in place equipment is not  
12 damaged. Sawcutting at limits of concrete to be removed shall only be done if  
13 indicated on the Drawings, or after obtaining written approval from the Engineer.  
14
- 15 B. Where existing reinforcing is exposed due to saw cutting/core drilling and no  
16 new material is to be placed on the sawcut surface, a coating or surface  
17 treatment of epoxy paste shall be applied to the entire cut surface to a thickness  
18 of 1/4-in.  
19
- 20 C. In all cases where the joint between new concrete or grout and existing concrete  
21 will be exposed in the finished work, except as otherwise shown or specified,  
22 the edge of concrete removal shall be a 1-in deep saw cut on each exposed  
23 surface of the existing concrete.  
24
- 25 D. Concrete specified to be left in place which is damaged shall be repaired by  
26 approved means to the satisfaction of the Engineer.  
27
- 28 E. The Engineer may from time to time direct the Contractor to make additional  
29 repairs to existing concrete. These repairs shall be made as specified or by  
30 such other methods as may be appropriate.  
31

32 **3.03 CONNECTION SURFACE PREPARATION**  
33

- 34 A. Connection surfaces shall be prepared as specified below for concrete areas  
35 requiring patching, repairs or modifications as shown on the Drawings, specified  
36 herein, or as directed by the Engineer.  
37
- 38 B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting  
39 materials from the surface by dry mechanical means, i.e. - sandblasting,  
40 grinding, etc, as approved by the Engineer. Be sure the areas are not less than  
41 1/2-in in depth. Irregular voids or surface stones need not be removed if they  
42 are sound, free of laitance, and firmly embedded into parent concrete, subject  
43 to the Engineer's final inspection.  
44
- 45 C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all  
46 contaminants, rust, etc, as approved by the Engineer. If half of the diameter of

1 the reinforcing steel is exposed, chip out behind the steel. The distance chipped  
2 behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not  
3 be damaged during the demolition operation.

- 4
- 5 D. Reinforcing from existing demolished concrete which is shown to be  
6 incorporated in new concrete shall be cleaned by mechanical means to remove  
7 all loose material and products of corrosion before proceeding with the repair.  
8 It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and  
9 provided with 1-in minimum cover all around.
- 10
- 11 E. The following are specific concrete surface preparation "methods" to be used  
12 where called for on the Drawings, specified herein or as directed by the  
13 Engineer.
- 14
- 15 1. Method A: After the existing concrete surface at connection has been  
16 roughened and cleaned, thoroughly moisten the existing surface with  
17 water. Brush on a 1/16-in layer of cement and water mixed to the  
18 consistency of a heavy paste. Immediately after application of cement  
19 paste, place new concrete or grout mixture as detailed on the Drawings.
- 20
- 21 2. Method B: After the existing concrete surface has been roughened and  
22 cleaned, apply epoxy bonding agent at connection surface. The field  
23 preparation and application of the epoxy bonding agent shall comply  
24 strictly with the manufacturer's recommendations. Place new concrete  
25 or grout mixture to limits shown on the Drawings within time constraints  
26 recommended by the manufacturer to ensure bond.
- 27
- 28 3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The  
29 hole shall be blown clear of loose particles and dust just prior to installing  
30 epoxy. The drilled hole shall first be filled with epoxy paste, then  
31 dowels/bolts shall be buttered with paste then inserted by tapping.  
32 Unless otherwise shown on the Drawings, deformed bars shall be drilled  
33 and set to a depth of ten bar diameters and smooth bars shall be drilled  
34 and set to a depth of fifteen bar diameters. If not noted on the Drawings,  
35 the Engineer will provide details regarding the size and spacing of  
36 dowels.
- 37
- 38 4. Method D: Combination of Method B and C.
- 39
- 40 5. Method E: Capsule anchor system shall be set in existing concrete by  
41 drilling holes to the required depth to develop the full tensile and shear  
42 strengths of the anchor material being used. The anchor bolts system  
43 shall be installed per the manufacturer's recommendation in holes sized  
44 as required. The anchor stud bolt, rebar or other embedment item shall  
45 be tipped with a double 45 degree chamfered point, securely fastened  
46 into the chuck of all rotary percussion hammer drill and drilled into the

1 capsule filled hole. The anchor may be installed in horizontal, vertical  
2 and overhead positions.  
3

4 3.04 GROUTING  
5

6 A. Grouting shall be as specified in Section 03600.  
7

8 3.05 CRACK REPAIR  
9

10 A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant  
11 into cracks per manufacturer's recommendations. If cracks are less than 1/16-in  
12 in thickness they shall be pressure injected.  
13

14 B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant  
15 through valves sealed to surface with crack repair epoxy adhesive per  
16 manufacturer's recommendations.  
17

18 C. Cracks shall be repaired according to the following generalized procedure:  
19

20 1. Remove any efflorescence, dirt, oil, etc. off the surfaces in the vicinity of  
21 the observed seepage. Where loose cementitious surfacer/slurry is  
22 encountered it shall be removed to reveal the original concrete surface.  
23 Removal shall be performed using mechanical methods chemical  
24 solutions provided they are approved by other product manufacturers  
25 which are to be used (i.e. paint).  
26

27 2. Apply adequate surface seal to crack to prevent leakage of epoxy.  
28

29 3. Establish injection points at a distance along crack not less than  
30 thickness of cracked member.  
31

32 4. Crack injection sequence:  
33

34 5. Ensure that tank is full of water.  
35

36 6. Inject epoxy into crack from exterior at first port with sufficient pressure  
37 to advance epoxy to adjacent port.  
38

39 7. Seal original port and shift injection to port where epoxy appears.  
40

41 8. Continue port-to-port injection until crack has been injected for its entire  
42 length.  
43

44 9. For small amounts of epoxy, or where excessive pressure developed by  
45 injection pump might further damage structure, premixed epoxy and use  
46 hand caulking gun to inject epoxy if acceptable to the Engineer.

10. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
  11. The crack is considered to be sealed once no moisture is transferred from the concrete to a dry hand for a minimum of 24 hours after injections. Continue injection procedures if the crack does not meet this condition.
  12. After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete including applying new surfacer patch material to match existing in thickness, texture, etc. All materials used for patching or repairs shall be coordinated with other products to be used such as paint to ensure conformance and applicability.

END OF SECTION

1 SECTION 03750  
2

3 FLOW CHANNEL COATING SYSTEM  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

9 A. Description:

10  
11 This section covers all workmanship, materials safety and quality requirements  
12 for concrete flow channel resurfacing and coating work. Provide and apply  
13 repair materials as specified herein to the limits directed by the Engineer  
14 and/or as indicated on drawings.

15 B. A general description of the work to be performed is listed below:  
16

- 17
- 18 • Power wash the interior surface of the channels to remove grease and  
19 contaminants.
  - 20 • Sand blast the interior surface of the channels to obtain the correct surface  
21 profile and surface mechanical grip properties.
  - 22 • Power rinse the interior surface of the channels to remove sand blasting  
23 debris, dust, and particles.
  - 24 • Apply Xypex Megamix II with BIO SAN

25  
26 C. Cracks and joints that require additional materials shall be injected with  
27 hydrophilic polyurethane grout.

28 1.02 RELATED WORK:

29  
30 Division 1 - General Requirements

31 1.03 REFERENCES:

- 32
- 33 A. This section contains references to the documents listed below. They are a  
34 part of this section as specified and modified. In case of conflict between the  
35 requirements of this section and those of the listed documents, the more  
36 stringent of the requirements shall prevail.
  - 37 B. Unless otherwise specified, references to documents shall mean the  
38 documents in effect at the time of receipt of Bids.
  - 39 C. Referenced publications found within this specification shall be the latest  
40 revision unless otherwise specified; and applicable parts of the referenced  
41 publications shall become a part of this specification as if fully included.

<u>Reference</u>	<u>Title</u>
3	<b>ASTM (American Society of Testing and Materials)</b>
4	ASTM C 920 Specification for Elastomeric Joint Sealants
5	ASTM D 3960 Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
6	ASTM D 4259 Practice for Abrading Concrete
7	ASTM E 337 Standard Practice Test Method for Measuring Humidity with a Psychrometer
10	
11	<b>Federal Standard Colors</b>
12	F 595 B Federal Standard Colors
13	Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
14	
15	
16	<b>ICRI (International Concrete Restoration Institute)</b>
17	Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
18	
19	
20	<b>NACE (National Association of Corrosion Engineers)</b>
21	Publication 6D-173 "A Manual for Painter Safety"
22	Publication 6G-164 "Surface Preparation Abrasives for Industrial Maintenance Painting"
23	Publication TPC2 Coatings and Linings for Immersion Service:
24	Chapter 1 Safety
25	Chapter 2 Surface Preparation
26	Chapter 3 Curing
27	Chapter 4 Inspection
28	Publication 6F-163 "Surface Preparation of Steel or Concrete Tank Interiors."
29	RP0892-92 Standard Recommended Practice, Lining over Concrete in Immersion Service
30	RP0288-88 Standard Recommended Practice, Inspection of Linings on Steel and Concrete
31	
32	
33	
34	
35	<b>SSPC (Steel Structures Painting Council)</b>
36	SSPC-SP 12 Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating
37	SSPC-SP 13 Surface Preparation of Concrete
38	SSPC-PA-3 "A Guide to Safety in Paint Application"
39	SSPC-Guide 12 Guide for Illumination of Industrial Painting Project
40	
41	
42	
43	<b>OSHA (Occupational Safety and Health Administration)</b>
44	1915.35 Standards – 29 CFR – Painting
45	
46	
47	<b>ANSI (American National Standards Institute)</b>
48	ANSI/ASC 29.4 Abrasive Blasting Operations — Ventilation and Safe Practice

1  
2   1.04 QUALITY ASSURANCE  
3

- 4           A. The manufacturer and/or applicator of the coating system shall be a company  
5           that specializes in the design, manufacture or installation of corrosion  
6           protection systems for wet wells. The applicator shall be completely trained in  
7           leak repair, surface preparation and corrosion materials application in wet  
8           wells.
- 9
- 10          B. The applicator shall be trained and certified by the manufacturer for the  
11          handling, mixing, application and inspection of the liner system as described  
12          herein.
- 13
- 14          C. To ensure total unit responsibility, all materials and installation thereof shall be  
15          furnished and coordinated with/by one supplier/applicator.
- 16
- 17          D. Requirements:
- 18
- 19           1. Do not use or retain contaminated, outdated, or diluted materials for  
20           resurfacing. Do not use materials from previously opened containers.
- 21           2. Use only products of the approved Manufacturer(s). Use products of  
22           one manufacturer with compatible materials. Provide same material  
23           product for touch-up as for original material.
- 24           3. If any requirements of this specification conflict with a referenced  
25           standard, the more stringent requirement shall apply.
- 26           4. Make all locations and phases of the work available for access by the  
27           Engineer. The Contractor shall provide ventilation and egress to safely  
28           access the coating work areas for construction and inspection.
- 29           5. Conduct work so that the resurfacing system is installed as specified  
30           herein. Inspect work continually to ensure that the resurfacing system  
31           is installed as specified herein. The Contractor shall inspect the work to  
32           determine conformance with the specifications and referenced  
33           documents. The Contractor shall inform the Engineer of the progress  
34           and the quality of the work through daily reports as specified below.  
35           Any nonconforming coating system work shall be corrected as specified  
36           herein or as recommended by the Manufacturer.
- 37           6. Summarize test data, work progress, areas covered, ambient  
38           conditions, quality control inspection test findings, and other information  
39           pertinent to the resurfacing system installation in daily reports to be  
40           submitted to the Engineer.
- 41           7. The methods of construction shall be in accordance with all  
42           requirements of this specification.
- 43           8. Employ only trades people who have at least five years of experience  
44           performing resurfacing work of similar size and complexity as the work  
45           specified in this Section. Submittals to verify these qualifications are to  
46           be made within thirty (30) days of the Notice-to-Proceed and are  
47           subject to approval by the Engineer.
- 48

1    1.05 SUBMITTALS

- 2
- 3       A. Submit the following prior to commencing with any phase of the work covered  
4       by this Section:
- 5
- 6           1. Manufacturer's current printed recommendations and product data  
7           sheets for all coating system products supplied under this section  
8           including performance criteria, surface preparation and applications,  
9           volatile organic compound (V.O.C.) data, and safety requirements.
- 10          2. Material Safety Data Sheets (MSDS) for any materials brought on-site  
11          including all resurfacing system materials, solvents, and abrasive blast  
12          media.
- 13          3. Storage requirements including temperature, humidity, and ventilation  
14          for resurfacing system materials.
- 15          4. Manufacturer's requirements, including application procedures for  
16          resurfacing materials shall be in writing and shall be followed in detail.  
17          All safety precautions recommended by the Manufacturer shall be  
18          strictly adhered to at all times when work is in progress.
- 19          5. Color samples for all surfaces to be resurfaced that have been field-  
20          matched to existing colors.
- 21          6. Submit applicators' certification that resurfacing materials comply with  
22          Federal, State, and Local regulations for VOC (Volatile Organic  
23          Compounds).
- 24          7. Submit daily reports that contain the following information: Substrate  
25          conditions, ambient conditions, application procedures, work completed  
26          and location thereof. Mark-up drawings that show location of work.
- 27          8. Submit letter(s) with associated product data signed by Manufacturer  
28          certifying that submitted products are suitable for application on the  
29          surfaces to be resurfaced and for the service conditions.

30

31    1.06 WARRANTIES

- 32
- 33       A. All patch or filler concrete used below the lining coating shall be warranted for  
34       the same length of times as the lining coating.
- 35
- 36       B. The Contractor shall warrant the lining coating for a period of 5 years. A  
37       coating failure will have occurred if the lining fails to prevent damage or  
38       corrosion to the structure, bubbles out from wall or metal, or fails to adhere to  
39       concrete or metal. Failure does not include mechanical or chemical abuse. If  
40       coatings are deemed to have failed, the Contractor shall at his expense  
41       completely repair the damaged area including an expanded area of a  
42       minimum of 6-inches in any direction.

43

44    1.07 DELIVERIES AND STORAGE

- 45
- 46       A. Materials shall be stored in accordance with Manufacturer's recommendations  
47       in enclosed structures and shall be protected from weather and adverse  
48       temperature conditions. Flammable materials shall be stored in accordance

1           with state and local codes. Materials exceeding storage life recommended by  
2           the manufacturer shall be removed from the site.  
3

- 4           B. Store all materials only in area or areas designated by the Engineer solely for  
5           this purpose. Confine mixing, thinning, clean-up and associated operations,  
6           and storage of materials-related debris before authorized disposal, to these  
7           areas. All materials are to be stored on pallets or similar storage/handling  
8           skids off the ground in sheltered areas in which the temperature is maintained  
9           between 70<sup>0</sup>F and 90<sup>0</sup>F.
- 10          C. Mix all resurfacing materials in a mixing area supplied by the Contractor. This  
11         enclosed area must protect the mixing operation and materials from direct  
12         sunlight, inclement weather, freezing, or other means of damage or  
13         contamination. Protect all other concrete and metallic surfaces and finishes  
14         from any spillage of material(s) within the mixing area.
- 15          D. Do not use floor drains, dikes or storm drains for disposal of resurfacing  
16         systems materials.
- 17          E. The Contractor shall take all precautions and implement all measures  
18         necessary to avert potential hazards associated with the resurfacing system  
19         materials as described on the pertinent Material Safety Data Sheets or  
20         container labels.
- 21          F. Deliver all materials to the job site in their original, unopened containers. Each  
22         container shall bear the Manufacturer's name and label.
- 23           1. Labels on all material containers must show the following information:
- 24              a. Name or title of product.  
25              b. Federal Specification Number if applicable.  
26              c. Manufacturer's batch number and date of manufacture.  
27              d. Manufacturer's name.  
28              e. Generic type of material.  
29              f. Application and mixing instructions.  
30              g. Hazardous material identification label.  
31              h. Shelf life date.  
32              i. Storage requirements.
- 33          G. All containers shall be clearly marked indicating any personnel safety hazards  
34         associated with the use of or exposure to the materials.
- 35          H. All materials shall be handled and stored to prevent damage or loss of label.
- 36          I. The Contractor shall provide resurfacing material storage and mixing areas.
- 37          J. Do not use or retain contaminated, outdated, prematurely opened, diluted  
38         materials, or materials which have exceeded their shelf life.

1  
2   1.08 COORDINATION OF WORK  
3

4       A. Work Areas:

5  
6       The work areas on the job site will be limited to the flow channels as  
7       designated by the Owner. The Contractor's personnel shall not be permitted  
8       in any area other than those expressly designated by the Owner.  
9

10      B. Coordination:

11  
12       The Contractor shall coordinate with the Engineer and Owner regarding  
13       availability of work areas, completion times, safety, access and other factors,  
14       which can impact plant operations.  
15

16   1.09 SAFETY  
17

18       A. The work may be inside a confined space. The Contractor's work forces shall  
19       comply with all applicable documentation and safety requirements related to  
20       confined spaces and all safety requirements referenced in Section 1.03.  
21

22       B. The Contractor shall provide personnel with all safety equipment necessary to  
23       protect them during any phase of the work. This shall include, but not be  
24       limited to safety glasses, goggles, earplugs, hard hats, steel toed work shoes,  
25       appropriate personal protective clothing, gloves, and plant approved escape  
26       respirators (where required).  
27

28       C. Keep any flammable materials such as cleaning solvents, thinners, or  
29       resurfacing materials away from open flames, sparks or temperatures higher  
30       than 150°F. Drums containing flammable materials will be grounded. No  
31       solvent in any quantity shall be allowed inside containment enclosures or  
32       permitted confined spaces at any time during resurfacing work.  
33

34       D. Power tools are to be in good working order to avoid open sparking. No spark  
35       producing tools shall be utilized in restricted areas as indicated herein.  
36

37       E. The Contractor shall fireproof all work areas by maintaining a clean work area  
38       and having Underwriter's Laboratories approved fire extinguishers on-hand.  
39       The Contractor shall furnish these fire extinguishers.  
40

41       F. Workers doing abrasive blasting operations shall wear a fresh air supplied  
42       protective helmet and hood and personal protective clothing acceptable to  
43       industry standards and all government regulations.  
44

45       G. Dispose of rags used for wiping up resurfacing materials, solvents, and  
46       thinners by drenching them with water and placing in a metal container with a  
47       tight fitting metal cover. Complete this disposal process at the end of each  
48       day. Final disposal of these materials is the Contractor's responsibility.

- H. Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work. Smoking is permitted only in designated areas of the plant.

## PART 2 – PRODUCTS

## 2.01 MANUFACTURERS

- A. Materials specified are those that have been evaluated for the specific service. Equivalent materials by other manufacturers may be submitted upon written approval of the Engineer. As part of the proof of equality, the Contractor shall submit certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests between the product specified and the requested substitution.
  - B. Requests for substitution shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified lab test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service.
  - C. All requests for product substitution shall be made at least 10 days prior to the bid opening date.
  - D. Any material savings shall be passed to the Owner in the form of a contract dollar reduction.
  - E. Approved manufacturers for this project include products of Xypex Chemical Corporation, the Sika Corporation, or equal.

## 2.02 MATERIALS

Specific Products are listed below to establish a quality benchmark.

- A. Structural Repair Mortar (XYPEX Megamix II with BIO-SAN)

  1. Structural repair mortar shall have low shrinkage, high strength, and durability against corrosion.
  2. Shall not contain volatile organic carbons (VOC).
  3. Typical Properties (@ 28 days unless otherwise specified):
    - a. Compressive Strength: 7700 psi
    - b. Flexural Strength: 1190 psi

c.	Splitting Tensile Strength:	603 psi
d.	Direct Tensile Bond to Concrete:	330 psi
e.	Elastic Modulus:	20.4 GPa
f.	Rapid Chloride Permeability:	572 C
g.	Carbonation Depth @ 49 days:	no measurable depth
h.	Scaling Resistance @ 50 cycles:	no scaling
i.	Acid Resistance @ 84 days:	negligible mass loss
j.	Initial Set:	3:25 hrs:min
k.	Final Set	5:00 hrs:min

4. The structural repair mortar shall be placeable in 3/8" to 2" lifts.

5. The materials shall be resistant to corrosion.

#### B. Hydrophilic Polyurethane Grout (SikaFix HH Hydrophilic)

1. Nonflammable hydrophilic polyurethane resin.

2. Cures to from a flexible adhesive closed cell foam.

3. The material shall not contain volatile solvents.

#### 4. Performance Criteria

##### a. Properties of the uncured resin grout.

- Shelf Life : 1 Year @ 73° F
- Solids (ASTM D 2369 B) 83%
- Viscosity (ASTM D 2196 A) 650-800 csp
- Density (ASTM D 3574-95) 8.7-9.2 lbs/gal
- Flashpoint F (ASTM D-92) 225
- Reaction Time 1:1 with Water 20 sec @ 68 F

##### b. Properties of the cured resin grout.

- Tensile Strength (ASTM D 3575-95) 380 psi
- Bond Strength 250-300 psi
- Elongation (ASTM D 3574-95) 400%
- Shrinkage (ASTM D 1042) less than 10%

### 2.03 ABRASIVE BLAST MEDIA

A. Provide the material, size, gradation, and quality necessary to produce the degree of cleanliness and surface profile required herein.

### PART 3 - EXECUTION

#### 3.01 GENERAL

1           A. Hoisting, Scaffolding, Staging, and Planking:

2  
3  
4           Provide, set-up, and maintain all required hoists, scaffolds, and staging and  
5           planking, and perform all access related hoisting work required to complete  
6           the work of this section as indicated and specified. Scaffolds shall have solid  
7           backs and floors to prevent dropping materials from there to the floors or  
8           ground below.

9  
10          B. Environmental Requirements:

11  
12          Comply with the Manufacturer's recommendations as to environmental  
13          conditions under which resurfacing system materials can be applied. Do not  
14          apply resurfacing system materials when dust is in work site. The Contractor  
15          shall provide all temporary lighting during the work.

16  
17          C. Protection:

18  
19          Cover or otherwise protect finish work or other surfaces not being resurfaced.  
20          Erect and maintain protective tarps, enclosures and/or maskings to contain  
21          debris (such as dust or airborne particles resulting from surface preparation)  
22          generated during any and all work activities. This includes but is not limited to  
23          the use of dust/debris collection apparatus as required.

24  
25          D. Initial Inspection Of Surfaces To Be Coated:

26  
27          It is the responsibility of the Contractor to inspect and report unacceptable  
28          concrete substrate surface conditions to the Engineer prior to the  
29          commencement of surface preparation activities. Unacceptable surface  
30          conditions are defined as the presence of cracked surfaces or concrete  
31          deteriorated to a depth of greater than 1-inch or otherwise unable to withstand  
32          surface preparation as specified herein.

33  
34          E. Thinners and Solvents:

35  
36          The Contractor shall use only solvents and thinners as recommended by the  
37          Manufacturer.

38  
39          **3.02 PREPARATION OF EXISTING SURFACES**

40  
41          A. Surface preparation shall produce a cleaned, abraded and sound surface with  
42          no evidence of laitance, loose dust, dirt, concrete, brick or mortar,  
43          contaminants or debris, and shall display a surface profile suitable for  
44          application of liner system

45  
46          B. Prior to abrasive media blasting, loose materials, acid constituents, grease, oil,  
47          and other contaminants shall be removed with a 2500-5000 psi power wash  
48          using potable water and an alkaline-based emulsifying detergent as

1 recommended by the resurfacing material manufacture.

2

3 C. Prepare the surface to be coated per the coating manufacturers'

4 recommendations.

5

6 D. Where reinforcing steel with active corrosion is encountered, sandblast the

7 steel to a white metal finish to remove all contaminants and rust. Where

8 corrosion has occurred due to the presence of chlorides, the steel shall be

9 high pressure washed after mechanical cleaning. Prime steel with 2 coats of

10 Sika Armatec 110 EpoCem as per the technical data sheet. (See Spec

11 Component SC-201-0699)

12

13 E. Abrasive Blast Cleaning

14

- 15 1. Sand blasting media shall be washed, graded and free of contaminants
- 16 that might interfere with the adhesion of the resurfacing materials.
- 17 Used or spent blast abrasive shall not be reused on work covered by
- 18 this section.
- 19 2. The compressed air used for blast cleaning will be filtered free of
- 20 condensed water or oil. Moisture traps will be cleaned at least once
- 21 every four hours or more frequently as is appropriate.
- 22 3. Oil separators shall be installed just downstream of compressor
- 23 discharge valves and at the discharge of the blast pot discharges. Oil
- 24 separators shall be cleaned at least once every four hours or more
- 25 frequently as is appropriate.
- 26 4. A paper blotter test shall be performed by the Contractor when
- 27 requested by the Engineer or the Engineer's representative to
- 28 determine if the air is sufficiently free of oil and moisture.
- 29 5. Regulators, gauges, filters, and separators will be in good working order
- 30 for all of the compressor air lines to blasting nozzles at all times during
- 31 this work.
- 32 6. An air dryer or drying unit shall be installed which dries the compressed
- 33 air prior to blast connections. This dryer shall be used and maintained
- 34 for the duration of surface preparation work.
- 35 7. The quality, volume, and velocity of life support and ventilation air used
- 36 during surface preparation shall be in accordance with applicable safety
- 37 standards and as required to ensure adequate visibility and proper
- 38 dissipation of volatiles without impacting the prepared surface or the
- 39 health of the public or personnel working for the Contractor,
- 40 Subcontractors, Engineer, Engineer's Representatives, or anyone who
- 41 may be affected by on-site maintenance coating work activities.
- 42 8. The abrasive blast nozzles used shall be the venturi or other high
- 43 velocity type supplied with a minimum of 100-psig air pressure and the
- 44 necessary volume to obtain the required blast cleaning production rates
- 45 and specified degree of cleanliness.
- 46 9. The Contractor must provide adequate ventilation for airborne
- 47 particulate evacuation and lighting (meeting all pertinent safety
- 48 standards) to optimize visibility for both blast cleaning and observation

1                   of the substrate during surface preparation work.  
2

- 3                   F. After abrasive blasting, the interior surface shall be power rinsed with potable  
4                   water to remove all loose materials and other contaminants.

5

6        3.03 APPLICATION REQUIREMENTS RESURFACING MORTAR

7

- 8                   A. Application of the resurfacing material shall be in accordance with the  
9                   manufacturers' recommendations.

10

11      3.04 APPLICATION REQUIREMENTS HYDROPHILIC POLYURETHANE GROUT

12

- 13                   A. Prepare materials per Manufacturer's recommendations.

- 14
- 15                   B. Drill injection ports at a 45° degree angle to intersect the crack at  
16                   approximately ½ the depth of the structure. Spacing of the injection ports  
17                   depends on crack width, but normal spacing varies from 6" to 24". It is  
18                   necessary to flush the drilled holes with water to remove drill dust from the  
19                   holes and cracks, and insure that the crack is wet enough to react with the  
20                   grout when introduced to the crack. On structures open on both sides, provide  
21                   ports on opposite sides at staggered elevations. Install the injection ports in  
22                   the holes.

- 23
- 24                   C. Inject first port with clean water at 250-psi minimum until air and water begin to  
25                   flow out of the crack and the other ports. Complete this step for every port.

- 26
- 27                   D. Limitation times and related temperature range restrictions between  
28                   successive lifts for all products specified herein per Manufacturer's stated  
29                   requirements.

- 30
- 31                   E. Inject the prepared cracks with a minimum of 250 psi in order to achieve  
32                   maximum filling and penetration without the inclusion of air pockets or voids in  
33                   the polyurethane chemical grout. Begin the pressure injection at the lowest  
34                   packer and continue until there is the appearance of the polyurethane  
35                   chemical grout at an adjacent packer, thus indicating travel. When travel is  
36                   indicated, a decision to discontinue or continue the pressure injection from that  
37                   packer should be made by the contractor, based on his experience, with the  
38                   approval of the engineer. Continue the procedure until all applicable cracks  
39                   have been filled.

- 40
- 41                   F. Pump polyurethane chemical grout for 45 seconds and then pause to allow the  
42                   material to flow into all of the cracks and crevices. Watch for material flow and  
43                   water movement to appear on the surface. When movement stops, begin  
44                   injection into the next packer. When sealing vertical cracks, begin injecting at  
45                   the bottom of the crack and work vertically. If site temperature are extremely  
46                   low, heat bands or heated water baths may be used on the pails, before and  
47                   during use to maintain the products temperature. Re-inject to assure that all  
48                   voids are properly sealed off.

- 1
- 2       G. If penetration of any cracks is impossible, consult the engineer before
- 3           discontinuing the injection procedure. If modification of the proposed
- 4           procedure is required to fill the cracks, submit said modification in writing to
- 5           the engineer for acceptance prior to proceeding.
- 6
- 7       H. Adhere to all limitations and cautions for the polyurethane chemical grout as
- 8           stated in the manufacturer's current printed literature.
- 9
- 10      I. Caution: Expanding chemical grout is exerting outward high pressures and
- 11           review of drawings of the area to be repaired is recommended.
- 12
- 13      J. All equipment and procedures used for polyurethane resin injection system
- 14           application shall be as recommended by the Manufacturer. Unless specified
- 15           elsewhere herein, the Contractor shall comply with the Manufacturer's most
- 16           recent written instructions.

17

18

19     **3.06 FIELD QUALITY CONTROL INSPECTION AND TESTING**

20

- 21       A. Inspection by the Engineer or others does not limit the Contractor's
- 22           responsibilities for quality control inspection and testing as specified herein or
- 23           as required by the Manufacturer's instructions.
- 24
- 25       B. Perform the quality control procedures listed below in conjunction with the
- 26           requirements of this Section.
- 27
- 28           1. Inspect all materials upon receipt to ensure that all are supplied by the
- 29            Manufacturer.
- 30
- 31           2. Provide specified storage conditions for the resurfacing system
- 32            materials, solvents, and abrasives.
- 33
- 34           3. The pH of the concrete substrate will be measured using pH-indicating
- 35            papers. pH testing is to be performed once every 50 sq. ft. Acceptable
- 36            pH values shall be between 9.0 and 11.0 as measured by a full range
- 37            (1-12) color indicating pH paper with readable color calibrations and a
- 38            scale at whole numbers (minimum). Use Hydron Insta-Check Jumbo
- 39            0-13 or 1-12 or equal. The paper shall be touched to the surface once
- 40            using moderate gloved finger pressure. The surface shall not be wiped
- 41            or moved laterally to disturb the surface during pH testing. Following
- 42            the one touch, lift the paper vertically to not "wipe" the surface.
- 43            Compare the color indicated with the scale provided and record the pH.
- 44
- 45           4. Inspect and record substrate profile (anchor pattern). Surfaces shall be
- 46            abraded, as a minimum, equal to the roughness of 40 grit sand paper.
- 47
- 48           5. Measure and record ambient air temperature once every two hours of

- 1                   each shift using a thermometer and measure and record substrate  
2                   temperature once every two hours using a surface thermometer.  
3
- 4                   6. Measure and record relative humidity every two hours of each shift  
5                   using a sling psychrometer in accordance with ASTM E337.  
6
- 7                   C. Provide correct mixing of resurfacing materials in accordance with the  
8                   Manufacturer's instructions.  
9
- 10                  D. Inspect and record that the "pot life" of resurfacing materials are not exceeded  
11                  during installation.  
12
- 13                  E. Verify curing of the resurfacing materials in accordance with the  
14                  Manufacturer's instructions.  
15
- 16                  F.  
17
- 18                  G. Upon completion of the lining system installation, the lined area shall be  
19                  cleaned and prepared to permit close visual inspection by the Engineer or the  
20                  Engineer's Representative. Any and all deficiencies or defective work (not in  
21                  compliance with this section or related sections) will be marked for repair or  
22                  removal/replacement by the Contractor at no additional cost to the Owner.  
23

24                  **3.07 ACCEPTANCE CRITERIA**  
25

- 26                  A. Acceptance Criteria for Surface Preparation Work: All surfaces shall be  
27                  prepared in accordance with the specification and referenced standards  
28                  herein.  
29
- 30                  B. Acceptance Criteria for Coating System Application Work: Acceptable coating  
31                  work will be based upon the following:  
32                   1. No pockmarks, trowel marks, depressions, unconsolidated areas,  
33                   waviness or ridges, pinholes or holidays in either size or frequency.  
34                   2. No inter-coat bond failures between lifts.  
35                   3. Proper curing of coatings.  
36
- 37                  C. Resurfaced areas shall pitch to drains. There shall be no areas that puddle  
38                  when flood tested.  
39
- 40                  D. The Engineer or Engineer's Representative shall, at their discretion, inspect  
41                  the following:  
42
- 43                   1. Profile and degree of cleanliness of substrate.  
44                   2. Thickness of materials/coverage rate confirmation.  
45                   3. Ambient temperature and humidity requirements, and substrate  
46                   temperature.  
47                   4. Curing and recoat times.  
48                   5. Proper curing of the resurfacing materials.

- E. Rework required on any holidays or any other inadequacies found by the Engineer or the Engineer's representative in the quality of the coating work should be marked. Such areas shall be recleaned and reworked by the Contractor according to these specifications and the manufacturer's recommendations at no additional cost to the Owner.
  - F. The Contractor is responsible for keeping the Engineer informed of all progress so that inspection for quality can be achieved.
  - G. The Contractor is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the Engineer or the Engineer's Representative do not limit this responsibility.

### **3.08 FINAL INSPECTION**

- A. Perform a final inspection to determine whether the resurfacing system work meets the requirements of the specifications. The Engineer and the Engineer's Representative will conduct final inspection with the Contractor.

END OF SECTION

1 SECTION 03800  
2

3 LEAKAGE TESTING OF WATER RETAINING STRUCTURES  
4

5  
6 PART 1 - GENERAL  
7

8 1.01 SCOPE OF WORK  
9

10 A. Water tightness testing of reinforced concrete water retaining structures.  
11

12 1.02 REFERENCE STANDARDS  
13

14 A. American Concrete Institute (ACI)  
15

16 1. ACI 350.1-01 – Tightness Testing of Environmental Engineering  
17 Concrete Structures.

18  
19 PART 2 - PRODUCTS  
20

21 2.01 GENERAL  
22

23 A. Provide potable or reclaimed water, piping, and equipment required to test  
24 concrete structures for leakage.

25  
26 PART 3 - EXECUTION  
27

28 3.01 GENERAL  
29

30 A. Hydrostatically test reinforced concrete structures that will contain water in  
31 accordance with the requirements specified below, and assure structures are  
32 free of detectable leaks.

33 B. Do not start leak testing or cleaning of surfaces until concrete is cured and  
34 joint sealants have set and cured a minimum of 14 days.

35 C. Conduct testing before backfill is placed against walls and prior to installing  
36 interior lining systems, if applicable.

37 D. Prior to testing, clean exposed surfaces by thorough hosing, and remove  
38 surface laitance and loose matter from walls and slabs. Remove wash water  
39 and debris by means other than washing through plant piping.

40  
41 3.02 TEST PROCEDURE  
42

43 LEAKAGE TESTING OF WATER RETAINING STRUCTURES

44 03800-1

03/22/2019

- A. Fill structure to be tested to the normal operating liquid level. Filling rate shall not exceed 4 feet of water per hour, and shall be at continuous uniform rate with continuous monitoring.
  - B. The exterior surface of the tank shall be monitored for flowing leaks. Repair any flowing leaks that occur before continuing filling.
  - C. The water shall be kept at the test level for at least three days prior to the actual test.
  - D. Measure the vertical distance to the water surface from a fixed point on the tank above the water surface. Record measurements at 24-hour intervals.
  - E. A drop of the water surface exceeding 1/20 of 1% of the normal volume of contained liquid is considered a failing leakage test.
  - F. The structure also fails the leakage test if flowing or seeping water is observed, or if moisture can be transferred to a dry hand from the exterior surface.
  - G. Independently measure change in water volume due to evaporation and precipitation using a 24 inch deep white, watertight container not less than 10 square feet of surface area. Position the container to experience environmental conditions similar to the structure being tested. The volume change of the structure shall be corrected based on the water volume change in the sample container.
  - H. Failing tanks that exhibit no visible signs of leaking or seepage may be permitted to be immediately retested.
  - I. Failing tanks shall be drained, repaired, and retested until the tank has met the test requirements.

### 3.03 REPAIR METHODS

- A. Methods for repairing concrete are described in section 03740.

END OF SECTION

1 SECTION 05500  
2

3 MISCELLANEOUS METAL  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor, materials, equipment and incidentals required and install  
10      miscellaneous metals as shown on the Drawings and as specified herein. The  
11      miscellaneous metal items include but are not limited to the following:  
12
- 13       1. All metal frames, ladders, stair rails, floor opening frames including  
14        gratings and supports.
  - 15       2. Prefabricated access hatches and frames.
  - 16       3. Anchors and anchor bolts except those specified to be furnished with all  
17        equipment.
  - 18       4. Railings, posts and supports both interior and exterior.
  - 19       5. Cast iron frames, covers, grates, drain leaders and drains.
  - 20       6. Stair nosings, steel plates, overhead steel door frames, angle frames,  
21        plates and channels.
  - 22       7. Guardrails and bollards.

23 1.02 COORDINATION  
24

- 25       A. The work in this section shall be completely coordinated with the work of other  
26      Sections. Verify at the site both the dimensions and work of other trades  
27      adjoining items of work in this Section before fabrication and installation of items  
28      herein specified.  
29
- 30       B. Furnish to the pertinent trades all items included under this Section that are to  
31      be built into the work of all other Sections.

32 1.03 SHOP DRAWINGS AND SAMPLES  
33

- 34       A. Detail Drawings, as provided for in the General Conditions, showing sizes of  
35      members, method of assembly, anchorage, and connection to other members  
36      shall be submitted to the Engineer for approval before fabrication.  
37
- 38       B. For each fabricated item include drawings, elevations, and details. Show the  
39      following:

- 1. Details of Sections
  - 2. Jointing and Connections
  - 3. Indicate welded connections using standard AWS symbols; indicate net weld length.
  - 4. Reinforcing
  - 5. Fasteners and Anchors
  - 6. Accessories
  - 7. Location of each finish

C. Manufacturer's specifications, details and installation instructions. Submit for:

  - 1. All manufactured products used in fabrications.

D. Samples shall be submitted at the request of the Engineer for concurrent review with shop drawings.

## 1.04 JOB CONDITIONS

- A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.
  - B. Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation, together with all coordination Drawings and installation instructions required. Provide temporary bracing or anchors in formwork where required for installation in new concrete or other adjacent work.

## 1.05 REFERENCE SPECIFICATIONS

- A. Design, manufacturing and assembly of elements of the materials herein specified shall be in accordance with the standards of the below listed organizations, except as otherwise shown or specified. Where reference is made to a standard of one of these or other organizations the version of the standard in effect at the time of bid opening shall apply.

1.	Welded and Seamless Steel Pipe	ASTM A53
2.	Gray Iron Castings	ASTM A48 (Class 30)
3.	Galvanizing, general	ASTM A123
4.	Galvanizing, hardware	ASTM A153
5.	Galvanizing, assemblies	ASTM A386

6. Stainless Steel Bolts, Fasteners - AISI, Type 316
  7. Stainless Steel Plate and Sheet Wire - AISI, Type 316
  8. Welding Rods for Steel -- AWS Spec. for Arc Welding
  9. ANSI/AWS D1.1-88 -- Structural Welding Code -- Steel
  10. ANSI/AWS D1.3-81 -- Structural Welding Code -- Sheet Steel
  11. ASTM A 36/A 36M-88d -- Standard Specification for Structural Steel
  12. ASTM A 307-88a -- Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  13. ASTM A 501-88 -- Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
  14. ASTM A 563-88a -- Standard Specification for Carbon and Alloy Steel Nuts
  15. ASTM B 221-85a -- Standard Specification for Aluminum and Alumi-num-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
  16. FS FF-S-92B -- Screw, Machine: Slotted, Cross-Recessed or Hexagon Head
  17. FS FF-W-84A -- Washers, Lock (Spring)
  18. FS FF-W-92B -- Washer, Flat (Plain)
  19. SSPC-PA 1 -- Shop, Field, and Maintenance Painting; Steel Structures Painting Council
  20. SSPC-Paint 12 -- Cold-Applied Asphalt Mastic (Extra Thick Film); Steel Structures Painting Council
  21. SSPC-Paint 13 -- Red or Brown One-Coat Shop Paint; Steel Structures Painting Council
  22. SSPC-SP 1 -- Solvent Cleaning; Steel Structures Painting Council
  23. SSPC-SP 3 -- Power Tool Cleaning; Steel Structures Painting Council
  24. SSPC-SP 5 -- White Metal Blast Cleaning; Steel Structures Painting Council
  25. SSPC-SP 6 -- Commercial Blast Cleaning; Steel Structures Painting Council
  26. SSPC-SP 8 -- Pickling; Steel Structures Painting Council
  27. SSPC-SP 10 -- Near-White Blast Cleaning; Steel Structures Painting Council
  28. 2010 Florida Building Code (FBC)

## PART 2 - PRODUCTS

## 2.01 MATERIALS

- A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1. Structural Steel
    - a. W Shapes: ASTM A992, Gr.50
    - b. M Shapes: ASTM A36
    - c. S, C and MC Shapes: ASTM A36
    - d. L Shapes: ASTM A36

1	e. Plates, rods and Bars:	ASTM A36
2	2. HSS Rectangular Shapes:	ASTM A500, Grade B, 42 ksi
3	3. HSS Round Shapes	ASTM A500, Grade B, 35 ksi
4	4. Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
5	5. Steel Sheets	ASTM A366
6	6. Gray Iron Castings	ASTM A48, Class 35
7	7. Ductile Iron Castings	ASTM A536, Grade 65-45-12
8	8. Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
9	9. Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
10	10. Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
11	11. Stainless Steel Plates, Sheets, and Structural Shapes	
12	a. Exterior, Submerged or Industrial Use	ASTM A240, Type 316 (Type 316L for welded)
13	b. Interior and Architectural Use	ASTM A240, Type 304
14	12. Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
15	13. Carbon Steel Bolts and Studs	ASTM A307, Grade A or ASTM F1154, Gr.36 (galvanized unless noted otherwise)
16	14. High Strength Steel Bolts, Nuts and washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
17	a. Elevated Temperature Exposure	Type I
18	b. General Application	Type I or Type II
19	15. Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
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## 2.02 ANCHORS, BOLTS, AND FASTENING DEVICES

- A. Furnish anchors, bolts, fasteners, etc., as necessary for installation of the work of this section or as specified for securing the work of other sections.
  - B. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather, when used with aluminum shapes or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-bolt III; ITW Ramset; Redhead trubolt, or equal.
  - C. Unless otherwise noted, adhesive anchors shall be a two-component chemical resin anchoring system. Capsules shall be self-contained, exactly premeasured amounts of polyester or vinyl ester resin, aggregate and hardener. Stud assemblies shall consist of a stainless steel type 316 all-thread anchor rod with nut and washer. Provide manufacturer's recommended installation tools for installing anchor components. Install anchors in full compliance with the manufacturer's recommendations. Adhesive anchor system shall be Hilti, HIT-RE 500-SD; Simpson Strong Tie, SET-XP Epoxy-Tie or Acrylic Tie; or approved equal.
  - D. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

## 2.03 ALUMINUM ITEMS

- A. Aluminum gratings shall be of serrated I-Bar Aluminum Alloy 6063-T6, and shall be Thompson Fabricating Company, Aluminum I-Bar Grating; or equal. Bearing bars shall be 1-1/2 inch minimum. Grating shall be of sufficient strength to carry a uniformly distributed live load of not less than 200 pounds per square foot with maximum deflection of 1/4" of the span length. Provide bearing angles, anchors, and bolts constructed of aluminum or stainless steel and as detailed. Grating shall be removable type with standard removable fasteners. Aluminum surfaces in contact with concrete surfaces shall be protected with a special protective lacquer or bituminous coating or other approved coating in order to keep stains to a minimum. Top surface of all bars shall be flush; ends of gratings shall be provided with binding strips of same depth and thickness as the main bars welded thereto. All openings 2 inches and greater in diameter shall be banded with a bar of the same depth and thickness as the main bearing bars of the grating, or furnished with continuous cross bridges. Each cut bar shall be welded to the band if banding is utilized. The ends of all grating sections shall

1           be likewise banded. Clamps and bolts used for attaching grating to supporting  
2           members shall be stainless steel. All grating shall be clamped unless noted  
3           otherwise. Clamps shall be as recommended by the manufacturer.  
4

- 5           B. Metal frames and supports for grating or hatches/access covers shall be of the  
6           same material as the grating or hatches/access covers unless otherwise shown  
7           on the Drawings. Where aluminum supports are used, they shall be fabricated  
8           from aluminum alloy 6061-T6.  
9
- 10          C. Stair treads shall be as specified above for grating and shall have abrasive  
11          nonslip nosing.  
12
- 13          D. Aluminum nosing at concrete stairs shall be an extrusion of 4-inch minimum  
14          width with abrasive filled and shall be Wooster Products, Inc., Alumogrit Treads,  
15          Type 116; equal by Barry Pattern and Foundry Co.; Andco; or equal. Embedded  
16          anchors shall be furnished with a minimum of three anchors per tread.  
17
- 18          E. Aluminum ladders shall be fabricated to the dimensions and details and installed  
19          as shown on the Construction Drawings.  
20
- 21          F. Aluminum Handrails, Mechanically Fastened Type:  
22
- 23           1. All aluminum mechanically fastened type pipe handrails and guardrails  
24           shall be clear anodized aluminum finish and installed as specified herein  
25           and indicated on the Construction Drawings. Handrails shall be made of  
26           nominal 1-1/2 inches inside diameter pipe (schedule 40 for rails,  
27           schedule 80 for posts) fabricated of seamless 6105-T5 or 6061-T6 alloy,  
28           ASTM B-429 or ASTM B-221. The supplier of the handrail system shall  
29           supply all necessary fittings, rackets, transition, corner and connector  
30           pieces, toe boards, protective gaskets, etc., for a complete job at the  
31           locations indicated on the Construction Drawings. All mounting hardware  
32           including bolts, studs, nuts, etc., shall be stainless steel Type 316. Bends  
33           shall be smooth and accurate to the details shown. The handrail systems  
34           shall comply with all OSHA codes and the Florida Building Code. Railing  
35           systems incorporating pop-rivets or glued fittings shall no be allowed.  
36
- 37           2. Handrail and components shall be as manufactured by Thompson  
38           Fabricating Company, Birmingham, Alabama, or approved equal.  
39
- 40           3. Handrails and stair rails shall be designed to withstand a 200 lb  
41           concentrated load applied in any direction at any point on the top rail.  
42           Handrails and stair rails shall also be designed to withstand a load of 50  
43           lb/ft. applied horizontally to the top rail. The 200 lb load will not be applied  
44           simultaneously with the 50 lb/ft. load. In addition, the handrails shall be  
45           designed to withstand a load of 100 lb/ft. applied vertically downward to  
46           the top rail and simultaneously with the 50 lb/ft. horizontal load. The 100  
47           lb/ft. vertical load does not apply to stair rails.

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4. Spacing of posts where posts are required shall be as noted on shop drawings, but in all cases shall be uniform and shall not exceed the requirements of OSHA and the Florida Building Code. Shorter spacing may be used where required to maintain the maximum spacing. The fabricator of the aluminum handrail and guardrail system shall be responsible for the design and preparation of shop drawings and design calculations (signed and sealed by Registered Engineer) to meet OSHA requirements and the Florida Building Code.
  5. All railings shall be erected in line and plumb. Field splicing and expansion compensation shall be accomplished using internal splice sleeves. Make provisions for removable railing sections, as detailed and where shown on the Construction Drawings.
  6. Where handrail or guardrail posts are set in concrete, as per the manufacturer's requirements, the posts shall be set into aluminum sleeves cast in the concrete and firmly cemented with 1651 epoxy resin by E-Bond Epoxies, Oakland Park, Florida, or Moulded Reinforced Plastics, Inc., Fort Lauderdale, Florida or equal. Collars shall be placed on the posts and fastened in place, as shown and as detailed on approved shop drawings.
  7. Where handrail is supported from structural members, it shall be done by the use of approved sockets, flanges, brackets, or other approved means, which will provide neat and substantial support for the pipe railing.
  8. All railing shall be properly protected by paper, plastic or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed.

34      G. Toe Boards:

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1. Contractor shall furnish and install aluminum toe boards conforming to latest OSHA requirements on all railings and other locations where indicated on the Drawings.
  2. Toe boards shall consist of an extruded 6063-T6 aluminum shape bolted by means of a pipe clamp to the railing posts without requiring any drilling or welding of the toeboard to the railing posts as manufactured by Thompson Fabricating Company, or approved equal. Toe boards shall have pitched top and tear drop bottom to prevent accumulation of dirt, or other material.

1           3. Toe boards shall be aluminum alloy 6063-T6. All fastening hardware  
2           shall be Type 316 stainless steel.

3           H. Kick plates, if required, shall be fabricated and installed as shown on the  
4           Construction Drawings.

5           I. Prefabricated checkerplate aluminum floor hatches/access covers shall be as  
6           noted on the drawings and shall be Type "S-S" as manufactured by Halliday  
7           Products or type "APD" as manufactured by USF Fabrication or equal, sized as  
8           shown. The access covers shall have integrally mounted hinged safety gratings  
9           for fall protection. Hatches with either dimension over 3 feet-6 inches shall be  
10          double leaf type. Hatches and gratings shall be designed for a live load of 300  
11          pounds per square foot. The access frames and covers shall have a 1/4" (7mm)  
12          thick one-piece, mill finish, extruded aluminum frame, incorporating a  
13          continuous concrete anchor, of otherwise suitable for mounting as shown on the  
14          drawings. A bituminous coating shall be applied to the frame exterior where it  
15          will come in contact with concrete. Door panel shall be 1/4" (7mm) aluminum  
16          diamond plate, reinforced to withstand a live load of 300 lbs. psf (1464 kg. psm).  
17          Uniform live load shall sustain a maximum allowable deflection of 1/150 of the  
18          span. Doors shall open to 90 degrees and automatically lock with a T-316  
19          stainless steel hold open arm with aluminum release handle. For ease of  
20          operation, the hold open arm shall incorporate an enclosed stainless steel  
21          compression spring assist. Doors shall close flush with the frame and rest on a  
22          built-in neoprene cushion/gasket. Hinges and all fastening hardware shall be  
23          T-316 stainless steel. Unit shall lock with a T-316 stainless steel slam lock with  
24          removable key and have a non-corrosive handle. Unit shall carry a lifetime  
25          guarantee against defects in material and/or workmanship.  
26  
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28           The protective grating panel shall be 1 inch (25 kg.) aluminum "I" bar grating  
29           with Safety Orange powder-coated finish. Grating shall be hinged with tamper  
30           proof stainless steel bolts, and shall be supplied with a positive latch to maintain  
31           unit in an upright position. Grating shall have a 6-in. (152mm) viewing area on  
32           each lateral unhinged side for visual observation and limited maintenance.  
33           Grating support ledges on 300 lbs. psf (1464 kg. per sq. meter) loaded access  
34           covers shall incorporate nut rail with a minimum of four (4) stainless steel spring  
35           nuts. A padlock hasp for owner-supplied padlock shall be provided.  
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38           J. Ship ladders shall be of all aluminum construction as detailed. Treads shall  
39           have abrasive nosing as manufactured by Thompson Fabricating Company,  
40           Birmingham, Alabama.

41           K. Checkplate aluminum cover plates shall be fabricated to the details shown and  
42           installed at the locations shown.

43           L. Structural aluminum angle and channel door frames shall be provided as shown  
44           on the Construction Drawings and shall be anodized. Frames shall be  
45           fabricated with not less than three anchors on each jamb.  
46  
47

1           M. Miscellaneous aluminum shapes and plates shall be fabricated as shown.  
2           Angle frames for hatches, beams, grates, etc., shall be furnished complete with  
3           welded strap anchors attached. Furnish all miscellaneous aluminum shown but  
4           not otherwise detailed. Structural shapes and extruded items shall conform to  
5           the detail dimensions or the Shop Drawings within the tolerances published by  
6           the American Aluminum Association.

7

8           **2.04 STEEL ITEMS**

- 9
- 10          A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as  
11           shown on the Construction Drawings. All pipe sleeves shall have center anchor  
12           around circumference as shown.
- 13
- 14          B. Miscellaneous steel pipe for sleeves and lifting attachments and other uses as  
15           required shall be Schedule 40 pipe fabricated according to the details as shown  
16           on the Construction Drawings.
- 17
- 18          C. Miscellaneous steel shall be fabricated and installed in accordance with the  
19           Drawings and shall include: beams, angles, support brackets, closure angles  
20           in roof at edge of T-beam; base plates to support ends of T-beams; door frames;  
21           splice plates, anchor bolts (except for Equipment furnished in Divisions 11, 13,  
22           14 and 15); lintels and any other miscellaneous steel called for on the  
23           Construction Drawings and not otherwise specified.
- 24
- 25          D. Guardrails shall be of a standard FDOT W-Beam design with reflectors. All  
26           mounting hardware including bolts, washers, and nuts shall be galvanized.

27

28           **2.05 CAST IRON ITEMS**

- 29
- 30          A. Outside pipe clean-out frames and covers, when and where shown on the  
31           Construction Drawings, shall be heavy duty, R-6013-R-6099 series as  
32           manufactured by Neenah Foundry Co., or equal. All outside pipe clean-outs  
33           shall be 6-inch diameter.
- 34
- 35          B. Frames, covers and grates for manholes, catch basins and inlets shall be of a  
36           good quality, strong, tough even grained cast iron and capable of supporting an  
37           H-20 loading. Castings shall be as manufactured by the U.S. Foundry, Neenah  
38           Foundry, Mechanics Iron Foundry or equal. Sizes shall be as shown on the  
39           Drawings. Covers to have letters "WATER", "SEWER" or "DRAIN", as  
40           applicable, embossed on top.
- 41
- 42          C. Electric and telephone manhole frames and covers, when and where shown on  
43           the Construction Drawings, shall be ductile iron castings conforming to all  
44           requirements of ASTM A536. The covers shall be watertight and shall have the  
45           letters "HIGH VOLTAGE," "LOW VOLTAGE," "SIGNAL," "TELEPHONE," as  
46

1 applicable, embossed on top in letters 2 inches high. The clear opening shall  
2 be 36-inches.  
3

4 2.06 STAINLESS STEEL ITEMS  
5

- 6 A. Stainless steel plates and shapes, when and where shown on the Drawings,  
7 shall be manufactured using 316 S.S.  
8

9 2.07 MATERIALS - MISCELLANEOUS  
10

- 11 A. Use fasteners of suitable size and length for the materials being fastened and  
12 for the type of connection required.  
13  
14 1. For concealed interior and exterior use or built into exterior walls:  
15 Nonferrous stainless steel and zinc coated.  
16  
17 2. For embedded anchor that will be protected from the elements, use  
18 fasteners of the same material as the miscellaneous stem being  
19 fastened.  
20

21 2.08 PRE-ENGINEERED ALUMINUM CANOPY  
22

- 23 A. Basis of Design: As manufactured by Mitchell Metals, LLC or equal. The  
24 manufacturer shall be responsible for the engineering, structural design,  
25 construction, and detailing of a nominal 20' x 10' x 12' tall free-standing canopy  
26 to meet the requirements of the project. The canopy to provide shelter for the  
27 air compressors and air receiver tank located adjacent to the electrical building  
28 for the equalization tank. Drawings and the following dimensions indicate  
29 minimum requirements of the canopy construction.  
30  
31 B. Columns: 6" x 6" x 1/4" thick.  
32  
33 C. Beams: Open top aluminum extrusion. Minimum beam size shall be 6" x 8" x  
34 1/4" thick.  
35  
36 D. Support Rods: Support rods shall be fabricated from minimum 1" diameter  
37 round galvanized steel rod with eye bolt welded to each end to emulate a  
38 turnbuckle design.  
39  
40 E. Decking: Decking shall be of extruded, rigid roll-locked design that is self-  
41 flashing and utilizes interlocking sections sufficiently sized for spending distance  
42 required.  
43  
44 F. Gutter: Gutter shall be radius cornered aluminum extrusion. Minimum size shall  
45 be 4" x 6" at 0.093" thick. Downspouts shall be installed on the south side and  
46 the roof shall be sloped to the south appropriately.  
47

- 1       G. False Fascia: False Fascia shall be aluminum extrusion. Minimum size shall  
2       be 1" x 8" at 0.070" thick.
- 3
- 4       H. Flashing: Flashing shall be made of aluminum sheet to match color of the  
5       canopy. Minimum flashing thickness shall be 0.040" thick.
- 6
- 7       I. Fasteners: Fasteners shall be stainless steel with neoprene washers, and rivets  
8       are 3/16". Isolate dissimilar metals.
- 9
- 10      J. Finishes: Factory applied baked enamel to comply with AAMA 2603. Color to  
11      be white.
- 12
- 13      K. Provide signed and sealed drawings and calculations performed by a State of  
14      Florida registered professional engineer for the canopy design which ensures  
15      that the structure meets or exceeds all applicable loading conditions in  
16      accordance with the applicable Florida Building Code and can withstand the  
17      wind loading as indicated on sheet S1.00.
- 18
- 19      L. The Contractor for General Construction shall provide all necessary parts,  
20      accessories and reinforcing that may not be included in the standard offerings  
21      of the manufacturer to complete the installation of the canopies.

- 1           E. Welding of aluminum work shall be on the unexposed side as much as possible  
2           in order to prevent pitting or discoloration.
- 3           F. All aluminum finish exposed surfaces, except as specified below, shall have  
4           manufacturer's standard mill finish. Aluminum handrails shall be given an  
5           anodic oxide treatment in accordance with the Aluminum Association  
6           Specification AA-C22-A41. A coating of methacrylate lacquer shall be applied  
7           to all aluminum before shipment from the factory.
- 8           G. Castings shall be of good quality, strong, tough, even-grained, smooth, free  
9           from scale, lumps, blisters, sand holes, and defects of any kind which render  
10          them unfit for the service for which they are intended. Castings shall be  
11          thoroughly cleaned and will be subjected to a hammer inspection in the field by  
12          the Engineer. All finished surfaces shown on the Drawings and/or specified  
13          shall be machined to a true plane surface and shall be true and seat at all points  
14          without rocking. Allowances shall be made in the patterns so that the thickness  
15          specified or shown shall not be reduced in obtaining finished surfaces. Castings  
16          will not be acceptable if the actual weight is less than 95 percent of the  
17          theoretical weight computed from the dimensions shown. The Contractor, if  
18          requested by the Owner or Engineer, shall provide facilities for weighing  
19          castings in the presence of the Owner or Engineer showing true weights,  
20          certified by the supplier.
- 21          H. All steel finish work shall be thoroughly cleaned, by effective means, of all loose  
22          mill scale, rust, and foreign matter before shipment and shall be given one shop  
23          coat of primer compatible with finish coats specified in Painting Section after  
24          fabrication but before shipping. Paint shall be applied to dry surfaces and shall  
25          be thoroughly and evenly spread and well worked into joints and other open  
26          spaces. Abrasions in the field shall be touched up with primer immediately after  
27          erection. Final painting is specified in Painting Section 09900.
- 28          I. Galvanizing, where required, shall be the hot-dip zinc process after fabrication.  
29          Following all manufacturing operations, all items to be galvanized shall be  
30          thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of  
31          molten zinc. The resulting coating shall be adherent and shall be the normal  
32          coating to be obtained by immersing the items in a bath of molten zinc and  
33          allowing them to remain in the bath until their temperature becomes the same  
34          as the bath. Coating shall be not less than 2 oz. per sq. ft. of surface.
- 35          J. Provide for anchorage of type indicated; use anchors of same material and finish  
36          as item except where specifically indicated otherwise.
- 37          K. Fabricate to prevent water intrusion or migration.

38           43           44           45           46           3.02    INSTALLATION

- 1           A. Install all items furnished except items to be imbedded in concrete or other  
2           masonry which shall be installed under Division 03. Items to be attached to  
3           concrete or masonry after such work is completed shall be installed in  
4           accordance with the details shown. Fastening to wood plugs in masonry will  
5           not be permitted. All dimensions shall be verified at the site before fabrication  
6           is started.
- 7           B. All steel surfaces to come in contact with exposed concrete or masonry shall  
8           receive a protective coating of an approved heavy bitumastic troweling mastic  
9           applied in accordance with the Manufacturer's instructions prior to installation.
- 10          C. Where aluminum is embedded in concrete, apply a heavy coat of approved  
11           bitumastic troweling mastic in accordance with the Manufacturer's instructions  
12           prior to installation.
- 13          D. Where aluminum contacts masonry or concrete, provide a 1/32-inch neoprene  
14           gasket between the aluminum and the concrete or masonry.
- 15          E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of  
16           zinc-chromate primer and provide a 1/32-inch neoprene gasket between the  
17           aluminum and the dissimilar metal.
- 18          F. Where aluminum contacts wood, apply two coats of aluminum metal and  
19           masonry paint to the wood.
- 20          G. Anchor metal fabrications to substrata indicated; set all fasteners required.
- 21          H. Cut, drill and fit items as required for installation.
- 22           1. Fit exposed connection together accurately to form tight hairline joints.
- 23           2. Weld joints as indicated.
- 24               a. Comply with AWS code for welding procedures, for appearance  
25               and quality of welds, and for corrective methods.  
26               b. Grind exposed joints smooth.
- 27          I. Set items accurately in location, alignment and elevation; level, true and free of  
28           rack, measured from established lines and levels.
- 29          J. Provide temporary bracing as required.

30          3.03 CLEANING AND TOUCH-UP

- 31           A. Touch up shop paint immediately after erection.
- 32           1. Clean field welds, bolted connections and abraded surfaces.

1  
2        2. Paint with same material used for shop painting, minimum 2 mils dry film  
3              thickness.

END OF SECTION

1 SECTION 06600  
2

3 FIBERGLASS REINFORCED PLASTIC FABRICATIONS  
4

5 PART 1 - GENERAL  
6

7 1.01 SUMMARY  
8

9 A. This section includes all Fiberglass Reinforced Plastic (FRP) Products and  
10 Fabrications, including but not limited to:

- 12 1. Molded Grating and Stair Treads  
13 2. Grating Embedment Angle Frames  
14 3. Structural Fabrications  
15 4. Stairs  
16 5. Handrail  
17 6. Ladders and Cages  
18 7. Troughs  
19 8. Weir Plates  
20 9. Scum Baffles  
21

22 1.02 SCOPE OF WORK  
23

24 A. The Contractor shall furnish all labor, materials, equipment, and incidentals as  
25 required for the provision and proper installation of all of the FRP Products as  
26 shown on the Drawings and specified herein. All anchor bolts, gaskets,  
27 sealants, and other accessories and appurtenances, required for a complete  
28 and operating installations shall be included whether specifically mentioned or  
29 not.  
30

31 1.03 REFERENCES  
32

- 33 A. ANSI/NSF 61 – Drinking Water System Components – Health Effects.  
34  
35 B. ANSI/AWWA F101 – Contact-Molded, Fiberglass-Reinforced Plastic Wash  
36 Troughs and Launders  
37  
38 C. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics.  
39  
40 D. ASTM D 695 – Standard Test Method for Compressive Properties of Rigid  
41 Plastics  
42  
43 E. ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced  
44 and Reinforced Plastics and Electrical Insulating Materials.  
45

46 1.04 QUALITY ASSURANCE  
47

- 1           A. All FRP Products and Fabrications shall be supplied by an experienced firm  
2           who has continually engaged in the manufacture and/or fabrication of  
3           fiberglass reinforced plastics. Firms not listed in this specification must clearly  
4           document a minimum of five years' experience with similar projects of equal  
5           scope or design.
- 6
- 7           B. The Contractor shall assure that all field dimensions are taken accurately and  
8           communicated properly to the FRP Fabricator, that other trades will not affect  
9           a proper installation of the FRP, and that all manufacturer's instructions and  
10          recommendations are followed.

11

12        **1.05 DESIGN REQUIREMENTS**

13

- 14           A. All fabrication shall comply with OSHA – 29 CFR as it pertains to worker safety  
15           and walking-working surfaces for stairs, ladders, handrail, and platforms.

16

17        **1.06 SUBMITTALS**

18

- 19           A. Submit complete shop drawings and product data for all FRP materials and  
20           fabrications as required by this scope of work in accordance with Sections  
21           01300 and 01340.

- 22           B. Product data:

- 23
- 24           1. Manufacturers catalog data with load and deflection charts for all FRP  
25           Gratings.
- 26
- 27           2. Manufacturers catalog data for all FRP Structural Shapes.
- 28
- 29           3. Manufacturer's 6-inch square samples of FRP laminate of the same  
30           construction, thickness, and color as the structural item.
- 31
- 32           4. Test results of FRP laminate.
- 33
- 34           5. Installation instructions and manufacturer certification that materials  
35           comply with specified requirements and are suitable for the intended  
36           application.

- 37
- 38           C. Shop drawings:

- 39
- 40           1. Shop drawings shall show all FRP materials as required and include all  
41           dimensions, connections, fasteners, structural supports, adjustments,  
42           openings, anchors, tolerances, assembly and installation details as  
43           required.

44

45        **PART 2 - PRODUCTS**

1    2.01 GENERAL

- 2
- 3       A. All FRP materials shall be manufactured with Vinylester, with chemical  
4           formulations as necessary to provide the corrosion resistance, strength and  
5           other physical properties as required.
- 6
- 7       B. All structural shapes shall be constructed of continuous strand roving,  
8           continuous transverse mat, and synthetic surface veil, and shall include  
9           ultraviolet (UV) inhibitors.
- 10
- 11      C. All structural grating & shapes shall be flame retardant per ASTM E-84 Class 1  
12           Flame Spread equal to or less than 25.
- 13
- 14      D. After fabrication of FRP, all cuts, holes, and abrasion shall be sealed  
15           according to MANUFACTURER'S instructions to prevent corrosion.

16    2.02 FRP GRATING AND STAIR TREADS

- 17
- 18       A. FRP grating to be molded fiberglass grating made with vinlyester.
- 19
- 20       B. Grating to be 1-5/8-inch thick with a grid pattern of 1-1/2-inch x 1-1/2-inch.
- 21
- 22       C. Color shall be dark grey.
- 23
- 24       D. FRP grating shall designed to support 100 lbs. per square foot uniform load.  
25           Deflection shall not exceed 0.25 inch.
- 26
- 27       E. All molded grating shall have ultraviolet (UV) inhibitors.
- 28
- 29       F. Grating and stair treads shall have integral embedded grit to a nominal depth  
30           of 3/16-inch for slip resistance.
- 31
- 32       G. The tops and bottoms of the bearing bars and cross bars of the grating shall  
33           be in the same plane.
- 34
- 35       H. Stair treads shall have 1 3/4-inch wide by 3/8-inch thick contrasting color  
36           integral bull nosing. The load-carrying bearing bars shall be on 1 1/4-inch  
37           centers.
- 38
- 39       I. All platform grating shall be attached with type 316 stainless steel grating clips.  
40           Minimum of four clips per piece.
- 41
- 42       J. Grating shall be manufactured by Fibergrate, Seasafe or approved equal.

43    2.03 FRP GRATING EMBEDMENT ANGLE FRAMES

- 44
- 45       A. All FRP grating set in concrete openings shall have a FRP embedment angle  
46           frame.
- 47

- 1           B. Embedment angle frame to be EBA-10, EBA-15, or EBA-20 as required for the  
2           thickness of grating specified above.  
3  
4           C. Embedment angle shall have a continuous integral anchor.  
5  
6           D. FRP embedment angle frames shall be vinylester resin.  
7  
8           E. FRP angle frames shall be manufactured by Fibergrate, Seasafe, or approved  
9           equal.

10          2.04 FRP STRUCTURAL FABRICATIONS

- 11          A. FRP structural shapes shall be Vinylester pultruded fiberglass shapes. All  
12           shapes shall meet ASTM E-84 Class 1 Flame Spread equal to or less than 25  
13           and ASTM D-635 self-extinguishing.  
14  
15          B. The minimum physical properties shall be:

Property	ASTM	Longitudinal Direction	Transverse Direction
Tensile Stress	D-638	30,000 psi	7,000 psi
Tensile Modulus	D-638	$2.5 \times 10^6$ psi	$0.8 \times 10^6$ psi
Compressive Stress	D-695	30,000 psi	15,000 psi
Compressive Modulus	D-695	$2.5 \times 10^6$ psi	$1.0 \times 10^6$ psi
Flexural Stress	D-790	30,000 psi	10,000 psi
Flexural Modulus	D-790	$1.8 \times 10^6$ psi	$0.8 \times 10^6$ psi
Modulus of Elasticity, E	Full Section	$2.8 \times 10^6$ psi	

- 16          C. All structural shapes shall be fabricated per the drawings with commercial  
17           workmanship, closely fitted joints, and finished true to line and in accurate  
18           position to permit installation and proper joining of parts in the field.  
19  
20          D. Use type 316 stainless steel bolts and washers.  
21  
22          E. All joint surfaces to be bonded shall be abraded to remove surface gloss and  
23           be free of burrs and other foreign materials that would prevent proper  
24           adhesion.  
25  
26          F. Use high-strength epoxy adhesives designed for FRP use and mechanical  
27           fasteners.  
28  
29          G. All pieces to have easily identified part numbers or pieces marks.  
30  
31          H. Shop assemble pieces into the largest practical assembly suitable for  
32           shipping.

1           I.     FRP structural fabrications shall be manufactured by Fibergrate, Seasafe or  
2           approved equal.  
3

4       **2.05 FRP STAIRS**  
5

- 6           A.    Fabricate structural support from FRP structural shapes as noted in section  
7           2.04.  
8  
9           B.    Use OSHA standards for rise and run.  
10  
11          C.    Use Stair Treads as specified in section 2.02.  
12  
13          D.    Use FRP handrail as specified in section 2.06.  
14  
15          E.    Use type 316 stainless steel hardware throughout.  
16  
17          F.    FRP stairs shall be manufactured by Fibergrate, Seasafe or approved equal.  
18

19       **2.06 FRP HANDRAIL**  
20

- 21          A.    The handrail system shall be made from vinylester.  
22  
23          B.    All handrail components shall be flame retardant per ASTM E-84 Class 1.  
24  
25          C.    Handrail posts and rail shall be 2-inch x 2-inch x ¼-inch square tube. All posts  
26          and rails shall use the same tube size. All tubing for handrail to have a  
27          minimum ¼-inch wall thickness.  
28  
29          D.    All handrail to be safety yellow.  
30  
31          E.    All post to rail connections to be fully bonded with an epoxy adhesive and shall  
32          have a 1 ½-inch square solid internal connection plug for added strength and  
33          durability. All connections to have a smooth transition between post and rail.  
34  
35          F.    FRP handrail to be standard two-rail design with kickplate unless otherwise  
36          noted.  
37  
38          G.    FRP handrail shall be manufactured by Fibergrate, Seasafe or approved  
39          equal.  
40

41       **2.07 FRP LADDERS AND CAGES**  
42

- 43          A.    Ladders and cages shall be made from vinylester.  
44  
45          B.    All ladder and cage components shall be flame retardant per ASTM E-84  
46          Class 1.  
47

- 1           C. Ladder rails shall be 2-inch x 2-inch x ¼-inch square tube. Ladder rungs shall  
2           be 1-inch diameter solid round.
- 3
- 4           D. Ladders and cages are to be safety yellow.
- 5
- 6           E. Ladder rungs are to penetrate inside wall of ladder rail tube and be  
7           countersunk into outside wall of ladder rail tube, providing support for the  
8           ladder rung in four places. This connection is to be fully bonded and with  
9           epoxy adhesives and pinned to prevent rung rotation.
- 10
- 11          F. Ladder rungs to have slip-resistant quartz epoxy grit surface.
- 12
- 13          G. Ladder stand-off brackets are to be FRP and are to be installed at a maximum  
14           of 6'-0 on center. Ladder base mount brackets are to be FRP. All hardware is  
15           to be type 316 stainless steel.
- 16
- 17          H. Ladder cages, if required per OSHA, shall be fabricated from FRP Hoops and  
18           Straps. FRP Hoops are to be 3-inch x ¼-inch preformed FRP. Hoop spacing  
19           shall be a max. of 4'-0" on center. FRP Straps are to be 2-inch x ¼-inch FRP  
20           and are to be spaced at 9-inch on center. Hoops and Straps are to be bonded  
21           with epoxy adhesives and riveted with type 316 stainless steel rivets.
- 22
- 23          I. FRP ladders and cages shall be manufactured by Fibergrate, Seasafe or  
24           approved equal.

25

26        **2.08 MOLDED COVERED FRP GRATING**

27

- 28          A. Manufacture: Grating shall be of a one piece molded construction with tops  
29           and bottoms of bearing bars and cross bars in the same plane. Grating shall  
30           have a square mesh pattern. Grating shall be reinforced with continuous  
31           rovings of equal number of layers in each direction. The top layer of  
32           reinforcement in the grating panel shall be no more than 3/16-inch below the  
33           top surface of the grating so as to provide maximum stiffness and prevent  
34           resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall  
35           not exceed 35% so as to achieve maximum corrosion resistance, and as  
36           required to maintain the structural requirements.
- 37
- 38          B. After molding, no dry glass fibers shall be visible on any surface of bearing  
39           bars or cross bars. All bars shall be smooth and uniform with no evidence of  
40           fiber orientation irregularities, resin rich or resin starved areas.
- 41
- 42          C. The grating cover plate shall be attached to the completed panel of grating by  
43           chemical means to ensure integral action of the panel and plate. The panel  
44           and grating shall be uniformly clamped together to ensure that all contact  
45           surface remain in contact throughout the curing process.
- 46
- 47          D. Non-slip surfacing: Covered grating shall have a gritted surface.

- 1           E. Grating bar intersections shall be filleted to a minimum radius of 1/16-inch to  
2           eliminate local stress concentrations and the possibility of resin cracking at  
3           these locations.
- 4           F. Fire rating: Grating shall be fire retardant with a tested flame spread rating of  
5           25 or less when tested in accordance with ASTM E 84. Certifications shall be  
6           dated within the past two years and test data performed only on the resin shall  
7           not be acceptable.
- 8           G. The resin system used in the manufacture of the grating shall be vinylester.  
9           Manufacturer may be required to submit corrosion data from tests performed  
10          on actual grating products in standard chemical environments. Corrosion  
11          resistance data of the base resin from the manufacturer is not a true indicator  
12          of grating product corrosion resistance and shall not be accepted.
- 13          H. Color shall be dark grey.
- 14          I. Depth: 2 1/8-inch with a tolerance of plus or minus 1/16-inch.
- 15          J. Mesh Configuration of grating: 2-inch x 2-inch with a tolerance of plus or  
16          minus 1/16-inch centerline to centerline
- 17          K. Covered grating load/deflection requirements at the required span (shown  
18          below) shall be less than manufacturers published maximum recommended  
19          loads. Maximum recommended loads shall be determined by acoustic  
20          emission testing. Grating shall be designed for a uniform load of 100 psf or  
21          concentrated load of 300 lb. Deflection is not to exceed 0.375-inch or L/D =  
22          120, whichever is less.
- 23          L. Covered FRP grating shall be manufactured by Fibergrate, Seasafe, or  
24          approved equal.

25           **2.09 FRP TROUGHS**

- 26          A. Fiberglass reinforced polyester resin contact-molded composite laminate, with  
27          1/4-inch minimum nominal thickness. Inside surface shall have a smooth gel-  
28          coat resin finish. Outside surface shall have gel-coat finish or resin sealed  
29          with no exposed glass fibers. Edges shall be seal cut with polyester resin.
- 30          B. Color shall be white unless otherwise noted or chosen by Engineer or Owner  
31          and shall be molded-in with ultraviolet inhibitor.
- 32          C. Fiberglass Reinforced Plastic (FRP) Laminate Physical Properties:  
33
- 34           1. Tensile Strength, ASTM D 638: 12,000 psi.  
35           2. Flexural Strength, ASTM D 790: 19,000 psi.

- 1                   3. Flexural Modulus, ASTM D 790: 900,000 psi.
- 2
- 3       D. Construction shall comply with all requirements of ANSI/AWWA/NSF  
4       standards listed above, and manufacturer shall provide proof of such  
5       certification.
- 6
- 7       E. The design shall support all applied downward vertical or gravity loadings  
8       associated with a water-filled trough in the layout and configuration as shown  
9       on the drawings. The design shall resist deflection under full buoyant and  
10      gravity water loads with maximum upward and downward deflection less than  
11      or equal to L/1000 where L equals the unsupported trough length; maximum  
12      deflection at midpoint shall not be greater than 1/8 inch.
- 13
- 14      F. The trough bottom shall be round, square, or V-shaped as indicated on the  
15      drawings, with vertical sides. The top edge shall be straight with a maximum  
16      of 1/8 inch deviation from true plane over 10 feet.
- 17
- 18      G. Longitudinal steel stiffening ribs shall be integrally molded on the outside of  
19      troughs to prevent deflection. One-inch diameter 316 stainless steel spacer  
20      rods shall be provided to maintain uniform width over the length of trough.
- 21
- 22      H. A 2-inch wide, ½-inch thick wall, grouting rib molded to outside of each trough  
23      at the gullet end to act as a water stop when trough is grouted in place.
- 24
- 25      I. Slotted holes in closed end of trough shall be provided to allow a minimum  
26      vertical level adjustment of 1 inch.
- 27
- 28      J. The saddle at the closed end of the trough shall be integrally molded-in at 1.5  
29      times the thickness of the trough body.
- 30
- 31      K. All wall anchors and flat bars shall be 316 stainless steel.
- 32
- 33      L. Adjustable weir plates shall be fiberglass reinforced plastic as specified herein,  
34      and shall be straight-edge as indicated on the drawings.
- 35
- 36      M. Troughs shall be installed in accordance with the manufacturer's instructions  
37      plumb, level, square, in true and proper alignment, free of warp or twist, within  
38      tolerances specified by the manufacturer and indicated herein.
- 39
- 40      N. Manufacturer is responsible for providing troughs of proper length for mounting  
41      to walls and for grouting water-stop. Lengths listed nominal and shall be  
42      verified by the Contractor.
- 43
- 44      O. Troughs shall be as manufactured by Warminster Fiberglass, or approved  
45      equal.

46

47    2.10 FRP WEIR PLATES

- 1           A. Except for bolts and hardware specified herein scum baffles and supports  
2           shall be polyester plastic resin, reinforced with glass fiber. All weir plates, weir  
3           washers, weir splice plates, and support brackets shall be fiberglass reinforced  
4           plastic molded to produce uniform smooth surfaces.  
5  
6           B. The glass content of the finished laminate shall not be less than 30% and not  
7           more than 32% using Type E silane glass with chrome or silane finish. Final  
8           laminate thickness shall be within 10% of nominal specified thickness.  
9  
10          C. The surface shall be resin rich, free of voids and porosity, without dry spots,  
11           crazes or unreinforced areas and shall provide for increased corrosion  
12           resistance and UV protection. All machines or cut edges shall be sealed with  
13           resin. The weirs shall be green or white in color.  
14  
15          D. Ultraviolet resistance is required in all laminates. Surfacing veil is required on  
16           all surfaces to increase chemical resistance and provide additional UV  
17           absorption.  
18  
19          E. The weir plates, splice plates and weir washers shall be 1/4-inch thick plastic  
20           lamine. Oversized mounting holes in the weir plates shall be provided for  
21           vertical and horizontal alignment of at least 2-inches with 5-inch diameter FRP  
22           weir washers to cover the holes. The weirs shall be mounted with 1/2-inch  
23           stainless steel expansion anchors 24-inch on center. Cut ends of non-standard  
24           lengths shall be sealed with resin.  
25  
26          F. Expansion anchors, nuts, bolts, washers and other hardware shall be Type  
27           316 stainless steel.  
28  
29          G. Fiberglass Reinforced Plastic (FRP) Laminate Physical Properties:  
30

<u>Method</u>	<u>Test</u>	<u>Min. Value</u>
ASTM D-638	Tensile Strength	24,000 psi
ASTM D-790	Flexural Strength	25,000 psi
ASTM D-790	Flexural Modulus	$1.4 \times 10^6$ psi
ASTM D-2583	Barcol Hardness	40
ASTM D-570	Water Absorption	0.2%

- 31           H. Construction shall comply with all requirements of ANSI/AWWA/NSF  
32           standards listed above, and manufacturer shall provide proof of such  
33           certification.  
34  
35          I. Straight weirs shall be cut from a flat sheet. Curvilinear weirs (clarifier) cut  
36           from a flat sheet will not be acceptable.  
37  
38          J. Weir notch configuration and dimensions shall be as shown on the drawings.

- 1           K. Weirs intended for attachment to FRP collection troughs shall be flat-crested  
2           and shall be a single section extending the full length of the trough, wall-to-  
3           wall. Clarifier weirs shall be V-notch as shown on the drawings. All other  
4           weirs shall be flat-crested.  
5
- 6           L. Mounting to trough: 1/2-inch diameter by 1-1/2-inch 316 stainless steel bolt,  
7           nut, and 2 washers including 5-inch diameter fiberglass reinforced plastic  
8           washer.  
9
- 10          M. Weir plates shall be as manufactured by Nefco Inc., Warminster Fiberglass, or  
11          approved equal.

12         **2.11 FRP SCUM BAFFLES**

- 15          A. Except for bolts and hardware specified herein, scum baffles and supports  
16          shall be polyester plastic resin, reinforced with glass fiber. All scum baffle  
17          panels, scum baffle splice plates and support brackets shall be fiberglass  
18          reinforced plastic molded to produce uniform smooth surfaces.  
19
- 20          B. The glass content of the finished laminate shall not be less than 30% and not  
21          more than 32% using Type E silane glass with chrome or silane finish. Final  
22          laminate thickness shall be within 10% of nominal specified thickness.  
23
- 24          C. The surface shall be resin rich, free of voids and porosity, without dry spots,  
25          crazes or unreinforced areas and shall provide for increased corrosion  
26          resistance and UV protection. All machines or cut edges shall be sealed with  
27          resin. The weirs and scum baffles shall be green or white in color.  
28
- 29          D. Ultraviolet resistance is required in all laminates. Surfacing veil is required on  
30          all surfaces to increase chemical resistance and provide additional uv  
31          absorption.  
32
- 33          E. Scum baffle panels and splice plates shall be 1/4-inch thick plastic laminate.  
34          The scum baffle panels shall be 12-inch high and shall not exceed 12' in  
35          length unless otherwise noted. Splice plates shall be 6-inch x 12-inch. The  
36          scum baffle brackets shall be 7-inch x 10-inch x 1/4-inch FRP with gussets on  
37          both sides and slotted holes to provide horizontal, vertical and radial  
38          adjustment of the baffle. The brackets shall be installed a maximum of 4' on  
39          center or as shown on the drawings. Fastening holes in the scum baffle panel  
40          shall be countersunk to accommodate 3/8-inch flat head fasteners. Cut ends  
41          of non-standard lengths shall be sealed with resin.  
42
- 43          F. Expansion anchors, nuts, bolts, washers and other hardware shall be Type  
44          316 stainless steel.  
45
- 46          G. Fiberglass Reinforced Plastic (FRP) Laminate Physical Properties:  
47

<u>Method</u>	<u>Test</u>	<u>Min. Value</u>
ASTM D-638	Tensile Strength	24,000 psi
ASTM D-790	Flexural Strength	25,000 psi
ASTM D-790	Flexural Modulus	$1.4 \times 10^6$ psi
ASTM D-2583	Barcol Hardness	40
ASTM D-570	Water Absorption	0.2%

- H. Construction shall comply with all requirements of ANSI/AWWA/NSF standards listed above, and manufacturer shall provide proof of such certification.
- I. Mounting holes shall allow 3 inches vertical adjustment, and shall be spaced as recommended by the manufacturer.
- J. Splice Plates are required to secure ends and to allow for horizontal expansion. Nominal thickness and color shall be the same as the weir.
- K. Scum baffle plates shall be as manufactured by Nefco Inc., Warminster Fiberglass, or approved equal.

### PART 3 - EXECUTION

#### 3.01 INSPECTION

- A. Upon receipt of material at job site, the Contractor shall inspect all materials for shipping damage. Any damage is to be noted on the shipping receipt / packing list and reported promptly to the shipper.

#### 3.02 HANDLING AND STORAGE

- A. Handle all FRP materials with reasonable care to prevent damage. Use shipping pallets to move material. Do not drag FRP materials.
- B. If FRP materials are not to be installed immediately, then store to prevent twisting, bending, breaking, or damage of any kind.

#### 3.03 INSTALLATION

- A. Installing contractor to coordinate and verify that other construction trades and materials have been installed per the contract drawings, and, that they are accurate in location, alignment, elevation, and are plumb and level
- B. Install FRP materials in accordance with the installation drawings and instructions supplied by the FRP Supplier.
- C. Install materials accurately in location and elevation, level, and plumb. Field fabricate as necessary for accurate fit.

- D. Troughs shall also be installed square, in true and proper alignment without warp or twist, within the tolerances specified by the manufacturer and as indicated herein. Troughs shall be set with weir edges to the elevations indicated on the drawings. Grout in place after leveling, and adjust lengths of plates as necessary under direction of manufacturer and Engineer.
  - E. All field cuts, holes or abrasions must be sealed with Manufacturer's sealing resin according to Manufacturer's instructions to prevent corrosion.
  - F. If the scope of work requires the contractor to perform additional tasks, which may damage the installed FRP materials, the contractor is responsible for covering the grating with plywood, or other suitable protective material.

END OF SECTION

1 SECTION 09865  
2

3 SURFACE PREPARATION AND SHOP PRIME PAINTING  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required for the surface  
10 preparation and application of shop primers on ferrous metals, excluding  
11 stainless steels, and concrete as specified herein.  
12

13 1.02 SUBMITTALS  
14

- 15 A. Submit to the Engineer for review, shop drawings, manufacturer's specifications  
16 and data on the proposed primers and detailed surface preparation, application  
17 procedures and dry mil thickness.  
18
- 19 B. Submit representative physical samples of the proposed primers, if required by  
20 the Engineer.  
21

22 PART 2 - PRODUCTS  
23

24 2.01 MATERIALS  
25

26 A. Submerged Services:  
27

- 28 1. Shop primer for ferrous metals that will be submerged or that are subject to  
29 splash action or that are specified to be considered submerged service shall  
30 be sprayed with one coat of Tnemec Series 66 at 3.0-5.0 mils (D.F.T.), PPG  
31 Pitt-Guard Epoxy Coating 97-145 at 4.0-6.0 mils (D.F.T.), or approved equal.  
32
- 33 2. Voids and bugholes in concrete surfaces must be filled with Tnemec Series  
34 218 (up to 1/4" deep) or Tnemec Series 219 (1/4" to 1 1/2" deep) or approved  
35 equal recommended by manufacturer of approved paint system.  
36

37 B. Non-submerged Services:  
38

- 39 1. Shop primer for ferrous metals other than those covered by Paragraph 2.01A  
40 shall be sprayed with one coat of Tnemec Series 66 Epoxy Fast Dry Primer  
41 94-109 (3.0-5.0 mils D.F.T.) or approved equal.  
42

43 C. Non-primed Surfaces:  
44

- 45 1. Gears, bearings surfaces, and other similar surfaces obviously not to be  
46 painted shall be given a heavy shop coat of grease or other suitable  
47

SURFACE PREPARATION AND SHOP PRIME PAINTING

09865-1

03/22/2019

rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

#### D. Compatibility of Coating Systems:

1. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09900 for use in the field and which are recommended for use together.

## PART 3 - EXECUTION

### 3.01 APPLICATION

#### A. Surface Preparation and Priming:

1. Non-submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10, Near White, immediately prior to priming.
  2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale, and other foreign material before priming. Concrete surfaces shall be prepared in accordance with ICRI CSP 4-6.
  3. Shop prime in accordance with approved paint manufacturer's recommendations.
  4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24 hours.
  5. Allow all new concrete to cure for a minimum of 28 days. Test for moisture by plastic film tape down test (ASTM D4263).

END OF SECTION

1 SECTION 09900  
2

3 PAINTING  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The work of this section consists of furnishing all materials, labor, equipment  
10      and incidentals required and performing all the painting necessary to complete  
11      this Contract in its entirety.  
12
- 13       B. It is the intent of these Specifications to paint all concrete where scheduled,  
14      exposed miscellaneous metal, pipe, fittings, supports, valves, equipment and all  
15      other work obviously required to be painted unless otherwise specified. Minor  
16      items omitted in the schedule of work shall be included in the work of this  
17      Section where they come within the general intent of the Specifications as stated  
18      herein.  
19
- 20       C. The following surfaces or items are not required to be painted:  
21
- 22           1. Portions of metal, other than aluminum, embedded in concrete. This  
23           does not apply to the back face of items mounted to concrete or masonry  
24           surfaces which shall be painted before erection. Aluminum to be  
25           embedded in or in contact with concrete or masonry shall be coated to  
26           prevent electrolysis.  
27
- 28           2. Stainless steel.  
29
- 30           3. Fencing  
31
- 32           4. Concealed surfaces of pipe or crawl spaces.  
33
- 34           5. Acoustical ceilings.  
35
- 36           6. Tile.  
37
- 38           7. Fiberglass other than piping.  
39
- 40           8. Packing glands and other adjustable parts and nameplates of  
41           mechanical equipment.  
42
- 43           9. Electrical switchgear, motor control centers, lighting and power panels,  
44           and control panels.  
45
- 46           10. Polyethylene chemical storage tanks.

- 1  
2   1.02 REFERENCES  
3  
4       A. Steel Structures Painting Council (SSPC)  
5  
6           1. SSPC-SP-1 through SSPC-SP-10 Surface Preparation Specifications  
7  
8       B. International Concrete Repair Institute (ICRI)  
9  
10           1. ICRI CSP – 3 through ICRI CSP – 6 Concrete Surface Preparation  
11           Standards.  
12  
13   1.03 SUBMITTALS  
14  
15       A. Submit to the Engineer for review in accordance with the General Conditions,  
16           shop drawings, working drawings and product data including manufacturer's  
17           specifications and data on the proposed paint systems and detailed surface  
18           preparation, application procedures and dry film thickness.  
19  
20       B. Submit to the Engineer for review in accordance with the General Conditions,  
21           color cards, including standard and special colors, for initial color selections.  
22  
23       C. Schedule of Painting Operations: Submit to the Engineer for review a complete  
24           Schedule of Painting Operations within 90 days after the Notice to Proceed.  
25           This Schedule is imperative so that the various fabricators may be notified of  
26           the proper shop prime coat to apply. Properly notify and coordinate the  
27           fabricators' surface preparation and painting operations with these  
28           Specifications. This Schedule shall include for each surface to be painted, the  
29           brand name, the percent volume of solids, the coverage and the number of  
30           coats the Contractor proposes to use in order to achieve the specified dry film  
31           thickness, and color charts. When the Schedule has been approved, apply all  
32           material in strict accordance with the approved Schedule and the  
33           manufacturer's instructions. Wet and dry paint film gages shall be made  
34           available to the Engineer to verify the proper application while work is in  
35           progress.  
36  
37   1.04 SPARE MATERIAL  
38  
39       A. Furnish one unopened gallon can of each type and each color of paint used.  
40  
41   1.05 CONTRACTOR QUALIFICATIONS  
42  
43       A. Contractor shall submit a list of projects successfully completed during the past  
44           3 years of similar projects. Contractor shall also supply record of Certificates of  
45           Approval from Manufacturers to show they have completed technical product

1 and application training. Contractors shall submit a list of surface preparation  
2 and application equipment sufficient to mix and apply the products specified.  
3

4 **PART 2 - PRODUCTS**

5 **2.01 MATERIALS**

- 6
- 7 A. All painting materials shall be fully equal to those manufactured by the Tnemec  
8 Company Inc., CarboLine, and PPG/Porter Coatings. The painting schedule has  
9 been prepared on the basis of these products and recommendations for  
10 applications. No brand other than those named will be considered for approval,  
11 unless the brand and type of paint proposed for each item in the following  
12 schedule, together with sufficient data substantiated by certified tests conducted  
13 at no expense to the Owner, to demonstrate its equality to the paint(s) named,  
14 is submitted in writing to the Engineer for approval within 30 days after the  
15 signing of the Notice to Proceed. The type and number of tests performed shall  
16 be subject to the Engineer's approval.
- 17
- 18 B. All painting materials shall be delivered to the mixing room in unbroken  
19 containers, bearing the manufacturer's brand, date of manufacturer, batch  
20 number, and name. They shall be used without adulteration and mixed, thinned,  
21 and applied in strict accordance with manufacturer's directions for the applicable  
22 materials and surface and with the Engineer's approval before using.
- 23
- 24 C. Shop priming shall be done with primers that are guaranteed by the  
25 manufacturer to be compatible with the finish paints to be used.
- 26
- 27 D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.
- 28
- 29 E. Work areas will be designated by the Engineer for storage and mixing of all  
30 painting materials. Materials shall be in full compliance with the requirements of  
31 pertinent codes and fire regulations. Proper containers outside of the buildings  
32 shall be provided and used for painting wastes, and no plumbing fixture shall be  
33 used for this purpose.
- 34
- 35 F. All recommendations of the paint manufacturer in regard to the health and safety  
36 of workmen shall be followed.
- 37

38 **2.02 PAINTING SYSTEMS**

- 39
- 40 A. Colors for pipe shall match that of existing connected piping. Colors for  
41 structural steel shall match that of existing connected structural steel.
- 42
- 43 B. The following surfaces shall have the types of paint scheduled below applied at  
44 the dry film thickness (D.F.T.) in mils per coat noted. Some of the painting  
45

systems listed below may not be used in this project. Some colors will require an additional coat from what is listed to get the proper color coverage.

1. Non-submerged concrete and precast concrete walls and ceilings:

- a. Tnemec
  - 1st Coat: Tnemec Series 66 (3.0 - 5.0 mils D.F.T.)
  - 2nd Coat: Tnemec Series 66 (4.0 - 6.0 mils D.F.T.)
- b. CarboLine
  - 1st Coat : Carboguard 890 (4.0-6.0 mils D.F.T.)
  - 2nd Coat : Carboguard 890 (4.0-6.0 mils D.F.T.)
- c. PPG/HPC
  - 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils D.F.T.)
  - 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils D.F.T.)

2. Submerged Concrete (except for where a lining system is specified)

- a. Tnemec
  - 1<sup>st</sup> Coat: Tnemec Series N69 (3.0 – 5.0 mils D.F.T.)
  - 2<sup>nd</sup> Coat: Tnemec Series N69 (4.0 – 6.0 mils D.F.T.)
- b. CarboLine
  - 1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)
- c. PPG/HPC
  - 2 Coats: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949 Series. (5.0-7.0 mils D.F.T. per coat)

3. Interior Exposed Masonry (above grade and interior partitions)

- a. Tnemec
  - 1<sup>st</sup> Coat: Tnemec Series 54-660- (80-100 sq. ft. per gal.)
  - 2<sup>nd</sup> Coat: Tnemec Series 66 (4.0 – 6.0 mils D.F.T.)
  - 3<sup>rd</sup> Coat: Tnemec Series 66 (4.0 – 6.0 mils D.F.T.)
- b. CarboLine
  - 1 Coat: Sanitile 600/600TG (60-80 sq. ft. per gal.)
  - 2 Coats: Sanitile 655 (4.0-6.0 mils D.F.T. per coat)
- c. PPG/HPC
  - 1 Coat: Aquapon Polyamide Epoxy Block Filler 97-685/686 (40 to 80 sq. ft. per gal @ 12.0-24.0 mils D.F.T.)
  - 2 Coats: Aquapon High Build Semi-Gloss Polyamide Epoxy Coating

## 97-130 Series. (4.0-6.0 mils D.F.T. per coat)

#### 4. Interior and Exterior Exposed Masonry (Unpainted)

- a. Tnemec  
Regular CMU  
2 Coats: Prime a Pell 200 @ 75-100 SF/gallon/coat  
Split face CMU  
2 Coats: Prime a Pell Plus @ 65-80 SF/gallon/coat
  - b. Carboline  
CMU  
1 Coat: Carbocrete Sealer WB @ 60-80 SF/gallon  
Split Face CMU  
2 Coats: Carbocrete Sealer WB, 1st coat @ 40-60 SF/gallon &  
2nd coat @ 80-120 SF/gallon
  - c. PPG/HPC  
2 Coats: PPG/HPC Canyon Tone Stain Clear at 100 to 150 SF  
per gallon.

## 5. Exterior Exposed Stuccoed Walls

- a. Tnemec
    - 1<sup>st</sup> Coat: Tnemec Series 180 smooth (4.0 – 6.0 mils D.F.T.)
    - 2<sup>nd</sup> Coat: Tnemec Series 180 smooth (4.0 –6.0 mils D.F.T.)
  - b. CarboLine
    - 1st Coat: Sanitile 100 (10.0-12.0 mils D.F.T.)
    - 2nd Coat: Sanitile 155 (2.0-3.0 mils DFT)
    - 3rd Coat: Sanitile 155 (2.0-3.0 mils D.F.T.) - OPTIONAL
  - c. PPG/HPC
    - 1st Coat Pitt-Flex Elastomeric Coating 4-110 (5.5-7.3 mils D.F.T.)
    - 2nd Coat Pitt-Flex Elastomeric Coating 4-110 (5.5-7.3 mils D.F.T.)

6. Ferrous metals submerged or subject to splashing

- a. Tnemec
    - 1<sup>st</sup> Coat: Tnemec Series 104-1211 High Solids Catalyzed Epoxy Coating (3.0-5.0 mils D.F.T.)
    - 2<sup>nd</sup> Coat: Tnemec Series 104-Color High Solids Catalyzed Epoxy Coating (8.0 – 10.0 mils D.F.T.)
  - b. CarboLine
    - 1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)

- 1                   c. PPG/HPC  
2                   1 Coat: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949  
3                   Series. (5.0-7.0 mils D.F.T per coat)  
4                   1 Coat: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949  
5                   Series. (5.0-7.0 mils D.F.T per coat)

6  
7                  7. Exterior non-submerged ferrous metals:

- 8  
9                  a. Tnemec  
10                 1st Coat: Tnemec Series 66 (3.0 - 5.0 mils D.F.T.)  
11                 2nd Coat: Tnemec Series 66 (4.0 - 6.0 mils D.F.T.)  
12                 3rd Coat: Tnemec Series 1074 (2.5 - 4.5 mils D.F.T.)
- 13  
14                  b. CarboLine  
15                 1st Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)  
16                 2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)  
17                 3rd Coat : Carbothane 133HB (3.0-4.0 mils D.F.T.)
- 18  
19                  c. PPG/HPC  
20                 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)  
21                 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
22                 D.F.T.)  
23                 3rd Coat: Pitthane HB Semi-Gloss Urethane 95-8800 (2.0-6.0 mils  
24                 D.F.T.)

25  
26                  8. Interior non-submerged ferrous metals:

- 27  
28                  a. Tnemec  
29                 1st Coat: Tnemec Series 66 Color (3.0 - 5.0 mils D.F.T.)  
30                 2nd Coat: Tnemec Series 66 Color (4.0 - 6.0 mils D.F.T.)
- 31  
32                  b. CarboLine  
33                 1st Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)  
34                 2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
- 35  
36                  c. PPG/HPC  
37                 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)  
38                 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
39                 D.F.T.)

40  
41                  9. Exterior galvanized and non-ferrous metal:

- 42  
43                  a. Tnemec  
44                 1st Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)  
45                 2nd Coat: Tnemec Series 1074 (2.5 – 3.5 mils D.F.T.)
- 46  
47                  b. CarboLine:  
48                 1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)

1                   2nd Coat : Carbothane 133HB (3.0-4.0 mils D.F.T.)  
2  
3  
4

5                   c. PPG/HPC  
6  
7  
8  
9

10                 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)  
11                 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
12                 D.F.T.)  
13                 3rd Coat: Pittthane HB Semi-Gloss Urethane 95-8800 (2.0-6.0  
14                 mils D.F.T.)  
15  
16

17                 10. Interior galvanized and non-ferrous metals:  
18  
19

20                 a. Tnemec  
21  
22

23                 1st Coat: Tnemec Series 66 Color (2.5 - 3.5 mils D.F.T.)  
24                 2nd Coat: Tnemec Series 66 Color (3.0 - 5.0 mils D.F.T.)  
25  
26

27                 b. CarboLine:  
28

29                 1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)  
30                 2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)  
31  
32

33                 c. PPG/HPC  
34

35                 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
36                 D.F.T.)  
37                 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
38                 D.F.T.)  
39  
40

41                 11. Galvanized and non-ferrous metal submerged or subject to splashing:  
42  
43

44                 a. Tnemec  
45

46                 1<sup>st</sup> Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)  
47                 2<sup>nd</sup> Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)  
48  
49

50                 b. CarboLine  
51

52                 1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)  
53  
54

55                 c. PPG/HPC  
56

57                 1st Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-  
58                 946/949 Series. (5.0-7.0 mils D.F.T per coat)  
59                 2nd Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-  
60                 946/949 Series. (5.0-7.0 mils D.F.T per coat)  
61                 3rd Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-  
62                 946/949 Series. (5.0-7.0 mils D.F.T per coat)  
63  
64

65                 12. Metal surfaces exposed to temperatures above 250°F:  
66  
67

68                 a. Tnemec  
69

70                 1<sup>st</sup> Coat: Tnemec Series 39-1261(0.7 – 1.5 mils D.F.T.)  
71                 2<sup>nd</sup> Coat: Tnemec Series 39-1261(0.7 – 1.5 mils D.F.T.)  
72  
73

- 1  
2       b.     Carboline  
3           1 Coat: Thermaline 450, up to 450°F (8.0-10.0 mils D.F.T.)  
4           or  
5           1st Coat: Carbozinc 11 or 11 HS (2.0-3.0 mils D.F.T.)  
6           2nd Coat: Thermaline 4700, 400-1000°F (2.0 mils D.F.T.)  
7  
8       c.     PPG/HPC  
9           2 Coats: Speedhide Int/Ext Aluminum Paint 6-230. (1.0 -1.3 mils  
10          D.F.T. per coat)  
11  
12      13.    Insulated Pipe:  
13  
14       a.     Tnemec  
15           1<sup>st</sup> Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)  
16           2<sup>nd</sup> Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)  
17  
18       b.     Carboline  
19           2 Coats: Sanitile 155 (2.0-3.0 mils D.F.T. per coat)  
20  
21       c.     PPG/HPC  
22           2 Coats: PITT-TECH Interior/Exterior Satin DTM Industrial  
23          Enamels 90-474 Series.(2.0-3.0 mils D.F.T. per coat)  
24  
25      14.    Aluminum in contact with dissimilar metals:  
26  
27       a.     Tnemec  
28           1st Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
29           2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
30  
31       c.     Carboline  
32           1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)  
33           2nd Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)  
34  
35       c.     PPG/HPC  
36           1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)  
37           2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
38          D.F.T.)  
39  
40      15.    Plastic Piping - Interior:  
41  
42       a.     Tnemec  
43           1st Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
44           2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
45  
46       b.     Carboline  
47           1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)  
48           2 Coats : Carboguard 893SG (3.0-4.0 mils D.F.T. per coat)

- 1  
2       c. PPG/HPC  
3        1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
4                   D.F.T.)  
5        2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
6                   D.F.T.)  
7

8       16. Plastic Piping - Exterior  
9

- 10      a. Tnemec  
11       1st Coat: Tnemec Series 73 (2.5 - 3.5 mils D.F.T.)  
12       2nd Coat: Tnemec Series 73 (2.5 - 3.5 mils D.F.T.)  
13  
14      b. CarboLine  
15       1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)  
16       2 Coats : Carbothane 133HB (3.0-4.0 mils D.F.T. per coat)  
17

- 18      c. PPG/HPC  
19       1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
20                   D.F.T.)  
21       2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
22                   D.F.T.)  
23       3rd Coat: Pittthane HB Semi-Gloss Urethane 95-8800 (2.0-6.0  
24                   mils D.F.T.)  
25

26       17. Interior Drywall and Plaster-Industrial Areas  
27

- 28      a. Tnemec  
29       1st Coat: Tnemec Series 51-792 (1.0 - 1.5 mils D.F.T.)  
30       2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
31       3rd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)  
32

- 33      b. CarboLine  
34       1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)  
35       2nd Coat : Sanitile 655 (4.0-5.0 mils DFT)  
36       3rd Coat : Sanitile 655 (4.0-5.0 mils D.F.T.)  
37

- 38      c. PPG/HPC  
39       1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
40                   D.F.T.)  
41       2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils  
42                   D.F.T.)  
43

44       18. Interior Drywall and Plaster-Office Areas  
45

- 46      a. Tnemec  
47       1st Coat: Tnemec Series 51-792 (1.0 – 1.5 mils D.F.T.)

PAINTING

09900-9

03/22/2019

1                   2<sup>nd</sup> Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)  
2                   3<sup>rd</sup> Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)  
3

- 4                   b.       Carboline  
5                   1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)  
6                   2 Coats: Sanitile 155 (2.0-3.0 mils D.F.T. per coat)  
7                   c.       PPG/HPC  
8                   1<sup>st</sup> Coat: Speedhide Interior Latex Primer/Sealer 6-2 (1 mil DFT)  
9                   2 Coats: Speedhide Int Latex Eggshell 6-411 (2 mils D.F.T. per  
10                  coat)

11                  19.     Interior Concrete Floors

- 12                  a.       Tnemec  
13                  1<sup>st</sup> Coat: Tnemec Series 201 (5.0 – 7.0 mils D.F.T>)  
14                  2<sup>nd</sup> Coat: Tnemec Series 280 (8.0 – 10.0 mils D.F.T.)

15                  Note: Apply 50 – 70 mesh silica sand at 5 lbs. per 150 sq. ft.  
16                  between  
17                  1st and 2<sup>nd</sup> coat to provide non-slip surface.

- 18                  b.       Carboline  
19                  1st Coat: Carboguard 1340 (1.0-2.0 mils D.F.T.)  
20                  2 Coats: Carboguard 890 (4.0-6.0 mils D.F.T. per coat)  
21                  Note: Utilize 40-60 mesh silica sand to provide non-slip surface.  
22                  Consult with Carboline for application details.

- 23                  c.       PPG/HPC  
24                  1st Coat: Megaseal High Solids Primer 99-6639 (5.0 – 7.0 mils  
25                  D.F.T)  
26                  2nd Coat: Megaseal Self-Leveling Epoxy 99-6680 (10.0-12.0 mils  
27                  D.F.T.)

28                  20.     Concrete in highly Corrosive Environment Special Coating

- 29                  a.       Tnemec  
30                  1st Coat: Tnemec Series 434 Perma-Shield H<sub>2</sub>S (125 mils D.F.T.)  
31                  2<sup>nd</sup> Coat: Tnemec Series 435 Perma-Glaze (12.0-15.0 mils  
32                  D.F.T.)

- 33                  b.       Carboline  
34                  1st Coat: Plasite 5371 (125 mils)  
35                  2nd Coat: Plasite 4500S (12.0-15.0 mils D.F.T.)

- 36                  c.       PPG/HPC/Polyspec (Concrete Headworks)  
37                  1st Coat: 300EX Epoxy Primer  
38                  2nd Coat: TuffRez 240 Chemical Resistant Epoxy Liner (100 mils)

PAINTING

09900-10

03/22/2019

- 1                   3rd Coat: TuffRez 240 Chemical Resistant Epoxy Liner (100 mils)  
2  
3                   PPG/HPC/Polyspec (Manholes/Lift Stations-Force & Gravity  
4                   Mains)  
5                   1st Coat: 300EX Epoxy Primer  
6                   2nd Coat: TuffRez 240 Chemical Resistant Epoxy Liner (100 mils)  
7                   3rd Coat: TuffRez 240 Chemical Resistant Epoxy Liner (100 mils)  
8  
9                   PPG/HPC/Enviroline (Concrete Headworks)  
10                  1st Coat #54 High Solids Epoxy Primer (3-5 mils DFT)  
11                  2nd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)  
12                  3rd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)  
13  
14                  PPG/HPC/Enviroline (Manholes/Lift Stations-Force & Gravity  
15                  Mains)  
16                  1st Coat #54 High Solids Epoxy Primer (3-5 mils DFT)  
17                  2nd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)  
18                  3rd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)  
19  
20                 21. Metals submerged or subject to splashing in highly corrosive  
21                 environment - Special coating  
22  
23                 a. Tnemec  
24                 1st Coat: Tnemec Series 435 Perma-Shield H<sub>2</sub>S (30 mils D.F.T.)  
25  
26                 b. CarboLine  
27                 1 Coat: Plasite 4500S (35.0-40.0 mils D.F.T.)  
28  
29                 c. PPG/HPC/Polyspec  
30                 1st Coat:  
31                 2<sup>nd</sup> Coat:  
32  
33                 22. Secondary Containment Concrete 12.5% Sodium Hypochlorite  
34  
35                 a. Tnemec  
36                 1st Coat: Tnemec Series 61-5002 Tenemeliner (8.0-10.0 mils  
37                 D.F.T.)  
38                 2<sup>nd</sup> Coat: Tnemec Series 61-5001 Tenemeliner (8.0-10.0 mils  
39                 D.F.T.)  
40  
41                 b. CarboLine  
42                 1st Coat: Semstone 800 primer  
43                 Finish Coats: Semstone 870  
44                 (reference Semstone 870 application spec for installation details)  
45                 c. PPG/HPC/Polyspec  
46                 1st Coat:  
47

1           23. Buried Pipe Appurtenances (Coal Tar Epoxy / Bitumastic Coating)

- 2
- 3           a. Tnemec
- 4            1<sup>st</sup> Coat Tnemec Series 46H-413 Tneme-Tar (14.0-20.0 mils
- 5            D.F.T)
- 6            2<sup>nd</sup> Coat Tnemec Series 46H-413 Tneme-Tar (14.0-20.0 mils
- 7            D.F.T)
- 8
- 9           b. CarboLine
- 10          1<sup>st</sup> Coat CarboLine Bitumastic 300M (14.0-20.0 mils D.F.T)
- 11          2<sup>nd</sup> Coat CarboLine Bitumastic 300M (14.0-20.0 mils D.F.T)
- 12
- 13          C. Any surfaces not specifically named in the Schedule and not specifically
- 14         excepted shall be prepared, primed and painted in the manner and with
- 15         materials consistent with these Specifications. The Engineer shall select which
- 16         of the manufacturer's products, whether the type is indicated herein or not, shall
- 17         be used for such unnamed surfaces. No extra payment shall be made for this
- 18         painting.
- 19

20        2.03 COLOR CODING FOR PIPES AND EQUIPMENT

- 21
- 22          A. Color coding shall consist of color code painting and identification of all exposed
- 23         conduits, trough items and pipelines for the transport of gases, liquid and semi-
- 24         liquids including all accessories such as valves, insulated pipe coverings,
- 25         fittings, junction boxes, bus bars, connectors and all operating accessories
- 26         which are integral to be whole functional mechanical pipe and electrical conduit
- 27         system. Colors shall be as noted in the Paint and Color Coding Schedules
- 28         attached at the end of this Section.
- 29
- 30          B. All hangers and pipe support floor stands shall be painted the same color and
- 31         with the same paint as the pipe it supports. The system shall be painted up to,
- 32         but not including, the flanges attached to the mechanical equipment nor the
- 33         flexible conduit connected to electrical motors. When more than one pipe
- 34         system is supported on the same bracket, the bracket shall be painted the same
- 35         color as the adjacent wall or ceiling. Colors shall be as noted in the Paint and
- 36         Color Coding Schedule.
- 37
- 38          C. All systems which are an integral part of the equipment, that is originating from
- 39         the equipment and returning to the same piece of equipment, shall be painted
- 40         between and up to, but not including, the fixed flanges or connections on the
- 41         equipment.
- 42

43        2.04 LETTERING OF TITLES

- 44
- 45          A. Each pipe system shall be labeled with the name of the materials in each
- 46         pipeline and alongside this an arrow indicating the direction of flow of liquids.

1           Titles shall read as shown in the attached schedule or as directed by the  
2           Engineer. Titles shall not be located more than twenty (20) linear feet apart and  
3           shall also appear directly adjacent to each side of any wall the pipeline  
4           breaches, adjacent to each side of the valve regulator, check, strainer clean-  
5           out, and all pieces of equipment.

- 6
- 7           B. Titles shall identify the contents by complete name. Identification title locations  
8           shall be determined by the Engineer but, in general, they shall be placed where  
9           the view is unobstructed and on the two lower quarters of pipe or covering where  
10          they are overhead. Title should be clearly visible from operating positions  
11          especially those adjacent to control valves.
- 12
- 13          C. Titles on equipment shall be applied at eye level on machines, where possible,  
14          or at the uppermost broad vertical surface of low equipment. Where more than  
15          one piece of the equipment item to be titled exists, the items shall be numbered  
16          consecutively, as indicated on the mechanical drawings, or as directed by the  
17          Engineer; for example Pump No. 1, Pump No. 2, etc. Titles shall be composed  
18          and justified on the left hand side as follows: Pump No. 1.
- 19
- 20          D. Application of titles.
- 21

- 22           1. The color of the titles shall be black or white, as approved, to best  
23           contrast with the color of the pipes and equipment and shall be stencil  
24           applied.
- 25
- 26           2. Stencil text is to be in ALL CAPS worded exactly as shown in the  
27           Schedule or as directed. Titles are to be printed in a single line.
- 28
- 29           3. Letter sizes.
- 30

Outside Diameter of Pipe or <u>Covering (inches)</u>	Size of Legend <u>Letters (inches)</u>
3/4 to 1-1/4	1/2
1-1/2 to 2	3/4
2-1/2 to 6	1-1/4
8 to 10	2-1/2
More than 10	3-1/2

41           Equipment titles are to be two inches high.

- 42
- 43           4. Arrow sizes. Where "a" is equal to 3/4 of outside diameter of pipe or  
44           covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrow  
45           head shall be an equilateral triangle with sides equal to "a." Maximum  
46           "a" dimension shall be 6 inches.

- 1  
2       5. When using direction arrows, point arrowhead away from pipe markers  
3                   and in direction of flow. If flow can be in both directions, use a  
4                   double-headed directional flow.  
5

6     **2.05 FABRICATED EQUIPMENT**  
7

- 8       A. Unless otherwise indicated, all fabricated equipment shall be shop primed and  
9                   shop or field finished.  
10  
11      B. All items to be shop primed shall be thoroughly cleaned of all loose material  
12                   prior to priming. If, in the opinion of the Engineer, any prime coating shall have  
13                   been improperly applied or if material contrary to these Specifications shall have  
14                   been used, that coating shall be removed by sandblasting to white metal and  
15                   re-primed in accordance with these Specifications.  
16  
17      C. All shop prime coats shall be of the correct materials and applied in accordance  
18                   with these Specifications. Remove any prime coats not in accordance with these  
19                   Specifications by sandblasting and apply the specified prime coat at no  
20                   additional cost to the Owner.  
21  
22      D. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots  
23                   retouched with the specified primer before the application of successive paint  
24                   coats in the field.  
25  
26      E. Be responsible for and take whatever steps are necessary to properly protect  
27                   the shop prime and finish coats against damage from weather or any other  
28                   cause.  
29  
30      F. A shop finish coat shall be equal in appearance and protection quality to a field  
31                   applied finish coat. If, in the opinion of the Engineer, a shop finish coat does  
32                   not give the appearance and protection quality of other work of similar nature,  
33                   prepare the surfaces and apply the coat or coats of paint, as directed by the  
34                   Engineer, to accomplish the desired appearance and protection quality. Submit  
35                   to the Engineer substantial evidence that the standard finish is compatible with  
36                   the specified finish coat.  
37  
38      G. Wherever fabricated equipment is required to be sandblasted, protect all  
39                   motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found  
40                   to contain grit shall be promptly and thoroughly cleaned.

41     **PART 3 - EXECUTION**  
42

43     **3.01 PREPARATION OF SURFACES**  
44

- 1           A. All surfaces to be painted shall be prepared, as specified herein or in Section  
2           09865, and shall be dry and clean before painting. Special care shall be given  
3           to thoroughly clean interior concrete and concrete block surfaces of all marks  
4           before application of finish.
- 5           B. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance  
6           with SSPC-SP-3 or in difficult and otherwise inaccessible areas by hand  
7           cleaning in accordance with SSPC-SP-2. All pits and dents shall be filled and  
8           all imperfections shall be corrected so as to provide a smooth surface for  
9           painting. All rust, loose scale, oil, grease and dirt shall be removed by use of  
10          approved solvents, wire brushing or sanding.
- 11          C. Concrete surfaces shall have been finished, as specified in Division 3. Report  
12          unsatisfactory surfaces to the Engineer. Concrete shall be free of dust, oil,  
13          curing compounds, and other foreign matter. Concrete surfaces should have  
14          any laitance or weak layers removed prior to install of coatings or linings using  
15          captive shot blasting systems. Concrete shall have a minimum surface tensile  
16          strength of at least 300 PSI per ASTM D-4541 standard. Testing is required to  
17          confirm this strength using ASTM D-4541 standard and methods. Surface  
18          profile shall be CSP-3 to CSP-6 meeting ICRI (International Concrete Repair  
19          Institute) standard guideline #03732 for Coating, Concrete, producing an anchor  
20          profile equal to 60-grit sandpaper or coarser. Prepare concrete surfaces by  
21          mechanical (captive shot blast) means to achieve this desired profile. Moisture  
22          Vapor Transmission should be 3 pounds or less per 1,000 square feet over 24  
23          hour timeframe as confirmed through a calcium chloride test as per ASTM E-  
24          1907. Quantitative relative humidity (RH) testing, ASTM F-2170, should confirm  
25          concrete RH results < 75%. Application of coatings and linings should be made  
26          when out gassing of concrete is declining during periods when surface  
27          temperatures of the concrete is falling. Use of a surface thermometer to  
28          determine when surface temperatures are falling is required. When in doubt,  
29          double priming may be required. All surface irregularities, cracks, expansion  
30          joints and control joints should be properly addressed prior to application of  
31          coatings and linings. Remove all contaminates and contaminated surface  
32          layers prior to application of coatings and linings.
- 33          D. Concrete block surface shall be smooth and cleaned of all dust, efflorescence,  
34          chalk, loose mortar, dirt, grease, oil, tar and other foreign matter.
- 35          E. All plastic pipe surfaces shall be lightly sanded before painting.
- 36          F. Wood surfaces shall be dry. Sand to obtain a smooth surface. All encrustations  
37          shall be removed.
- 38          G. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations.  
39          Pipe which shall be exposed after project completion shall be primed in  
40          accordance with the requirements herein. Any bituminous coated pipe which is

1 inadvertently installed in exposed locations shall be sandblasted clean before  
2 priming and painting. After installation all exterior, exposed flanged joints shall  
3 have the gap between adjoining flanges sealed with a single component  
4 polysulfide sealant to prevent rust stains.

- 5
- 6 H. Primed or Previously Painted Surfaces and Nonferrous Surfaces: All coated  
7 surfaces shall be cleaned prior to application of successive coats. All  
8 nonferrous metals not to be coated shall be cleaned. This cleaning shall be done  
9 in accordance with SSPC-SP-1, Solvent Cleaning.
- 10
- 11 I. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from  
12 damage and corrosion before and after installation by treating damaged areas  
13 immediately upon detection. Abraded or corroded spots on shop-coated  
14 surfaces shall be "Hand Cleaned" and then touched up with the same materials  
15 as the shop coat. All shop coated surfaces which are faded, discolored, or  
16 which require more than minor touch-up, in the opinion of the Engineer, shall  
17 receive new surface preparation before being repainted. Cut edges of  
18 galvanized sheets and exposed threads, and cut ends of galvanized piping,  
19 electrical conduit and metal pipe sleeves, that are not to be finished painted,  
20 shall be "Solvent Cleaned" and primed with zinc dust-zinc oxide metal primer.
- 21
- 22 J. Galvanized and Zinc-Copper Alloy Surfaces: These surfaces to be painted shall  
23 be "Solvent Cleaned" and treated as hereinafter specified. Such surfaces not  
24 to be painted shall be "Solvent Cleaned." (Carboline recommends brush off  
25 blasting per SSPC-SP7 of galvanized surfaces to insure optimum coating  
26 adhesion).
- 27
- 28 K. Aluminum embedded or in contact with concrete must be painted with one shop  
29 coat of zinc chromate followed by one heavy coat of aluminum pigmented  
30 asphalt paint. (Carboline recommends brush off blasting per SSPC-SP7 of  
31 galvanized surfaces to insure optimum coating adhesion).

32

33 3.02 WORKMANSHIP

- 34
- 35 A. General:
- 36
- 37 1. Primer (spot) and paint used for a particular surface shall, in general, be  
38 as scheduled for that type of new surface. Confirm with the paint  
39 manufacturer that the paint proposed for a particular repaint condition will  
40 be compatible with the existing painted surface. Sample repainted areas  
41 on the actual site will be required to insure this compatibility. Finished  
42 repainted areas shall be covered by the same guarantee specified for  
43 remainder of work.
- 44
- 45 2. At the request of the Engineer, samples of the finished work prepared in  
46 strict accordance with these Specifications shall be furnished and all

1 painting shall be equal in quality to the approved samples. Finished  
2 areas shall be adequate for the purpose of determining the quality of  
3 workmanship. Experimentation with color tints shall be furnished to the  
4 satisfaction of the Engineer where standard chart colors are not  
5 satisfactory.

- 6
- 7 3. Protection of furniture and other movable objects, equipment, fittings and  
8 accessories shall be provided throughout the painting operations.  
9 Canopies of lighting fixtures shall be loosened and removed from contact  
10 with surface, covered and protected and reset upon completion. Remove  
11 all electric plates, surface hardware, etc., before painting, protect and  
12 replace when completed. Mask all machinery name plates and all  
13 machined parts not receiving a paint finish. Dripped or spattered paint  
14 shall be promptly removed. Lay drop cloths in all areas where painting  
15 is being done to adequately protect flooring and other work from all  
16 damage during the operation and until the finished job is accepted.
- 17
- 18 4. On metal surfaces apply each coat of paint at the rate specified by the  
19 manufacturer to achieve the minimum dry mil thickness required. If  
20 material has thickened or must be diluted for application by spray gun,  
21 the coating shall be built up to the same film thickness achieved with  
22 undiluted material. One gallon of paint as originally furnished by the  
23 manufacturer shall not cover a greater area when applied by spray gun  
24 than when applied unthinned by brush. Deficiencies in film thickness  
25 shall be corrected by the application of an additional coat(s). On  
26 masonry, application rates will vary according to surface texture,  
27 however, in no case shall the manufacturer's stated coverage rate be  
28 exceeded. On porous surfaces, it shall be the painter's responsibility to  
29 achieve a protective and decorative finish either by decreasing the  
30 coverage rate or by applying additional coats of paint.
- 31
- 32 5. Paints shall be mixed in proper containers of adequate capacity. All  
33 paints shall be thoroughly stirred before use and shall be kept stirred  
34 while using. No unauthorized thinners or other materials shall be added  
35 to any paint.
- 36
- 37 6. Only skilled painters shall be used on the work and specialists shall be  
38 employed where required.
- 39

40 B. Field Priming:

- 41
- 42 1. Steel members, metal castings, mechanical and electrical equipment and  
43 other metals which are shop primed before delivery at the site will not  
44 require a prime coat on the job. All piping and other bare metals to be  
45 painted shall receive one coat of primer before exposure to the weather,

1 and this prime coat shall be the first coat as specified in the painting  
2 schedule.  
3

- 4 2. Equipment which is customarily shipped with a baked-on enamel finish  
5 or with a standard factory finish shall normally be field painted unless the  
6 prefinished equipment is specifically color selected and unless the finish  
7 has not been damaged in transit or during installation. Surfaces that  
8 have been shop painted and have been damaged, or where the shop  
9 coats or coats of paint have deteriorated, shall be properly cleaned and  
10 retouched before any successive painting is done on them in the field.  
11 All such field painting shall match as nearly as possible the original finish.  
12

13 C. Field Painting:  
14

- 15 1. All painting at the site shall be designated as Field Painting.  
16  
17 2. All paint shall be at room temperature before applying, and no painting  
18 shall be done when the temperature is below 50°F, in dust-laden air,  
19 when rain or snow is falling, or until all traces of moisture have completely  
20 disappeared from the surface to be painted.  
21  
22 3. Successive coats of paint shall be tinted so as to make each coat easily  
23 distinguishable from each other with the final undercoat tinted to the  
24 approximate shade of the finished coat.  
25  
26 4. Finish surfaces shall not show brush marks or other irregularities.  
27 Undercoats shall be thoroughly and uniformly sanded with No. 00  
28 sandpaper or equal to remove defects and provide a smooth even  
29 surface. Top and bottom edges of doors shall be painted and all exterior  
30 trim shall be back-primed before installation.  
31  
32 5. Painting shall be continuous and shall be accomplished in an orderly  
33 manner so as to facilitate inspection. All exterior concrete and masonry  
34 paint shall be performed at one continuous manner structure by  
35 structure. Materials subject to weathering shall be prime coated as  
36 quickly as possible. Surfaces of exposed members that will be  
37 inaccessible after erection shall be cleaned and painted before erection.  
38  
39 6. All materials shall be brush painted unless spray painting is specifically  
40 approved by the Engineer. The Contractor shall be responsible for all  
41 damage caused by overspray or drifting.  
42  
43 7. All surfaces to be painted, as well as the atmosphere in which painting is  
44 to be done, shall be kept warm and dry by heating and ventilation, if  
45 necessary, until each coat of paint has hardened. Any defective paint

1 shall be scraped off and repainted in accordance with the Engineer's  
2 directions.  
3

- 4 8. Before final acceptance of the work, all damaged surfaces of paint shall  
5 be cleaned and repainted as directed by the Engineer.  
6
- 7 9. Any pipe scheduled to be painted and having received a coating of a tar  
8 or asphalt-compound shall be painted with two coats of PPG/HPC PITT-  
9 GUARD® Epoxy Penetrating Sealer 95-2328 or equal before successive  
10 coats are applied per the schedule. Tnemec recommends using 66  
11 Hi-Build Epoxoline over tar, but a test patch must be run initially to test  
12 the paint's compatibility with the tar. Carboiline does not recommend  
13 application of their coatings over tar. Instead, Carboiline recommends  
14 removal of the tar followed by the application of suitable coatings based  
15 on the substrate and intended service application.  
16

17 3.03 CLEANUP  
18

- 19 A. The premises shall at all times be kept free from accumulation of waste material  
20 and rubbish caused by employees or work. At the completion of the painting  
21 remove all tools, scaffolding, surplus materials, and all rubbish from and about  
22 the buildings and leave work "broom clean" unless more exactly specified.  
23
- 24 B. Upon completion, remove all paint where it has been spilled, splashed or  
25 splattered on all surfaces, including floors, fixtures, equipment, furniture, etc.,  
26 leaving the work ready for inspection.  
27
- 28 C. All cloths and waste that might constitute a fire hazard shall be placed in closed  
29 metal containers or destroyed at the end of each day. Upon completion of the  
30 work, the entire job left clean and acceptable to the Engineer.  
31

32 3.04 INSPECTION, TESTING EQUIPMENT & PROCEDURES  
33

- 34 A. Inspection
- 35 1. All phases of the work are subject to inspection by the Engineer to assure  
36 proper performance and compliance with the specifications.  
37
- 38 2. The Engineer shall be advised of the proper time to inspect surface  
39 preparation, prime coat and each succeeding coat. The Contractor shall  
40 apply additional coats only after the previous coat has been approved by  
41 the Engineer or owner's representative.  
42
- 43 B. Testing
- 44 1. The Contractor shall have on the project site the following testing  
45 equipment. Equipment shall be in calibration and proper working order.  
46

1                   Equipment shall be used in accordance with the manufacturers'  
2                   instructions or as directed by the Engineer.  
3

4                   A. Sling Psychrometer: Relative humidity and dew point readings  
5                   shall be taken at intervals throughout each work day. Readings  
6                   shall be taken at the start of the mornings work, mid-day and  
7                   afternoon. Should environmental conditions change, additional  
8                   reading shall be taken to assure that coatings are being applied  
9                   under the conditions as outlined by the coatings manufacturer.  
10

11                  B. Surface Temperature Thermometer: Surface temperatures shall  
12                  be taken in areas where work is being performed. Surface  
13                  temperature shall be that as specified by the coatings  
14                  manufacturer.  
15

16                  C. Replica Tape & Micrometer: Testex X-Course Replica Tape shall  
17                  be employed to determine the surface profile of blasted surfaces.  
18                  Surface profile shall be as specified.  
19

20                  D. Dry Film Thickness Measurements: Dry film thickness reading  
21                  shall be taken with a properly calibrated (per the manufacturer's  
22                  instructions) Type 1 (magnetic) or Type 2 (electromagnetic)  
23                  instrument. Dry film thickness reading will be taken and recorded  
24                  in the in a frequency and manner as dictated by the Engineer.  
25

26                  E. Holiday Detection: After completion of immersion coating systems  
27                  on steel surfaces, all surfaces shall be holiday detected in  
28                  accordance with ASTM G 62 low voltage holiday detection.  
29                  Holiday detector shall be a Tinker & Rasor Model M-1 or equal.  
30                  Areas found to have holidays shall be marked and repaired in  
31                  accordance with the paint manufacturer's instructions. The  
32                  Engineer shall be notified of time of testing so that he might be  
33                  present to witness testing. The Contractor shall provide ladders,  
34                  rigging, etc. as necessary to allow the Engineer to spot check  
35                  paint thickness of each coat.  
36

### 3.05 PAINT

37                  A. General Notes & Guidelines:  
38

- 40                  1. All color numbers and names herein refer to master color card. Colors  
41                  of specified equal manufacturers may be substituted with approval of the  
42                  Engineer.  
43                  2. Pipe lines, equipment, or other items which are not listed here shall be  
44                  assigned a color by the Engineer and shall be treated as an integral part  
45                  of the Contract.  
46

1           3. When color coding is specified or directed by the Engineer, it shall consist  
2           of color code painting and identification of all exposed conduits, through  
3           lines and pipelines for the transport of gases, liquids or semi-liquids,  
4           including all accessories such as valves, insulated pipe coverings,  
5           fittings, junction boxes, bus bars, connectors and any operating  
6           accessories which are integral to a whole functional mechanical pipe and  
7           electrical conduit systems.

8           9. 4. The colors of the Finish Schedule shall be interpreted as follows:

<u>COLORS</u>	<u>TNEMEC #</u>	<u>COLORS</u>	<u>TNEMEC #</u>
White	11WH	Tank Blue	25BL
Ivory	01BR	Blue	11SF
Red	06SF	D. Blue	78BL
L. Green	52GN	L. Blue	26BL
Green	09SF	Aqua	10GN
D. Green	08SF		
<u>COLORS</u>	<u>TNEMEC #</u>	<u>COLORS</u>	<u>TNEMEC #</u>
L. Brown	06BR	Inter. Orange	05SF
Brown	84BR	Orange	04SF
Bronze	86BR	Tan	04BR
L. Gray	31GR	Yellow	03SF
M. Gray	33GR	Safety Yellow	02SF
D. Gray	34GR		

- 27           5. All moving parts, drive assemblies, and covers for moving parts that are  
28           potential hazards, shall be Safety Orange 04SF
- 30           6. All safety equipment shall be painted in accordance with OSHA  
31           standards.
- 33           7. All in line equipment and appurtenances not assigned another color shall  
34           be painted the same base color as the piping. The pipe system shall be  
35           painted with the pipe color up to, but not including, the flanges attached  
36           to pumps and mechanical equipment assigned another color. Tanks  
37           shall be painted the color of the piping system that they serve, unless the  
38           tank is fiberglass or polyethylene.
- 40           8. All conduit shall be painted to match its background surface.
- 42           9. Building surface colors shall be painted, as scheduled in the Finish  
43           Schedule, or as selected by the Engineer.
- 45           10. Control panels shall be factory finished.

1      3.06 GUARANTEE AND ANNIVERSARY INSPECTION

- 2
- 3      A.     All work shall be warranted for a period of one year from date of acceptance of  
4            the project.
- 5
- 6      B.     The Owner will notify the Contractor at least 30 days prior to the anniversary  
7            date and shall establish a date for the inspection. Any defects in the coating  
8            system shall be repaired by the Contractor at no additional cost to the Owner.  
9            Should a failure occur to 25% of the painted surface, either interior or exterior,  
10          the entire surface shall be cleaned and painted in accordance with these  
11          specifications.
- 12

13     3.07 PAINT AND COLOR CODING SCHEDULE

<u>Piping and Legend</u>	<u>Color</u>	<u>Bands</u>
Backwash Waste	Light Brown	
Blower Air	Green	Orange
Coagulant	Aqua	
Compressed Air	Dark Green	Red
Drains	Black	
Fuel	Red	White
Potable Water	Dark Blue	
Process Sample	Light Grey	Red
Reclaimed Effluent	Pantone Purple 522C	
Return Activated Sludge	Brown	
Sodium Hypochlorite	Yellow	
Sprinkler	Red	
Thickened Sludge	Dark Brown	Orange
Wastewater	Dark Gray	
Waste Activated Sludge	White	
<u>Equipment and Building</u>		<u>Color</u>
Exterior Equipment, Valves, Gates, Fans		Match System
Interior Equipment and Pumps		Match System
Structural Steel (Interior)		White
Ceiling		White
Cranes and Hoists		Yellow
Ductwork		Match Surface
Interior Air Handling and Ventilation Equipment		Match Surface
Valve and Gate Operators		Match System
Electrical Conduit and Junction Boxes		Match Surface
Submerged Concrete		Black

## 1 3.08 PAINT SCHEDULE

The following areas of the plant shall be coated. Those areas without a special note shall be coated in accordance with the standard coating systems specified above.

1. All above ground ductile iron piping systems
  2. Miscellaneous Steel
  3. Stainless Steel, PVC, and galvanized steel shall not be painted
  4. Aluminum shall not be painted except where it is contact with concrete.
  5. All ductile iron pipe in the headworks building shall be considered metals submerged or subject to splashing in highly Corrosive Environment and shall use a Special Coating per Section 2.02 B. 21.
  6. All other above ground ductile iron piping shall be considered subject to splashing and shall be coated in accordance with Section 2.02 B. 6. Ferrous metals submerged or subject to splashing.

END OF SECTION

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1 SECTION 11203

2  
3 WATER CONTROL GATES  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor, materials, equipment and incidentals required to install all  
10      water control slide gates, weir gates and appurtenances as shown on the  
11      Drawings or as specified herein.  
12
- 13      B. These Specifications are intended to give a general description of what is required,  
14      but do not cover all details, which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the unit as herein specified, whether specifically mentioned in these Specifications or not.  
19
- 20      C. For these units, there shall be furnished and installed all specified and necessary equipment and appurtenances for a complete and fully functional installation in accordance with these plans and specifications, including field testing of the entire installation and instructing the regular operating personnel in the care, operation and maintenance of all equipment.

26 1.02 QUALIFICATIONS  
27

- 28       A. The gates specified under this Section shall be furnished by a manufacturer, who is fully experienced, reputable, and qualified in the manufacture of the equipment furnished. The gates and all related equipment shall be designed, constructed and installed with the best practices and methods.  
32
- 33       B. Manufacturer shall have installations functioning for at least ten (10) years.  
34
- 35       C. Gates, weir gates, and stop logs shall be as manufactured by Ashbrook Simon Hartley, Rodney Hunt, Fontaine, or approved equal.  
37

38 1.03 SUBMITTALS  
39

- 40       A. Materials and Shop Drawings:  
41
- 42           1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:  
43
- 46           a. Certified shop and erection drawings and data regarding slide gates.  
47

WATER CONTROL GATES

11203-1

03/22/2019

- 1                   b. Literature on drawings describing the equipment and showing all  
2                   important details of construction and dimensions.  
3  
4                   c. Manufacturers recommended method for anchoring gates.  
5  
6  
7                   B. The Manufacturer shall provide installation instructions. The installation and  
8                   adjustment of gates, operators and all accessories shall be in full accordance  
9                   with these instructions. All gates shall be installed by the best practices and  
10                  methods.  
11  
12                  C. Manufacturer shall submit drawings and comprehensive design criteria to  
13                  substantiate that the required deflection figure for each gate has been achieved.  
14                  Comprehensive safety factor calculations shall include bending moments,  
15                  buckling stress, and bonding stress with thermal expansion factors suitable for  
16                  reference in NASA CR-1457, "Manual for Plates and Shells," et al. Safety  
17                  factors shall be calculated for the disc under maximum head, and shear at the  
18                  disc/seal interface.  
19  
20                  D. Manufacturer shall submit affidavit of compliance that gates meet Standard  
21                  AWWA C 563 or C 561 of the latest revision.  
22  
23                  E. Manufacturer shall submit contact information for ten facilities with a similar or  
24                  identical product to the project site.  
25  
26                  F. Operating and maintenance instructions shall be furnished to the Engineer in  
27                  accordance with Section 01730.

28                  **1.04 TOOLS AND SPARE PARTS**

- 29  
30                  A. Special tools, if required for normal operation and maintenance, shall be  
31                  furnished with the equipment by the manufacturer.

32                  **1.05 PATENTS AND LICENSES**

- 33  
34                  A. The equipment Manufacturer shall be responsible for all patents or licenses that  
35                  exist because of the equipment that may be provided.  
36  
37                  B. The Manufacturer shall assume all costs of patent fees or licenses for the  
38                  equipment or process, and shall safeguard and save harmless the Owner from  
39                  all damages, judgments, claims and expenses arising from license fees, or  
40                  claimed infringement of any letters, patent or patent rights, or fees for the use  
41                  of any equipment or process, structural feature or arrangement of any of the  
42                  component parts of the installation, and the price bid shall be deemed to include  
43                  payment of all such patent fees, licenses or other costs pertaining thereto.

44                  **1.06 WARRANTY AND GUARANTEE**

- 1           A. The Manufacturer shall guarantee the gates, when installed and operated as  
2           recommended by the Manufacturer with a documented maintenance program,  
3           trouble-free operation for a period of ten (10) years. The Manufacturer shall  
4           guarantee the following:  
5  
6           1. Leakage shall be no more than that allowed by the AWWA C561 or C563  
7           Standards.  
8  
9           2. Door (disc) shall be free of sticking or binding (move freely via operator  
10          provided) and frame members will not deflect with 2.0 times the  
11          recommended force on the operating mechanism. Gate operators shall  
12          be warranted by the operator manufacturer.

14        1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- 15           A. All equipment shall be delivered in suitable packaging, cases, or crates and  
16           stored or placed in an appropriate manner to prevent damage to gate and  
17           appurtenances. Each package shall have an identifying mark and a complete  
18           list showing contents.

21        PART 2 – PRODUCTS

22        2.01 SLIDE GATES AND WEIR GATES

- 23           A. The slide gates shall be furnished at the locations shown on the Drawings with  
24           sizes, as specified in the Gate Schedule and as shown on the Drawings. All  
25           gates shall have a pipe cover with position markings over every operating stem.  
26           Stem guides shall be 316 or 316L stainless steel located as required by the  
27           manufacturer.
- 28           B. The frames shall be 316 or 316L stainless steel. The frames shall be of ample  
29           length to completely support the disc in the open position. All frames shall have  
30           a member across the top for support that shall not deflect at 2.0 times the  
31           recommended force on the operating mechanism. Mounting angles are to be  
32           continuous along the length of the frame; mounting tabs will not be acceptable.
- 33           C. The sealing arrangement shall be comprised of sealing faces and side guides  
34           constructed of ultrahigh molecular weight polyolefin having an extremely low  
35           coefficient of friction with backing constructed of highly resilient expanded  
36           neoprene or EPDM. Guides and seating of the gate shall be easily adjustable  
37           (min. 5/8-inch). All moving contact surfaces shall be incompatible to each other  
38           in order to minimize sticking / jamming, facilitating operation.
- 39           D. Slide (Disc) shall be constructed of reinforced rigid composite plastic material  
40           or 316 stainless steel, having a minimum thickness of 1/8-inch. Slide (disc) shall  
41           have an internal matrix of carbon steel of suitable strength for the specified

1 service. The slide (disc) outer surface skins shall be a homogeneous plastic  
2 material having extremely high tensile and impact strength, be nontoxic and  
3 shall be stabilized against ultraviolet light. The composite material shall be an  
4 Aramid fiber from the KEVLAR family of fibers, and shall have the following  
5 minimum properties and shall be designed to limit the deflection to a maximum  
6 of 1/1000 of the span under design head conditions based upon horizontal  
7 support members only. Manufacturer shall submit drawings and  
8 comprehensive design criteria to substantiate that the required deflection figure  
9 for each door has been achieved. Comprehensive safety factor calculations  
10 shall include bending moments, buckling stress, and bonding stress with  
11 thermal expansion factors suitable for reference in NASA CR-1457, "Manual for  
12 Plates and Shells", et al. Safety factors shall be calculated for the disc under  
13 maximum head, and shear at the disc/seal interface. No substitute of fiber type  
14 will be acceptable. Glass fiber is not acceptable.  
15

16 E. The stems shall be manufactured from stainless steel Type 304 with a minimum  
17 diameter of 1 1/4". Stems shall be of ample gross section to prevent distortion  
18 and shall have stub acme threads. Stems shall be designed to withstand tensile  
19 and compressive loads that occur under maximum operating conditions.  
20 Design for compressive loading shall meet AISC code where K-1 with a  
21 minimum safety factor of 2 to 1. The stems shall not deflect at 2.0 times the  
22 recommended force on the operating mechanism. Stems shall be cold rolled  
23 with a double start stub acme thread with a finish of 32 mic or less. Stem shall  
24 be fixed to the disc by a threaded and keyed assembly into a lifting nut, attached  
25 to the disc in a lifting bracket that is bolted to the disc.  
26

27 F. At the design seating head and under normal conditions, the leakage rate of the  
28 gates shall not exceed 0.1 gallons per minute per foot of seating perimeter. At  
29 the design unseating head and under normal conditions, the leakage rate of the  
30 gates shall not exceed 0.2 gallons per minute per foot of seating perimeter.  
31

32 G. Stem Covers  
33

34 Rising stem gates shall be provided with clear plastic stem covers to facilitate  
35 indication of gate position, permit inspection of the stem threads, and to protect  
36 the stem from contamination. Vent holes shall be provided to prevent  
37 condensation.  
38

39 H. Operator  
40

41 The benchstand hoists shall be sized to permit operation of the gate under the  
42 full operating head with a maximum effort of 40 pounds on the crank or  
43 handwheel. The hoist nut shall be manganese bronze conforming to ASTM  
44 B584 C86500. The hoist nut shall be supported on roller bearings. A lubrication  
45 fitting shall be provided for lubrication of hoist bearings without disassembly of  
46 the hoist. Suitable seals shall be provided to prevent entry of foreign matter.  
47 The direction of handwheel or crank rotation to open the gate shall be clearly  
48 and permanently marked on the hoist.

1  
2     I. Motor-Operated Actuators  
3

- 4         1. Motor-Operated actuators shall include the electric motor, reduction  
5             gearing, valve stem drive nut/bushing, position sensor, overload torque  
6             sensor, ductile iron gear case, automatic declutchable handwheel, local  
7             control & mechanical position indication, and remote control & position  
8             indication. All actuators shall be designed for severe duty use in a  
9             corrosive environment contaminated with ammonia and hydrogen sulfide  
10            gas.
- 11         2. Motors shall be totally enclosed, non-ventilated 480 volt, 3 phase and  
12            specifically designed for high torque, low inertia duty and for a corrosive  
13            atmosphere. Motors for actuators shall also be specifically designed and  
14            rated for 15-minute duty operation at 104°F (40°C). Output capacity shall  
15            be sufficient to open or close the valve against the maximum differential  
16            pressure when the voltage is 10% above or below normal at the specified  
17            service conditions. Motors shall have Class F insulation. Motors must be  
18            protected by 3 thermal contacts, which are embedded in the motor  
19            windings. The actuator shall be suitable for up to 60 starts per hour for  
20            open/close service and 1200 starts per hour for modulating service.
- 21         3. The actuators shall be suitable for use on nominal 3 phase power supply  
22            and must include motor, integral reversing starters, local controls and  
23            terminals for remote control and indication housed within a self-  
24            contained, sealed enclosure. The actuator gearing shall be totally  
25            enclosed in a lubricant filled cast iron gearcase suitable for operation in  
26            any orientation. Non-metallic gearing is not acceptable. For rising stem  
27            valves the output shaft shall be hollow to accept a rising stem, and  
28            incorporate thrust bearings of the roller type at the base of the actuator.  
29            All gearing and bearings shall be oil or grease lubricated and suitable for  
30            year-round service based on prevailing ambient temperature conditions.
- 31         4. The actuator shall be furnished with a handwheel with a maximum rim  
32            pull requirement of 40 pounds for valve travel loads. An external manual  
33            declutch lever shall be included to place actuator in the manual mode.  
34            The lever shall not require more than 10 pounds of force to engage even  
35            when the valve has been tightly seated. The lever is to be padlockable  
36            in either handwheel or motor mode. Operation by motor shall not cause  
37            the handwheel to rotate, or operation of the handwheel shall not cause  
38            the motor to rotate. Handwheel shall operate in the clockwise direction  
39            to close.
- 40         5. Two nameplates, made of stainless steel, shall be attached to each  
41            actuator; one on the motor housing, showing all relevant motor data, one  
42            on the actuator housing showing all relevant actuator data. Special  
43            information, such as the valve tag no., shall be shown if required. The

1 nameplates shall be securely fixed to the actuator and motor, so that they  
2 cannot be removed or scratched off during shipment, installation,  
3 operation or maintenance.  
4

- 5 6. The rated output torque of the motor actuator shall be at least 1.5 times  
7 the maximum torque required to open or close the valve at any position  
8 including seating and unseating conditions when subjected to the most  
9 severe operating condition including any mechanical friction and/or other  
10 restrictive conditions that are inherent in the valve assembly. Do not  
11 include hammer-blow effect in sizing the actuator to comply with this  
12 torque requirement. Valve manufacturer is responsible to assure that the  
13 motor actuator stall torque output does not exceed the torque limits of  
14 the valve operating stem or shaft. Maximum torque shall include seating  
15 or unseating torque, bearing torque, dynamic torque, and hydrostatic  
16 torque. Assume that the differential pressure across the valve is equal to  
17 the pressure or head rating of the valve.
- 18 7. Actuator housings, supports, and connections to the valve shall have a  
19 minimum safety factor of five based on the ultimate strength or three  
20 based on the yield strength of the material used. Actuators shall be O-  
21 ring sealed, watertight to NEMA 4/6 (6 feet for 30 minutes). All external  
22 fasteners shall be of stainless steel. Gear case shall be cast iron.
- 23 8. Torque switch bypass to be provided for the torque sensing system to  
24 inhibit torque switch trip during unseating or during starting in mid-travel  
25 against high inertia loads. Manual operation shall be by handwheel.  
26 Manual operation shall be via power gearing to minimize required rimpull  
27 and facilitate easy changeover from motor to manual operation when the  
28 actuator is under load. A seized or inoperable motor shall not prevent  
29 manual operation.
- 30 9. Test each actuator prior to shipment in accordance with AWWA C540.  
31 The application torque shall be the maximum torque required to open or  
32 close the valve at any position including seating and unseating  
33 conditions.
- 34 10. For all actuators that are installed greater than five (5) feet above the  
35 finished floor surface, the actuator manufacturer shall furnish for  
36 installation by the Contractor a remote control unit, such that the operator  
37 is able to manually control the actuator while standing on floor grade.  
38 The remote control unit shall be hardwired to the actuator and be  
39 equipped with all the controls/functionality as on the face of the actuator.  
40 Remote controllers shall be mounted between 3 feet and 5 feet from the  
41 nearest operator accessible floor surface.
- 42 11. The operator face plate shall include as a minimum:  
43  
44  
45  
46  
47

1 Buttons for OPEN - STOP – CLOSE – RESET.  
2 Backlit LCD display showing the actuator status in plain English text.  
3 Lockable selector switch with LOCAL - OFF - REMOTE function.  
4 Indication lights for CLOSED, OPEN, RUNNING, and FAULT.

- 5
- 6 12. The terminal compartment shall provide sufficient space to  
7 accommodate the possible maximum number of incoming wires. A  
8 minimum of three cable entries must be provided. Each cable entry shall  
9 be properly sealed by cable glands during site installation. The cable  
10 glands size shall be chosen by the Contractor, responsible for wiring  
11 during the commissioning phase.
- 12
- 13 13. Liquid Crystal Display (LCD) – back-lit for setting menu showing status  
14 indication and diagnostic information. The actuator shall include a digital  
15 position indicator with a display from fully open to fully closed in 1%  
16 increments. For all actuators that utilize a battery, the actuator  
17 manufacturer shall furnish one (1) spare battery for each actuator  
18 furnished.
- 19
- 20 14. Setting of all actuator parameters including the torque levels, position  
21 limits, configuration of the indication contacts, and positioner functionality  
22 shall be accomplished without removing covers from the actuator control  
23 assemblies or housing.
- 24
- 25 15. Actuators shall be suitable for indoor and outdoor use. The actuator shall  
26 be capable of functioning in an ambient temperature ranging from -20 °F  
27 to +140°F, up to 100% relative humidity. In order to prevent  
28 condensation, a space heater shall be installed inside the actuator,  
29 suitable for continuous operation. The actuator shall be stored according  
30 to the Manufacturer's instructions. If the Contractor voids the actuator  
31 warranty in any way, he shall replace the actuator at no cost to the  
32 Owner.
- 33
- 34 16. Actuators are to receive remote input commands for OPEN, CLOSE, and  
35 POSITION (as required). Actuators are to provide remote indication as  
36 listed above.
- 37
- 38 17. Contractor is to provide startup, inspection, and instruction services from  
39 the Manufacturer's authorized technical representative. Startup and  
40 inspection shall not be less than five (5) days. One (1) day shall be  
41 provided for training of plant personnel in operation and maintenance of  
42 electric operators.
- 43
- 44 18. All electric actuators for this project shall be provided by one  
45 Manufacturer. Contractor shall coordinate installation on valves and  
46 gates with valve and gate manufacturers. Electric actuators shall be as  
47 manufactured by EIM Tec 2000, Auma Matic, Rotork IQ, Limitorque or

approved equal.

19. Each actuator shall be warranted for a minimum of 24 months from the date of system acceptance by the Owner.

#### J. Valve/Gate Limit Switches:

1. Type: Mechanical cam gear for remote operation, indication, and other control; compatible with associated operation and suitable for service intended; for valves/gates specified and indicated on the Drawings; with racks, gears, cam, linkages mountings, and accessories.
  2. Mechanical Limit Switches: 2-pole, 3-pole, or 4-pole, gang-mounted in required multiples, and with necessary mechanical linkage.
  3. Contact Ratings: 120 volt alternating current, 20 amperes at 75 to 100 percent power factor, and 24 volt direct current, 5 amperes minimum.
  4. Enclosures: Watertight and oil tight for normal service, Class 1, Division 1, Group D for gates located in hazardous locations.
  5. Valve box: Large enough to contain and to allow easy adjustment of limit switch without switch's removal.

Provide a handwheel for manual operation of the motor operator unit. The handwheel shall be integral to the unit and require less than 60 ft-pounds of torque to rotate either open or closed. The handwheel shall be a non-corrosive metal and have arrows to indicate "open" rotation. The stem and the gate frame shall not deflect if 80 ft-pounds or less is applied to the handwheel.

All mounting brackets and mounting hardware shall be stainless steel if exposed to the elements. All operator and motor assembly hardware shall be stainless steel if exposed to the elements.

All necessary attaching bolts and anchor bolts shall be 316 stainless steel and shall be furnished by the slide gate manufacturer.

1      2.02 GATE SCHEDULE

2

Actuator	Type	Width	Height	Frame Mounting	Operator Mounting	Num Req'd	Seating – Unseating Static Head	LOCATION
Manual	Slide Gate	6 ft	6 ft	Channel Mounted	Frame Raise to allow water through	2	6/0 ft	Headworks Building Downstream of Screens
Electric	Weir Gate	8 ft	Note 1	Channel Mounted	Frame Raise to allow water through	1	4/4 ft	Headworks Building Downstream of Screens
Manual	Weir Gate	2 ft	Note 2	Face Mounted	Frame Lower to allow water to overflow	1	4/0 ft	Scum Well for Primary Bldg.
Manually Install or Remove Gate	Stop Gate	4 ft Field Verify	10'-9" Field Verify	No Frame - Existing Slots Formed with Aluminum Angle Embedded in Concrete	No Operator - Fabricate Gate with 2 Reinforced Lifting Eyes	1	0/10 ft	Second Anoxic Tank Diverion Box

3

4      Note 1:

- 5            • Top Concrete Channel = Elev. 71.25
- 6            • Top of Weir – Up Position = Elev. 69.5 (no flow over weir)
- 7            • Maximum Upstream Water Elevation = Elev. 69.25
- 8            • Top of Weir – Down Position = Elev. 68.5 (12 in. flow over weir)
- 9            • Maximum Downstream Water Elevation = Elev. 68.0
- 10          • Invert Concrete Channel = Elev. 65.25

11

12       Note 2:

- 13          • Top Concrete Channel = Elev. 67.5
- 14          • Top of Weir – Up Position = Elev. 67.0 (no flow over weir)
- 15          • Maximum Upstream Water Elevation = Elev. 67.0
- 16          • Minimum Upstream Water Elevation = Elev. 62.75
- 17          • Top of Weir – Down Position = Elev. 62.5
- 18          • Maximum Downstream Water Elevation = Elev. 67.0
- 19          • Invert Splitter Box = Elev. 56.17

20

## PART 3 – EXECUTION

21

### 3.01 INSTALLATION

22

- 23       A. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the Manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane with 90-degree corners.
- 24       B. Frames and guides shall be set in place using non-shrink grout as listed in Section 03600 of the Specifications. Gates shall be protected and cleaned from over spray and grout splatter. Contractor shall replace or repair without cost to

1 Owner any damaged gate as instructed by the Engineer. Repairs shall be done  
2 by Manufacturer or Manufacturer's approved representative.  
3

- 4 C. Prior to initial start-up, the Contractor shall provide to the owner written  
5 certification from the manufacturer that the equipment has been installed and  
6 tested in accordance with the Manufacturer's approved methods, and that the  
7 equipment is ready for permanent operation.

8 3.02 SERVICES  
9

- 10 A. The Contractor shall provide the services of each gate Manufacturer's field service  
11 technician for a period of not less than one (1) day to inspect the installed  
12 equipment and instruct operating personnel.  
13
- 14 B. At least one half of a day of the one (1) day period shall be allocated solely to the  
15 instruction of operating personnel on the proper operations and maintenance of  
16 the equipment. This inspection and instruction shall be scheduled at least ten (10)  
17 days in advance with the Owner and shall take place prior to start-up and  
18 acceptance by the Owner.  
19

20  
21 END OF SECTION  
22  
23

SECTION 11306

## SUMP PUMP

## PART 1 – GENERAL

## 1.01 SCOPE OF WORK

Furnish and install four pairs (8 total) sump pumps, each with swing check valves installed in a horizontal run of piping, discharge piping, discharge pipe supports, self-contained on-off controls, and auxiliary equipment as shown in the drawings and specified herein. The pumps will be installed as pairs. Each pair will be installed in the same sump but at slightly different elevations.

## 1.02 DESCRIPTION OF THE SYSTEM

- A. The proposed equipment is intended to pump seal water drainage and liquids from pump cleanout events that may accumulate on the Equalization Basin pump slab, the Macerator slab, and the Moving Belt Filter slab. The pump at the EQ basin discharge pipe will be up into the Equalization Basin. The discharge for the other sump pumps is into the existing splitter box. Each pair of pumps shall be identical and shall be single phase units with integral controls.
  - B. Two (2) of the eight (8) pumps shall be installed in the existing sump on the lower level of the headworks building. These pumps are also intended to pump seal water drainage and other liquids from pump cleanout events that may accumulate in the sump.

## 1.03 SUBMITTALS

- A. Shop drawings shall be submitted to the Engineer for review in accordance Sections 01300 and 01340.
  - B. Product technical data including:
    - 1. Certification that the product submitted meets the requirements of standards referenced.
    - 2. Manufacturer's installation instructions.
    - 3. Manufacturers cut sheet including a dimensioned drawing, power requirements, and discharge pipe connection.
    - 4. Pump curve showing flow and total dynamic head relationships.

#### **1.04 WARRANTY**

- 1           A. The equipment shall be warranted to be free from defects in workmanship,  
2           design and materials. If any part of the equipment should fail during the  
3           warranty period, it shall be replaced in the machine(s) and the unit(s) restored  
4           to service at no expense to the Owner.  
5
- 6           B. The manufacturer and the Contractor shall warrant the equipment against  
7           defects in workmanship and materials for a period of one (1) year under normal  
8           use, operation and service, commencing at the time of final system acceptance  
9           by the Owner.

10          **PART 2 - PRODUCTS**

11          **2.01 EXTERIOR SUBMERSIBLE SUMP PUMPS**

- 12           A. The Contractor shall furnish and install 115 Volt, single phase, submersible  
13           sump pumps with a minimum 1/2 HP motors. Each pump shall pump a  
14           minimum 15 gallons per minute at a minimum 29.5 feet of total dynamic head.  
15
- 16           B. The curve submitted for approval shall state head and capacity performance of  
17           the pump.  
18
- 19           C. Pumps shall be able to operate dry for extended periods without damage to  
20           motor and/or seals.  
21
- 22           D. Pump shall be easily removable for inspection or service, requiring no bolts,  
23           nuts or other fasteners to be disconnected other than the discharge piping, or  
24           the need for personnel to enter the sump. The motor and pump shall be  
25           designed, manufactured and assembled by the same manufacturer.  
26
- 27           E. Materials of construction:  
28
- 29           1. The pump shall be constructed with single row upper and lower ball  
30           bearings.  
31
- 32           2. The pump volute, motor, and seal housing shall be 304 stainless steel or  
33           high quality cast iron, ASTM A48, Class 30, with smooth surfaces devoid  
34           of blow holes or other casting irregularities.  
35
- 36           3. Impeller shall be cast stainless steel, cast iron or ductile iron, ASTM  
37           A536, Class 40.  
38
- 39           4. The motor shaft shall be 304 Stainless Steel  
40
- 41           5. All external mating parts shall be machined and sealed with Buna N O-  
42           Rings.  
43
- 44           6. All exposed bolts and nuts shall be 316 stainless steel.  
45

1  
2       7. All power cords shall be water resistant UL or CSA approved, with double  
3           insulation and sized as a function of amperage draw. Sufficient cord  
4           length shall be provided to connect to weatherproof receptacles.  
5

- 6       F. Provide a minimum 2- inch threaded NPT discharge connection with a steel  
7           handle for lifting the pump out of the sump.  
8  
9       G. The pumps shall be supplied with mechanical seals that have carbon/ceramic  
10           faces, a stainless steel body and spring, and a Buna-N bellows.  
11  
12      H. The pumps shall be manufactured by Aurora Pumps, Hydromatic, Flygt, Weil,  
13           BJM or approved equal.  
14  
15      I. The pumps shall be supplied with an integral on-off float control system. No  
16           other controls are required.  
17

18     2.02 HEADWORKS BUILDING SUMP PUMPS  
19

- 20       A. The Contractor shall furnish and install (two) 230V, single phase, submersible  
21           sump pumps with 1.5 HP motors. The capacity of each pump shall be nominally  
22           100 gallons per minute at a minimum of 20 feet of total dynamic head. Each  
23           pump shall operate at 1750 RPM and be capable of passing a 2-inch diameter  
24           sphere. The pumps shall be Series 3MW manufactured by Pentair Myers or  
25           approved equal.  
26  
27       B. The curve submitted for approval shall state head and capacity performance of  
28           the pump.  
29  
30       C. Pumps shall be able to operate dry for extended periods without damage to  
31           motor and/or seals.  
32  
33       D. Pump shall be easily removable for inspection or service, requiring no bolts,  
34           nuts or other fasteners to be disconnected other than the discharge piping, or  
35           the need for personnel to enter the sump. Provide a quick disconnect in the  
36           discharge piping, upstream of the discharge check valve, to allow the pump to  
37           be removed by grasping the piping. The motor and pump shall be designed,  
38           manufactured and assembled by the same manufacturer.  
39  
40       E. Materials of Construction:  
41  
42           1. The pump shall be constructed with two ball bearings to support the shaft  
43           and take radial and thrust loads.  
44  
45           2. The pump volute, motor, and seal housing shall be 304 stainless steel or  
46           cast iron, ASTM A48, Class 30, with smooth surface devoid of blow holes  
47           or other casting irregularities.

- 1           3. Impeller shall be cast stainless steel, cast iron or ductile iron, ASTM  
2           A536, Class 40.  
3           4. The motor shaft shall be 304 Stainless Steel.  
4  
5           5. All external mating parts shall be machined and sealed with Buna N O-  
6           Rings.  
7  
8           6. All exposed bolts and nuts shall be 316 stainless steel.  
9  
10          7. All power cords shall be water resistant UL or CSA approved, with double  
11           insulation and sized as a function of amperage draw. Sufficient cord  
12           length shall be provided to connect to weatherproof receptacles.  
13  
14          F. Provide a minimum 2-inch threaded NPT galvanized steel discharge connection  
15           with a steel handle for lifting the pump out of the sump.  
16  
17          G. The pumps shall be supplied with dual mechanical seals that have  
18           carbon/ceramic faces, a stainless-steel body and spring, and a Buna-N bellows.  
19  
20          H. The pump manufacturer's typical duplex control panel shall be provided and  
21           installed. The control panel shall be equipped with on/off manual switches for  
22           each pump, a pump alternator, and audible and visual alarms. Four (4) floats  
23           shall be provided and installed to provide on/off, override, and high-level alarm  
24           signals to the control panel. No backup battery power supply or SCADA  
25           connection is required for this control panel.  
26  
27

28           **PART 3 – EXECUTION**

29           **3.01 INSTALLATION**

- 30           A. Install pumping equipment in accordance with the manufacturer's written  
31           recommendations.

32           **3.02 INSPECTION AND TESTING**

- 33           A. The pump shall be individually tested to include the following:  
34  
35           1. Verify proper alignment and freedom from binding, scraping, or other  
36           defects.  
37  
38           2. Ensure that the equipment is secure in position and neat in appearance.  
39  
40           3. The pump and power cord shall be visually inspected for imperfections,  
41           cuts or nicks.

4. Pump shall be allowed to run dry to check for proper rotation.

B. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

END OF SECTION

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2

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SUMP PUMP  
11306-6

06/25/2019

1 SECTION 11310  
2

3 END SUCTION PUMPS  
4

5 PART 1 – GENERAL  
6

7 1.01 DESCRIPTION  
8

9       A. This specification covers non-clog, end suction, back pullout centrifugal pumps  
10      designed specifically to pump raw wastewater in municipal wastewater  
11      treatment plants.  
12

13 1.02 RELATED WORK SPECIFIED ELSEWHERE  
14

- 15       A. Painting  
16       B. Basic Mechanical Requirements  
17

18 1.03 QUALITY ASSURANCE  
19

- 20       A. Pumps shall be in accordance with applicable Hydraulic Institute Standards,  
21      including the default pump acceptance test grades specified in ANSI/HI 14.6.  
22
- 23       B. Motors shall conform to all applicable NEMA Standards.  
24
- 25       C. All of the equipment specified under this Section shall be furnished by a single  
26      Manufacturer, who shall be fully experienced, reputable and qualified in the  
27      manufacture of the equipment furnished.  
28
- 29       D. The pumps and all related equipment shall be designed, constructed and  
30      installed in accordance with the best practices and methods. The pumps shall  
31      be suitable for satisfactory operation with the operating levels shown on the  
32      Drawings or specified herein.  
33
- 34       E. Requests for substitution shall include manufacturer's literature for each product  
35      giving name, product number, type, descriptive information, and independent  
36      lab test reports showing results to equal the performance criteria of the  
37      equipment specified herein. In addition, a list of five projects shall be submitted  
38      in which identical equipment has been used and rendered satisfactory service.  
39
- 40       F. Should equipment that differs from these Specifications be offered and  
41      determined to be the approved equal of that specified, such equipment will be  
42      acceptable only on the basis that any revisions in the design and/or construction  
43      of the structures, piping, appurtenant equipment, electrical work, etc., required  
44      to accommodate such a substitution, shall be made at no additional cost to the  
45      Owner and be as approved by the Engineer.  
46

1           G. The pump supplier shall guarantee the performance of each pump. The pumps  
2           shall be as manufactured by Xylem A-C NSY Series, or equal.  
3

4        **1.04 SUBMITTALS**  
5

- 6           A. Pump submittals shall be in accordance with Section 01300 and 01340 and  
7           shall include installation and start up instructions.  
8
- 9           B. Submit dimensional drawings showing weights and materials of construction by  
10          ASTM reference and grade. Show pump surface preparation and coatings.  
11
- 12          C. Submit pump performance curves showing the specified operating points,  
13          including the pump head, efficiency, brake horsepower and NPSH required at  
14          full speed; the impeller diameter and pump sphere size capability; the reduced  
15          speed head, efficiency and brake horsepower curves for all specified reduced  
16          speed operating points and speeds with a minimum of two additional speeds  
17          (85 and 70% if not otherwise specified) in addition to the full speed curve.  
18
- 19          D. Submit motor data for approval including manufacturer, model or type, and  
20          dimensional drawing. Show horsepower, service factor, full load speed, NEMA  
21          design, frame size, weight, enclosure, winding insulation class and treatment,  
22          rated ambient temperature, voltage, phase, frequency, full load current and  
23          locked rotor current. Also show the guaranteed efficiency and power factor at  
24          full,  $\frac{3}{4}$ , and  $\frac{1}{2}$  loads. Provide a statement from the pump manufacturer that the  
25          motors are compatible with the VFDs to be furnished.  
26
- 27          E. Furnish wiring diagrams and elementary or control schematics as requested.  
28
- 29          F. Submit manufacturer's short commercial motor test data prior to shipment.  
30
- 31          G. Submit Operation and Maintenance manuals and Training manuals in  
32          accordance with Section 01730 and Section 01820, respectively, for approval  
33          prior to start-up. These manuals shall include all of the approved and corrected  
34          submittal data, installation, operation and maintenance requirements and test  
35          data on all equipment furnished by the pump supplier. If test data has not been  
36          completed at the time these manuals are prepared, this test data may be  
37          furnished later.  
38
- 39          H. The weight of the equipment components, including the weights of the larger  
40          components.  
41
- 42          I. A complete bill of materials for all equipment and a listing of the  
43          manufacturer's recommended spare parts.  
44
- 45          J. Provide exploded views of all assemblies with all parts and materials of  
46          construction identified.  
47

1    1.05 WARRANTY

2

3       A.      Provide the Manufacturer's equipment warranty in accordance with Section  
4                    01740 of these Specifications.

5

6    PART 2 – PRODUCTS

7

8    2.01 GENERAL

- 9
- 10      A.     All equipment for the pumps, including motors and bases, shall be furnished as  
11                    a complete unit by the pump supplier. The Pump Data Table included at the  
12                    end of this section shows the minimum pump requirements.
- 13
- 14      B.     The pumps and motors shall be rated for continuous duty and shall be capable  
15                    of pumping the specified flow range without cavitation or excessive vibration.  
16                    The pumps and drives shall not infringe upon the motor service factor at any  
17                    point on the pump's full speed curve.
- 18
- 19      C.     The amplitude of vibration shall not exceed the limits set forth in the latest edition  
20                    of the Hydraulic Institute Standards.
- 21
- 22      D.     Corrosion resistant nameplates with the name of the manufacturer and the  
23                    serial number shall be attached to each pump shall be permanently affixed to  
24                    the pump.
- 25
- 26      E.     Corrosion resistant nameplates with the name of the manufacturer, serial  
27                    number, horsepower, speed, voltage and amperes shall be attached to each  
28                    motor.

29

30    2.02 MATERIALS

<u>Part:</u>	<u>Material:</u>	<u>Designation:</u>
Casing	Cast Iron	ASTM A48, Class 30
Suction Cover	Cast Iron	ASTM A48, Class 30
Suction Cover Wear Plate	Stainless	AISI 410 SS
Impeller	Cast Iron	2-3% Nickel Cast Iron
Impeller Nut & Set Screw	Stainless Steel	18-8
Impeller Wear Ring	Stainless Steel	AISI 410
Stuffing Box	Cast Iron	ASTM A48, Class 30
Bearing Frame	Cast Iron	ASTM A48, Class 30
Shaft	Stainless Steel	AISI 4140
Shaft Sleeve	Stainless Steel	316
Base	Stainless Steel	304

45

46    2.03 PUMP CONSTRUCTION

- 1           A. Casing - The pump casing shall be of sufficient strength, weight and metal  
2           thickness to insure long life, accurate alignment and reliable operation. The  
3           volute shall have smooth fluid passages large enough at all points to pass any  
4           size solid that can pass through the impeller and provide smooth, unobstructed  
5           flow. A large clean out opening with removable cover, having its interior  
6           surfaces match the volute contour, shall be located on the casing at the impeller  
7           centerline to allow access to the interior of the impeller. The casing shall be  
8           split perpendicular to the shaft with removable suction cover and stuffing box  
9           cover. Machined fits for these parts shall be accurately aligned and identical so  
10          that the casing may be installed for either clockwise or counterclockwise  
11          direction of rotation. The casing shall be arranged so that the impeller may be  
12          removed without disturbing either suction or discharge piping. The discharge  
13          flange shall be ANSI 125# flat face. All flange bolt holes shall be slotted for  
14          ease of assembly and disassembly. The discharge flange shall be drilled and  
15          tapped for a pressure gauge connection. Furnish pressure gauges for each  
16          pump as specified elsewhere.
- 17          B. Suction Cover - The suction cover shall be removable to allow for access to the  
18          impeller.
- 19          C. Suction Cover Wear Plate - A suction cover wear plate shall be furnished. It  
20          shall provide  $\frac{1}{4}$ -inch minimum wear and shall be installed with its wear surface  
21          parallel to the end of the impeller inlet.
- 22          D. Impeller - The impeller shall be of the enclosed type and shall be keyed and  
23          secured to the shaft by a lock nut and set screw. The impeller shall have a  
24          tapered bore and be readily removable without the use of special tools. The  
25          impeller clearance adjustment shall be made through the use of shims placed  
26          between the frame and the outboard bearing housing. Pump impellers shall be  
27          dynamically balanced.
- 28          E. Impeller Wear Ring - A replaceable "L" shaped wear ring shall be mounted on  
29          the impeller to provide a renewable surface opposite the suction cover wear  
30          plate.
- 31          F. Stuffing Box - The stuffing box cover shall be made with an integral stuffing box  
32          and shall be designed to accept either packing or a mechanical seal. Drilled  
33          and tapped sealing liquid connection and drain ports shall be provided.
- 34          1. Pumps shall be supplied with John Crane Type 3740 split mechanical  
35          seals.
- 36          G. Bearing Frame - The pump bearing frame shall be a one-piece rigid frame with  
37          a cast iron bearing housing mounted at the outboard end and a cast iron end  
38          cover mounted at the inboard end. Both ends of the frame shall be provided  
39          with lip type grease seals and labyrinth type deflectors to prevent the entrance  
40          of contaminants. The frame shall be provided with a  $\frac{3}{4}$ -inch tapped hole,

1 located as low as possible, to drain the leakage from the packing gland.  
2

- 3       1. Pump bearings shall be designed for a minimum 50,000 hours life at the  
4           worst-case design point specified. Inboard bearings shall be the radial  
5           type and outboard bearings shall be the radial and axial type suitable for  
6           thrust loads in two directions. Bearings shall be grease lubricated with  
7           provisions for the addition and relief of grease. The outboard bearing  
8           shall be locked to the shaft with a nut and lock washer. The lock washer  
9           shall have a key seat tab on its inside diameter to prevent it from turning  
10          and a set of tabs on its outside diameter, one of which will align with a  
11          notch in the nut, to prevent it from turning.  
12
- 13       H. Shaft - The pump shall be fully and accurately machined, tapered at the impeller  
14          end and of sufficient size to transmit the full driver output.  
15
- 16       I. Shaft Sleeve - A renewable 316 SS shaft sleeve shall be provided that extends  
17          through the stuffing box and under the gland. An O-ring seal shall be provided  
18          between the sleeve and shaft.  
19
- 20       J. Couplings - The pump shall utilize the manufacturer's recommended flexible  
21          coupling. Coupling halves shall be secured to the driver and driven shafts by a  
22          set screw located over the key. Couplings shall be suitable for the speed range  
23          specified or required. Coupling guards shall be the expanded metal type and  
24          shall meet OSHA standards.  
25
- 26       K. Hardware - All machine bolts, nuts and cap screws shall be of the hex head  
27          type. Hardware or parts requiring special tools shall not be used.  
28
- 29       L. Cleanout Handhole - The pumps be provided with separate suction and  
30          discharge cleanout handholes. The handholes shall have a removable cast iron  
31          cover. The handhole shall have a minimum diameter of 4 inches and shall have  
32          its inner surface match the contour of the pump.  
33
- 34       M. Baseplate and Pedestal - The pumps shall have a 304 SS drip rim baseplate  
35          with a tapped hole at one end for drain piping connection.  
36

37      **2.04 TOOLS AND SPARE PARTS**  
38

- 39       A. Furnish the Manufacturer's recommended spare parts for each pump. Furnish  
40          lubricants as required for all scheduled maintenance for a period of one (1) year  
41          following Substantial Completion.  
42
- 43       B. Furnish one set of all special tools required for normal operation and  
44          maintenance.  
45
- 46       C. The following spare parts shall be provided, if not furnished with the  
47          Manufacturer's recommended spare parts:

- 1        1. One mechanical seal for each pump.
- 2        2. One set of gaskets for each pump.
- 3        3. One impeller wear ring for each pump.
- 4        4. One casing wear ring for each pump.
- 5        5. Enough lubricants as required for a period of one (1) year.

## 7        2.05 MOTORS

- 8            A. Pump motors shall be in accordance with Division 16 requirements. The motors  
9            shall be 3 phase, 60 hertz and 460 volts and shall be sized so that the service  
10          factor is not infringed upon throughout the full speed performance curve of the  
11          pumps. At minimum, motors shall have Class B insulation and a 1.15 service  
12          factor. Motors shall have re-greaseable or oil lubricated bearings. Variable  
13          speed motors shall be rated for inverter duty per NEMA MG-1, Part 31.  
14  
15          B. The motors shall be driven by variable frequency drives.

## 16        2.06 FACTORY TESTS

- 17            A. Each motor shall be given a non-witnessed short commercial test to determine  
18            that the motor is free from electrical and mechanical defects and to provide  
19            assurance that it meets the specifications. Testing shall be in accordance with  
20            NEMA standards and shall consist of no load current, locked rotor current,  
21            winding resistance, high potential and bearing inspection.  
22  
23            B. Each pumping unit, with a calibrated factory test motor, shall be given a factory  
24            performance test to provide assurance that the unit meets the specifications.  
25            Tests shall be performed in accordance with Hydraulic Institute Standards  
26            ANSI/HI 14.6. Variable speed pumps shall be tested at full speed and at 85%  
27            and 70% speed. . Copies of the test reports shall be provided to the Engineer.  
28  
29

## 30        2.07 FACTORY PAINTING

- 31            A. The pumps shall be cleaned and blasted to SSPC-SP10 and shall be given one  
32            coat of rust inhibitive primer to a minimum of 4-6 mils DFT and one coat of epoxy  
33            finish to 4-8 mils DFT.

## 34        2.08 ROTATION

- 35            A. The rotation shall be marked on the pump casing and the pumps shall be  
36            clocked as shown on the Drawings.

## 37        PART 3 – EXECUTION

### 38        3.01 INSTALLATION

- 1           A. Pumps, drivers and bases shall be precisely leveled and aligned, accurately  
2           anchored into position and grouted by the Contractor. Installation shall be in  
3           strict accordance with the manufacturer's instructions and recognized industry  
4           practices. The Contractor shall furnish the anchor bolts and the required  
5           lubricants for initial operation. The existing concrete maintenance pads shall be  
6           removed and new bases shall be installed.  
7
- 8           B. Pressure gauge assemblies shall be furnished and installed by the Contractor  
9           on the suction and discharge of each pump. The gauges shall have a 2.5 inch  
10          dial and be installed with a pressure snubber, isolation valve, brass tee handle  
11          and a seal with a 316 SS diaphragm. The gauge calibration ranges shall be as  
12          small as is practical so that full range is utilized, but safely within maximum  
13          conditions.  
14
- 15          C. The Contractor shall connect the new seal water system to each pump as shown  
16          on the drawings such that seal water is automatically supplied to the inlet port  
17          of the stuffing box when the pump is started and in operation.

19          3.02 JOBSITE PAINTING  
20

- 21          A. The Contractor shall field paint the pumping equipment in accordance with  
22          Section 09900.  
23

24          3.03 INSPECTION AND TESTING  
25

- 26          A. General - Furnish the services of a factory representative in accordance with  
27          Specification Section 01820 to inspect the final installation, supervise a test run  
28          of the equipment, and provide operator training. The factory representative  
29          shall provide a written certification that the pumps are installed in accordance  
30          with the manufacturer's recommendations.  
31
- 32          B. Motors - The Contractor shall check all motors for correct clearances and  
33          alignment, and for correct lubrication in accordance with the manufacturer's  
34          instructions. The Contractor shall verify the proper rotation of all motors.  
35
- 36          C. Pumps - After the pumps have been completely installed and inspected by a  
37          factory representative, field tests shall be conducted on each unit in the  
38          presence of the Engineer to show conformance with the specifications. The  
39          Contractor shall supply all labor, equipment and incidentals required to  
40          complete these tests. The factory representative shall provide a complete  
41          startup report for each pump, documenting the pump operating conditions at  
42          startup. This report shall be made part of the operation and maintenance  
43          manual. Pumps that cannot be made to comply with the specifications shall be  
44          removed and replaced with pumps that satisfy the conditions specified.  
45

46          3.04 PUMP DATA TABLE  
47

Service	EQ Tank Supply	EQ Tank Return	Salsnes Filter Feed
Quantity	2	2	3
Location	Outdoors	Outdoors	Indoors
Position/Orientation	Horizontal		
Drive	480-V 3 phase A/C Variable Speed (VFD)		
Gauges	Discharge		
Design Point - Full Speed			
Flow, gpm	972	1632	1700
TDH, feet	29	28	12.4
Min. Efficiency, %	71.5	74	78
Runout Point - Full Speed			
Max Flow, gpm	1425	2950	2300
TDH, feet	18	17	9
NPSH Required, feet	11	18	12
Max. Solids Sphere Size, In	3.63	3.75	3.75
Min. Casing Thickness	0.5	0.5	0.5
Nominal Shaft Diameter, In.	2.75	2.50	2.50
Max. Motor Speed, RPM	1170	875	695
Max. Motor HP	15	20	10
Min. Shutoff Head, feet	48	39	20.3
Suction x Discharge, inch	8 X 6	10 X 10	10 X 10
Min. Weight, lbs. (w/o motor or base)	750 ± 10%	1,600 ± 10%	1,600 ± 10%
Basis of Design	Xylem A-C Series		

1  
2  
3  
4  
5  
6  
7

END OF SECTION

1 SECTION 11317  
2

3 PROGRESSING CAVITY PUMPS  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required and install,  
10 place in operation, and field test three (3) horizontal variable speed  
11 progressing cavity pumps and motors with bases and appurtenances,  
12 designed specifically to pump primary sludge with 4%-6% solids content;  
13 complete with motors, control systems, and seal water systems at the  
14 Salsnes Filters area as hereinafter specified to perform the intended  
15 function and achieve a fully integrated and operational system.  
16
- 17 B. Furnish all labor, materials, equipment and incidentals required and install,  
18 place in operation, and field test one (1) horizontal constant speed  
19 progressing cavity pump and motor with base and appurtenances,  
20 designed specifically to pump primary scum with 0.25%-2% solids content;  
21 complete with motor, control system, and seal water system in the  
22 Salsnes Filters Feed Pump Building as hereinafter specified to perform the  
23 intended function and achieve a fully integrated and operational system.  
24
- 25 C. These Specifications are intended to give a general description of what is  
26 required, but do not cover all details which will vary in accordance with the  
27 requirements of the equipment application. It is, however, intended to  
28 cover the furnishing, the shop testing, the delivery and complete  
29 installation and field testing, of all materials, equipment and all  
30 appurtenances for the complete pumping system as herein specified,  
31 whether specifically mentioned in these Specifications or not.  
32

33 1.02 DESCRIPTION OF THE SYSTEM  
34

35 Sizing and Performance Criteria: Provide pumps with the following design  
36 criteria:  
37

38 Salsnes Filters Primary Sludge Pumps

Number of Pumps.....	3
Maximum Pump Speed (rpm) .....	140
Design Capacity (gpm) .....	15
TDH at Design Capacity (psi) .....	60
Pump Inlet.....	Open Throat with Screw Auger Feed
Pump Outlet.....	3-inch Flanged
Maximum Motor Horsepower.....	5
Configuration .....	Variable Speed Motor with Gear Box

1                   Fabricated Base Material ..... 304 Stainless Steel  
2                   Dry Solids Content of Primary Sludge ..... 4%-6%  
3

4                   Primary Scum Pump

5                   Number of Pumps ..... 1  
6                   Maximum Pump Speed (rpm) ..... 275  
7                   Design Capacity (gpm) ..... 90  
8                   TDH at Design Capacity (psi) ..... 65  
9                   Pump Inlet ..... 6-inch Flanged  
10                  Pump Outlet ..... 6-inch Flanged  
11                  Maximum Motor Horsepower ..... 10  
12                  Configuration ..... Constant Speed Motor with Gear Box  
13                  Fabricated Base Material ..... 304 Stainless Steel  
14                  Dry Solids Content of Primary Scum ..... 0.25%-1.0%  
15

16                  **1.03 REFERENCE STANDARDS**

17                  A.     Design, manufacturing and assembly of elements of the equipment herein  
18                  specified shall be in accordance with the standards of the below listed  
19                  organizations. Where reference is made to a standard of any  
20                  organization, the version of the standard in effect at the time of bid  
21                  opening shall apply.

- 22
- 23                  1.     American Iron and Steel Institute (AISI)
  - 24                  2.     American Society of Mechanical Engineers (ASME)
  - 25                  3.     American National Standards Institute (ANSI)
  - 26                  4.     American Society for Testing Materials (ASTM)
  - 27                  5.     American Water Works Association (AWWA)
  - 28                  6.     Hydraulic Institute Standards
  - 29                  7.     National Electrical Manufacturers Association (NEMA)
  - 30                  8.     Underwriters Laboratories, Inc. (UL)
  - 31                  9.     Anti-Friction Bearing Manufacturers Association (AFBMA)
  - 32                  10.    American Gear Manufacturers Association (AGMA)
  - 33                  11.    Occupational Safety and Health Administration (OSHA)

34                  **1.04 QUALITY ASSURANCE**

35

36                  A.     To ensure a consistently high standard of quality, the manufacturer of this  
37                  pumping equipment shall comply with the requirements of the ISO 9001  
38                  Quality System, and such compliance shall be verified by an independent  
39                  certification agency approved by the International Organization for  
40                  Standardization. Documentation shall be submitted for approval showing  
41                  compliance with this requirement, and the equipment will not be released  
42                  for shipment until approved.

43

44                  B.     Motors shall be in accordance with NEMA Standards.

- 1           C. All of the equipment specified under this Section shall be furnished by a  
2           single Manufacturer, who is fully experienced, reputable and qualified in  
3           the manufacture of the equipment furnished. The pumps shall be suitable  
4           for satisfactory operation with the normal operating levels shown on the  
5           Drawings. The Contractor shall assume full responsibility for the  
6           satisfactory installation and operation of the entire pumping system as  
7           specified.
- 8
- 9           D. The pumps and all related equipment shall be designed, constructed and  
10          installed in accordance with the best practices and methods.
- 11
- 12          E. Requests for substitution shall include manufacturer's literature for each  
13          product giving name, product number, type, descriptive information, and  
14          independent lab test reports showing results to equal the performance  
15          criteria of the equipment specified herein. In addition, a list of five projects  
16          shall be submitted in which identical equipment has been used and  
17          rendered satisfactory service.
- 18
- 19          F. The pump manufacturer shall be fully responsible for the design,  
20          arrangement and operation of all connected and rotating components of  
21          the assembled pumping units to ensure that neither harmful nor damaging  
22          vibrations occur at any speed within the specified operating range.
- 23
- 24          G. Should equipment which differs from these Specifications be offered and  
25          determined to be the approved equal of that specified, such equipment will  
26          be acceptable only on the basis that any revisions in the design and/or  
27          construction of the structures, piping, appurtenant equipment, electrical  
28          work, etc., required to accommodate such a substitution, shall be made at  
29          no additional cost to the Owner and be as approved by the Engineer.
- 30
- 31          H. The pump supplier shall guarantee the performance of each pump. The  
32          pumps shall be as manufactured by Moyno and shall be the EZ-Strip  
33          Models or approved equals.
- 34

35        **1.05 SUBMITTALS**

- 36          A. Submit to the Engineer, in accordance with Sections 01300 and 01340,  
37          copies of all materials required to establish compliance with this Section.  
38          Submittals shall include at least the following:
- 39
- 40           1. Certified shop drawings, erection drawings, and installation  
41           instructions showing all important details of construction,  
42           dimensions and anchor bolt locations. Provide exploded views of  
43           all pump assemblies with all parts and materials of construction  
44           identified.
- 45
- 46

- 1           2. Descriptive literature, bulletins and/or catalogs of the equipment.
- 2           3. Data on the characteristics and performance of the pumps. The  
3            data shall include performance curves, based on actual shop tests  
4            of like pumping units, which show that they meet the specified  
5            requirements for head, capacity and horsepower. Curves shall be  
6            submitted on 8-1/2-in by 11-in sheets.
- 7           4. Submit motor data for approval including manufacturer, model or  
8            type, and dimensional drawing. Show horsepower, service factor,  
9            full load speed, NEMA design, frame size, weight, enclosure,  
10          winding insulation class and treatment, rated ambient temperature,  
11          voltage, phase, frequency, full load current and locked rotor current.  
12          Also show the guaranteed efficiency and power factor at full,  $\frac{3}{4}$ ,  
13          and  $\frac{1}{2}$  loads. Provide a statement from the pump manufacturer  
14          that the motors are compatible with the VFDs to be furnished.
- 15          5. Furnish wiring diagrams and elementary or control schematics as  
16          requested.
- 17          6. Submit complete data on pump drive including gearbox.
- 18          7. The weight of the equipment components, including the weights of  
19          the larger components.
- 20          8. A complete bill of materials for all equipment.
- 21          9. Complete description of surface preparation and shop prime  
22          painting.
- 23          B. In the event that it is impossible to conform to certain details of this  
24          Section due to different manufacturing techniques, describe completely all  
25          nonconforming aspects.
- 26          C. Operating and Maintenance Data and Training
- 27          1. Operating and maintenance instructions shall be furnished to the  
28          Engineer as provided for in Section 01730. The instructions shall  
29          be prepared specifically for this installation and shall include all  
30          cuts, drawings, equipment lists, and descriptions that are required  
31          to instruct operating and maintenance personnel unfamiliar with  
32          such equipment.
- 33          2. A factory representative who has complete knowledge of proper  
34          operation and maintenance of the pumps shall be provided in

1 accordance with Specification Section 01820 to provide  
2 training/instruction to operations and maintenance personnel on  
3 proper operation and maintenance. The work may be conducted in  
4 conjunction with the inspection of the installation and test run as  
5 provided. If there are difficulties in operation of the equipment due  
6 to the manufacturer's design or fabrication, additional service shall  
7 be provided at no additional cost to the Owner.

8

#### 9 1.06 TOOLS AND SPARE PARTS

- 10
- 11 A. Furnish the Manufacturer's recommended spare parts for each pump.  
12 Furnish lubricants as required for all scheduled maintenance for a period  
13 of one (1) year following Substantial Completion.

14

  - 15 B. Furnish one set of all special tools required for normal operation and  
16 maintenance.

17

  - 18 C. At minimum the following spare parts shall be provided.  
19
    - 20 1. One mechanical seal for each pump.
    - 21 2. One complete set of gaskets for each pump.
    - 22 3. One complete set of O-rings for each pump.
    - 23 4. One complete set of seals for each pump.
    - 24 5. One stator and rotor assembly for each pump.
    - 25 6. One set of bearings for each pump. List the bearings by the  
26 bearing manufacturer's numbers only.
    - 27 7. One set of the split coupling rods for each pump.
    - 28 8. One set of coupling rod bushings for each pump.
    - 29 9. One set of coupling rod pins for each pump.
    - 30 10. Enough lubricants as required for a period of one (1) year

31

#### 32 1.07 PRODUCT HANDLING

- 33
- 34 A. All parts shall be properly protected so that no damage or deterioration will  
35 occur during a prolonged delay from the time of shipment until installation  
36 is completed and the units and equipment are ready for operation.

37

  - 38 B. All equipment and parts must be properly protected against any damage  
39 during a prolonged period at the site.

40

  - 41 C. Factory assembled parts and components shall not be dismantled for  
42 shipment unless permission is received in writing from the Engineer.

43

  - 44 D. Finished surfaces of all exposed openings shall be protected by wooden  
45 blanks, strongly built and securely bolted thereto.

46

- 1           E. Finished iron or steel surfaces not painted shall be properly protected to  
2           prevent rust and corrosion.
- 3
- 4           F. After hydrostatic or other tests, all entrapped water shall be drained prior  
5           to shipment and proper care shall be taken to protect parts from the  
6           entrance of water during shipment, storage and handling.
- 7
- 8           G. Each box or package shall be properly marked to show its net weight in  
9           addition to its contents.

10          1.08 WARRANTY

- 11
- 12           A. In order to assure proper performance and compatibility, all equipment  
13           supplied within this Specification shall be warranted by the same supplier.
- 14
- 15           B. The equipment shall be warranted to be free from defects in workmanship,  
16           design and materials. If any part of the equipment should fail during the  
17           warranty period, it shall be replaced in the machine(s) and the unit(s)  
18           restored to service at no expense to the Owner.
- 19
- 20
- 21           C. The pump manufacturer and the Contractor shall warrant the pumps  
22           against defects in workmanship and materials in accordance with Section  
23           01740 of these Specifications.

24          1.09 MANUFACTURER'S REPRESENTATIVE

- 25
- 26           A. Provide the services of a qualified factory certified representative for a  
27           minimum of (1) day for each pump for equipment installation inspection,  
28           certification, start-up, training, and corrective adjustments.

29          PART 2 - PRODUCTS

30          2.01 MATERIALS AND EQUIPMENT

- 31
- 32           A. General
- 33
- 34           1. The equipment specified herein is intended to be standard pumping  
35           equipment of proven ability as manufactured by a reputable firm  
36           having long experience in the production of such equipment. The  
37           equipment furnished shall be designed and constructed in  
38           accordance with the best practices and methods and the same  
39           model and pump performance currently in use at the plant.
- 40
- 41           2. All parts shall be so designed and proportioned as to have liberal  
42           strength and stiffness and to be especially adapted for the work to  
43           be done. Ample room and facilities shall be provided for inspection,

1                   repairs and adjustment.  
2

- 3                   3. All necessary foundation bolts, plates, nuts and washers shall be of  
4                   Type 316 stainless steel.
- 5                   4. Brass or stainless steel nameplates giving the name of the  
6                   manufacturer, pump model and serial number shall be attached to  
7                   each pump and motor.
- 8                   5. The nameplate rating of the motors and drives shall not be  
9                   exceeded, nor shall the motor design service factor be reduced  
10                  when its pump is operating at the maximum design performance.

11                 2.02 PUMP

- 12                 A. Pump shall be heavy duty, positive displacement, and progressing cavity  
13                 type. The pump body shall be of thick-walled cast iron and shall  
14                 incorporate two inspection ports 180 degrees apart. The pump shall be  
15                 mounted to permit the suction port to be rotated to any angle  
16                 perpendicular to the centerline of the pump. Discharge connections shall  
17                 be 125 lb ANSI cast iron flanged. The suction port shall be rectangular  
18                 shaped open throat design with a screw auger on the three sludge pumps  
19                 and a flanged pipe connection on the scum pump. All wetted internal  
20                 components shall be alloy steel unless otherwise described in this  
21                 specification.
- 22                 B. The pump rotor shall be one-piece alloy steel conforming to BS970 grade  
23                 708M40T/709M40T (ASTM A322 grade 4140/4145) or equivalent. The  
24                 rotor shall be machined and coated with a hard chrome plate to a nominal  
25                 thickness of 0.10 inches at the scroll peaks. The chrome plate shall be  
26                 hardened to a Rockwell "C" value of 57 to 60 and polished to a minimum  
27                 of Ra value of 1.6 um.
- 28                 C. The rotor shall rotate relative to a one-piece, medium-high acrylonitrile  
29                 Buna "N" rubber stator of approximate 70 Durometer hardness (Shore A)  
30                 securely bonded to its steel tube housing. The stator shall be arranged to  
31                 prevent the pumped material from contacting the bonding or the tube.
- 32                 D. The rotor shall be joined to the drive shaft by a 2-piece connecting rod and  
33                 pin type connection with 2 pins and 2 bushings as the wear components.  
34                 The 2-piece connecting rod allows the rotor and stator to be removed  
35                 without disturbing or dismantling the pump pin-joint drive connections.
- 36                 E. The rotor, stator, connecting rod, main drive shaft, and gland seal shall be  
37                 capable of being removed and replaced without disturbing or removing the  
38                 pump suction or discharge connections.

- 1                   F. The suction chamber area shall have unrestricted 360 degree access.
- 2
- 3                   G. The pump stuffing box shall be equipped with a John Crane Bellows Type
- 4                   mechanical seal with SilCar/SilCar/Fluoroelastomer and 316 SS
- 5                   components.
- 6
- 7                   H. The pumps shall fit in the available space provided without encroaching on
- 8                   adjacent pump access space or working space. To this end, the
- 9                   Contractor shall, with 30 days from the Notice to Proceed, submit
- 10                  installation drawings (scaled and dimensioned) of any pump whose
- 11                  dimensions differ more than 2-inches from the specified pump. The
- 12                  Engineer will review the installation drawings and advise the Contractor
- 13                  whether the proposed pump is acceptable. The Engineer shall be the sole
- 14                  judge of the acceptability of pumps other than that specified.
- 15

16

## 2.04 MOTORS

- 17
- 18                  A. Pump motors shall be in accordance with Division 16 requirements. The
- 19                  motors shall be 3 phase, 60 hertz and 460 volts and shall be sized so that
- 20                  the service factor is not infringed upon throughout the full speed
- 21                  performance curve of the pumps. At minimum, motors shall have Class B
- 22                  insulation and a 1.15 service factor. Motors shall have re-greaseable or
- 23                  oil lubricated bearings. Variable speed motors shall be rated for inverter
- 24                  duty per NEMA MG-1, Part 31.
- 25
- 26                  B. The motor shall be mounted in-line with the pump to a gearbox as shown
- 27                  on the drawings and directly drive the gearbox. The motor shall be rated
- 28                  for outdoor use.
- 29
- 30                  C. The pump shaft shall be connected to the drive with a close-coupled,
- 31                  flange-mounted gear motor with a cross drilled shaft.
- 32
- 33                  D. The motors shall be driven by variable frequency drives on the three
- 34                  sludge pumps and be constant speed on the scum pump.
- 35

36

## 2.05 BASE

- 37
- 38                  A. The motor and pump shall be mounted in-line on a fabricated/bent 304
- 39                  stainless steel base. The base shall be fitted with lifting lugs and grout
- 40                  holes for grouting to the concrete maintenance pad.
- 41

42

## 2.06 TEMPERATURE AND PRESSURE SWITCH

- 43
- 44                  A. The pump manufacturer shall furnish for each pump a temperature and
- 45                  pressure switch with all suitable accessories for outdoor installation and
- 46

1 connection to the pump. The switches shall be wired to deactivate the  
2 pump motor if the temperature or pressure exceed the manufacturer's  
3 recommended settings.

4

5 **2.07 SURFACE PREPARATION AND SHOP PRIME PAINTING**

6

- 7       A. All surfaces shall be prepared and shop primed as part of the work under  
8           this Section. Surface preparation and shop priming shall be as specified  
9           in Section 09900.

10

11 **PART 3 - EXECUTION**

12

13 **3.01 INSTALLATION**

14

- 15       A. Installation shall be in strict accordance with the manufacturer's  
16           instructions and recommendations at the locations shown on the  
17           Drawings. Installation shall include furnishing the required oil and grease  
18           for initial operation. The grades of oil and grease shall be in accordance  
19           with the manufacturer's recommendations. Anchor bolts shall be set in  
20           accordance with the manufacturer's recommendations.
- 21
- 22       B. The base shall be set on a concrete pad and grouted in place after proper  
23           leveling with an approved non-shrink grout.

24

25 **3.02 INSPECTION AND TESTING**

26

- 27       A. Furnish the services of a factory representative in accordance with  
28           specification 01820 who has complete knowledge of proper operation and  
29           maintenance to inspect the final installation and supervise a test run of the  
30           equipment.
- 31
- 32       B. The Contractor shall fabricate and connect a seal water supply system to  
33           the pump such that seal water is automatically supplied to the inlet port of  
34           the stuffing box when the pump is started and in operation. The seal  
35           water system shall start and stop with the pump motor and shall provide  
36           pressure above the pump discharge pressure.
- 37
- 38       C. After all pumps have been completely installed under the direction of the  
39           manufacturer's factory representative the Contractor shall conduct, in the  
40           presence of the Engineer, such tests as are necessary to ensure that the  
41           pumps conform to the requirements specified herein. Field tests shall be  
42           performed on all pumps included under this Section. Pumps shall be  
43           operated for at least 24 hours run time prior to acceptance.
- 44
- 45       D. If the pump performance does not meet the specified requirements,  
46           corrective measures shall be taken, or pumps shall be removed and

1 replaced with pumps that satisfy the conditions specified.  
2

- 3       E. The factory representative shall provide written certification that the pump  
4       is installed in accordance with the manufacturer's recommendations.

5  
6  
7                   END OF SECTION  
8  
9

1 SECTION 11320  
2

3 RECESSED IMPELLER PUMPS  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish all labor, materials, equipment and incidentals required and install,  
10 place in operation, and field test four (4) horizontal vortex-type recessed  
11 impeller pumps designed specifically to pump wastewater containing a grit  
12 slurry in municipal wastewater treatment plants with motors, bases, control  
13 systems, and seal water systems at the Headworks area as hereinafter  
14 specified to perform the intended function and achieve a fully integrated and  
15 operational system.  
16
- 17 B. These Specifications are intended to give a general description of what is  
18 required, but do not cover all details, which will vary in accordance with the  
19 requirements of the equipment application. It is, however, intended to cover  
20 the furnishing, the shop testing, the delivery and complete installation and field  
21 testing, of all materials, equipment and all appurtenances for the complete  
22 pumping system as herein specified, whether specifically mentioned in these  
23 Specifications or not.  
24

25 1.02 DESCRIPTION OF THE SYSTEM  
26

27 Sizing and Performance Criteria: Provide pumps with the following design criteria:  
28

29 Number of Pumps.....	4
30 Maximum Pump Speed (rpm).....	1,100
31 Design Capacity (gpm) .....	150
32 TDH at Design Capacity (ft).....	50.9
33 TDH at Shutoff (ft).....	8.5
34 Pump Inlet/Outlet.....	4-inch/3-inch flanged
35 Maximum Horsepower.....	15
36 Minimum Efficiency %.....	25
37 Configuration .....	Constant Speed Belt Driven

38 1.03 REFERENCE STANDARDS  
39

- 40 A. Design, manufacturing and assembly of elements of the equipment herein  
41 specified shall be in accordance with the standards of the below listed  
42 organizations. Where reference is made to a standard of any organization, the  
43 version of the standard in effect at the time of bid opening shall apply.  
44

- 45 1. American Iron and Steel Institute (AISI)  
46 2. American Society of Mechanical Engineers (ASME)

3. American National Standards Institute (ANSI)
4. American Society for Testing Materials (ASTM)
5. American Water Works Association (AWWA)
6. Hydraulic Institute Standards
7. National Electrical Manufacturers Association (NEMA)
8. Underwriters Laboratories, Inc. (UL)

## 1.04 QUALITY ASSURANCE

- A. Pumps shall be in accordance with applicable Hydraulic Institute Standards. To ensure a consistently high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality System, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.
- B. Motors shall be in accordance with NEMA Standards.
- C. All of the equipment specified under this Section shall be furnished by a single Manufacturer, who is fully experienced, reputable and qualified in the manufacture of the equipment furnished. The pumps shall be suitable for satisfactory operation with the normal operating levels shown on the Drawings. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire pumping system as specified.
- D. The pumps and all related equipment shall be designed, constructed and installed in accordance with the best practices and methods.
- E. All requests for equipment substitution shall be made at least 10 days prior to the bid opening date.
- F. Requests for substitution shall include manufacturer's literature for each product giving name, product number, type, descriptive information, and independent lab test reports showing results to equal the performance criteria of the equipment specified herein. In addition, a list of five projects shall be submitted in which identical equipment has been used and rendered satisfactory service.
- G. The pump manufacturer shall be fully responsible for the design, arrangement and operation of all connected rotating components of the assembled pumping units to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- H. Should equipment which differs from these Specifications be offered and determined to be the approved equal of that specified, such equipment will be

1 acceptable only on the basis that any revisions in the design and/or  
2 construction of the structures, piping, appurtenant equipment, electrical work,  
3 etc., required to accommodate such a substitution, shall be made at no  
4 additional cost to the Owner and be as approved by the Engineer.  
5

- 6 I. The pump supplier shall guarantee the performance of each pump. The  
7 pumps shall be as manufactured by WEMCO Model C, Hayward Gordon  
8 Torus XR, or equal.  
9

10 1.05 SUBMITTALS  
11

- 12 A. Submit to the Engineer for review in accordance with Section 01340 and 01730  
13 complete installation drawings, shop drawings, working drawings, O&M  
14 Manuals and product data for all materials and equipment furnished under this  
15 Section. Submittals shall include at least the following:  
16

- 17 1. Certified shop drawings, erection drawings and installation instructions  
18 showing all important details of construction, dimensions and anchor  
19 bolt locations.  
20  
21 2. Descriptive literature, bulletins and/or catalogs of the equipment.  
22  
23 3. Data on the characteristics and performance of each pump. Data shall  
24 include guaranteed performance curves, based on actual shop tests of  
25 similar units, which show that they meet the specified requirements for  
26 head, capacity, efficiency, NPSHR and horsepower. Curves shall be  
27 submitted on 8-1/2" x 11" sheets, at as large a scale as is practical.  
28 Curves shall be plotted from no flow at shut off head to pump capacity  
29 at minimum specified total head. Catalog sheets showing a family of  
30 curves will not be acceptable.  
31  
32 4. Complete master wiring diagrams, elementary or control schematics,  
33 including coordination with other electrical control devices such as the  
34 pump control system and suitable outline drawings shall be furnished  
35 for approval before proceeding with manufacture. Provide suitable  
36 outline drawings showing such details as are necessary to locate  
37 conduit stub-ups and field wiring. Due to the complexity of the system,  
38 it is imperative the above drawings be clear and carefully prepared to  
39 facilitate interconnections with other equipment. Standard pre-printed  
40 sheets or drawings simply marked to indicate applicability to this  
41 contract will not be acceptable.  
42  
43 5. A complete total bill of materials of all equipment (may be furnished with  
44 Operation and Maintenance manuals specified herein).  
45  
46 6. A list of the manufacturers recommended spare parts to be supplied in  
47 addition to those specified, with the manufacturer's current price for

1                   each item. Include gaskets, packing, etc. on the list. List bearings by  
2                   the bearing manufacturer's numbers only.

- 3
- 4                   7. Complete motor data.
- 5
- 6                   8. The weight of the pump assembly not including the base, the motor, or  
7                   the coupling.

8

9                   B. Test Reports to be Submitted

- 10
- 11                  9. Description of factory testing procedures and equipment.
- 12
- 13                  10. Copies of all test results, as specified in Parts 2 and 3 of this Section.
- 14
- 15                  11. Copies of all start-up test reports which show compliance with these  
16                  Specifications.

17

18                  C. The submittal data shall be prepared, in its entirety, by the equipment  
19                  manufacturer. Shop drawings prepared by the manufacturer's sales  
20                  representative, fabrication shops, or other than the listed manufacturers will  
21                  not be acceptable. No additions or modifications to the manufacturer's  
22                  submittal will be accepted, with the sole exception of a cover sheet provided  
23                  by the manufacturer's local Representative and the Contractor.

24

25                  D. The operating and maintenance information shall include lubrication  
26                  instructions, troubleshooting data, full preventative maintenance schedules,  
27                  complete spare parts lists with ordering information, and exploded views of all  
28                  components and equipment with part numbers and the materials of  
29                  construction identified.

30

31                  E. In the event that is impossible to conform to certain details of the  
32                  Specifications due to different manufacturing techniques, describe completely  
33                  all non-conforming aspects.

34

35                  1.06 TOOLS AND SPARE PARTS

36

37                  A. Furnish one (1) set of all special tools required for normal operation and  
38                  maintenance.

39

40                  B. Furnish and package for storage all of the manufacturer's recommended spare  
41                  parts to assure normal running and maintenance for a period of two (2) years  
42                  assuming all units are in continuous operation.

43

44                  C. Furnish and package for storage a quantity of the recommended lubrication to  
45                  meet the manufacturers' recommended lubrication change intervals for 1 year  
46                  assuming all units are in continuous operation. Lubricants shall include summer  
47                  and winter grades with alternate reference to equal products of other

1 manufacturers, and shall include all lubricant specification such as viscosity,  
2 AGMA numbers, etc.

- 3
- 4 E. All spare parts shall be furnished in containers clearly identified with indelible  
5 markings as to contents. Each container shall be packed with its contents  
6 protected for prolonged storage.
- 7
- 8 F. In addition to items A-E, the following spare parts shall be supplied with the  
9 equipment:

10

11 Four (4) sets of drive belts  
12 One (1) completely assembled motor  
13 One (1) completely assembled bare shaft pump  
14 Four (4) complete sets of wear plates or wear elements as applicable  
15 Four (4) mechanical seals  
16 Four (4) sets of pump gaskets  
17 Enough lubricants as required for a period of one (1) year

18

19 1.07 PRODUCT HANDLING

- 20
- 21 A. All parts shall be properly protected so that no damage or deterioration will  
22 occur during a prolonged delay from the time of shipment until installation is  
23 completed and the units and equipment are ready for operation.
- 24
- 25 B. All equipment and parts must be properly protected against any damage  
26 during a prolonged period at the site.
- 27
- 28 C. Factory assembled parts and components shall not be dismantled for  
29 shipment unless permission is received in writing from the Engineer.
- 30
- 31 D. Finished surfaces of all exposed openings shall be protected by wooden  
32 blanks, strongly built and securely bolted thereto.
- 33
- 34 E. Finished iron or steel surfaces not painted shall be properly protected to  
35 prevent rust and corrosion.
- 36
- 37 F. After hydrostatic or other tests, all entrapped water shall be drained prior to  
38 shipment and proper care shall be taken to protect parts from the entrance of  
39 water during shipment, storage and handling.
- 40
- 41 G. Each box or package shall be properly marked to show its net weight in  
42 addition to its contents.

43

44 1.08 WARRANTY

- 45
- 46 A. In order to assure proper performance and compatibility, all equipment  
47 supplied within this Specification shall be warranted by the same supplier.

- 1           B. The equipment shall be warranted to be free from defects in workmanship,  
2           design and materials. If any part of the equipment should fail during the  
3           warranty period, it shall be replaced in the machine(s) and the unit(s) restored  
4           to service at no expense to the Owner.  
5  
6           C. The pump manufacturer and the Contractor shall warrant the pumps against  
7           defects in workmanship and materials in accordance with Section 01740 of  
8           these Specifications.

10          1.09 MANUFACTURER'S REPRESENTATIVE

- 11          A. Provide the services of a qualified factory certified representative for a  
12           minimum of (2) days for each machine for equipment installation inspection,  
13           certification, start-up, training, and corrective adjustments.

14          1.10 PERFORMANCE TESTING

- 15          A. Factory and performance testing shall be conducted by the Contractor on each  
16           pump as described in Part 3 of this specification.

17          PART 2 - PRODUCTS

18          2.01 GENERAL

- 19          A. All equipment for the pumps, including motors and bases, shall be furnished  
20           as a complete unit by the pump supplier. The Pump Data Sheet included at  
21           the end of this section shows the minimum pump requirements.
- 22          B. The pumps and motors shall be rated for continuous duty and shall be capable  
23           of pumping the specified flow range without cavitation or excessive vibration.  
24           The pumps and drives shall not infringe upon the motor service factor at any  
25           point on the pump full speed curve.
- 26          C. The amplitude of vibration shall not exceed the limits set forth in the latest  
27           edition of the Hydraulic Institute Standards.
- 28          D. The pumping units required under this Section shall be complete including,  
29           where required, proper alignment and balancing of the individual units. All  
30           parts shall be so designed and proportioned as to have liberal strength,  
31           stability and stiffness and to be especially adapted for the service to be  
32           performed. Ample room for inspection, repairs and adjustment shall be  
33           provided.
- 34          E. Corrosion resistant nameplates with the name of the manufacturer and the  
35           serial number shall be attached to each pump.

1 F. Corrosion resistant nameplates with the name of the manufacturer, serial  
2 number, horsepower, speed, voltage and amperes shall be attached to each  
3 motor.

5 G. The pumping equipment shall be WEMCO Model C, Hayward Gordon Torus  
6 XR, or approved equal, meeting the design requirements herein.  
7

8 2.02 MATERIALS  
9

<u>Part:</u>	<u>Material:</u>	<u>Designation:</u>
Casing	See 2.03 Below	
Suction Cover	See 2.03 Below	
Wear Plate	See 2.03 Below	
Impeller	See 2.03 Below	
Impeller Nut & Set Screw	Stainless	18-8 SS
Stuffing Box	Cast Iron	ASTM A48, Class 30
Bearing Frame	Cast Iron	ASTM A48, Class 25 or Class 30
Shaft	Stainless Steel	ASTM A108 or AISI Grade 1045 or 4140
Shaft Sleeve	Stainless	ASTM A582 Type 416 or Type 410
Base	Stainless	304 SS

27 2.03 PUMP CONSTRUCTION  
28

29 A. The parts exposed to abrasive wear - casing, removable suction cover, wear  
30 plate, and the impeller, shall be of Ni-Hard, ASTM A532 Class I Type A or Hi-  
31 Chrome Iron ASTM A532, Class III, Type A material, and be a minimum of 650  
32 Brinell hardness for maximum wear resistance.  
33

34 B. The pump(s) shall be of a fully recessed, slurry type design, with the impeller  
35 mounted completely out of the flow path between the pump inlet and  
36 discharge connection, so that solids are not required to flow through the  
37 impeller. All flow path clearances within the pump shall be equal to or greater  
38 than the discharge diameter, so that all solids which will pass through the  
39 discharge will pass through the pump.  
40

41 C. The casing shall be a minimum of  $\frac{3}{4}$ -inch thickness. The pump casing shall be  
42 of sufficient strength, weight and metal thickness to ensure long life, accurate  
43 alignment and reliable operation. The volute shall have smooth fluid passages  
44 large enough at all points to pass any size solid which can pass through the  
45 impeller and provide smooth, unobstructed flow.  
46

47 1. For pumps with cup-type impeller: The casing shall be split

1           perpendicular to the shaft with removable suction cover and stuffing box  
2           cover. Machined fits for these parts shall be accurately aligned and  
3           identical so that the casing may be installed for either clockwise or  
4           counterclockwise direction of rotation. The casing shall be arranged so  
5           that the impeller may be removed without disturbing either suction or  
6           discharge piping. The discharge flange shall be ANSI 125# flat face.  
7           All flange bolt holes shall be slotted for ease of assembly and  
8           disassembly. The discharge piping immediately downstream of the  
9           discharge flange shall be drilled and tapped for a gauge connection.

- 10
- 11         2. For pumps with radial-vane impeller: The casing shall consist of a one  
12           piece casting with integral suction and discharge nozzles plus a back  
13           plate with integral wear element. The casing will have cast on feet,  
14           which will fully support the volute, to allow removal of the complete  
15           rotating assembly, without disturbing suction or discharge piping.

- 16
- 17         D. Suction Cover (if required) - The suction cover shall be removable to allow for  
18           access to the impeller. The suction flange shall be 125# flat face with slotted  
19           bolt holes. The suction piping immediately upstream of the suction flange  
20           shall be drilled and tapped for a gauge connection. Special case slots shall be  
21           cast in to retain bolts and to fasten the case to the bearing housing and to the  
22           intake for easy case removal.

- 23
- 24         E. Impeller – The impeller shall be specifically designed and constructed to  
25           maintain hydraulic pumping performance as wear occurs.

26

27         1. Cup Type Impellers:

28

29           a. The impeller shall be of cup design such that the deepest portion  
30           of the vane is not located at the vane tips and the tips are  
31           surrounded by a thick-sectioned rim of at least 1 inch

32

33           b. The hydraulic design shall be such that the length of the impeller  
34           vane increases as wear occurs to the rim, allowing as-new or  
35           better pumping performance throughout the wear cycle of the  
36           impeller

37

38           c. The hydraulic design of the impeller shall preferentially direct  
39           flow to a sacrificial, independently replaceable suction piece.  
40           The suction piece shall be easily accessible and replaceable,  
41           without the need to disassemble any other component of the  
42           pump.

43

44           d. Pump-out vanes on the rear shroud of cup type impellers are not  
45           acceptable.

46

47         2. Radial Vane Impellers

- 1                   a. Impellers shall be fitted with full back pump out vanes to restrict  
2                   flow behind the impellers and shall be keyed to the shaft and  
3                   secured by a shrouded securing bolt and lock washer.  
4  
5                   b. Minimum thickness at the front edge of the impeller vane shall be  
6                    $\frac{1}{2}$ ".  
7

8  
9                  F. Impeller Wear Plate:

- 10                 1. For Cup Type Impellers: A replaceable wear plate shall be mounted in  
11                 the back of the impeller to provide a renewable surface. The wear plate  
12                 shall be designed to direct flow from behind the impeller to the center of  
13                 the volute for maximum protection to the casing.  
14  
15                 2. For Radial Vane Impellers: Pumps with radial vane impellers shall be  
16                 fitted with a rear casing wear plate and integral radial wear element,  
17                 which will protect the area behind and at the periphery of the impeller  
18                 from brunt of abrasive wear. The radial wear element will be of a  
19                 tapered design to promote flow of solid out of the impeller recess.  
20  
21

22                 G. Stuffing Box - The stuffing box shall be designed to accept either packing or a  
23                 mechanical seal.  $\frac{3}{4}$ " NPT drilled and tapped sealing liquid connection and  
24                 drain ports shall be provided. The pumps shall be supplied with John Crane  
25                 Type 3740 split mechanical seal or Chesterton 442.  
26

27                 H. Bearings - Bearings shall be oil bath lubricated. The oil reservoir shall be  
28                 sealed at both ends to prevent entrance of foreign matter. The thrust bearings  
29                 shall consist of three angular contact ball bearings for maximum protection  
30                 from all thrust loads. The bearing housing will be equipped with a pressure  
31                 venting device and oil fill and drain taps. A built-in sight glass shall be  
32                 furnished to check proper oil level. Alternatively, bearings shall be grease  
33                 lubricated with deep groove ball bearing and 2 angular contact bearing. The  
34                 bearings shall be rated for a minimum B-10 life of 100,000 hours.  
35

36                 I. Shaft - The shaft shall be protected throughout the packing area by a  
37                 removable, hardened stainless steel shaft sleeve.  
38

39                 J. Shaft Sleeve - A renewable shaft sleeve shall be provided that extends  
40                 through the stuffing box and under the gland. An O-ring seal shall be provided  
41                 between the sleeve and shaft.  
42

43                 K. Hardware - All machine bolts, nuts and cap screws shall be of the hex head  
44                 type and made of 316 stainless steel. Hardware or parts requiring special  
45                 tools shall not be used.  
46

47                 L. Belts - The pump manufacturer shall furnish and install belts and sheaves to

1           drive the pump at the speed necessary to meet the design conditions.  
2

- 3           M. Baseplate and Pedestal - The pump and motor shall be mounted on a  
4           common base constructed of a minimum 3/8" thick 304 stainless steel, suitably  
5           reinforced to support the full weight of the motor and pump. The pump  
6           manufacturer shall furnish and mount a separate, adjustable motor base  
7           constructed of 304 stainless steel so that the motor can be easily moved for V-  
8           belt tensioning and adjustment.

9

10          2.04 MOTORS

- 11
- 12          A. Pump motors shall be in accordance with Section 16480 and shall be TEFC  
13           type, 3 Phase, 460 Volt with a maximum speed 1,750 RPM and shall conform  
14           to NEMA standards and specifications. The motor supplied with the pump  
15           shall be suitable for constant speed use.
- 16
- 17          B. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and  
18           standards, where applicable.
- 19
- 20          C. Motor manufacturers shall be GE, US Motors, Reliance, or Baldor or WEG.
- 21
- 22          D. The motors shall be sized such that the service factor is not infringed upon  
23           throughout the full speed performance curve of the pumps. At minimum,  
24           motors shall have Class B insulation and a 1.15 service factor. Motors shall  
25           have re-greaseable or oil lube bearings.
- 26
- 27          E. The motors shall be connected to the pump by the drive method specified. All  
28           motors shall be of nationally known manufacture and shall conform to NEMA  
29           standards and specifications

30

31          2.05 CONTROLS

- 32
- 33          A. Furnish and install controls for the grit pumps as described in Section 13640.

34

35          2.06 SHOP PAINTING

- 36
- 37          A. Before exposure to weather and prior to shop painting, all surfaces shall be  
38           thoroughly cleaned and blasted to SSPC-SP10, dry and free from all mill-  
39           scale, rust, grease, dirt and other foreign matter.
- 40
- 41          B. All exposed portions of the pumps and motors shall be shop primed, with rust  
42           inhibitive primer to a minimum of 4-6 mils FDT and one coat of epoxy finish to  
43           4-8 mils DFT. Primer and epoxy must be compatible with field painting as  
44           specified in Division 9.
- 45
- 46          C. All nameplates shall be properly protected during painting.

1           D. Gears, bearing surfaces and other similar surfaces obviously not to be painted  
2           shall be given a heavy shop coat of grease or other suitable rust resistant  
3           coating. This coating shall be maintained as necessary to prevent corrosion  
4           during periods of storage and erection and shall be satisfactory to the  
5           Engineer up to the time of the final acceptance test.

6  
7           E. Stainless steel components shall not be painted.  
8

9        2.07 ROTATION  
10

11          A. The rotation direction shall be marked on the casing and the pump clocked to  
12           the discharge position as shown on the Drawings.  
13

14        PART 3 - EXECUTION  
15

16        3.01 INSTALLATION  
17

18          A. Pumps, drivers and bases shall be precisely leveled and aligned, accurately  
19           anchored into position and grouted by the Contractor. Installation shall be in  
20           strict accordance with the manufacturer's instructions and recognized industry  
21           practices. The Contractor shall furnish and install anchor bolts and the  
22           required lubricants for initial operation. The grades of oil and grease shall be in  
23           accordance with the manufacturer's recommendations. Anchor bolts shall be  
24           304 stainless steel set in accordance with the manufacturer's  
25           recommendations. The existing concrete maintenance pads shall be modified  
26           or removed and replaced as necessary to accommodate the new base plates.  
27

28          B. Pressure gauge assemblies shall be furnished and installed on the suction  
29           side and the discharge side of each pump by the Contractor. The gauge  
30           assemblies shall be per the seal water detail in the drawings. The gauge  
31           calibration ranges shall be as small as is practical so that that full range is  
32           utilized, but safely within maximum conditions.  
33

34          C. The Contractor shall connect the new seal water system to each pump as  
35           shown on the drawings such that seal water is automatically supplied to the  
36           mechanical seal when the pump is started and in operation.  
37

38          D. Prior to initial start-up, the pump manufacturer's representative shall provide  
39           written certification to the Owner that the equipment has been installed, tested  
40           in accordance with the Manufacturer's approved method, and testing  
41           requirements specified herein and shall certify that the equipment is ready for  
42           permanent operation.  
43

44        3.02 FIELD PAINTING  
45

46          A. Field painting is specified under Section 09900 - Painting. The primer and  
47           paint used in the shop shall be products of the same manufacturer as the field

1                   paint to assure compatibility.  
2

3                 B. All nameplates shall be properly protected during painting.  
4

5             3.03 FACTORY TESTS  
6

7                 A. Each motor shall be given a non-witnessed short commercial test to determine  
8                   that the motor is free from electrical and mechanical defects and to provide  
9                   assurance that it meets the specifications. Testing shall be in accordance with  
10                  NEMA standards and shall consist of no load current, locked rotor current,  
11                  winding resistance, high potential and bearing inspection.  
12

13                 B. Each pumping unit, with a calibrated factory test motor, shall be given a  
14                  factory performance test to provide assurance that the unit meets the  
15                  specifications. Tests shall be performed in accordance with Hydraulic Institute  
16                  Standards. Variable speed pumps shall be tested at full speed and all  
17                  specified reduced speeds with a minimum of two reduced speeds. Copies of  
18                  the test reports shall be provided to the Engineer.  
19

20                 C. If any pump tested fails to meet any Specification requirement it shall be  
21                  modified until it meets all Specification requirements. If any pump tested fails  
22                  to meet the efficiency requirements at any of the specified flow or head  
23                  conditions, and all reasonable attempts to correct the inefficiency are  
24                  unsuccessful, the pump(s) shall be replaced with unit(s) that meet the  
25                  specified requirements.  
26

27                 D. Hardness Testing  
28

29                 1. Before final shipment, a Brinell hardness test shall be conducted  
30                  showing compliance to ASTM A532 and shall be submitted for  
31                  approval. Each individual casting shall be Brinell tested at the  
32                  manufacturer's plant to ASTM Method E-10. Each casting shall be  
33                  checked in a minimum of two places, in an area that is representative of  
34                  casting thickness.  
35

36                 2. Results of the Brinell tests shall be certified by a Registered  
37                  Professional Engineer and submitted for approval before final shipment.  
38

39                 3. Hardness tests may be witnessed by a representative of the Owner if  
40                  so desired.  
41

42                 E. Performance Testing  
43

44                 1. A certified shop test shall be performed on each pumping unit in  
45                  accordance with the test code of the Hydraulic Institute Section 14.6,  
46                  Level 2B. Tests shall be sufficient to determine the curves of head,  
47                  input horsepower, and efficiency for capacity from shutoff to runout. A

1                   minimum of six points, including shutoff, shall be taken for each test  
2                   run. At least one point of the six shall be taken as near as possible to  
3                   each specified condition.

- 4
- 5                   2. Results of the performance tests shall be certified by a Registered  
6                   Professional Engineer and submitted for approval before final shipment.

7

8                  3.04 FIELD INSPECTION AND TESTING

- 9
- 10                 A. General - Furnish the services of a factory representative in accordance with  
11                 Specification Section 01820 to inspect the final installation, supervise a test  
12                 run of the equipment, and provide operator training. The factory  
13                 representative shall provide a written certification that the pumps are installed  
14                 in accordance with the manufacturer's recommendations.
- 15
- 16                 B. The final copies of Operation and Maintenance manuals specified in Section  
17                 01730 must be delivered to the Engineer prior to scheduling the instruction  
18                 period with the Owner.
- 19
- 20                 C. Motors - The Contractor shall check all motors for correct clearances and  
21                 alignment, and for correct lubrication in accordance with the manufacturer's  
22                 instructions. The Contractor shall check the direction of rotation of all motors  
23                 and reverse if necessary.
- 24
- 25                 D. Pumps - After the pumps have been completely installed and inspected by a  
26                 factory representative, field tests shall be conducted on each unit in the  
27                 presence of the Engineer to show conformance with the specifications. The  
28                 Contractor shall supply all labor, equipment and incidentals required to  
29                 complete these tests.
- 30
- 31                 E. The factory representative shall include certification of proper installation and  
32                 provide a complete startup report for each pump, documenting the pump  
33                 operating conditions at startup. This report shall be made part of the operation  
34                 and maintenance manual. Pumps that cannot be made to comply with the  
35                 specifications shall be removed and replaced with pumps that satisfy the  
36                 conditions specified.

37

38

39                  END OF SECTION

40

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RECESSED IMPELLER PUMPS  
11320-14

03/22/2019

## SECTION 11321

# STACKED TRAY GRIT CONCENTRATORS

## PART 1 – GENERAL

## 1.01 SCOPE OF WORK

- A. Furnish and install all labor, equipment, materials, tools and incidentals required for a complete and operable installation as necessary to provide complete and operational stacked tray grit concentrators as shown on the drawings and specified herein. The equipment shall be of the latest design and shall be fabricated of materials and in a fashion that will fully perform the functions described below. An approved Manufacturer shall supply the equipment and the Contractor shall install the equipment.
  - B. The grit concentrators shall consist of but not be limited to the following:
    1. Four (4) independent stacked tray grit removal units
    2. Each stacked tray grit concentrator shall consist of three trays and a collector
    3. Each tray shall be 12-foot in diameter.
  - C. The concentrators shall be installed as shown on the plans, as recommended by the manufacturer, and in compliance with all OSHA, local, state, and federal codes and regulations.
  - D. All metal components shall be 316 stainless steel. Metal components that will be fully submerged at all times shall be 304 stainless steel. All components shall be furnished by one manufacturer who shall be responsible for the design, coordination and proper operation of the entire system.
  - E. These Specifications are intended to give a general description of the system required, but do not cover all details; which will vary in accordance with the requirements of the equipment as offered. They are, however, intended to cover the furnishing, shop testing, delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete unit as herein specified, whether specifically mentioned in these Specifications or not. The scope of work includes providing a manufacturer's authorized representative to perform start-up of the equipment, and to instruct the Owner's personnel in the care, operation and maintenance of all equipment provided under this section.

## 1.02 SUBMITTALS

- A. Provide shop drawings and product data as specified in Division 1 for the equipment being furnished. The submittal information shall at minimum include the following:

- 1
- 2
- 3     1. Certified shop drawings showing all details of construction, dimensions  
4                 and anchor bolt requirements.
- 5     2. Descriptive product literature and catalog cuts.
- 6     3. Complete exploded view of parts and materials of construction identified  
7                 and bill of materials lists for the equipment.
- 8     4. Manufacturer's installation drawings and instructions
- 9     5. Operation and Maintenance Data as specified in Division 1.
- 10    6. Manufacturer's Certificate of Compliance certifying compliance with the  
11                 referenced Specification and standards
- 12    7. Certified copies of reports of factory tests specified in this Section and  
13                 required by the referenced standards.
- 14    8. Equipment weights and lifting points.
- 15    9. Recommendations for unloading, handling, short and long term storage,  
16                 including procedures and equipment to be used for removal of the  
17                 existing roof, equipment rigging and equipment placement.
- 18    10. A copy of the manufacturer's warranty.
- 19    11. Installation reference list.

- 20
- 21    B. Furnish Operation and Maintenance Manuals in accordance with Section  
22                 01730. At minimum, the manuals shall include equipment descriptions,  
23                 operating instructions, drawings, exploded views, parts listings, troubleshooting  
24                 techniques, a recommended maintenance schedule and the recommended  
25                 lubricants
- 26
- 27    C. Failure to include all drawings applicable to the equipment specified in this  
28                 section will result in rejection of the entire submittal with no further review.
- 29
- 30    D. A copy of documents proving certification of the Manufacturer's Quality  
31                 Management System according to ISO 9001 and Environmental Protection  
32                 Management System according to ISO 14001.

33

34    **1.03 REFERENCE STANDARDS**

- 35
- 36    A. Codes, Specifications and Standards referred by number or title shall form a  
37                 part of this Specification to the extent required by the references thereto. Latest  
38                 revisions as of the date of bid opening shall apply, unless otherwise shown or  
39                 specified.
- 40
- 41    1. American Iron and Steel Institute (AISI).
- 42    2. American National Standards Institute (ANSI).
- 43    3. American Society for Testing and Materials (ASTM).
- 44    4. American Bearing Manufacturers Association (ABMA).
- 45    5. American Gear Manufacturers Association (AGMA).
- 46    6. National Electrical Manufacturers Association (NEMA).
- 47    7. National Fire Protection Association (NFPA).

1                   8. Underwriters Laboratory (UL).

2

3    **1.04 QUALITY ASSURANCE**

- 4
- 5       A. The grit concentrators shall be Manufacturer's standard product and only  
6       modified as necessary to comply with the drawings, specifications, and  
7       specified service conditions. All equipment covered by these specifications  
8       shall be manufactured and provided by one manufacturer, and shall be  
9       complete including all appurtenances.
- 10
- 11      B. Certificate of Compliance
- 12
- 13       1. The manufacturer shall certify in writing that the stacked tray grit  
14       concentrators shall be manufactured in strict compliance with the  
15       Contract Specifications and that all quality and quality control standards  
16       are met. The manufacturer shall submit the written certification along  
17       with the Shop Drawing submittal.
- 18
- 19      C. The Manufacturer shall completely shop assemble and adjust the equipment  
20       prior to shipment. The Owner shall be notified 30 days in advance of the  
21       expected assembly date and again two weeks prior to when the assembled  
22       components are available for inspection prior to shipment.
- 23
- 24      D. Should equipment which differs from these Specifications be offered and  
25       determined to be the approved equal of that specified, such equipment will be  
26       acceptable only on the basis that any revisions in the design and/or construction  
27       of the structures, piping, appurtenant equipment, electrical work, etc., required  
28       to accommodate such a substitution, shall be made at no additional cost to the  
29       Owner and the Engineer and be as approved by the Engineer.

30

31    **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- 32
- 33      A. The Contractor shall be responsible for the delivery, proper storage and  
34       handling of products in accordance with the manufacturer recommendations.
- 35
- 36      B. The Contractor shall be responsible for promptly removing damaged products  
37       from the job site and replacing damaged products with undamaged products
- 38
- 39      C. Thoroughly clean all equipment and subassemblies of all water, sand, grit, weld  
40       splatter, grease, oil and other foreign materials before preparation for shipment.  
41       Protect all machined surfaces against physical damage and exposure to the  
42       elements during shipment, handling, storage and installation.
- 43
- 44      D. Pack equipment to provide ample protection from damage during shipment,  
45       handling and storage. Cap and seal all openings.

- 1           E. The equipment and material shall be shipped complete except where partial  
2           disassembly is required by transportation regulations or for protection of  
3           components.
- 4
- 5           F. In order to install the concentrators, the Contractor shall remove the existing  
6           double-tee roof over the existing screens in order to provide access for the  
7           equipment. After moving the concentrator equipment into the building, the roof  
8           shall be re-installed/re-constructed. The Contractor shall submit a detailed  
9           procedure and schedule for installing the concentrators that shall minimize the  
10          time that the roof is open. The procedure and schedule shall be subject to  
11          review by the Engineer and approval of the Owner.

12

13        **1.06 MANUFACTURER QUALIFICATIONS**

- 14
- 15        A. The grit concentrators shall be supplied by a single manufacturer in order to  
16           provide standardization for appearance, operation, maintenance, spare parts  
17           and manufacturer's service.
- 18
- 19        B. The manufacturer shall be have been regularly engaged in the production of  
20           equipment for the specified use for a minimum of 10 years. The Contractor and  
21           the manufacturer shall have the responsibility for the proper functioning of the  
22           equipment furnished.
- 23
- 24        C. Subject to compliance with the requirements of the specification, the acceptable  
25           manufactures and products shall be the Head Cell grit concentrator as  
26           manufactured and supplied by Hydro, International or approved equal.

27

28        **1.07 WARRANTY**

- 29
- 30        A. The equipment shall be warranted in accordance with Section 01740. Any  
31           product or part that proves defective in material, workmanship, or design within  
32           twelve (12) months from the date of substantial completion shall be repaired,  
33           modified, or replaced, at no expense to the Owner.

34

35        **1.08 DESIGN CRITERIA**

- 36
- 37        A. The grit concentrator design shall be based on surface area and flow. The  
38           design requirements of the grit concentrator are listed below. All grit removal  
39           components shall be sized for a peak flow rate of 27 mgd.

Number of grit concentrators	4
Number of trays in each grit concentrator	3
Diameter of each tray	12-feet
Peak process flow to each grit concentrator	6.25 mgd
Peak hydraulic flow to each grit concentrator	6.75 mgd
Maximum headloss at 27 mgd with all 4 units in service	8-inches
Fluidizing water requirements for each concentrator	20 gpm @ 50 psi

1  
2   **1.09 PERFORMANCE GUARANTEE**  
3

4       A.     The grit concentrator Manufacturer shall provide a performance guarantee as  
5           outlined below using the design criteria in the previous Section:  
6

- 7           1. Minimum capture efficiency at flows  $\leq$  6.25 mgd with specific gravity 2.65 or  
8           greater shall be 95% by weight for all grit  $\geq$  106 microns.  
9
- 10          2. Minimum capture efficiency at flows  $\geq$  6.25 mgd and  $\leq$  6.75 mgd with specific  
11           gravity 2.65 or greater shall be 95% by weight for all grit  $\geq$  125 microns.  
12

13   **PART 2 – PRODUCTS**  
14

15   **2.01 MATERIALS AND FINISHES**  
16

17       A.     **MATERIALS**  
18

- 19           1. All stainless steel used for the fabrication of the equipment shall conform  
20           to the following standards:  
21
- 22            a. Plate and Sheet: ASTM A 167; ASTM A 240  
23            b. Bar: ASTM A 276; ASTM A 479  
24            c. Tube: ASTM A 312  
25

26       B.     **EXTERIOR SURFACES FINISHES**  
27

- 28           1. All surfaces shall be free of sharp edges, weld spatter and residue. All  
29           welds shall be ground smooth.  
30
- 31           2. All stainless steel surfaces shall be acid washed.  
32

33   **2.02 GRIT CONCENTRATOR**  
34

- 35       A.     The grit concentrator design shall be a stacked tray type with cone shaped trays  
36           and a cone shaped bottom. Grit concentrator shall be placed in a concrete tank  
37           to receive the incoming screened flow. Grit concentrators shall provide  
38           sufficient surface area to remove the specified grit particles from the specified  
39           peak flow and concentrate the grit in a sump at the bottom of the unit. The de-  
40           gritted effluent from the grit concentrators shall discharge over a weir as shown  
41           on the drawings.  
42
- 43       B.     The grit concentrator inlet manifold shall be 316 stainless steel and function as  
44           a flow splitter to direct and equally divide the flow between each of the trays.  
45

1           C. The grit concentrators shall be all-hydraulic, self-activating and shall not require  
2           internal moving parts. The underflow connection shall be as required by the  
3           manufacturer.

4

5           D. Construction

6

- 7           1. The grit concentrator trays shall be 12-feet diameter and constructed with  
8           a minimum  $\frac{1}{4}$  inch thick PE.
- 9
- 10          2. The trays shall fit securely into a 304 stainless steel support frame  
11          provided by the manufacturer.
- 12
- 13          3. All structural members of the stainless steel support frame shall be  $\frac{1}{4}$ "  
14          thick minimum.
- 15
- 16          4. The support frame shall fit inside and be secured to the bottom of a  
17          concrete support structure.
- 18
- 19          5. The concrete support structure shall also serve as a tank and shall  
20          incorporate an effluent overflow weir as shown on the drawings.
- 21
- 22          6. A stainless steel underflow grit collector shall be provided by the  
23          manufacturer for collection and removal of settled solids. The grit  
24          collector shall be installed at the bottom of the concrete tank and at the  
25          tip of the concentrator cone and incorporate flanged underflow and  
26          threaded fluidizing pipe connections.
- 27
- 28          7. All pipe flanges shall conform to ANSI B16.1 bolt patterns.
- 29

30           E. Accessories

31

- 32           1. Each grit concentrator unit shall be supplied with a brass throttling valve,  
33           a brass shut off valve, and a stainless steel and acrylic in-line flow meter  
34           for the fluidizing water system.
- 35

36           **2.03 GRIT PUMP**

37

- 38           A. Grit pump requirements are specified in Section 11320.
- 39

40           **2.04 OPERATION DESCRIPTION**

41

- 42           A. Screened raw wastewater shall be gravity fed into the individual grit  
43           concentrators through a manually controlled gate.
- 44

- 45           B. Grit Slurry Pumps
- 46

- 1           1. Slurry from the grit concentrators shall be pumped continuously or  
2           intermittently at the plant operator's discretion. If intermittent operation  
3           is desired, the system shall be capable of starting and stopping  
4           automatically based on an adjustable time interval.  
5  
6           2. Control and operation of the grit pumps are described in Section 13640  
7           of the Specifications.

8  
9       **2.05 UTILITY REQUIREMENTS**

10      A. **WATER**

- 11  
12       1. Each grit concentrator shall be furnished with a connection at the  
13           collector section for 20 gpm of non-potable water at a minimum 50 psig  
14           for fluidizing the deposited grit.  
15

16  
17       **2.06 MODIFICATIONS TO EXISTING WASTEWATER SCREENS**

- 18  
19       A. The Contractor shall coordinate with the manufacturer (Huber) of the existing  
20           screens to provide a qualified factory technician to re-program and start-up the  
21           screen differential set point based on the higher downstream water level.  
22

23       **PART 3 – EXECUTION**

24  
25       **3.01 INSTALLATION**

- 26  
27       A. Install equipment in accordance with the approved shop drawings and the  
28           manufacturer's installation instructions.  
29  
30       B. Prior to initial start-up, the Manufacturer's representative shall provide written  
31           certification to the Owner that the equipment has been installed, tested in  
32           accordance with the Manufacturer's approved method, and testing  
33           requirements specified herein and shall certify that the equipment is ready for  
34           permanent operation.  
35

36       **3.02 FIELD QUALITY CONTROL**

- 37  
38       A. The Manufacturer shall provide an authorized field technician to perform the  
39           following services.  
40  
41       1. Inspect the completed installation and note any deficiencies and provide  
42           an installation report.  
43  
44       2. Provide equipment startup and provide a startup report.  
45  
46       3. Conduct performance verification testing and provide a performance  
47           verification report along with a certificate of proper installation.

4. Instruct plant personnel in the operation and maintenance of the equipment.
    - a. Training sessions shall include, but not be limited to, a classroom session and a hands-on session. The training shall be provided for a minimum of one (1) day.

### 3.04 STARTUP AND PERFORMANCE TESTING

- A. The Manufacturer shall submit to the Engineer through the Contractor a proven test procedure that can be conducted following startup that will demonstrate the specified performance criteria has been met, including removal efficiencies, solids loading parameters, and solids concentration criteria as previously described.
  - B. The Manufacturer shall conduct the performance testing in accordance with the approved test procedure and provide a report on the results of the testing.
  - C. Should the results of the performance testing indicate that specified performance criteria is not met, the Contractor shall make those modifications necessary to achieve compliance with the criteria and shall re-perform the test at no additional cost to the Owner.

END SECTION

1 SECTION 11323  
2

3 GRIT SEPARATION EQUIPMENT  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish and install grit separation and removal equipment consisting of one (1)  
10      10-inch diameter cyclonic separator and one (1) 12-inch diameter full flared 316  
11      stainless steel screw-type dewatering classifier, including 316 stainless steel  
12      supports for this equipment. The classifier shall be fitted with a grit discharge  
13      chute, which shall connect the classifier and direct grit by gravity to a new  
14      opening in the floor as shown on the drawings.  
15
- 16       B. In addition, the Contractor shall furnish replacement parts and refurbish two  
17      (2) existing cyclonic separators and one (1) existing classifier as described in  
18      Part 3 herein.

19 1.02 DESCRIPTION OF THE SYSTEM  
20

- 21       A. The cyclonic separator (cyclone) shall receive flow from the grit pumps and  
22      separate the inlet feed into two streams: overflow and underflow. The  
23      overflow shall include the majority of the liquid along with lighter organic  
24      materials. The underflow shall consist of concentrated grit slurry that shall  
25      flow by gravity into the grit classifier. The grit classifier shall further remove  
26      organic material and shall separate the grit for discharge into a grit disposal  
27      system.  
28
- 29       B. The cyclone shall be sized for an inlet feed rate of 300 gpm at an inlet  
30      pressure of 10 psi and an underflow of 16 gpm. At those conditions, the  
31      cyclone shall be capable of removing 95 percent of 106 micron grit entering  
32      the inlet feed with a specific gravity of 2.65 or greater.  
33
- 34       C. The classifier shall be capable of the same removal rates for the 16 gpm  
35      entering the classifier from the cyclone underflow. The classifier shall be 316  
36      stainless steel construction and shall be an inclined screw with a pooling  
37      section at the lower end with an adjustable weir.  
38

39 1.03 REFERENCE STANDARDS  
40

- 41       A. Design, manufacturing and assembly of elements of the equipment herein  
42      specified shall be in accordance with the standards of the below listed  
43      organizations. Where reference is made to a standard of any organization, the  
44      version of the standard in effect at the time of bid opening shall apply.  
45

- 1        1. American Iron and Steel Institute (AISI)
- 2        2. American Society of Mechanical Engineers (ASME)
- 3        3. American National Standards Institute (ANSI)
- 4        4. American Society for Testing Materials (ASTM)
- 5        5. American Water Works Association (AWWA)
- 6        6. Hydraulic Institute Standards (HI)
- 7        7. National Electrical Manufacturers Association (NEMA)
- 8        8. Underwriters Laboratories, Inc. (UL)

10      1.04    QUALITY ASSURANCE

- 13       A. All grit separation, classification and removal equipment furnished under this  
14      Section shall be of a design and manufacture that has been used in similar  
15      applications and it shall be demonstrated to the satisfaction of the Owner that  
16      the quality is equal to equipment made by that manufacturer specifically  
17      named herein. Manufacturers shall provide evidence of at least five (5)  
18      installations in which identically sized equipment has provided satisfactory  
19      performance for a minimum of ten (10) years in a similar application. No  
20      consideration will be given to individually sized equipment that has not been  
21      commercially available for at least ten (10) years.
- 23       B. To ensure a consistently high standard of quality, the manufacturer of this  
24      equipment shall comply with the requirements of the ISO 9001 Quality  
25      System, and such compliance shall be verified by an independent certification  
26      agency approved by the International Organization for Standardization.  
27      Documentation shall be submitted for approval showing compliance with this  
28      requirement, and the equipment will not be released for shipment until  
29      approved.
- 31       C. The cyclone, classifier, and appurtenant equipment shall be a complete  
32      system and shall be furnished by, and be the product of, one manufacturer  
33      who is fully experienced, reputable and qualified in the manufacture of the  
34      equipment furnished. The grit concentration and removal equipment shall be  
35      suitable for satisfactory operation with the normal operating levels shown on  
36      the Drawings and described herein. The Contractor shall assume full  
37      responsibility for the satisfactory installation and operation of the entire grit  
38      separation, classification and removal system as specified.
- 40       D. Motors shall be in accordance with NEMA Standards.
- 42       E. The cyclone and classifier and all related equipment shall be designed,  
43      constructed and installed in accordance with the best practices and methods.
- 45       F. Requests for substitution shall include manufacturer's literature for each

1 product giving name, product number, type, descriptive information, and  
2 independent lab test reports showing results to equal the performance criteria  
3 of the equipment specified herein. In addition, a list of five projects shall be  
4 submitted in which identical equipment has been used and rendered  
5 satisfactory service.

- 6
- 7 G. The cyclone and classifier manufacturer shall be fully responsible for the  
8 design, arrangement and operation of all connected rotating components of  
9 the assembled pumping units to ensure that neither harmful nor damaging  
10 vibrations occur at any speed within the specified operating range.
- 11
- 12 H. Should equipment which differs from these Specifications be offered and  
13 determined to be the approved equal of that specified, such equipment will be  
14 acceptable only on the basis that any revisions in the design and/or  
15 construction of the structures, piping, appurtenant equipment, electrical work,  
16 etc., required to accommodate such a substitution, shall be made at no  
17 additional cost to the Owner and be as approved by the Engineer.
- 18
- 19 I. The cyclone and classifier operating parameters, i.e., cyclone feed rate,  
20 pressure and underflow and classifier pool area, weir length, screw speed,  
21 submergence, and slope, shall be designed to avoid build-up of fine grit in the  
22 classifier tank, which would cause grit of the desired size to be lost. Changes  
23 in any of these parameters will not be acceptable unless a detailed submittal  
24 showing calculations and operating data provides evidence that any such  
25 change will not affect the ability of the system to perform as specified.
- 26
- 27 K. The equipment manufacturer shall guarantee the performance of each  
28 component. The cyclones and classifier shall be as manufactured by WEMCO  
29 and be a WEMCLONE Model 1000C and a WEMCO 12-inch Full Flare  
30 Classifier or equal.

31

32 1.05 SUBMITTALS

- 33
- 34 A. Copies of all materials required to establish compliance with the Specifications  
35 shall be submitted. The submittal format shall be in the form of a booklet,  
36 suitably tabbed and divided to cover at least the areas noted below for each  
37 major equipment item. The submittal booklet shall include adequate detail and  
38 sufficient information for the Engineer to determine that all of the equipment  
39 proposed meets the detailed requirements of the Specifications. Incomplete  
40 or partial submittals will not be reviewed. Submittals shall include at least the  
41 following:
- 42
- 43 B. Certified shop and erection drawings showing all important details of  
44 construction, dimensions and anchor bolt locations and in accordance with  
45 provisions of Section 01300.

- 1           C. Descriptive literature, bulletins and/or catalogs of the equipment.
- 2           D. A complete total bill of materials of all equipment (may be furnished with
- 3           Operation and Maintenance manuals specified herein).
- 4           E. A list of the manufacturer's recommended spare parts to be supplied in addition
- 5           to those specified herein. Include gaskets, packing, etc. on the list. List bearings
- 6           by the bearing manufacturer's numbers only. Provide an exploded view showing
- 7           part numbers and materials of construction for all components.
- 8           F. Complete motor data.
- 9           G. Test Reports to be Submitted

10           Data on the characteristics and performance of each component. Data shall  
11           include guaranteed removal rates based on actual shop tests of similar units,  
12           which show that they meet the specified requirements for removal efficiency.

- 13           1. Description of factory testing procedures and equipment.
- 14           2. Copies of all test results, as specified in Parts 2 and 3 of this Section.
- 15           3. Copies of all start-up test reports showing compliance with these  
16           Specifications.
- 17           H. In the event that is impossible to conform to certain details of the  
18           Specifications due to different manufacturing techniques, completely describe  
19           all non-conforming aspects.
- 20           I. Submit manufacturer's installation instructions under provisions of Division 1.
- 21           J. The submittal data shall be prepared, in its entirety, by the equipment  
22           manufacturer. Shop drawings prepared by the manufacturer's sales  
23           representative, fabrication shops, or other than the listed manufacturers will  
24           not be acceptable. No additions or modifications to the manufacturer's  
25           submittal will be accepted, with the sole exception of a cover sheet provided  
26           by the manufacturer's local Representative.

27           **1.06 OPERATION AND MAINTENANCE DATA**

- 28           A. Complete operating and maintenance instructions in accordance with  
29           Specification 01730 shall be furnished for all equipment included under these  
30           Specifications. The maintenance instructions shall include installation  
31           instructions, lubrication instructions, troubleshooting data, full preventative

1 maintenance schedules, complete spare parts lists with ordering information,  
2 and exploded views of all equipment with part numbers identified.  
3

4 **1.07 TOOLS AND SPARE PARTS**

- 5
- 6 A. Furnish one (1) set of all special tools required for normal operation and  
7 maintenance.
- 8
- 9 B. Furnish and package for storage all of the manufacturer's recommended spare  
10 parts to assure normal running and maintenance for a period of two (2) years  
11 assuming all units are in continuous operation.
- 12
- 13 C. Furnish and package for storage a quantity of the recommended lubrication to  
14 meet the manufacturers' recommended lubrication change intervals for 1 year  
15 assuming all units are in continuous operation. Lubricants shall include summer  
16 and winter grades with alternate reference to equal products of other  
17 manufacturers, and shall include all lubricant specification such as viscosity,  
18 AGMA numbers, etc.
- 19
- 20 D. All spare parts shall be furnished in containers clearly identified with indelible  
21 markings as to contents. Each container shall be packed with its contents  
22 protected for prolonged storage.
- 23
- 24 E. In addition to items A-D, the following spare parts shall be supplied with the  
25 equipment:
- 26
- 27 One (1) set of drive belts (or coupling) for the new classifier  
28 One (1) set of drive belts for the existing classifier  
29 One (1) complete set of molded replaceable liners for each of the three  
30 cyclones  
31 Two (2) complete sets of feed box liners as applicable for each  
32 classifier  
33 One (1) set of UHMW or ARS wearing shoes for the new classifier  
34 One (1) set of UHMW or ARS wearing shoes for the existing classifier  
35 One (1) complete lower bearing assembly for the new classifier  
36 One (1) complete lower bearing assembly for the existing classifier  
37 Ten (10) lower bearing rubber toric seals for the existing classifier  
38 One (1) lower bearing seal tool for the new classifier  
39 One (1) lower bearing seal tool for the existing classifier (if different)  
40 Six (6) lower bearing O-Rings for each classifier

41

42 **1.08 DELIVERY, STORAGE AND HANDLING**

- 43
- 44 A. The equipment and material shall be shipped complete except where partial  
45 disassembly is required by transportation regulations or for protection of

1 components.  
2

- 3       B. All parts shall be properly protected so that no damage or deterioration will  
4           occur during a prolonged delay from the time of shipment until installation is  
5           completed and the units and equipment are ready for operation.  
6
- 7       C. All equipment and parts must be properly protected against any damage  
8           during a prolonged period at the site.  
9
- 10      D. Factory assembled parts and components shall not be dismantled for  
11           shipment unless permission is received in writing from the Engineer.  
12
- 13      E. Finished surfaces of all exposed openings shall be protected by wooden  
14           blanks, strongly built and securely bolted thereto.  
15
- 16      F. Finished iron or steel surfaces not painted shall be properly protected to  
17           prevent rust and corrosion.  
18
- 19      G. After hydrostatic or other tests, all entrapped water shall be drained prior to  
20           shipment and proper care shall be taken to protect parts from the entrance of  
21           water during shipment, storage and handling.  
22
- 23      H. Each box or package shall be properly marked to show its net weight in  
24           addition to its contents.  
25

26     1.09 WARRANTY  
27

- 28      A. In order to assure the proper performance and compatibility of all equipment  
29           supplied within the intent of this Specification shall be warranted by the same  
30           supplier.  
31
- 32      B. The equipment shall be warranted to be free from defects in workmanship,  
33           design and materials. If any part of the equipment should fail during the  
34           warranty period, it shall be replaced in the machine(s) and the unit(s) restored  
35           to service at no expense to the Owner.  
36
- 37      C. The manufacturer and the Contractor shall warrant the equipment against  
38           defects in workmanship and materials for a period of one (1) year under  
39           normal use, operation and service, commencing at the date of substantial  
40           completion.  
41

42     1.10 SERVICES OF MANUFACTURER  
43

- 44      A. Provide the services of a qualified factory certified representative for a total of  
45           four (4) days for equipment installation inspection, certification, start-up,

training, and corrective adjustments for the new equipment and existing equipment

## PART 2 - PRODUCTS

## 2.01 CYCLONE

- A. Each cyclone shall consist of a heavy-duty cast iron volute feed chamber with one fabricated stainless steel cylindrical section with 2 conical sections and two apex sections of aluminum to minimize overhung weight.
  - B. Each interior section of the cyclone shall be individually lined and protected from the high velocity grit by a replaceable rubber or neoprene liner. The cyclone shall be constructed so that any section of the liner can be replaced independently.
  - C. A quick disconnect clamp shall be provided between the apex assembly and lower cone section to allow removal of material which may clog the apex, without disconnecting any piping on the cyclone itself.
  - D. The inlet feed to the cyclone shall be 4-inch, the overflow 6-inch, with Victaulic connections furnished by the cyclone manufacturer. Cast iron adaptor pieces will be provided with ANSI 125 lb. flat face flanges. The adaptor piece will be fitted with a cast iron elbow on the overflow so that the flange face will mate up with horizontal piping.
  - E. Each cyclone shall be supplied complete with a 2-inch apex.
  - F. The cyclone vortex finder shall be 4-inch diameter and made of Ni-Hard with a minimum hardness of 500 Brinnell.
  - G. Each cyclone inlet feed shall be tapped for a 1" NPT gauge connection and a diaphragm-protected pressure gauge assembly shall be provided by the cyclone manufacturer.
  - H. The cyclone underflow shall feed into the classifier for washing and dewatering, and be sized so that the proper hydraulic loading is provided to the classifier.
  - I. The cyclone overflow will connect to piping furnished by the Contractor, which must be properly and adequately vented to prevent siphoning.
  - J. The cyclone manufacturer shall supply a fabricated 316 stainless steel mounting plate that connects to the cyclone support structure. The mounting plate shall be minimum 3/8 inch thick and properly oriented such that the cyclone underflow is directed into the classifier at the appropriate location.

1  
2   2.02 CLASSIFIER  
3

- 4           A. Each classifier shall consist of a full flare fabricated 316 stainless steel grit  
5           settling tank with a screw-type grit conveyor.
- 6           B. Each classifier shall have a minimum pool area at maximum water level of 8.3  
7           square feet, a minimum weir length of 28.3 inches, and a screw speed of 12  
8           RPM maximum.
- 9           C. The classifier pool depth and weir height shall be adjustable by removable weir  
10          bars.
- 11          D. The grit settling tank shall be constructed of 1/4" 316 stainless steel plate,  
12          suitably reinforced and mounted on 316 stainless steel supports at a slope of not  
13          more than 3-1/2 inches per foot. The tank shall be designed to provide a settling  
14          compartment where grit separation takes place, with a minimum full water depth  
15          of 150% of the screw diameter.
- 16          E. The weir overflow shall discharge into a launder box equipped with a screwed  
17          pipe nozzle or Victaulic fitting for connection to 2 ½ inch drain connection.
- 18          F. The classifier tank shall be provided with a welded bar, running from the top of  
19          the tank to below the water level to provide a sluice channel, in order to prevent  
20          the buildup of grit opposite the raked material, to aid in drainage.
- 21          G. The manufacturer shall supply and install a valve cock with a 3/8 -inch NPT  
22          nipple for the spiral sluice water. A 115 volt, single phase solenoid valve, which  
23          is compatible with the motor enclosure, shall also be supplied and installed by  
24          the manufacturer for the sluice water line and connected by the electrical  
25          contractor to open when the Classifier motor is activated.
- 26          H. Each classifier tank shall be fitted with a grit discharge opening, located such  
27          that accumulated grit at the top (dry) end of the screw conveyor shall exit the  
28          tank in a vertical down direction through the grit discharge opening.
- 29          I. Each classifier tank shall be fabricated to accept the underflow from the  
30          cyclone. The flow receiving area shall function as a splash guard and be fitted  
31          with a wear protector and a cover allowing inspection of the cyclone apex  
32          without disturbing the cyclone piping or alignment.
- 33          J. The flow receiving area shall be designed and located by the manufacturer to  
34          minimize short-circuiting to the overflow weir of the classifier, and to handle  
35          maximum cyclone underflow discharge.

- 1           K. The classifier manufacturer shall be responsible for ensuring that the flow  
2 receiving area is designed to dissipate energy generated from the cyclone  
3 underflow, to minimize disruption of the classifier pool.
- 4
- 5           L. The grit shall be removed from the bottom of the settling compartment and  
6 discharged by means of a 50% pitch, 12-inch diameter screw-type conveyor.
- 7
- 8           M. The screw shall be made from pre-formed heavy 316 stainless steel flight  
9 sections welded to a 316 stainless steel shaft and fitted with replaceable wearing  
10 shoes.
- 11
- 12          N. The shaft of the conveyor shall be a minimum of 3-inch diameter, Schedule 80  
13 stainless steel pipe, and shall be designed with a maximum stress of 3000 psi,  
14 and a fatigue at 98% reliability of 20 years minimum.
- 15
- 16          O. The screw conveyor shall be rigidly supported at both the upper and lower ends,  
17 so that the screw conveyor is mounted above, and does not contact, the  
18 classifier tank. This mounting shall provide for a clearance between the screw  
19 conveyor and the tank bottom, so that a buildup of sand or grit will provide a bed  
20 for the screw, eliminating tank wear, and providing a drainage area for the  
21 conveyed grit.
- 22
- 23          P. The flights shall be a minimum thickness of 12 gage 316 stainless steel, welded  
24 to the pipe shaft. The flights shall be a minimum height of 4-1/8 inches, as  
25 measured along the face of the flight. The flights shall travel above the structure  
26 and therefore no wear to the walls or the bottom of the structure shall occur.
- 27
- 28          Q. Wearing shoes shall be abrasion resistant and mounted on the flights by  
29 means of hardened flat head screws and nuts. The abrasion resistant wearing  
30 shoes shall be made of UHMW or ARS and shall be a minimum of 10 gage  
31 thickness by 4 inches high.
- 32
- 33          R. The screw shall have the capacity to remove 3/4 ton(s) per hour of grit from the  
34 grit settling tank.
- 35
- 36          S. The upper end of the screw conveyor shall be connected to a direct drive or v-  
37 belt speed reducer drive unit. The drive unit shall be fitted with a stainless steel  
38 guard.
- 39
- 40          T. The lower end of the screw shall be supported by a submerged bearing, housed  
41 in a water-tight cast iron housing, suitable for completely submerged operation in  
42 grit service. The bearing shall be designed to accept radial and axial loads from  
43 the spiral screw conveyor. The cast iron housing shall be provided with stainless  
44 steel cap screws, and fill and drain plugs. The lower bearing shall utilize a  
45 sealed bronze sleeve-type bearing, running completely submerged in oil, and

1 shall require only yearly inspection and oil change. The bearing shall be  
2 provided with permanent stellite seals to prevent the leakage of oil and infiltration  
3 of grit and other foreign particles into the housing. The seal shall be of the self-  
4 compensating type, consisting of two mating hardened steel alloy rings, each  
5 held in place by a rubber toric. The wearing surfaces of the rings shall be  
6 precision lapped to form an initial sealing band of approximately 1/32 inch in  
7 width. The seal shall be designed such that as seal rings wear through normal  
8 operation, the pressure from the rubber torics shall push the rings further against  
9 each other to form a broadened contact band.

- 10
- 11 U. An alternative lower bearing design may be acceptable upon approval by the  
12 owner.
- 13
- 14 V. The complete drive assembly, screw conveyor, and lower bearing assembly  
15 shall be designed so that the screw can be raised for inspection without the  
16 need to disassemble any components, or to drain the classifier tank.
- 17
- 18 X. The complete drive assembly shall be pivoted at the shaft centerline so that the  
19 screw assembly can be raised for periodic inspection.
- 20
- 21 Y. The lower end of the assembly shall be attached to a manually operated lifting  
22 device designed to allow the entire assembly to be lifted above the maximum  
23 water level.
- 24
- 25 Z. The classifier shall be fitted with an OSHA approved cover to enclose the  
26 entire settling tank during normal operation. The cover shall be designed to  
27 prevent objects from coming into contact with moving parts while the classifier  
28 is in operation. The cover shall be provided in two pieces and clamped to the  
29 classifier tank, to allow for removal, regular maintenance, and inspection. The  
30 clamps shall be designed so that they cannot be removed without the use of  
31 tools. The cover shall be made of the same material as tank with stainless  
32 steel expanded metal viewing windows to allow for inspection of the settling  
33 pool and upper portion of the spiral.
- 34
- 35 AA. All submerged metal pieces shall be 316 stainless steel or other non-corrosive  
36 metal.
- 37
- 38 AB. Stainless steel parts shall receive a cosmetic blast with to remove all weld stain  
39 markings and give the surface a uniform appearance. Stainless steel parts will  
40 not be coated.
- 41
- 42 AC. The drive assembly shall be fitted with mechanical type torque limiter affixed to  
43 the drive or an over-current device connected to the motor circuit. Either device  
44 shall stop the screw from turning before any mechanical or electrical damage  
45 occurs.

- 1           1. The torque limiter shall be adjustable and shall be set to disengage when  
2           the torque on the spiral exceeds the operating limit of the drive.  
3  
4           2. Upon disengaging, the torque limiter will open the motor control circuit  
5           and disconnect power to the motor.  
6  
7           AD. Classifier safety stop switches: Each classifier, one new and one existing, shall  
8           be fitted with an emergency stop system.  
9  
10          1. The tank will be fitted with a vinyl coated wire rope running the periphery  
11         of the classifier tank and connected to the safety stop switch.  
12  
13          2. When the wire rope is pulled, it will actuate a safety stop switch that will  
14         open the motor control circuit and disconnect power to the motor.  
15  
16          3. The safety stop switch shall be fitted with a raised flag for positive  
17         identification of when the switch has been actuated. The switch shall be  
18         reset by raising the flag arms to their original position.  
19

20           **2.03 CONTROLS**

- 21  
22          A. Furnish and install controls for the grit separation equipment as described in  
23         Section 13640.  
24  
25          B. Furnish a zero-speed switch mounted to the classifier input shaft of each  
26         classifier, one new and one existing, to provide an output signal the PLC.  
27

28           **PART 3 - EXECUTION**

29           **3.01 INSTALLATION**

- 30  
31          A. Install the new grit equipment in accordance with the manufacturer's  
32         instructions and as shown on the drawings.  
33  
34          B. Lubricate the equipment before start-up.  
35

36           **3.02 FIELD INSPECTION AND TESTING**

- 37  
38          A. General - Furnish the services of a factory representative in accordance with  
39         Specification Section 01820 to inspect the final installation, supervise a test  
40         run of the equipment, and provide operator training. The factory  
41         representative shall provide a written certification that the grit separation  
42         equipment is installed in accordance with the manufacturer's  
43  
44  
45

- 1 recommendations.
- 2
- 3     B. The final copies of Operation and Maintenance manuals specified in Section
- 4         01730 must be delivered to the Engineer prior to scheduling the instruction
- 5         period with the Owner.
- 6
- 7     C. Motors - The Contractor shall check all motors for correct clearances and
- 8         alignment, and for correct lubrication in accordance with the manufacturer's
- 9         instructions. The Contractor shall check the direction of rotation of all motors
- 10        and reverse if necessary.
- 11
- 12     D. After the grit separation equipment has been completely installed and
- 13         inspected by a factory representative, startup testing shall be conducted by
- 14         the Contractor in accordance with specification 01625. The Contractor shall
- 15         supply all labor, equipment and incidentals required to complete the startup
- 16         activities. The factory representative shall provide a complete startup report
- 17         documenting the operating conditions at startup. This report shall be made
- 18         part of the operation and maintenance manual. Equipment that cannot be
- 19         made to comply with the specifications shall be removed and replaced with
- 20         equipment that satisfy the conditions specified.

21

22     **3.03 REHABILITATE EXISTING CYLONES**

- 23
- 24     A. Rehabilitate each existing cyclone by furnishing and replacing all wear items,
- 25         seals, and gaskets including but not limited to a complete set of liners.
- 26
- 27     B. Replacement items shall be sourced from the original equipment manufacturer
- 28         to ensure proper fit and function.
- 29
- 30     C. Clean and paint the exterior in accordance with Section 09900, including all
- 31         carbon steel supports.
- 32
- 33     D. One existing cyclone shall remain in service at all times.

34

35     **3.04 REHABILITATE THE EXISTING GRIT CLASSIFIER**

- 36
- 37     A. Rehabilitate the existing classifier by furnishing and replacing the upper
- 38         bearing, the lower bearing, the screw, the wearing shoes and hardware
- 39         mounted to the screw, all seals, gaskets, zero speed switch, water solenoid,
- 40         emergency stop switch, and all other typical wear items. Furnish all new
- 41         conduit and wiring required for retrofitting the existing grit classifier with an e-
- 42         stop and a zero-speed switch as are specified or shown on the drawings for
- 43         the new classifier.
- 44
- 45     B. Replacement items shall be sourced from the original equipment manufacturer

to ensure proper fit and function.

- C. The existing classifier shall be rehabilitated after the new classifier has been installed and placed in service.

END OF SECTION

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1 SECTION 11324  
2

3 MACERATOR  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor, materials, equipment and incidentals required and install,  
10      place in operation, and field test one (1) horizontal in-line type sludge macerator  
11      designed specifically for primary thickened sludge applications in municipal  
12      wastewater treatment plants complete with motor, base and controls at the  
13      location shown on the drawings and as hereinafter specified to perform the  
14      intended function and achieve a fully integrated and operational system.  
15
- 16       B. These Specifications are intended to give a general description of what is  
17      required, but do not cover all details, which will vary in accordance with the  
18      requirements of the equipment application. It is, however, intended to cover the  
19      furnishing, the shop testing, the delivery and complete installation and field  
20      testing, of all materials, equipment and all appurtenances for the complete  
21      pumping system as herein specified, whether specifically mentioned in these  
22      Specifications or not.

23 1.02 DESCRIPTION OF THE SYSTEM  
24

- 25       A. Sizing and Performance Criteria: Provide macerator with the following design  
26      criteria:

29           Number of Macerators .....	1
30           Maximum Primary Sludge Flow Rate (gpm) .....	60
31           Maximum Line Pressure (psi) .....	60
32           Primary Sludge Pipe Size .....	6-inch flanged
33           Thickened Primary Sludge Solids Content .....	4% - 6%
34           Motor .....	460-volt Constant Speed with Controls
35           Minimum Peak Shaft Torque .....	4,700 lb-in / hp
36           Minimum Peak Force at Cutter Tip .....	2,000 lb / hp

37 1.03 REFERENCE STANDARDS  
38

- 39       A. Design, manufacturing and assembly of elements of the equipment herein  
40      specified shall be in accordance with the standards of the below listed  
41      organizations. Where reference is made to a standard of any organization, the  
42      version of the standard in effect at the time of bid opening shall apply.

- 43       1. American Iron and Steel Institute (AISI)  
44       2. American Society of Mechanical Engineers (ASME)

3. American National Standards Institute (ANSI)
4. American Society for Testing Materials (ASTM)
5. American Water Works Association (AWWA)
6. Hydraulic Institute Standards
7. National Electrical Manufacturers Association (NEMA)
8. Underwriters Laboratories, Inc. (UL)
9. Society of Automotive Engineers (SAE)
10. National Electric Manufacturers' Association (NEMA)
11. National Electric Code (NEC)
12. International Electro-technical Commission (IEC)

## 1.04 QUALITY ASSURANCE

- A. The Macerator shall be in accordance with applicable requirements of the ISO 9001 Quality System, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.
- B. Motors and Controls shall be in accordance with NEMA Standards and shall be UL certified.
- C. The equipment furnished under this Section shall be supplied by a single Manufacturer, who is fully experienced, reputable and qualified in the manufacture of the equipment furnished. The equipment shall be suitable for operation with the normal operating levels shown on the Drawings. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire system as specified.
- D. The macerator and all related equipment shall be designed, constructed and installed in accordance with the best practices and methods.
- E. Requests for substitution shall include manufacturer's literature for each product giving name, product number, type, descriptive information, and independent lab test reports showing results to equal the performance criteria of the equipment specified herein. In addition, a list of five projects shall be submitted in which identical equipment has been used and rendered satisfactory service.
- F. The macerator manufacturer shall be fully responsible for the design, arrangement and operation of all connected rotating components of the assembled units to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- G. Should equipment which differs from these Specifications be offered and determined to be the approved equal of that specified, such equipment will be acceptable only on the basis that any revisions in the design and/or construction

1 of the structures, piping, appurtenant equipment, electrical work, etc., required  
2 to accommodate such a substitution, shall be made at no additional cost to the  
3 Owner and be as approved by the Engineer.

- 4
- 5 H. The macerator manufacturer and supplier shall guarantee the performance of  
6 each unit. The macerator shall be a Muffin Monster In-Line Electric Grinder type  
7 as manufactured by JWC Environmental, similar by Franklin Miller, or equal.

8

9 1.05 SUBMITTALS

- 10
- 11 A. Submit to the Engineer for review in accordance with Section 01340 and 01730  
12 complete installation drawings, shop drawings, working drawings, O&M Manuals  
13 and product data for all materials and equipment furnished under this Section.  
14 Submittals shall include at least the following:

- 15
- 16 1. Certified shop drawings, erection drawings and installation instructions  
17 showing all important details of construction, dimensions and anchor bolt  
18 locations.
- 19
- 20 2. Descriptive literature, bulletins and/or catalogs of the equipment.
- 21
- 22 3. Data on the characteristics and performance of each unit. Data shall  
23 include guaranteed performance, based on actual shop tests of similar  
24 units, which show that they meet the specified.
- 25
- 26 4. Complete master wiring diagrams and control schematics, including  
27 coordination with other electrical control devices such as the pump  
28 control system and suitable outline drawings shall be furnished for  
29 approval before proceeding with manufacture. Provide suitable outline  
30 drawings showing such details as are necessary to locate conduit stub-  
31 ups and field wiring. Due to the complexity of the system, it is imperative  
32 the above drawings be clear and carefully prepared to facilitate  
33 interconnections with other equipment. Standard pre-printed sheets or  
34 drawings simply marked to indicate applicability to this contract will not  
35 be acceptable.
- 36
- 37 5. Refer to Specification 13640 Control Strategy for specific information on  
38 how this unit is controlled.
- 39
- 40 6. A complete total bill of materials of all equipment (may be furnished with  
41 Operation and Maintenance manuals specified herein).
- 42
- 43 7. A list of the manufacturers recommended spare parts to be supplied in  
44 addition to those specified, with the manufacturer's current price for each  
45 item. Include gaskets, packing, etc. on the list. List bearings by the  
46 bearing manufacturer's numbers only.
- 47

8. Complete motor data.
  9. The weight of the entire assembly including the motor.
- B. Test Reports to be submitted
1. Description of factory testing procedures and equipment.
  2. Copies of all test results, as specified in Parts 2 and 3 of this Section.
  3. Copies of all start-up test reports which show compliance with these Specifications.
- C. The submittal data shall be prepared, in its entirety, by the equipment manufacturer. Shop drawings prepared by the manufacturer's sales representative, fabrication shops, or other than the listed manufacturers will not be acceptable. No additions or modifications to the manufacturer's submittal will be accepted, with the sole exception of a cover sheet provided by the manufacturer's local Representative and the Contractor.
- D. The operating and maintenance information shall include lubrication instructions, troubleshooting data, full preventative maintenance schedules, complete spare parts lists with ordering information, and exploded views of all components and equipment with part numbers and the materials of construction identified.
- E. In the event that is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all non-conforming aspects.
- 1.06 TOOLS AND SPARE PARTS
- A. Furnish one (1) set of all special tools required for normal operation and maintenance as recommended by the manufacturer.
  - B. Furnish and package for storage of the manufacturer's recommended spare parts to assure normal running and maintenance for a period of two (2) years assuming all units are in continuous operation.
  - C. Furnish and package for storage a quantity of the recommended lubrication to meet the manufacturers' recommended lubrication change intervals for 1 year assuming all units are in continuous operation. Lubricants shall include summer and winter grades with alternate reference to equal products of other manufacturers, and shall include all lubricant specification such as viscosity, AGMA numbers, etc.
  - E. All spare parts shall be furnished in containers clearly identified with indelible

1 markings as to contents. Each container shall be packed with its contents  
2 protected for prolonged storage.

3

4 F. Furnish one complete sludge macerator cartridge to be used as a spare.

5

6 1.07 PRODUCT HANDLING

7

8 A. All parts shall be properly protected so that no damage or deterioration will occur  
9 during a prolonged delay from the time of shipment until installation is completed  
10 and the units and equipment are ready for operation.

11

12 B. All equipment and parts must be properly protected against any damage during  
13 a prolonged period at the site.

14

15 C. Factory assembled parts and components shall not be dismantled for shipment  
16 unless permission is received in writing from the Engineer.

17

18 D. Finished surfaces of all exposed openings shall be protected by wooden blanks,  
19 strongly built and securely bolted thereto.

20

21 E. Finished iron or steel surfaces not painted shall be properly protected to prevent  
22 rust and corrosion.

23

24 F. After all factory testing or other tests, all entrapped water shall be drained prior  
25 to shipment and proper care shall be taken to protect parts from the entrance of  
26 water during shipment, storage and handling.

27

28 G. Each box or package shall be properly marked to show its net weight in addition  
29 to its contents.

30

31 1.08 WARRANTY

32

33 A. In order to assure proper performance and compatibility, all equipment supplied  
34 within this Specification shall be warranted by the same supplier.

35

36 B. The equipment shall be warranted to be free from defects in workmanship,  
37 design and materials. If any part of the equipment should fail during the  
38 warranty period, it shall be replaced in the machine(s) and the unit(s) restored  
39 to service at no expense to the Owner.

40

41 C. The unit manufacturer and the Contractor shall warrant the macerator against  
42 defects in workmanship and materials in accordance with Section 01740 of  
43 these Specifications.

44

45 1.09 MANUFACTURER'S REPRESENTATIVE

46

47 A. Provide the services of a qualified factory certified representative for a minimum

1                   of (2) days for equipment installation inspection, certification, start-up, training,  
2                   and corrective adjustments.

3

#### 4     1.10 PERFORMANCE TESTING

5

6                   A.     Factory and performance testing shall be conducted by the Contractor on the  
7                   macerator as described in Part 3 of this specification.

8

#### 9     PART 2 - PRODUCTS

10

11    2.01 GENERAL

12                   A.     All equipment for the unit, including the motor and base, shall be furnished as a  
13                   complete unit by the supplier.

14                   B.     The macerator and motor shall be rated for continuous duty and shall be  
15                   capable of processing the specified flow range without cavitation or excessive  
16                   vibration. The macerator and drive shall not infringe upon the motor service  
17                   factor.

18                   D.     The specified macerator shall be complete including, proper alignment and  
19                   balancing of the individual units. All parts shall be so designed and proportioned  
20                   as to have liberal strength, stability and stiffness and to be especially adapted  
21                   for the service to be performed. Ample room for inspection, repairs and  
22                   adjustment shall be provided.

23                   E.     Corrosion resistant nameplate with the name of the manufacturer and the serial  
24                   number shall be attached to each macerator.

25                   F.     Corrosion resistant nameplate with the name of the manufacturer, serial  
26                   number, horsepower, speed, voltage and amperes shall be attached to each  
27                   motor.

28    2.02 MATERIALS

<u>Part:</u>	<u>Material:</u>	<u>Designation:</u>
Housing and Covers	Ductile Iron	ASTM A536-84
Cutters and Spaces	Alloy Steel	AISI 4130
Shafts	Alloy Steel	ASTM A4140
Intermediate Shaft Supports	Stainless Steel	ASTM A743, AISI 17-4
Intermediate Shaft Bearings	Bronze	SAE 660

2.03 MACERATOR CONSTRUCTION

44                   A.     The Macerator shall reduce or shred sludge solids and all material captured by  
45                   the moving belt filters for protection of downstream equipment. The Macerator

1 shall be two shafted design consisting of individual cutters and spacers with a  
2 single piece main body housing consisting of pipe flanges and inspection ports.  
3 The cutter cartridge shall be removable from the main body without removing  
4 the main body from the pipeline. The Macerator shall have a motor and a speed  
5 reducer that drives the cutter shafts.

6

7     B. Cutters and Spacers

- 8
- 9       a. Cutting stack shall be a nominal height of 12 inches (203.2mm).
- 10
- 11       b. Cutter shall be an individual disk constructed of AISI 4130 alloy steel surface  
12           ground to thickness of .215-inches +.000/-001.
- 13
- 14       c. Cutters shall be heat treated to produce a hardness of 45-50 Rockwell C.
- 15
- 16       d. Cutters shall have 13 cam shaped teeth. Tooth height shall not be greater  
17           than ½-inch (13 mm) above the root diameter of the cutter. OD shall be 4.71-  
18           inches (120 mm).
- 19
- 20       e. Spacers shall be an individual disk constructed of AISI 4130 alloy steel  
21           surface ground to a thickness of .223-inches +.001/-000.
- 22
- 23       f. Spacers shall have a hardness of 34-38 Rockwell C.
- 24
- 25       g. Spacers shall have a smooth outside diameter with no tooth profiles.

26

27     C. Shafts

- 28
- 29       a. Shafts shall be ASTM 4140 alloy steel with a minimum tensile strength of  
30           149,000 PSI (1,027 kPA).
- 31
- 32       b. Shafts shall measure nominal 2-inches (51 mm) across flats of hex.
- 33
- 34       c. Shafts shall be hardened to 38-42 Rockwell C.

35

36     D. Intermediate Shaft Supports

- 37
- 38       a. Intermediate shaft supports shall be ASTM A743 stainless steel, AISI 17-4  
39           stainless steel and SAE 660 bearing bronze.
- 40
- 41       b. Shaft supports shall be lubricated with high temperature marine grade  
42           grease at the factory.
- 43
- 44       c. Intermediate shaft supports shall provide additional support to the shafts  
45           during severe grinding demands.
- 46
- 47       d. Intermediate shaft supports shall be provided only for cutter stacks of 24

1                   inches (610 mm).

2

3       E. Seal Cartridges

- 4
- 5           a. Seal cartridges shall be rated to a maximum of 90 PSI (620 kPA).
- 6
- 7           b. Seal cartridges shall not require flushing.
- 8
- 9           c. Dynamic and rotating seal faces shall be tungsten carbide with 6% nickel
- 10           binder.
- 11
- 12           d. O-rings shall be Buna-N (Nitrile).
- 13
- 14           e. Radial and axial loads shall be borne by sealed, oversized, deep-groove ball
- 15           bearings.

16

17       F. Housings and Covers

- 18
- 19           a. Main body, gear, base, and end housings shall be ASTM A536-84 ductile
- 20           iron.
- 21
- 22           b. Top cover and inspection port covers shall be ASTM A536-84 ductile iron.
- 23
- 24           c. Main body housing shall have inlet and outlet flanges with bolt pattern
- 25           machined to 8-inch pipe flange size.
- 26
- 27           d. Main body housing shall have integral side wall deflectors to direct solids
- 28           into cutters.
- 29
- 30           e. Inspection port covers shall be on both inlet and outlet sides of main body
- 31           housing.
- 32
- 33           f. End housing shall have integral bushing deflectors to guide solids away from
- 34           seal cartridges.

35

36       G. Speed Reducer

- 37
- 38           a. Reducer shall be manufactured by Sumitomo Machinery Corporation of
- 39           America.
- 40
- 41           b. Reducer shall be internal planetary mechanism with trochoidal curved tooth
- 42           profile.
- 43
- 44           c. Reducer shall be a vertically mounted with 29:1 single reduction.
- 45
- 46           d. Reducer shall be grease lubricated.
- 47

1    2.04 CONTROLS

- 2
- 3       A. See Specification 13630 and 13640 for the Control Strategy, the Controls, and  
4                      the Control Panel requirement for this equipment.

5

6    2.05 SHOP PAINTING

- 7
- 8       A. Before exposure to weather and prior to shop painting, all surfaces shall be  
9                      thoroughly cleaned and blasted to SSPC-SP10, dry and free from all mill-scale,  
10                     rust, grease, dirt and other foreign matter.
- 11
- 12       B. All exposed portions of the casing and motor shall be shop primed, with rust  
13                     inhibitive primer to a minimum of 4-6 mils FDT and one coat of epoxy finish to  
14                     4-8 mils DFT. Primer and epoxy must be compatible with field painting as  
15                     specified in Division 9.
- 16
- 17       C. All nameplates shall be properly protected during painting.
- 18
- 19       D. Gears, bearing surfaces and other similar surfaces obviously not to be painted  
20                     shall be given a heavy shop coat of grease or other suitable rust resistant  
21                     coating. This coating shall be maintained as necessary to prevent corrosion  
22                     during periods of storage and erection and shall be satisfactory to the Engineer  
23                     up to the time of the final acceptance test.
- 24
- 25       E. Stainless steel components shall not be painted.

26

27    2.06 ROTATION

- 28
- 29       A. The rotation direction shall be permanently marked on the casing and the unit  
30                     clocked to the discharge position as shown on the Drawings.

31

32    PART 3 - EXECUTION

33

34    3.01 INSTALLATION

- 35
- 36       A. Drivers and bases shall be precisely leveled and aligned, accurately anchored  
37                     into position and grouted by the Contractor. Installation shall be in strict  
38                     accordance with the manufacturer's instructions and recognized industry  
39                     practices. The Contractor shall furnish and install anchor bolts and the required  
40                     lubricants for initial operation. The grades of oil and grease shall be in  
41                     accordance with the manufacturer's recommendations. Anchor bolts shall be  
42                     304 stainless steel installed in accordance with the manufacture's  
43                     recommendations.
- 44
- 45       B. The Contractor shall furnish and install pressure gauge assemblies on the  
46                     suction side and the discharge side of each unit. The gauge assemblies shall  
47                     be per the seal water detail in the drawings. The gauge calibration ranges shall

1           be as small as is practical so that that full range is utilized, but safely within  
2           maximum conditions.

- 3
- 4       C. The Contractor shall connect the controls such that in the automatic mode, the  
5           macerator is in operation when any of the moving belt filter sludge pumps is in  
6           operation.
- 7
- 8       D. Prior to initial start-up, the pump manufacturer's representative shall provide  
9           written certification to the Owner that the equipment has been installed, tested  
10          in accordance with the Manufacturer's approved method, and testing  
11          requirements specified herein and shall certify that the equipment is ready for  
12          permanent operation.
- 13

14      3.02 FIELD PAINTING

- 15
- 16       A. Field painting is specified under Section 09900 - Painting. The primer and paint  
17           used in the shop shall be products of the same manufacturer as the field paint  
18           to assure compatibility.
- 19
- 20       B. All nameplates shall be properly protected during painting.
- 21

22      3.03 FACTORY TESTS

- 23
- 24       A. Each motor shall be given a non-witnessed short commercial test to determine  
25           that the motor is free from electrical and mechanical defects and to provide  
26           assurance that it meets the specifications. Testing shall be in accordance with  
27           NEMA standards and shall consist of no load current, locked rotor current,  
28           winding resistance, high potential and bearing inspection.
- 29
- 30       B. If any unit tested fails to meet any Specification requirement it shall be modified  
31           until it meets all Specification requirements.
- 32
- 33       C. Hardness Testing
- 34
- 35        1. Before final shipment, a Rockwell hardness test shall be conducted  
36           showing compliance to the specifications. Each individual and applicable  
37           component shall be tested at the manufacturer's plant to ASTM Method  
38           E-18. Each casting shall be checked in a minimum of two places, in an  
39           area that is representative of casting thickness.
- 40
- 41        2. Results of the testing shall be certified by a Registered Professional  
42           Engineer and submitted for approval before final shipment.
- 43
- 44        3. Hardness tests may be witnessed by a representative of the Owner if so  
45           desired.
- 46

47      3.04 FIELD INSPECTION AND TESTING

- A. General - Furnish the services of a factory representative in accordance with Specification Section 01820 to inspect the final installation, supervise a test run of the equipment, and provide operator training. The factory representative shall provide a written certification that the macerator is installed in accordance with the manufacturer's recommendations.
  - B. The final copies of Operation and Maintenance manuals specified in Section 01730 must be delivered to the Engineer prior to scheduling the instruction period with the Owner.
  - C. Motors - The Contractor shall check all motors for correct clearances and alignment, and for correct lubrication in accordance with the manufacturer's instructions. The Contractor shall check the direction of rotation of all motors and reverse if necessary.
  - D. After the Macerator has been completely installed and inspected by a factory representative, field tests shall be conducted on each unit in the presence of the Engineer to show conformance with the specifications. The Contractor shall supply all labor, equipment and incidentals required to complete these tests.
  - E. The factory representative shall include certification of proper installation and provide a complete startup report for each unit, documenting the operating conditions at startup. This report shall be made part of the operation and maintenance manual. Macerators that cannot be made to comply with the specifications shall be removed and replaced with units that satisfy the conditions specified.

END OF SECTION

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2

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SECTION 11335

# FIBERGLASS REINFORCED PLASTIC TANK

## PART 1 - GENERAL

## 1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required and shall install, complete and ready for operation, and field test one (1) vertical fiberglass reinforced plastic (FRP) tank as shown on the Contract Drawings and specified herein.

## 1.02 DESCRIPTION OF SYSTEMS

- A. The tank shall serve as a collection chamber for screened and degritted wastewater pumped from the equalization tank and simultaneously allow this water to flow by gravity to downstream treatment processes through a piping connection at the bottom of the tank. Under normal conditions, the hydraulic grade line in the tank will be at a constant depth of 6- to 7-feet, due to a weir located downstream of the tank, however, the tank shall be designed to hold water to its full depth. The pitched bottom, open top FRP tank shall be nominal 48-inch diameter, 24-feet tall, and furnished complete with all reinforcement, flanged nozzles where shown on the drawings, gaskets, lifting lugs, supporting legs and anchor bolts to properly anchor the tank to a concrete pad.

## 1.03 QUALIFICATIONS

- A. All of the equipment specified under this Section shall be furnished by a single manufacturer, fully experienced, reputable and qualified in the manufacture of the equipment furnished. The fiberglass tank and all related equipment shall be designed, constructed and installed in accordance with the best practices and methods. All equipment furnished under these Specifications shall be new and unused and shall be the standard product of a manufacturer having a successful record of manufacturing and servicing the equipment specified herein for a minimum of five (5) years.
  - B. Should equipment that differs from these Specifications be offered and determined to be the approved equal of that specified, such equipment will be acceptable only on the basis that any revisions in the design and/or construction of the structures, piping, appurtenant equipment, electrical work, etc., required to accommodate such a substitution, shall be made at no additional cost to the Owner and be as approved by the Engineer.
  - C. The tank fabricator shall hold a current ASME RTP-1 "Certificate of Authorization" and the tank shall bear an ASME RTP-1 label.

1      1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- 2
- 3      A.     Design, manufacturing and assembly of elements of the equipment herein specified  
4        shall be in accordance with the standards listed below, except as otherwise shown  
5        or specified. Where reference is made to a standard of one of these, or other  
6        organizations the version of the standard in effect at the time of bid opening shall  
7        apply.
- 8
- 9            1.     AWWA D120-09 Thermosetting Fiberglass –Reinforced Plastic Tanks
- 10
- 11            2.     ASME RTP-1 Reinforced Thermoset Plastic Corrosion Resistant Equipment
- 12
- 13            3.     ASTM D2563 Classifying Visual Defects in Glass Reinforced Plastic  
14            Laminate Parts
- 15
- 16            4.     ASTM D2583 Test Method for Indentation Hardness of Rigid plastics by  
17            Means of a Barcol Impresser
- 18
- 19            5.     ASTM D3299 Filament-Wound Glass-Fiber-Reinforced Thermoset Resin  
20            Chemical-Resistant Tanks
- 21

22      1.05 SUBMITTALS

- 23
- 24      A.     Copies of all materials required to establish compliance with the specifications shall  
25        be submitted in accordance with the provisions of Sections 01300 and 01340.  
26        Submittals shall include at least the following:
- 27
- 28            1.     Certified shop and erection drawings showing all important details of  
29            construction, dimensions and anchor bolt locations.
- 30
- 31            2.     Descriptive literature, bulletins and/or catalogs of the equipment.
- 32
- 33            3.     A complete, total bill of materials for all equipment with the O&M manual.
- 34
- 35            4.     A list of the manufacturer's recommended spare parts with the  
36            manufacturer's current price for each item.
- 37
- 38            5.     Certifications as required by ASME RTP-1.
- 39

40      1.06 OPERATING AND MAINTENANCE MANUALS

- 41
- 42      A.     Complete copies of the Operating and Maintenance manuals shall be furnished in  
43        accordance with Specification 01730. The manuals shall be prepared specifically  
44        for this installation and shall include all required cuts, drawings, equipment lists,  
45        descriptions, etc. that are required to instruct operating and maintenance personnel  
46        unfamiliar with such equipment.
- 47

1    1.07 TOOLS AND SPARE PARTS

- 2
- 3    A.    Furnish one (1) set of all special tools required for normal operation and  
4                 maintenance.
- 5
- 6    B.    Furnish one (1) set of manufacturer's recommended spare parts. All spare parts  
7                 shall be properly protected for prolonged periods of storage and packed in suitable  
8                 containers that are clearly identified with indelible markings as to contents.
- 9

10    1.08 WARRANTY

- 11
- 12    A.    The equipment manufacturer shall provide a twelve (12) month warranty  
13                 commencing at the time of substantial completion and acceptance by the Owner as  
14                 outlined in Specification 01740. The equipment manufacturer shall guarantee that  
15                 the equipment furnished is suitable for the purpose intended and free from defects  
16                 of design, material and workmanship. In the event the equipment fails to perform as  
17                 specified, the equipment manufacturer shall promptly repair or replace the defective  
18                 equipment without any cost to the Owner (including handling and shipment costs).
- 19

20    PART 2 - PRODUCTS

21    2.01 GENERAL

- 22
- 23    A.    These Specifications are intended to give a general description of what is required,  
24                 but do not cover details that may vary in accordance with the exact requirements of  
25                 the equipment as offered. They are, however, intended to cover the furnishing,  
26                 delivery, installation and field testing of all materials, equipment and apparatus, as  
27                 required. Any additional auxiliary equipment necessary for the proper operation of  
28                 the proposed installation not mentioned in these Specifications, or shown on the  
29                 Drawings shall be furnished and installed.
- 30
- 31    B.    The material covered by these Specifications is intended to be standard equipment  
32                 of proven ability and as manufactured by reputable concerns having experience in  
33                 the production of such equipment. The equipment furnished shall be designed,  
34                 constructed and installed in accordance with best practice and methods and shall  
35                 operate satisfactorily when installed as shown on the Drawings.
- 36
- 37    C.    Stainless steel nameplates giving the name of the manufacturer, model number,  
38                 serial number, capacity, and any other pertinent data shall be attached to each tank.
- 39
- 40    D.    All hardware such as bolts, nuts and washers shall be AISI 316 stainless steel  
41                 furnished in accordance with ASTM A193/A194.
- 42
- 43    E.    All tanks shall be designed and furnished with all mounting hardware required to  
44                 securely fasten the tank to a concrete pad and shall withstand 130 mph sustained  
45                 winds.
- 46
- 47

F. The fiberglass tanks shall be as manufactured by Augusta Fiberglass, Design Tanks, or approved equal.

## 2.02 TANK SHELL AND JOINTS

- A. The tank shall be manufactured using the filament wound or contact molded process with the following physical properties as a minimum:

Min. Tensile Strength (psi)	29,000
Min. Flexural Strength (psi)	30,000

- B. The shell thickness design shall be determined based on a full tank of wastewater. Liners and corrosion barriers shall not be considered as contributing structural strength to the laminate.
  - C. All tanks subject to hydrostatic heads shall have minimum wall thickness of  $\frac{1}{4}$ -inch. The equipment manufacturer shall be responsible for properly sizing the tank wall thickness to provide a structurally sound tank when completely full.
  - D. Stiffener ribs or other means shall be used to provide structural rigidity.
  - E. The knuckle radius shall be 1-1/2-inch minimum. The knuckle area shall be reinforced in accordance with ASTM D-3299-00.
  - F. All cut edges shall be coated with resin such that no glass fibers are exposed and all voids shall be filled. All exterior surfaces shall be relatively smooth with no exposed fibers or sharp projections.

## 2.03 LAMINATE

- A. The laminate shall consist of an inner surface, an interior layer, and an exterior layer or structural laminate.
  - B. An ultraviolet outdoor stabilizer shall be incorporated in the final coat of resin to improve weather resistance. Resins may contain pigments provided their concentration does not prevent detection of visual defects. Manufacturer shall submit color chart of available pigments of the exterior of the tank for selection by the Owner.
  - C. A corrosion barrier made of an isophthalic polyester surfacing mat (veil) shall be Type C glass, 10 mils thick, with a silane finish and a binder compatible with the resin.
  - D. The inner surface shall be free of cracks and crazing with a smooth finish and with a maximum of 10 pits per square foot. All pits shall be less than 1/8 inch diameter and

1 less than 1/32 inch deep. All pits shall be covered with sufficient resin to avoid  
2 exposure of inner surface fabric. A minimum of 7-20 mils of reinforced, resin-rich  
3 surface shall be provided. The surface shall be reinforced with a glass surfacing veil  
4 or a synthetic fiber veil.

- 5
- 6 E. A minimum of 90 mil of laminate is required in the corrosion barrier and shall be  
7 reinforced with not less than 27 percent by weight of non-continuous glass strands  
8 having fibers lengths from 0.5 and 2.0 inches.
- 9
- 10 F. Where separate layers such as mat is used, all layers shall be lapped a minimum of  
11 one inch. Laps shall be staggered as much as possible. The exterior surface shall  
12 be relatively smooth with no exposed fibers or sharp projections.
- 13
- 14 G. The structural wall glass content of filament wound laminate shall be a minimum  
15 of 50% by weight.
- 16

## 17 2.04 TANK CONNECTIONS AND APPURTENANCES

- 18
- 19 A. All connections for equipment shall be FRP conically-gusseted flanges located as  
20 shown on the Drawings. Flanges for pipe connections shall be drilled in accordance  
21 with ANSI B-16.5 for 150# bolting configuration.
- 22
- 23 B. All flanges shall be furnished with a 1/8-inch EPDM full face gasket with a minimum  
24 durometer of 50 and 316 SS bolting hardware.
- 25
- 26 C. Tank shall be furnished with a 24-inch side access manway with a blind flange,  
27 EPDM gasket and 316 SS bolts.
- 28
- 29 D. All tanks shall be furnished with 316 stainless steel support ring/legs, bolting pads,  
30 anchor bolts and all other necessary hardware required to securely fasten the tank  
31 to a concrete pad.
- 32
- 33 E. All tanks shall be furnished with mold-in stainless steel clips for mounting electrical  
34 and instrumentation conduit and piping as required.
- 35

## 36 PART 3 - EXECUTION

### 37 3.01 INSTALLATION

- 38
- 39 A. Each unit shall be installed in accordance with the manufacturer's instructions and  
40 accurately aligned in orientation with related equipment in order to insure proper  
41 operation.
- 42
- 43 B. The Contractor shall supply all necessary anchor bolts, washers, nuts, temporary  
44 lifting equipment, power, labor and all other requirements for satisfactory installation.
- 45

### 46 3.02 MANUFACTURER'S SERVICES

- A. Prior to initial start-up, the manufacturer's representative shall provide written certification to the Owner that the equipment has been properly installed, tested in accordance with the Manufacturer's approved method and the testing requirements specified herein and shall certify that the equipment is ready for permanent operation.
  - B. The manufacturer shall provide an affidavit that the materials comply with the applicable requirements of this specification.

### 3.03 PAINTING

- A. All exposed metal surfaces, other than aluminum, galvanized steel and stainless steel, shall be shop primed and painted.
  - B. Surface preparation and shop prime painting shall be as specified in Section 09865.
  - C. Field painting shall be as specified in Section 09900.

### 3.04 TESTING

- A. Upon completion of installation, the Contractor shall in the presence of the Engineer and a qualified manufacturer's representative, perform a preliminary test on the tank to insure no leaks are detected. The Contractor shall furnish all labor, materials, supplies, test equipment, water and power required to perform each test. Tests shall verify proper alignment, proper connection and satisfactory performance of the FRP tank.
  - B. The Contractor shall furnish the services of a factory representative who has complete knowledge of proper operating and maintenance to inspect the final installation and supervise a test run of the equipment.
  - C. In the event of improper installation, the Contractor and the manufacturer shall be responsible for supervising the correction of the work and subsequent test runs until the defects are corrected without any additional cost to the Owner.

END OF SECTION

1 SECTION 11350

2

3 CONTINUOUS LOOP MOVING BELT FILTER

4

5 PART 1 - GENERAL

6

7 1.01 SCOPE

8

- 9 A. Provide all labor, materials, equipment and appurtenances required to furnish,  
10 install, and startup three complete continuous loop moving belt filters for  
11 wastewater solids separation (belt filter). Equipment, ancillaries and services  
12 shall be fully functional and automated and shall be suitable for raw domestic  
13 wastewater. The overall scope of supply shall be for factory assembled and  
14 tested units incorporating a continuous loop moving mesh screen (filter belt), a  
15 belt cleaning system, a discharge sludge chute, blowers, and system control  
16 panels for automatic operation. The basis for design is the Salsnes Filter and  
17 shall be capable of meeting the minimum criteria standards listed in this section.
- 18
- 19 B. Alternate equipment manufacturers shall not be allowed. Only equipment from  
20 the approved manufacturer shall be considered.
- 21
- 22 C. Prior to ordering equipment the Contractor shall coordinate with the  
23 manufacturer and conduct sieve testing and column testing and particle size  
24 distribution testing at a representative location in the process to confirm the  
25 machine and belt pore size. The sieve and column testing and reporting shall  
26 be similar to preliminary testing conducted on April 14, 2016. The particle size  
27 and distribution analysis shall use a procedure based on Standard Methods or  
28 other industry-accepted standard. The belt filter unit manufacturer shall provide  
29 the method for review prior to conducting the testing. The testing shall  
30 indicate the percentage of particles larger than 350 microns. All testing and  
31 analyses shall be supervised by a NELAC certified laboratory and all results  
32 shall be submitted to the Engineer.
- 33
- 34 D. The Contractor shall furnish and install the Inlet, outlet, overflow, vent, drain,  
35 cold water, hot water, bottom bearing flush water, and air piping associated with  
36 each each belt filter unit.
- 37

38 1.02 DESCRIPTION OF THE SYSTEM

39

- 40 A. Sizing and Performance Criteria: Provide equipment that will process raw  
41 wastewater without the use of a coagulant and with the following characteristics:
- 42
- 43 1. Number of Belt Filter Units: 3
- 44 2. Each Belt Filter Flow Capacity: 1736 GPM
- 45 3. Influent Solids Concentration (TSS): 178 mg/L (average)
- 46 4. Minimum TSS Removal Required: 47% (average)
- 47 5. Influent BOD: 220 mg/L (average)

CONTINUOUS LOOP MOVING BELT FILTER

11350-1

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- 1           6. Minimum Primary Sludge Solids Content       5% (average by weight)  
2           7. Typical Influent Solids Concentration (TSS) Range : 140 to 240 mg/L  
3           (monthly average)  
4           8. Typical Influent Biological Oxygen Demand (BOD) Range: 160 to 250  
5           mg/L (monthly average)  
6           9. Typical Particle Size Distribution (PSD):       At least 47% of particles  
7           greater than 350 micron.

- 8
- 9           B. Provide complete and operational Belt Filters consisting of self-cleaning filter  
10          belts and dedicated appurtenant equipment. Each Belt Filter unit shall be  
11          equipped with an inclined continuous loop filter belt, compartment access  
12          covers, belt cleaning provisions, a blower, and control panel and a level  
13          transmitter for monitoring and belt speed control.
- 14
- 15          C. The system shall be sized for continuous operation (24-hour/day, 365-  
16          days/year).

17          1.03 SUBMITTALS

- 18
- 19          A. Manufacturer shall submit, to the Owner or Engineer, Shop Drawings for review  
20          and to establish compliance with the specifications. Shop Drawings shall  
21          include the following:
- 22
- 23           1. Complete description in sufficient detail to permit an item comparison  
24           with the specification.  
25           2. Drawings showing plan and elevation views of the Belt Filter and  
26           requirements for any external piping and utilities  
27           3. Electrical schematics and layouts  
28           4. Installation requirements  
29           5. Descriptive literature, bulletins and catalogue cuts of the major system  
30           components;  
31           6. Statement of warranty.  
32           7. Exploded views identifying all part numbers and materials of  
33           construction
- 34
- 35          B. Manufacturer shall submit, upon system delivery, complete Operations and  
36          Maintenance manuals in accordance with Section 01730.

37          1.04 QUALITY ASSURANCE

- 38
- 39          A. Motors shall be in accordance with NEMA Standards.
- 40
- 41          B. All of the equipment specified under this Section shall be furnished by a single  
42          Manufacturer, who is fully experienced, reputable and qualified in the  
43          manufacture of the equipment furnished. The equipment shall be suitable for  
44          satisfactory operation with the normal operating levels shown on the Drawings.  
45          The Contractor shall assume full responsibility for the satisfactory installation

1 and operation of the entire system as specified.  
2

- 3 C. The belt filter units and all related equipment shall be designed, constructed and  
4 installed in accordance with the best practices and methods.  
5
- 6 D. The manufacturer shall be fully responsible for the design, arrangement and  
7 operation of all connected rotating components of the assembled filter units to  
8 ensure that neither harmful nor damaging vibrations occur at any speed within  
9 the specified operating range.  
10
- 11 E. The equipment manufacturer shall guarantee the performance of each belt filter.  
12

13 1.05 TOOLS AND SPARE PARTS  
14

- 15 A. Furnish one (1) set of all special tools required for normal operation and  
16 maintenance.  
17
- 18 B. Furnish and package for storage all of the manufacturer's recommended spare  
19 parts to assure normal running and maintenance for a period of two (2) years  
20 assuming all three filter screens are in continuous operation.  
21
- 22 C. Furnish and package for storage a quantity of the recommended lubrication to  
23 meet the manufacturers' recommended lubrication change intervals for 1 year  
24 assuming all three filter screens are in continuous operation. Lubricants shall  
25 include summer and winter grades with alternate reference to equal products of  
26 other manufacturers, and shall include all lubricant specification such as viscosity,  
27 AGMA numbers, etc.  
28
- 29 D. Furnish and package for storage one continuous loop belt filter cartridge  
30 assembly including all rollers, bearings, seals, etc., less the motors and gear  
31 boxes and identical to those installed on the complete machines. Furnish a  
32 portable stand fabricated of 316 stainless steel to support the cartridge assembly  
33 12-inches above the stand mounting elevation.  
34
- 35 E. All spare parts shall be furnished in containers clearly identified with indelible  
36 markings as to contents. Each container shall be packed with its contents  
37 protected for prolonged storage.  
38
- 39 F. In addition to items A-E, the following spare parts shall be supplied with the  
40 equipment:  
41
- 42 1. Two (2) additional filter belts and lacings  
43 2. Three (3) belt drive motors  
44 3. Three (3) belt drive gear boxes  
45 4. Three (3) sets of drive bearings  
46 5. Three (3) sets of lower bearings  
47 6. Three HMI units for the Northeast WRF belt filter units

1  
2   1.06 WARRANTY  
3

- 4           A. All equipment supplied under this Specification except the knife gate valve and  
5           the actuator for the bottom roller bearing flush system shall be warranted to  
6           perform as specified for a period of eighteen (18) months from the date of  
7           shipment or one (1) year from when placed in continuous operation, whichever  
8           comes first. The knife gate valve and the actuator for the the bottom roller  
9           bearing flush system shall be warranted for 5 years parts. One (1) complete  
10          spare valve with actuator and set of bearings shall be furnished for each filter.  
11
- 12           B. If any part of the equipment supplied under this Specification should fail during  
13          the warranty period, it shall be covered by the terms of the Manufacturer's  
14          standard warranty.

15  
16   1.07 PRODUCT HANDLING  
17

- 18           A. All parts shall be properly protected so that no damage or deterioration will occur  
19          during a prolonged delay from the time of shipment until installation is completed  
20          and the units and equipment are ready for operation.  
21
- 22           B. All equipment and parts must be properly protected against any damage during  
23          a prolonged period at the site.  
24
- 25           C. Factory assembled parts and components shall not be dismantled for shipment  
26          unless permission is received in writing from the Engineer.  
27
- 28           D. Finished surfaces of all exposed openings shall be protected by wooden blanks,  
29          strongly built and securely bolted thereto.  
30
- 31           E. Finished iron or steel surfaces not painted shall be properly protected to prevent  
32          rust and corrosion.  
33
- 34           F. After hydrostatic or other tests, all entrapped water shall be drained prior to  
35          shipment and proper care shall be taken to protect parts from the entrance of  
36          water during shipment, storage and handling.  
37
- 38           G. Each box or package shall be properly marked to show its net weight in addition  
39          to its contents.

40  
41   1.08 MANUFACTURER'S REPRESENTATIVE  
42

- 43           A. Provide the services of a qualified factory certified representative for a minimum  
44          of (2) days for each machine for equipment installation inspection, certification,  
45          start-up, training, and corrective adjustments.

46  
47   1.09 PERFORMANCE TESTING

- 1  
2       A. Performance testing shall be conducted by the Contractor on each belt filter unit  
3           as described in Part 3 of this specification. Sample collection and analysis  
4           shall be supervised or performed by a NELAC certified laboratory.  
5  
6

7       **PART 2 - PRODUCTS**  
8

9       **2.01 MANUFACTURER**  
10

11       The physical layout of the system shown on the drawings and the equipment specified  
12           herein is based on the Filter System Model SF6000 as manufactured by Salsnes Filter  
13           / Trojan Technologies, London Ontario, Canada.  
14

15       **2.02 DESIGN, CONSTRUCTION AND MATERIALS**  
16

17       A. **Filter Unit General**  
18

- 19           1. Each Belt Filter unit shall be freestanding, designed for installation on a  
20           concrete slab or concrete pedestals.  
21           2. Each Belt Filter's weight, including water, shall not exceed 5732 lbs.  
22           3. Each Belt Filter shall contain one (1) rotating filter belt with horizontal  
23           gravity thickening stage, air knife belt cleaning system, hot water spray  
24           system, fresh water flush system, water level transmitter, and an  
25           integrated sludge collection chute.  
26           4. Each Belt Filter shall be supplied with the following connections:  
27              a) One 16-inch inlet flange located at the front of the machine  
28              b) One 16-inch outlet flange – side discharge only – can be either left  
29              or right discharge  
30              c) One 16-inch overflow flange side discharge only – can be either  
31              left or right discharge  
32              d) One 1/2-inch NPT connection for cold water (EFW) and one 1/2"  
33              NPT hot water (Potable) connection  
34              e) One 4-inch NPT connection for filter drain.  
35              f) One 3-inch flanged connection for the air supply  
36  
37           5. Each Belt Filter and all welded metal components in contact with effluent  
38           shall be constructed of 355 or 316L stainless steel. No other materials of  
39           construction shall be acceptable.  
40

41       B. **Belt Filter Internals**  
42

- 43           1. The filter belt mesh screen shall be contained in the filter compartment.  
44           The filter mesh screen shall be constructed of polyethylene with Kevlar-  
45           reinforced drive ends. The mesh screen porosity (opening size) shall be  
46           initially sized at 350 microns. Prior to ordering the equipment the pore  
47           size shall be confirmed by testing as outlined in Section 101 C. of this

1 specification.

- 2
- 3 2. A level monitor and transmitter device for monitoring the water level in
- 4 the influent compartment shall be provided. The equipment shall be
- 5 specifically designed for use in raw wastewater applications. Level
- 6 transmitter shall utilize a ceramic sensing element resistant to sludge
- 7 build up, ASTM A-316L stainless steel housing, and a vented
- 8 polyurethane insulated cable.
- 9
- 10 3. An air knife and blower suitable for continuous operation shall be
- 11 provided for removal of solids from the surface of the filter belt. The air
- 12 knife shall be fabricated of ASTM A-316L stainless steel and HDPE.
- 13 The device shall be piped to the exterior of the filter compartment for
- 14 supply air connection.
- 15
- 16 4. Filter mesh cleaning is to be performed by pressurized air and periodic
- 17 hot water.
- 18
- 19 5. Each unit shall include a horizontal gravity thickening zone to facilitate
- 20 removal of water and increase the dry solids content of the sludge.
- 21
- 22 6. Hot water spray nozzles shall be provided for cleaning the filter belt and
- 23 in the dewatering chamber. Spray nozzles and manifolds shall be
- 24 constructed of stainless steel. A 2-way solenoid valve shall be provided
- 25 for automated control. Manifolds for hot water supply connection shall
- 26 combine and terminate at a strainer on the exterior of the filter
- 27 compartment. Hot water shall be potable water.
- 28
- 29 7. A reclaimed water flush manifold shall be provided for automated
- 30 cleaning of the lower belt roller compartment. The reclaimed water flush
- 31 shall be controlled with a 2-way solenoid valve provided with the unit.
- 32 The reclaimed water manifold connection shall terminate at a strainer on
- 33 the exterior of the unit. The flush water shall exit the unit through a 3-
- 34 way solenoid valve. Energizing the 3-way solenoid valve shall open a
- 35 drain valve for the compartment allowing flush water to exit the unit.
- 36
- 37 8. All internal Filter components shall be installed by the Manufacturer prior
- 38 to the Filter Unit being shipped to the job site.
- 39
- 40 9. Electrical drive motors shall be UL approved and/or for a Class 1 Div 1
- 41 hazardous location if applicable. Filter instrumentation and solenoid
- 42 valves shall be intrinsically safe or UL approved for a Class 1 Div 1
- 43 hazardous location if applicable.

44 C. Filter Fittings and Connections

- 45 1. Flange drilling and bolting for all flange connections shall be in

46 CONTINUOUS LOOP MOVING BELT FILTER

accordance with ANSI/ASME B-16.5 class 150.

2. All threaded connectors to the Salsnes Filter Unit(s) shall be NPT.
  3. For all plain end pipe terminations, flexible sewer connectors (Fernco or equal) shall be provided by the Contractor.

#### D. System Piping and Ducting

All Filter System piping including small diameter hot and cold water piping shall be ASTM A316L stainless steel or specified hose. Hot and cold small diameter water piping shall use threaded connections and fittings with the appropriate pressure ratings.

#### 2.03 SYSTEM CONTROLS- See Control Strategy Specification 13640

## 2.04 BLOWER PACKAGES

- A. The manufacturer of the Belt Filter shall provide three rotary lobe positive displacement blower packages, with each package dedicated to a single belt filter unit and sized to meet the required conditions of airflow and pressure to each unit. The Contractor shall install these units.
  - B. The blowers shall be positive displacement rotary lobe type with sound attenuation enclosure as manufactured by Kaeser - BB Compact series or equal. The sound enclosure shall be fabricated with non-corrosive material.
  - C. Each blower package shall include an inlet filter with removal efficiency of 90 percent or better on particles 10 microns and larger.
  - D. Intake and discharge silencers of heavy duty, all welded, carbon steel sheet and plate construction featuring treated inlets and outlets for pulse control shall be provided.
  - E. Provide flexible expansion joint connectors as recommended by the blower manufacturer to connect the inlet and discharge silencers of each blower to the piping. Connectors shall be designed for temperatures 50 degrees F above the discharge temperature of the blower air and 25 psi. Connector size and end connections shall be the same as the inlet and discharge silencer connections.
  - F. Pressure relief valves shall be a weight type or spring loaded valve properly sized for the application. The size shall be as recommended by the blower manufacturer. Each relief valve shall have the capacity of relieving the entire blower flow. Set point pressure shall be at the blower's maximum pressure rating. Inlet and outlet shall be standard threaded connections. The design of the valve shall permit the discharge of the relief valve to be piped away.

- 1           G. Each blower shall be provided with a stem mounted stainless steel liquid filled  
2           discharge pressure gauge assembly with a 2.5 inch casing, a 270 degree 0-25 psi  
3           scale and accurate to 2% of the full scale. The gauge assembly shall be  
4           equipped with an isolation valve such that the gauge can be replaced while the  
5           blower is running.
- 6
- 7           H. Provide each blower with a Dwyer type inlet pressure gauge to accurately  
8           measure pressure loss through the inlet filter.
- 9
- 10          I. Each blower shall be mounted on specially vibration pads as recommended by the  
11           blower manufacturer.
- 12
- 13          J. Furnish and package for storage all of the blower manufacturer's recommended  
14           spare parts to assure normal running and maintenance for a period of two (2)  
15           years assuming all three blowers are in continuous operation.

16

17        **2.05 BLOWER SOUND REDUCTION ENCLOSURE**

- 18
- 19          A. Each blower assembly shall be furnished with a weather tight, self-ventilating  
20           sound attenuating enclosure. The enclosure shall be manufactured of 16 gauge  
21           aluminum and lined with acoustical foam and perforated stainless steel sufficient  
22           to meet 75 dba noise level at 3 feet from any exterior surface of the enclosure.  
23           The enclosure shall have removable side panels which shall allow full access to  
24           the assembly for maintenance or repair. No part of the sound enclosure or sound  
25           hardware shall be carbon steel.
- 26
- 27          B. An air ventilation fan shall be mounted in/on the enclosure and sized as necessary  
28           to keep the assembly ventilated at a temperature to maintain proper operation as  
29           recommended by the assembly manufacturer. The fan motor shall be powered  
30           by the blower control panel.
- 31
- 32          C. Pipe and conduit penetrations shall be sized to allow for passage of flanges and  
33           fittings. All penetrations shall have flash rings installed to seal around the pipe.
- 34
- 35          D. The enclosure and the blower shall be free standing and not attached or mounted  
36           to the blower package frame or base plate in any way. The enclosure shall be  
37           supplied and shipped from the manufacturer as one unit completely assembled  
38           and painted and shall not require field assembly at the site.

39

40        **2.06 HOT WATER HEATER**     See Electric Water Heater Specification 15480

41

42        **2.07 SLUDGE DISCHARGE CHUTE**

- 43
- 44          A. A sludge discharge chute shall be furnished with each filter. Chutes shall be  
45           fabricated of 316 stainless steel, with integral SS supports for mounting to the  
46           concrete slab and the structural steel members supporting the moving belt  
47           filters. The Chutes shall be furnished with flanges for connecting to the filter

1 and to the pump via flanged flexible couplings as shown on the drawings.  
2 Chutes shall have an access opening at the top, adjacent to the filter discharge,  
3 for mounting a level sensor. The chute shall also have a  $\frac{3}{4}$ -inch SS nipple with  
4 SS ball valve for a hose connection and a 4-inch SS cam-lok connection with  
5 cap properly arranged to flush the chute. The chute shall be so designed and  
6 properly reinforced and supported to prevent any loads from being transferred  
7 through the flexible connector to the connected equipment (pump and filter)  
8 when completely filled with sludge. In addition, the members of the chute shall  
9 not bulge or distort when filled completely with sludge.

10

## 11 PART 3 – EXECUTION

12

13

### 3.01 SITE AND UTILITIES

14

15 The belt filters shall be located and installed as shown on the drawings. Site  
16 preparation, utility service and installation are the responsibility of the Contractor.

- 17
- 18 A. Hot and cold water supply lines for each belt filter shall be provided and installed  
19 by the Contractor. The cold water supply to each belt filter will be reclaimed  
20 water. The hot water supply will be potable water from the water heating  
21 system located in the feed pump building. The hot water piping downstream of  
22 the hot water heater shall be insulated.

23

  - 24 B. Water temperature at the belt filter shall be at least 160°F and shall not exceed  
25 195°F.

26

  - 27 C. The sizing of the electrical service and belt filter interconnecting piping shall be  
28 in accordance with the Manufacturer's recommendations.

29

  - 30 D. Electric: 460-volt, 3-phase electrical service shall be supplied and installed by  
31 the Contractor.

32

  - 33 E. Air piping from each blower to the dedicated to the belt filter shall be supplied  
34 and installed by the Contractor. The piping will be 3-inch Schedule 10s stainless  
35 steel ASTM A312 and the fittings shall be schedule 40 ASTM A774 or ASTM  
36 A403. No threaded connections shall be used on the blower piping.

37

  - 38 F. Drain piping from the flush valves (filter and chute) shall be provided and  
39 installed by the Contractor as shown on the drawings.

40

### 41 3.02 INSTALLATION

42

- 43 A. The Contractor shall install the Salsnes Filter system in accordance with  
44 instructions provided by the Manufacturer. Contractor's installation personnel  
45 shall be qualified in the areas of plumbing, electrical work, and instrumentation  
46 as required to properly complete the installation.

- 1           B. The Contractor shall provide protection for all equipment so that no damage or  
2           deterioration will occur from the time of delivery until installation is completed  
3           and the units and equipment are ready for operation.
- 4
- 5           C. Finished surfaces of all exposed equipment openings shall be protected.  
6           Finished iron or steel surfaces not painted or coated shall be properly protected  
7           to prevent rust and corrosion.
- 8
- 9           D. Contractor shall be responsible for connecting all plumbing, ducting and  
10          electrical interconnections to the belt filter system as detailed in the  
11          Manufacturer's installation instructions.

12         **3.03 INSPECTION, START UP AND TRAINING**

- 13
- 14         A. The Contractor shall provide the services of a trained and certified technical  
15          service representative from the Manufacturer to be on-site and inspect the final  
16          installation, perform start-up, and train the WWTP Operations personnel.  
17          Training of plant personnel shall be required only on the first trip and will require  
18          two sessions on one day.
- 19
- 20         B. Startup of two machines at the same time may be permitted if influent flow is  
21          sufficient. Startup of three machines at the same time shall not be permitted.
- 22
- 23         C. Following proper start-up of each machine, the manufacturer's field service  
24          representative through the Contractor shall provide a certificate of proper  
25          installation (COPI) stating that the equipment has been properly installed and is  
26          ready to be placed in service.
- 27

28         **3.04 FIELD PERFORMANCE TESTING**

- 29
- 30         A. After the COPI has been received for a particular machine, three 12-hour  
31          performance tests shall be conducted on that particular machine on three  
32          consecutive days by the Contractor to demonstrate conformance with the  
33          criteria outlined in Section 1.02. The machine shall be operated by the  
34          Contractor in accordance with the equipment O&M Manual at 1730 gpm ( $\pm 10\%$ )  
35          for 12 consecutive hours on three consecutive days and provide 47% (or higher)  
36          TSS removal and produce primary sludge cake with a dry solids content with an  
37          average value not less than 5% by weight.
- 38
- 39         B. The performance testing shall be performed on each machine individually.  
40          Performance testing shall not be conducted on multiple machines at the same  
41          time.
- 42
- 43         C. The Contractor shall provide verification of the performance by sampling and  
44          analyzing the influent and effluent TSS values, influent particle size distribution,  
45          and primary sludge moisture content. All four of these parameters shall be  
46          sampled (grab) and analyzed every half hour for the 12 hour duration (24

1 samples).

- 2
- 3 D. The arithmetic average of the 24 samples for each day shall be used as the
- 4 pass/fail yardstick for each day. The system shall be considered to have
- 5 passed that day's performance test if the average TSS percent removal is 47%
- 6 or higher for the 12 hour test period. Three consecutive days of passing results
- 7 are required for the machine to pass the performance test.
- 8
- 9 E. A sampling and testing protocol to comply with A, B, and C above shall be
- 10 provided by the Contractor and submitted for review. The testing and analyses
- 11 shall be supervised and conducted by a NELAC Certified Laboratory using
- 12 Standard Methods as described in the Northeast Wastewater Treatment Plant
- 13 FDEP Operating Permit.
- 14
- 15 F. Each machine shall be subject to the performance testing.
- 16
- 17 G. Plant influent TSS, BOD, and particle size distribution parameters must be
- 18 within typical ranges for those parameters for the testing to be considered valid.
- 19 Daily influent TSS and BOD values for the previous 12-month period will be
- 20 made available by the City. It is the Contractor's responsibility to determine
- 21 and verify influent water quality, if the Contractor elects to do so. The
- 22 Contractor is not required to conduct influent sampling and testing. However,
- 23 it will be assumed that the influent TSS, BOD, and particle size distribution
- 24 values are within typical ranges unless proven otherwise by the Contractor.
- 25
- 26 H. The Contractor shall furnish the results of all testing to the Owner and the
- 27 Engineer. The Contractor shall submit records of flow and all laboratory
- 28 analyses conducted as part of the performance testing on each machine.
- 29
- 30 I. The Contractor shall notify the Engineer when the performance testing has been
- 31 completed and passed for each machine.
- 32
- 33 J. Should any daily average of TSS removal or daily average primary sludge solids
- 34 connected not meet the performance requirement, the Contractor shall perform
- 35 a Particle Size Distribution Analysis as described previously of the filter influent
- 36 flow. Should the percentage of particles larger than 350 microns be within 10%
- 37 of the previously measured value, then the Contractor shall modify the belt filter
- 38 and re-conduct the performance test until the belt filter TSS removal and primary
- 39 sludge solids content meets the performance requirements.
- 40
- 41 K. If the belt filter fails the performance test under influent conditions within
- 42 specification, the Manufacturer, at the Owner's request, shall correct any
- 43 system deficiencies and re-test at the Manufacturer's expense.
- 44
- 45 L. Exclusive Remedy
- 46

1           In the event the any belt filter fails to meet the Process Performance  
2           Requirements, the Contractor's sole remedy shall be to replace the filtration  
3           system to enable the process to meet such Performance Requirements, at no  
4           additional cost to the Owner.

5

6        3.05 PARTIAL SUBSTANTIAL COMPLETION

7

- 8           A. At the Contractor's discretion, after the moving belt filters and all related  
9           subsystems, including inlet and sludge pump systems, piping systems,  
10          mechanical systems, water systems, electrical systems and instrumentation  
11          and controls have been installed and successfully tested to the satisfaction of  
12          the Engineer and Owner, the Contractor may request partial substantial  
13          completion and the City will assume responsibility fo the moving belt filter  
14          system.

15

16

17

18

19

20           END OF SECTION

1 SECTION 11560  
2

3 COMPRESSED GAS MIXING SYSTEM  
4

5  
6 PART 1 – GENERAL  
7

8 1.01 SCOPE OF WORK  
9

10 A. This section covers the furnishing of a compressed gas mixing system for  
11 the Equalization Tank including air compressors, compressed air receiver,  
12 master control panel, valve panel, header supply piping, nozzle headers,  
13 nozzles, auxiliary equipment and accessories as specified herein.  
14

15 1.02 DESCRIPTION OF THE SYSTEM  
16

17 A. The system shall intermittently and sequentially inject compressed air  
18 through fixed nozzles located on the basin floor to create large bubbles  
19 which effectively mix the basin contents with negligible oxygen transfer from  
20 the mixing system to the bulk liquid.  
21

22 1.03 REFERENCES  
23

24 A. ASTM International (ASTM)  
25

- 26 1. A240/A240M, Standard Specification for Chromium and Chromium-  
27 Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and  
28 General Applications.  
29
- 30 2. A276, Standard Specification for Stainless Steel Bars and Shapes.  
31
- 32 3. A312, Standard Specification for Seamless, Welded, and Heavily Cold  
33 Worked Austenitic Stainless Steel Pipe  
34
- 35 4. A380, Standard Practice for Cleaning, Descaling, and Passivation of  
36 Stainless Steel Parts, Equipment, and Systems  
37

38 1.04 DEFINITIONS  
39

- 40 A. Basin: The structure within which mixing occurs; i.e., Anoxic/Swing Zones.  
41
- 42 B. Header Supply Pipe: Piping between a valve panel and respective nozzle  
43 headers.  
44
- 45 C. Nozzle Header: Continuous (i.e., not branched) horizontal piping with  
46 nozzle offsets, with single inlet connection to header supply pipe and outlet  
47 offset connections to nozzles.  
48

- 1           D. Nozzle Offset: Piping branching off nozzle header trunk piping and which  
2           connects to nozzles either at a 90 degree angle or vertically.  
3  
4           E. Nozzle: Floor-anchored, large bubble-emitting device.  
5  
6           F. Standard Cubic Feet per Minute (scfm): Air at 68° F, 14.7 psia, and  
7           0 percent relative humidity as defined by the Compressed Air & Gas  
8           Institute.  
9  
10          G. Actual Cubic Feet per Minute (acfm): Terminology to quantify volume of air  
11          at the standardized reference condition (ISO 1217) delivered to the terminal  
12          point of the compressor package.  
13  
14          H. Valve Panel (VP): Control panel that controls the firing of solenoid-actuated  
15          air control valves, which intermittently emit compressed air bursts to the  
16          respective header supply pipes.  
17  
18          I. Master Control Panel (MCP): Single control panel that controls the firing of  
19          solenoid-actuated air control valves in one or more remote VPs.

22        1.05 SUBMITTALS

- 24          A. Submit to the Engineer for review in accordance with Section 01340 and  
25          01730 complete installation drawings, shop drawings, working drawings,  
26          O&M Manuals and product data for all materials and equipment furnished  
27          under this Section. Submittals shall include at least the following:  
28  
29           1. Certified shop and erection drawings showing all important details of  
30           construction, dimensions and anchor bolt locations.  
31  
32           2. Descriptive literature, bulletins and/or catalogs of the equipment.  
33  
34           3. Data on the characteristics and performance of each diffuser including  
35           pressure drop across each diffuser  
36  
37           4. A complete total bill of materials of all equipment (may be furnished with  
38           Operation and Maintenance manuals specified herein).  
39  
40          B. The submittal data shall be prepared, in its entirety, by the equipment  
41          manufacturer. Shop drawings prepared by the manufacturer's sales  
42          representative, fabrication shops, or other than the listed manufacturers will  
43          not be acceptable. No additions or modifications to the manufacturer's  
44          submittal will be accepted, with the sole exception of a cover sheet provided  
45          by the manufacturer's local Representative and the Contractor.  
46  
47          C. Complete operating and maintenance instructions in accordance with  
48          Specification 01730 shall be furnished for all equipment included under

1           these Specifications. The maintenance instructions shall include  
2           installation instructions, lubrication instructions, troubleshooting data, full  
3           preventative maintenance schedules, complete spare parts lists with  
4           ordering information, and exploded views of all equipment with part  
5           numbers identified.

- 6
- 7           D. In the event that is impossible to conform to certain details of the  
8           Specifications due to different manufacturing techniques, describe  
9           completely all non-conforming aspects.

10          1.06 TOOLS AND SPARE PARTS

- 11
- 12           A. Furnish one (1) set of all special tools required for normal operation and  
13           maintenance.
- 14
- 15           B. Furnish and package for storage all of the manufacturer's recommended  
16           spare parts to assure normal running and maintenance for a period of two (2)  
17           years assuming all units are in continuous operation.
- 18
- 19           C. All spare parts shall be furnished in containers clearly identified with indelible  
20           markings as to contents. Each container shall be packed with its contents  
21           protected for prolonged storage.
- 22
- 23           D. In addition to items A-C, the following spare parts shall be supplied with  
24           the equipment:
- 25
- 26           1. Six (6) Air Control Valve (ACV) rebuild kits
- 27           2. One (1) pilot air filter assembly
- 28           3. One (1) solenoid
- 29           4. One (1) valve plug and cable assembly
- 30           5. One (1) relay
- 31           6. One (1) 5-micron pilot air filter
- 32           7. One (1) compressor intake air filter element per compressor  
33           provided
- 34           8. One (1) compressor oil filter element per compressor provided
- 35           9. One (1) each compressor separator element per compressor  
36           provided
- 37           Any other standard parts recommended by the Manufacturer.

38          1.07 WARRANTY

- 39
- 40           A. In accordance with Section 01740 the Compressed Gas Mixing  
41           Manufacturer and the Contractor shall warrant the compressed gas mixing  
42           system against defects in workmanship and materials for a period of one  
43           (1) year under normal use, operation and service, commencing at the time  
44           of final system acceptance by the Owner.
- 45
- 46           B. All equipment supplied within this Specification shall be warranted by the  
47           same manufacturer.
- 48

1           C. The equipment shall be warranted to be free from defects in workmanship,  
2           design and materials. If any part of the equipment should fail during the  
3           warranty period, it shall be replaced in the machine(s) and the unit(s)  
4           restored to service at no expense to the Owner.

5

6        **1.08 DELIVERY, STORAGE, AND HANDLING**

7

- 8           A. All parts shall be properly protected so that no damage or deterioration will  
9           occur during a prolonged delay from the time of shipment until installation  
10          is completed and the units and equipment are ready for operation.
- 11          B. All equipment and parts must be properly protected against any damage  
12          during a prolonged period at the site.
- 13          C. Equipment shall be protected from exposure to the elements and kept dry  
14          at all times. Handle and store equipment on site to prevent damage and in  
15          accordance with manufacturer's recommendations
- 16          D. Factory assembled parts and components shall not be dismantled for  
17          shipment unless permission is received in writing from the Engineer.
- 18          E. Finished surfaces of all exposed openings shall be protected by wooden  
19          blanks, strongly built and securely bolted thereto.
- 20          F. Finished iron or steel surfaces not painted shall be properly protected to  
21          prevent rust and corrosion.
- 22          G. Each box or package shall be properly marked to show its net weight in  
23          addition to its contents.
- 24          H. Equipment damaged by handling and storage shall be repaired or replaced  
25          by the Contractor as directed by the Engineer.

26

27        **1.09 MANUFACTURER'S REPRESENTATIVE**

28

- 29           A. Provide the services of a qualified factory certified representative for a  
30           minimum of (4) days for final equipment installation inspection, certification,  
31           start-up, training, and corrective adjustments.

32        **1.10 QUALITY ASSURANCE**

33

- 34           A. All equipment furnished under this Section shall be of a design and  
35           manufacture that has been used in similar applications and it shall be  
36           demonstrated to the satisfaction of the Owner that the quality is equal to  
37           equipment made by that manufacturer specifically named herein. Alternate  
38           manufacturers shall provide evidence of at least five (5) installations in  
39           which identically sized equipment has provided satisfactory performance for  
40           a minimum of five (5) years in a similar application. No consideration will

1           be given to individually sized equipment that has not been commercially  
2           available for at least five (5) years.  
3

- 4           B. All equipment shall be supplied by the same system supplier who is fully  
5           experienced, reputable and qualified in the manufacture of the equipment  
6           furnished and the process. The Contractor shall assume full responsibility  
7           for the satisfactory installation and operation of the system as specified.  
8
- 9           C. Motors shall be in accordance with NEMA Standards.  
10
- 11          D. All equipment shall be designed, constructed and installed in accordance  
12          with the best practices and methods.  
13
- 14          E. Requests for substitution shall include manufacturer's literature for each  
15          product giving name, product number, type, descriptive information, and  
16          independent lab test reports showing results to equal the performance  
17          criteria of the equipment specified herein. In addition, a list of five projects  
18          shall be submitted in which identical equipment has been used and  
19          rendered satisfactory service.  
20
- 21          G. The system supplier shall be fully responsible for the design, arrangement  
22          and operation of all components to ensure that neither harmful nor  
23          damaging vibrations occur at any speed within the specified operating  
24          range.  
25
- 26          H. Should equipment which differs from these Specifications be offered and  
27          determined to be the approved equal of that specified, such equipment will  
28          be acceptable only on the basis that any revisions in the design and/or  
29          construction of the structures, piping, appurtenant equipment, electrical  
30          work, etc., required to accommodate such a substitution, shall be made at  
31          no additional cost to the Owner and be as approved by the Engineer.  
32
- 33          I. Changes in the number of nozzles, valves, or compressors will not be  
34          acceptable unless a detailed submittal showing calculations and operating  
35          data provides evidence that any such change will not affect the ability of the  
36          system to perform as specified.  
37
- 38          J. The equipment manufacturer shall guarantee the performance of each  
39          component. The compressed gas mixing system shall be as manufactured  
40          and provided by EnviroMix in Charleston South Carolina.  
41

42          PART 2 – PRODUCTS  
43

44          2.01 PERFORMANCE AND DESIGN REQUIREMENTS  
45

- 46           A. Provide a compressed gas mixing system for mixing the Equalization Tank.  
47           The system shall intermittently and sequentially inject compressed air  
48           through nozzles located on the basin bottom to create large bubbles that

1 will completely mix the basin with no moving parts located within the basin.  
2

- 3       1. Basin mixing shall be uniform throughout the basin with effective mixing  
4           confirmed through a Field Performance Test as specified.
- 5       B. Air distribution and balancing shall be sufficient to maintain suspended  
6           solids in a state of suspension over entire basin. The operator interface shall  
7           allow control of firing parameters (sequence, duration, and frequency) to  
8           achieve basin mixing.
- 9       C. Firing flow rate shall be adjustable via the throttling valve. The compressed  
10          gas mixing system equipment and piping shall be sized to thoroughly mix  
11          the contents of the basins for which the systems are designed.
- 12       D. Treatment Process

Basin	Equalization
Basin Diameter (ft.)	120
Side Water Depth (ft.)	24
Number of Basins	1
Number of VPs per Basin	1
Number of ACVs per VP	13
Number of Nozzle Headers	Varies
Number of Nozzles	143
Nozzle Density (ft <sup>2</sup> basin area / # nozzles)	79
Minimum Header Supply Pipe Dia. (in.)	2.0
Number and size of air compressors	2-Rotary Screw 30 HP
Air Receiver Size	400 gallon

- 17       E. Performance Requirements Refer to section 3.03 of this specification.
- 18       F. The compressed gas mixing system Manufacturer shall be responsible for  
19           sizing and selecting all system components to meet the requirements of the  
20           field mixing performance test specified herein. The compressor size,  
21           number of nozzles and piping size specified herein and shown on the  
22           Drawing are minimum. Any increase in the number and size of system  
23           components required in order to meet the performance and testing criteria  
24           shall be supplied and installed at no additional cost to the Owner.

25       **2.02 MATERIALS**

- 26       A. Header Supply Piping
- 27           1. Provide threaded connections only where required.
- 28           2. Sch 5S, stainless steel Press technology system (Viega, or equal),

1 comprised of stainless steel Press technology fittings, couplings, and  
2 pipe, unless specified otherwise.

- 3           3. Maximum working pressure of 150 psi.  
4           4. Couplings and fittings: Press technology products formed of Type  
5           304/304L stainless steel tubing including a self-contained o-ring seal(s)  
6           molded of synthetic FKM rubber.  
7  
8           5. Pipe: Type 304/304L ASTM A312 stainless steel.

9  
10          B. Nozzle Headers

- 11  
12          1. Sch 10S, 304/304L stainless steel with 1" Sch 40S, stainless steel  
13           nozzle offsets.  
14  
15          2. Nozzle couplings: 1" NPT, 150 lb, 304/304L stainless steel.  
16  
17          3. Delivered from the Manufacturer pre-assembled to the extent  
18           practicable to minimize field assembly error and installation time.  
19  
20          4. Pipe: Type 304/304L ASTM A312 stainless steel.  
21  
22          5. Provide nozzle headers in maximum 20-ft segments with two bolt  
23           304/304L stainless steel flexible gasketed coupling connections.  
24           Flexible couplings shall be rated for a maximum working pressure of 150  
25           psi.  
26  
27          6. Provide nozzle headers with removable end caps to facilitate clean-out.

28  
29          C. Nozzles

- 30  
31          1. Top plate fabricated from 1/8" stainless steel plate, ASTM A240/A240M,  
32           Type 304/304L with a 2D finish.  
33  
34          2. Bottom plate fabricated from HDPE and gasketed to prevent air from  
35           leaking between the top plate and the bottom plate.  
36  
37          3. Top and bottom nozzle plates shall be joined together using Type  
38           304/304L stainless steel hardware. Nozzles shall come pre-assembled.  
39  
40          4. Nozzles shall be designed with adequate strength to withstand vertical  
41           thrust of mixing air.  
42  
43          5. Threaded Rod Anchors: Use Hilti HIT-RE 500 adhesive or equal to be  
44           provided by the Contractor. A minimum of two threaded rods shall be  
45           installed per nozzle for flat floor installations, one each on opposite  
46           diagonal corners. Three threaded rods shall be installed per nozzle for  
47  
48

1 slope floor installations.  
2

3 6. Nozzles shall be installed in the locations as shown on the Drawings.  
4

5 D. Appurtenances  
6

7 1. Miscellaneous: Nuts, bolts, washers, threaded rod, and other non-  
8 welded parts shall be stainless steel, ASTM A240/A240M, Type 304.  
9 Threaded assemblies shall be chemically treated or lubricated prior to  
10 assembling to prevent galling.

11 2.03 FABRICATION  
12

13 A. The piping used for the air mixing system shall be Type 304/304L stainless  
14 steel unless otherwise noted.

15 B. Shop fabricate welded metal parts and assemblies from stainless steel,  
16 ASTM A240/A240M, Type 304/304L with a 2D finish.

17 C. Shop fabricate non-welded parts and pieces from sheets and plates of  
18 stainless steel, ASTM A240/A240M, Type 304 or from bars of stainless  
19 steel ASTM A276, Type 304, unless specified otherwise.

20 D. Welds and Welding Procedure  
21

22 1. Shop weld with filler wire using MIG, TIG or shield-arc, or plasma-arc  
23 welding inert gas processes. Provide a cross-section equal to or greater  
24 than parent metal.

25 2. Provide full penetration welds to interior surface with gas shielding to  
26 interior and exterior of joint.

27 3. Provide smooth, evenly distributed interior weld beads with an interior  
28 projection not exceeding 1/16 inch beyond inner diameter of nozzle  
29 header or fittings.

30 4. Field welding is not permitted.

31 5. Clean all welded stainless steel surfaces and welds after fabrication to  
32 remove weld splatter and finish clean all exterior welds, carbon deposits  
33 and contaminants by passivation per ASTM A380 Section 6.2.11.

34 2.04 CONTROLS  
35

36 A. Master Control Panel (MCP) Enclosure  
37

38 1. MCP shall have UL-rated NEMA 12 painted steel enclosure. The MCP  
39 shall be sized to provide heat dissipation such that, at 80 degrees F  
40 ambient temperature, the operating temperature rating of the lowest-

1                   rated component in the panel is not exceeded. The MCP shall meet the  
2                   requirements of Section 13630, including the requirement to furnish and  
3                   install a managed switch and a UPS in the MCP.

4

5                   B.     Valve Panel (VP) Enclosure

6

- 7
- 8                   1. VP shall have UL-rated NEMA 4X 304 stainless steel enclosures.  
9                   Control panels shall be sized to provide heat dissipation such that, at a  
10                  110 degree F ambient temperature, the operating temperature rating of  
11                  the lowest-rated component in the panel is not exceeded.

12

13                  C.     Power Connection

14

- 15
- 16                  1. All panels shall accept a single source 120 VAC power connection.  
17                  Lightning and surge protection shall be provided on the incoming line  
18                  power. Lightning and surge protection shall be as specified in Section  
19                  13630, 2.10.

20

21                  D.     MCP Operator Interface Terminal (OIT)

22

- 23
- 24                  1. The MCP shall have an OIT to make operating parameter changes and  
25                  acknowledge alarms. The OIT shall be an Allen Bradley Panel View  
26                  color touchscreen or equal. The OIT shall have flash memory capacity,  
27                  USB port, and Ethernet communication.

28

29                  E.     Controller

30

- 31
- 32                  1. The master control panel shall be equipped with an Allen Bradley  
33                  Compact Logix controller which controls the sequence, duration, and  
34                  frequency of ACV openings, or equal. The controller shall also provide  
35                  alarming functionality and network communication capabilities via  
36                  Ethernet TCP/IP protocols.

37

38                  F.     Air Control Valves (ACVs)

39

- 40
- 41                  1. The air control valves shall be, mounted to a common manifold. The  
42                  valves shall have a life expectancy of 15,000,000 cycles. Valves shall  
43                  vent to the outside of the panel.

44

45                  G.     Throttling Valve

46

- 47
- 48                  1. Each VP shall be equipped with a throttling valve to adjust the volume  
49                  of air released to the ACVs and corresponding header supply piping.  
50                  The throttling valve shall be pre-plumbed into the VP.

51

52                  H.     Control Air Filter

- 1       1. Each VP shall include a pre-plumbed 5-micron filter with a drain to  
2           remove fine particles, water vapor, and oil from the air supply. The filter  
3           shall be Watts F603D or approved equal.

4  
5       I. Heater

- 6  
7       1. Each control panel located outdoors shall be provided with a 120 VAC  
8           heater designed to maintain 40° F in an ambient outside temperature of  
9           20° F. The heater shall be equipped with a thermostat to turn the heater  
10          off at temperatures above 40° F.

11  
12      J. Nameplate

- 13  
14       1. A stainless steel nameplate shall be provided on the control panel. The  
15           nameplate shall be securely fastened in a conspicuous place and clearly  
16           inscribed with the Manufacturer's name, year of manufacture, and serial  
17           number.

18  
19       2.

20  
21      2.05 CONTROL AND OPERATION

22  
23       A. All control features shall be adjustable from the Operator Interface Terminal  
24           (OIT) provided by the mixing system Manufacturer. Control features shall  
25           be adjustable at any time during the operation of the system. Control  
26           features shall be initially set according to Manufacturer recommendations.

27  
28       B. Mixing Parameters

29  
30       1. The operator shall be able to enable/disable mixing operation, select the  
31           firing sequence, the firing duration and the frequency of firing. Minimum  
32           control features selected through the OIT shall include the following:

33  
34       a. Enable / Disable

35        1) ACV firing can be started and stopped at any point during  
36           operation without powering down the system.

37  
38       b. Firing Sequence

39        1) Order and operation in which ACVs are fired, e.g.  
40           1,2,3,..8 1,1,2,2,3,..8 8,1,7,2,..1.

41  
42       c. Firing Duration

43        1) Length of time an individual ACV is open during a firing  
44           event. The duration shall be operator adjustable within  
45           programmed limits and configurable for each ACV individually.

46  
47       d. Firing Frequency

48        1) Length of time to complete the firing sequence. Frequency shall  
49           be operator adjustable within programmed limits.

- 1  
2       e. Valve Isolation  
3           1) Individual ACVs or specific groups of ACVs may be added and/or  
4           removed from the firing sequence at any point during operation.  
5

6       C. Startup Modes  
7

- 8           1. The Controller shall enable startup modes that utilize the Manufacturer  
9           default settings, firing parameters set during the preceding mixing  
10          system operation, as well as new settings entered through the OIT.  
11

12       D. Alarms  
13

- 14           1. Each VP shall come equipped with a pressure transducer plumbed to  
15           the valve manifold. The pressure transducer shall transmit pressure  
16           anomalies to the controller. The controller shall interpret the pressures  
17           transmitted to provide a low system pressure alarm and monitor ACV  
18           position.  
19

20       E. Alarm Indication  
21

- 22           1. When either the low system pressure or Valve Fail to Open, Valve Fail  
23           to Close alarms occur, a red general alarm light shall be illuminated on  
24           the VP. The specific alarm shall be indicated on the alarm shall remain  
25           until the fault is corrected or the system is turned off.  
26

27       F. Heartbeat Function  
28

- 29           1. The controller shall have a register with a bit that toggles at a regular  
30           interval to act as a heartbeat for confirmation of continued controller  
31           operation and network communication.  
32

33       G. The controller shall communicate the following through Ethernet.  
34

- 35           1. System pressure
- 36           2. Firing sequence
- 37           3. Firing frequency
- 38           4. Firing duration (each valve)
- 39           5. System running (enabled)
- 40           6. Low pressure
- 41           7. Valve fail to open (each valve)
- 42           8. General alarm
- 43           9. Heartbeat
- 44           10. Compressor fault (each compressor)

45       H. The controller shall accept the following parameters through Ethernet:  
46

- 47           1. Enable Mixing
- 48           2. Firing sequence (up to 16 firing events)
- 48           3. Firing frequency

1                  4. Firing duration (each valve)

2                  2.06 AIR COMPRESSORS

- 5                  A. Two (2) air compressors shall be supplied. Each unit shall include an inlet air filter,  
6                  compressor with an AC motor, air/oil separator reservoir, air cooled oil cooler,  
7                  cooling fan, separator pressure relief valve, discharge check valve, air dryer,  
8                  moisture separator, particulate and coalescing filters, controls, control panel, base,  
9                  and unloading system.
- 10                B. Each compressor module shall be completely factory assembled requiring only  
11                field connection of electrical power, and air and condensate drain piping.
- 12                C. Each compressor shall be of the single stage, positive displacement, oil-flooded,  
13                rotary screw type. The compressor shall be provided with an integral skid or lifting  
14                lugs for unloading and placement.
- 15                D. Each compressor rotors shall be asymmetrical, steel or high strength ductile iron  
16                integral shafts, and dynamically balanced. Housings shall be cast iron. Rotors  
17                and housings shall be precision machined for accurate bearing positioning and  
18                running clearances. The drive arrangement shall be a gear driven design.
- 19                E. Positive pressure lubrication shall be provided by an inherent pressure differential  
20                system. Lubricant shall be provided as recommended by the Manufacturer. A  
21                lubricant filter shall have a high-capacity 10 micron rating.
- 22                F. An air/oil separator reservoir shall be provided for each compressor. The reservoir  
23                shall be designed and constructed in accordance with the ASME Code for Unfired  
24                Pressure Vessels and shall bear the code stamp. The reservoir shall include two-  
25                stage filtration to remove oil from air stream. Oil carry-over downstream of  
26                compressor modules shall not exceed 3 mg/m3.
- 27                G. Each air compressor module shall have automatic controls integral to the unit  
28                which open (loaded condition) and close (unloaded condition) the inlet valve to the  
29                air end to deliver appropriate volume to meet demand and maintain system target  
30                pressure. On sensing a low demand, the motor will keep running but the air end  
31                inlet valve will close, resulting in a decreased "idling" power draw on the motor.  
32                The valve shall reopen when system pressure drops below the set point.
- 33                H. Each baseplate shall be constructed of one-piece folded mild-steel with structural  
34                members and shall be designed for no measurable deflection with the equipment  
35                mounted thereon and the baseplate supported around its perimeter. Each base  
36                shall be designed so that all equipment bolted to it can be removed without access  
37                to the underside of the plate and with a flat top surface for ease of cleaning.  
38                Structural stiffeners shall be located under the compressors at the compressor  
39                anchor points.
- 40                I. Valves and piping within the enclosure shall be the compressor Manufacturer's  
41                standard. Relief valves shall be provided for equipment protection on the air and  
42                coolant systems as required
- 43                J. Each compressor shall be provided with an integral, dry-type intake filter. Intake  
44                filters shall have replaceable filter element(s). Particle arrestance shall be not less

1 than 99.9% efficient at 10 microns and above.  
2

- 3 K. Each compressor shall be supplied in a sound attenuated enclosure. The  
4 enclosure shall reduce the measured sound to a maximum of 85 decibels, as  
5 measured by ISO 8571, while the compressor is operating and the sound level is  
6 measured a distance of three feet from the enclosure.  
7
- 8 L. Each compressor electrical control cabinet shall be a NEMA 3R rated enclosure.  
9
- 10 M. A high air/fluid temperature shutdown system shall be provided. The unit must  
11 have safety devices mounted and wired. Safety devices shall include motor  
12 thermal overload and high compressor discharge temperature shut-down. These  
13 systems must be designed to prevent the compressor from running in an over  
14 temperature situation or motor from running in an overload condition.  
15
- 16 N. The two compressors shall each feature controls capable of operating at two  
17 pressure settings, selected by a panel mounted switch on the compressor's control  
18 panel. The controller shall allow one of two different pressure control settings to  
19 be chosen for each compressor. If the demand is greater than one unit's capacity  
20 (the lead compressor), the second compressor (the lag compressor) will  
21 automatically turn itself on until the excess demand has been satisfied. The lag  
22 compressor's motor will shut down after a set period of time in which it is not loaded  
23 as described in paragraph above. The lead/lag circuits shall be fully incorporated  
24 inside the compressor's control panel. No additional separate control sequence  
25 panels shall be required.  
26
- 27 O. The compressors shall be as manufactured by Atlas Copco, Model GA22+ or  
28 equal.  
29
- 30 P. Refrigerated Dryers  
31

- 32 1. A cycling refrigerated air dryer shall be provided for each compressor.  
33 The dryers shall produce an ISO Class 4, 7°C dew point at the dryer exit  
34 when operating continuously at the rating conditions of 2°C and RH of  
35 60%.  
36
- 37 2. The dryers shall be capable of continuously drying the maximum  
38 discharge capacity of the air compressor.  
39
- 40 3. The dryers shall be integral or separately mounted to the compressor  
41 package.  
42

43 2.07 FREE STANDING AIR RECEIVER  
44

- 45 A. One (1) air receiver shall be provided. The receivers shall be designed and  
46 constructed in accordance with the ASME Code of Unfired Pressure Vessels and  
47 shall bear the code stamp.  
48
- 49 B. Receivers shall be factory powder coated. One quart touch-up paint shall be  
50 provided.  
51
- 52 C. Each receiver shall be provided with mounting feet, safety relief valve and pressure

1                   gauge.  
2

- 3                   D. Each receiver shall be provided with a 24 VDC motor-operated ½" FNPT stainless  
4                   steel ball valve powered and controlled out of an adjacent VP or MCP.

5

6

7        **2.08 COMPRESSOR SYSTEM PARTICULAR AND COALESCING OIL FILTERS**

8

- 9                   A. Replaceable-cartridge primary particulate and secondary high-efficiency oil-  
10                  removal filters shall be provided for the compressor package. Following both  
11                  filters, the maximum particulate size removal shall be to 1 micron and coolant  
12                  removal shall be to 0.1 mg/m<sup>3</sup> at 21°C.  
13
- 14                   B. The filters shall be rated for the maximum discharge capacity of the air  
15                  compressor.

16

17        **2.09 COMPRESSOR SYSTEM ELECTRICAL**

18

- 19                   A. All electrical and control equipment for the air compressor module shall be  
20                  furnished as required for a complete installation, requiring only field connection of  
21                  480 VAC, three phase power supply.  
22
- 23                   B. The compressor electric motor shall be rated 480 volts, 60 Hz, three phase.

24

25        **2.10 COMPRESSOR SYSTEM CONTROL PANEL**

26

- 27                   A. An enclosure-integrated control panel mounted on the compressor module shall  
28                  include:  
29
- 30                   1. Full voltage, non-reversing, motor starters sized as required by the  
31                  Manufacturer.  
32
- 33                   2. Control power transformers shall have both primary leads fused, one  
34                  secondary lead fused, and one secondary lead grounded.  
35
- 36                   3. Terminal blocks for all system wiring. Internal panel wiring shall be  
37                  neatly bundled and tied and shall be identified with suitable wire markers  
38
- 39                   4. Controller shall be provided to indicate the following conditions;  
40                  Differential pressure across fluid filter, discharge pressure, compressor  
41                  discharge temperature, power on, hours of operation, operating mode,  
42                  differential separator, percent capacity, air filter.  
43
- 44                   5. A contact which closes under alarm conditions shall be provided for the  
45                  compressor for remote "FAIL" alarm. The contact shall close when any  
46                  alarm occurs for the compressor.  
47
- 48                   6. Remote mounted fusible disconnects with time delay fuses shall be  
49                  provided by Contractor.  
50

1    2.11 COMPRESSOR SHOP PAINTING

- 2  
3    A.    All components of the compressed air equipment system shall be shop primed and  
4        finish painted with the Manufacturer's standard paint system prior to shipment to  
5        the site.

6  
7    2.12 COMPRESSOR SYSTEM PERFORMANCE AND DESIGN REQUIREMENTS

- 8  
9    A.    The compressed air equipment shall be designed for the following operating  
10      conditions:

Ambient Conditions		
	Max Air temperature, F	100
	Min Air temperature, F	35
	Relative humidity, percent	100
	Barometric pressure, psia	14.7
Compressors		
	Number required	2
	Maximum discharge pressure, psig	100
	Capacity at operating target pressure, acfm	140
	Motor size, hp	30
	Max motor shaft speed, rpm	3600
	Max free field noise $\pm 3$ dB(A) when measured in free field conditions at a distance of 1 meter according to ISO1217	70
Receivers		
	Number required	1
	Design pressure, psig	200
	Nominal volume, gal	400
Filters		
	Type	Particulate and Oil Removal
	Number required	1 each/compressor
Refrigerated Air Dryer		
	Type	Cycling
	Number required	1
	Target Pressure Dew Point ( $^{\circ}$ C)	1 – 3

14

15

16    2.13 COMPRESSOR PRESSURE TRANSDUCER

17

18    A.    Each compressor shall be equipped with a pressure transducer plumbed to the

19        discharge piping to monitor the common discharge pressure from the

20        compressors.

21

1 PART 3 – EXECUTION  
2

3 3.01 INSTALLATION  
4

- 5       A. Install items in accordance with approved shop drawings, Manufacturer's  
6       printed instructions and as indicated.  
7  
8       B. All nozzles on respective nozzle header shall be level within ½-inch of a  
9       common horizontal plane.

10 3.02 MANUFACTURER'S FIELD SERVICES  
11

- 12       A. General - Furnish the services of a factory representative to inspect the  
13       installation, supervise a test run of the system, conduct the performance  
14       testing, and provide training for the Owner's operations and maintenance  
15       staff in proper operation and maintenance of the equipment. The factory  
16       representative shall provide a written certification that the system is installed  
17       in accordance with the manufacturer's recommendations.  
18  
19       B. The final copies of Operation and Maintenance manuals specified in Section  
20       01730 must be delivered to the Engineer prior to scheduling the instruction  
21       period with the Owner.  
22  
23       C. A minimum of 4-on-site days shall be scheduled by the Manufacturer's  
24       technical representative to provide the services described.

25 3.03 FIELD PERFORMANCE TESTING AND GUARANTEE  
26

- 27       A. All mixer piping and components shall be field tested with 2-feet nominal of  
28       submergence initial for leaks. All leaks shall be repaired as required.  
29  
30       B. After initial leak testing has been conducted and all leaks repaired, the  
31       Contractor shall fill the tank with reclaimed water to the invert of the tank  
32       overflow pipe. All mixer piping and components shall be field tested with a  
33       full tank of reclaimed water and repairs made as required.  
34  
35       C. Exposed, non-submerged air piping shall be tested by Contractor for leaks  
36       using soapy water on all joints and applying 100 psi test pressure. Buried  
37       air piping shall be tested using this method before the trench is filled.  
38  
39       D. The Contractor shall operate the mixing system with reclaimed water at the  
40       maximum water surface elevation in the basins for a continuous period of  
41       not less than 72 hours. The Contractor shall correct and resolve all  
42       operating problems, deficiencies, etc., determined as a result of the tests.  
43  
44       E. After the above testing is complete, field mixing performance testing of the  
45       installed compressed gas mixing system shall be performed by the  
46       Manufacturer as described below.

- 1       1. Mixing performance testing shall be conducted in the Equalization Tank.
- 2
- 3
- 4       2. All personnel and equipment necessary to conduct and supervise all
- 5       testing shall be provided by the compressed gas mixing system
- 6       Manufacturer. Engineer/Owner shall be notified of the test to witness at
- 7       their option and expense.
- 8
- 9       3. The tank shall be filled with typical influent wastewater with TSS in
- 10      typical operating range of 150 – 350 mg/L. No flow shall enter or exit
- 11      the respective basin for two hours prior to and during the test.
- 12
- 13      4. The compressed gas mixing system Manufacturer shall conduct total
- 14      suspended solids (TSS) testing using a Cerlic TSS probe, or equal,
- 15      suspended solids analyzer.
- 16
- 17      5. Testing Procedure:
  - 18           a. In the mixing test, the compressed gas mixing system shall have
  - 19           been in normal operating mode for at least two days prior to testing
  - 20           and must have TSS in the typical operating range indicated above.
  - 21
  - 22           b. Four horizontal-plane sample sites to be tested shall be selected by
  - 23           the Engineer. At each sample site, three vertical samples shall be
  - 24           collected as follows: 24-inches from the surface, tank sidewall mid-
  - 25           point and 24-inches above the tank sidewall bottom. Each sample
  - 26           site must be a minimum of 4 ft away from any structure within the
  - 27           tank. The samples for each location shall be analyzed as described
  - 28           above.
  - 29
  - 30           c. The Coefficient of Variation (Cv) shall be determined for the sample
  - 31           set, excluding the maximum and minimum samples. The Cv shall be
  - 32           calculated by taking the resultant set of ten (10) samples as follows:
  - 33            $Cv = (100 \times \text{Standard Deviation of Ten Samples}) / (\text{Mean Value of Ten Samples})$ .
  - 34
  - 35           d. If the Cv is less than or equal to 10% then the mixer performance
  - 36           shall be acceptable for that location.
  - 37
  - 38           e. If the Cv is greater than 10%, then the mixer performance shall be
  - 39           unacceptable for that location and the Contractor and/or
  - 40           Manufacturer shall make all necessary improvements (at no
  - 41           additional cost to the Owner) and repeat the testing procedure at no
  - 42           additional cost to the Owner until the Cv is less than or equal to 10%
  - 43           for that location.
  - 44
  - 45
  - 46
- 47           END OF SECTION
- 48

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1 SECTION 13210  
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3 BOLTED STEEL WATER STORAGE TANK  
4

5 PART 1 GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. Furnish and erect one (1) glass-fused-to-steel bolted water storage tank including  
10 foundation, tank structure, and tank appurtenances as shown on the contract  
11 drawings and described herein.  
12
- 13 B. All required labor, materials and equipment shall be included.  
14

15 1.02 SUBMITTALS  
16

- 17 A. Construction shall be governed drawings and Specifications showing general  
18 dimensions and construction details, after review by the Engineer of detailed  
19 erection drawings prepared by the tank manufacturer. There shall be no deviation  
20 from the drawings and specifications, except upon written order from the Engineer.  
21
- 22 B. The Contractor shall furnish six (6) sets of shop drawings in accordance with  
23 Section 01300 and 01340. A complete set of structural calculations shall be  
24 provided for the tank structure and foundation. All such submissions shall be  
25 stamped by a Registered Professional Engineer licensed in the State of Florida,  
26 as well as, by a Registered Professional Engineer employed on the tank  
27 manufacturer's engineering staff.  
28
- 29 C. The tank manufacturer's standard published warranty shall be included with  
30 submittal information. Submit detailed design drawings sealed by a professional  
31 engineer registered in the State of Florida.  
32
- 33 D. Submit design calculations sealed by a professional engineer registered in the  
34 State of Florida.  
35
- 36 E. Submit mix designs for floor slab and footing concrete mixes.  
37

38 1.03 QUALIFICATIONS OF TANK SUPPLIER  
39

- 40 A. The Engineer's selection of factory applied glass-fused-to-steel bolt together tank  
41 construction for this facility has been predicated upon the design criteria,  
42 construction methods specified, and optimum coating for resistance to internal and  
43 external tank surface corrosion. Deviations from the specified design,  
44 construction, or coating details, will not be permitted.  
45
- 46 B. The Contractor shall furnish a new tank structure as supplied from a  
47 manufacturer/erector specializing in the design, fabrication and erection of factory

BOLTED STEEL WATER STORAGE TANK

1 applied glass-fused-to-steel, bolt together tank systems. The  
2 manufacturer/erector shall employ a staff of full time engineers, and shall own and  
3 operate its production plant, fabricate and glass coat the tank at one location.  
4

- 5 C. The tank shall be a glass coated, rolled tapered panel (RTP) bolted tank as  
6 manufactured by CST Storage of DeKalb, Illinois; Tank Connection of Parsons,  
7 Kansas; or equal.  
8
- 9 D. Alternate glass-fused-to-steel tank products, as provided by other manufacturers,  
10 will be considered for prior approval by the Engineer. Manufacturers lacking the  
11 experience requirement will not be considered.  
12
- 13 E. Strict adherence to the standards of design; fabrication; erection; product quality;  
14 and long term performance, established in this Specification will be required by the  
15 Owner and Engineer.  
16
- 17 F. Tank substitutions that cause engineering and contract changes - the tank  
18 installation as shown on the plans and specified herein, is based on the equipment  
19 furnished by one manufacturer. A tank that is offered as a substitute to the specific  
20 requirements of these Specifications and that differs in detail and arrangement  
21 from that shown may require changes in design and construction. All costs  
22 resulting from such changes in design and construction are to be borne entirely  
23 and unconditionally by the Contractor; said costs to include but not be limited to  
24 structural, piping, mechanical and electrical changes and all engineering costs  
25 incurred as a result of the substitution, in the revision of Plans and Specifications,  
26 review of design changes by others, preparation of change orders, and any other  
27 costs directly resulting from said substitution.  
28

29 **1.04 TANK DESIGN CRITERIA**

30     A. Tank Design Standards  
31

- 32         a. The materials, fabrication, and erection of the bolt together tank shall conform  
33 to the AWWA Standard for "Factory Coated Bolted Steel Tanks For Water  
34 Storage" - ANSI/AWWA D103, latest revision (potable water applications) or  
35 AISC for wastewater tank applications.  
36         b. Florida Building Code 2017.  
37         c. The tank coating system shall conform solely to Section 12.4 of ANSI/AWWA  
38 D103. NOTE: Baked-on epoxy painted or galvanized bolt-together tanks are  
39 not considered equal.  
40         d. The glass coating on the tank, bolt head encapsulation material, and joint  
41 sealant shall have been approved for listing under ANSI/NSF Standard 61 for  
42 Indirect Additives.  
43         e. The tank manufacturer shall be ISO-9001 certified to assure product quality.  
44

45     B. Tank Size: The factory-coated glass-fused-to-steel, bolt together tank shall have a  
46 nominal diameter of 120 feet, with a nominal sidewall height of 25 feet.  
47

- 1           C. Tank Capacity: Tank effective capacity shall be 2,021,000 gallons (nominal, U.S.  
2           gallons) with 24" freeboard.
- 3           D. Floor Elevation: Finished floor elevations shall be as shown on the Drawings.
- 4           E. Design Loads:  
5            a. Specific Gravity 1.0 (Min. design shall be 1.0)  
6            b. Wind Velocity 160 mph (ASCE 7-05 Design)  
7            c. Wind Default: AWWA D103-09  
8            d. Allowable Soil Bearing Capacity: Per Geotechnical Report in the Appendix  
9            e. Roof Snow Load: N/A  
10           f. Seismic Design: AWWA D103-09  
11           g. Seismic Site Class D  
12           h. Seismic Importance Factor (Ie): 1.5; Seismic TL: 8
- 13           F. Tank Design will include provisions for a future domed cover with an eight (8)  
14           foot vertical skirt.

15           **PART 2       PRODUCTS**

16           **2.01 PLATES AND SHEETS**

- 17           A. Plates and sheets used in the construction of the tank shell, tank floor and tank  
18           roof, shall comply with the minimum standards of AWWA D103, Section 4.4.
- 19           B. Design requirements for high strength steel shall be per AWWA D103.
- 20           C. The annealing effect created from the glass coated firing process shall be  
21           considered in determining ultimate steel strength. In no event shall a yield strength  
22           greater than 50,000 psi be utilized for calculations as detailed in AWWA D103,  
23           Sections 5.4 and 5.5.
- 24           D. Sheet edge protection: each full size steel sheet, all rectangular floor sheets (if  
25           glass/steel floor is designed) and all foundation/starter sheets will have a  
26           mechanically rounded edge (bullnose profile) to specific radii per Porcelain Enamel  
27           Institute PEI-101. The sheets shall be glass coated with a minimum of 5 mil  
28           thickness along the rounded edges. Edge coating shall provide full encapsulation  
29           of the sheet edges.
- 30           E. Concrete materials shall meet the requirements of ACI 301. Cement shall be  
31           Portland Type I or II. Up to 25% of cement may be replaced by fly ash. The design  
32           mix shall have a minimum compressive strength of 4,000 psi.

33           **2.02 ROLLED STRUCTURAL SHAPES**

- 34           A. Material shall conform to minimum standards of ASTM A36 or AISI 1010.

1

2 2.03 HORIZONTAL WIND STIFFENERS

3

- 4 A. Design requirements for intermediate horizontal wind stiffeners shall be of the "web  
5 truss" design with extended tail to create multiple layers of stiffeners, permitting  
6 wind load to be distributed around the tank.
- 7 B. Web truss stiffeners shall be of steel with hot dipped galvanized coating.
- 8 C. Rolled steel angle stiffeners are not permitted for use as intermediate stiffeners.

9

10 2.04 BOLT FASTENERS

11

- 12 A. Bolts used in tank lap joints shall be  $\frac{1}{2}$  - 13 UNC-2A rolled thread, and shall meet  
13 the minimum requirements of AWWA D103, Section 2.
- 14 B. Bolt Material – SAE J429 Grade 8
- 15 C. Bolt Finish – JS1000 or mechanically deposited finish
- 16 D. Bolt Head Encapsulation
- 17 1. High impact polypropylene copolymer encapsulation of entire bolt head.
- 18 2. Resin shall be stabilized with an ultraviolet light resistant material such that  
19 the color shall appear black. The bolt head encapsulation shall be certified  
20 to meet the ANSI/NSF Standard 61 for indirect additives.
- 21 E. All bolts on the vertical tank wall shall be installed such that the head portion is  
22 located inside the tank, and the washer and nut are on the exterior.
- 23 F. All lap joint bolts shall be properly selected such that threaded portions will not be  
24 exposed in the "shear plane" between tank sheets.
- 25 G. Bolt lengths shall be sized to achieve a neat and uniform appearance. Excessive  
26 threads extending beyond the nut after torqueing will not be permitted.
- 27 H. All lap joint bolts shall include a minimum of four (4) splines on the underside of  
28 the bolt head at the shank in order to resist rotation during torqueing.
- 29 I. Polyethylene co-polymer "bolt caps" and sealant shall be used to cover the bolts,  
30 nuts, and washers exposed on the outside of the tank sidewall.

31

32 2.05 SEALANTS

33

- 34 A. The lap joint sealant shall be a one component, moisture cured, polyurethane  
35 compound. The sealant shall be suitable for contact with potable water and meet

1 applicable FDA Title 21 regulations, as well as, ANSI/NSF Additives Standard 61.  
2

- 3       B. The sealant shall be used to seal lap joints and bolt connections. The sealer shall  
4       not be used as a coating except for minimal exposed panel edges for the  
5       embedded starter ring, notches of sidewall panels, and edges exposed for nozzle  
6       connections. The sidewall panel edges shall be protected by the fused glass  
7       coating (spray or brush on coatings are not acceptable). The sealant shall cure to  
8       a rubber like consistency, have excellent adhesion to the glass coating, have low  
9       shrinkage, and be suitable for interior and exterior exposure.
- 10      C. Sealant curing rate at 73° F and 50% RH  
11       1. Tack-free time: 6 to 8 hours.  
12       2. Final cure time: 10 to 12 days.
- 13      D. Neoprene gaskets and tape type sealer shall not be used.

14     **2.06 GLASS PROCESS**

- 15       A. Surface Preparation: The tank sheets shall be steel grit-blasted on both sides to  
16       the equivalent of SSPC-10 (near white blast cleaning). Sand blasting and chemical  
17       pickling of steel sheets is not acceptable. The surface anchor pattern shall be not  
18       less than 1.0 mil. These sheets shall be evenly oiled on both sides to protect them  
19       from corrosion during fabrication.
- 20       B. Cleaning: After fabrication and prior to application of the coating system, all sheets  
21       shall be thoroughly cleaned by a caustic wash and hot rinse process followed  
22       immediately by hot air drying. Inspection of the sheets shall be made for traces of  
23       foreign matter, soil particles, grease, or rust. Any such sheets shall be re-cleaned  
24       or grit-blasted to an acceptable level of quality.
- 25       C. Coating:  
26       1. A base coat of glass frit containing nickel oxide shall be applied to both sides  
27       of the sheet.  
28       2. A second coat of milled cobalt blue glass shall be applied to both sides of the  
29       sheet.  
30       3. A third coat of glass shall be applied to all interior sidewall and floor sheet  
31       surfaces which must be a titanium dioxide reinforced mixture, white color. The  
32       specified coating shall be AQUA AGT 2020 or Aquastore Vitrium. An  
33       acceptable alternate three coat system must be submitted for approval at least  
34       three weeks prior to the bid.  
35       4. The same glass coating as applied to the exterior sheet surfaces shall be  
36       applied to the exposed edges.  
37       5. The sheets shall then be fired at a minimum temperature of 1500 degrees F in  
38       strict accordance with the manufacturer's ISO 9001 quality control procedures,  
39       including firing time, furnace humidity, temperature control, etc.

- 1       6. The interior coating process for sidewall sheets and floor must be a 3 coat  
2       process. The interior color shall be white. The exterior color shall be cobalt  
3       blue.  
4       7. Dry film interior coating thickness shall be 10.0 -18.0 mils (0.010 to 0.018  
5       inches) minimum.  
6       8. Dry film exterior coating thickness shall be 7.0 – 15.0 mils (0.007 to 0.015  
7       inches) minimum.  
8       9. The finished exterior color shall be the manufacturer's standard cobalt blue.  
9

10      D. Factory Inspection: The manufacturer's quality system shall be ISO 9001 certified  
11      and refer to ISO (International Organization for Standardization) for the following  
12      testing and procedures.

- 13      1. Chemical Resistance of Glass Coating: Frits shall be individually tested in  
14      accordance with pertinent sections of ISO 28706-1:2008.  
15  
16      2. Measurement of Glass Thickness: Glass thickness shall be measured using an  
17      electronic dry film thickness gage (magnetic induction type). The thickness  
18      gage shall have a valid calibration record.  
19  
20      a. The thickness of the glass shall be between 10.0 and 18.0 mils (0.010 and  
21      0.018 inches).  
22  
23      3. Measurement of Color: The exterior color of the sheets shall be measured  
24      using a colorimeter. The colorimeter shall have a valid calibration record. The  
25      color must fall within the tolerances specified by the tank manufacturer, else  
26      the panel shall be rejected.  
27  
28      4. Factory Holiday Test: A dry volt test using a minimum of 1100 volts is required.  
29      Frequency of the test shall be every sheet. Any sheet registering a discontinuity  
30      on the interior surface or floor shall be rejected.  
31  
32      5. Fishscale test: The glass coating shall be tested in-house for fishscale by  
33      placing the full size production sheets in an oven at 400° F for one hour. The  
34      sheets shall then be examined for signs of fishscale. Any sheet exhibiting  
35      fishscale shall be rejected and all sheets from the gage lot will be similarly  
36      tested.  
37  
38      6. Impact Adherence Test: The adherence of the glass coating to the steel shall  
39      be tested in accordance with ISO standards. Any sheet that has poor  
40      adherence shall be rejected.

41      2.07 PACKAGING

- 42      A. All approved sheets shall be protected from damage prior to packing for shipment.  
43  
44      B. Heavy paper or plastic foam sheets shall be placed between each panel to  
45      eliminate sheet-to-sheet abrasion during shipment.

- 1           C. Individual stacks of panels will be wrapped in heavy mil black plastic and steel  
2           banded to special wood pallets built to maintain the roll-radius of the tank panels  
3           and minimize contact or movement of finished panels during shipment.  
4
- 5           D. Shipment from the factory to the job site will be by truck, hauling the tank  
6           components exclusively. No common carrier, drop, or transfer shipments.  
7

8           **2.08 ROOF**

- 9
- 10          A. The tank shall be designed to accept the addition of a tank roof at a later date (a  
11           clear-span, aluminum geodesic dome) along with an 8-foot tall structural aluminum  
12           skirt enclosure 360 degrees around the top of the tank sidewall. The aluminum  
13           dome cover shall be constructed of non-corrugated triangular aluminum panels,  
14           which are sealed and firmly clamped in an interlocking manner to a fully  
15           triangulated aluminum space truss system of wide flange extrusions, thus forming  
16           a spherical dome structure.  
17
- 18          B. The aluminum dome shall be clear-span and designed to be self-supporting from  
19           the periphery structure with primary horizontal thrust contained by an integral  
20           tension ring. The dome dead weight shall not exceed 3 pounds per square foot of  
21           surface area.  
22
- 23          C. The actual dome and skirt are not part of this project.  
24

25           **2.09 APPURTENANCES**

- 26
- 27
- 28          A. Pipe Connections: Where pipe connections are shown to pass through tank  
29           panels, they may be factory located prior to glass coating, or field located, saw cut,  
30           (acetylene torch cutting or welding is not permitted), and utilize an interior and  
31           exterior flange assembly. For field located openings, a single component urethane  
32           sealer shall be applied on any cut panel edges or bolt connections.  
33
- 34          B. The tank manufacturer shall coordinate with the contractor and supply all required  
35           pipe and conduit supports and hardware that attach to the tank. All supports and  
36           hardware shall be 316 stainless steel.  
37
- 38          C. Sidewall Access Manway: One sidewall access manway shall be provided as  
39           shown on the Drawings in accordance with AWWA D-103. Such manway shall be  
40           a minimum of 30-inches in diameter and shall include a properly designed  
41           reinforcing frame and cover plate. A davit to hold the cover plate, when opened,  
42           shall be furnished and installed.  
43
- 44          D. Identification Plate: A manufacturer's nameplate shall list the tank serial number,  
45           tank diameter and height, and maximum design capacity. The nameplate shall be  
46           affixed to the tank exterior sidewall at a location approximately five (5') feet from  
47           grade elevation in a position of unobstructed view.

1  
2       E. Cathodic Protection: The manufacturer shall design and supply a passive,  
3           sacrificial anode cathodic protecting system. The anodes shall be floor mounted.  
4           The cathodic protection system shall be designed for protection of uncoated steel  
5           surfaces in the product zone, including rebar within the uncoated concrete tank  
6           floor.

7  
8       **PART 3      EXECUTION**

9  
10      **3.01 FOUNDATION**

- 11  
12       A. The tank foundation is a part of the tank manufacturer's contract and shall be  
13           installed by the tank manufacturer/erector per the tank manufacturers' drawings.
- 14  
15       B. The tank foundation shall be designed by the manufacturer to safely sustain the  
16           structure and its live loads.
- 17  
18       C. Tank stem wall design shall be based on the soil bearing capacity given in the  
19           geotechnical report located in the Appendix.
- 20  
21       D. The tank manufacturer shall notify the Engineer of any soil bearing strengths less  
22           than that required.
- 23  
24       E. Embedded starter ring shall be 19-inch minimum or as determined by the  
25           manufacturer.
- 26  
27       F. Slot mount concrete footing is not acceptable. The floor shall be reinforced  
28           concrete construction and shall be designed as a membrane slab in accord with  
29           AWWA D-110.

30  
31      **3.02 TANK FLOOR**

- 32  
33       A. The floor shall be of reinforced concrete with an embedded glass fused to steel  
34           starter sheet per the manufacturer's design, and is an integral element of the tank  
35           assembly; therefore, the tank floor slab with embedded starter sheet shall be  
36           constructed by the tank manufacturer/erector using manufacturer-trained  
37           personnel regularly engaged in this type of tank construction. Floor shall be sloped  
38           to the sump as shown on the drawings. The tank floor slab shall have a minimum  
39           thickness of 6-inches and shall have a minimum reinforcement ratio (ratio of gross  
40           concrete area to reinforcement area) of 0.005.
- 41  
42       B. Leveling of the starter ring shall be required and the maximum differential elevation  
43           within the ring shall not exceed one-eighth (1/8) inch, nor exceed one-sixteenth  
44           (1/16) inch within any ten (10) feet of length.
- 45  
46       C. A leveling plate assembly, consisting of two 18-inch anchor rods (3/4-inch dia.) and  
47           a slotted plate (3 1/2" X 11" X 3/8" thick) shall be used to secure the starter ring,

1 prior to encasement in concrete. Installation of the starter ring on concrete blocks  
2 or bricks, using shims for adjustment, is not permitted.  
3

- 4 D. Two water stop seals made of a butyl rubber elastomer special for this application  
5 shall be placed on the inside surface of the starter ring below the concrete floor  
6 line. These materials shall be installed as specified by the tank  
7 manufacturer/erector.

8  
9 3.03 SIDEWALL STRUCTURE

- 10 A. Field erection of the Glass Fused to Steel, bolted-steel tank shall be in strict  
11 accordance with the procedures outlined in the manufacturer's erection manual,  
12 and performed by an authorized dealer of the tank manufacturer, regularly  
13 engaged in erection of these tanks. Dealer's field supervisor shall be certified by  
14 the manufacturer as having undergone factory training in proper tank erection  
15 techniques.
- 16 B. Specialized erection jacks and building equipment developed and manufactured  
17 by the tank manufacturer shall be used to erect the tanks.
- 18 C. Particular care shall be taken in handling and bolting of the tank panels and  
19 members to avoid abrasion of the coating system. Prior to liquid test, all surface  
20 areas shall be visually inspected by the Engineer.
- 21 D. An electrical leak test shall be performed during erection using a nine (9) volt leak  
22 detection device. All electrical leak points found on the inside surface shall be  
23 repaired in accordance with manufacturer's published touch up procedure.
- 24 E. The placement of sealant on each panel may be inspected prior to placement of  
25 adjacent panels. However, the Engineer's inspection shall not relieve the  
26 manufacturer/erector from his responsibility for liquid tightness.
- 27 F. No backfill shall be placed against the tank sidewall without prior written approval  
28 and design review of the tank manufacturer. Any backfill shall be placed according  
29 to the strict instructions of the tank manufacturer.

30  
31 3.04 TESTING

- 32 A. Hydrostatic Testing: Following completion of erection and cleaning of the tank, the  
33 structure shall be tested for liquid tightness by filling tank to its overflow elevation  
34 with reclaimed water. Any leaks disclosed by this test shall be corrected by the  
35 erector in accordance with the manufacturer's recommendations. Water required  
36 for testing shall be furnished by the owner at the time of tank erection completion,  
37 and at no charge to the tank erector. Disposal of test water shall be the  
38 responsibility of the Contractor.

39  
40 3.05 WARRANTY

- 1
- 2       A. Tank Manufacturer's Warranty: The tank manufacturer shall include a warranty for
- 3           the tank materials and coating. As a minimum, this warranty shall provide
- 4           assurance against defects in material or workmanship of the glass-coated surface
- 5           for the minimum period specified. The tank manufacturer shall warrant the liquid
- 6           storage tank shall be free from any defect in material or workmanship under normal
- 7           and proper use, maintenance and operation, during the period expiring on the
- 8           earlier of five (5) years after liquid is first introduced into the tank or 62 months
- 9           after the substantial portion of the tank sheets is delivered to the site where the
- 10          tank is erected.
- 11
- 12       B. Tank Erector's Warranty: The tank erector shall warrant the tank
- 13           erection/installation to be free from defects in workmanship and materials during
- 14           the period expiring on the earlier of one (1) year after liquid is first introduced into
- 15           the tank or 14 months after notice of substantial completion of the tank erection.
- 16           In addition, any defect to be corrected under the tank manufacturer's warranty shall
- 17           be corrected by the Tank manufacturer/erector at no cost to the Owner.
- 18
- 19
- 20
- 21

END OF SECTION

1 SECTION 13300  
2

3 FRP COVER SYSTEM  
4

5 PART 1 - GENERAL  
6

7 1.01 DESCRIPTION OF WORK  
8

9       A. Furnish all labor materials, equipment and hardware required to place in  
10      satisfactory service fiberglass reinforced plastic flat covers over the four grit  
11      removal tanks as shown on the drawings and specified herein. The FRP  
12      covers shall include all support beams and composite panels, anchor bolts,  
13      fasteners and gaskets required for a complete installation. Loose pieces,  
14      such as closure strips or seals and other such items shall not be allowed.  
15

16 1.02 QUALITY ASSURANCE  
17

18       A. Quality assurance shall be as required in other Sections of the specifications  
19      and the following requirements:

21       1. Manufacturer and erector shall demonstrate experience of a minimum  
22      of five (5) years in Industrial Construction and FRP erection.

24       B. A system of quality control is required of the manufacturer of the panels to  
25      assure and to document that the panels are manufactured to the following  
26      standards and conditions where applicable:  
27

28             ASTM D638 - Tensile Properties of Plastics

29             ASTM D790 - Flexural Properties of Plastics

30             ASTM D2538 - Indentation Hardness of Plastics (barcol)

31             National Bureau of Standard, PS 15-69

33       C. FRP Covers shall be flat covers as manufactured by Midwestern Fabricators,  
34      or approved equal.

36 1.03 SUBMITTALS  
37

38       A. General arrangement drawings showing complete structure, fasteners, other  
39      such items and erection procedures for a complete assembly.

41       B. Shop drawings showing detail of all components including installation  
42      instructions.

44       C. Design calculations sealed by a registered professional engineer in the state  
45      of Florida.  
46

- 1           D. Certification that manufacturer has been actually engaged in the manufacture  
2           of fiberglass flat panel covers for a minimum of five years.  
3  
4           E. Color samples for approval.  
5  
6           F. Operation and maintenance manuals to include:  
7  
8                 1. Installation instructions, operation and maintenance  
9                 instructions, copies of all approved drawings, material  
10                specifications of resin used, procedures, and repair procedures  
11                for fiberglass.

12

## PART 2 - PRODUCTS

13

### 2.01 DESIGN

- 14
- 17           A. Flat covers shall be designed to provide a minimum safety factor of three to  
18           one against maximum calculated stresses and ultimate physical properties of  
19           the laminate.
- 20
- 21           B. The panels shall be designed to withstand a combined live load of 2-inch  
22           water column vacuum, 150 PSF live load and 5 psf dead load with a  
23           maximum deflection of L/120.
- 24
- 25           C. All panels shall be completely sealed and any access holes, or other  
26           penetrations that pass through the panels shall be completely sealed.
- 27
- 28           D. Each tank covers shall be furnished with four (4) 30-inch by 30-inch access  
29           hatches to allow inspection of the equipment below. Coordinate the location  
30           of the hatches with the stacked tray grit removal equipment supplier.
- 31
- 32           D. Panels shall be designed to support a 250 lb. point load on an area 1 ft. x 2  
33           ft. anywhere on the cover.
- 34
- 35           E. Any connections, such as ducting or vents that fasten to the panels, shall be  
36           provided with molded-in nut plates or molded-in studs in the panels so that  
37           bolting shall be from the exterior of the cover.

38

### 2.02 MATERIALS

- 39
- 42           A. FRP covers shall be specifically designed, constructed and installed for the  
43           service intended. The materials shall provide a minimum of three to one  
44           factor of safety against the maximum calculated stresses.
- 45
- 46           B. Resin shall be suitable for Fiberglass reinforcement shall consist of a  
47           combination of chopped strand matt and woven roving suitably treated with a

- 1                   finish compatible with the resin system. Glass content shall not be less than  
2                   25 percent.
- 3
- 4                   C. Panels shall be manufactured using sandwich type construction but the effect  
5                   of the core material will not be allowed in calculating the bending, tensile,  
6                   rigidity or buckling stresses of the fiberglass skins and panel, i.e., the  
7                   fiberglass shell shall support all of the loads as though the core material was  
8                   not present.
- 9
- 10                  D. Each panel will be manufactured with overlapping seams. These seams  
11                  shall contain molded-in Type 304 S.S. nut plates for fastening the panels  
12                  together with stainless steel bolts from the exterior of cover.
- 13
- 14                  E. Gaskets shall be supplied and installed between the seams and along the  
15                  outside edge of all panels. The gaskets shall be suitable for service over raw  
16                  municipal wastewater grit removal tanks with high levels of hydrogen sulfide  
17                  gas, other organic sulfide gases, and ammonia gas.
- 18
- 19                  F. The panels shall rest on the concrete slab, curb wall or be supported from  
20                  above and held in place by 304 SS anchor bolts with suitable SS washers.
- 21
- 22                  G. The top of the panels shall be peaked, to allow for drainage, with a non-skid  
23                  surface. The panels shall be 3-inches high in the center and slope towards  
24                  the ends, at approximately  $\frac{1}{4}$ -inch per foot. Any structure needed for support  
25                  of the panels shall be placed to the topside of the panels. All structural  
26                  beams shall be box beam fabricated using the filament winding method.
- 27
- 28                  H. The exterior surface of the fiberglass panels shall contain ultra-violet  
29                  stabilizers for protection against sunlight. The color of the cover system to be  
30                  selected by owner/engineer.
- 31
- 32                  I. The interior of the panels shall be lined with a corrosion resistant liner.

33

### PART 3 - EXECUTION

34

#### 3.01 INSPECTION

- 35
- 36                  A. Owner shall be allowed access to the manufacturing area for the purpose of  
37                  inspection.
- 38
- 39                  B. The manufacturer shall include in its submittal, complete quality assurance  
40                  procedures and inspection forms. The manufacture shall provide at the time  
41                  of delivery complete inspection forms.

42

#### 3.02 ERECTION

- 1        A. Erection shall proceed in strict accordance with the manufacturer's written
- 2                instructions, according with sequences as shown on the shop drawings and
- 3                in the installation instructions.
- 4
- 5        B. Shim FRP framing only with approved shims. The use of scrap, off-fall or
- 6                other building materials as shims is not allowed.
- 7
- 8        C. Install FRP framing members on location, as shown on the approved
- 9                submittals. Field modifications (cuts, copes, holes, etc.) other than work
- 10              shown on the drawings are not allowed without the manufacturer's written
- 11              consent.
- 12
- 13       D. Place FRP deck units on supporting members and install fastening systems.
- 14
- 15       E. Cut and trim FRP deck units as shown on the shop drawings. Adjust into
- 16              final position with proper bearing and alignment at joints, laps and supports.
- 17
- 18       F. Fasten FRP panels to the FRP supports as shown on the shop drawings.
- 19              Refer to the manufacturer's installation instructions for proper fastener
- 20              selection and installation techniques.
- 21
- 22       G. Place and fasten FRP hatches as shown on approved shop drawings.
- 23

### 24        3.03 MATERIAL HANDLING AND STORAGE

### 25

- 26        A. At the time of delivery, all material be inspected for shipping and handling
- 27              damage. The Contractor shall notify the freight company and the
- 28              manufacturer immediately of any damage.
- 29
- 30        B. Protect the surface of FRP covers from cuts, scratches, gouges, abrasions,
- 31              and impacts. Do not use wire slings unless material is fully protected. Use
- 32              spreader bars when lifting these materials. Do not drag panels or flashing
- 33              across one another unless separated by a non-scratching spacer.
- 34
- 35        C. Store all FRP panels on edges, do not store flat. Keep all FRP materials
- 36              covered - do not stack or store other building materials on top of unprotected
- 37              units. Store materials in a dry location, off the ground, for ventilation.
- 38

### 39        3.04 DAMAGED MATERIAL

### 40

- 41        A. Replace or repair all damaged material to the satisfaction of the Engineer.
- 42
- 43        B. Contact the FRP cover manufacturer for instructions regarding the proper
- 44              materials and procedures for the repair of FRP products before commencing
- 45              repair.
- 46

47              END OF SECTION

SECTION 13525

## WET TAP SYSTEM

## PART 1 – GENERAL

## 1.01 DESCRIPTION

- A. The Contractor shall furnish and install two (2) permanent wet taps in the existing 48-inch diameter primary treatment effluent piping while maintaining the upstream and downstream portions of the primary effluent piping system in service. The wet taps sizes are 48" x 30" as shown on the drawings.
  - B. The existing primary effluent piping system is approximately 30 years old, potentially corroded and, as such, subject to failure. The Contractor shall take every precaution necessary to protect the existing pipelines and assure their continued availability and functionality.
  - C. The existing primary effluent pipe is called out on the drawings provided by the City as 48-inch ductile iron. It is the Contractor's responsibility to verify the material, and outside diameter of the existing pipe before ordering the wet tap equipment.
  - D. The wet tap installation fittings and valves shall be subject to the same standards and testing as other pipe fittings and shall provide a leak free connection to the host pipe.
  - E. The wet tap system shall include, but not be limited to, a tapping sleeve fitting with flanged connection, a gate valve that bolts to the flanged connection, and a drilling machine that bolts to the gate valve. The wet tap sleeve and valve shall provide a leak free sealed connection between the existing and proposed piping.
  - F. All work, materials, and incidentals necessary for the construction and testing of the wet tap system including scaffolding, excavation, excavation support systems, shoring, dewatering, hauling, removal, and disposal of excess and unsuitable material, test pit to locate the pipe section where the wet tap sleeve will be installed, providing and installing the sleeve on the existing pipe, protection of the existing piping systems, suitable backfill material, backfilling, compaction, furnishing all materials, cutting and removal of existing pipe, testing, protection of existing surface features and utilities, all miscellaneous materials, labor, equipment, tools, and incidentals necessary to complete the work per the requirements of the Specifications, except as may be modified herein.
  - G. The wet tap systems shall be as provided by Rangeline Tapping Services., TDW Services Inc., or approved equal.

1  
2   1.02 SUBMITTALS  
3

- 4       A. Submit complete information on the subcontractor that will install the permanent  
5       wet tap system. The subcontractor shall have a minimum of 5 years of  
6       experience in the installation of wet taps on existing pipelines. The submittal  
7       shall include a client contact list that includes wet taps which have been installed  
8       on ductile iron pipe of the same diameter. The client list shall include the names  
9       and telephone numbers of a minimum of 20 client contacts.  
10  
11      B. The Contractor shall make all submittals in accordance with Sections 01300 and  
12       01340 of these Specifications.  
13  
14      C. Shop Drawings shall be submitted for the wet tap sleeve, tapping valve, and  
15       drilling machine and shall include a statement that the wet tap will perform  
16       properly under the existing service conditions.  
17

18   1.03 QUALITY ASSURANCE  
19

- 20       A. Quality control shall be in accordance with Section 01640 of these  
21       Specifications.  
22

23   1.04 EXISTING UTILITIES  
24

- 25       A. Existing utilities are as indicated on the Drawings based on the best available  
26       information. The Contractor shall excavate test pits as required and verify the  
27       horizontal and vertical location of the piping systems (primary effluent piping)  
28       and all existing and known conflicting utilities prior to construction. Existing  
29       utilities and services shall be carefully investigated and protected by the  
30       Contractor. Damage to existing utilities caused by the Contractor or the  
31       Contractor's work shall be immediately reported to the Owner and the Engineer.  
32       The Contractor shall be responsible for repairing the damage as directed by the  
33       Owner of the utility.  
34  
35       B. The Contractor shall verify all materials of construction, pipe wall thicknesses,  
36       roundness, and any other information needed for performing the wet tap  
37       operation.  
38

39   PART 2 – MATERIALS  
40

41   2.01 GENERAL  
42

- 43       A. Wet tap equipment shall be water tight, suitable for the low internal pressure of  
44       the primary effluent pumping system, estimated to be about 5 psi at peak flow.  
45  
46       B. The wet tap sleeve and valve shall be installed on the primary effluent piping  
47       and shall be rated for a minimum pressure of 30 psi.

- 1  
2       C. All wet tap equipment including the tapping sleeve, the tapping valve, the cutter,  
3           and all hardware shall be furnished and installed by the subcontractor  
4           performing the wet tap work.  
5

6       **2.02 SHELL CUTTER**  
7

- 8       A. The shell cutter shall be cylindrical design, with an O.D. (outside diameter)  
9           tolerance that will allow for the I.D. (inside diameter) of the valve. The cutting  
10          tips will be constructed of carbide or high strength carbon steel to enable a  
11          complete and smooth cut. The coupon section cut from the host pipe shall be  
12          removed and submitted to the Owner.  
13

14       **2.03 PILOT BIT**  
15

- 16       A. The pilot bit shall be designed with a carbide or high strength carbon steel tip.  
17           The pilot bit shall be constructed to ensure the retrieval of the coupon section of  
18           pipe. The coupon section cut from the host pipe shall be removed and  
19           submitted to the Owner.  
20

21       **2.04 TAPPING VALVE**  
22

- 23       A. The tapping valve shall be a non-rising stem RWGV conforming to all applicable  
24           sections of AWWA C500 and C509 Standards and suitable for buried  
25           applications. One end of the valve will be flanged with alignment device to  
26           attach to the tapping sleeve flange. The other end will be mechanical joint with  
27           a special adapter to allow attachment of the drilling machine.  
28

29       **2.05 TAPPING SLEEVE, GASKET, AND FLANGE**  
30

- 31       A. The wet tap sleeve shall be manufactured in two sections. The back section  
32           shall be full encirclement design with an outside diameter range specific to the  
33           pipe it is being installed on. The front half shall be of full encirclement design  
34           matching the back half with a welded nozzle and flange outlet. Wet tap fittings  
35           shall be the high strength type having a wide body, made of a minimum material  
36           strength of ASTM 285 Grade C, ASTM A-36 Steel, or equal that conforms to  
37           and reinforces the pipe. The sleeve shall have a gasket of Nitrile Butadiene  
38           Rubber (NBR, Buna-N) per ASTM D2000 with corrosion resistant alloy bolts  
39           (per ANSI 21.11/AWWA C-111) and nuts (per A563) or equal and sized  
40           appropriately, and a 3/4" forged steel test outlet. The flanged outlet shall be  
41           AWWA C207 Class D, ANSI 150 lb. drilling.  
42
- 43       B. Finish: Wet tap fittings and hardware that remain after the temporary equipment  
44           is removed shall be epoxy coated.  
45

## PART 3 – EXECUTION

### **3.01 GENERAL**

- A. Excavate and expose the existing piping to be wet tapped. Suitably protect the existing pipe from all loads associated with the sleeve, attributable to the wet tap equipment mounted to the sleeve, and the weight of the pipe itself. Such protection may include, but not be limited to, pouring concrete fill against undisturbed earth to support the pipe and the equipment. Particular care should be exercised in protecting the pipe at the point where it extends into the open excavation.
  - B. Verify that the existing piping is furnished with thrust restraint. Provide a concrete thrust collar around the pipe as necessary to prevent movement of unrestrained pipe.
  - C. Clean piping as required to obtain proper sealing.
  - D. Tapping must be accomplished while the primary effluent piping system is in operation and under pressure.
  - E. The Contractor shall provide written notification to the Owner two weeks in advance of performing the wet tap procedure.
  - F. The wet tap system shall be installed per the wet tap installation Subcontractor's instructions and recommendations and the various pieces of equipment manufacturer's instructions and recommendations.

END OF SECTION

1 SECTION 13567  
2

3 TEMPORARY BYPASS PUMPING, TREATMENT AND PIPING SYSTEM  
4

5  
6 PART 1 – GENERAL  
7

8 1.01 SCOPE OF WORK  
9

- 10 A. The Contractor shall design, furnish, install, startup, operate, maintain, and  
11 coordinate a temporary raw sewage bypass pumping and preliminary treatment  
12 system including temporary piping systems (temporary bypass system) as  
13 shown, specified or required. The temporary bypass system shall be designed  
14 for "firm" continuous duty 24-hours per day operation. The temporary bypass  
15 treatment system shall include facilities for flow measurement, screening and  
16 grit removal. Collectively, the temporary bypass pumping, treatment and piping  
17 system, when operated in conjunction with the new moving belt filters, shall  
18 allow the entire existing preliminary treatment and primary treatment systems,  
19 between the existing bar screens and the existing Diversion Chamber, to be  
20 taken out of service to construct improvements associated with these facilities.  
21 Refer to Sheet G1.05.
- 22 B. The temporary pumping system shall pump raw sewage from upstream of the  
23 existing mechanical bar screens to a temporary screening facility and then  
24 through a temporary grit removal facility. Effluent from the temporary grit  
25 removal process shall overflow a weir and be conveyed by a temporary gravity  
26 piping system that is to be connected to the existing 48-inch pipe carrying flows  
27 to secondary treatment, where shown on the drawings. The elevation of the  
28 weir on the grit removal process shall be designed and selected to allow a  
29 portion of the effluent to be routed from the temporary grit removal process to  
30 each of the three (3) new Moving Belt Filters. Filtered water from the Moving  
31 Belt Filters shall be conveyed in a separate temporary gravity piping system to  
32 the existing 48-inch pipe carrying flows to secondary treatment where shown on  
33 the Drawings. Design flow rates for the temporary bypass pumping, treatment,  
34 and piping systems are shown on Sheet G1.05.
- 35 C. All temporary systems shall be disassembled and removed after the permanent  
36 systems are completed, tested, accepted and placed in service.
- 37 D. The Contractor shall employ the services of a subcontractor specializing in the  
38 design, furnishing, installation and operation of similar temporary pumping,  
39 treatment and piping systems. The Contractor shall provide five (5) references  
40 for projects performed by the subcontractor of similar size and complexity as  
41 the proposed system for review by the Engineer. The proposed systems shall  
42 meet the requirements of all codes and regulatory agencies having jurisdiction.
- 43

- 1           E. The Contractor shall be fully responsible for the hydraulic design, for the  
2           equipment design and selection, and for the installation, operation and  
3           maintenance of the entire temporary bypass pumping, treatment and piping  
4           systems.
- 5
- 6           F. Operation and maintenance of the temporary bypass pumping and treatment  
7           system requires personnel with appropriate skill sets but does not require a  
8           State of Florida Licensed Wastewater Operator and does not require a person  
9           to be on site 24 hours/day, or 7 days per week. The Contractor shall provide a  
10          telecommunications system to provide remote monitoring of alarms for its staff,  
11          with the ability for the Owner and Engineer to also monitor system alarms.
- 12
- 13          G. The Contractor may propose alternative treatment systems or processes for  
14          approval by the Owner/Engineer. The alternative system shall have the same  
15          performance and treatment levels as the existing system. The design TSS  
16          removal requirement shall be 7,000 pounds/day at a flow rate of 13.5 MGD and  
17          must be variable with the incoming flow.

18

19        1.02 SUBMITTALS

20

- 21          A. The Contractor shall prepare a written Temporary Bypass Pumping, Treatment  
22          and Piping Plan (Plan) in accordance with Specification Section 01300 and  
23          submit it to the Engineer for review prior to beginning any work at the site. The  
24          Contractor shall attend a meeting with the Engineer and the Owner to review  
25          the Plan, then update the plan to address the comments received from the  
26          Owner and Engineer. The Plan shall be prepared, signed and sealed by a  
27          Professional Engineer licensed in the State of Florida.
- 28
- 29          B. The Plan shall consist of detailed written descriptions of the proposed systems,  
30          calculations supporting the sizing and elevation settings of all equipment and  
31          piping, and general arrangement drawings of the proposed equipment and  
32          piping systems layouts and routing. The Plan shall include process flow  
33          diagrams and a process and instrumentation diagram.
- 34
- 35          C. The Plan shall include equipment schedules, time schedules, locations, pumps,  
36          pump controls, piping and valves. Cut sheets for all equipment and materials  
37          shall be submitted. All valves and pipe routing shall be enumerated and shown  
38          on the diagrams.
- 39
- 40          D. Calculations shall be provided detailing the determination of the total dynamic  
41          head and horsepower requirements for pumping from the screen chamber to  
42          the temporary screening facility and from the temporary screening facility to the  
43          temporary grit removal facility.
- 44
- 45          E. The Plan shall show at a minimum the following information:
- 46

- 1           1. Number, size, material, and location of all pumps, flow meters, screens,  
 2           tanks, piping and valves.
- 3
- 4           2. Hydraulic calculations signed and sealed by a registered professional  
 5           engineer showing that weir elevations, water elevations, freeboard  
 6           elevations, headloss values, and velocities of the proposed Plan  
 7           temporary bypass facilities "fit" within the hydraulic profile of the existing  
 8           plant as shown on sheet 5 of 166 of the October 1988 drawings.
- 9

10          **PART 2 – PRODUCTS**

11          **2.01 GENERAL REQUIREMENTS AND MATERIALS**

- 14           A. All piping used shall be in accordance with the applicable specification.
- 15
- 16           B. Valves, suitable for throttling service and acceptable to the Engineer, shall be  
 17           installed as required. Existing valves shall not be used.
- 18
- 19           C. The Hazen-Williams C Value used for the design of temporary bypass piping  
 20           shall not exceed 140. Velocity in any pipe shall not exceed 8.5 feet per second.
- 21
- 22           D. Tank freeboard shall be not less than 12-inches.
- 23
- 24           E. Suitable automatic air release valves shall be installed at each high point in the  
 25           temporary bypass piping system. Air release valves shall be in accordance with  
 26           Specification Section 15100.
- 27
- 28           F. Actual plant flow rates for the 2-year period ending in April 2016 are identified  
 29           in the table below and are provided for information only. Up to-date flow data is  
 30           available each month for the previous month and is reported to FDEP by the  
 31           City.
- 32

<b>FLOW</b>	<b>NORTHEAST WRF</b>
All Days	
Average Day	6.6 MGD
Maximum Day (Volume)	12.1 MG
Peak Hour Flow (Rate)	15.8 MGD
Dry Season Average Day Flow (ADF)	6.4 MGD
Wet Season Average Day Flow (ADF)	7.0 MGD
Dry Season Average Diurnal Peaking Factor	1.21
Wet Season Average Diurnal Peaking Factor	1.19

1  
2   2.02 TEMPORARY BYPASS SYSTEM DESIGN AND PERFORMANCE CRITERIA  
3

- 4           A. All temporary bypass system facilities and components shall be designed with  
5           a hydraulic capacity of 27 MGD in accordance with Class I Reliability as defined  
6           the EPA Document Design Criteria for Mechanical, Electric, and Fluid System  
7           and Component Reliability – MCD-05. EPA-430/99-74-001.  
8
- 9           B. Furnish and install a temporary bypass pumping system designed with a firm  
10          pumping capacity of 27 MGD. The bypass pumping system shall be  
11          automatically controlled to match the influent flow rate, i.e., constant level in the  
12          chamber upstream of the existing screens. Each bypass pump shall have  
13          variable speed drives.  
14
- 15          C. Furnish and install on the discharge of the temporary bypass pump system a  
16          temporary flowmeter suitable for raw sewage with an accuracy of 5% of range  
17          over a 5-27 MGD. Furnish meter with a 4-20 mADC ouput signal and wire to  
18          the existing plant SCADA system.  
19
- 20          D. Furnish and install a manually or automatically cleaned temporary screening  
21          facility with maximum ¾-inch clear openings. Removal, collection, dewatering,  
22          and disposal of the screenings is the responsibility of the Contractor. A suitable  
23          allowance shall be provided in the hydraulic design of the temporary screening  
24          facility for partial clogging of the screen.  
25
- 26          E. Furnish and install a temporary grit removal system consisting of a tank with a  
27          detention time of not less than 3-5 minutes at a flow rate of 27 MGD with  
28          dimensions meeting generally accepted design criteria for such tanks. Grit  
29          removal may be automatic (continuous) or may be manually removed  
30          periodically from the bottom of the tank by the Contractor using a Sand Dragon  
31          or similar portable device. The existing grit and screenings collection container  
32          volume is 10 yards and the container is typically emptied twice per week by the  
33          City. The City will continue to haul the grit and screenings container throughout  
34          the construction period unless the contents of the container do not pass the  
35          paint filter test for free water, at which point disposal shall be by the Contractor  
36          at no additional cost to the Owner.  
37
- 38          F. Furnish and install temporary piping from the grit removal system to the new  
39          Moving Belt Filters. The piping system shall be designed to convey up to 3500  
40          gpm total to the Moving Belt Filters, and up to 1750 gpm to each Moving Belt  
41          Filter.  
42
- 43          G. Furnish and install temporary piping from the grit removal system to the existing  
44          48-inch primary effluent piping downstream of the Diversion Chamber where  
45          shown on the drawings. The piping system shall be designed to convey up to  
46          27 MGD.  
47

- 1           H. Furnish and install temporary piping from the Moving Belt Filters to the existing  
2           48-inch primary effluent piping downstream of the Diversion Chamber where  
3           shown on the drawings. The piping system shall be designed to convey up to  
4           3500 gpm.  
5
- 6           I. Furnish a temporary steel slide gate in the Diversion Chamber to isolate the  
7           Diversion chamber from the downstream 48-inch effluent piping in order to take  
8           the underground primary effluent channel that is upstream of the Diversion  
9           Chamber out of service.  
10
- 11          J. The temporary bypass systems may use the existing plant power supply and  
12           distribution system, however the Contractor shall furnish and install an  
13           independent automatic backup power generating system with on-site fuel  
14           storage. A 4-day supply of fuel at a pumping rate of 27 MGD shall be furnished  
15           by the Contractor and stored on site for the temporary backup power system.  
16
- 17          K. The temporary bypass system shall include alarm systems that will notify both  
18           the Contractor's responsible personnel and the Owner's plant personnel via  
19           telephone autodialer of the following conditions at a minimum:  
20
- 21           a. Pump failure.  
22           b. High water level at the existing screen chamber, the inlet of the  
23           temporary screen facility, the grit removal facility, and the level  
24           downstream of the grit removal system weir.  
25

26          The temporary bypass pump system shall have visible and audible alarms for  
27           pump failure and high water level. These visual and audible alarms shall be  
28           made obvious to the plant operator while checking equipment in the area.  
29

### 30         PART 3 – EXECUTION 31

#### 32         3.01 STARTUP AND OPERATION 33

- 34          A. The Contractor shall install and demonstrate the mechanical and functional  
35           integrity of the system to the Engineer and the Owner prior to beginning the  
36           work on facilities for which the temporary bypass system is provided. The  
37           system shall function to the Engineer's satisfaction for a period of not less than  
38           72 consecutive hours prior to taking any of the existing equipment or piping out  
39           of service.  
40
- 41          B. The Contractor shall be responsible for operation and maintenance of the  
42           system 24 hours per day and shall not depend on the Owner to perform any  
43           operations or maintenance tasks.  
44

1           C. The Contractor shall be responsible for any wastewater or fuel spills attributable  
2           to the system, and its operation, and shall pay for any and all fines, fees,  
3           property damage, environmental damage, and cleanup costs that are  
4           associated with the spills.

END OF SECTION

1 SECTION 13600  
2

3 INSTRUMENTATION GENERAL PROVISIONS  
4

5 PART 1 – GENERAL REQUIREMENTS  
6

7 1.01 DESCRIPTION  
8

9 A. General  
10

- 11 1. This Section of the Specifications covers the general requirements for  
12 the furnishing and installation of a Primary Instrumentation, Control, and  
13 Monitoring System complete in every detail for the purposes specified  
14 and shall form a part of any other technical specifications supplied unless  
15 otherwise specified.  
16
- 17 2. The intent of this specification is to require that the Supervisory Control  
18 and Data Acquisition (SCADA) System, including all Sections of this  
19 Specification, i.e., primary elements, panel mounted and miscellaneous  
20 field instruments, etc., be furnished by a single Primary Instrumentation  
21 and Control System Supplier (System Integrator, SI) to assure system  
22 uniformity, subsystem compatibility and coordination of all secondary  
23 system interfaces. Where specific manufacturers are designated,  
24 substitutions will not be accepted. Deviations may be considered in  
25 special circumstances but must be approved by the Engineer. The  
26 Contractor shall include in his bid, the name of the System Integrator that  
27 will be used to furnish the system as described herein.  
28

29 The Contractor shall provide, through the services of a single Systems  
30 Integrator (SI), all components, system installation services, systems  
31 programming, as well as all required and specified ancillary services, in  
32 connection with the Instrumentation and Control System (ICS).  
33

34 B. The Contractor shall provide all application software services. The City has  
35 preapproved for bidding four (4) Systems Integrators.  
36

- 37 1. McKim and Creed  
38 2. Curry Controls  
39 3. Commerce Controls Inc.  
40 4. Revere Controls  
41

42 C. The system shall include all materials, labor, tools, fees, and documentation  
43 required to furnish, install, test, and place into operation, a complete and  
44 operable ICS as shown and/or specified within this section, related ICS  
45 specification sections, and subsections within equipment specifications.  
46

- 1           D. The system shall include all measuring elements, signal converters,  
2           transmitters, specialty cables, control panels, digital hardware and software,  
3           remote telemetry units (RTU), signal and data transmission systems,  
4           interconnecting wiring and such accessories as shown, specified, and/or  
5           required to provide the functions indicated, whether specifically mentioned or  
6           not.
- 7
- 8           E. The specifications provided within this section shall be applied to all of the  
9           Instrumentation and Control specifications, as well as additional specifications  
10          sections as referenced or where applicable. The ICS shall be provided as a  
11          single and complete system as specified herein and as specified within the  
12          following ICS specifications:
- 13           1. Section 13615 – Process Instrumentation & Equipment  
14           2. Section 13630 – Local Control Panels and Control Systems  
15           3. Section 13640 – Control Strategy
- 16
- 17           F. Where references are made to the SCADA System Programmer or the SSP, it  
18           shall be understood that all application software services will be provided by the  
19           SI. The Contractor shall provide, through the SI, all materials, labor,  
20           documentation, etc., including coordination, programming, startup, and testing  
21           services, as necessary to ensure the complete system is fully capable of  
22           providing all specified functions.
- 23
- 24           G. The Contractor shall be ultimately responsible for installation of the ICS.  
25           However, the SI will include installation within the scope of his subcontract to  
26           provide for installation of the complete system as specified. The SI shall also  
27           coordinate this work with the Contractor to ensure that the proper type, size,  
28           and number of wires with their conduits are provided and installed. This  
29           coordination will also ensure that proper electrical power circuits are provided  
30           for all components and systems.
- 31
- 32           H. The Contractor's responsibilities, in addition to the SI's responsibilities, shall be  
33           to provide all additional materials and work necessary to supplement the  
34           materials and work provided by the SI; thereby satisfying all requirements that  
35           are within ICS specification sections.
- 36
- 37           I. The Contractor shall coordinate structural work, penetrations, painting, etc., as  
38           required for installation of a complete ICS. In-line or integrally mounted items  
39           (such as flow elements, level sensors, etc.) shall be installed under the  
40           supervision of the SI.
- 41
- 42           J. The Contractor shall be responsible for coordinating interfaces between ICS  
43           equipment provided under the ICS specification sections and the equipment  
44           provided under other sections of the specifications. The Contractor shall verify  
45           and coordinate space requirements, process equipment power supply and

voltage, process equipment control power supply and voltage, compatibility of control signals, details of equipment installation and interconnection. Coordination shall include distribution of approved shop drawings to all vendors, subcontractors, etc., involved in the control interface. Likewise, the Contractor shall ensure that instrumentation and control devices provided under other sections of the specifications are compatible and of the same quality and characteristics as similar devices specified under the ICS specification sections.

## 1.02 SCOPE OF WORK

- A. Furnish and install all instrumentation and control systems hereinafter specified to perform the intended function. Work shall include all labor, materials and equipment, performance of all work necessary to complete the manufacture, to make factory tests, to prepare and load for shipment, to deliver to the site, to provide programming, configuration, related wire coordination, calibration, installation supervision, system start-up, services and incidentals required to completely furnish and install a programmable controller based control and data acquisition system with instruments, modification to existing controls and control devices for the automation of the Northeast WRF and including all work necessary during the Warranty Period, as specified herein, under Section 01740: Warranties and Bonds, and shown on the Contract Drawings. The installation of the system hardware shall be by the Contractor with supervision by the System Integrator.
- B. Furnish all tools, equipment, materials, and supplies and perform all labor required to complete the furnishing, installation, validation, start-up and operational testing of a complete SCADA System as specified herein.
- C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, shunt resistors or relays to interface with existing equipment or equipment provided under other Sections of this Specification, shall be included whether specified or not.
- D. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment Manufacturer as approved by the Engineer.
- E. The SI shall furnish all materials, labor, and services specified in the following specifications sections as required to ensure that a single, coordination system is supplied:
  - Section 13615 – Process Instrumentation and Equipment
  - Section 13630 – Local Control Panels and Control Systems
  - Section 13640 – Control Strategy
  - Section 13650 – Fiber Optic Cabling

1                   F. Divisions required coordination shall include, but not be limited to, the following:

- 2                   Division 1 – General Requirement  
3                   Division 11 – Equipment  
4                   Division 13 – Special Construction  
5                   Division 15 – Mechanical  
6                   Division 16 – Electrical

7                   1.03 QUALITY ASSURANCE

- 8                   A. The SCADA System as specified in this Specification shall be an integrated  
9                   system and therefore shall be provided by a competent, qualified  
10                  instrumentation and control SI who shall have total responsibility for the work of  
11                  this Specification and other related Specification. Entire system installation  
12                  including process parameter verification, calibration, validation, start-up, testing,  
13                  and training shall be performed by qualified personnel, possessing all the  
14                  necessary equipment and who have had a minimum of 5 years experience in  
15                  engineering, programming and installing of similar SCADA systems. The  
16                  system shall be integrated using the latest, most modern and proven design  
17                  and shall, as far as practical, be of one SI.
- 18                   B. The SI shall be responsible for the correct selection of all instrumentation and  
19                  installation of all hardware and secondary control systems specified in this and  
20                  other related sections of this Specification.
- 21                   C. Prior to the selection of any device coming in contact with the process, actual  
22                  on-site process conditions and the suitability of the device and materials of  
23                  construction for the stated application shall be verified with the original  
24                  equipment manufacturer by the SI. Unless notified in writing all devices and  
25                  component part numbers, when provided, shall be assumed to have been  
26                  verified as having been selected based on actual process parameters and  
27                  application. Ultimately, the Contractor shall be responsible for all cost  
28                  associated with replacements and delays due to improper equipment selection.
- 29                   D. The SI shall be responsible that all components of the primary as well as  
30                  secondary control systems, including measuring, indicating, transmitting,  
31                  receiving, totaling, controlling, alarming devices and all appurtenances are  
32                  completely compatible, correctly sized for actual process conditions, and  
33                  properly interface to each other and shall function as outlined. The SI shall  
34                  furnish and install such additional equipment, accessories, etc. as are  
35                  necessary to meet these objectives at no additional cost to the Owner or  
36                  Engineer.
- 37                   E. The SI shall be a recognized supplier of instrumentation, control panels, and  
38                  systems, etc., of the general type and complexity of the system specified herein

1 and shall have been regularly engaged in providing and engineering  
2 instrumentation, control, and monitoring systems on a single system  
3 responsibility basis for a minimum of five (5) consecutive years. The personnel  
4 employed for system engineering, supervision, start-up, operational testing and  
5 training shall have been regularly employed and factory trained by the System  
6 Integrator for a minimum of two (2) years.  
7

- 8 F. The SI shall submit a detailed description of the experience of each engineer  
9 that will be assigned for the duration of the project for review and approval. The  
10 SI lead engineer shall be an electrical or control systems Professional Engineer  
11 registered in the state of Florida specializing in the selection and  
12 implementation of instrumentation, control, and monitoring systems of the type  
13 specified herein for the past five (5) consecutive years. References shall be  
14 provided for all projects successfully completed by each engineer or software  
15 programmer assigned to this project.  
16
- 17 G. Actual installation may or may not be performed by the SI employees but the SI  
18 shall be responsible for the technical supervision of the installation to ensure  
19 that it is proper in all respects.  
20
- 21 H. Secondary control systems shall include all instrumentation, switchgear,  
22 variable frequency drives, and controls (including but not limited to gauges,  
23 transmitters, panels, process and manual switches, indicators, controllers, etc.)  
24 existing and/or furnished under other sections and are generally considered as  
25 a "packaged" system supplied specifically for the equipment being specified  
26 under that section.  
27
- 28 I. Major constituents of each secondary system shall include, but not limited to, all  
29 materials, equipment, field wiring and work required to implement a complete  
30 and operating system of instrumentation and controls for its associated  
31 equipment. The systems shall include primary elements for process variable  
32 measurements, analog display and control elements, and discrete display and  
33 control elements as noted hereinafter and in the referenced Specification  
34 sections.  
35
- 36 J. Qualifications of the secondary System Supplier engineers shall be as specified  
37 herein above unless otherwise noted. The Engineer reserves the right to reject  
38 the use of any supplier not meeting the qualifications specified herein and under  
39 the specific equipment specification.  
40
- 41 K. Each bidder or his authorized representatives shall, before preparing a  
42 proposal, visit all areas of the existing building(s) and/or proposed site where  
43 work will take place and be performed to carefully inspect the present  
44 installation and conditions. The submission of the bid proposal shall be  
45 considered evidence that the bidder has visited the project, fully reviewed the  
46 Contract Documents, and noted the locations and conditions under which the

1 work will be performed, and that the bidder takes full responsibility for a  
2 complete knowledge of all factors governing his work.  
3

4 L. The SI shall coordinate all work related to the instrumentation and control  
5 system with the Contractor, their sub-contractors and suppliers including as a  
6 minimum the following services:  
7

- 8     1. Attend all construction progress meetings.  
9     2. Review all shop drawings related to the Primary Instrumentation and  
10      Control System and provide responses to the Engineer and Contractor.  
11     3. Coordinate with the Owner/Engineer for Ethernet IP list for configuration  
12      of the electronic overload devices and power monitor device. The  
13      Contractor to provide the electronics devices configuration and data table  
14      to SSP for SCADA configuration.  
15  
16

17     1.04 RESPONSIBILITY  
18

- 19     A. The Contractor shall be ultimately responsible and shall provide for the  
20      verification of process conditions, supply, installation, certification, adjustment,  
21      and start-up, of complete, coordinated systems, which shall reliably perform the  
22      specified functions.  
23  
24     B. All interconnecting conduit and wiring, between elements of a single secondary  
25      control system shall be furnished, installed and connected under the same  
26      section as is the secondary control system unless the electrical drawings  
27      specifically indicate otherwise.  
28  
29     C. All other electrical conduit and wiring are provided, installed and connected  
30      under Division 16, Electrical. System Integrator is responsible for coordinating  
31      all related control and wiring interfaces with control system supplied by other  
32      sections of these specifications.  
33  
34

35     1.05 PRE-SUBMITTAL CONFERENCE  
36

- 37     A. General  
38  
39         1. The Contractor/System Integrator shall arrange a pre-submittal  
40          conference with the Owner or his representative within thirty (30) days  
41          after award of the Contract for the purpose of informally discussing in  
42          detail and verifying the correctness of the Contractor/System Integrator's  
43          engineering methods, equipment, and to generally provide a framework  
44          for communication and coordination. This meeting shall be attended by  
45          the Contractor/System Integrator's Engineers, and duly authorized  
46

representatives of the Owner.

2. The Contractor/System Integrator shall prepare a project schedule and identify all major milestones in accordance with the project requirements.
  3. The Contractor/System Integrator shall prepare a draft copy of the material that will be submitted for Owner's review. The draft shall include the following, as a minimum:
    - a. Listing of major items proposed. Identify items by tag number, description, function, manufacturer, model number, descriptive literature and statement as to whether item is "as specified or equivalent". Items identified, as "equivalent" shall be accompanied by a comparative listing of the published specifications for the item specified and for the item proposed.
    - b. Prior to making any submittals, the Contractor/System Integrator shall submit to the Owner, a listing of all electrical components, assemblies and panel(s) that are intended to be furnished that are not UL approved or recognized or that does not comply with any other Owner recognized third party approval agency. The System Integrator shall utilize UL approved and recognized components, panel(s), and assemblies when available.
    - c. Review and approval of all unlisted electrical devices, by the Owner, is required prior to manufacturing. Any additional costs associated with materials, installation of those materials, and special on-site inspections necessary to meet the applicable NEC and local electrical codes shall be arranged by and borne by the System Integrator.

## 1.06 ENGINEERING SUBMITTALS

- A. Before proceeding with any manufacturing, submit the following for approval in complete bound sets indexed by specification number. Describe and verify all component part numbers for the items being submitted. Submit only complete systems, not pieces of equipment from various systems. Show dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Schematics shall be complete with all components identified by a unique tag reference in accordance with ISA-5.1 Instrumentation Symbols and Identification. Terminal number identification associated with relays, lights, electrical devices, etc., shall be clearly identified on all drawings. Submit fabrication drawings, nameplate legends, and control panel internal wiring and piping schematic drawings clearly showing all equipment and tag numbers for all components. Submit panel graphic drawings when applicable. Include material specifications listed where

1 applicable.  
2

- 3       B. Include a draft of the theory of operation for all relay circuits including software  
4       logic implemented via programmable controllers that will eventually be included  
5       in the operation and maintenance instruction manuals required below.  
6
- 7       C. Network riser diagram detailing all network components, interconnections  
8       physical locations, and IP addressing. This diagram shall be designed such  
9       that it shows the "schematic" layout of the network and how it functions and  
10      shall encompass the entire project on one sheet.  
11
- 12      D. Computer generated document detailing the license agreements for each  
13      installation of software in the SCADA system including license numbers, license  
14      details (product, number of tags, etc.), registered contact, key type (hard or  
15      soft), expiration dates of support agreements and any other data that may be  
16      helpful to personnel supporting the system in the future.  
17
- 18      E. Computer generated document detailing all user names and passwords for  
19      each PC in the system. This document shall be given directly to the Owner in a  
20      sealed envelope to be kept in a safe location.  
21
- 22      F. Each submittal shall be bound in a white, standard three ring, clear view type,  
23      hard cover binder which indicates the system name, submittal content, project  
24      reference, revision date and purpose of the submittal on the spine as well as  
25      the cover which shall also include the Engineers name, location, and supplier's  
26      name. Binders shall not exceed three inches in thickness.  
27
- 28      G. Provide copies of each of the following submittals per Section 01340 to the  
29      Engineer for review and approval:  
30
- 31        1. Hardware Submittal  
32
- 33            a. Index and Comments  
34
- 35              1) Provide a detailed index identifying each tabbed section  
36              and its content.  
37
- 38              2) If there are any deviations or clarifications to the  
39              specifications, they shall be documented in writing in this  
40              section. If there are no comments or concerns identified in  
41              the submittal, it will be presumed that there are no  
42              deviations from the Contract Documents for the system  
43              being furnished.  
44
- 45            b. Component Data Sheets  
46

- 1           1) Component Data Sheets shall be specifically prepared for  
2           all components being furnished under these Specifications.  
3           The purpose of this material is to supplement the  
4           generalized catalog information by providing the specifics  
5           of each component (e.g., individual component tag ID  
6           reference, service, quantity supplied, part number,  
7           breakdown and descriptions for all options, scales, ranges,  
8           materials of construction, component location reference,  
9           and reference to associated drawings).  
10           2) Include such other necessary data as would provide a  
11           complete and adequate specification for re-ordering an  
12           exact duplicate of the original item from the manufacturer at  
13           some future date. More than one tag numbered item with  
14           the same part number may be included on a sheet.

17           c. Catalog Cuts

- 18           1) Manufacturer's standard specification or data sheets shall  
19           be clearly marked to delineate the options or styles to be  
20           furnished. Standard manufacturer catalog information,  
21           descriptive literature, wiring diagrams, and shop drawings  
22           shall be provided for all devices, whether electrical or  
23           mechanical, furnished under these Specifications. This  
24           includes, but is not limited to, pressure switches, gauges,  
25           solenoid valves, controllers, indicators, power supplies,  
26           switches, lights, relays, timers, circuit breakers, fuses, etc.

27           d. Sizing Calculations

- 28           1) Complete certified sizing calculations shall be provided for  
29           all control valves and flow elements. The calculations shall  
30           include the process data used, minimum and maximum  
31           values, permanent head loss and all assumptions made.  
32           Equations shall be submitted for all computing modules  
33           and function generating modules and shall include the  
34           actual scaling factors and units used.

35           e. System Hardware Submittal Format

- 36           1) Tab 1. Component Index and Comments  
37           2) Tab "N" through "NN" (as required)  
38           3) Component "X" Data Sheet(s) - one tab shall be provided  
39           per each component type and shall include the standard

1 manufacturer catalog information and sizing calculations  
2 (when required).

3

4 2. System Control Panel(s) Drawing Submittal

5

- 6 a. All drawings shall be provided on "B" size paper and shall be laser  
7 generated with a 300 DPI resolution, tabbed, and bound as  
8 directed above. Drawing submittal may be combined with the  
9 Hardware submittal providing the binder capacity is not exceeded.

10

11 1) Index and Comments

12

- 13 a) Provide a detailed index identifying each tabbed  
14 section and its content.

- 15 b) If there are any deviations or clarifications to the  
16 specifications, they shall be documented in writing in  
17 this section. If there are no comments or concerns  
18 identified in the submittal, it will be presumed that  
19 there are no deviations from the contract documents  
20 for the system being furnished.

21

22 2) Panel Layout Drawings

23

- 24 a) Provide detailed shop drawings for all panels and  
25 enclosures. Drawings shall show the location of all  
26 exterior and internal panel mounted devices to scale  
27 and shall include a panel legend and bill of  
28 materials. Layout drawings shall show all major  
29 dimensions, front, back, side, and mounting details,  
30 as well as all elevations, in inches from the base up,  
31 of all rows of components.

- 32 b) The panel legend shall list and identify all front of  
33 panel devices by the components unique tag  
34 identifier, all nameplate inscriptions, service legends,  
35 and annunciator inscriptions when applicable.  
36 Service legends, and nameplate inscriptions shall  
37 show size, engraving per line, character height and  
38 color. Information may be included on the layout  
39 drawing if spacing permits.

- 40 c) The bill of materials shall include all components  
41 mounted within or on the panel that are not listed in  
42 the panel legend, and shall include the component

1 identification tag, description, manufacturer, and  
2 complete part number for re-ordering. Information  
3 may be included on the layout drawing if spacing  
4 permits.  
5

- 6 d) Fabrication drawings shall be submitted for review  
7 and shall show all cut-out dimensions, support  
8 details, brackets, materials of construction, finish,  
9 etc. to be used for fabrication of each panel.  
10 Fabrication drawings may be submitted separately  
11 after the layout drawings have been approved.  
12 Construction of panels shall not be started until the  
13 approval of the fabrication drawings is received.  
14

15       3. Detailed Panel Wiring Diagrams  
16

- 17 a) Wiring diagrams shall be provided in the form of  
18 ladder type schematics with line numbers for all  
19 devices. All components shall be identified by a  
20 unique identification tag, terminal block numbers,  
21 wire sizes and color codes clearly identified, and  
22 external interconnections noted. Drawings shall be  
23 drawn in "landscape" mode.  
24
- 25 b) Provide complete terminal identification of all internal  
26 and external elements, panels, and junction boxes.  
27
- 28 c) Polarity of all analog signals shall be shown at each  
29 terminal as well as all shielded cable connections  
30 and grounding requirements.  
31
- 32 d) All external panel wiring that must be provided and  
33 installed shall be clearly identified as a dashed line.  
34 Use unique terminal symbols to denote MCC  
35 locations.  
36
- 37 e) All special cables that are provided with purchased  
38 equipment external to panels shall be identified as  
39 being supplied by the System Integrator.  
40
- 41 f) Wiring diagrams shall show all circuits individually;  
42 no common diagrams will be allowed.  
43
- 44 g) Provide panel power wiring diagrams for all panels.  
45 The diagrams shall include all grounding  
46 requirements.

- 1  
2                  4. Control Panel Submittal Format  
3  
4                  a) Tab 1. Index and Comments  
5  
6                  b) Tab "N" through "NN" as required:  
7  
8                  1) Heat Dissipation and Power Calculations  
9                  Summary.  
10  
11                2) Panel "A" Layout Drawing (one tab per  
12                panel).  
13                3) Panel "A" with Fabrication Drawing  
14                Legend/Engravings/Bill of Materials.  
15  
16                4) Panel "A" Power Wiring.  
17  
18                5) Panel "A" Wiring Diagrams.  
19  
20                c) Tab "X". Loop Drawings (When Applicable)  
21  
22                d) Tab "Y". Installation Details (When Applicable)

23  
24                  3. Analog Loop Drawing Submittal  
25

- 26                a. Provide an individual loop wiring diagram for each analog loop  
27                showing all terminal numbers, the location of the DC power  
28                source, the location of any dropping resistors, polarity, etc. The  
29                loop diagrams shall meet the minimum requirements of ISA - S5.4  
30                (latest edition), plus the following requirements:  
31  
32                1) Loop diagrams shall be on 11-inch by 17-inch paper. Only  
33                one loop shall be shown on each drawing.  
34  
35                2) Reference to supplementary records and drawings, such  
36                as installation details, P&IDs, location drawings, wiring  
37                diagrams or drawings, and instrument specifications shall  
38                be included. Drawings may be included in the Control  
39                Panel Drawing Submittal when only a few drawings are  
40                required.

41  
42                  4. Instrument Installation Details Submittal  
43

- 44                a. The System Integrator shall develop and submit for review,  
45                complete installation details for each field mounted device and  
46                panel furnished prior to shipment and installation. Common

1 details may be referenced by an index showing the complete  
2 instrument tag number, service, location, and device description.  
3 Installation details shall be provided as required to adequately  
4 define the installation of the components. Drawings may be  
5 included in the Control Panel Submittal when only a few are  
6 required.

7

8       5. Power Requirement and Heat Dissipation Summary

9

- 10
- 11       a. Provide a summary of the power requirements and heat  
12 dissipation for all control panels furnished. Power requirements  
13 shall state required voltages, currents, and phase(s). Heat  
14 dissipations shall be maximums and shall be given in BTU/Hr.  
15 Summary shall be supplemented with calculations and show  
16 expected temperatures to be maintained for proper control  
17 equipment operation.

18

19       6. PLC Subsystem Submittal

20

- 21       a. In addition to the detailed hardware submittal requirements noted  
22 herein, the following shall also be provided:
- 23           1) Theory of Operation and Logic Descriptions.  
24           2) System block diagram and cabling requirements.  
25           3) Annotated software program listing and I/O address  
26           mapping.  
27           4) I/O arrangement and wiring drawings.

28

29       7. Operation and Maintenance Manuals Submittal

30

- 31       a. Submit two (2) complete sets of Operation and Maintenance  
32 Instruction Manuals and Part Lists to the Engineer for all  
33 equipment provided. Manuals shall be delivered no later than the  
34 equipment shipment date. After installation is complete, update  
35 the manuals to reflect any changes that occurred during  
36 installation and deliver the balance of the six (6)-required manuals  
37 to the Engineer.
- 38       b. All manuals shall be original manufacturers literature provided as  
39 noted herein above.
- 40       c. Include in the manuals not less than the following applicable  
41 information for each instrument, component, subsystem and/or  
42 control loop.
- 43           1) Index and Comments

- a) Provide a detailed index identifying each tabbed section and its content.
  - b) If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are not comments or concerns identified in the submittal, it will be presumed that there are no deviations from the contract documents for the system being furnished.

## 2) Bill of Materials

- a) A listing of all the panels, racks, instruments, components, and devices furnished. All components shall be grouped by component type, i.e., pressure switches, pressure gauges, indicators, etc. The list shall contain, as a minimum:

  - i) Instrument, panel, rack or device tag number
  - ii) Description
  - iii) Quantity supplied
  - iv) Reference to component data sheet and/or catalog cut
  - v) Component type

### 3) Component Data Sheets

- a) Refer to 1.05-7, A, (2) specified herein before.

## 4) Catalog Cuts

- a) Refer to 1.05-7, A, (3) specified herein before.

## 5) Operation and Maintenance Manuals

- a) Operation and Maintenance manuals shall be submitted for all instruments and devices supplied. The O&M manuals shall contain, as a minimum:

  - i) Operation procedures
  - ii) Installation procedures
  - iii) Maintenance procedures
  - iv) Troubleshooting procedures

- v) Calibration procedures
  - vi) Internal device schematics and wiring diagrams
  - vii) Shut-down procedures
  - viii) Component parts list
  - ix) Detailed circuit operational description including programmable controller ladder diagrams
  - x) Listing of Manufacturers with local telephone numbers and contacts for all instrumentation hardware furnished.

## 6) Spare Parts and Expendables List

- a) A spare parts and expendables list shall be submitted to include not only those items being supplied, but also any additional items recommended for successful long term operation.

## 7) Operation and Maintenance Manual Format

- a) Volume I (or as required) - Hardware
    - i) Tab 1. Component Index and Comments
    - ii) Tab 2. Theory of Operation
    - iii) Tab "N" through "NN" as required:
      - a) Component "X" Data Sheet(s) (one table per component type as required).
      - b) Standard Manufacturer Catalog Information, and Manufacturers O&M Manual.
    - iv) Tab "X" Recommended Spare Parts and Expendables Listing.
    - v) Tab "Y" Current Manufacturers/Locations Representatives Telephone/address listing for all major components.
  - b) Volume II
    - i) Tab 1. Index and Comments

1  
2                   ii) Tab "N" through "NN" as required:

- 3  
4                   a) Panel "X" Layout Drawing  
5                   b) Panel "X" Fabrication Drawing  
6                   c) Panel "X" Legend/Engravings/Bill of  
7                   Materials  
8                   d) Panel "X" Power Wiring  
9                   e) Panel "X" Wiring Diagrams

10  
11                  iii) Tab "X" Loop Drawings (When  
12                   Applicable)

13  
14                  iv) Tab "Y" Installation Details (When  
15                   Applicable)

16  
17                 8. System Calibration and Test Documentation Submittal

- 18  
19                 a. The System Integrator shall submit an example of each type of  
20                   Instrument Calibration Report and Loop Functional Test Report  
21                   that will be used to verify that all preliminary calibration and testing  
22                   has been performed and the system is considered, by the  
23                   supplier, to be ready for the Engineer's acceptance testing.
- 24  
25                 b. After approval of the examples, the System Integrator shall  
26                   prepare Loop Functional Test Report(s) for each loop and an  
27                   Instrument Calibration Sheet for each active element (except  
28                   simple hand switches, lights, etc.). These sheets shall be  
29                   completed and submitted to the Engineer after completion of the  
30                   operational availability field tests.

31  
32                 1) Instrument Calibration Reports

- 33  
34                 a) An Instrument Calibration report shall be used to  
35                   certify that each instrument requiring calibration has  
36                   been calibrated to its published specified accuracy  
37                   shall be submitted to the Engineer. This report shall  
38                   include all applicable data as listed below plus an  
39                   area to identify any defects noted, corrective action  
40                   required, and corrections made.
- 41  
42                 b) Facility identification (Name, location, etc.)
- 43  
44                 c) Loop identification (Name or function)
- 45  
46                 d) Equipment tag and serial numbers

- e) Scale ranges and units
  - f) Test mode or type of test
  - g) Input values or settings
  - h) Expected outputs and tolerances
  - i) Actual readings at 0, 10, 25, 50, 75, 90 and 100 percent of span
  - j) Percent of error for each reading
  - k) Explanations or special notes as applicable
  - l) Date, time, and weather conditions
  - m) Tester's certification with name and signature

2) Loop and Functional Test Reports

  - a) Loop Status Report - For each function that can be demonstrated on a loop-by-loop basis:
    - i) Each form shall include:
      - a) Project name
      - b) Loop number
      - c) Loop description
      - d) Test procedure description, with a space after each specific test to facilitate sign off on completion of each test.
      - e) For each component: tag number, description, manufacturer, and data sheet number.
      - f) Space for sign off and date by the System Integrator
  - b) Functional Acceptance Test Report - For those

## INSTRUMENTATION GENERAL PROVISIONS

functions that cannot be demonstrated on a loop-by-loop basis:

- i) Each form shall include a listing of the specific tests to be conducted. With each test description the following information shall be included:
  - a) Specification page and paragraph of function to be demonstrated
  - b) Description of function
  - c) Test procedure description
  - d) Space after each specific test to facilitate sign off on completion of each test

3. System Integrator's Installation Certification Reports

- a) Upon completion of all preliminary calibration and functional testing, the SI, shall submit a certified report for each control panel and its associated field instruments certifying that the equipment (1) had been properly installed under his or her supervision, (2) is in accurate calibration, (3) was placed in operation, (4) has been checked, inspected, calibrated, and adjusted as necessary, (5) has been operated under maximum power variation conditions and operated satisfactorily, and (6) is fully covered under the terms of the guarantee.

9. Functional Acceptance Test Procedures Submittal

- a. Submit for approval not later than 30 days prior to the functional acceptance test demonstration, a written plan for demonstrating that each device and function of the equipment provided under these specifications meets the specified operational requirements.
- b. The plan shall detail procedures to be used in the functional acceptance testing of all systems. The plan shall include a description of test methods and materials that will be utilized for testing each system.
- c. Immediately correct defects and malfunctions with approved

methods and materials in each case and repeat the testing.

### 3 1.07 SYSTEM TESTING AND ACCEPTANCE

## A. Factory Tests

## 1. Factory Testing

- a. Each panel, computer and networking components shall have been completely tested by the manufacturer personnel. Provide a report certifying the control panel(s) are fully operable and meet the Specifications. Factory testing may be witnessed by Owner/Engineer at the Owner's option. Provide 2-weeks' notice prior to factory testing for all panels. If upon arrival, the panel(s) are not ready for testing, the SI is liable for back charges for all costs associated with the visit by the Owner/Engineer. The Owner/Engineer shall have the right to check all test observations. The SI shall demonstrate that the results of the Factory Tests are accurate. As a minimum, tests shall verify the following:

  1. Accuracy of panel instruments for 4-20 mA inputs and outputs
  2. Location of interface wires on terminal blocks
  3. Function of discrete panel components
  4. Control logic
  5. Network Hubs and Switches
  6. Computers, Printers, etc.
  7. Media Converters, Network Devices
  8. HMI Graphics Operations

#### B. Installation Supervision

1. Furnish the services of authorized factory personnel specially trained and experienced in the installation of the equipment to: (1) supervise the installation in accordance with the approved Instruction Manuals; (2) be present when the instruments and equipment are first delivered, installed, and put into operation; (3) inspect, check, adjust as necessary, and approve the installation; (4) calibrate the instruments, in accordance with the Specifications herein, until all trouble or defects are corrected

1 and the installation and operation are acceptable.  
2

3 C. Preliminary Calibration and Functional Testing  
4

5 1. After approval of the Loop Status Report and Calibration Worksheets  
6 described herein, the System Integrator shall prepare Loop Status  
7 Report(s) for each loop and an Instrument Calibration Worksheet for  
8 each active element (except simple hand switches, lights, etc.). These  
9 sheets shall be completed, signed, and submitted to the Engineer after  
10 the Preliminary Calibration and Functional Testing is completed.

11 2. Although the Preliminary Calibration and Functional Testing does not  
12 require witnessing, the equipment System Integrator shall maintain the  
13 reports and calibration worksheets at the job-site and make them  
14 available for the Engineer's review at any time.

15 a. Preliminary Calibration  
16

17 1) Provide the services of factory trained instrumentation  
18 technician, tools and equipment to field calibrate each  
19 instrument to its specified accuracy in accordance with the  
20 manufacturer's specifications and instructions for  
21 calibration.  
22

23 b. Functional Testing  
24

25 1) Provide Loop Status Report(s) for verifying all control  
26 system functions as follows:  
27

28 (a) Provide the services of factory trained and field  
29 experienced instrumentation engineer(s) to validate  
30 each system to verify that each system is  
31 operational and performing its intended function  
32 within system tolerance. System tolerance is  
33 defined as the root-mean-square sum of the system  
34 components specified accuracy from input to output.  
35

36 (b) Validate calibration of each system by simulating  
37 Inputs at the first element in the loop (i.e., sensor) of  
38 zero, 10, 25, 50, 75, 90 and 100 percent of span, or  
39 on/off and verify loop output devices (i.e., recorder,  
40 indicator, alarm, etc. except controllers). During  
41 system validation, make provisional settings on  
42 levels, alarms, etc. Verify that all logic sequences  
43 operate in accordance with the specifications.  
44

- (c) Cause malfunctions to sound alarms or switch to standby to check system operation. Check all systems thoroughly for correct operation.
  - (d) Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest.

c. System Integrator's Certified Reports

  - 1) Upon completion of the Preliminary Calibration and Functional Testing, the System Integrator shall submit a certified report for each control panel and associated field instruments certifying that the equipment (1) had been properly installed under his supervision, (2) is in accurate calibration, (3) was placed in operation, (4) has been checked, inspected, calibrated, and adjusted as necessary, (5) has been operated under maximum power variation conditions and operated satisfactory.

#### D. Functional Demonstration Testing

- Upon completion of the Preliminary Calibration and Functional Testing, re-test all systems in the presence of the Engineer (or representative). The intent of this test is to demonstrate and verify the operational interrelationship of all instrumentation systems. This testing shall include, but not be limited to, all specified operational modes, taking process variables to their limits (simulated or actual) to verify all alarms, failure interlocks, and operational interlocks between systems and/or mechanical equipment. Notify the Engineer in writing a minimum of 48 hours prior to the proposed date for commencing the test. Upon successful completion of this test the System Integrator shall begin the Operational Acceptance Test Demonstration.

#### E. Operational Acceptance Test Demonstration

- Upon completion of the Functional Demonstration Testing, re-test all systems under actual process conditions in the presence of the Engineer and the Engineer's Operators. The intent of this test is to demonstrate and verify the operational interrelationship of all instrumentation systems to the Engineer's Operators. This testing shall include, but not be limited to, all specified operational modes, taking process variables to their limits (simulated or actual) to verify all alarms, failure interlocks, operational interlocks between systems and/or mechanical equipment, and making final adjustments. Notify the Engineer in writing a minimum of 48 hours prior to the proposed date for commencing the test. Upon successful

1 completion of this test the System Integrator shall begin the 30 Day  
2 Availability Test.  
3

4 F. 30 Day Availability Test  
5

- 6 1. After completion of the Operational Acceptance Test Demonstration, the  
7 System Integrator shall be responsible for the operation of the supplied  
8 system full time on-site for a period of 30 consecutive days, under  
9 conditions of full process operation, without a single non-field repairable  
10 malfunction.  
11
- 12 2. During this test, plant operating and System Integrator personnel shall be  
13 present as required. While the test is proceeding, the Engineer shall  
14 have full use of the system.  
15
- 16 3. If any failures should occur that cannot be corrected within 24 hours, or  
17 more than two similar failures of any duration, the failure will be  
18 considered as a non-field-repairable malfunction. The system shall be  
19 repaired and the 30 day test period shall be re-started. Engineer  
20 reserves the right to set the schedule.  
21
- 22 4. Total availability of the system shall be greater than 99.5 percent during  
23 this test period. Availability shall be defined as "Availability = (Total  
24 Down Time) ÷ (Total Time)".  
25
- 26 5. Down times due to power outages or other factors outside the normal  
27 protection devices or back-up power supplies provided, shall not  
28 contribute to the availability test times above.  
29
- 30 6. Upon successful completion of the system availability testing, submit a  
31 certified report, with substantiating data sheets, indicating that the  
32 equipment furnished meets all the functional requirements specified  
33 herein. The Engineers will countersign this report and it shall constitute  
34 acceptance of the control system hardware.  
35

36 1.08 FINAL DOCUMENTATION  
37

38 A. Reproducible Drawings  
39

- 40 1. The SI shall submit one (1) set of full size reproducible of complete  
41 schematics, wiring diagrams and installation drawings to include all  
42 installed field and panel instruments, mounting details, point-to-point  
43 diagrams with cable, wire, and termination numbers. Drawings shall be  
44 a record of work as actually constructed and shall be labeled "As-  
45 Installed". One copy of applicable schematics and diagrams shall be  
46 placed in each control panel in a protective envelope or binder.

- a. Loop Diagrams
    - (1) Refer to Section 1.05 specified herein before.
  - b. Panel Construction Drawings and Wiring Diagrams
    - (1) Refer to Section 1.05 specified herein before.
  - c. Interconnecting Wiring Diagrams
    - (1) Refer to Section 1.05 specified herein before.
  - d. Instrument Installation Details
    - (1) Refer to Section 1.05 specified herein before.

## B. Software

1. In addition to the reproducible hard copy of drawings and literature specifically generated for the project, one (1) CD-ROM shall be submitted to the Engineer which shall include a copy of all files specifically generated to create the drawings, data sheets, bill of materials, operating and test procedures, control logic, etc. Drawing format shall be compatible with "AutoCAD", release version as directed by the Engineer. Diskettes shall be clearly labeled with the following:
    - a. Project Name
    - b. Volume Number
    - c. Software Program Name and Version used to generate the files
    - d. Label "As-Installed"
  2. Provide one copy of all programming software, application programs, and source code utilized to generate, annotate, and debug all software provided. Programming software, detailed programming instructions, software keys, cables, and licenses shall be provided for all programmable devices, i.e., PLC, HMI, controllers, and smart transmitters. Special devices used in programming supplied hardware shall be provided. It is the intent that the Engineer shall have the full capability to re-program and modify any application on-site without the need to purchase additional software or hardware.

## C. Operation and Maintenance Manuals

1. Furnish the balance of the Operation and Maintenance Manuals for equipment provided under these Specifications per Section 01730.

1                   Content shall be as described above for the submittals.  
2

3     **1.09 TRAINING REQUIREMENTS**

4  
5     **A. General**

- 6
- 7       1. Provide the services of a factory trained and field experienced control  
8       systems engineer to conduct group training of the Owner's designated  
9       personnel in the operation of all Instrumentation, Control and Monitoring  
10      equipment furnished. Include instruction covering basic system theory,  
11      operating principles and adjustments, routine maintenance and repair,  
12      and "hands-on" operation. The text for this training shall be the P&IDs,  
13      panel wiring diagrams, layouts, ladder listings, and the operation and  
14      maintenance manuals furnished under these Specifications.

15  
16     **B. Duration**

- 17
- 18       1. Training specific to the system hardware shall be provided for a minimum  
19       of three operating shifts with a time period necessary to cover complete  
20       Operator and Maintenance Training.

21  
22     **C. Operator Training**

- 23
- 24       1. Operator training shall include instruction in the use of all control system  
25       hardware and software furnished. A detailed written description of the  
26       system furnished and all equipment start-up, shut-down, troubleshooting,  
27       and maintenance procedures shall be provided to each Operator  
28       attending the training sessions. Training material shall be organized and  
29       bound in appropriate binders. One digital and one hard copy of the  
30       training manual shall be submitted to the Engineer prior to scheduling  
31       any training sessions. As a minimum, the format for the training material  
32       shall be as follows:

- 33
- 34           a. General system description and overview  
35           b. Process and Instrumentation Diagrams  
36           c. Sequence of Operation

- 37
- 38                  1) Panel Layout Drawing  
39                  2) Legend  
40                  3) Alarm Handling  
41                  4) System Start-Up  
42                  5) System Shut-Down  
43                  6) Operator Adjustment & Setpoints

- 44
- 45           d. General Troubleshooting Techniques  
46           e. Recommended Maintenance Procedures

f. Recommended Spare Parts

#### D. Maintenance Training

1. Maintenance training shall include instruction in the calibration, maintenance, programming, and repair for all systems furnished.
  2. Maintenance training shall include instruction in the maintenance of all control system hardware and software furnished. A detailed written description of the system furnished and all equipment start-up, shutdown, troubleshooting, and maintenance procedures shall be provided to each person attending the training sessions. Training material shall be organized and bound in appropriate binders. One digital and one hard copy of the training manual shall be submitted to the Engineer prior to scheduling any training sessions. As a minimum, the format for the training material shall be as follows:
    - a. General system description and overview
    - b. Process and Instrumentation Diagrams
    - c. Sequence of Operation
      - 1) Panel Layout Drawing
      - 2) Legend
      - 3) Alarm Handling
      - 4) System Start-Up
      - 5) System Shut-Down
      - 6) Operator Adjustment & Setpoints
    - d. Detailed review of all schematic diagrams
    - e. Detailed review of all software functions using actual software listings
    - f. Detailed programming instruction of hardware furnished unless otherwise noted
    - g. Detailed calibration procedures for all furnished
    - h. Recommended Maintenance Procedures
    - i. Recommended Spare Parts

#### E. Final Acceptance

1. Final Engineer acceptance is defined as a point in time when (1) all training has been performed, (2) final "As Installed" documentation and software (when applicable) have been received and approved, (3) the system has successfully passed the availability test period, and (4) all punch list items have been resolved.

#### F. Guarantee and Warranties

- 1           1. Guarantee all work of these Specifications for a period of one (1) year  
2           from the date of final acceptance by the Engineer. With respect to  
3           instruments and equipment, guarantee shall cover (a) faulty or  
4           inadequate design; (b) improper assembly or erection; (c) defective  
5           workmanship or materials; and (d) leakage, breakage, or other failure not  
6           caused by Engineer misuse. For equipment bearing a manufacturer's  
7           warranty in excess of one year, furnish a copy of the warranty to  
8           Engineer with Owner named as beneficiary.  
9

10          11 PART 2 - PRODUCTS  
12

13          2.01 JOB CONDITIONS  
14

- 15           A. Exercise care (1) to secure neat arrangement of all piping, valves, conduit, and  
16           like items, and (2) to overcome structural interferences. Verify dimensions and  
17           conditions at the place of work, and install materials and equipment in the  
18           available spaces.

19          2.02 MATERIALS AND STANDARD SPECIFICATIONS  
20

- 21           A. Provide instruments, equipment and materials suitable for service conditions  
22           and meeting standard specifications such as Instrumentation, Systems and  
23           Automation (ISA). The intent of this Specification is to secure instruments and  
24           equipment of a uniform quality and manufacture throughout the facilities; i.e., all  
25           instruments furnished by the System Integrator of the same type of function  
26           shall be by the same manufacturer. This allows the stocking of the minimum  
27           number of spare parts.  
28

29          30 2.03 PRODUCT DELIVERY, STORAGE, AND HANDLING  
31

- 32           A. Box, crate or otherwise enclose and protect instruments and equipment during  
33           shipment, handling and storage. Keep all equipment dry and covered from  
34           exposure to weather, moisture, corrosive liquids, and gases or any element  
35           which could degrade the equipment. Protect painted surfaces against impact,  
36           abrasion, discoloration, and other damage. Repair any damage as directed and  
37           approved.

38          39 2.04 MOUNTING  
40

- 41           A. Mount and install equipment as required. Mount field instruments according to  
42           the best standard practice on pipe mounts, pedestal mounts, or other similar  
43           means in accordance with manufacturer's recommendations.  
44  
45           B. Equipment specified for field mounting shall be suitable for direct pipe

mounting, pedestal mounting, or surface mounting. Non in-line indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than three (3) feet nor higher than five (5) feet above walkways, platforms, catwalks, etc. All such equipment shall be weather and splash proof, and electrical equipment shall be in NEMA 4X cases unless otherwise noted.

## 2.05 COMPONENT TAG NUMBERING SCHEME

- A. All control equipment shall be identified by unique alphanumeric code or tag number based on the latest ISA standards S5.1.

## Tag Numbering Scheme: a-b-c-d

Equipment tagging shall be based on the following scheme:

	Description	TAG	Explanation
a.	ISA Functional Identification	HS	Hand Switch
b.	Loop Number	23	Loop 23
c.	Component Number	2	Second HS in Loop
d.	Unit	3 (When Required)	Third Identical Process Control System

### Example 1: HS-23-2-3

Tag number identifies a Hand Selector Switch. It is part of Loop 23 and the second hand selector switch in the loop. This is the third identical process unit (i.e., three identical pump control stations). It is also the only hand selector switch in the loop.

### Example 2: HS-23

Tag number identifies a Hand Selector Switch in Loop 23. It is also the only hand selector switch in the loop.

## 2.06 INSTRUMENT IDENTIFICATION

- A. All components provided, both field and panel mounted, shall be provided with permanently mounted name tags bearing the entire tag number of the component. Panel mounted tags shall be white with black lettering lamicoid

- 1 plastic; field mounted tags shall be stamped stainless steel.
- 2
- 3 B. Nameplates for panels and panel mounted equipment shall be as indicated on
- 4 the Drawings.
- 5
- 6 C. Field mounted tags shall be 16-gauge, 316 stainless steel with 3/16 inch high
- 7 characters.
- 8
- 9 D. Tags shall be attached to equipment with a commercial tag holder using a
- 10 stainless steel band with a worm screw clamping device or by a holder
- 11 fabricated with standard stainless steel hose clamps and meeting the same
- 12 description. In some cases where this would be impractical, use 20-gauge
- 13 stainless steel wire.
- 14
- 15 E. For field panels or large equipment cases use stainless steel screws, however,
- 16 such permanent attachment shall not be on an ordinarily replaceable part. In all
- 17 cases, the tag shall be plainly visible to a standing observer and not obscure
- 18 adjustment ports or impair the function of the instrument. Field mounted control
- 19 stations, recorders or indicators shall have a nameplate indicating their function
- 20 and the variable controlled or displayed. Nameplate shall be attached by one of
- 21 the above methods.

22

23 2.07 STANDARD LIGHT COLORS AND INSCRIPTIONS

24

25 Unless otherwise noted, the following color code and inscriptions shall be followed:

26

<u>Tag Function</u>	<u>Inscription(s)</u>	<u>Color</u>
ON	ON	RED
OFF	OFF	GREEN
OPEN	OPEN	RED
CLOSED	CLOSED	GREEN
LOW	LOW	GREEN
FAIL	FAIL	RED
HIGH	HIGH	AMBER
AUTO	AUTO	WHITE
MANUAL	MANUAL	YELLOW

LOCAL	LOCAL	WHITE
REMOTE	REMOTE	AMBER

1  
2 Lettering shall be black on white and amber lenses. Lettering shall be white on red  
3 and green lenses.  
4

5    2.08 STANDARD PUSHBUTTON COLORS AND INSCRIPTIONS  
6

<u>Tag Function</u>	<u>Inscription(s)</u>	<u>Color</u>
OO	ON	RED
OC	OFF	GREEN
OC	OPEN CLOSED	RED GREEN
OCA	OPEN CLOSED AUTO	RED GREEN WHITE
OOA	ON AUTO	RED WHITE
OC	OFF AUTO	GREEN WHITE
MA	MANUAL AUTO	YELLOW WHITE
SS	START STOP	RED GREEN
RESET	RESET	RED

7  
8 All unused or non inscribed buttons shall be black. Lettering shall be black on white  
9 and yellow buttons. Lettering shall be white on black, red, and green  
10

11    2.09 ELECTRONIC EQUIPMENT  
12

13    A. If the equipment is electronic in nature, provide industrial duty, solid state  
14    equipment to the greatest extent practicable. Select components of  
15    construction for their suitability and reliability. Employ adequate component de-  
16    rating to preclude failures because of transients and momentary overloads  
17    reasonably expected in normal operation. Where conduit connection is

1 provided for mounting a surge/lightning suppressor directly to the instrument,  
2 the arrestor shall be so mounted.

3

4 2.10 EQUIPMENT OPERATING CONDITIONS

5

6 A. All equipment shall be rated for normal operating performance with varying  
7 operating conditions over the following ranges:

8 1. Power:

9 120 Vac  $\pm$  10%, 60 Hz  $\pm$  1 Hz except where specifically stated otherwise  
10 on the drawings or in the specifications.

11 14 2. Environmental Conditions:

12 16 a. Equipment rated NEMA 1 or NEMA 12 shall be suitable for the  
17 following environmental conditions:

- 18 19 1) Temperature: 40 to 105 degrees F.  
20 2) Relative Humidity: 10 to 80 percent.  
21 3) Classification: Non-hazardous.

22 b. Equipment rated NEMA 4X shall be suitable for the following  
23 environmental conditions:

- 24 26 1) Temperature: 20 to 105 degrees F.  
27 2) Relative Humidity: 10 to 100 percent.  
28 3) Classification: Non-hazardous.  
29 4) Atmosphere: Corrosive.

30 31 2.11 SIGNAL ISOLATORS, CONVERTERS AND CONDITIONERS

32 A. Insure that input-output of all instruments and control devices (whether  
33 furnished by the System Integrator or not) are compatible. Analog signals  
34 between field and panels shall be 4 to 20 mA dc unless specifically approved  
35 otherwise. Granting such approval does not relieve the System Integrator from  
36 the compatibility requirement above. Provide signal isolators and converters as  
37 necessary to obtain the required system performance. Mount the devices in  
38 control panels or in the field at point of application, as required for accurate  
39 signal acquisition.

40 41 2.12 AUXILIARY CONTACTS BY OTHERS

42 A. Provide instruments and equipment to connect to auxiliary contacts provided by  
43 others for alarms, status of equipment, interlocking, and other functions as  
44 indicated and as specified herein.

1  
2   2.13 ELECTRICAL  
3

- 4           A. The construction work shall include all power supply wiring, instrumentation  
5           wiring, interconnecting wiring and equipment grounding as indicated, specified,  
6           and required.  
7  
8           B. Wiring installations shall include cables, conductors, terminals, connectors, heat  
9           shrunken wire markers on all terminations, conduits, conduit fittings, supports,  
10          hardware, and all other required materials.  
11  
12          C. Provide the materials and complete all the required installations for equipment  
13          grounding.  
14  
15          D. Incidental items not specifically included in the Contract Documents that can  
16          legitimately and reasonably be inferred to belong in the instrumentation work  
17          shall be provided and installed by the System Integrator at no additional cost to  
18          the Owner.  
19  
20          E. Ring out all signal wiring prior to termination. Provide wire number tags marked  
21          in indelible waterproof form of slip-on type and heat shrunk for each wire  
22          termination point in the panel and field. Wire tagging shall identify the  
23          destination point of the wire and when applicable, shall include the signal  
24          polarity for analog signals. Each destination point shall be coded as follows:  
25  
26           1. Destination ID - Terminal Block ID - Terminal Number - (Polarity)

27  
28   2.14 ELECTRICAL TRANSIENT PROTECTION  
29

- 30          A. All instrument and control equipment mounted outside of protective structures  
31          (field mounted equipment) shall be equipped with suitable surge-arresting  
32          devices to protect the equipment from damage due to electrical transients  
33          induced in the interconnecting lines from lightning discharges or nearby  
34          electrical devices. Both power and signal circuits shall be protected with surge  
35          and transient protectors installed at the source and destination ends of the  
36          circuits. Protective devices used on 120V ac inputs to field mounted equipment  
37          shall be secondary valve surge protectors conforming to the requirements of  
38          IEEE Standard 28-1972 (ANSI C62.1-1971).  
39  
40          B. Surge and transient protectors shall be normally connected to the electrical  
41          system ground. When an electrical system ground is not available near the  
42          device, the protectors shall be connected to a ground rod 10 ft. in length by 3/4  
43          inch in diameter and located within 10 feet of the device.  
44  
45          C. Protectors for signal circuits at the field transmitter shall be Joslyn Model No.  
46          1669-06, 1669-02, and 1800-20 in panels. Protectors for 120-volt power

1                   circuits shall be UL listed Joslyn Model No. 1250-32 secondary arrestor.  
2

3       **2.15 PROCESS CONNECTIONS**

- 4
- 5       A.     Provide instrument piping, tubing, and capillary tubing to meet the intended  
6           process service and ambient environmental condition for corrosion resistance,  
7           etc. All instrument pneumatic tubing shall be stainless steel with stainless steel  
8           fittings. Slope lines according to service to promote self draining or venting  
9           back to the process. Terminate connection to process lines or vessels in a  
10          service rated block valve that will permit closing off the sense line or removal of  
11          the element without requiring shut down of the process. Include drip legs and  
12          blow-down valves for terminations of sense lines at the instruments when  
13          mounted such that condensation can accumulate.
- 14

15       **2.16 MISCELLANEOUS MECHANICAL**

- 16
- 17       A.     Three Valve Instrument Equalizing Manifold
- 18
- 19           1.    Manifolds shall be of stainless steel construction for isolation and  
20           equalization of differential pressure transducers. Units shall be  
21           Rosemount or equal.
- 22
- 23       B.     Welding of S.S. enclosures and instrument supports shall be TIG welded and  
24           finished to provide corrosion free appearance.
- 25

26       **2.17 PAINTING**

- 27
- 28       A.     Provide factory paint for all instruments and equipment. Provide paint as  
29           required for non-stainless steel structural supports, brackets, etc.
- 30

31       **2.18 CORROSION PROTECTION**

- 32
- 33       A.     All control panels, enclosures, and other equipment containing electrical or  
34           instrumentation and control devices, including spare parts, shall be protected  
35           from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to  
36           shipment, the capsules shall be provided within the shipping containers and  
37           equipment as recommended by the capsule manufacturer's recommendations.  
38           The Contractor, just prior to Engineer's final acceptance of the equipment, shall  
39           replace all capsules. The corrosion-inhibiting vapor capsules shall be Northern  
40           Instruments Model Zerust VC or Hoffman Model A-HCI. NEMA 4x panels shall  
41           be provided with breather/drains, Crouse-Hinds Model ECD18; or approved  
42           equal.
- 43
- 44

45       **2.20 WORKMANSHIP**

1           A. General

- 2
- 3       1. Install materials and equipment in a workmanlike manner utilizing
- 4           craftsman skilled in the particular trade. Provide work which has a neat
- 5           and finished appearance.
- 6
- 7       2. Coordinate work with the Engineer, and work of other trades to avoid
- 8           conflicts, errors, delays, and unnecessary interference with operation of
- 9           the facilities during construction.

10          B. Protection during Construction

- 11
- 12       1. Throughout this Contract, the Contractor shall provide protection for
- 13           materials and equipment against loss or damage and the effects of
- 14           weather. Prior to installation, store items in indoor, dry locations.
- 15           Provide heating in storage areas for items subject to corrosion under
- 16           damp conditions. Specific storage requirements shall be in accordance
- 17           with the Engineer reviewed Contractor recommendations.

18

19          C. Material and Equipment Installation

- 20
- 21       1. Follow manufacturers' installation instructions explicitly, unless otherwise
- 22           indicated. Wherever any conflict arises between manufacturers'
- 23           instructions, and these Contract Documents, follow the Engineers
- 24           decision, at no additional cost to the Engineer. Keep copy of
- 25           manufacturers' installation instructions on the jobsite available for review
- 26           at all times.

27

28          D. Removal or Relocation of Materials and Equipment

- 29
- 30       1. Where existing materials and equipment are removed or relocated,
- 31           remove and deliver to the Engineer all materials no longer used unless
- 32           otherwise directed by the Engineer. Repair affected surfaces to conform
- 33           to the type, quality, and finish of the surrounding surface in a neat and
- 34           workmanlike manner. Follow any specific instructions by the Engineer.

35

36          E. Cleaning and Touchup Painting

- 37
- 38       1. Keep the premises free from accumulation of waste material or rubbish.
- 39           Upon completion of work, remove materials, scraps, and debris from
- 40           premises and from interior and exterior of all devices and equipment.
- 41           Touch-up scratches, scrapes, or chips in interior and exterior surfaces of
- 42           panels and equipment with finishes matching as nearly as possible the
- 43           type, color, consistency, and type of surface of the original finish.

44

45          F. Panels and Panel-Mounted Equipment

46

1. Panels and panel-mounted equipment shall be assembled as far as possible at the factory. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the jobsite.

## G. Electrical

1. Arrange wiring neatly, cut to proper length, and remove surplus wire. Provide abrasion protection for any wire bundles which pass through holes or across edges of sheet metal.
  2. Wiring shall not be spliced or taped except at the device terminals or terminal blocks.
  3. Use manufacturer's recommended tool with the proper sized anvil, for all crimp terminations. No more than one wire may be terminated in a single crimp lug and no more than two lugs may be installed on a single screw terminal.

## H. Inspections

1. All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer. Correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer at no additional cost to the Engineer.

END OF SECTION

1 SECTION 13615  
2

3 PROCESS INSTRUMENTATION AND EQUIPMENT  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. The Contractor shall furnish and install all instrumentation and controls  
10      hereinafter specified to perform the intended function and achieve a fully  
11      integrated and operational system. The equipment and services defined herein  
12      shall be furnished by a single instrumentation system integrator who shall  
13      coordinate the instrument and control system for proper operation with related  
14      equipment and materials provided by other suppliers of the Owner.  
15
- 16       B. Work shall include all labor, materials, plant facilities and equipment,  
17      performance of all work necessary to complete the manufacture, to make  
18      factory tests, to prepare and load for shipment, to deliver to the site, to provide  
19      programming, calibration, installation supervision, training system start-up,  
20      services and incidentals required to completely furnish and install an  
21      instrumentation and control systems, including all work necessary during the  
22      Warranty Period, as specified herein, in other specification sections as listed  
23      below under related work, and as shown on the Contract Drawings.  
24
- 25       C. The equipment and services to be provided include:  
26
- 27          1. All general instrumentation requirements as specified herein.  
28          2. All field and analytical equipment and services as specified herein.  
29          3. All control panels and control panel mounted equipment and services as  
30             specified herein and in Division 16  
31          4. All coordination and interfacing with the control system equipment  
32             specified under Section 13630.  
33          5. All coordination and interfacing with each piece of equipment specified  
34             under Division 11 (equipment), Division 15 (mechanical), and Division 16  
35             (Electrical), where applicable.  
36
- 37       D. Auxiliary and accessory devices necessary for system operation or  
38      performance, such as transducers or relays to interface with existing equipment  
39      or equipment provided by other suppliers under other Sections of these  
40      Specifications, shall be furnished, coordinated and interfaced by the  
41      instrumentation system integrator whether or not they are shown on the  
42      drawings or specified herein.  
43
- 44       E. Equipment shall be fabricated, assembled, installed, and placed in proper  
45      operating condition in full conformity with detail Drawings and Specifications,  
46      engineering data, instructions and recommendations of the equipment  
47      manufacturer as approved by the Engineer.

## **1.02 SUBMITTALS**

- A. The submittals shall be in accordance with Section 01300 and shall include.

  1. Manufacturer's data.
  2. Shop drawings.
  3. Certificates of compliance.
  4. Certified test reports.
  5. Operation and maintenance manual.

## 1.03 QUALITY ASSURANCE

- A. Instrumentation and control equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. Equipment furnished shall be new and of current design.
  - B. Equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.
  - C. Materials and Installation shall comply with the requirements of the referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. Equipment of the same type shall be a product of the same manufacturer. Capacities of equipment shall not be less than that indicated on the drawings or specified.
  - D. All exposed pneumatic tubing shall be routed through a device designed to protect the tubing from crushing through incidental contact. The pneumatic tubing shall be attached to the protective track as required by manufacturer's recommendations and shall be protected from crimping by those attachment methods. The protective track devices shall be stainless steel and shall be "Tube-Track" or approved equal.
  - E. All exterior mounted instruments shall be furnished with appropriately sized 304 stainless steel rain and sun shields.
  - F. Model numbers and names for equipment listed herein are for the purpose of establishing a standard of quality or matching existing instrumentation. Like equipment of a different manufacturer must be approved by the Engineer.

1    1.04 PRODUCT HANDLING

2            A.     Shipping Precautions

- 5            1. After completion of shop assembly, factory test and approval, all  
6            equipment, cabinets and the panel insert shall be packed in protective  
7            crates and enclosed in heavy duty polyethylene envelopes or secured  
8            sheeting to provide complete protection from damage, dust and moisture.  
9            Dehumidifiers shall be placed inside the polyethylene coverings. Boxed  
10          weights shall be shown on shipping tags together with instructions for  
11          unloading, transporting, storing and handling at job site.
- 13          2. Special instructions for proper field handling, storage and installation  
14          required by manufacturer for proper protection shall be securely attached  
15          to each piece of equipment prior to packaging and shipment.
- 17          3. None of the central control and monitoring equipment shall be shipped to  
18          the site until the room(s) is/are environmentally suitable.

20           B. Identification

- 22          1. Each component shall be tagged to identify its location, tag number and  
23          function in the system. Identification shall be prominently displayed on  
24          the outside of the package.
- 26          2. A permanent stainless steel or other non-corrosive material tag firmly  
27          attached and permanently and indelibly marked with the instrument tag  
28          number, as given in the tabulation, shall be provided on each piece of  
29          equipment supplied.

31           C. Storage

- 33          1. Equipment shall not be stored out-of-doors. Equipment shall be stored  
34          in dry permanent shelters including in-line equipment, and shall be  
35          adequately protected against mechanical injury. If any apparatus has  
36          been damaged, such damage shall be repaired by the contractor at his  
37          own expense. If any apparatus has been subject to possible injury by  
38          water, it shall be thoroughly dried out and put through such tests as  
39          directed by the engineer. This shall be at the cost and expense of the  
40          contractor, or the apparatus shall be replaced by the contractor at his  
41          own expense.

43           PART 2 – PRODUCTS

45           2.01 INSTRUMENTATION GENERAL

47           A. Type

- 1           1. All instrumentation supplied shall be of the manufacturer's latest design  
2           and shall produce or be activated by signals, which are established  
3           standards for the water and wastewater industries.  
4  
5  
6           2. Outputs of equipment that are not of the standard signals as outlined,  
7           shall have the output immediately raised and/ or converted to compatible  
8           standard signals for remote transmission. No zero based signals will be  
9           allowed.  
10  
11          3. All instruments shall be provided with mounting hardware and floor  
12          stands, wall brackets, or instrument racks as shown on the drawings or  
13          as required.  
14  
15          4. Equipment installed in a hazardous area shall meet class, group and  
16          division classification as shown on the electrical drawings, or comply with  
17          the local or national electrical code, whichever requirement is most  
18          stringent.  
19  
20          5. All indicators and recorder readouts shall be linear in process units.  
21  
22          6. All transmitters shall be provided with either integral indicators or conduit  
23          mounted indicators in process units, accurate to two percent.  
24  
25          7. Electronic equipment shall be of the manufacturer's latest design,  
26          utilizing printed circuitry and suitably coated to prevent contamination by  
27          dust, moisture, and fungus. Solid-state components shall be  
28          conservatively rated for their purpose, to assure optimum long term  
29          performance and dependability over ambient atmosphere fluctuations  
30          and 0 to 100 percent relative humidity. The field mounted equipment and  
31          system components shall be designed for installation in dusty, humid,  
32          and slightly corrosive service conditions.  
33  
34          8. All equipment, cabinets and devices furnished hereunder shall be heavy-  
35          duty type, designed for continuous industrial service. The system shall  
36          contain products of a single manufacturer, insofar as possible, and shall  
37          consist of equipment models, which are currently in production. All  
38          equipment provided shall be of modular construction and shall be  
39          capable of field expansion.  
40

41           B. Electrical

- 42           1. All equipment shall be designed to operate on a 60 hertz alternating  
43          current power source at a normal 120 volts, plus or minus 10 percent,  
44          except where specifically noted. All regulators and power supplies  
45          required for compliance with the above shall be provided between power  
46  
47

1 supply and interconnected instrument loop. Where equipment requires  
2 voltage regulation, constant voltage transformers shall be furnished and  
3 installed.

- 4
- 5 2. All analog transmitter and controller outputs shall be 4 to 20 millamps  
6 into a minimum load range of 0-750 ohms, unless specifically noted  
7 otherwise.
- 8
- 9 3. All switches shall have double-pole, double-throw contacts rated at a  
10 minimum of 600 volts-amperes (VA), unless specifically noted otherwise.
- 11
- 12 4. Materials and equipment used shall be U.L. approved wherever such  
13 approved equipment and materials are available.
- 14
- 15 5. All equipment shall be designed and constructed so that in the event of  
16 a power interruption, the equipment specified hereunder shall resume  
17 normal operation without manual resetting when power is restored.
- 18

19 2.02 LIGHTNING/SURGE SUPPRESSION

20

- 21 A. General - in addition to manufacturer's standard, internal protection,  
22 supplementary lightning/surge protection shall be provided to protect all  
23 systems from surges propagating along the signal and power supply lines. The  
24 protection systems shall be such that the protective level shall not interfere with  
25 normal operation, but shall be lower than the instrument surge withstand level,  
26 and shall be maintenance-free and self-restoring. Instruments shall be housed  
27 in a suitable metallic case, and properly grounded. Ground wires for all surge  
28 protectors shall be connected to a good earth ground and, where practical, each  
29 ground wire shall be run individually and insulated from each other. These  
30 protectors and specified instrumentation/transmitters shall be mounted in a  
31 separate NEMA 3R stainless steel vented enclosure. The units shall be  
32 manufactured by DEHN. Substitutions will not be considered by the City.
- 33
- 34 B. Power supply - additional protection of all alternating current (ac) instrument  
35 power supply lines shall be provided. Cabinet(s)/panel(s) and groups of field  
36 instruments, as approved by the Engineer, shall be protected by isolation  
37 transformers and surge suppressors. Individual field instruments shall be  
38 protected by high discharge heavy-duty zinc oxide varistors/spark gap  
39 combination. The ac suppressor shall have a response time of less than 25  
40 nanoseconds, a surge current rating of 4kA, an input voltage of 120 VAC, 50/60  
41 Hz, and have a 6kAms short-circuit withstand capability. Surge protection  
42 device model 953 204 manufactured by DEHN. Substitutions will not be  
43 considered by the City.
- 44
- 45 C. Signal line - protection of all field analog, discrete, digital and telemetered signal  
46 lines shall be provided. Protection devices shall be installed at the both ends  
47 as close to the instrument being protected as possible. Where signal lines enter

control rooms through an interface cabinet, the protection devices shall be mounted in the interface cabinet. Protection shall be with the use of silicone avalanche diodes or approved equal. The suppressor shall be capable of protecting a signal pair plus the cable shield with a DC clamping level of 33V, be rated 20kA nominal discharge current and have at least a .75A current rating. Surge protection device model 920 300 + 926 324 manufactured by DEHN. Substitutions will not be considered by the City.

## 2.03 MAGNETIC FLOWMETERS

### A. Primary Flow Head

1. Electromagnetic flowtube shall be Siemens Mag 5100W or Engineer-approved equal.
2. Each meter will have an epoxy-coated steel metering tube welded at all joints and a non-conductive liner, suitable for the liquid being metered.
3. Each connection will be steel flanged ANSI Class 150/300, for meter sizes up to 24" and AWWA Class B, D or F for meters larger than 24".
4. There will be no electronic components on the primary flow head. An integral or remote converter will supply coil drive power. Output signal from the primary will be fed through cable supplied with the meter to the signal converter.
5. Electrode material will be compatible with the process fluid. Liner material shall be hard rubber (ebonite) and measurement and grounding electrodes shall be Hastelloy-C for wastewater/sewage applications.
6. Meter shall have field replaceable electrodes with access ports or an active electrode cleaning feature to remove grease deposits or build-up
7. When installed in lined or non-metallic piping, the meter will be provided with corrosion-resistant grounding rings or electrodes.
8. Meter calibration will be performed by a volumetric comparison method. A calibration certificate will accompany each meter. The calibration facility will be certified to 0.5% accuracy. The calibration facility must be traceable to national standards.
9. The instrument will be manufactured in an ISO 9001 approved facility.
10. The meter shall communicate by HART protocol.

### B. Converter

- 1       1. The Magnetic Flowmeter Converter shall be remote mounted. It will  
2       provide precisely controlled and regulated primary field excitation. It shall  
3       convert the primary flowmeter signal into a 4-20 mA DC and pulse output  
4       directly proportional to the flow rate.  
5
- 6       2. The full scale measuring range shall be a direct digital input in  
7       engineering units and fully adjustable over a range from 1.0 to 33 ft/sec.  
8
- 9       3. Each converter shall contain internal self-diagnostics, automatic data  
10      integrity checking, and be completely interchangeable with other  
11      converters of the same type without need for recalibration. No auxiliary  
12      test meter or primary simulator shall be required for commissioning,  
13      zeroing, or interchanging of flow meter/converter.  
14
- 15      4. Each converter shall contain the following features as standard  
16      equipment:  
17
  - Simultaneous analog output (500-ohm load) and a scaled pulse  
output.
  - Status output.
  - Low flow cutoff.
  - Forward / reverse flow measurement capabilities.
  - Integral rate of flow indicator and 7-digit resettable LCD totalizer.
  - Capability of testing analog and frequency outputs.
  - Engineering units for display and programming; flow and total shall  
be user programmable in any engineering unit of measure.
- 18
- 19      5. All adjustments and changes of programming shall be by local  
20      pushbutton of direct digital input.  
21
- 22      6. For ease of repair / replacement all converter configuration and totalizer  
23      data shall be stored on a removable EPROM. When removed and placed  
24      into a replacement / spare converter, no additional programming shall be  
25      required.  
26
- 27      7. For ease of wiring, power and output wiring terminals shall be a plug in  
28      type, removable from the instrument without disconnecting wiring.  
29
- 30      8. Repeatability shall be 0.10% of rate.  
31
- 32      9. Accuracy of the system (Primary Flow Head and Converter) shall be:  
33
- 34
  - Meter sizes up to 40" +/- 0.4% of actual flow rate (for velocities >1  
m/sec)
- 35      10. The enclosures shall be rated NEMA 4X minimum and in accordance  
36      with the NFPA 820 classification in which it is located. The converter  
37      shall incorporate EMI/RFI protection / suppression as well as overload  
38
- 39
- 40
- 41
- 42
- 43
- 44
- 45
- 46
- 47

## PROCESS INSTRUMENTATION AND EQUIPMENT

1 protection for output circuits and meet the requirements of the EU-EMC  
2 Directives and bear the CE Approval symbol.

3

4 11. The instrument shall be manufactured in an ISO 9001 approved facility.

5

6 2.04 LIQUID LEVEL FLOAT SWITCH

7

8 A. Type SO ball float switch shall be installed in the following locations and as  
9 shown on the drawings:

10 B. Functional/performance:

11 1. Differential - less than one-inch.

12 2. Switch rating - 4.5 amps at 115V AC, 3.0 amps at 230V AC

13 C. Physical:

14 1. Float - molded high density polyethylene.

15 2. Switch - totally encapsulated mercury switch.

16 3. Cable - heavy duty, synthetic rubber jacketed, integral to float.

17 D. Options/accessories required:

18 1. Provide 316 stainless steel adjustable clamp tubes, pipe brackets, and  
19 u-bolts;

20 2. The floats shall be mounted on a vertical one-inch stainless steel pipe  
21 with all stainless steel hardware;

22 3. The lead wire shall be a waterproof cable of sufficient length so that no  
23 splice is required prior to the junction box; and,

24 4. Provide a castle-aluminum NEMA 4X junction box with terminals for all  
25 floats and tapped as required for conduit connections.

26 E. Manufacturers:

27 1. Consolidated Electric Co., Model LS.

28 2. Flygt ENH-10

29 3. Roto-float

30 4. Engineer approved equal

1  
2 2.05 ULTRASONIC LEVEL TRANSMITTER  
3

- 4 A. Ultrasonic level transmitter systems shall be furnished for fluid level  
5 measurement. The ultrasonic level transmitter system shall include an  
6 ultrasonic transducer and transmitter connected by a cable. The ultrasonic level  
7 transducer shall be designed to operate on the principle of sound echoing to  
8 provide level measurement without contact of fluid. The transducer shall  
9 provide electronic signal output to the transmitter proportional to the fluid level.  
10 The transmitter shall be furnished with all equipment as necessary to meet the  
11 requirements as set forth herein shall be included and connected so as to  
12 provide a complete and operational system.  
13
- 14 B. The Contractor shall furnish cable with sufficient length for connection of the  
15 transducer and the transmitter. Contractor shall size ultrasonic transducer to  
16 measure entire depth of structure.  
17
- 18 C. The transmitter shall operate on 120 volts, 60Hz, and shall have a minimum  
19 NEMA 4X rated polycarbonate enclosure and shall be rated in accordance with  
20 NFPA area classification requirements for the area in which it installed. The  
21 transmitter output shall be 4-20 mA DC. Calibration parameters shall be  
22 permanently stored even during power interruptions. Contractor shall be  
23 responsible for calibration.  
24
- 25 D. System shall operate off of a dynamic TVT curve with multiple algorithms  
26 available to diagnose the true level.  
27
- 28 E. Accuracy: +/- 1 mm plus 0.17 % of distance  
29
- 30 F. Resolution: 0.1% of measurement or 2mm (.08") whichever is greater  
31
- 32 G. The ultrasonic level transducers shall be Siemens Echomax XPS and  
33 transmitters shall be Siemens LUT 400 or Engineer approved equal.  
34
- 35 H. Ultrasonic level indicators shall be installed in the locations as shown on the  
36 drawings using the manufacturers recommended mounting recommendations.  
37

38 2.06 TRANSIENT PROTECTION/SURGE SUPPRESSION DEVICES  
39

- 40 A. Surge and transient protection devices shall be two-stage units incorporating  
41 gas discharge tube and diodes to earth. Surge protective device shall be rated  
42 10kA nominal discharge current for surge events and 1kA current for lightning  
43 events. Surge protection shall be used on all 4-20 mA transmitters (e.g. LIT,  
44 PIT, FIT). Surge protection devices for instrument loops of 4-20 mA shall be  
45 Model 929 921 manufactured by DEHN. Substitutions will not be considered  
46 by the City.  
47

1  
2   **2.07 SUBMERSIBLE TRANSDUCER AND PUMP CONTROLLER/DISPLAY**

- 3  
4   A. A submersible transducer type level transmitter system shall be furnished for  
5   the sludge level measurement in the hoppers of each Salsnes Filter sludge  
6   pump. Each system shall include a submersible level transducer connected to  
7   a pump controller/display unit with 4 relays, cable, power supply, and a NEMA  
8   4X stainless steel mounting enclosure.
- 9  
10   B. The submersible level transducer shall measure the height of liquid above its  
11   mounting position referenced to atmospheric pressure. The transducer shall  
12   provide an electronic signal output to the controller proportional to the sludge  
13   level. The system shall be furnished with all equipment as necessary to meet  
14   the requirements as set forth herein and connected so as to provide a complete  
15   and operational system.
- 16  
17   C. The Contractor shall furnish cable with sufficient length for connection of the  
18   transducer and the controller. The system shall be sized to measure entire  
19   depth of the progressive cavity pump hoppers.
- 20  
21   D. The controller/display units shall be ProVu Dual Line 6-Digit Process Meters  
22   with 4-relays by Precision Digital or approved equal. The transducers shall be  
23   GES 870xxx Submersible Level Transducers by Gilson Engineering or  
24   approved equal.
- 25  
26   E. The Contractor shall make connections to I/O, modify existing and develop new  
27   HMI graphic screens on the existing SCADA System and provide PLC ladder  
28   logic programming to monitor all new I/O, register alarms, and provide control  
29   and observation capabilities as appropriate for the new system.
- 30  
31   F. The controller/display unit shall display the sludge level and provide a level  
32   signal to the pump control PLC.
- 33  
34   G. The submersible transducers and controllers/display units shall be installed in  
35   the locations as shown on the drawings using the manufacturers mounting  
36   recommendations.

37  
38   **PART 3 – EXECUTION**

39  
40   **3.01 INSTALLATION**

- 41  
42   A. Field mounted elements shall be installed, calibrated, and started-up in strict  
43   compliance with the manufacturer's requirements and recommendations.  
44   Conflicts between the manufacturer's requirements and recommendations and  
45   these Specifications or the Drawings shall be presented to the Engineer for  
46   resolution before any affected work is started. Installed equipment shall be  
47   certified as appropriate for the application and process by the Contractor.

- 1           B. Connections of instruments to process piping shall include, as close as practical  
2           to the point of connection, a tight closing block valve suitable for the maximum  
3           process pressure and temperature and for the material involved. If connections  
4           are of threaded or welded pipe, there shall be a union or flanged connection  
5           located to facilitate disassembly of the connection and removal of the instrument  
6           without interrupting process operation.
- 7
- 8           C. All field-mounted instruments shall be protected and isolated from vibration,  
9           temperature extremes, radiant heat, rain, sleet or falling water, and similar  
10          adverse conditions.
- 11
- 12          D. Impulse lines of pressure instruments shall be as short as practical and shall be  
13          installed with a minimum slope of 1-inch per foot (1:12) downward toward the  
14          instrument in liquid system and upward toward the instrument in gaseous  
15          systems. If this preferred direction of slope cannot be maintained, the contractor  
16          shall submit for approval an installation configuration utilizing traps, drains,  
17          and/or vents at high and low points, which will ensure freedom from mixed  
18          phase offset effects and provide ease of purging or draining. Pressure lines of  
19          pressure instruments shall be insulated.
- 20
- 21          E. Field mounted elements shall be marked with data required for calibration such  
22          as location of adjustments, span, offset, zero suppression, and test voltages. If  
23          such data are not provided in permanent markings or on the manufacturer's  
24          nameplate, a durable tag or label shall be affixed in a protected location that will  
25          become readily visible in the normal course of servicing the instrument.
- 26
- 27          F. Provide DC power supplies for devices as required. Mount on a stanchion in  
28          proximity of device in a NEMX 4X box. Provide conduit and wire to device.

30         3.02 EQUIPMENT TESTING AND CALIBRATION

- 31          A. Factory Tests and Calibration. All field-mounted elements shall be  
32          factory-tested by the manufacturer to assure satisfactory performance prior to  
33          shipment to the job site. Whenever possible, this shall include calibration to the  
34          actual range and conditions of use. Calibration shall be traceable to the National  
35          Bureau of Standards with an uncertainty not more than 1/2 of the specified or  
36          claimed accuracy of the instruments.
- 37
- 38          B. Field Tests and Calibration. Field mounted elements which were not calibrated  
39          to final working values of range, span, and zero suppression at the factory shall  
40          be so calibrated prior to or at the time of installation. This calibration shall meet  
41          the same requirements for accuracy and be traceable, as required for factory  
42          testing above. The Engineer shall be given 48 hours' notice and the opportunity  
43          to witness this calibration.
- 44
- 45
- 46

1       C. The Contractor shall submit a certificate of proper installation and operation for  
2           each field instrument. The certificates will be signed by the various equipment  
3           factory representatives.

END OF SECTION

SECTION 13630

## CONTROL PANELS AND CONTROL SYSTEM

## PART 1 – GENERAL REQUIREMENTS

## 1.01 SCOPE OF WORK

- A. Design, furnish and/or install local control panels in accordance with the contract documents for the following new equipment:
    - Grit Pumps (LCP-G1, LCP-G2, LCP-G3, LCP-G4)
    - Grit Classifier (LCP-GC2)
    - Moving Belt Filter Feed Pumps (LCP-SF1, LCP-SF2, LCP-SF3)
    - Moving Belt Filter Sludge Pumps (LCP-SL1, LCP-SL2, LCP-SL3)
    - Moving Belt Filters (LCP-S1, LCP-S2, LCP-S3)
    - Scum Pump (LCP-SC1)
    - Equalization Basin Feed Pumps (LCP-S1, LCP-S2)
    - Equalization Basin Return Pumps (LCP-R1, LCP-R2)
    - Equalization Basin Compressors (LCP-C1, LCP-C2)
    - Equalization Basin Compressed Gas Mixing System Valve Panel (EMX-VM-1)
    - Macerator (LCP-MAC)
    - In Plant Lift Station 2 (LCP-LS2)
  - B. Design, furnish and/or install control panels in accordance with the contract documents for the following new equipment:
    - Control Panel with PLC for Moving Belt Filter No. 1 (MCP-MBF1)
    - Control Panel with PLC for Moving Belt Filter No. 2 (MCP-MBF2)
    - Control Panel with PLC for Moving Belt Filter No. 3 (MCP-MBF3)
    - Master Control Panel with PLC for Moving Belt Filter Feed Pumps, Moving Belt Filter Sludge Pumps, Grit Pumps, and Grit Classifier (MCP-15)
    - Master Control Panel with PLC for Equalization Basin Feed Pumps and Equalization Basin Return Pumps (MCP-16)
    - Master Control Panel with PLC for Equalization Basin Compressed Gas Mixing System (MCP-CGM)
  - C. The Contractor shall furnish the services of a Systems Integrator (SI), as specified in Section 13600 to perform the work of this section and related work in Division 13 and Division 16 specifications, to install and coordinate equipment start-up with the equipment manufacturers who are providing the PLC programs, and to test a complete and operable system as indicated on the Drawings and as specified herein. .
  - D. PLC ladder logic programming for the new Moving Belt Filter PLCs and Compressed Gas Mixing System PLC shall be provided by the equipment

1 manufacturer as specified in Division 11. PLC ladder logic programming for  
2 the remaining Master Control Panels shall be provided by the SI. HMI  
3 graphics, and alarms for the monitoring and control of equipment as specified  
4 herein, shall be performed by the SI. The Contractor shall be responsible for  
5 furnishing, installing and testing the complete control system. The Contractor  
6 shall be responsible for all labor, materials, equipment, calibration,  
7 coordination and incidentals required to furnish and install the control system  
8 specified or required.  
9

- 10 E. These Specifications are intended to give a general description of what is  
11 required, but do not cover all details, which will vary in accordance with the  
12 requirements of the equipment furnished. They are, however, intended to  
13 cover the furnishing, the shop testing, the delivery and complete installation  
14 and field testing, of all materials equipment and appurtenances for the  
15 complete system herein specified, whether or not specifically mentioned in the  
16 Specifications.  
17
- 18 F. For all systems, the Contractor shall furnish and install all necessary and  
19 desirable accessory equipment and auxiliaries, whether or not specifically  
20 mentioned in these Specifications. This work shall include field-testing of the  
21 entire installation and instruction of the operating personnel in the care,  
22 operation and maintenance of all equipment.  
23

24 1.02 QUALIFICATIONS  
25

- 26 A. The Contractor, thru the SI, shall assume full responsibility for the satisfactory  
27 installation and operation of the control system.  
28
- 29 B. All equipment furnished under these Specifications shall be new and unused  
30 and shall be the standard cataloged product of a manufacturer having a  
31 successful record of manufacturing and servicing the equipment and systems  
32 specified herein.  
33

34 1.03 SUBMITTALS  
35

- 36 A. Copies of all materials required to establish compliance with the Specifications  
37 shall be submitted in accordance with the General Conditions and the General  
38 Requirements. Submittals shall include, but not be limited to, the following:  
39
- 40 1. Shop drawings prepared by the manufacturer and submitted to the  
41 Engineer for review prior to the manufacture of the equipment. The  
42 shop drawings shall include outline dimensions and external connection  
43 diagrams. A list of components, interface cables, specifications and a  
44 copy of the manufacturer's warranty shall be included with the  
45 submitted data.  
46
- 47 2. Operating Instructions: The Contractor shall submit operation and

maintenance manuals for the entire control system.

- a. General - equipment function, description and normal and limiting operating characteristics.
  - b. Installation instructions - assembly procedures and alignment and adjustment procedures.
  - c. Operation instructions - start-up procedures, normal operating conditions, emergency and normal shutdown procedure.
  - d. Maintenance instructions.
  - e. Trouble-shooting guide.
  - f. Parts list and predicted life of parts subject to wear.
  - g. Drawings - cross sectional view, assembly and wiring diagrams.

3. Complete master wiring diagrams and control schematics shall be furnished for approval before proceeding with manufacture or modification of an existing panel.

4. Ethernet Network Drawings: furnish an Ethernet network drawing showing cable types, all equipment (new and existing) connected to the Ethernet network, and IP addresses.

5. Certifications: The Contractor shall furnish the Engineer with a written certification signed by the manufacturer's representative that the equipment has been properly installed, tested, calibrated, and operated under typical operating conditions, and satisfactory operation has been obtained.

6. The Contractor, through the SI, shall provide to the Owner and Engineer a completed as-built drawing showing the actual control components and devices (show existing and new devices) that are mounted in the existing panels after modification. Drawing shall also include identification of each wire in the existing panel to which terminal strip it is connected, circuit breaker identification, Flex I/O modules and corresponding I/O, etc. Two additional copies of the panel as-built shall be placed in the pocket holder on the door of the new panel.

## 1.04 OPERATING INSTRUCTIONS

- A. Operating and maintenance manuals shall be furnished in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, programming logic, calibration requirements, etc., that are required to instruct

1 operating and maintenance personnel unfamiliar with such equipment the  
2 number and special requirements shall be as specified.  
3

4 **1.05 SPARE PARTS**  
5

6 A. The Contractor shall furnish the following spare parts:  
7

- 8 1. One (1) spare of each type of PLC I/O module shall be provided.
- 9 2. One (1) spare DC power supply of each size and type shall be  
10 provided.
- 11 3. Fuses: 20 percent of each size and type used, but no less than ten of  
12 each size and type.
- 13 4. Relays: 20 percent of each type used, but no less than ten of each  
14 type.
- 15 5. One copy of the PLC program, after debugging, recorded on CD-ROM  
16 for each PLC.
- 17 6. One master copy of all PLC programs on a USB flash drive
- 18 7. One spare Operator Interface Terminal (OIT) for the Master Control  
19 Panels.
- 20 8. Corrosion Inhibiting Vapor Capsules: Provide 100 of each type and  
21 size used.

22 B. Spare parts shall be properly protected for long periods of storage and packed  
23 in a box clearly identified with indelible markings as to the contents in  
24 accordance with Division 1 General Requirements.  
25

26 **1.06 WARRANTY**  
27

28 A. The Contractor shall provide a warranty in accordance with Section 01740 and  
29 shall guarantee that the equipment furnished is suitable for the purpose  
30 intended and free from defects of design, material and workmanship. In the  
31 event the equipment fails to perform as specified, the Contractor shall  
32 promptly repair or replace the defective equipment without any cost to the  
33 Owner (including handling, shipment and labor costs).  
34

35 **PART 2 – PRODUCTS**  
36

37 **2.01 CONTROL PANELS**  
38

- 39 A. All new local control panels shall be at minimum NEMA 4X 316 S.S. and shall  
40 comply with NFPA 820 area classifications. All panels shall be as  
41 manufactured by Hoffman or approved equal.  
42
- 43 B. The panels shall be the free standing or wall mounted and be complete with all  
44 controls including switches, push buttons and speed adjustment  
45 potentiometers as applicable and as specified herein.  
46

- 1           C. Any control panels to be located in a non-air-conditioned space as shown on  
2           the Drawings shall be designed to operate between 0 – 100 degrees F without  
3           air conditioning including all components, wiring, and equipment. The three (3)  
4           manufacturer-furnished Moving Belt Filter Master Control Panels(MCP-MBF1,  
5           MCP-MBF2, MCP-MBF3), the two (2) Master Control Panels (MCP15,  
6           MCP16), and the Compressed Gas Mixing System Master Control Panel  
7           (MCP-CGM) shall be located in air-conditioned electrical enclosures and shall  
8           be designed to operate between 0 – 80 degrees F.  
9
- 10          D. Unless otherwise specified on applicable panel drawings, all panels shall be of  
11         the fully enclosed type designed for use with high density instrumentation  
12         mounting.
- 13          E. Conductors running from the field to the panels shall be continuous without  
14         splices, except at approved junction boxes. The junction boxes shall have  
15         terminal blocks with 20 percent spare terminals. Special care shall be  
16         exercised to carry grounding lines through such junction boxes with the least  
17         possible resistance. Cables entering panels shall be multi-conductor. Conduit  
18         and multi-conductor cables entering panels shall be sealed to prevent the  
19         intrusion of gas and moisture.
- 20          F. Multi-conductor cable shall be used between junction boxes and the panels.
- 21          G. Control panels shall be completely fabricated, with instruments installed and  
22         wired, at the System Integrator's facility, except for the manufacturer-supplied  
23         Moving Belt Filter Control Panels and the Compressed Gas Mixing System  
24         Control Panel, which shall be completely fabricated, with instruments installed  
25         and wired, at the manufacturer's facility.
- 26          H. All components shall be mounted in a manner that permits servicing,  
27         adjustment, testing and removal without disconnecting, moving or removing  
28         any other component. Components mounted on the inside of panels shall be  
29         mounted on removable plates and not directly to the enclosure. Mounting  
30         shall be rigid and stable unless shock mounting is otherwise required by the  
31         manufacturer to protect equipment from vibration. Component mounting shall  
32         be oriented in accordance with other internal components and shall be  
33         identified with suitable plastic or metal engraved tags attached with drive pins  
34         adjacent to (not on) each component, identifying the component in accordance  
35         with the drawing, specifications, and System Integrator's data.
- 36          I. All exterior panel mounted equipment shall be installed with suitable gaskets,  
37         faceplates, etc. required to maintain the NEMA rating of the panel.
- 38          J. All panels shall be supplied with suitable nameplates that identify the panel  
39         and individual devices.
- 40          K. All panels and panel assemblies shall be assembled by a UL 508 approved

1 panel shop. Each panel and panel assembly shall bear the mark of such.  
2

- 3 L. Panels shall be constructed of stainless steel with angle or channel bracing.  
4 Side filler panels, top filler panels, and sub panels shall be 12 gauge stainless  
5 steel. Panels shall be suitable for the environments they are to be installed  
6 within.
- 7 M. Panels shall be of continuous welded stainless steel construction. Provide  
8 stainless steel angle stiffeners as required on the back of the panel face to  
9 prevent panel deflection under instrument loading or operation. Internally the  
10 panels shall be supplied with a structural stainless steel framework for  
11 instrument support purposes and panel bracing. The internal framework shall  
12 permit panel lifting without racking or distortion. Provide removable lifting rings  
13 designed to facilitate simple, safe rigging, and lifting of the control panels  
14 during installation. Plugs shall be provided and shall unobtrusively fill the  
15 panel lifting ring holes when substituted for the lifting rings after installation is  
16 complete. All exposed welds, seams, or edges shall be ground smooth.
- 17 N. Each panel shall be provided with full height, fully gasketed access doors.  
18 Doors shall be provided with a three point latch and heavy duty locking handle.  
19 Rear access doors shall be conveniently arranged and sized such that they  
20 extend no further than 24 inches beyond the panel when opened to the 90  
21 degree position. Panel access doors shall be provided with full length,  
22 continuous, piano type, and stainless steel hinges with stainless steel pins.
- 23 O. The panels, including component parts, shall be constructed and assembled in  
24 a thoroughly workmanlike manner and shall be free from sharp edges and  
25 welding flaws. Wiring shall be free from kinks and sharp bends and shall be  
26 routed for easy access to other components for maintenance and inspection  
27 purposes.
- 28 P. Provide overhead switched lighting and at least one (1) GFI convenience  
29 duplex receptacle 110/120VAC in each Master Control Panel.
- 30 Q. The panel shall be suitable for top or bottom conduit entry as required. For top  
31 mounted conduit entry the panel top shall be provided with nominal one foot  
32 square removable access plates, which may be drilled to accommodate  
33 conduit and cable penetrations. All conduit and cable penetrations shall be  
34 provided with ground bushings, hubs, gasketed locknuts, or other accessories  
35 as required to maintain the NEMA rating of the panel and electrical rating of  
36 the conduit system.
- 37 R. Internal Electrical Wiring
- 38 1. Panel equipment shall be mounted and wired on or within the cabinet.  
39 Wiring shall comply with the National Electrical Code. Wiring within the  
40 panel shall be grouped together with harnesses or ducts and secured to

1                   the structure. Wiring shall be numbered in compliance with the  
2                   numbering system used on the wiring/connection diagrams. Wiring and  
3                   connection diagrams shall comply with ISA 5.4 Instrument Loop  
4                   Diagrams and shall be submitted by the System Integrator as part of  
5                   the Shop Drawings for review by the Engineer.  
6

- 7                   2. Power and low voltage DC signal wiring shall be routed in separate wire  
8                   ways. Crossing of the two system wires shall be at right angles.  
9
- 10                  3. Control wire shall be 14 AWG Type THWN stranded and shall be insu-  
11                  lated for not less than 600 volts unless specified otherwise. Conductors  
12                  shall be of tinned copper construction. All interconnecting wiring,  
13                  except for electronic circuits, shall be rated for not less than 90 degrees  
14                  C.  
15
- 16                  4. Signal wire shall be 1 pair 16 AWG shielded. Conductors shall be of  
17                  tinned copper construction.  
18
- 19                  5. Wire color shall be: Line Power - Black; Neutral or Common - White;  
20                  AC Control - Red; DC Control - Blue; Equipment or Chassis  
21                  Ground - Green; specified externally powered circuits - Orange.  
22
- 23                  6. Wiring shall terminate at a master terminal board, rigid type and  
24                  numbered. The master terminal board shall have a minimum of 25  
25                  percent spares.  
26
- 27                  7. Terminal blocks shall be arranged in vertical rows and separated into  
28                  groups (Power, AC control, and DC signal).  
29
- 30                  8. Terminal blocks shall be barrier type with the appropriate voltage rating  
31                  (600 volts minimum). Terminal strips shall be provided for the purpose  
32                  of connecting all control and signal wiring. They shall be the raised  
33                  channel mounted type as manufactured by Allen Bradley or approved  
34                  equal.  
35
- 36                  9. Wiring trough for supporting internal wiring shall be plastic type with  
37                  snap on covers. The side walls shall be open top type to permit wire  
38                  changing without disconnecting. Trough shall be supported to the sub  
39                  panel by stainless steel screws. Trough shall not be bonded to the  
40                  panel with glue or adhesives.  
41
- 42                  10. Each wire shall be provided with numbered heat shrink tubing  
43                  identification markers at both ends and the numbering shall be in  
44                  accordance with the Control Panel Drawings. Identification markers  
45                  shall be pre-typed. Handwritten markers or paper markers are not  
46                  permitted.  
47

- 1           11. Direct interlock wiring between equipment is not allowed. Only one side  
2           of a terminal block row shall be used for internal wiring. The field wiring  
3           side of the terminal shall not be within 6-inches of the side panel or  
4           adjacent terminal.
- 5           12. Wiring troughs shall not be more than 60 percent visible fill. Wiring  
6           trough covers shall be match marked to identify placement. If  
7           component identification is shown on covers for visibility, the ID shall  
8           also appear on the mounting sub-panel.
- 9           13. Each panel shall be provided with an isolated copper grounding bus for  
10          all signal and shield ground connections. Shield grounding shall be in  
11          accordance with the instrumentation manufacturer's recommendations.
- 12          14. Each panel shall be provided with a separate copper power grounding  
13          bus (safety) in accordance with the requirements of the National  
14          Electrical Code.
- 15          15. Each panel, where required, shall be provided with analog signal  
16          isolation (I/I) where analog signals are sent from one panel or console  
17          to another.
- 18          16. Each panel shall be provided with surge suppression protection  
19          (electrical transients) for connections between AC power systems and  
20          electrical and electronic equipment. Surge suppressor grounding shall  
21          be in accordance with the manufacturer's recommendations.
- 22          17. All wiring to hand switches and the like that are live circuits independent  
23          of the panel's normal circuit breaker protection shall be clearly identified  
24          as such.
- 25          S. Relays not provided under Division 11, 15, or 16 and required for properly  
26          completing the control function defined in this Section, shown on the  
27          Drawings, or required for the proper operation of the equipment being  
28          provided shall be provided under this Section. For example, discrete field  
29          control and status circuitry shall be isolated from PLC I/O termination boards  
30          using relays. Relays shall have red LED indicators that illuminate upon coil  
31          energization.
- 32          T. Relays shall be mounted in their respective panel and shall be clearly  
33          identified as being live circuits independent of the panel's normal circuit  
34          breaker protection.
- 35          U. Nameplates shall be provided for flush mounted equipment. The nameplates  
36          shall be approximately 1-in x 3-in constructed of black and white laminated,  
37          phenolic material having engraved Helvetica letters approximately 1/4-in high,  
38          extending through the black face into the white layer. Nameplates shall be

39           LOCAL CONTROL PANELS AND CONTROL SYSTEM

1           beveled and attached to panels by self-tapping stainless steel screws.  
2           Adhesive bonded or glued-on name plates shall not be accepted.

- 3
- 4       V. Components shall be mounted in a manner that permits servicing, adjustment,  
5           testing, and removal without disconnecting, moving or removing any other  
6           component.
- 7
- 8       W. Components shall be mounted on plates on the inside of panels in such a  
9           manner that allows for removal of the components without removal of the  
10          plate. Components shall not be mounted directly to the enclosure.
- 11
- 12      X. Internal components shall be identified with suitable plastic engraved name  
13           plates attached with stainless steel drive pins adjacent to (not on) each  
14           component identifying the component in compliance with the Drawings,  
15           Specifications, and System Supplier's data.

16

17     **2.02 INSTRUMENT IDENTIFICATION**

- 18
- 19      A. All components provided, both field and panel mounted, shall be provided with  
20           permanently mounted name tags bearing the entire tag number of the  
21           component. Panel mounted tags shall be white with black lettering lamicoid  
22           plastic; field mounted tags shall be stamped stainless steel.
- 23
- 24      B. Nameplates for panels and panel mounted equipment shall be as indicated on  
25           the Drawings or as directed by the Engineer.
- 26
- 27      C. Field mounted tags shall be 16-gauge 316 stainless steel, with 3/16-inch high  
28           characters.
- 29
- 30      D. Tags shall be attached to equipment with a commercial tag holder using a  
31           stainless steel band with a worm screw clamping device or by a holder  
32           fabricated with standard stainless steel hose clamps and meeting the same  
33           description. In some cases where this would be impractical, use 20-gauge  
34           stainless steel wire.
- 35
- 36      E. For field panels or large equipment cases, use stainless steel screws,  
37           however, such permanent attachment shall not be on an ordinarily replaceable  
38           part. In all cases, the tag shall be plainly visible to a standing observer and  
39           not obscure adjustment ports or impair the function of the instrument. Field  
40           mounted control stations, recorders or indicators shall have a nameplate  
41           indicating their function and the variable controlled or displayed. Nameplate  
42           shall be attached by one of the above methods.

43

44     **2.03 PANEL COMPONENTS**

- 45
- 46      A. All control panels shall accept a 110/120 VAC, 60 hertz, single phase power  
47           input and be equipped with a fused disconnect switch. When the disconnect  
48           switch is in the open position, all power shall be removed from the control

1 system. Control panels shall also be equipped with a 120VAC transient  
2 voltage surge suppressor (TVSS).

3

4 B. Industrial Relays and Time Delays

5

6 1. Type:

7

8 a. Industrial heavy duty relays.

9

10 2. Functional/Performance:

11

12 a. Contact arrangement/function shall be as required to meet the  
13 specified control function.

14

15 b. Contacts shall be rated 10 amps continuous at 600 volts.

16

17 c. Relays shall be provided with convertible contact blocks.

18

19 d. Pneumatic time delay relays shall be used on time delays less  
20 than 180 seconds and shall be adjustable.

21

22 e. Solid state time delay relays shall be used on time delays  
23 between 180 seconds and one-hour.

24

25 3. Options/Accessories Required:

26

27 a. Provide all mounting rails, etc., as required.

28

29 4. Manufacturers:

30

31 a. Allen Bradley

32

33 b. Square D

34

35 C. General Purpose Relays and Time Delays

36

37 1. Relays shall be double pole, double throw, octal plug in type with a  
38 transparent dust cover. The relay shall be equipped with an indicating  
39 light to indicate when its coil is energized. The mechanical life of the  
40 relay shall be 10,000,000 operations, minimum.

41

42 a. Type:

43

44 (1) Units shall be of the general purpose plug-in type.

45

46 b. Functional/Performance:

- (1) Coil voltage shall match supply voltage.
  - (2) Contact arrangement/function shall be as required to meet the specified control function.

c. Duty cycle shall be rated for continuous operation.

d. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.

e. Time delay units shall be adjustable and available in ranges from 0.1 second to 4.5 hours.

## 2. Physical:

- a. For 120VAC service, provide contacts rated 10 amps at 120VAC; for 24VDC service provide contacts rated 5 amps at 28VDC, for electronic (milliamp/ millivolt) switching applicator provide gold plated contacts rated for electronic service.

- b. Relays shall be provided with dust and moisture resistant covers.

### 3. Options/Accessories Required:

- a. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.

- b. Provide mounting rails/holders as required.

#### **4. Manufacturers:**

- a. Allen Bradley

- b. Potter & Brumfield

- c. Eagle Signal Controls

#### D. Signal Isolators/Boosters/Converters

### 1. Type:

- a. Externally powered solid state electronic type. Loop powered devices are not acceptable.

## 2. Functional/Performance:

- a. Accuracy - 0.15 percent.

- 1                   b. Inputs - Current, voltage, frequency, temperature, or resistance  
2                   as required.  
3  
4                   c. Outputs - Current or voltage as required.  
5  
6                   d. Isolation - There shall be complete isolation between input  
7                   circuitry, output circuitry, and the power supply.  
8  
9                   e. Adjustments - Zero and span adjustment shall be provided.  
10  
11                  f. Protection - Provide RFI protection.

12                 3. Physical:

- 13                   a. Mounting - Suitable for mounting in an enclosure or instrument  
14                   rack.

15                 4. Options/Accessories Required:

- 16                   a. Mounting rack or general purpose enclosure as required.

17                 5. Manufacturers:

- 18                   a. Phoenix Contact or approved equal

19                 E. Signal Relay Switches (Current Trips)

20                 1. Type:

- 21                   a. Solid state electronic type.

22                 2. Functional/Performance:

- 23                   a. Input - 4-20 mA.

- 24                   b. Output - Isolated contact output, double pole double throw, rated  
25                   5 amps at 120 VAC.

- 26                   c. Accuracy - 0.1 percent.

- 27                   d. Protection - Provide RFI protection.

- 28                   e. Deadband - Adjustable between 0.1 to 5.0 percent of span.

- 29                   f. Setpoint Adjustment - Provide graduated dial for each alarm

1                   setpoint from 0 to full scale. Alarms shall be adjustable to trip on  
2                   rising or falling input signal.  
3

4                   g.        Repeatability - Trip point repeatability shall be at least 0.1  
5                   percent of span.  
6

7                   3.      Physical:  
8

9                   a.        Mounting - Suitable for mounting in an enclosure or high density  
10                  instrument rack.  
11

12                  4.      Options/Accessories Required:  
13

14                  a.        Mounting rack or general purpose enclosure as required.  
15

16                  5.      Manufacturers:  
17

18                  a.        Rochester Instrument Systems  
19

20                  b.        Acromag Inc.  
21

22                  c.        Moore Industries  
23

24                  F.      Intrinsically Safe Relays  
25

26                  1.      Type:  
27

28                  a.        Relays shall be of the solid state electronic type in which the  
29                  energy level of the sensing or actuation circuit is low enough to  
30                  allow safe usage in hazardous areas.  
31

32                  2.      Options/Accessories Required:  
33

34                  a.        Relays shall match power supply provided.  
35

36                  b.        Relays shall be located in non-hazardous areas.  
37

38                  3.      Manufacturers:  
39

40                  a.        Consolidated Electric  
41

42                  b.        Gems Safe-Pak  
43

44                  c.        Warrick Controls  
45

46                  d.        R. Stahl, Inc.  
47

1           G. All other relays, switches, timers, lights, and ancillary control devices, ancillary  
2           wiring, and hardware, whether specified herein or not, and required for a  
3           complete and operational control system shall be furnished and installed.  
4

5        2.04 PROGRAMMABLE LOGIC CONTROLLER (PLC) SYSTEM  
6

7           A. New PLCs shall be furnished and installed in the respective master control  
8           panels as applicable.  
9

10          B. PLCs shall be an Allen-Bradley CompactLogix 5370 Model 1769-L33ER, with  
11           Dual Ethernet, 2MB memory, and 2GB SD card.  
12

13          C. PLCs shall be furnished with an Allen-Bradley series 1769 Power Supply to  
14           provide power to the PLC and all I/O modules.  
15

16          D. PLCs shall be furnished with sufficient I/O modules for all I/O plus 20%  
17           installed spare. All I/O modules (AI, AO, DI, and DO) shall be series 1769 as  
18           manufactured by Allen-Bradley.  
19

20          E. All installed I/O shall be wired to terminal blocks for field termination.  
21

22          F. All input/output shall be color coded and titled with a distinctive label.  
23

24          G. PLC Programming Software  
25

26           1. The Moving Belt Filter Manufacturer and the Compressed Gas Mixing  
27           System Manufacturer shall be responsible for developing the program  
28           for controlling their respective equipment. The Systems Integrator shall  
29           be responsible for developing all other programs. As such, the Moving  
30           Belt Filter equipment manufacturer, the Compressed Gas Mixing  
31           System Manufacturer, and the Systems Integrator shall possess a  
32           complete licensed copy of the latest version of Rockwell Automation  
33           RSLogix, RSLinx and RSNetworx programming software compatible  
34           with the PLC specified herein.  
35

36           2. The Moving Belt Filter manufacturer and the Compressed Gas Mixing  
37           System Manufacturer shall supply all programming necessary to  
38           provide a fully debugged and operating system. The SCADA Systems  
39           Programmer shall supply all programming necessary to provide a fully  
40           debugged and operating system for all other new equipment. The  
41           software required shall consist of those programs necessary for the  
42           equipment to efficiently perform the functions specified herein or other  
43           parts of the Contract Documents. The Contractor shall provide any and  
44           all additional controls required for smooth operation of the system,  
45           whether or not specified herein, at no additional cost to the Owner. The  
46           Owner and Engineer shall not be required to expend any programming  
47           effort in order to achieve a fully operational system.

1  
2   2.05 OPERATOR INTERFACE TERMINAL (OIT)  
3

- 4       A. The Master Control Panels shall be furnished with color active-matrix TFT, 15-  
5        inch touchscreen and keypad OIT.  
6  
7       B. The OIT shall communicate with the PLC via Ethernet.  
8  
9       C. Door mounted touchscreen and keypad OIT shall be Allen-Bradley Panelview  
10      Plus 2711P-B15C4A8.  
11  
12      D. The OIT shall be furnished with Rockwell Automation Factory Talk Studio  
13      software to allow the Systems Integrator to develop graphic screens for the  
14      OIT.

15  
16   2.06 DC POWER SUPPLIES  
17

- 18       A. 24VDC power supplies shall be provided in the control panels. 24VDC power  
19        supplies shall be switching type, din rail mountable power supplies.  
20  
21       B. 24VDC power supplies shall be approved for use in UL-580 industrial control  
22        cabinets.  
23  
24       C. Provide fuse or short-circuit protection. Provide a minimum of 1 set of dry  
25        contacts configured to change state on failure for monitoring and signaling  
26        purposes.  
27  
28       D. Operating temperature range: 0 degrees Celsius to 50 degrees Celsius.  
29  
30       E. Touch safe design: All connection terminals to be protected against accidental  
31        touch.  
32  
33       F. Provide self-protecting power supplies with a means of limiting DC current in  
34        case of short circuit.  
35  
36       G. 24VDC power supplies shall be Allen Bradley 1606 Series Power Supply.

37  
38   2.07 UPS AND SURGE SUPPRESSION  
39

- 40       A. An Uninterruptible Power Supply (UPS) shall be furnished in the LCP to  
41        operate all critical components of the panel in the event of a power failure.  
42  
43       B. The UPS shall provide backup power for the entire PLC system including PLC  
44        power supply, I/O modules, 24VDC power supplies and any other devices  
45        inside the LCP.  
46  
47       C. The UPS shall be capable of sustaining the operation of the equipment for a

1                   minimum ten (10) minutes in the event of a power failure.  
2

- 3                   D. There shall be no measureable break in the output power of the UPS during  
4                   transfer from normal AC line supply to battery power or from battery power  
5                   back to normal AC line supply.
- 6
- 7                   F. Exact sizing of the UPS shall be the responsibility of the Systems Integrator.  
8                   Submit LCP load calculation with UPS product data showing compliance with  
9                   specifications.
- 10
- 11                  G. The UPS shall be capable of providing surge suppression for all equipment in  
12                  the event of a surge or spike on the incoming 120VAC power lines.
- 13
- 14                  H. The UPS shall be by Allen-Bradley.
- 15
- 16                  I. All UPS units shall be true online type.

17

18                  **2.08 MANAGED SWITCHES**

19

- 20                  A. Where shown on the drawings or required for proper communication, Ethernet  
21                  switches shall be furnished and installed in all control panels containing a  
22                  PLC.
- 23
- 24                  B. All switches shall be capable of 10/100BT/X connection speeds and shall  
25                  auto-detect the appropriate speed for communication with the connected  
26                  device.
- 27
- 28                  C. All switches shall have one port capable of being configured as an uplink port  
29                  to another switch for future expansion or shall provide an expansion slot for  
30                  this purpose.
- 31
- 32                  D. All switches shall be capable of operating on 110-120VAC/60Hz or 24VDC  
33                  power.
- 34
- 35                  E. All switches shall be capable of operation in a temperature range from 0 to 55  
36                  deg C with relative humidity of 90% non-condensing.
- 37
- 38                  F. All switches shall provide diagnostic indicators for each channel indicating  
39                  connection speed, traffic and collision status.
- 40
- 41                  G. All switches shall be capable of DIN rail mounting as designed or through the  
42                  use of a provided kit.
- 43
- 44                  H. Managed switches shall be sized by the Systems Integrator with sufficient  
45                  quantities of Ethernet ports and Fiber Optic ports to connect all Ethernet/Fiber  
46                  devices as shown on the drawing plus two (2) spare Ethernet ports..

- 1           I.     Managed switches shall be Allen-Bradley Stratix Switch 1783 series.  
2  
3           J.     The Systems Integrator shall be responsible for configuring the Ethernet  
4           switch (IP address, subnet, etc.) to be compatible with the existing Ethernet  
5           network.

6

7       **2.09 ETHERNET MEDIA AND SURGE SUPPRESSION**

8

- 9           A.    The network equipment shall be connected using pre-molded Cat-5e or Cat-6  
10          patch cords with RJ-45 connectors. Lengths shall be as required.
- 11          B.    If it is not possible to use pre-molded cables due to installation requirements,  
12          plenum rated Cat-5e or Cat-6 cable shall be used. In addition, a qualified  
13          installer must be employed to make the RJ-45 connections at each end of the  
14          Ethernet run, as well as to test the cable. Testing shall include a computer  
15          generated print-out of the test results, including pin connections and dB loss in  
16          the cable. Furnish test results to the Engineer.
- 17
- 18          C.    All non-fiber communications cables leaving a PLC panel or a network  
19          enclosure shall be equipped with surge suppression devices capable of  
20          protecting the communications cards in the event of a voltage spike on the  
21          communications line.
- 22
- 23          D.    Ethernet surge suppression rated for Cat 5/6 and POE applications shall be  
24          fully shielded, provide protection for all pins, and shall be DEHN 929 121.  
25          Substitutions will not be considered by the City.

26

27       **2.10 LIGHTNING/SURGE SUPPRESSION**

28

- 29          A.    General - in addition to manufacturer's standard, internal protection,  
30          supplementary lightning/surge protection shall be provided to protect all  
31          systems from surges propagating along the signal and power supply lines.  
32          The protection systems shall be such that the protective level shall not  
33          interfere with normal operation, but shall be lower than the instrument surge  
34          withstand level, and shall be maintenance-free and self-restoring. Instruments  
35          shall be housed in a suitable metallic case, and properly grounded. Ground  
36          wires for all surge protectors shall be connected to a good earth ground and,  
37          where practical, each ground wire shall be run individually and insulated from  
38          each other. These protectors and specified instrumentation/transmitters shall  
39          be mounted in a separate NEMA 3R stainless steel vented enclosure. The  
40          units shall be manufactured by DEHN. Substitutions will not be considered by  
41          the City.
- 42
- 43          B.    Power supply - additional protection of all alternating current (AC) instrument  
44          power supply lines shall be provided. Cabinet(s)/panel(s) and groups of field  
45          instruments, as approved by the Engineer, shall be protected by isolation  
46          transformers and surge suppressors. Individual field instruments shall be

1                   protected by high discharge heavy-duty zinc oxide varistors/spark gap  
2                   combination. The ac suppressor shall have a response time of less than 25  
3                   nanoseconds, a surge current rating of 4kA, an input voltage of 120 VAC,  
4                   50/60 Hz, and have a 6kAms short-circuit withstand capability. Surge  
5                   protection device model 953 204 manufactured by DEHN. Substitutions will  
6                   not be considered by the City.  
7

- 8                   C. Signal line - protection of all field analog, discrete, digital and telemetered  
9                   signal lines shall be provided. Protection devices shall be installed at the both  
10                  ends as close to the instrument being protected as possible. Where signal  
11                  lines enter control rooms through an interface cabinet, the protection devices  
12                  shall be mounted in the interface cabinet. Protection shall be with the use of  
13                  silicone avalanche diodes or approved equal. The suppressor shall be  
14                  capable of protecting a signal pair plus the cable shield with a DC clamping  
15                  level of 33V, be rated 20kA nominal discharge current and have at least a  
16                  0.75A current rating. Surge protection device model 920 300 + 926 324  
17                  manufactured by DEHN. Substitutions will not be considered by the City.  
18

19                  2.11 IP ADDRESSING  
20

- 21                  A. The existing plant network has an IP address scheme defined for some  
22                  existing equipment. All new equipment requiring IP addresses shall be  
23                  assigned IP addresses matching the existing plant network IP address  
24                  scheme to allow the complete and operational control of all equipment as  
25                  specified herein.  
26
- 27                  B. The Contractor shall submit a list of proposed IP addresses for all new  
28                  equipment requiring IP addresses to be approved by the Owner.  
29

30                  2.12 FIBER OPTIC CONVERTERS  
31

- 32                  A. Media converters shall be industrially hardened and rated for use in the  
33                  environment specified or shown. Office grade media converters are not  
34                  acceptable.  
35
- 36                  B. The copper side of each media converter shall be a 10/100BT/X RJ-45  
37                  connector. The media converter shall support both 10Base-T and 100Base-  
38                  TX Ethernet.  
39
- 40                  C. The fiber side of each media converter shall be a standard ST or SC  
41                  connector.  
42
- 43                  D. The media converter shall provide an auxiliary RJ-45 port to maintain a local  
44                  programming connection for a laptop.  
45
- 46                  E. Sufficient quantities of Cat-5e or Cat-6 patch cable and fiber patch cables with  
47                  appropriate connectors shall be provided and installed where a fiber

1 connection is required. Patch cables shall conform to the specification  
2 provided herein.  
3

4 F. Fiber Optic Converters shall be as manufactured by Phoenix Contact or  
5 approved equal.  
6

7 **2.13 CORROSION CONTROL**  
8

9 A. Panels shall be protected from internal corrosion by the use of  
10 corrosion-inhibiting vapor capsules as manufactured by Northern Instruments  
11 Model Zerust VC, Hoffman Engineering Model A-HCI or approved equal.  
12

13 **2.14 OIT GRAPHIC SCREENS**  
14

15 A. The Contractor shall submit to the Engineer for review all OIT graphic screens  
16 in color print on 8.5" x 11" sized paper. The Contractor shall provide the  
17 following as a minimum for all OIT graphic screens:  
18

- 19 1. All new OIT graphics for the filters shall generally match the existing  
20 filter HMI graphics and include any new equipment installed as part of  
21 the project.  
22
- 23 2. All 4-20mA signals, such as level, pressure and flow signals, shall be  
24 capable of being "trended" (depict historical data) on the OIT.  
25
- 26 3. Each piece of equipment with a motor shall have a minimum one (1)  
27 dedicated OIT graphic screen for control and monitoring.  
28

29 **2.15 EXISTING SCADA HMI GRAPHICS**  
30

31 A. The existing plant SCADA HMI System software is Citect SCADA.  
32

33 B. The existing SCADA HMI graphics screens for all new equipment shall be  
34 modified/updated to match those screens developed on the OIT.  
35

36 C. The Systems Integrator shall be responsible for mapping the I/O in the SCADA  
37 HMI System so that the monitoring and control functions that are on the  
38 existing SCADA HMI System are available on the new HMI.  
39

40 D. The Contractor shall submit to the Owner for approval all SCADA HMI graphic  
41 screens that are new or being modified/updated in color print on 8.5" x 11"  
42 sized paper.  
43

44 **PART 3 - EXECUTION**  
45

46 **3.01 INSTALLATION**  
47

- 1           A. The work included in this section consists of furnishing, installing and placing  
2           in operation the instruments and appurtenances, including all conduit, wiring  
3           and circuitry necessary to provide the Owner with a fully operable system  
4           properly calibrated and installed.
- 5           B. Install and mount equipment in accordance with the Contract Documents,  
6           manufacturer's instructions and installation detailed shop drawings. Mount  
7           equipment so that it is rigidly supported, level and plumb, and in such a  
8           manner as to provide accessibility; protection from damage; isolation from  
9           heat, shock and vibration; and freedom from interference with other  
10          equipment, piping and electrical.
- 11          C. Include the services of a factory trained, qualified service engineer of the  
12          equipment manufacturer and the Systems Integrator to inspect the complete  
13          equipment installation to assure that it is installed in accordance with the  
14          manufacturer's recommendations, make all adjustments necessary to place  
15          the system in trouble-free operation and instruct the operating personnel in the  
16          proper care and operation of the equipment furnished.
- 17          D. All workmanship utilized in the manufacture and installation of this system  
18          shall be of the highest quality and performed in a manner consistent with all  
19          accepted practices for industrial controls.

20           **3.02 START-UP SUPERVISION**

- 21           A. The Systems Integrator shall provide a qualified service technician to inspect  
22           all final connections and check the system prior to start-up. The service  
23           technician shall coordinate with the Owner's representative and the equipment  
24           manufacturer's representative for functional check-out of the complete system.
- 25           B. The Systems Integrator and SCADA Systems Programmer shall be on site  
26           during start-up of the system to make adjustments and tune the system as  
27           deemed necessary by the equipment manufacturer's representative and the  
28           Engineer.

29           **3.03 FIELD TESTS AND ACCEPTANCE**

- 30           A. Field tests shall consist of the sequential installation check-out, Field  
31           Acceptance Test and Final Inspection. Each phase of testing shall not be  
32           commenced until the preceding phase is complete as determined by the  
33           Engineer.
- 34           B. Field Test: When the operating setpoints have been established to the  
35           satisfaction of the Engineer and the facility is complete and ready for  
36           operation, the PLC and associated components shall be inspected and tested  
37           for compliance with the Contract Documents. Testing of the equipment shall  
38           be made by the Contractor in the presence of the Systems Integrator, the

1 SCADA Systems Programmer, the Engineer, the Electrical subcontractor, the  
2 equipment manufacturer's representative, and the Owner's representative.  
3 The equipment field tests shall include, but not be limited to, the following:  
4

- 5     1. Controls: Controls shall be tested to determine satisfactory  
6         performance.
- 7     2. Electrical: Contractor shall record readings of voltage and amperage  
8         on all electrical components at start and steady state operating  
9         conditions. Such readings shall be recorded on a form provided by the  
10        manufacturer and the results shall meet the manufacturer's prescribed  
11        limits. If a tested item fails to meet its requirements, then it shall be  
12        replaced. Results of the tests, including the serial number of the  
13        accessories tested, shall be furnished to the Engineer.
- 14     3. Inspection: A thorough inspection of all mechanical and electrical  
15        equipment and controls, fittings, brackets, mountings, seals, conduit,  
16        painting, components, and features shall be made while the facility is  
17        being tested to determine performance and compliance with design  
18        requirements and specifications.
- 19     4. Repairs, Adjustments and Replacements: The Systems Integrator shall  
20        make any and all necessary repairs, adjustments, and replacements  
21        until performance has been demonstrated to the satisfaction of the  
22        Engineer. The Contractor shall bear the cost of any repair, adjustment  
23        and replacement.
- 24     5. Upon completion of the installation, the LCP equipment manufacturer's  
25        field service technician shall furnish a certificate of compliance stating  
26        that the local control panel and all components and materials have  
27        been installed in strict accordance with the manufacturer's instructions.

33     3.04 TRAINING

- 34
- 35     A. Provide up to eight (8) hours of operator training by the Systems Integrator in  
36        accordance with Section 01820 to train the Owner's personnel. Training shall  
37        highlight procedures on navigating through screens, adjusting setpoints, and  
38        turning on/off equipment through the OIT. Training shall also include the  
39        operation and maintenance of all networking equipment and all new  
40        equipment control panel PLCs.

41     3.05 AS-BUILT DRAWINGS

- 42
- 43
- 44     A. The Contractor, through the Systems Integrator, shall provide to the Owner  
45        and Engineer complete as-built drawing(s) showing the actual control  
46        components and devices. Drawings shall also include identification of each  
47        wire in the new panels, to which a terminal strip it is connected, circuit breaker

1 identification, I/O modules, corresponding I/O, etc. Two additional copies of  
2 the panel as-built drawings shall be placed in the pocket holder in the door of  
3 the existing panel.

4  
5  
6  
7

END OF SECTION

1  
2  
3  
4

## SECTION 13640

### CONTROL STRATEGY

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

Requirements specified in the conditions of the Contract and Division 1 form a part of this section.

- A. This section specifically describes the instrumentation, control and monitoring system for the project. It is the intent of this Section to also supplement where applicable, other Sections of Division 13.
- B. The Contractor shall furnish the services of a Systems Integrator (SI) to perform the work of this section and all related Division 13 and 16 specifications to install, program start-up, and test a complete and operable instrumentation, control and monitoring system as indicated on the Drawings and specified herein. The Contractor shall be responsible for coordinating with all equipment manufacturers specified in Division 11, 13, and 16 to provide the monitoring and controls specified herein.
- C. It is the intent of this specification to briefly describe each main system so that both the Contractor and the SI are aware of the magnitude of the total instrumentation system and to ensure compatibility with systems already existing. Certain systems described are to be furnished under other Divisions. Interfacing and coordination with these systems is the responsibility of the SI and is part of the Work of this Division. Manufacturer-supplied control panels that are provided with equipment specified in Division 11 and 13 and containing programmable logic controllers (PLCs) or other logic controllers shall comply with this specification. All integration of manufactured supplied control panels to the HMI SCADA System as specified herein shall be provided by the SI.

##### 1.02 SUBMITTALS

- A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the General Conditions. Submittals shall include, but not be limited to, the following:
  - 1. Shop drawings prepared by the manufacturer and submitted to the Engineer for review prior to the manufacture of the equipment. The shop drawings shall include outline dimensions and external connection diagrams. A list of components, interface cables, specifications and a copy of the manufacturer's warranty shall be included with the submitted data.

- 1  
2       2. Operating Instructions: The Contractor shall submit operation and  
3           maintenance manuals for the entire control system.  
4  
5           a. General - equipment function, description and normal and  
6                   limiting operating characteristics.  
7  
8           b. Installation instructions - assembly procedures and alignment  
9                   and adjustment procedures.  
10  
11          c. Operation instructions - start-up procedures, normal operating  
12                   conditions, emergency and normal shutdown procedure.  
13  
14          d. Maintenance instructions.  
15  
16          e. Trouble-shooting guide.  
17  
18          f. Parts list and predicted life of parts subject to wear.  
19  
20          g. Drawings - cross sectional view, assembly and wiring diagrams.  
21  
22        3. Complete master wiring diagrams and control schematics shall be  
23           furnished for approval before proceeding with manufacture or  
24           modification of an existing panel.  
25  
26        4. Ethernet Network Drawings: furnish an Ethernet network drawing  
27           showing cable types, all equipment (new and existing) connected to the  
28           Ethernet network, and IP addresses.  
29  
30        5. Certifications: The Contractor shall furnish the Engineer with a written  
31           certification signed by the manufacturer's representative that the  
32           equipment has been properly installed, tested, calibrated, and operated  
33           under typical operating conditions, and satisfactory operation has been  
34           obtained.  
35  
36        6. The Contractor through the Systems Integrator shall provide to the  
37           Owner and Engineer a completed as-built drawing showing the actual  
38           control components and devices (show existing and new devices) that  
39           are mounted in the existing panels after modification. Drawing shall  
40           also include identification of each wire in the existing panel to which  
41           terminal strip it is connected, circuit breaker identification, Flex I/O  
42           modules and corresponding I/O, etc. Two additional copies of the panel  
43           as-built shall be placed in the pocket holder on the door of the new  
44           panel.

45  
46       1.03 GENERAL

47  
48       A. Definitions

1. HMI – Human Machine Interface, the existing software configured to  
2 run on a computer located in the control room at the Clearwater  
3 Northeast WRF.
  4. CP – Control Panel. Control Panel with an OIT and a PLC located  
5 remote from the piece of equipment and usually in the MCC enclosure.
  6. LCP – Local Control Panel. Control Panel with a LOCAL-OFF-  
7 REMOTE switch and an ON/OFF pushbutton switch mounted in the  
8 field near the piece of equipment. Equipment that is driven at variable  
9 speed shall have a manual potentiometer scaled 0-100% and readout  
10 installed on the LCP.
  11. OIT – Operator Interface Terminal, a terminal mounted on the CP that  
12 allows the operator to control the equipment. All OITs shall include a  
13 display that shows at a minimum the following parameters as  
14 applicable:
    - 15. • Equipment Speed, 0-100%
    - 16. • Equipment Amps
    - 17. • Water/Tank/Wet Well Level
    - 18. • Flow (gpm)
    - 19. • Temperature
    - 20. • Pressure
    - 21. • Elapsed Run Time
    - 22. • Alarms
    - 23. • Set Points
24. B. All controls including delay timers, PLC ladder logic programming, HMI  
25. graphics, ancillary programming and configuration as generally described  
26. herein shall be provided by the Contractor at no additional cost to the Owner.
27. C. All control commands made by the operator at the LCP shall override any  
28. control commands from the HMI. The precedence for control shall be:
29. 1. Any manual controls from the LCP located at the piece of equipment.  
30. 2. Any manual controls from the OIT on the CP.  
31. 3. Any automatic controls from the OIT on the CP.  
32. 4. Any manual controls from the HMI.  
33. 5. Any automatic controls from the HMI.
34. D. Each piece of equipment shall have a LCP with a LOCAL-OFF-REMOTE  
35. switch and an ON/OFF pushbutton switch mounted in the field adjacent to the  
36. piece of equipment. All equipment shall operate as follows:
37. 1. In LOCAL, the equipment shall start when the ON button is pushed and

#### CONTROL STRATEGY

- 1                   shall run in manual mode. No automatic control, interlocks, or other  
2                   safety features shall be available in this mode of operation.
- 3                   2. In OFF, the equipment shall turn off.  
4                   3. In REMOTE, the equipment shall be controlled remotely from the  
5                   respective PLC/OIT, or by the HMI.
- 6
- 7                   E. All interlocks, such as low liquid level switches (LSL) described herein, shall  
8                   be hardwired to prevent pumps from operating under the interlock conditions  
9                   such as low water level.
- 10
- 11                  F. Where I/O is available all equipment run status shall be displayed on the HMI  
12                  and LCP whether specified herein or not.
- 13
- 14                  G. The SI shall be responsible for programming, configuring and modifying the  
15                  existing HMI SCADA System graphic screens for all I/O shown in the Drawing  
16                  and specified herein.
- 17
- 18                  H. Any additional HMI graphic screens required to provide controls and  
19                  monitoring as specified in Section 13630 shall be furnished by the Contractor  
20                  at no additional cost to the Owner. The Contractor shall furnish a minimum  
21                  additional 20% quantity of HMI graphics screens and PLC ladder logic  
22                  programming to provide controls and monitoring of any additional I/O at no  
23                  additional cost to the Owner.
- 24
- 25                  I. All alarm conditions shall be indicated on an ALARM screen of the OIT and  
26                  HMI.
- 27
- 28                  J. Any additional controls, including delay timers and ancillary programming  
29                  needed for the proper operation of the various systems, as directed by the  
30                  Engineer or required, shall be provided by the Contractor at no additional cost  
31                  to Owner or Engineer.
- 32
- 33                  K. All panels shall have lightning and surge protection for all electrical power,  
34                  electrical controls, transmitters, and sensors.
- 35
- 36                  L. At the completion of the project the Contractor shall furnish to the Owner on  
37                  CD ROM and on paper hardcopy, two (2) copies of all HMI/OIT program files,  
38                  PLC ladder logic and any changes made to the Owner's existing HMI  
39                  software.

40

41                  1.04 CONTROL STRATEGY

42

43                  A. Flow Meters (FM)

- 44
- 45                  1. Flow meters shall measure, record, totalize and indicate rate of flow.
- 46

1           2. The instantaneous flow rate, daily maximum flow rate, daily minimum  
2           flow rate, a daily flow total, and yesterday's flow total shall be displayed  
3           at the HMI SCADA System. The HMI Scada System shall store the  
4           daily flow totals for each day for the most recent 6 months and make  
5           that data available for recall.  
6

7           B. Level Indicating Transmitters (LIT)  
8

- 9           1. The level transmitters shall measure, record, and indicate the water  
10          level in the structure they are installed within.  
11          2. The water level in the various structures shall be displayed at the  
12          appropriate OIT/HMI.  
13          3. Each level transmitter shall have an operator adjustable low level  
14          setpoint and high level setpoint that shall be indicated and alarmed at  
15          the OIT/HMI. The low and high level setpoints shall shutdown  
16          applicable equipment that is in operation and prevent equipment from  
17          starting until the alarm conditions are cleared.  
18

19           C. Headworks Grit Pumps (GP)  
20

- 21          1. Four (4) constant speed grit pumps are to be installed as shown on the  
22          Drawings.  
23          2. Each grit pump shall have a control panel with a LOCAL-OFF-REMOTE  
24          switch and an ON/OFF pushbutton switch mounted near each pump. In  
25          addition, the new grit pumps and seal water solenoids shall be capable  
26          of being controlled by the PLC in MCP-15 located in the SF-MCC room.  
27          The grit pumps shall operate as follows:  
28  
29           a. In LOCAL, the pump shall run when the ON button is pushed  
30           and shall run in manual mode. No automatic control, interlocks,  
31           or other safety features are available in this mode of operation.  
32  
33           b. In OFF, the pumps shall turn off.  
34  
35           c. In REMOTE the pump shall be controlled from MCP-15. The  
36           HMI shall be capable of monitoring and displaying the run status,  
37           trip status, and elapsed run time of each pump. In the REMOTE  
38           mode, each pump shall be automatically controlled from the HMI  
39           using individual 24-hour ON/OFF timers.  
40  
41           d. The seal water solenoid valves shall open when the pump  
42           receives a run signal and shall close when the pump is stopped.  
43

44           D. Headworks New Grit Classifier (GC)  
45

- 1
- 2     1. One (1) constant speed grit classifier is to be installed as shown on the
- 3         Drawings.
- 4
- 5     2. The Grit Classifier shall have a control panel with a LOCAL-OFF-
- 6         REMOTE switch and an ON/OFF pushbutton switch mounted in the
- 7         headworks building near the classifier and shall operate as follows:
- 8
- 9         a. In LOCAL, the classifier shall run when the ON button is pushed
- 10             and shall run in manual mode. No automatic control, interlocks,
- 11             or other safety features are available in this mode of operation.
- 12
- 13         b. In OFF, the classifier shall turn off.
- 14
- 15         c. In REMOTE the classifier shall be controlled by the PLC in MCP-
- 16             15. The grit classifier shall start and run when either of the grit
- 17             pumps associated with it are started. The HMI shall be capable
- 18             of monitoring and displaying the run status, trip status, and
- 19             elapsed run time of the motor starter for the grit classifier. No
- 20             control functions shall be available from the HMI.
- 21
- 22         d. A zero speed switch, torque overload switch, and emergency
- 23             stop switch shall be provided by the manufacturer and installed
- 24             by the Contractor for the new grit classifier. The PLC shall
- 25             monitor and the HMI shall display the status of the zero speed
- 26             switch, the torque overload switch, and the emergency stop
- 27             switch and shall initiate an alarm when these devices detect a
- 28             problem.
- 29

30     E. Headworks Existing Grit Classifier

31

- 32     1. The existing headworks grit classifier is operated from a control panel
- 33         located in the MCC room on the lower level of the headworks building.
- 34         That control panel will remain in service and will be re-powered from
- 35         Panel L15 in the SF MCC. All existing monitoring and control
- 36         capabilities by the existing plant SCADA system shall be maintained.
- 37

38     F. Moving Belt Filters (Salsnes Filters - SAF)

39

- 40     1. Three (3) Moving Belt Filters (Salsnes Filters – SAF) are to be installed
- 41         with provisions for a future fourth unit as shown on the Drawings.
- 42
- 43     2. Each of the three filters shall have a dedicated main control panel with
- 44         a dedicated PLC furnished by the SAF manufacturer. That PLC
- 45         controls all functions specific to that SAF, except the associated feed
- 46         pump and sludge pump for that SAF. Each dedicated main control
- 47         panel shall include a PLC, equipment controllers, motor starters, drives,

etc. and will be located in the climate controlled building on the SAF platform. Each main control panel shall include the following:

- a. Operator Interface Terminal (OIT) located on the front enclosure door.
- b. Programmable Logic Controller (PLC): Allen Bradley Compact Logix L16, or equal.
- c. Belt Filter Variable Frequency Drive (VFD): Yaskawa V1000, or equal
- d. Blower Motor Starter: Allen-Bradley SMC-3 or equal.
- e. Unfused main disconnect operated from a flange mount disconnect switch, or door mount disconnect switch.
- f. All other equipment as required, for automatic operation and SCADA functions of the Belt Filter.
- g. Fiber optic Ethernet switch for communications with the plant SCADA system.

3. A secondary control panel shall be located on or near each individual SAF and have LOCAL-OFF-REMOTE switches, ON/OFF pushbutton switches, and speed controls. The secondary control panels shall operate as follows:
  - a. In LOCAL, the feed pump motor, sludge pump motor, blower motor, and belt drive motor shall run. Speed control for the feed pump, the sludge pump, and the belt drive to be adjusted manually by speed potentiometers located on the secondary control panel. The blower shall run at constant speed.
  - b. In OFF, the feed pump motor, sludge pump motor, blower motor, and belt drive motor shall turn off.
  - c. In REMOTE, the belt drive motor and blower motor shall be controlled by the SAF control panel PLC. The feed pump motor, and sludge pump motor shall be controlled by the main control panel PLC (MCP-15) located in the SAF electrical enclosure.
4. The secondary control panels shall be provided with a sun shield to prevent direct sun exposure on the enclosure.
5. All control panels shall be shipped pre-assembled and pre-tested for field wire connections.
6. The SAF system controls shall be completely self-contained and capable of automatic operation. All SAF system control parameters shall be adjustable at their respective control panel OIT's, and displayed at the HMI.

- 1           7. In AUTO, the filter belt speed shall be paced by the level in the filter  
2           inlet compartment, as measured by SAF LIT. Operator adjustable level  
3           setpoints shall be made available at the SAF OIT and displayed at the  
4           HMI.
- 5           8. Hot water spray shall be controlled via operator adjustable frequency  
6           and duration timers at the SAF OIT and displayed at the HMI.
- 9           9. Reclaimed water flush shall be controlled via operator adjustable  
10          frequency and duration timers at the SAF OIT and displayed at the HMI.
- 11          10. A pressure transducer shall be mounted on the Air Knife bayonet  
12         coupling. The SAF PLC shall monitor for absolute pressure, high and  
13         low pressure alarms.
- 14          11. The HMI shall be capable of communicating with each SAF PLC and  
15         MCP-15 and shall monitor and display the status of all outputs of all  
16         four PLCs. However, no control functions shall be available from the  
17         HMI for the Salsnes Filters.

21          G. Salsnes Filter Feed Pumps (SAF FP)

- 22          1. The SAF feed pumps shall be controlled by an independent master  
23         control panel (MCP-15), not supplied by the SAF manufacturer.
- 24          2. Three (3) feed pumps, with provisions for a future feed pump, are to be  
25         provided as shown on the drawings and specified herein.
- 26          3. Each feed pump will be equipped with a variable speed drive (VFD) and  
27         each shall have a dedicated local control panel with a LOCAL-OFF-  
28         REMOTE switch and an ON/OFF pushbutton switch mounted near the  
29         pump. The VFDs shall be mounted in the SF-MCC building. The feed  
30         pumps shall operate as follows:
- 31           a. In LOCAL, the pump shall run when the ON button is pushed  
32         and shall have manual speed control. The speed shall be  
33         adjustable with a 0-100% potentiometer located on the  
34         respective local pump control panel. No automatic control,  
35         interlocks, or other safety features shall be available in this mode  
36         of operation.
- 37           b. In OFF, the pump shall turn off.
- 38           c. In REMOTE, the pump shall be controlled by the PLC in MCP-  
39         15. The speed of the pump shall be automatically controlled  
40         using a PID loop to maintain a preset adjustable SAF influent  
41         flow set point selected by the operator. In REMOTE, a level

1 indicating transmitter in the splitter box shall activate an alarm  
2 and shall shut down all operating feed pumps on low level. The  
3 Salsnes Filter feed pump flow rate in GPM shall be displayed on  
4 the MCP-15 HMI. The flow setpoint in GPM shall be readily  
5 changed from the MCP-15 HMI.

6  
7 d. For each pump the OIT/HMI shall be capable of monitoring,  
8 displaying, and archiving in digital or graphical format the  
9 parameters listed below.

- 10  
11     • The run status and trip status of the motor and VFD  
12     • The speed of the motor on a 0-100% scale  
13     • The instantaneous flow rate (gpm)  
14     • The daily flow total (gallons) from each machine  
15     • The sum of the daily total flows from all machines  
16     (gallons)  
17     • Daily flow totals shall be stored for a minimum of 6  
18     months.  
19     • Continuing elapsed run time

20     H. Salsnes Filter Sludge Pumps (SAF PP)

21  
22     1. The SAF sludge pumps shall be controlled by an independent master  
23       control panel (MCP-15) not supplied by the SAF manufacturer.

24  
25     2. Three (3) SAF pumps, with provisions for a future fourth sludge pump  
26       are to be provided as shown on the drawings and specified herein.

27  
28     3. Each sludge pump will be equipped with a variable speed drive (VFD)  
29       and each pump shall have a dedicated local control panel with a  
30       LOCAL-OFF-REMOTE switch and an ON/OFF pushbutton switch  
31       mounted near the pump. The VFDs shall be mounted in the SF MCC  
32       building. The sludge pumps shall operate as follows:

33  
34       a. In LOCAL, the pump shall run when the ON button is pushed  
35       and shall have manual speed control. The speed shall be  
36       adjustable with a 0-100% potentiometer located on the  
37       respective local pump control panel. No automatic control,  
38       interlocks, or other safety features shall be available in this mode  
39       of operation.

40  
41       b. In OFF, the pump shall turn off.

42  
43       c. In REMOTE, the respective pump shall be controlled by the PLC  
44       in MCP-15 to maintain sludge level in the dedicated SAF  
45       discharge sludge hopper as measured by the level transmitter.  
46       The sludge level shall be preset and adjustable by the plant  
47       operator at the OIT/HMI. In REMOTE, the level indicating

CONTROL STRATEGY

1 transmitter in the sludge hopper shall activate an alarm and act  
2 to shut down the sludge pump on low level, high discharge  
3 pressure, or high stator temperature. The SAF sludge pump  
4 speed RPM shall be displayed on the MCP-15 HMI. The sludge  
5 hopper level and level setpoint shall be shown on the MCP-15  
6 HMI.

- 7
- 8 d. For each pump, the HMI shall be capable of monitoring,  
9 displaying, and archiving in digital or graphical format the  
10 parameters listed below.

- 11     • The run status and trip status of the motor and VFD  
12     • The speed of the motor on a 0-100% scale  
13     • Continuing elapsed run time  
14     • Pump discharge pressure and stator temperature

- 15
- 16 4. The pump manufacturer shall supply and the Contractor shall install a  
17 pump discharge pressure monitor, a discharge pressure gauge, a  
18 discharge pressure switch, a stator temperature monitor and a stator  
19 temperature switch for each pump as previously described. The pump  
20 discharge pressure gauge shall be visible from the local ON/OFF  
21 Switch.

22

23 I. Flow Equalization Tank (FET)

- 24
- 25 1. One (1) flow equalization tank shall be constructed as shown on the  
26 drawings and specified herein. Two (2) feed pumps and two (2) return  
27 pumps shall be provided. Provisions for a third feed pump and a third  
28 return pump shall be provided.
- 29
- 30 2. Each pump shall be driven at variable speeds and each shall have a  
31 dedicated local control panel with a LOCAL-OFF-REMOTE switch, an  
32 ON/OFF pushbutton switch, and a manual potentiometer with readout  
33 mounted near the pump.
- 34
- 35 3. One (1) new Master Control Panel (MCP-16) shall be provided for  
36 REMOTE control of the FET process, located in the new FET-MCC  
37 electrical enclosure. MCP-16 shall be equipped with a PLC and an  
38 OIT.
- 39
- 40 4. MCP-16 shall control all functions of the FET process except mixing. A  
41 separate and independent control panel provided by the mixing process  
42 equipment manufacture shall control the compressed air system (CAS).  
43 The CAS control system shall include a PLC that shall communicate  
44 with MCP-16.
- 45
- 46 5. The HMI shall be capable of communicating with the FET PLC and the  
47 CAS PLC monitoring and displaying the status of all inputs and outputs

1 of both PLCs. The only FET control function available from the HMI is  
2 the plant flow rate set point. No other FET control functions shall be  
3 available from the HMI.  
4

5 J. Flow Equalization Tank Supply Pumps (FET SP)  
6

- 7 1. Two (2) FET feed pumps are being installed and provisions for a future  
8 third pump shall be provided as shown on the drawings and specified  
9 herein. Only two pumps shall be capable of operating simultaneously  
10 with one pump designated as LEAD pump and the other pump  
11 designated as LAG pump. Three pumps should never be operated  
12 simultaneously. Should the third feed pump be installed, it will be  
13 necessary to re-write the control strategy to accommodate the third  
14 pump.  
15
- 16 2. Each pump is variable speed and each shall have a dedicated local  
17 control panel with a LOCAL-OFF-REMOTE switch and an ON/OFF  
18 pushbutton switch mounted near the pump. The FET feed pumps shall  
19 operate as follows:  
20
- 21 a. In LOCAL, the pump shall run when the ON button is pushed  
22 and shall have manual speed control. The speed shall be  
23 adjustable with a 0-100% potentiometer located on the  
24 respective local pump control panel. No automatic control,  
25 interlocks, or other safety features shall be available in this mode  
26 of operation.  
27
- 28 b. In OFF, the pump shall turn off.  
29
- 30 c. In REMOTE the pump shall be controlled remotely from the FET  
31 PLC. The PLC shall have options for either manual or automatic  
32 control.  
33
- 34 d. When in REMOTE the status of each pump as a LEAD or LAG  
35 pump must be determined. The FET PLC will make this  
36 designation automatically and the LEAD pump will alternate each  
37 on/off run cycle. The operator may override the lead pump  
38 selection thru the OIT.  
39
- 40 e. PLC logic and other equipment interlocks that must be satisfied  
41 for feed pump operation in REMOTE include the following:  
42
  - The tank must not be at a high level condition
  - The return pumps are disabled
  - The desired plant flow rate set point has been entered by the  
operator
  - The actual plant influent flume flow rate is more than 10%  
(adjustable) higher than the set point flow rate and has been  
43  
44  
45  
46  
47

1 at that rate for a minimum of 30 minutes (adjustable).  
2

- 3 3. When called for and when the conditions outlined previously are  
4 satisfied, the LEAD pump shall start and run at an adjustable minimum  
5 speed for an adjustable minimum length of time. The LEAD pump shall  
6 operate at a variable speed throughout its range. After the LEAD pump  
7 has reached an adjustable maximum speed for an adjustable length of  
8 time, the FET PLC shall call the LAG pump to start and run at an  
9 adjustable minimum speed for an adjustable minimum length of time.  
10 When both pumps are running, both pumps shall operate in "load  
11 sharing" mode such that both pump speeds are identical.  
12
- 13 4. The PID loop logic consists of a flow meter signal from the existing  
14 influent flume, a signal from new flow meters installed in the FET supply  
15 pipe and return pipe, and an adjustable desired plant flow rate setpoint  
16 input by the operator. The control signal to the feed pump VFDs is  
17 generated by the PID loop which shall make the following equation true  
18 at all times by increasing/decreasing the FET supply pipe flow or the  
19 FET return pipe flow continuously:  
20
- 21 • *flume flow – FET supply pipe flow + FET return pipe flow = plant flow rate set point*  
22
- 23 5. A high level pump cutoff signal is provided by the FET level sensing  
24 device and shall be adjustable with an initial setting equal to 1-foot  
25 below the overflow pipe invert. Upon reaching the high level cutoff  
26 setpoint, a high level alarm shall be registered by the PLC, displayed at  
27 the OIT/HMI and all feed pumps shall stop. The status of the feed  
28 pumps shall remain unchanged until the high level alarm condition is  
29 cleared.  
30
- 31 6. The HMI shall be capable of monitoring, displaying, and archiving in  
32 digital or graphical format at minimum the parameters listed below for  
33 the feed pump system.  
34 • The run status and trip status of the motor VFDs  
35 • Motor amps  
36 • The speed of the motor on a 0-100% scale  
37 • The instantaneous flow rate (gpm)  
38 • The daily flow total (gallons)  
39 • Daily flow totals shall be stored for a minimum of 6 months.  
40 • Continuing elapsed run time for each pump  
41 • All alarms and high level cutoffs  
42 • The tank level  
43

44 K. Flow Equalization Tank Return Pumps (FET RP)  
45

- 46 1. Two (2) FET return pumps are being installed and provisions for a  
47 future third pump shall be provided as shown on the drawings and  
CONTROL STRATEGY

1 specified herein. Only two pumps shall be capable of operating  
2 simultaneously with one pump designated as LEAD pump and the other  
3 pump designated as LAG pump. Three pumps should never be  
4 operated simultaneously. Should the third feed pump be installed, it will  
5 be necessary to re-write the control strategy to accommodate the third  
6 pumps.

- 7
- 8 2. Each pump is variable speed and each shall have a dedicated local  
9 control panel with a LOCAL-OFF-REMOTE switch and an ON/OFF  
10 pushbutton switch mounted near the pump.
- 11
- 12 a. In LOCAL, the pump shall run when the ON button is pushed  
13 and shall have manual speed control. The speed shall be  
14 adjustable with a 0-100% potentiometer located on the  
15 respective local pump control panel. No automatic control,  
16 interlocks, or other safety features are available in this mode of  
17 operation.
- 18
- 19 b. In OFF, the pump shall turn off
- 20
- 21 c. In REMOTE the pump shall be controlled remotely from the FET  
22 PLC.
- 23
- 24 d. When in REMOTE the status of each pump as a LEAD or LAG  
25 pump must be determined. The FET PLC will make this  
26 designation automatically and the LEAD pump will alternate each  
27 on/off run cycle. The operator may override the lead pump  
28 selection thru the OIT.
- 29
- 30 e. PLC logic and other equipment interlocks that must be satisfied  
31 for feed pump operation in REMOTE include the following:  
32
  - 33         • The tank must not be at a low level condition
  - 34         • The feed pumps are disabled
  - 35         • The desired plant flow rate set point has been entered by  
36             the operator
  - 37         • The actual plant influent flume flow rate is more than 10%  
38             (adjustable) lower than the set point flow rate and has  
39             been at that rate for a minimum of 30 minutes  
40             (adjustable).
- 41 3. When called for and when the conditions outlined previously are  
42 satisfied, the LEAD pump shall start and run at an adjustable minimum  
43 speed for an adjustable minimum length of time. The LEAD pump shall  
44 operate at a variable speed throughout its range. After the LEAD pump  
45 has reached an adjustable maximum speed for an adjustable length of  
46 time, the PLC shall call the LAG pump to start and run at an adjustable  
47 minimum speed for an adjustable minimum length of time. When both

#### CONTROL STRATEGY

13640-13

12/18/2020

1                   pumps are running, both pumps shall run at the same speed.  
2

- 3                  4. The PID loop logic consists of a flow meter signal from the existing  
4                   influent flume, a signal from new flow meters installed in the FET supply  
5                   pipe and return pipe, and an adjustable desired plant flow rate setpoint  
6                   input by the operator. The control signal to the supply pump VFDs is  
7                   generated by the PID loop which shall make the following equation true  
8                   all the times:

9

10                 • *flume flow – FET supply pipe flow + FET return pipe flow = plant flow rate set point*

- 11
- 12                 5. A low level pump cutoff signal is provided by the FET level sensing  
13                   device and shall be adjustable with an initial setting of 4 feet of water  
14                   above the bottom. Upon reaching the low level cutoff setpoint, a low  
15                   level alarm shall be registered by the PLC, displayed at the OIT/HMI  
16                   and all return pumps shall stop, and all return pump MOVs shall close.  
17                   The status of the return pumps shall remain unchanged until the low  
18                   level alarm condition is cleared.
- 19
- 20                 6. The HMI shall be capable of monitoring, displaying, and archiving in  
21                   digital or graphical format at minimum the parameters listed below for  
22                   the feed pump system.
- 23                 • The run status and trip status of the motor VFDs  
24                 • Motor amps  
25                 • The speed of the motor on a 0-100% scale  
26                 • The instantaneous flow rate (gpm)  
27                 • The daily flow total (gallons)  
28                 • Daily flow totals shall be stored for a minimum of 6 months.  
29                 • Continuing elapsed run time for each pump  
30                 • All alarms and low level cutoffs  
31                 • The tank level

32

33                 L. Compressed Air Mixing System (FET CAS)

- 34
- 35                 1. The CAS is a stand-alone system with a master control panel, a valve  
36                   control panel and 2 air-compressors. These components shall be  
37                   supplied by the mixing system manufacturer. Control of the CAS is  
38                   described in the Compressed Gas Mixing System Specification and is  
39                   also provided by the CAS manufacturer.
- 40
- 41                 2. The HMI shall be capable of monitoring, displaying, and archiving in  
42                   digital or graphical format at minimum the parameters listed below for  
43                   the CAS system.
- 44                 • The run status and trip status of the compressor motors  
45                 • Compressor motor amps  
46                 • Compressor temperature status

- 1           • Intake filter differential pressure  
2           • System pressure in PSI  
3           • Elapsed run time for each compressor  
4           • All alarms and equipment cutoffs  
5

6           M. Scum Pumps (SCP)

- 7           1. One constant speed progressive cavity scum pump and control panel  
8           shall be provided as shown on the drawings and specified herein.  
9  
10          2. The scum pump shall have a dedicated local control panel with a  
11           manual ON/OFF switch mounted such that the level in the scum well is  
12           visible from the control panel. The starter for the scum pump shall be  
13           mounted inside the scum pump control panel.  
14  
15          3. Control of this pump will be manual by the plant operator.  
16  
17          4. The pump manufacturer shall supply and the Contractor shall install a  
18           pump discharge pressure monitor, a discharge pressure gauge, a  
19           discharge pressure switch, a stator temperature monitor and a stator  
20           temperature switch for the scum pump.  
21  
22          5. The pressure and temperature monitors and switches shall activate an  
23           alarm in the control panel and act to shut down the scum pump on high  
24           discharge pressure or high stator temperature.  
25  
26          6. The scum pump control panel shall be equipped with an analog hour  
27           meter to track elapsed run time for the pump.

28           N. Existing Mechanical Screens

- 29           1. The Contractor shall furnish the services of the manufacturer of the  
30           existing screenings equipment as necessary to reset the level controls  
31           (elevations initiating automatic raking mechanism) for proper operation  
32           of the screen at the higher downstream depths resulting from the  
33           improvements to the grit system.

34           O. Macerator

- 35           1. One (1) constant speed sludge Macerator shall be installed as shown  
36           on the Drawings.  
37  
38           2. A control panel shall be furnished for the Macerator with a LOCAL-OFF-  
39           REMOTE switch and an ON/OFF pushbutton switch mounted adjacent  
40           to the Macerator and shall operate as follows:  
41  
42           a. In LOCAL, the Macerator shall run when the ON button is

43           CONTROL STRATEGY

44           13640-15

45           12/18/2020

1 pushed and shall run in manual mode. No automatic control,  
2 interlocks, or other safety features are available in this mode of  
3 operation.

- 4
- 5 b. In OFF, the Macerator shall turn off.
- 6
- 7 c. In REMOTE the classifier shall be controlled by the PLC in MCP-  
8 15. The grit classifier shall start and run when any of the sludge  
9 pumps associated with the Moving Belt Filters are operated. The  
10 HMI shall be capable of monitoring and displaying the run status,  
11 trip status, and elapsed run time of the motor starter for the  
12 Macerator. No control functions shall be available from the HMI.
- 13

14 P. Lift Station #2

15

- 16 1. One (1) constant speed duplex lift station shall be rehabilitated  
17 as shown on the Drawings.
- 18
- 19 2. One new Nema 4X control panel shall be furnished for the lift  
20 station with typical duplex pump controls including a pump  
21 alternator, audible and visual alarms, phase detection and  
22 protection, ultrasonic water level detection with backup floats,  
23 provisions for connection to a remoter generator, elapsed time  
24 meters for both pumps, moisture detectors for the pump seal  
25 systems, lightning and surge protection systems.
- 26
- 27 3. The lift station control panel shall be provided by the pump  
28 supplier.
- 29

30 1.05 TAG NAMES

31

- 32 A. Tag names shall be furnished for all equipment. The tag names listed below  
33 do not necessarily represent all equipment included in the project. Any  
34 equipment not listed below that is shown elsewhere in the Drawings or  
35 specifications shall be furnished and installed and identified using the following  
36 tag naming scheme.
- 37
- 38

Tag Name	Description
<b>Grit Removal System</b>	
GP 1-4	Grit Pumps 1-4
GP LCP 1-4	Grit Pump Local Control Panels
GS CP	Grit System Control Panel
GC	Grit Classifier
GC ZSW	Grit Classifier Zero Speed Switch

---

**Salsnes Filters**

---

SAF 1-3	Salsnes Filters 1-3
SAF CP 1-3	Salsnes Filters Control Panels 1-3
SAF FP 1-3	Salsnes Filters Feed Pumps 1-3
SAF FP LCP 1-3	Salsnes Filters Feed Pump Local Control Panels 1-3
SAF FP FM 1-3	Salsnes Filter Feed Pump Flow Meter 1-3
SAF FP LIT	Salsnes Filter Feed Pump Level Detector
SAS LIT 1-3	Salsnes Filter Level 1-3
SAS BL 1-3	Salsnes Filter Blower 1-3
SAS BL PIT 1-3	Salsnes Filter Blower Pressure Transmitter 1-3
SAF SP 1-3	Salsnes Filters Sludge Pumps 1-3
SAF SP LCP 1-3	Salsnes Filters Sludge Pump Local Control Panels 1-3
SAF CP CP	Salsnes Filter Common Pump Control Panel
SAF SP LIT 1-3	Salsnes Filter Sludge Pump Level Detectors 1-3
SAF SV 1-9	Salsnes Filter Solenoid Valve 1-9
SAF MAC 1	Salsnes Filter Sludge Macerator

### **Flow Equalization Tank**

FET MCP	Flow Equalization Tank Master Control Panel
FET LIT	Flow Equalization Tank Level Detector
FET SP 1-2	Flow Equalization Tank Supply Pumps 1-2
FET SP LCP 1-2	Flow Equalization Tank Supply Pumps Local Control Panels 1-2
FET SFM	Flow Equalization Tank Supply Flow Meter
FET RP 1-2	Flow Equalization Tank Return Pumps 1-2
FET RP LCP 1-2	Flow Equalization Tank Return Pumps Local Control Panels 1-2
FET RFM	Flow Equalization Tank Return Flow Meter
FET COM 1-2	Flow Equalization Tank Compressor 1-2
FET CAS MCP	Flow Equalization Tank Compressed Air Mixing System Master Control Panel
FET AC LCP 1-2	Flow Equalization Tank Air Compressors Local Control Panels 1-2
FET SV 1-13	Flow Equalization Tank Solenoid Valves 1-13

- 1  
2 PART 2 – PRODUCTS (NOT USED)  
3  
4 PART 3 – EXECUTION  
5  
6 3.01 INSTRUMENTATION LEGEND  
7  
8 A. The following table is the legend for the instrumentation drawings included in  
9 the Contract Documents.  
10

First Letters		Succeeding Letters		
Measured/Initiating Variable	Variable Modifier	Readout/Passive Function	Output/Active Function	Function Modifier
A	Analysis	Alarm		
B	Burner, Combustion	User's Choice	User's Choice	User's Choice
C	User's Choice		Control	Close
D	User's Choice	Difference, Differential		Deviation
E	Voltage	Sensor, Primary Element		
F	Flow, Flow Rate	Ratio		
G	User's Choice	Glass, Gauge, Viewing Device		
H	Hand			High
I	Current	Indicate		
J	Power	Scan		
K	Time, Schedule	Time Rate of Change	Control Station	
L	Level	Light		Low
M	User's Choice			Middle, Intermediate
N	User's Choice	User's Choice	User's Choice	User's Choice
O	User's Choice	Orifice, Restriction		Open
P	Pressure	Point (Test Connection)		
Q	Quantity	Integrate, Totalize	Integrate, Totalize	
R	Radiation	Record		Run
S	Speed, Frequency	Safety	Switch	Stop
T	Temperature		Transmit	
U	Multivariable	Multifunction	Multifunction	
V	Vibration, Mechanical Analysis		Valve, Damper, Louver	
W	Weight, Force	Well, Probe		
X	Unclassified	X-axis	Accessory Devices, Unclassified	Unclassified
Y	Event, State, Presence	Y-axis		Auxiliary Devices,
Z	Position, Dimension	Z-axis, Safety Instrumented System		Driver, Actuator, Unclassified final control element

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END OF SECTION

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## SECTION 13650

### FIBER OPTIC CABLE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install fiber optic cabling, including fiber testing, accessories and splicing requirements.
- B. The entire fiber optic system is considered to be one component and provided by a single source, hereafter referred to as the Supplier.
- C. The Contractor shall furnish and install fiber optic (FO) data lines and connection equipment for the following:
  - 1. Fiber optic cable for connection of all SCADA system equipment as shown on the Drawings.

##### 1.02 REFERENCES

- A. Standards referenced in this Section are listed below:
  - 1. ASTM D 1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
  - 2. ASTM D 1603, Test Method for Carbon Black in Olefin Plastics.
  - 3. ASTM D 1765, Classification System for Carbon Blacks used in Rubber Products.
  - 4. ASTM D 3349, Test Method for Absorption Coefficient of Ethylene Polymer Material Pigmented with Carbon Black.

##### 1.03 SUBMITTALS

- A. Shop Drawings: Submit the following:
  - 1. Cut sheets and catalog literature for proposed fiber optic cable, and fiber optic cable accessories (terminations).
  - 2. Manufacturer specifications and data clearly and unambiguously showing that the fiber optic cable meets all the requirements specified herein.

- 1       3. Samples of the proposed cable.
- 2
- 3       4. Physical dimensional drawings of all fiber optic accessories.
- 4
- 5       5. Proposed fiber identification sequence and labeling.
- 6
- 7       6. Provide a Recommended Spare Parts List (RSPL).
- 8

9       **1.04 MAINTENANCE AND SPARE PARTS**

- 10      A. Provide off-line maintenance aids and on-line diagnostics to check the  
11        performance of the communication links and interfaces of devices on the data  
12        highway.
- 13
- 14      B. Provide a list of recommended special tools for fiber installation, testing or  
15        maintenance.
- 16
- 17      C. Furnish to the Owner one (1) hand-held optical light source with ATT-compliant  
18        adapters (SC or ST), Corning, or equal.
- 19
- 20      D. Furnish to the Owner one hand-held optical power meter with ATT-compliant  
21        adapters (SC or ST), Corning, or equal.
- 22
- 23

24       **PART 2 - PRODUCTS**

25       **2.01 FIBER OPTIC CABLE SUMMARY SPECIFICATIONS**

- 26      A. The Contractor shall use multimode fiber where distances between connecting  
27        equipment are within the fiber optic cable manufacturer's recommended  
28        maximum distance. The Contractor shall submit to the Engineer, for approval,  
29        the type of fiber optic cable that shall be used if distances between connecting  
30        equipment exceed the multimode fiber optic cable manufacturer's  
31        recommendation. The fiber optic cable shall meet the following summary  
32        specifications:  
33
- 34
  - 35          1. Fiber Type: Multimode.
  - 36          2. Core Diameter: 62.5 microns.
  - 37          3. Cladding Diameter: 125 microns.
  - 38          4. Cable Outside Diameter: 13.30-mm (0.52-in).
  - 39          5. Cable Weight: 191 kg/km (128 lbs/1000 ft).
  - 40          6. Maximum Attenuation: 3.5 dB/km at 850 nm, 1.0 dB/km at 1300 nm.
  - 41          7. Bandwidth: 160/500 (MHZ X km)2.
  - 42          8. Buffer Type: Loose tube, gel filled.
  - 43          9. Number of Fibers: Twenty-four (24)
  - 44          10. Cable Central Strength Member: Dielectric.
  - 45          11. Cable Fill: Waterbocked, gel-free
  - 46          12. Outer Jacket: MDPE.

- 1           13. Maximum Pulling Load: 600 lbf (2700 N).  
2           14. Operating Temperature Range: -40°C to +70°C.  
3           15. Parallel Plate Crush Resistance: 400 lbf.  
4           16. Quantity: As shown.  
5           17. Packaging: Spools/reels, protected from shipment.
- 6
- 7       B. Fibers within the cable shall be color-coded so that each fiber may be  
8           individually identified. The color sequence suggested is as follows: blue,  
9           orange, green, brown, slate, white, red, black, yellow and violet. Dashed  
10          versions of the same colors may be used to continue the sequence, depending  
11          on the cable structure and fiber count.
- 12
- 13     C. The outer jackets of the cable shall be continuous, free from holes, splits,  
14           blisters or inclusions. The same requirement holds for any inner jackets within  
15          a given cable structure as well as for fiber coatings.
- 16
- 17     D. Materials used for fiber optic cable shall present no environmental or  
18           toxicological hazards as defined by current industry standards and shall comply  
19          with OSHA and EPA standards or applicable federal or state laws or regulations.
- 20
- 21     E. The color of the polyethylene outer jacket material shall be black in accordance  
22          with ASTM D 1248, and contain a suitable antioxidant substance. The carbon  
23          black used shall be furnace-type conforming to designation N 110 in accordance  
24          with the requirements of ASTM D 1765. The carbon black content in the jacket  
25          material when measured in accordance with the requirements of ASTM D 1603  
26          shall be 2.6 percent  $\pm 0.25$  percent by weight. The light absorption coefficient of  
27          the jacket material shall be at least 400 when measured at a wavelength of 375  
28          nm in accordance with the requirements of ASTM D 3349.
- 29
- 30       1. Outer polyethylene jacket materials shall meet tensile strength and  
31           elongation minimum requirements for unaged and aged samples as  
32           follows:
- 33
- 34           a. Tensile Strength at Break: 2800 psi (Unaged), 2100 psi (Aged).  
35           b. Elongation at Rupture: 400 percent (Unaged), 375 percent  
36           (Aged).
- 37
- 38     F. The cable jacket shrinkage test measures the shrinkage or expansion of a cable  
39          jacket exposed to temperature aging for a specified period of time. Maximum  
40          shrinkage shall be less than five percent for each specimen tested. The test  
41          procedure is described in EIA-RS-455, FOTP-86.

42

## 43     2.02 CABLE PACKAGING

44

- 45       A. The cable shall be permanently marked to identify the manufacturer, date of  
46           manufacture, length markings, a product identification code, and UL messages,  
47           where appropriate. The markings shall be printed at regular intervals of not

1 more than two feet apart.  
2

- 3       B. The cable shall be packaged on a reel with inner hub diameter greater than the  
4 recommended minimum bending diameter of the cable. The anchor holes on  
5 the reels shall admit a 2-1/2-inch diameter spindle without binding. The package  
6 shall be sturdy enough to endure reasonable handling in the process of shipping  
7 and storage. The package shall bear the name of the manufacturer, the product  
8 identification code and the total amount of product on the reel.  
9
- 10      C. The following information shall be securely attached to the reel as a tag or  
11 clearly and permanently stenciled or labeled on each reel:  
12
- 13       1. Customer Order Number.  
14       2. Customer Job Number.  
15       3. Customer Reel Number.  
16       4. Termination.  
17       5. Ship Date.  
18       6. Manufacturer's Name.  
19       7. Factory Reel Number.  
20       8. Manufacturer's Cable Code (Type and Fiber count).  
21       9. Length of Cable.  
22       10. Weight of Cable and Reel.  
23       11. Defect Tag.  
24

- 25       D. The ends of all cable shall be sealed to prevent the escape of filling compound  
26 and to prevent the entry of moisture during shipping, handling, storage and  
27 installation.

28      2.03 ADDITIONAL FIBER  
29

- 30       A. The fiber count of the cable shall be as specified above. Each fiber will be tested  
31 at the completion of cable installation to verify that there are, indeed, the total  
32 quantity of fibers, which conforms to these Specifications.  
33
- 34       B. Contractor may, at their option, furnish a cable with more than the specified  
35 numbers of fibers to allow for accidental fibers damaged during installation.  
36

37      2.04 FIBER OPTIC CABLE MANUFACTURER  
38

- 39       A. Manufacturers: Provide products of one of the following:  
40
- 41           1. Corning Inc.  
42           2. Lucent.  
43           3. Or equal.  
44

45      2.05 MANUFACTURER TEST DOCUMENTATION  
46

- 1           A. Test documentation from the fiber optic cable manufacturer shall be delivered  
2           to the Engineer upon delivery of the cable to the Site, as a prerequisite for cable  
3           installation.
- 4           B. The documentation shall include Optical Time Domain Reflectometer (OTDR)  
5           traces for each fiber of each reel at 850 nm and 1300 nm. Optical attenuation  
6           test data shall be furnished for each fiber of each reel, as measured at 850 nm  
7           and 1300 nm.
- 8
- 9

10          2.06 PRE-INSTALLATION TESTING

- 11           A. Contractor shall test the fiber optic cable prior to its installation. This testing  
12           shall be witnessed by the Engineer.
- 13
- 14           B. Testing shall consist of making an OTDR trace of each fiber of each reel, at both  
15           850 nm and 1300 nm. The test shall incorporate a one km long backscatter  
16           suppression cable inserted between the OTDR and the fiber end. Each trace  
17           shall include the optical length and average attenuation.
- 18
- 19           C. The results of the testing shall be submitted to the Engineer prior to installation.  
20           Any cable that shows "out-of-spec" performance shall be replaced, at no  
21           additional cost to the Owner.
- 22
- 23

24          2.07 CABLE TERMINATION ENCLOSURE AND HARDWARE

- 25           A. Cable termination enclosures shall be furnished and installed at each site  
26           accessed by fiber optic cable. The enclosures shall be used to terminate each  
27           fiber of the cable.
- 28
- 29           B. The enclosures/cabinets shall be suitable to be mounted within a control panel  
30           and having provisions for terminating multiple fiber optic cables. Splice trays,  
31           strain relief cable attachment points, fiber organizers and bend radius hardware  
32           shall be furnished within each termination cabinet. The cabinets shall be  
33           furnished with an integral lock to prevent unauthorized entry. All locks shall be  
34           keyed identically, and two keys shall be furnished for each cabinet installed.
- 35
- 36           C. The enclosure cabinets shall house a patch panel internally. The patch panel  
37           shall swing out for ease of use. Panel size shall be suited to the number of  
38           fibers in the cable, for both directions. Bayonet/flanged couplings shall be  
39           furnished and mounted for each fiber to be terminated.
- 40
- 41           D. The termination enclosure shall have a swing-down front door that provides  
42           access to all splice trays and patch panels. They shall be sized to accept two,  
43           12 fiber cables and provide space for unstripped, coiled cable, each being up to  
44           25 feet long.
- 45
- 46           E. The cable termination enclosures and hardware shall be manufactured by
- 47

1                   Blackbox, or equal.  
2

3           **2.08 PIGTAIL CABLES AND CONNECTORS**

- 4
- 5           A.    Each of the fibers shall be terminated by splicing pigtails in the termination  
6            enclosures.
- 7
- 8           B.    Pigtails shall be nine feet long. They shall be multimode for operation at 850  
9            nm and 1300 nm, loose-buffered and manufactured from fiber meeting these  
10            Specifications described for the main cable.
- 11
- 12           C.    All connectors shall be identical. They shall be stainless steel AT&T and be  
13            compatible with the equipment to which the fiber optic cable is connected.

14

15           **2.09 SPLICING**

- 16
- 17           A.    Contractor shall field splice each fiber to a pigtail cable at the termination  
18            enclosures. All splices shall be made by the fusion process and shall have a  
19            splice loss no greater than 0.35 dB. Loss measurement shall be performed at  
20            the time of splicing and documentation shall be furnished for each splice. Splice  
21            testing shall be witnessed by the Engineer.
- 22
- 23           B.    Prior to stripping the cable, Contractor shall record the cable length from the  
24            cable jacket. This length shall be documented and included in the test  
25            documentation, specified elsewhere.

26

27           **2.10 COMMUNICATIONS PULL BOXES**

- 28
- 29           A.    Pull boxes shall be manufactured of fiber reinforced polymer concrete. Minimum  
30            dimensions shall be 24" wide x 36" long x 30" deep.
- 31
- 32           B.    Pull boxes shall be equipped with cable racking on both long walls, suitable to  
33            support fiber optic cable of all sizes.
- 34
- 35           C.    All pull boxes shall be provided with 20K traffic-rated lids. Lids shall have the  
36            identification marking of "FIBER OPTIC" permanently indented in the cover.

37

38           **2.11 FINK PLATED MARKER POSTS**

- 39
- 40           A.    All fiber optic cables shall be furnished with fiber optic and electrical buried Fink  
41            Plated marker warning posts that meet the following requirements:
- 42
- 43              1. Material: Composite reinforced thermoplastic, or High Density Polymer.  
44              2. Length: 6 ft.  
45              3. Top: Domed Cap  
46              4. Color: White Post and Cap (orange cap at pull box)  
47              5. Text: Caution Buried Communication Cable Call (front and back).

- 1           6. Text Color: Black on Orange Background.  
2           7. Width: 3-inch minimum (diameter).  
3           8. Phone number to call if line is hit  
4
- 5       B. Fink Plated marker warning posts, (Model 303 or current Model) shall be  
6           provided by Pro-Mark or approved equal.  
7
- 8       C. Marker post shall be installed at 100 feet spacing and shall be buried a minimum  
9           18-inch and encased in 12-inch deep concrete footing.

10      2.12 DETECTION WIRE AND WARNING TAPE

- 11
- 12       A. Fiber optic warning tape shall be bright orange color, minimum 3-inches wide.  
13           Warning tape shall be installed for the full length of the cable or conduit run.  
14
- 15       B. Warning tape shall be marked "WARNING FIBER OPTIC CABLE."  
16
- 17       C. Warning tape shall be buried 12-inches below existing grade.  
18
- 19       D. The tape shall be a dielectric, polyolefin film tape. The tape shall be  
20           constructed using material and ink colors, which will not change when  
21           exposed to acids and other destructive substances commonly found in the  
22           soil.  
23
- 24
- 25       E. Detection wire of #12 gauge (minimum) shall be woven into the tape.  
26

27      2.13 CONDUIT

- 28
- 29       A. All fiber optic cable shall be installed in conduit specified herein. Conduit shall  
30           be manufactured from virgin high-density polyethylene. Conduit shall be  
31           extruded from colored material for uniform full-thickness coloring. Where  
32           striping is required, a minimum of three colored longitudinal stripes of HDPE  
33           material shall be co-extruded on the conduit outer wall. The three stripes shall  
34           be equally spaced around the circumference and continuous for the entire  
35           length of conduit. Printed or embossed striping is not permitted.  
36
- 37       B. All conduit shall be labeled with durable identification giving the name of the  
38           manufacturer, conduit size (inner diameter trade size and wall thickness/rating),  
39           manufacture/date codes, and sequential foot marking. Labeling shall occur a  
40           maximum of every 2 feet. Conduits to be used in bends and sweeps shall have  
41           a minimum burn through time of 30 minutes when tested in accordance with  
42           Generic Requirement GR-356-CORE, Issue 1, October 1995.  
43
- 44       C. Conduits shall be 2 in. diameter and shall conform to ASTM D-3035 meeting  
45           the following requirements:  
46
- 47           1. Smoothwall SDR 11

- 1                   2. Nominal outer diameter: 2 in  
2                   3. Minimum inner diameter: 2 in.  
3                   4. Minimum wall thickness: 0.151 in.  
4
- 5                   D. Conduits shall be factory treated with an atomized silicone or manufactured in  
6                   a manner to reduce friction during pulling of fiber optic cable.

7

## 8 PART 3 - EXECUTION

9

10

### 3.01 CABLE INSTALLATION

- 11                  A. All fiber optic cable shall be installed, terminated, and tested by the fiber  
12                   subcontractor specified above.
- 13                  B. In pulling the cable, strain-release, or other tension limiting devices shall be  
14                   used to limit the pull tension to less than 600 pounds. The Engineer shall  
15                   witness the cable being pulled.
- 16                  C. Minimum bend radius restrictions shall be satisfied both during and after cable  
17                   installation.
- 18                  D. All conduit and cabinet entrances shall be sealed with RTV or other re-enterable  
19                   sealant material to prevent ingress of water, dust or other foreign materials.
- 20                  E. Splices in the fiber optic cable shall only be made at termination points where  
21                   connectorized pigtails are applied. Non-terminating field splices shall not be  
22                   made, unless authorized by the Engineer, in writing. If a field splice is required,  
23                   it shall be fusion spliced and placed in a buried pull box. Closures shall be AT&T  
24                   UCB1 with Type 2000 outer case, Siecor SC5, or equal. Encapsulant shall be  
25                   placed between inner and outer closures. Such splices shall meet the loss  
26                   parameters/testing requirements specified elsewhere.

27

### 3.02 CABLE DAMAGE DURING INSTALLATION

- 28                  A. If the cable is damaged during installation, Contractor shall stop operations and  
29                   notify the Engineer, in writing, immediately. The Owner and Engineer will decide  
30                   whether to replace the entire reel of cable or to install a splice at the damaged  
31                   section.
- 32                  B. If the Owner decides to replace the entire reel of cable, Contractor shall begin  
33                   the installation at the last designated splice point. The damaged cable between  
34                   these points shall be removed, coiled, tagged, and given to the Owner.  
35                   Installation of new cable to replace damaged cable shall not be a basis of extra  
36                   payment.
- 37                  C. If the Owner decides to install a splice at the damaged point, and the cable is  
38                   damaged a second time, the entire reel of damaged cable (and all subsequent

damaged reels) shall be replaced with new reels at the Contractor's expense.

### 3.03 CABLE ACCEPTANCE TESTING

- A. Acceptance testing of the data highway (fiber and electronic equipment) shall be conducted as a part of integrated system field-testing, as specified elsewhere. Prior to such tests, however, the fiber optic cable shall be tested as specified herein.
  - B. The Contractor shall conduct fiber optic cable testing as specified below. All testing shall be witnessed by the Engineer and the Owner. A test plan shall be submitted at least one week prior to the proposed test date(s). The test plan and procedures shall be mutually agreed upon prior to conducting the tests.
  - C. Each optical fiber in every span shall be tested after installation and termination. For each fiber, an OTDR trace hardcopy shall be provided. This end-to-end trace shall be performed from BOTH ends of the fiber. The traces shall be made at 850 nm and 1300 nm. Also for each fiber, an end-to-end power attenuation (insertion loss) test shall be performed from BOTH ends of the fiber. The attenuation test shall use a stabilized optical source and an optical power meter calibrated to the appropriate operating wavelength (850 nm and 1300 nm).
  - D. For each installed fiber, the power attenuation shall not exceed the following, tested from connector to connector at the respective patch panels, at 850 nm and 1300 nm. For the 1300 nm test, substitute 0.0020 for 0.0035 in the first term of the equation.

$$(0.0035)L + (0.35)N + 3.0 \text{ dB}$$

where L = the length of the fiber in meters, and N = the number of fusion splices in the fiber.

- E. Any fiber optic cables containing one or more fibers not meeting this performance criteria will not be accepted by the Owner, and shall be repaired or replaced at no additional cost to the Owner.
  - F. All fiber optic testing shall be documented on approved test forms. Three copies of all documents (including OTDR traces) shall be submitted to the Engineer upon successful completion of the testing.
  - G. Work at the termination cabinets shall be performed such that the fiber optic cables, and the fibers, are not subjected to undesirable bending both during the Work and when permanently fixed in place. The cables, fibers, pigtails, etc. shall be organized in a neat and orderly fashion within the enclosure. Inspection of the Work shall be performed by the Engineer. Unsatisfactory Work shall be reworked.

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END OF SECTION

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1 SECTION 15010  
2

3 BASIC MECHANICAL REQUIREMENTS  
4

5 PART 1 – GENERAL  
6

7 1.01 RELATED DOCUMENTS  
8

9 Drawings and general provisions of the Contract, including all specification sections  
10 apply to the work.  
11

12 1.02 SUMMARY  
13

14 This Section specifies the basic requirements for mechanical installations and includes  
15 requirements common to more than one section of these specifications.  
16

17 1.03 ACCESSIBILITY  
18

19 Equipment and materials shall be installed allowing for adequate access for service.  
20 Coordinate the final location of concealed equipment with the final location of access  
21 panels and doors. Allow ample space to remove all parts that may be replaced or  
22 require service. Extend all grease fittings to an accessible location.  
23

24 1.04 MECHANICAL INSTALLATIONS  
25

26 A. Coordinate mechanical equipment and materials installation with other building  
27 components. Verify all dimensions by field measurements. Verify final locations  
28 for rough-ins with field measurements and with the requirements of the actual  
29 equipment to be connected. Arrange for chases, slots, and openings in other  
30 building components to allow for mechanical installations.  
31

32 B. Coordinate the installation of supporting devices and sleeves to be set in poured  
33 in place concrete and other structural components, as they are constructed.  
34 Sequence, coordinate, and integrate installations of mechanical materials and  
35 equipment for efficient flow of the work. Give particular attention to large  
36 equipment requiring positioning.  
37

38 C. Where mounting heights are not detailed or dimensioned, install mechanical  
39 services and overhead equipment to provide the maximum headroom possible.  
40 Coordinate the installation of mechanical materials and equipment above  
41 ceilings with suspension system, light fixtures, and other installations.  
42

43 D. Coordinate connection of mechanical systems with exterior underground and  
44 overhead utilities and services. Comply with requirements of governing  
45 regulations, franchised service companies, and controlling agencies. Provide  
46 required connection for each service.

1  
2  
3 1.05 NAMEPLATE DATA  
4  
5 Provide permanent operational data nameplate on each item of power operated  
6 mechanical equipment, indicating manufacturer, product name, model number, serial  
7 number, capacity, operating and power characteristics, labels of tested compliances,  
8 and similar essential data. Locate nameplates in an accessible location.  
9  
10 1.06 THIRD PARTY CERTIFICATION  
11  
12 All packaged equipment shall be Independently Third Party labeled as a system for its  
13 intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with  
14 OSHA Federal Regulation 29CFR1910.399 and NFPA 70, "National Electrical Code"  
15 (NEC), Article 90-7.  
16  
17 PART 2 – PRODUCTS (NOT USED)  
18  
19 PART 3 – EXECUTION (NOT USED)  
20  
21  
22 END OF SECTION

1 SECTION 15062  
2

3 DUCTILE IRON PIPE AND FITTINGS  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9 A. The Contractor shall furnish all the materials, tools, labor, supervision and  
10 appliances for and properly install, connect, adjust, test and place in continuous  
11 satisfactory service all ductile iron pipe and fittings at the locations and to the  
12 elevations indicated, specified or required for the proper completion of all work.  
13
- 14 B. Wherever Construction activities disturb existing conditions or work already  
15 completed, Contractor shall restore the same to its original condition in every  
16 detail. All such replacement and repair shall be a no additional expense to the  
17 Owner.  
18
- 19 C. Ductile iron pipe and fittings are not necessarily completely indicated or detailed  
20 on the Construction Drawings. The Drawings are schematic only, and indicate  
21 pipe and fittings in a general way. It is the Contractor's responsibility to furnish  
22 all materials, pipe and fittings required.  
23
- 24 D. It is the intent of these Contract Documents to require an installation, complete  
25 in every detail, whether or not indicated on the Construction Drawings, or  
26 specified herein. Consequently, the Contractor shall be responsible for all  
27 details, devices, accessories, and special construction necessary to properly  
28 furnish, install, adjust, test, place into continuous satisfactory service, and  
29 complete the Work in an acceptable manner.  
30
- 31 E. Full responsibility for designing, fabricating, and installing the ductile iron pipe  
32 and fittings, for selecting materials of construction, and for demonstrating  
33 compliance with specified performance requirements shall rest with the  
34 Contractor, and through the Contractor, the Manufacturer and the Material  
35 Supplier. The Engineer's review of 1) the manufacture and installation of the  
36 ductile iron pipe and fittings 2) the use of materials included in this Specification,  
37 and 3) alternative materials offered by the Contractor, shall not relieve the  
38 Contractor and Supplier of full responsibility for meeting all performance  
39 requirements and guarantees.  
40
- 41 F. The requirements of this specification 15062 supersede relevant articles in  
42 Section IV.  
43

44 1.02 DESCRIPTION OF SYSTEM  
45

- 46 A. Piping shall be installed in the locations as shown on the Drawings and as

DUCTILE IRON PIPE AND FITTINGS

15062-1

03/22/2019

1 specified herein.  
2

- 3       B. All pipe, fittings, specials and appurtenances used for potable water piping shall  
4           be NSF-61 certified for continuous contact with potable water.

5       6.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS  
6

7       8. All Work specified herein shall be in accordance with the standards of the below listed  
9           organizations, except as otherwise shown or specified. Where reference is made to a  
10          standard of one of these, or other organizations the version of the standard in effect at  
11          the time of bid opening shall apply.

12       13. American National Standards Institute (ANSI)

14       15. B1.1 - Standard Specification for Unified Inch Screw Threads.

16       17. B16.5 - Standard Specification for Pipe Flanges and Flanged Fittings and other  
18          special Alloys.

19       20. American Society for Testing Materials (ASTM)

21       22. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi  
23          Tensile Strength.

24       25. C33 - Standard Specification for Concrete Aggregates.

26       27. C128 - Standard Specification for Specific Gravity and Absorption of Fine  
28          Aggregate.

29       29. C144 - Standard Specification for Masonry Mortar.

30       30. C150 - Portland Cement.

31       31. D75- Standard Practice for Sampling Aggregates.

32       32. E8 - Methods of Tension Testing of Metallic Materials.

33       33. E23 - Methods for Notched Bar Impact Testing of Metallic Materials.

34       34. G95 - Cathodic Disbondment Test.

35       35. American Water Works Association (AWWA)

36       36. C104 - Standard for Cement - Mortar Lining for Ductile Iron Pipe and Fittings for  
37          Water.

38       38. C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for Water  
39          and Other Liquids.

40       40. C111 - Standard for Rubber - Gasket Joints for Ductile Iron Pressure Pipe and  
41          Fittings.

42       42. C115 - American National Standard for Flanged Ductile-Iron Pipe with Threaded  
43          Flanges.

44       44. C150 - Standard for the Thickness Design of Ductile Iron Pipe.

45       45. C151 - Standard for Ductile - Iron Pipe. Centrifugally Cast for Water or Other  
46          Liquids.

47       47. C153 - Standard for Ductile Iron Compact Fittings. 3-inch through 16-inch for  
48          Water and Other Liquids.

49       49. C600 - Standard for Installation of Ductile Iron Water Mains and Their  
50          Appurtenances.

51       51. C651 - Standard for Disinfecting Water Mains.

1  
2       NSF International, The Public Health and Safety Company  
3  
4  
5

6           No. 60 - Drinking Water Treatment Chemicals - Health Effects.  
7  
8

9           No. 61 -Drinking Water System Components - Health Effects.  
10  
11  
12

13       **1.04 SUBMITTALS**  
14  
15

- 16       A. The Contractor shall submit Shop Drawings to the Engineer of pipe, fittings and  
17           all appurtenances in accordance with these Contract Documents and Sections  
18           01300 and 01340. The requirements of AWWA C110, C150, C151 and the  
19           following supplemental requirements are applicable:  
20  
21           1. Certified dimensional drawings of all pipe, specials and fittings.  
22  
23           2. Joint and pipe/fitting wall construction details, which indicate the type and  
24           thickness of the wall; manufacturing tolerances; performance history; and  
25           all other pertinent information required for the manufacture of the  
26           product.  
27  
28           3. Details of fittings and specials such as elbows, wyes, tees, outlets,  
29           connections, test bulkheads, bosses and nozzles or other specials where  
30           shown on the Construction Drawings, which indicate amount and position  
31           of reinforcement. All fittings and specials shall be properly reinforced to  
32           withstand the internal pressure both circumferential and longitudinal, and  
33           the external loading conditions as indicated in the Contract Documents.  
34           Shop Drawings shall clearly detail special castings indicating all pertinent  
35           dimensions.  
36  
37       B. The Contractor shall furnish a certified affidavit of compliance for all pipe and  
38           other products or materials furnished under this Section of the Specifications,  
39           as specified in ANSI/AWWA C105, C110, C150, and C151; respectively, and  
40           certified copies of the following supplemental data for all pipe, fittings, and  
41           specials:  
42  
43           1. The Supplier shall provide, through the Contractor, a sworn statement  
44           that the inspection and all specified tests have been made and all results  
45           thereof comply with the requirements of these Specifications.  
46  
47       C. All expenses incurred in making samples for certification of tests and in the  
48           preparation of any design reports shall be borne by the Contractor.  
49  
50       D. Review of the Shop Drawings shall not relieve the Contractor of the  
51           responsibility to ensure that the pipe is designed and installed in strict  
52           accordance with the Contract Documents.

## 1.05 QUALITY ASSURANCE

- A. The Contractor shall furnish materials under this Section that are new, unused and as specified, or if not particularized herein, which are the best of their respective kind, free of defects and imperfections, and suitable for the service intended, subject to review by the Engineer.
  - B. The Contractor shall provide workmanship that is first class in every respect, and have the installation performed by workmen thoroughly experienced in such work. A neat and workmanlike appearance in the finished Work shall be required.
  - C. The Contractor shall perform Work in accordance with all applicable laws and regulations and in accordance with all applicable permits and easements.
  - D. The ductile iron pipe furnished under this Specification shall comply with AWWA C151 except as it may be modified herein.
  - E. Welders and welding methods shall be certified to a nationally recognized welding specification for the type of ductile iron used to manufacture the pipe and fittings.
  - F. All test equipment used in activities affecting quality control shall be calibrated and certified at no longer than annual intervals, unless otherwise specified or required.
  - G. All pipe shall be clean, sound, and without defects. No manner of repair will be accepted, unless otherwise specified by the Engineer.
  - H. The Contractor, at no additional cost to the Owner, shall perform all the testing and recording that is required in these Specifications unless otherwise specified.
  - I. The Engineer shall have the right to determine the amount of pipe to be rejected as defined in AWWA C151 Section 5.7.1 "Determining Rejection."

#### 1.06 SUPPLIER'S QUALIFICATIONS

All pipe shall be manufactured, fabricated, coated, cement mortar-lined or epoxy-lined by a single qualified Manufacturer. Fittings may be fabricated and the lining for force main pipe and fittings may be applied at a site other than where the pipe is manufactured. The Manufacturer shall have at least 5 years of experience in work similar in specification to that which is to be furnished on this project. The Manufacturer shall be required to show experience in supplying pipe in environments similar to those expected to exist on this project and that the pipe supplied in those environments has functioned satisfactorily.

1    1.07 SHOP TESTS

3       All pipes shall be tested by the Manufacturer in accordance with AWWA C104, C110,  
4       C150, and C151, the Manufacturer's standard procedures, and this Specification.  
5       Shop Tests shall be subject to witness by the Engineer and/or Owner, and/or the  
6       Owner's Representative and certified test reports shall be submitted to the Engineer  
7       by the Contractor. No lot of pipe shall be shipped to the site of the Work until  
8       acceptable shop tests are completed and have been reviewed by the Engineer.

10    1.08 INSPECTION

- 12       A. All Work under this Specification, including but not limited to proof of design  
13       testing, shop testing and the production of the pipe, fittings and specials, shall  
14       be subject to inspection by the Owner's representatives and/or the Engineer in  
15       the Supplier's plant. All travel, lodging and meal costs associated with this plant  
16       inspection shall be incurred by the Owner and/or the Engineer.
- 18       B. The Engineer shall have the right to order any pipe that, in the Engineer's  
19       opinion, does not meet the Specifications to be rejected and not shipped to the  
20       Project site.

22    PART 2 – PRODUCTS

24    2.01 GENERAL

- 26       A. All ductile iron pipes, including flanged, mechanical joint, push-on joint,  
27       restrained joint, and plain end pipe, shall be manufactured in accordance with  
28       ANSI/AWWA Specification C 151/A 21.51.
- 30       B. Where ductile iron pipe is supplied for the Project or shown on the Drawings,  
31       above ground pipe shall be flanged and buried (underground) pipe shall be  
32       mechanical joint, restrained joint or push-on joint, as required.
- 34       C. All ductile iron fittings shall be marked in accordance with ANSI/AWWA C 110/A  
35       21.10 Section 10-9, "Markings on Fittings." All ductile iron pipe shall be marked  
36       in accordance with Section 51-10, "Marking Pipe" of ANSI/AWWA Specification  
37       C 151/A 21.51.
- 39       D. Maximum pipe laying lengths shall be 20 feet with shorter lengths provided as  
40       required by the Construction Drawings or to complete the Work and as allowed  
41       by AWWA C151.
- 43       E. Shop cement-mortar lined pipe shall have smooth dense interior surfaces and  
44       shall be free from fracture, excessive interior surface crazing and roughness.
- 46       F. Pipe joints shall not be bonded for electrical conductivity in accordance with

1           these Specifications and the details as shown on the Construction Drawings  
2           and the following schedule:  
3

- 4           1.       All blow-offs, air valve assemblies, and lateral connections to or from the  
5           pipe shall not be fitted with dielectric gaskets and/or couplings.  
6
- 7           G.      All materials that may be in contact with the water being conveyed (linings,  
8           gaskets, lubricants, grout, disinfecting agents, etc.) shall be in accordance with  
9           and approved by the appropriate NSF Standard 60 or 61.

10          2.02 DESIGN CRITERIA

- 11          A.     The pipe furnished under this section shall be ductile iron pipe, cement mortar  
12           or epoxy lined and asphalt coated, with EPDM gasket joints. The pipe shall  
13           consist of a cast ductile iron wall, shop lined with Portland cement mortar  
14           (potable water and reclaimed water) or epoxy (sanitary force main) and an  
15           exterior coating of asphalt.  
16
- 17          B.     The pipe shall be designed, manufactured, tested, inspected, and marked  
18           according to applicable requirements stated herein and except as modified,  
19           shall conform to ANSI/AWWA C104, C150, C151.  
20
- 21          C.     Pipe supplied for this project shall be suitable for use with neutral pH  
22           (approximately 7.0) meeting FDEP Part IV water quality standards (reclaimed  
23           water), domestic raw sewage (force mains) or chloraminated drinking water  
24           (potable water).  
25

26          2.03 PIPE DESIGN

- 27          A.     All ductile iron pipe shall have a minimum wall thickness corresponding to Class  
28           150, as calculated according to AWWA C150.  
29
- 30          B.     Where threaded flanges are used on ductile iron pipe, the minimum thickness  
31           of the pipe wall at the last critical thread after threading shall not be less than  
32           the minimum calculated thickness of the pipe including net thickness, casting  
33           tolerance and service allowance.  
34
- 35          C.     The Contractor shall provide design data on the pipe including calculations  
36           showing the separate and combined stresses in the wall of the pipe due to the  
37           design loads.  
38

39          2.04 MATERIALS

- 40          A.     All ductile-iron pipes shall meet the requirements of ANSI/AWWA C 151/A21.51.  
41           The interior of the pipe shall be finished so that the Hazen-Williams friction factor  
42           will not be less than 130. Each length of pipe shall be hydrostatically tested to  
43

1 at least 500 psi by the manufacturer in accordance with ANSI/AWWA C  
2 151/A21.51. Additionally, 30-inch and larger pipe shall be hydrostatically tested  
3 to 75% of the yield strength of the metal, based on the nominal thickness of the  
4 pipe.

- 5
- 6 B. Castings and connecting pieces, such as bell and bell, bell and spigot, bell and  
7 flange, flange and flange, flange and spigot, and flange and flare, shall meet the  
8 requirements of ANSI/AWWA C110/A21.10. Connecting pieces may be  
9 fabricated.
- 10
- 11 C. The exterior of exposed ductile iron pipe, fittings, glands and bolts shall be field  
12 coated with one prime coat of Tnemec 66, 3.0 to 5.0 mils minimum dry film  
13 thickness, a second coat of compatible Tnemec Enamel, 4.0 to 6.0 mils per coat  
14 minimum dry film thickness and a final coat of Tnemec 73, 2.5 to 4.5 mils per  
15 coat minimum dry film thickness. Field coatings shall be applied in strict  
16 conformance with the coating manufacturer's recommendations and Section  
17 09900.
- 18
- 19 D. Pipe that is to be buried shall have the standard asphaltic outside coating  
20 specified in ANSI/AWWA C151/A21.51.
- 21
- 22 E. The weight and class designation shall be painted conspicuously in a  
23 contrasting color on the outside of each pipe, fitting, and special casting after  
24 the shop coat has cured.
- 25
- 26 F. Epoxy lining for force mains shall be an amine cured epoxy containing at least  
27 20% ceramic quartz pigment by volume. The standard of quality is Proteco 401  
28 Ceramic Epoxy.

29

30 2.05 JOINTS

31

- 32 A. Flanges and flanged joints for ductile iron piping shall conform to the dimensions  
33 and requirements of ANSI Specification B 16.1. Where threaded flanges are  
34 used, they shall be ductile iron and conform to the requirements of ANSI/AWWA  
35 Specification C 115/A 21.15. All flanged ductile iron pipe and fittings shall be  
36 rated for 250 pound working pressure and shall be faced and drilled to match  
37 ANSI B16.1 Class 125 flanges unless special drilling is called for or required.  
38 Where tap or stud bolts are required, flanges shall be drilled and tapped  
39 accordingly.
- 40
- 41 B. All pipe flanges shall be coated with a rust preventive coating, as specified in  
42 ANSI/AWWA Specification C 115/A 21.15, immediately after they have been  
43 faced and drilled.
- 44
- 45 C. Flanged bolt holes on each end of flanged pipe and fittings shall accurately  
46 straddle the same horizontal and vertical centerlines unless special drilling is

called for, or required.

- D. The Contractor shall be responsible for assuring that the flanges of the pipe are compatible with the flanges of the various components and/or appurtenances.
  - E. Flanged pipe, approximately twelve (12) inches or less in length, shall have flanges cast solidly to pipe barrel. Flanges on pipe longer than twelve (12) inches in length may be of the threaded type. Pipe threads shall be of such length that, with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be faced to give a flush finish to the flange and the flange surface shall be normal to the axis of the pipe. Flanges shall be of such design that the flanged neck completely covers the threaded portion of the pipe to protect it against damage and corrosion.
  - F. Push-on joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C111/A 21.11 as they apply to push-on joints.
  - G. Mechanical joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C 111/A 21.11. Where stud bolts are required, bells shall be drilled and tapped accordingly. The Contractor shall tighten joint bolts with appropriate wrenches, to a tension recommended by the pipe Supplier.
  - H. Where joints are in contact with liquids, or buried underground, the Contractor shall paint all bolts and nuts with two (2) heavy coats of coal tar pitch and where joints are buried, the joints, including glands and bolts, shall be wrapped with two laps of 8 mil polyethylene film and sealed to the pipe with polyethylene adhesive tape.
  - I. Restraint Joints:
    1. All buried pipe shall be restrained as shown on the Drawings and as specified herein. Pipes subject to pressure or being fed by a pumping system shall be restrained based on the pressures shown on the drawings or specified elsewhere herein. Pipes subject to gravity flow shall be restrained based on 30 psi of working pressure. Restrained joint length indicated in the Tables included on the Drawings represents the length on all sides of fittings and valves within which all joints must be restrained. As a minimum, the joints at all fittings and valves shall be restrained.
    2. Restrained joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure, but not less than 200 psi. The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.

- 1  
2       3. The pipe Supplier's standard restrained joints shall be of the type utilizing  
3       cast lugs, shop welded retainer lugs or retainer rings bearing against pipe  
4       shoulders. Field installed joint restraint systems, such as Megalugs, as  
5       manufactured by EBAA Iron, or equal, are required for restraining  
6       mechanical joint fittings. Field welding or grooving of the restrained joint  
7       or components shall not be acceptable. Restrained joints shall be  
8       capable of withstanding full bulkhead thrust that can be developed within  
9       the pipeline due to the sum of the working and surge pressures.  
10  
11      4. Thrust blocks shall not be permitted unless specifically identified on the  
12       Drawings.  
13  
14      5. Joints in tunnels and casings shall be restrained joints as defined  
15       previously.

16  
17     **2.06 FITTINGS**

- 18  
19     A. All restrained joint, flanged, mechanical joint, and push-on joint shall be ductile  
20       iron and shall be manufactured in accordance with, and shall meet the  
21       requirements of ANSI/AWWA Specification C 110/A 21.10 or C153.  
22  
23     B. Dimensions of flanged fittings not included under ANSI/AWWA Specification  
24       C110/A 21.10 shall conform to the requirements of ANSI Specification B 16.1,  
25       Class 125. Fittings shall be short radius (compact) type were possible.  
26  
27     C. All fittings shall meet the requirements, as to dimensions and weights, as shown  
28       in the current Edition of the "Handbook of Ductile Iron Pipe" of the Ductile Iron  
29       Pipe Research Association.  
30  
31     D. All fittings furnished under ANSI/AWWA Specification C110/A 21.10 or C153  
32       shall be ductile iron and shall have the same minimum pressure rating as the  
33       pipe to which it is connected.  
34  
35     E. Special fittings, where required, shall have the same diameters and thickness  
36       as standard fittings, unless otherwise required, but their laying lengths and other  
37       functional dimensions shall be determined by their positions in the pipelines and  
38       by the particular piping materials to which they connect.

39  
40     **2.07 INTERIOR LINING**

- 41  
42     A. Potable Water and Reclaimed Water Piping:  
43  
44       1. All ductile iron pipe and fittings shall be lined with standard single  
45       thickness cement mortar lining and bituminous seal coated inside, at the  
46       point of manufacture, in accordance with ANSI/AWWA Specification C

1           104/A 21.4. Portland cement for cement mortar lining shall be in  
2           accordance with the requirements of ASTM C150, Type II cement. Shop  
3           cement-mortar lined pipe shall have smooth dense interior surfaces and  
4           shall be free from fractures, excessive interior surface crazing,  
5           disbondment, and roughness.  
6

- 7           2. The Contractor shall take precautions to prevent damage to the interior  
8           lining and shall repair all damaged linings to the satisfaction of the  
9           Engineer.  
10          3. Test records shall be submitted to the Engineer for review.  
11          4. The use and type of any admixtures must be reviewed by the Engineer  
12           prior to their use. All material batching shall be by weight.  
13          5. The method of placing and curing of the mortar lining shall be one with  
14           which the manufacturer has experience and can demonstrate a  
15           successful history. The lining shall be cured in a manner acceptable to  
16           the Engineer so that it will provide a hard and durable lining with a  
17           minimum of cracks, surface crazing and disbonded areas.  
18

19          B. Epoxy Lining for Wastewater Service  
20

- 21          1. All pipe and fittings for sewer force mains shall be Coated with Protecto  
22           401 as specified.  
23          2. Prior to abrasive blasting, the entire area to receive the protective  
24           compound shall be inspected for oil, grease, etc. Any areas with oil,  
25           grease, or any substance that can be removed by solvent, shall be  
26           solvent cleaned to remove those substances. After the surface has been  
27           made free of grease, oil or other substances, all areas to receive the  
28           protective compounds shall be abrasive blasted using sand or grit  
29           abrasive media. The entire surface to be lined shall be struck with the  
30           blast media so that all rust, loose oxides, etc., are removed from the  
31           surface. Only slight stains and tightly adhering oxide may be left on the  
32           surface. Any area where rust reappears before lining must be re-blasted.  
33          3. After the surface preparation and within 8 hours of surface preparation,  
34           the interior of the pipe shall receive 40 mils nominal dry film thickness of  
35           Protecto 401. No lining shall take place when the substrate or ambient  
36           temperature is below 40 degrees Fahrenheit. The surface also must be  
37           dry and dust free. If flange pipe or fittings are included in the project, the  
38           lining shall not be used on the face of the flange.  
39          4. Due to the tolerances involved, the gasket area and spigot end up to 6  
40           inches back from the end of the spigot end must be coated with 6 mils  
41

nominal, 10 mils maximum using Protecto Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining.

5. The number of coats of lining applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. To prevent delamination between coats, no material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.
6. Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

## 2.08 EXTERIOR COATINGS

- A. The exterior of all pipe and fittings to be submerged in water and for underground installation shall be given a bituminous coating at the point of manufacture, in accordance with ANSI/AWWA Specification C 151/A 21.51.

## 2.09 PIPE APPURTENANCES

- A. Threaded flanges shall be ductile iron and shall meet the requirements of ANSI/AWWA C115/A21.15. Flanges with long hubs for flanged pipe shall be screwed on the threaded end of the pipe in the shop. The face of the flange and the end of the pipe shall be refaced together. There shall be no leakage through the pipe threads, and the flanges shall be designed to prevent corrosion of the threads from outside. Flanges shall meet the requirements of ANSI B16.1, and shall be faced and drilled to that standard, unless special drilling is called for or required. The Contractor shall be responsible for assuring that the flanges of the pipe are compatible with the flanges of the various components and/or appurtenances. They shall be faced accurately at right angles to the pipe axis, drilled smooth and true, and the machined faces covered with zinc dust and tallow or equivalent material. The back of the flanges and bolt holes shall be coated with asphaltic coating meeting the requirements of ANSI/AWWA C151/A21.51, Section 51-8.1. Coating material shall be applied immediately after facing and drilling. Where tap or stud bolts are required, flanges shall be tapped. All flanged joints shall be thoroughly bolted through, stud or tap bolts of required size. All flanged joints buried underground shall also be protected as specified under Section 2.08. Only flanges made in USA shall be supplied to the Project.

- 1           B. All bolts, studs, and threaded rods used in the finished work for flanges shall be  
2           of carbon steel and shall conform to the ASTM A 307 Grade B. All bolts and  
3           nuts intended for underground service shall be corrosion resistant Cor-Ten  
4           ASTM A242. The ends of all bolts shall be finished to the standard radius in an  
5           acceptable manner. All screw threads shall be "American Standard, Coarse  
6           Thread (N.C.). Stud bolts shall be hexagonal, cold pressed semi-finished and  
7           made of medium open-hearth steel. All dimensions shall be in accordance with  
8           "American Standard, Heavy." Nuts used shall be "Grade A Heavy Hex" in  
9           conformance with ASTM A563 and be compatible with the bolts. Bolts and nuts  
10          shall be cadmium or zinc plated at the point of manufacture with a plating  
11          thickness of 0.0003 to 0.0005 inches. All bolts and nuts furnished shall be  
12          delivered to the field free from grease, rust, and dirt.
- 13
- 14          C. All nuts and bolts that come into contact with water or that are to be buried shall  
15          be painted with two (2) heavy coats of an coat tar pitch, in accordance with  
16          Section 09900.
- 17
- 18          D. Gaskets for flanged joints shall be full-faced type EPDM gaskets one-eighth  
19          (1/8) inch thick. All gaskets for flanged joints shall be EPDM having a Durometer  
20          of 75 to 85 or neoprene having a Durometer of 55 to 65. As an alternate, the  
21          Contractor may supply the pipe Supplier's (manufacturer's) gasket such as  
22          American Cast Iron Pipe Company's "Toruseal" gasket or U.S. Pipe's "Flange  
23          Tyte" gasket. Gaskets for bell and spigot joints shall be fabricated and tested  
24          in accordance with AWWA C111.
- 25
- 26          E. Subject to the Engineer's review, welded outlets shall be allowed; however, the  
27          welded-on outlet diameter shall not be greater than one quarter the diameter of  
28          the main line.

29

30        **2.10 COMPRESSION SLEEVE COUPLINGS**

- 31
- 32          A. The Contractor shall furnish and install where required or where shown on the  
33          Drawings, manufactured compression couplings equal to Style 38 or Style 39  
34          where isolating dielectric couplings are required, as manufactured by the  
35          Dresser Manufacturing Division of Dresser Industries or equal. The  
36          compression couplings shall consist of two (2) steel follower flanges, one (1)  
37          steel middle ring with pipe stops removed, and sufficient rolled thread,  
38          track-head bolts to properly compress the gaskets. After fabrication, the middle  
39          and follower rings shall be cold expanded to size and dimension. Thickness of  
40          the middle ring shall be suitable for the pressures specified, and the application,  
41          and in no case be less than one-half (1/2) inch thick. All parts of the  
42          compression coupling shall be galvanized or heavily cadmium plated at the  
43          point of manufacture and shall be epoxy coated in accordance with AWWA  
44          C210 or AWWA C203.
- 45
- 46          B. The entire compression sleeve coupling unit shall be rated for working pressure

1 plus surge pressure as a minimum.  
2

- 3 C. The Contractor shall provide field coating for buried couplings in accordance  
4 with AWWA C203 and these Contract Documents.  
5
- 6 D. Small deflections in the pipe alignment shall be allowed at compression type  
7 coupling joints, but such deflections shall not exceed three (3) degrees between  
8 any two (2) adjacent pipe sections. Where changes in line and/or grade in  
9 excess of three (3) degrees are required the deflections shall be made by  
10 deflecting multiple joints.

11

## PART 3 – EXECUTION

12

13

### 3.01 HANDLING PIPE AND FITTINGS

14

- 16 A. The Contractor shall transport, deliver and distribute along the line of the work,  
17 the pipe, specials and appurtenances. All Work shall be in strict accordance  
18 with the provisions of applicable permits and easements.  
19
- 20 B. Pipe shall be loaded for shipment upon suitable cars or trucks that shall be  
21 provided with padded bunks with nylon belt tie-down straps or padded banding.  
22 In loading and unloading the pipe, more than ordinary care shall be taken to  
23 prevent any injury to the pipe, ends, coatings and connections. Such work shall  
24 be done slowly with the pipe at all times under control, and under no condition  
25 shall the pipe be dropped. Field repair of damaged pipe shall not be allowed,  
26 except for linings and coatings. The pipe shall be protected during shipping by  
27 covering or some other means acceptable to the Engineer to prevent  
28 contamination of the pipe and to protect the lining from drying during transport.  
29
- 30 C. All pipe, fittings, etc., shall be carefully handled and protected against damage  
31 to the lining and coating/interior and exterior surfaces, impact shocks, and free  
32 fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe  
33 handling equipment shall consist of wide belt slings, padded cradles, or other  
34 devices designed and constructed to prevent damage to the pipe or coatings.  
35 The use of forks, chains, hooks, or other equipment that may damage the pipe  
36 or its lining or coating shall not be allowed.  
37
- 38 D. In distributing the pipe in the field, each pipe shall be placed as nearly as  
39 possible to the point where it is to be laid, and facing in the proper direction.  
40 Pipe shall not be placed directly on rough ground but shall be supported in a  
41 manner that will protect the pipe against injury whenever stored at the trench  
42 site or elsewhere. Coated pipe shall be stored on padded skids, sand or dirt  
43 berm, sand bags, or other suitable means so that coating will not be damaged.  
44 Coated pipe shall be handled with wide belt slings. Pipe fittings and specials  
45 which are placed in storage, streets or drives must be so arranged as not to  
46 cause undue inconvenience to traffic and must be protected sufficiently to

1 prevent any damage including but not limited to the interior lining and exterior  
2 coatings. Chains, cables or other equipment likely to cause damage to the pipe,  
3 fitting or special coating or lining shall not be used. Pipe which has been  
4 improperly distributed and which must be moved longitudinally along the trench  
5 shall be reloaded on a suitable car or truck or lifted and swung by a derrick or  
6 moved by such means as may be satisfactory to the Engineer.  
7

- 8 E. If in the process of manufacture, transportation, or handling, any ductile iron  
9 pipe, fitting or special receives any deformation to the pipe wall, ends or  
10 connections, such pipe, fitting or special shall be rejected and replaced at the  
11 Contractor's expense.  
12
- 13 F. In the presence of the Engineer, the Contractor shall inspect upon delivery all  
14 pipe, fittings, and specials and mark as "rejected" all pipe lengths and fittings or  
15 specials exhibiting signs of damage to the exterior coating, interior cement  
16 mortar linings, joint ends, or pipe wall and the Contractor shall at the  
17 Contractor's expense immediately remove the same from the job site, or repair  
18 to the Engineer's satisfaction. Any pipe, fittings or specials deemed not suitable  
19 for installation shall be replaced in kind by the Contractor at the Contractor's  
20 own expense.  
21
- 22 G. The Contractor shall inspect each pipe and fitting to insure that there are no  
23 damaged portions of the pipe. If any defective pipe is discovered after having  
24 been laid, it shall be removed and replaced with a sound pipe or fitting in a  
25 satisfactory manner, by the Contractor at the Contractor's own expense.  
26
- 27 H. The Contractor shall thoroughly clean each pipe or fitting of any foreign  
28 substance that may have collected on or in it prior to the pipe or fitting being  
29 placed in the trench. The openings of all pipes and fittings in the trench shall  
30 be closed during any interruption of the Work. As pipe laying progresses, the  
31 Contractor shall keep the pipe interior free of all debris. The Contractor shall  
32 completely clean the interior of the pipe of all sand, dirt, mortar splatter, and any  
33 other debris following completion of pipe laying, pointing of joints and any  
34 necessary interior repairs prior to testing and disinfecting the completed  
35 pipeline.  
36

37 3.02 INSTALLATION OF PIPE  
38

- 39 A. Ductile iron piping shall be installed in strict accordance with the manufacturer's  
40 instructions. Pipe shall be laid only after the trench has been excavated as  
41 described Division 2 of the Specifications. Pipe laid in trench shall be laid to a  
42 firm and even bearing for its full length. Precautions shall be taken against  
43 flotation. The pipe shall be backfilled with selected fine excavated material as  
44 shown on the Drawings and thoroughly compacted to one foot above the top of  
45 the pipe and thereafter backfilled as specified in Section 02221.  
46

- 1           B. Precautions shall be taken against flotation. Pipe shall be laid directly on the  
2 bedding material. Pipe shall be laid in the trench where the bedding forms a  
3 continuous and uniform support for the full length of the pipe except that the  
4 grade may be disturbed for the removal of lifting tackle. Bell holes shall be  
5 formed at the ends of the pipe to prevent point loading at the bells or couplings.  
6 Excavation shall be made as needed outside the normal trench section at field  
7 joints to permit adequate access to the joints for field connection operations.  
8
- 9           C. Each section of pipe shall be laid in the order and position shown on the laying  
10 schedule. In laying pipe, it shall be laid to the set line and grade, within plus or  
11 minus one inch.
- 12           D. The maximum obtainable separation between raw water, potable water,  
13 reclaimed water and sewage lines shall be practiced. A minimum horizontal  
14 separation of 3 feet, outside to outside, shall be maintained between raw water  
15 lines, potable water mains and reclaimed water mains or a minimum of 6 feet  
16 separation between sewage lines and either water or potable water lines. In  
17 instances where water lines cross a potable water main or a sewage collection  
18 line, a minimum vertical separation of 12 inches shall be maintained between  
19 the invert of the upper pipe and the crown of the lower pipe. In instances where  
20 a vertical separation of 12 inches between a raw water line and a potable water  
21 main or a sewage collection line cannot be achieved, then the raw water line  
22 shall be placed in a cast iron sleeve or encased in concrete centered at the point  
23 of crossing.
- 24           E. Where necessary to raise or lower the pipe due to unforeseen obstructions or  
25 other causes, the Engineer may change the alignment and/or the grades. Such  
26 change shall be made by the deflection of joints, or by the use of additional  
27 fittings.
- 28           F. Except for short runs that may be permitted by the Engineer, pipe shall not be  
29 laid uphill on grades exceeding 10 percent. Pipe that is laid on a downhill grade  
30 shall be blocked and held in place until sufficient support is furnished by the  
31 following pipe to prevent movement.
- 32           G. Contractor shall coordinate yard piping installation such that a minimum of 36  
33 inches of cover is maintained over piping at all times, unless otherwise indicated  
34 on the plans. At crossings, a minimum of 6 inches of vertical separation  
35 between pipes shall be maintained while also maintaining 36-inch minimum  
36 cover, unless otherwise indicated on the Drawings.
- 37           H. Bedding and backfilling shall be in accordance with Section 02221 of these  
38 Specifications and the details shown on the Construction Drawings.
- 39           I. Bedding shall be carefully worked into the area between the trench bottom and  
40 the pipe wall to keep it round. Bedding shall not be deposited on top of the pipe,

1                   but alongside it, and in such a way that it rises evenly on both sides.  
2

- 3                   J. All joints shall be assembled in accordance with the Manufacturer's  
4                   recommended procedures. In general the procedure shall be as described  
5                   herein. Immediately before jointing pipe, the bell of the pipe shall be thoroughly  
6                   cleaned, and a clean gasket shall be placed in the bell groove. The spigot shall  
7                   be carefully cleaned and the bell containing the gasket and the spigot lubricated  
8                   with a vegetable-based lubricant. The spigot of the pipe section shall then be  
9                   aligned with the bell end and inserted into the bell of the previously laid joint and  
10                  telescoped into its proper position. Tilting of the pipe to insert the spigot into the  
11                  bell will not be permitted.
- 12                  K. Restrained joints shall be assembled in a similar manner as described above  
13                  except that the restraining device shall be installed in accordance with the  
14                  Manufacturer's recommended procedures.
- 15                  L. Bolt holes of flanges shall straddle the field horizontal and field vertical  
16                  centerlines of the pipe. The Contractor shall clean flanges by wire brushing  
17                  before installing flanged fittings. The Contractor shall clean flange bolts and  
18                  nuts by wire brushing.
- 19                  M. The Contractor shall insert the nuts and bolts (or studs), finger tighten, and  
20                  progressively tighten diametrically opposite bolts uniformly around the flange to  
21                  the proper tension. The Contractor shall execute care when tightening joints to  
22                  prevent any strain upon valves, pumps and other equipment. After tightening  
23                  all bolts any stulls shall be removed from the interior of the pipe if it is not to be  
24                  buried.
- 25                  N. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset  
26                  or replace the gasket, reinstall or retighten the bolts and nuts, and retest the  
27                  joints. Flanged joints shall be watertight.
- 28                  O. Pipe stulls, if recommended by the Supplier, shall be left in place until bedding  
29                  and backfilling operations have been completed. After the backfill has been  
30                  placed, the stulls shall be removed and shall remain the property of the  
31                  Contractor.
- 32                  P. After stulls are removed, the Contractor shall check the inside diameter of the  
33                  pipe to verify that deflection has not exceeded the allowable 3 percent. The  
34                  frequency of checking shall be as directed by the Engineer but in no case shall  
35                  be less than the frequency of soil density testing.
- 36                  Q. All pipes shall be laid with a 2-inch metallic tape, appropriately color coded and  
37                  imprinted with the type of service, 12 inches below final grade and directly above  
38                  the utility, for identification and ease of location. The appropriate tape color  
39                  codes are as follows:

1  
2  
3  
4  
5

Sanitary Force Main: Green  
Potable Water: Blue  
Reclaimed Water: Purple

- 6 R. Care shall be taken in bolting flanged joints so that there is no restraint on the  
7 opposite end of one piece which would induce stresses in the pipe or fitting or  
8 prevent pressure from being evenly and uniformly applied upon the gasket. The  
9 pipe or fitting shall be free to move in any direction while bolting. Bolts shall be  
10 gradually tightened, each in turn, at a uniform rate of gasket compression  
11 around the entire flange.
- 12 S. No pipe shall be installed upon a foundation into which frost has penetrated or  
13 at any time that there is a danger of the formation of ice or penetration of frost  
14 at the bottom of the excavation. No pipe shall be laid unless it can be  
15 established that the trench will be backfilled before the formation of ice and frost  
16 occurs.
- 17 T. Pipes underneath structures and slabs shall be ductile iron and shall have a 6-  
18 inch minimum concrete encasement for pipes 24 inches and smaller (except  
19 pipes 3 inches and smaller, which shall be SCH 80 PVC). 8-inch minimum  
20 concrete encasement for pipes larger than 24 inches up to and including 36  
21 inches and 9 inches minimum concrete encasement for pipes larger than 36  
22 inches. Concrete encasement shall extend a minimum of 12 inches past edge  
23 of structure or slab.
- 24 U. All pipe and fitting joints occurring within restrained joint limits as required on  
25 the Construction Drawings, or as ordered, shall be properly secured to prevent  
26 thrust forces from pulling the pipeline joints apart. All tied joints shall be  
27 harnessed by using the pipe Manufacturer's standard restrained joint  
28 arrangements conforming to these Specifications. Certain joints may be  
29 restrained by the use of rods and clamps as directed by the Engineer. The rods  
30 and clamp harnessing arrangements shall be installed utilizing lugged fittings  
31 and pipe with saddle clamps placed to bear against the pipe bells. Saddle  
32 clamps around the barrel of the pipe that depend on friction or set screws to  
33 prevent sliding of the clamp are not acceptable. The pipe clamps, tie rods and  
34 their assembly shall meet the requirements of the National Fire Protection  
35 Association Bulletin No. 24. After each tied joint is connected up, all pipe  
36 clamps, bolts, heads, tie rods and nuts shall be coated as recommended by the  
37 Supplier.
- 38 V. Careful inspection shall be made of every joint to insure a smooth continuous  
39 interior surface. The Contractor shall thoroughly clean the interior of the pipe  
40 and remove any obstructions that may reduce the pipe's carrying capacity.  
41 Following completion of pipeline progressively or in sections, including  
42 completion of inside inspections, insofar as might be possible or practicable, the  
43

1 line shall be kept partially filled with water.  
2

- 3 W. The Contractor shall patch the cement mortar lining of any pipe that has a crack  
4 exceeding the allowable crack as determined by the Engineer. Lining failures  
5 that exceed 100 square inches and that have dimension greater than 12-inches  
6 shall be cause for the pipe to be rejected. There shall not be more than one  
7 patch on the lining of any one joint of pipe, fitting or special.  
8
- 9 X. Wherever necessary and directed by the Engineer, patches shall be made by  
10 the Contractor with a mortar of one part Portland cement and two parts clean,  
11 sharp sand; all measurements to be by weight. No pipe requiring the lining to  
12 be patched shall be installed until the patch is placed. Pipe thus patched shall  
13 not be installed until the patch has been properly and adequately cured and  
14 observed by the Engineer.  
15
- 16 Y. All buried process piping (excluding drainage and stormwater piping) shall be  
17 restrained in accordance with the restrained joint table provided in the Drawings.  
18 Pipes subject to pressure or being fed by a pumping system shall be restrained  
19 based on a 150 psi working pressure. Pipes subject to gravity flow shall be  
20 restrained based on a 30 psi working pressure. Restrained joint length indicated  
21 in the Tables represents the length on all sides of fittings and valves within which  
22 all joints must be restrained. As a minimum, the joints at all fittings and valves  
23 shall be restrained. Restrained joints shall be capable of holding against  
24 withdrawal for line pressures 50 percent above the normal working pressure but  
25 not less than 150 psi on pipe subject to pressure and 30 psi on pipe subject to  
26 gravity flow. The pipe and fittings shall be restrained mechanical joints.  
27

28 3.03 CUTTING PIPE  
29

30 Whenever pipes require cutting to fit into the lines, the work shall be done in a  
31 satisfactory manner so as to leave a smooth end, at right angles to the axis of the pipe.  
32 Pipe cutting shall only be done by saws specifically designed for that purpose. After  
33 cutting, the end of the pipe shall be beveled to the dimensions of the Manufacturer's  
34 specifications.  
35

36 3.04. COMPRESSION SLEEVE COUPLINGS  
37

- 38 A. The Contractor shall thoroughly clean with a wire brush all surfaces that will be  
39 in contact with the gaskets.  
40
- 41 B. The follower rings shall be placed over the pipe ends, then the Contractor shall  
42 slip the lubricated gaskets (vegetable based lubricant) over the pipe ends. The  
43 Contractor shall place the middle ring over the previously laid pipe then insert  
44 the end of the joining pipe into the middle ring, and position both gaskets evenly  
45 in the middle ring gasket grooves. The Contractor shall insert bolts in bolt holes  
46 of follower rings and tighten nuts in the sequence and with the torque

1 requirements of the coupling manufacturer. After tightening all bolts the stulls  
2 shall be removed from the interior of the pipe if it is not to be buried.  
3

4 **3.05 DRILLING AND TAPPING**

- 5
- 6 A. Where shown on the Construction Drawings or where required, ductile iron pipe,  
7 fittings or specials shall be drilled and tapped to receive drainage outlets, air  
8 relief outlets, or other pipe or plugs for pressure testing and/or chlorination.  
9 Holes shall be drilled accurately and at right angles to the axis of the pipe or  
10 fitting.
- 11
- 12 B. Where size of the outlet pipe to be connected is such as to require bosses or  
13 reinforcement saddles for making the connection, the Contractor shall furnish  
14 such outlet connections with bosses or reinforcement saddles drilled and tapped  
15 as indicated on the Construction Drawings or as directed by the Engineer.
- 16

17 **3.06 SURFACE PREPARATION AND PAINTING**

- 18
- 19 A. The Contractor shall remove all debris, dirt, grease, mortar and other foreign  
20 material by the use of soap and water or other solvent as may be required.
- 21
- 22 B. After each joint has been made the Contractor shall give all steel bolts and nuts  
23 a chemical wash of the phosphate type followed by one (1) coat of primer  
24 especially prepared for the finish of the bolt and nut installed. After this  
25 pretreatment, the Contractor shall coat all bolts and nuts as follows:
- 26
- 27 C. Give all bolts and nuts that will be exposed one (1) coat of primer.
- 28
- 29 D. Paint all bolts and nuts that will be underground in accordance with these  
30 Contract Documents.
- 31
- 32 E. All piping and fittings shall have its surface prepared and painted as specified  
33 in Sections 09865 and 09900.
- 34

35 **3.07 SUPPLIER'S FIELD SERVICE**

36

37 Contractor shall, at no additional cost to Owner, arrange for pipe Manufacturer's field  
38 representative to be on-site and provide instruction to each crew working during the  
39 installation of a minimum of four push-on joints and four restrained joints. The  
40 Manufacturer's field representative shall certify that the installations observed were  
41 satisfactorily completed and all pipe installation crews were familiar with the proper  
42 methods and procedures for the pipeline installations.

43

44 **3.08 FLUSHING AND TESTING**

- 45
- 46 A. The Contractor shall remove all sand and foreign matter from the pipeline as

work progresses. The ends of all pipes shall be suitably closed at each break or pause in pipe laying, and at the end of each work day, so as to minimize the amount of materials that can enter the pipe.

- B. Prior to pressure testing, all 24-inch and smaller mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall not be less than 2 feet per second. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing property damage or violation of environmental regulations or permits.
  - C. Prior to pressure testing, all 30-inch and larger mains shall be televised. All dirt and foreign matter shall be removed and the pipe shall be cleaned. After cleaning, the mains shall be re-televised. Pre-and post-cleaning videotapes shall be furnished to the Owner.
  - D. Testing of lines shall be as specified in Section 01625.

## END OF SECTION

1 SECTION 15064  
2

3 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor, materials, equipment and incidentals required and install in  
10      the locations as shown on the Drawings, the PVC piping, fittings and  
11      appurtenances as specified herein.  
12
- 13       B. The requirements of this specification 15064 supersede relevant articles in  
14      Section IV.  
15

16 1.02 DESCRIPTION OF SYSTEM  
17

- 18       A. Piping shall be installed in the locations as shown on the Drawings.  
19
- 20       B. All pipe, fittings, valves, solvents and glue used for potable water piping shall  
21      be NSF-61 certified for continuous contact with potable water.  
22

23 1.03 QUALIFICATIONS  
24

- 25       A. All PVC pipe, fittings and appurtenances shall be furnished by a single  
26      manufacturer who is fully experienced, reputable and qualified in the  
27      manufacture of the items to be furnished. The equipment shall be designed,  
28      constructed, and installed in accordance with the best practices and methods  
29      and shall comply with these Specifications.  
30

31 1.04 SUBMITTALS  
32

- 33       A. Shop drawings shall be submitted to the Engineer for review in accordance  
34      with the General Conditions and shall include dimensioning and technical  
35      specification for all piping to be furnished.  
36
- 37       B. Submit to the Engineer, for review, samples of all materials specified herein.  
38

39 1.05 TOOLS  
40

- 41       A. Special tools, solvents, lubricants, and caulking compounds required for  
42      normal installation shall be furnished with the pipe.  
43

44 PART 2 - PRODUCTS  
45

46 2.01 MATERIALS  
47

1           A. Polyvinyl Chloride (PVC) Pipe:

- 2
- 3       1. Class-rated PVC pipe and accessories four to twelve inches (4"-12") in  
4           diameter, where shown or as specified on the Drawings, shall meet the  
5           requirements of AWWA Specification C900 "Polyvinyl Chloride (PVC)  
6           Pressure Pipe." Pipe shall be Class 235, meeting requirements of  
7           Dimension Ratio (DR) 18 with cast iron outside diameters. Each length  
8           of pipe shall be hydrotested to four (4) times its class pressure by the  
9           manufacturer in accordance with AWWA C900. W3 RCW piping shall  
10          be pipe Class 200 meeting requirements of Dimension Ratio (DR) 14.
- 11
- 12       2. Class-rated fourteen inch (14") or larger PVC pipe and accessories for  
13           force main use only shall meet the requirements of AWWA Speci-  
14           fication C905, "Polyvinyl Chloride Water Transmission Pipe". Pipe shall  
15           be Class 235, meeting the requirements of DR 18 with cast iron outside  
16           diameters. Each length of pipe shall be hydrotested by the  
17           manufacturer to two (2) times its class pressure in accordance with  
18           AWWA C905.
- 19
- 20       3. Pressure rated PVC pipe smaller than 4" shall be 200 psi SDR-21  
21           conforming to the requirements of ASTM D2241. Potable water main  
22           pipe shall have EPDM gasket push-on joints conforming to ASTM F  
23           477. Force main pipe shall have SBR gasket push-on joints conforming  
24           to ASTM F-477.
- 25
- 26       4. PVC pipe less than 4" in diameter that is exposed to view shall be  
27           ASTM D-1785 Schedule 80 pipe with UV inhibitors.
- 28
- 29       5. All PVC pipe shall be new, unused and manufactured for this project.  
30           Polyvinyl chloride sewer pipe shall conform to ASTM D-3034 and D-  
31           1784 (PVC compound). Profile pipe shall conform to ASTM F-794.  
32           The PVC pipe shall be manufactured by Johns-Manville Corporation,  
33           Certain-Teed Corporation, or equal. All PVC sewer pipe shall be green  
34           and conspicuously labeled with the manufacturer's name, nominal pipe  
35           size, applicable material code or PVC cell classification, standard  
36           dimension ratio number, product type, standard specification  
37           designation, and production record code.
- 38
- 39       6. Pipe shall be listed by Underwriters Laboratories. Provisions shall be  
40           made for expansion and contraction at each joint with an elastomeric  
41           ring, and shall have an integral thickened bell as part of each joint.  
42           PVC Class pipe shall be installed in accordance with the Uni-Bell  
43           Plastic Pipe Association Guide Specification UNI-B-3-76, and as  
44           recommended by the manufacturer.
- 45
- 46       7. Pipe shall be furnished in nominal lengths of approximately 20 feet,  
47           unless otherwise directed by the Engineer. Pipe for potable water

1 supply and accessories shall bear the NSF mark indicating pipe size,  
2 manufacturer's name, and AWWA and/or ASTM Specification number,  
3 working pressure and production code. Pipe and couplings shall be  
4 made from Class 12454-A or Class 12454-B virgin compound, as  
5 designed in ASTM D1784.

- 6
- 7 8. PVC pipe shall be color coded as follows: sanitary mains - green;  
8 potable water mains - blue; reclaimed water mains – lavender, process  
9 piping – brown. Specific colors shall match county standard colors as  
10 applicable.

11 B. Joints:

- 12
- 13 1. Joints for PVC sewer shall be of the bell and spigot type conforming to  
14 ASTM D-3212 using factory installed flexible elastomeric seals  
15 (gaskets). These gaskets shall be SBR and shall conform to ASTM F-  
16 477. Joints for PVC water pipe shall be of the bell and spigot type  
17 using factory installed, flexible elastomeric seals (gaskets). These  
18 gaskets shall be EPDM and shall conform to ASTM F-477.
- 19
- 20 2. The PVC joints for buried pipe shall be of the push-on type unless  
21 otherwise directed by the Engineer so that the pipe and fittings may be  
22 connected on the job without the use of solvent cement or any special  
23 equipment. The push-on joint shall be a single rubber gasket joint  
24 designed to be assembled by the positioning of a continuous, molded  
25 rubber ring gasket in annular recess in the pipe or fitting socket and the  
26 forcing of the plain end of the entering pipe into the socket, thereby  
27 compressing the gasket radially to the pipe to form a positive seal. The  
28 gasket and annular recess shall be designed and shaped so that the  
29 gasket is locked in place against displacement as the joint is  
30 assembled. The rubber ring joint shall be designed for thermal  
31 expansion or contraction with a total temperature change of at least 75  
32 degrees F in each joint per length of pipe. The bell shall consist of an  
33 integral wall section with a solid cross-section elastomeric ring which  
34 shall meet requirements of ASTM D1869. The thickened bell section  
35 shall be designed to be at least as strong as the pipe wall. Lubricant  
36 furnished for lubricating joints shall be nontoxic, shall not support the  
37 growth of bacteria, shall have no deteriorating effects on the gasket or  
38 pipe material, and shall not impart color, taste, or odor to the water.
- 39
- 40 3. PVC joints for exposed pipe shall be threaded or solvent welded joints  
41 where called for on the Drawings, unless otherwise directed by the  
42 Engineer. Teflon thread tape or liquid Teflon thread lubricant shall be  
43 used on all threaded joints to serve as both a sealer and lubricant.  
44 Threaded joints should be made hand tight (hard). When the joint is  
45 hand tight a strap wrench should be used to make up one to two (1-2)

1 additional full turns past the hand tight point. Do not use pipe wrenches  
2 or pump pliers on plastic pipe or fittings.  
3

4 C. Fittings:

- 5
- 6 1. Fittings for pressure rated PVC pipe smaller than 4" in diameter shall be  
7 solvent weld or threaded Schedule 80 PVC and shall conform to ASTM  
8 Specification D 2467 or D D2464 as appropriate.  
9
- 10 2. The manufacturer of the pipe shall supply all polyvinyl chloride  
11 accessories as well as any adaptors and/or specials required to perform  
12 the work as shown on the Drawings and specified herein. Standard  
13 double bell couplings will not be accepted where the pipe will slip  
14 completely through the coupling.

15

16 2.02 RESTRAINED JOINTS

- 17
- 18 A. All buried piping shall be restrained in accordance with the restrained joint  
19 table provided in the Drawings. Pipes subject to pressure or being fed by a  
20 pumping system shall be restrained based on a 150 psi working pressure.  
21 Pipes subject to gravity flow shall be restrained based on a 30 psi working  
22 pressure. Restrained joint length indicated in the Tables represents the length  
23 on all sides of fittings and valves within which all joints must be restrained. As  
24 a minimum, the joints at all fittings and valves shall be restrained.  
25
- 26 B. Restrained joints shall be capable of holding against withdrawal for line  
27 pressures 50 percent above the normal working pressure but not less than  
28 150 psi. The pipe and fittings shall be restrained push-on joints or restrained  
29 mechanical joints.  
30
- 31 C. PVC push-on pipe bell and spigot joints shall be restrained with the Uni-Flange  
32 Corp. Series 1390 Restrainer or equal. The restraining device shall be  
33 manufactured of high strength ductile iron meeting ASTM A-536, Grade 65-45-  
34 12. Connecting rods and clamping bolts and nuts shall be manufactured of  
35 corrosion resistance high strength, low alloy COR-TEN steel meeting the  
36 requirements of ASTM A-242 or AWWA C111.  
37
- 38 D. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained  
39 with the Uni-Flange Corp. Series 1300 Restrainer, EBAA Iron, Inc., Series  
40 2000PV Mechanical Joint Restraint Gland, or equal. The restraining device  
41 shall be manufactured of high strength ductile iron meeting ASTM A-536,  
42 Grade 65-45-12. T-bolts and clamping bolts and nuts shall be manufactured  
43 of corrosion resistance high strength, low alloy COR-TEN steel meeting the  
44 requirements of ASTM A-242 or AWWA C111.  
45
- 46 E. Thrust blocks shall not be permitted unless specifically shown on the  
47 Drawings.

1  
2 PART 3 – EXECUTION  
3

4 3.01 HANDLING PIPE AND FITTINGS  
5

- 6 A. Care shall be taken in loading, transporting, and unloading to prevent injury to  
7 the pipe. Pipe or fittings shall not be dropped. Any damaged pipe or fittings  
8 shall be replaced.
- 10 B. All pipe and fittings shall be subjected to a careful inspection just prior to being  
11 laid or installed, and no piece shall be installed which is found to be defective.
- 13 C. If any defective pipe is discovered after it has been laid or installed, it shall be  
14 removed and replaced with a sound pipe in a satisfactory manner at no  
15 additional expense to the Owner. All pipe and fittings shall be thoroughly  
16 cleaned before laying, shall be kept clean until they are used in the work, and  
17 when installed or laid, shall conform to the lines and grades required.

18 3.02 INSTALLING EXPOSED PVC PIPE AND FITTINGS  
19

- 21 A. All piping and fittings shall be installed true to alignment and rigidly supported  
22 thrust anchors shall be provided where required. Each length of pipe shall be  
23 cleaned out before erection.
- 25 B. Sleeves shall be installed of proper size for all pipes passing through floors or  
26 walls as shown on the Drawings. Where indicated on the Drawings or  
27 required for liquid or gas-tightness the pipe be sealed with a mechanical seal  
28 equal to Link-Seal as manufactured by Thunderline Corp., Wayne, Michigan.
- 30 C. Concrete inserts for hangers and supports shall be furnished and installed in  
31 the concrete as it is placed. The inserts shall in accordance with the  
32 requirements of the piping layout and jointing method and their locations shall  
33 be verified from piping layout drawings and the structural drawings. Pipe  
34 hangers and supports are specified in Section 15094 of these specifications.
- 36 D. All valves, fittings, equipment, and appurtenances needed upon the pipelines  
37 shall be set and jointed as indicated on the Drawings or as required. Valves  
38 and appurtenances are included in Section 15100 of these specifications. All  
39 pipe and appurtenances connected to equipment shall be supported in such a  
40 manner as to prevent any strain being imposed on the equipment. When  
41 manufacturers have indicated requirements that piping loads shall not be  
42 transmitted to their equipment, a certification shall be submitted stating that  
43 such requirements have been complied with.

45 3.03 FLUSHING AND TESTING  
46

- 1           A. Prior to pressure testing, all mains shall be flushed to remove all sand and  
2           other foreign matter. The velocity of the flushing water shall not be less than 2  
3           feet per second. Flushing shall be terminated at the direction of the Engineer.  
4           The Contractor shall dispose of the flushing water without causing a nuisance  
5           or property damage.

6

7           B. Complete PVC piping systems shall be field pressure tested after installation  
8           and including all components to 150 psi for 2 hours. Any leaks discovered  
9           during testing shall be repaired. The repaired component or portion must be  
10          retested until the entire system passes the pressure testing. Perform pressure  
11          testing in accordance with Section 01625.

### 13 3.04 SURFACE PREPARATION AND PAINTING



## END OF SECTION

1 SECTION 15065  
2

3 STAINLESS STEEL PIPE AND FITTINGS  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE  
8

- 9       A. This specification covers the preparation of detailed shop drawings and the  
10      fabrication, furnishing, installation, inspection and testing of stainless steel  
11      process piping systems as shown on the drawings and described herein.  
12
- 13       B. All work shall be done in accordance with applicable standards as listed herein  
14      unless otherwise stated in the purchase order and/or attached addenda to this  
15      specification. Sound engineering practices shall be followed in the absence of  
16      specified standards or specifications.  
17
- 18       C. Fabrication of piping subject to the requirements of the ASME boiler and  
19      Pressure Vessel Code, Section I, "Power Boilers," is not covered in this  
20      specification.

21 1.02 APPLICABLE STANDARDS  
22

- 23       A. ANSI and/or ASME Standards  
24

25           B1.1      Unified Inch Screw Threads  
26           B1.20.1    Pipe Threads (Except Dryseal)  
27           B16.5     Pipe Flanges and Flanged Fittings  
28           B16.9     Factory-made Wrought Steel Butt welding Fittings  
29           B16.11    Forged Steel Fittings, Socket Welding and Threaded  
30           B16.25    Buttwelding Ends  
31           B18.2.2   Square and Hex Nuts  
32           B31.3     ASME Code for Pressure Piping - Process Piping  
33           B36.10    Welded and Seamless Wrought Steel Pipe  
34           B36.19    Stainless Steel Pipe.  
35

- 36       B. MSS Standards  
37

38           SP-43     Wrought Stainless Steel Butt Welding Fittings  
39

- 40       C. PFI Standards  
41

42           ES-3     Fabricating Tolerances  
43

- 44       D. Standards  
45

1. ASTM A 999 – Standard Specification for General Requirements for  
2 Alloy and Stainless Steel Pipe.
3. ASTM B 804 - Standard Specification for UNS N08367 and UNS  
4 N08926 Welded Pipe.
5. ASTM A 403 - Standard Specification for Wrought Austenitic Stainless  
6 Steel Piping Fittings.
7. ASTM A 276 - Standard Specification for Stainless Steel Bars and  
8 Shapes.
9. ASTM A 312 - Standard Specification for Seamless and Welded  
10 Austenitic Stainless Steel Pipes.
11. ASTM A 403 – Standard Specification for Wrought Austenitic Stainless  
12 Steel Piping Fittings.
13. ASTM A 774 - Standard Specification for As-Welded Wrought  
14 Austenitic Stainless Steel Fittings for General Corrosive Service at Low  
15 and Moderate Temperatures.
16. ASTM A 778 - Standard Specification for Welded Unannealed Austenitic  
17 Stainless Steel Tubular Products.
18. AWWA C220 - Stainless Steel Pipe
19. AWWA C226 - Stainless Steel Fittings for Waterworks Service
20. AWWA C228 Stainless Steel Pipe Flange Joints for Water Service

- 21
- 22 E. Documents referenced in each of the above are hereby incorporated by  
23 reference.
- 24
- 25 F. The latest revision of all documents shall apply unless otherwise noted herein.
- 26

27 **1.03 SUBMITTALS**

28

- 29 A. The fabricator shall prepare the necessary detail fabrication drawings from the  
30 isometric piping drawings. Pipe size and dimensions of the existing piping  
31 system shall be verified and measured in the field before the drawings are  
32 submitted.
- 33
- 34 B. All piping shown on the isometric drawings is shown in normal assembly and  
35 operating position. When specifically required, thermal expansion  
36 requirements and cold springing will be shown on the drawings.
- 37
- 38 C. Pipe detail pieces shall be fabricated in accordance with the piece marks  
39 shown on the drawings, unless otherwise required for handling and/or  
40 shipping. Changes from the piece mark arrangement shown on the drawings  
41 shall require approval of the Engineer.
- 42
- 43 D. If any conflicts exist between the Isometric Drawings and the Piping Material  
44 Specification, such conflict shall be immediately brought to the attention of the  
45 Engineer.
- 46

1           E. In addition to the above, the following shall be submitted:

- 2
- 3           1. The weight of each length of completed piping.
- 4           2. A complete total bill of materials.
- 5           3. Applicable Material Data Sheets from the supplying mill.
- 6           4. Original copies of mill certifications for each heat of material to be
- 7           utilized.
- 8           5. Original copies of certified design calculations.
- 9           6. Original written certification from the supplying mill stating that the
- 10           fabricator has been pre-qualified for all required fabrication processes.
- 11           7. Original copies of certified test reports including a statement that the
- 12           pipe, flanges and appurtenances have been fabricated in accordance
- 13           with all applicable standards.
- 14           8. Recommended solvents and cleaning procedures for removal of
- 15           protective coatings applied prior to shipment.
- 16           9. Proposed welding repair methods.
- 17           10. A complete fabrication schedule.

18

#### 19        1.04 APPROVAL OF PROCEDURES

- 20
- 21           A. The fabricator shall submit a minimum of five (5) copies of his welding
- 22           procedures and procedure qualification records to the Engineer for review.
- 23
- 24           B. An approval of welding procedures is required from the supplying mill, in
- 25           writing, before welding is performed.

26

#### 27        PART 2 – PRODUCTS

28

#### 29        2.01 PROCESS PLANT INFLUENT PIPE AND FITTINGS

- 30
- 31           A. The Contractor shall furnish and install the pipes, fittings, supports, hangers,
- 32           hardware, as shown on the drawings.
- 33
- 34           B. All stainless steel piping shall be provided with flanged or welded connections
- 35           as shown.

36

#### 37        2.02 FABRICATION DIMENSIONAL TOLERANCES

- 38
- 39           A. Flanged branches with raised face or lap joint flanges:

40

41           center of header to face of flange or lap                    $\pm 1/8"$  (3.2 mm)

42           maximum lateral offset    $\pm 1/16"$  (1.6 mm)

- 43
- 44           B. Flanged branches with RTJ or tongue and groove flanges:

45

46           center of header to face of flange                            $\pm 3/32"$  (2.4 mm)

maximum lateral offset  $\pm 1/16"$  (1.6 mm)

C. Beveled end branches:

center of header to end of bevel  $\pm 1/8"$  (3.2 mm)  
maximum lateral offset  $\pm 1/16"$  (1.6 mm)

D. In fitting reinforcing pads to the curvature of the pipe the maximum allowable gap shall be 1/8" (3.2 mm).

E. Flange faces must be square with the pipe. The tolerance measured across the outside diameter of the gasket surface with a level and thickness gage shall be with the following:

Up to 4"	$\pm 1/32"$ (0.8 mm)
6" to 8"	$\pm 1/16"$ (1.6 mm)
10"	$\pm 3/32"$ (2.4 mm)
12" and Up	$\pm 1/8"$ (3.2 mm)

F. Bolt holes shall straddle the vertical centerlines of horizontal piping and in vertical piping the centerline of the detail (spool) unless otherwise specified, and shall be within 1/16" (1.6 mm) of exact alignment

2.03 MATERIALS

A. All stainless steel pipe shall be a minimum wall thickness of Schedule 40, and rated for a minimum of 150 psi.

B. All stainless steel pipe and fittings shall be fabricated from Type 316L extra low carbon grade austenitic stainless steel.

1. Pipe shall conform to ASTM A-312 or ASTM A 778.
2. Fittings shall conform to ASTM A-403 or ASTM A-774.
3. Ends of pipe shall be true and perpendicular to the longitudinal axis with the edges deburred.
4. Longitudinal seams on pipe and fittings shall be shop welded by either tungsten gas or the metallic-gas method. Welding rod or wire shall be of same composition or superior to the pipe and fittings material.
5. The weld deposit at the seam shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed. Excessive weld deposits, slag, weld spatter, and projections into interior of pipe shall be removed by grinding. The interior welds shall be smooth, even, and

1 shall not have an internal bead higher than 1/16 inch.  
2

- 3       6. All pieces shall be marked with gauge and type of stainless steel.  
4  
5       7. Pipe and fittings shall be immersed in pickling solution in  
6       Manufacturer's plant and scrubbed and washed until all discoloration  
7       and possible iron, picked up from manufacturing process, is removed.  
8

9       D. Fittings:  
10

- 11      1. All fittings for buried or submerged pipe shall be shop fabricated, butt-  
12       welded and flanged conforming to ASTM A403, class WP, using the  
13       same material and wall thickness as the pipe, conforming to ANSI  
14       B16.9. Elbows shall be long radius.  
15  
16      2. Flanges shall be Class 150 per ANSI B16.5. Flanges shall be welded  
17       on both sides.  
18  
19      3. Pipe ends shall be prepared for flanges and couplings as required.  
20  
21      4. Blind flanges shall be constructed entirely of the same material (or  
22       better) as the pipe (minimum thickness 3/8-inch).  
23

24       E. Any material which is not in accordance with the classification shall be noted  
25       on the Fabricator's Drawings as "out of spec." material. Material substitutions  
26       must be approved in writing.  
27

- 28      1. The fabricator shall provide Mill Test Reports for pipe and Certificates of  
29       Compliance for fittings and flanges.  
30

31       F. All materials shall be heat treated, welded, pickled, passivated and tested in  
32       accordance with the supplying mill's requirements for the intended service  
33       conditions. Any conflict between the supplying mill's requirements and these  
34       specifications shall be immediately brought to the Engineer's attention.  
35

36     **2.04 SOCKET WELD FITTINGS**  
37

38       A. To avoid possible cracking of fillet welds when the pipe is seated against the  
39       bottom of the socket prior to welding, it is required that the pipe be withdrawn  
40       approximately 1/16" (1.6 mm) away from contact with the bottom of the socket  
41       before starting welding.  
42

43     **2.05 FABRICATION**  
44

45       A. Fabrication shall be in accordance with American National Standard, ASME  
46       B31.3, "Process Piping" latest edition. Any allowable exceptions are noted on

1                   the Piping Drawings or Piping Material Specifications.  
2

3                   B.     Shop Welding  
4

- 5                   1.     All welding procedures shall be in accordance with the requirements of  
6                   the mill supplying the pipe and fittings. Any conflicts between the mill  
7                   requirements and those specified herein shall be brought to the  
8                   Engineer's attention prior to initiating welding.  
9
- 10                  2.     Welding procedures and operators shall be qualified for welding  
11                  materials specified in accordance with ASME Boiler and Pressure  
12                  Vessel Code, Section IX, "Welding and Brazing Qualifications," latest  
13                  issue. Welding Procedures and Welder's Qualification Test records  
14                  shall be available for examination by the Owner.  
15
- 16                  3.     All welding shall be performed by welders or welding operators qualified  
17                  in accordance with ASME Boiler and Pressure Vessel Code, Section IX,  
18                  "Welding and Brazing Qualifications" welder performance qualification.  
19
- 20                  4.     All welding, brazing and cutting shall be performed in accordance with  
21                  Occupational Safety and Health Standards (OSHA).  
22
- 23                  5.     The fabricator's welding techniques shall be GTAW, GMAW, SAW and  
24                  SMAW, used either individually or in combination with one another.  
25
- 26                  6.     The design of weld joint, welding bevel, and reinforcement shall be in  
27                  accordance with ASME B31.3.  
28
- 29                  7.     Prior to welding, the welding groove and adjacent base metal shall be  
30                  cleaned inside and outside of all scale, rust, oxides, paints, oils, or other  
31                  materials that may affect the welding.  
32
- 33                  8.     The edges or surfaces of parts to be joined by welding shall be prepared  
34                  in the manner specified in the fabricator's qualified welding  
35                  procedure.  
36
- 37                  9.     The ends of piping components to be joined by welding shall be aligned  
38                  as accurately as is practicable within the tolerances of diameter, wall  
39                  thickness, etc. Where the misalignment exceeds 1/16" (1.6 mm), the  
40                  inside diameter of the pipe extending internally shall be trimmed with  
41                  the angle of the bevel not to exceed 30 degrees. However, this  
42                  trimming shall not result in a piping component wall thickness less than  
43                  the design thickness plus corrosion allowance.  
44
- 45                  10.   Alignment shall be preserved during welding by tack welds, spaced as  
46                  required, but with at least one tack weld in each quadrant. Tack welds

1 shall be of the same quality and material as the completed weld and  
2 shall be thoroughly fused with the weld beads. Otherwise they shall be  
3 removed during the welding operation.  
4

- 5       11. The use of backing rings or strips is not permitted in the welding of girth  
6 or longitudinal joints.  
7
- 8       12. The total joint penetration shall not be less than the thinner of the two  
9 components being joined, except that incomplete root penetration is  
10 permissible if it does not exceed 1/32" (0.8 mm) or 20 percent of the  
11 nominal wall thickness of the thinner component, whichever is smaller.  
12 The total length of such incomplete root penetration shall not exceed 1-  
13 1/2" (38 mm) in any 6" (150 mm) of weld length. Welds on which 100  
14 percent radiography is specified shall have complete joint penetration.  
15
- 16       13. The undercut and weld reinforcement of a butt weld shall be in  
17 accordance with Table 341.3.2 of ASME B31.3. For double welded  
18 joints this limitation on reinforcement shall apply to each surface of the  
19 weld separately.  
20
- 21       14. On large diameter lines, where practicable, weld metal shall be  
22 deposited from both sides (double welded).  
23
- 24       15. Prior to depositing each weld layer, the previous weld shall be  
25 thoroughly cleaned to remove all oxide, scale, slag, flux, or defects.  
26 Grinding or chipping may be required to correct the defects. Peening  
27 shall not be used to close cavities in the weld metal.  
28
- 29       16. Longitudinal seams shall be located to clear openings and attachments  
30 where practicable, and shall be staggered a minimum of 5t or 2" (50  
31 mm) whichever is less in adjoining courses. Where necessary to add  
32 outside structural attachment to pipe across longitudinal seam weld,  
33 omit attachment weld where crossing seam weld and notch out  
34 attachment.  
35
- 36       17. The fabricator shall bevel, or otherwise prepare joint ends that are to be  
37 field welded.  
38
- 39       18. Alloy welding electrodes (filler metal) should be of the same  
40 approximate analysis as piping material being welded.  
41

42       2.06 ACCESSORIES  
43

44           A. Bolts and Nuts for Flanged Fittings:  
45

- 46           1. Bolts and nuts for flanged connections shall be Type 316 stainless steel

1                   conforming to ASTM A913, Grade B8M, for bolts and ASTM A194,  
2                   Grade 8M, for nuts.

3  
4                 2. Provide washer for each nut. Washers shall be the same material as  
5                   the nuts.

6  
7                 B. Gaskets for flanged connections shall be full-faced gaskets for flat-faced  
8                   flanges and ring gaskets for raised face flanges. Gaskets shall be EPDM or  
9                   FKM suitable for the service of the pipe.

10                **2.07 TESTING**

11  
12                A. Testing of the pipe and pipe materials shall be as outlined in Section 3.07 of  
13                   this specification.

14                **2.08 EXAMINATION AND INSPECTION**

15  
16                A. Examination

17  
18                1. The fabricator shall examine all welds in accordance with the  
19                   requirements set forth by ASME B31.3.

20  
21                2. The acceptance criteria for welds shall be per Table 341.3.2 of ASME  
22                   B31.3. If weld examination reveals a defect it shall be repaired per  
23                   paragraph 328.6 of ASME B31.3. Further, for any weld defect revealed  
24                   with random or spot examination, additional items per paragraph  
25                   341.3.4 of ASME B31.3 shall be examined.

26  
27                3. The Engineer and/or Owner's Inspector may specify further  
28                   examination in any category where he feels it is necessary.

29  
30                4. The intent of these examinations is to provide the examiner and the  
31                   inspector with reasonable assurance that the requirements of ASME  
32                   B31.3 and the engineering design have been met. The fabricator shall  
33                   provide the inspector a certification that all the quality control  
34                   requirements of the Code have been met.

35  
36                B. The Owner's Inspector shall perform such inspection as deemed necessary.

37                **PART 3 – EXECUTION**

38                **3.01 PREPARATION FOR SHIPMENT**

39  
40                A. All pipe shall be delivered clean. Cleaning shall consist of removing all non-  
41                   adhering material such as loose scale, sand, weld spatter particles, rust,  
42                   cutting chips, oil or mineral spirits, etc., from the inside of the piping assembly

1 by any suitable means. Pipe shall not be coated with any protective or oil  
2 based coatings.

- 3
- 4 B. Open ends, whether plain, beveled, or flanged shall be protected from damage  
5 or entrance of foreign materials with suitable protectors securely fastened.
- 6
- 7 C. Small pieces shall be boxed or wired together to avoid loss in transit.
- 8
- 9 D. Loading and handling shall be done with reasonable care and details braced  
10 where required to prevent damage during transit.

11

12 E. Marking

13

- 14
- 15 1. Each fabricated pipe detail shall be marked as follows, using waterproof  
paint, or paint protected with a clear waterproof varnish.
- 16
- 17 2. On stainless steel and alloy material, the marker shall be lead, zinc and  
sulfur free, and less than 200 PPM chlorides.
- 18
- 19 3. The Pipe Detail Number shall be marked on each end of the detail on  
opposite sides. The detail number consists of area number, piece  
20 designation, and line number.
- 21

22 Example: 111-A-25, 111-B-25, etc.

23

- 24
- 25 4. The welders identification symbol shall be marked adjacent to each  
weld. Metal stamping shall not be used on austenitic stainless and  
26 other high alloy type materials. Additionally, stamping on carbon and  
27 alloy steel materials shall be prohibited when the design temperature  
28 specified is below -20°F (-29°C). In these cases, the welders symbol  
29 shall be applied in waterproof paint.
- 30

31

### 3.02 FIELD WELDING

- 32
- 33 A. Field welding shall only be allowed when approved by the Engineer. Welding  
procedures and operators shall be qualified for welding materials specified in  
34 accordance with ASME Boiler and Pressure Vessel Code, Section IX,  
35 "Welding and Brazing Qualifications," latest issue. Welding Procedures and  
36 Welder's Qualification Test records shall be submitted in accordance with  
37 Section 01300.
- 38
- 39 B. Gas tungsten arc, gas metal arc, shielded metal arc or submerged arc welding  
40 (GTAW, GMAW, SMAW & SAW) may be used. An inert gas purge shall be  
41 used for the root and second passes in all welding processes except the  
42 shielded metal arc.
- 43

- 1           C. Preheat is not required unless the metal temperature is below 50°F (10°C).  
2           When such a condition exists, the metal shall be heated until it is warm to the  
3           hand before any welding is performed.  
4
- 5           D. Post weld heat treatment (stress relieving) is not required  
6

7        3.03 ERECTION  
8

- 9           A. The piping systems shall be erected to conform to the piping drawings and  
10          specifications. Qualified craftsmen shall perform all work in a neat and  
11          workmanlike manner.  
12
- 13          B. Piping shall be installed in a manner such that the resultant forces on the  
14          equipment will be kept to a minimum. Particular care shall be taken at  
15          mechanical equipment where piping forces can cause misalignment. Flange  
16          misalignment beyond the acceptable tolerance shall be corrected by cutting  
17          and re-welding, and not by the use of force on the bolting. Bending of pipe  
18          and fittings is not allowed.  
19
- 20          C. Pipe supports, anchors and guides shall be installed and adjusted in  
21          accordance with the pipe support drawings and specifications to properly  
22          support the piping and to control movements due to expansion of piping and  
23          equipment. Sufficient ties shall be installed to prevent excessive sway and/or  
24          vibration of the piping and lines having outstanding unsupported corners.  
25
- 26          D. Where necessary to provide piping anchor points that are not shown on the  
27          job pipe support drawings, consideration shall be given to expansion and  
28          contraction movements of the piping and equipment, with minimum forces and  
29          stress being transmitted to the equipment.  
30
- 31          E. When permanent pipe supports cannot be installed during erection, adequate  
32          temporary supports shall be provided, so that piping is not strained or  
33          deformed during the erection process.  
34
- 35          F. All precautions shall be taken to assure internal cleanliness of installed piping.  
36          Flange protectors, or other end closures shall not be removed until time of  
37          installation. Pipe sections shall be inspected just prior to installation, to assure  
38          that all debris has been removed. Wherever practicable, hydrostatic test water  
39          shall be drained quickly to promote flushing for further cleaning.  
40

41        3.04 EXAMINATION AND INSPECTION  
42

- 43          A. Examination  
44
- 45          1. The acceptance criteria for welds shall be per Table 341.3.2 of ASME  
46          B31.3. If weld examination reveals a defect it shall be repaired per

paragraph 328.6 of ASME B31.3. Further, for any weld defect revealed with random or spot examination, additional items per paragraph 341.3.4 of ASME B31.3 shall be examined.

2. The Welding Inspector may specify further examination in any category where he feels it is necessary.

- B. Inspector shall inspect all piping systems including pipe supports to assure that the installation has been made in a good workmanlike manner and conforms to the drawings and specifications. In addition, the work may be subject to inspection by the client's authorized agency such as an insurance company or government agency.

### 3.05 TESTING

- A. A general hydrostatic test of all completed shop fabricated details is not required.
  - B. Testing shall be conducted after the completion of all erection by deadheading the pumps at the valve vault and running them for 1 minute. Testing medium shall be water.
  - C. All visible leaks shall be corrected. Any defective material or components and all lines that fail to meet the test shall be repaired and retested as necessary, until all test requirements are met. All repairs and retests shall be performed at the Contractor's own expense with no additional cost to the Owner.

END SECTION

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1 SECTION 15080  
2

3 SMALL DIAMETER METAL PIPE AND FITTINGS  
4

5  
6 PART 1 - GENERAL  
7

8 1.01 WORK INCLUDED  
9

10 The Contractor shall furnish all the materials, tools, labor, supervision and appliances  
11 for and shall properly install, connect, adjust, test and place at the locations shown  
12 on the Drawings, or as directed, all copper pipe and fittings and small diameter  
13 miscellaneous pipe and fittings at the locations and to the elevations indicated,  
14 specified or required, as necessary for the proper completion of the Work.  
15

16 Attention is called to the fact that miscellaneous pipe and fittings are not necessarily  
17 shown complete on the Drawings, which are more or less schematic, but the  
18 Contractor shall do all piping work indicated or required for the proper operation of  
19 all equipment and services requiring such piping, and all such work shall be done by  
20 competent workmen in a thorough workmanlike manner, according to best custom  
21 and practice, and in compliance with all laws and regulations, with proper provisions  
22 for dismantling, draining, expansion and contraction.  
23

24 Wherever the Work disturbs existing conditions or Work already completed, the same  
25 shall be restored to its original condition in every detail. All such replacement and  
26 repair shall meet with the approval of the Engineer.  
27

28 It is the intent of these Contract Documents to require an installation under this  
29 Section complete in every detail, whether or not indicated on the Drawings, or  
30 specified herein. Consequently, the Contractor shall be responsible for all details,  
31 devices, accessories and special construction necessary to properly furnish, install,  
32 adjust, test and place in continuous and satisfactory service a complete installation of  
33 miscellaneous pipe and fittings.  
34

35 Full responsibility for fabricating, and installing the miscellaneous pipe and fittings, for  
36 selecting materials of construction, and for demonstrating strict compliance with  
37 specified performance requirements shall rest with the Contractor and, through the  
38 Contractor, the Supplier. The Engineer's approval of the 1) Shop Drawings, 2)  
39 construction of the miscellaneous pipe and fittings, 3) the use of materials included in  
40 this Specification, shall not relieve the Contractor and Suppliers of full responsibility  
41 for meeting all performance requirements and guarantees specified in the Contract  
42 Documents.  
43

44 1.02 REFERENCE TO OTHER SECTIONS  
45

1 Requirements contained herein under the Specification for Ductile Iron Pipe 42  
2 Inches and Less, Section 02060, shall be considered as and are hereby made a part  
3 of the Specifications for Small Diameter Pipe and Fittings, Section 15080, insofar as  
4 they may apply.

5

6 **1.03 WORKMANSHIP AND MATERIALS**

7

8 The Contractor shall furnish materials under this Specification which are new, unused  
9 and as specified, or if not particularized herein, which are the best of their respective  
10 kind, free of defects and imperfections, and suitable for the service intended, subject  
11 to the approval of the Engineer.

12

13 The Contractor shall provide workmanship which is first class in every respect and  
14 have the installation performed by workers thoroughly experienced in such work. A  
15 neat and workmanlike appearance in the finished work shall be required.

16

17 The Contractor shall perform the Work in accordance with all Laws and Regulations.

18

19 **1.04 SUBMITTALS**

20

21 The Contractor shall submit detailed, dimensioned Shop Drawings and data  
22 conforming to the requirements of Section 01300 of the General Requirements to the  
23 Engineer for approval before fabrication, shipment or Work specified under this  
24 Section begins.

25

26 The Contractor shall make detail drawings for pipe and fittings to a scale of not less  
27 than 1/4 inch equals one (1) foot, indicating piping layout in plan and elevation as  
28 may be required to clearly indicate all pipe and fittings. Completely dimension the  
29 drawings and indicate connections to equipment and reference to approved shop  
30 drawings of such equipment.

31

32 The Contractor shall include a complete schedule of pipe, fittings and specials with  
33 mark numbers on the schedules and on drawings corresponding to the mark  
34 numbers which will be on the pipe, fittings and specials when delivered to the job site,  
35 as called for hereinafter.

36

37 The Contractor shall indicate location and type of pipe supports, hangers and  
38 anchors on the Shop Drawings.

39

40 **PART 2 - MATERIALS**

41

42 **2.01 STEEL PIPE AND FITTINGS**

43

44 Steel pipe, when specifically called for, shall meet the "Standard Specification for  
45 Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless,

for Ordinary Uses," - A.S.T.M. Designation: A 53. Schedule 40 pipe shall be "Standard Weight" pipe and used except as modified herein. Fittings used on black steel pipe lines two and one-half (2-1/2) inches or less in diameter, unless otherwise specifically called for, shall be standard weight, one hundred fifty (150) pound, beaded, malleable iron conforming to ASTM A338 for "Malleable Iron Flanges, Pipe Fittings and Valve Parts for Railroad, Marine and other Heavy Duty Service" at temperatures up to 650°F (345°C), Class 150. Fittings used on black steel pipe lines three (3) inches and larger shall be of the welded American National Standards Institute (A.N.S.I.) type, long radius design of standard weights, A.N.S.I. B 16.9-1971, "Factory- Made Wrought Steel Butt welding Fittings."

Flanges shall be of the forged steel slip-on type, faced and drilled, of the one hundred fifty (150) pound series, meeting A.N.S.I. Specification B 16.5-1977 "Steel Pipe Flanges and Flanged Fittings", and "Standard Specification for Forging, Carbon Steel for General Purpose Piping," A.S.T.M. Designation: A 181-83.

All gaskets for flanged pipe joints except for air or steam service shall be full face type with a minimum thickness of one-eighth ( 1/8) inch and shall be red rubber or neoprene. Air and steam service gaskets shall be compressed non-asbestos material Style No. 3000 Garlock Blue Gard, similar products by Cranite or equal.

The Contractor shall provide unions in each run of pipe and at equipment for easy removal. Furnish unions of the ground joint type with brass seats. No gasketed unions shall be permitted.

The Contractor shall provide fittings as required and expansion couplings in each run of straight pipe and at structural expansion joints. Groove pipe for expansion couplings where noted or specified.

The Contractor shall provide each length of pipe with a coupling, if applicable.

Malleable iron screwed fittings shall meet the standards of A. N.S.I. B 16.3-1977, "Malleable Iron Threaded Fittings". Hot-dipped galvanized malleable iron fittings shall be used on all galvanized steel pipe lines. Malleable iron grooved end fittings shall meet the requirements of "Standard Specification for Malleable Iron Castings", A.S.T.M. A 47-77 and be hot-dipped galvanized. Furnish pipe and fittings with sound, well-fitting threads. Pieces having defective threads shall be rejected.

## 2.02 STAINLESS STEEL PIPE AND FITTINGS

All stainless steel pipe and fittings shall be made of Type 304 stainless steel, unless shown or specified otherwise. Stainless steel pipe shall be seamless or welded and furnished in strict accordance with "Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe" , A.S. T.M. Designation A 312-83 and fittings in

1 accordance with "Standard Specification for Wrought Austenitic Stainless Steel  
2 Piping Fittings", A.S.T.M. Designation A 403-83a. Butt welded fittings shall meet  
3 the standards of ANSI B 16.9-1971. All pipe and fittings shall be annealed and  
4 pickled, and shall have a surface finish equivalent to a No. 1 Mill Finish in accordance  
5 with "Standard Specification for General Requirements for Flat-Rolled Stainless and  
6 Heat- Resisting Steel Plate, Sheet and Strip", A.S.T.M. Designation A 480/ A 480M-  
7 83a. Schedule 40 pipe shall be "Standard Weight." Fittings shall have the same  
8 schedule wall thickness as the pipe.  
9

10 Where stainless steel pipe is connected by grooved-end couplings or flange  
11 adaptors, the pipe shall be of the roll grooved (no metal removed) end type.  
12

13 All welding shall be done by a fully automatic, shielded arc, inert gas method. Welds  
14 shall be fully penetrated and gas shielded on both sides. All welds shall be smooth,  
15 uniform bead and thickness, and brushed with stainless steel wire brush, with  
16 deposits and discoloration removed.  
17

## 18 2.03 COPPER PIPE AND FITTINGS 19

20 All copper pipe shall be of standard size, as indicated on the Drawings, specified or  
21 required and shall conform in all respects to the "Standard Specification for Seamless  
22 Copper Water Tube," A.S.T.M. Designation: B 88-83. The Contractor shall provide  
23 copper tubing manufactured by Anaconda American Brass Company, Revere Copper  
24 and Brass, Inc., or equal. Copper water pipe, when used underground, shall be Type  
25 K, soft temper, coil or straight lengths as directed and when used elsewhere shall be  
26 Type L, hard temper, drawn copper tubing, unless otherwise specifically called for.  
27 All fittings on these lines shall be cast bronze fittings, as manufactured by Mueller  
28 Company; Stanely G. Flagg Co.; or equal. For soft temper tubing the Contractor shall  
29 provide cast bronze flared tube type fittings. For hard drawn copper tube fittings the  
30 Contractor shall provide the cast bronze sweat type. Unions shall be of the solder  
31 type, with brass-to-brass seats. Gasketed unions shall not be acceptable. A liberal  
32 amount of unions shall be installed to allow removal of valves and equipment.  
33

34 Where copper piping is connected to steel pipe, the Contractor shall furnish and  
35 install an insulating union, by EPCO Sales, Incorporated, or Capital Manufacturing  
36 Co., or equal.  
37

38 Where copper pipe is connected to ductile iron pipe, the Contractor shall furnish and  
39 install a tapped cap, Clow F-1042, or ACIPCO Type A-338 or equal, and a brass  
40 corporation stops, Type HI5025 by Mueller Co., or equal.  
41

## 42 2.04 BRASS PIPE AND FITTINGS 43

44 Brass pipe shall meet the "Standard Specification for Seamless Brass Tube,"  
45 A.S.T.M. Designation: B 135-82, drawn temper. Fittings shall be brass.  
46

1  
2  
3 2.05 PIPING SCHEDULE  
4

5 Unless otherwise called for by the Drawings or elsewhere in these Specifications, the  
6 following schedule shall be a guide of minimum requirements for piping for the Work.  
7

8 I. Pipe for Underground Service  
9

10 A. Potable Water and Sealing Water  
11

12 1. 3" and smaller - Type K (heavy wall) soft temper copper tube  
13 with soldered fittings.  
14

15 B. Compressed Air  
16

17 1. 2" and smaller - Type K (heavy wall) soft temper copper tube  
18 with soldered fittings.  
19

20 2. 2-1/2" to 4" - Schedule 40 galvanized steel pipe with  
21 screwed joints, slip-on flanges or compression couplings.  
22

23 All ungalvanized (black) steel pipe for underground service shall be  
24 coated with a polyethylene sheath. The coating system shall meet  
25 Federal Specification L-C-530B. All joints shall be wrapped after  
26 laying, so that the finished job shall be completely protected.  
27

28 II. Pipe for Nonburied Service, Carrying:  
29

30 A. Potable Water and Sealing Water  
31

32 1. 3" and smaller - Type L (medium wall) hard temper copper pipe  
33 with soldered fittings. Red brass pipe around equipment, and in other  
34 locations where vibration is expected.  
35

36 B. Compressed Air  
37

38 1. 2" and smaller - Type L (medium wall), hard temper copper pipe  
39 with soldered fittings. Red brass pipe around equipment, and in other  
40 locations where vibration is expected.  
41

42 2. 2-1/4" to 6" - Schedule 40 galvanized steel pipe, with screwed  
43 joints, slip-on flanges or compression couplings.  
44

45 C. Vent Gases

1  
2       1. 3-1/2" and smaller - Schedule 40 galvanized steel, with  
3       screwed joints, slip-on flanges or compression couplings, unless  
4       otherwise shown on the drawings.  
5

6           D. Hydraulic Piping  
7

8       1. 1/2" and less - Schedule 40 stainless steel pipe with  
9       hydraulic connectors.  
10

11       2. 3/4" and larger - Schedule 40 stainless steel pipe with  
12       screwed joints or welded joints.  
13

14       All ungalvanized (black) steel piping for interior use, that is not covered  
15       by insulation, shall be primed and painted as specified under the  
16       painting schedule of Section 09900.  
17

18       Where more rigidity is required in erecting and supporting copper pipe,  
19       the Contractor shall, with the approval of the Engineer or when so  
20       directed by the Engineer, substitute brass pipe.  
21

22       **2.06 HANGERS AND SUPPORTS**  
23

24       The Contractor shall provide all necessary hangers and supports for piping installed  
25       in the Work.  
26

27       Hangers and supports for all steel or other piping shall meet the following  
28       requirements. No perforated strap hangers and no wire supports shall be permitted.  
29

30       Hangers supporting insulated piping 2-1/2" and larger shall be sized to fit the pipe  
31       plus the insulation. The insulation at support points shall be provided with metal  
32       shields to prevent damage to the insulation.  
33

34       Pipe hangers used to support uninsulated copper piping shall be copper or copper  
35       plated.  
36

37       Guides shall be located not more than twenty (20) feet away from each expansion  
38       loop or joint.  
39

40       Horizontal runs of pipe shall have supports spaced so that the sag of the  
41       unsupported length shall not create any pockets in the piping.  
42

43       All vertical piping shall be supported at the base with fittings made for this purpose or  
44       supported from the nearest horizontal member or floor with a riser extension pipe  
45       clamp. The Contractor shall provide riser extension clamps at each floor.  
46

1  
2 All anchors that are installed in existing concrete shall be Grinnell Figure 117, Modem  
3 Figure 740, or equal expansion case inserts. The Contractor shall drill clean holes for  
4 insertion of case and patch concrete around drill hole as required.

5  
6 The Contractor shall furnish and install concrete inserts that shall be cast in the  
7 concrete walls and slabs as required for the proper hanging and supporting of the  
8 piping and equipment that is to be furnished and installed in the Work.

9  
10 If approved by the Engineer, continuous slotted concrete inserts shall be Crawford  
11 Figure 148, Fee & Mason 9000, or equal. The Contractor shall provide secondary  
12 angle supports between main inserts to hang the various pipes where the loads are  
13 such that they can be properly supported by this arrangement.

14  
15 All inserts and support bolts shall be galvanized.

16  
17 **2.07 SLEEVES AND FLOOR PLATES**

18  
19 Wherever pipes pass through floors, walls or ceilings, the Contractor shall provide  
20 Standard Wall steel pipe sleeves of the proper size. The Contractor shall properly  
21 cement or build sleeves into the masonry in a rigid position. The Contractor shall set  
22 ends of the sleeves flush at wall and ceiling surfaces and to extend one inch above  
23 floor surfaces.

24  
25 For sleeves in walls below grade, the Contractor shall provide water stops and tightly  
26 caulk with oakum and lead after the pipe is installed. Such sleeves shall be  
27 completed tight and tested for leaks.

28  
29 **PART 3 - EXECUTION**

30  
31 **3.01 INSTALLATION**

32  
33 All pipe shall be carefully placed by the Contractor to proper lines and grades and  
34 shall be connected up, unless otherwise shown or indicated, with screw fittings.  
35 Screw joints shall be made tight, with an approved jointing compound, and screwed  
36 home. If welding of pipe is called for, it shall be installed in accord with the  
37 requirements of the Engineer.

38  
39 All piping shall be installed in such manner and at such times as will require a  
40 minimum of cutting and repairing of the building structures. In case any such cutting  
41 and repairing is necessary, it shall be done only with the permission of the Engineer.  
42 All cutting and repairing shall be performed by mechanics of the trade which originally  
43 executed the work, with all repairs matching the original condition.

44  
45 The following general piping practices, when applicable, shall be followed in installing

1 all steel, copper and brass piping:

- 2
- 3 1. Full lengths of pipe shall be used wherever possible; short lengths of pipe with
- 4 couplings shall not be permitted.
- 5
- 6 2. All pipe shall be cut to exact measurement and shall be installed without
- 7 forcing or springing.
- 8
- 9 3. Tool marks and unnecessary pipe threads shall not be allowed. Burrs formed
- 10 when cutting pipe shall be removed by reaming. Before installing any pipe,
- 11 care shall be taken that the inside is thoroughly clean and free of cuttings and
- 12 foreign matter.
- 13
- 14 4. In general, all changes in direction shall be made by using pipe fittings. Field
- 15 bends of pipe shall not be permitted. Wherever there is a galvanized steel
- 16 pipeline longer than 30 feet, the Contractor shall provide a plugged tee in the
- 17 line.
- 18
- 19 5. A liberal number of unions shall be used on pipe two and one-half (2-1/2)
- 20 inches or smaller in diameter, and companion flanges on pipe three (3)
- 21 inches and larger, to permit the ready removal of any section. Unions shall
- 22 be installed in all piping connections to equipment, to regulating valves, and
- 23 wherever necessary to facilitate the removal of valves, strainers, accessories
- 24 and other items requiring maintenance. Flanges on equipment may be
- 25 considered as unions when connecting pipe is provided with companion
- 26 flanges. All unions shall be of the ground joint type, with brass-to-metal seats.
- 27 No gasketed unions will be permitted. Where wrought iron or steel pipe is to
- 28 be connected to copper pipe, a dielectric union, such as those
- 29 manufactured by EPCO Sales, Inc., Capital Manufacturing Company, or
- 30 equal, shall be used.
- 31
- 32 6. Exposed piping shall be neatly arranged, straight, run parallel and at right
- 33 angles to walls, unless otherwise directed or shown, and shall be so graded
- 34 that the entire system can be drained. Drain valves or stop and waste valves
- 35 shall be installed at all low points of piping.
- 36
- 37 7. Installed piping shall not interfere with the operation or accessibility of doors or
- 38 windows, shall not encroach on aisles, passageways, and equipment, and
- 39 shall not interfere with the servicing or maintenance of any equipment.
- 40
- 41 8. The Contractor shall cut annealed, Type K, copper tube square, ream ends
- 42 and flare using suitable tools. The Contractor shall use bending tools for
- 43 making bend on annealed copper pipe only and shall assemble hard drawn,
- 44 Type L, copper tubing, using solder alloy and flux as recommended by the
- 45 manufacturer of the tubing. The Contractor shall cut tubing square, ream ends,

1 and polish both fitting and tube with steel wool before fluxing; properly heat,  
2 taking care not to overheat and after running solder, wipe the joint clean. The  
3 Contractor shall install copper tubing only in accordance with the Supplier's  
4 instructions.

- 5
- 6 9. Where copper tubing is connected to ferrous piping or equipment with ferrous  
7 fittings, the Contractor shall provide approved insulating bushings.
- 8 10. Where copper lines pass through exterior walls, the Contractor shall carry  
9 Type K through a pipe sleeve provided for this purpose and connect Type L  
10 inside the building by use of adapter fittings.
- 11 12. All welding of steel pipe shall be carried out in strict accordance with A.W.S.  
12 procedures, and all Laws and Regulations. Welding of black steel pipe shall be  
13 accomplished by means of the manual, shielded metal-arc process. Welding  
14 of stainless steel pipe shall be by the shielded arc, inert gas method.
- 15 16. All welding shall be performed by men who are thoroughly qualified for this  
17 type of work.
- 18 19. 12. When cast iron companion flanges are required to connect steel piping to cast  
20 iron piping, or in steel pipe two and one-half (2-1/2) inches or larger in lieu of  
21 unions, such flanges shall be furnished drilled and tapped, as necessary, and  
22 included with the pipe.
- 23 13. After welding slip-on flanges to galvanized steel pipe, the disturbed galvanized  
24 interior and exterior areas the Contractor shall clean and restore, by hot-dip  
25 galvanizing or painting with a zinc-rich cold galvanizing paint.
- 26 14. After testing, exposed pipe threads on joints laid in the ground the Contractor  
27 shall paint with one (1) coat of Bitumastic No. 50, Tnemecol or equal coal-tar  
28 pitch paint.
- 29 15. In general, the Contractor shall furnish and install pipe expansion joints on all  
30 piping where such piping crosses structure expansion joints, whether or not  
31 shown on the Drawings. The Contractor shall assemble expansion couplings  
32 with bolts drawn sufficiently tight to prevent leakage but not to prevent  
33 expansion and contraction.
- 34 16. Where pipes pass through concrete or masonry walls or floors, the Contractor  
35 shall provide galvanized pipe sleeves. For pipe two (2) inches and smaller in  
36 diameter, provide sleeves two (2) sizes larger than the pipe itself. For pipe 2-  
37 1/2 inches and larger in diameter, provide sleeves one (1) pipe size larger than  
38 the pipe itself. The Contractor shall extend sleeves through the floor two (2)  
39 inches above the finished slab, except in finished areas where the Contractor  
40
- 41
- 42
- 43
- 44
- 45

1 shall finish the sleeve just above the finished slab, unless it is noted to be  
2 flush. The Contractor shall make ends of sleeves flush with wall and ceiling  
3 surface, shall render sleeves gas tight and caulk sleeves passing through  
4 exterior walls watertight using lead wool.

5  
6 17. Provide chromium plated floor, wall and ceiling plates to cover exposed piping  
7 passing through surfaces; furnish Grinnell Fig. 10, American Standard, or  
8 equal.

9  
10 18. Underground piping shall be cradled and backfilled as specified under  
11 Sections 02221, as applicable. The use of slag for cradle or backfill material  
12 under, around or over steel, copper and brass pipe will be prohibited.

13 3.02 TESTING

14  
15 After all piping has been connected up in place and before application of  
16 insulation or covering, the Contractor shall test to the satisfaction of the Engineer  
17 all piping in accordance with the requirements of Section 01625 of these  
18 Specifications, as applicable. Any leaks which develop shall be made tight before  
19 final acceptance of the work, by rewelding, tightening, renewing packing, or  
20 replacing materials, as required or as ordered. Caulking will not be permitted. All  
21 labor, material and equipment for tests shall be furnished by the Contractor. After  
22 all lines have been tested and approved, they shall be blow n dry with  
23 compressed air and carefully cleaned by the Contractor.

24 3.03 DISINFECTION

25  
26 All steel or copper or brass piping carrying potable water shall be disinfected after  
27 testing, in accordance with the procedures specified in Section 01625, as applicable.

28  
29  
30  
31  
32 END OF SECTION

1 SECTION 15094  
2

3 PIPE HANGERS AND SUPPORTS  
4

5 PART 1 – GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. It is the intent of the project to remove existing pipe supports, hangers, and  
10      straps and furnish and install new pipe supports, hangers, and straps as  
11      shown on the Drawings.  
12  
13       B. Furnish all labor, materials, equipment and incidentals and install hangers,  
14      supports, concrete inserts, and anchor bolts, including metallic hanging and  
15      supporting devices for supporting exposed piping.  
16  
17       C. All new pipe supports, hangers, straps hardware, clips, unistrut, and anchors  
18      shall be 304 stainless steel and shall match the number, type, location, and  
19      capacity of the existing supports.

20 1.02 QUALIFICATIONS  
21

- 22       A. Hangers and supports shall be of standard design and shall be adequate to  
23      maintain the supported load in proper position under all operating conditions.  
24      The minimum working factor for pipe supports shall be five (5) times the  
25      ultimate tensile of the material, assuming 10 feet of water filled pipe being  
26      supported.  
27  
28       B. All pipe and appurtenances connected to equipment shall be supported in  
29      such a manner as to prevent any strain being imposed on the equipment.  
30      When manufacturers have indicated requirements that piping loads shall not  
31      be transmitted to their equipment, the Contractor shall submit a certification  
32      stating that such requirements have been complied with.  
33

34 1.03 SUBMITTALS  
35

- 36       A. Submit to the Engineer for review, as provided in the General Conditions, shop  
37      drawings of all items to be furnished under this section.  
38  
39       B. Submit to the Engineer, for review, samples of all materials specified herein.  
40

41 PART 2 – PRODUCTS  
42

43 2.01 GENERAL  
44

- 45       A. All pipe and tubing shall be supported as required to prevent significant  
46      stresses in the pipe or tubing material, valves and fittings, and to support and  
47

secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe and personnel contact. All pipe supports shall be reviewed by the Engineer prior to installation.

- B. All materials used in manufacturing hangers and supports shall be capable of meeting, the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.
- C. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 that the maximum unsupported span shall not exceed 10 feet otherwise specified herein.
- D. Unless otherwise specified herein, pipe hangers and supports shall be manufactured by Piping Technology & Products, Inc. or equal. Any reference to a specific figure or number is for the purpose of establishing a type and quality of and shall not be considered as proprietary.

## 2.02 PIPE HANGERS AND SUPPORTS FOR METAL PIPE

- A. Suspended single pipes shall be supported by 304 SS hangers suspended by steel from 304 SS concrete inserts, beam clamps or ceiling mounting as follows:

### 1. Hangers:

Pipe Size, Inches	Piping Technology & Products Fig. No.
1/2" to 3"	50
3" to 30"	83
Above 30"	See SPECIAL SUPPORTS, Paragraph 2.04

- 2. Hanger rods shall be rolled 304 stainless steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

Pipe Size, Inches	Min. Rod Diameter, In.
Less than 2-1/2	3/8
2-1/2 though 4	1/2
4	5/8
6	3/4
8-12	7/8
14-16	1
20-30	1-1/2
Above 30	See SPECIAL SUPPORTS,

## Paragraph 2.04

3. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnell Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnell Fig. No. 228 or equal.
  4. Concrete inserts for pipe hangers shall be designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers or ceiling mounting bolts for individual pipe hangers, and shall be as manufactured by Ramset/Red Head, or equal, and shall be as follows:
    - a. 304 SS Multi Set II drop in style anchors shall be used where applicable and shall be used for hanger rods up to and including 7/8-inch diameter.
    - b. Ceiling mounting plates shall be used, where applicable, and be for hanger rod sizes 1-inch through and including 1-1/4 inches, shall be Fig. 47, Fig. 49 or Fig. 52 as manufactured by Grinnell or equal. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall 304 SS be equal to Grinnell Fig. No. 230. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnell Fig. 194, 195, and 199, as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.
  5. Where the pipe is located above the bracket, the pipe shall be set on a 0.5-inch neoprene pad and U-bolt assembly supported by the bracket for pipes 4-inches and larger or by a U-bolt for pipes smaller than 4-inches. U-bolts shall be equal to Grinnell Fig. 120 and 137.
  6. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.
  7. Wall or column supported pipes 8-inches and smaller may be supported by hangers equal to Grinnell Figures 103, as required.

40  
41       B. Floor supported pipes 3-inches and larger in diameter shall be supported by  
42           either cast-in-place concrete supports or adjust-able pipe saddle supports as  
43           directed by the Engineer. In general, concrete supports shall be used when  
44           lateral displacement of the pipes is probable (unless lateral support is  
45           provided), and adjustable pipe saddle type supports shall be used where  
46           lateral displacement of the pipes is not probable.  
47

- 1       1. Each concrete support shall conform to the details shown on the  
2       Drawings. Concrete shall be poured after the pipe is in place with  
3       temporary supports. Top edges and vertical corners of each concrete  
4       support shall have 1-inch bevels. Each pipe shall be secured on each  
5       concrete support by a wrought iron or steel anchor strap anchored to  
6       the concrete with cast-in-place bolts or with expansion bolts. Where  
7       directed by the Engineer, vertical reinforcement bars shall be grouted  
8       into drilled holes in the concrete floor to prevent overturning or lateral  
9       displacement of the concrete support. Unless otherwise directed by the  
10      Engineer, maximum height shall be five (5) feet.  
11  
12      2. Concrete piers used to support base elbows and tees shall be similar to  
13      that specified above. Piers may be square or rectangular.  
14  
15      3. Adjustable pipe saddle support shall be screwed or welded to the  
16      corresponding size 150 lb. companion flanges or slip-on welding  
17      flanges respectively. Supporting pipe shall be of Schedule 40 steel  
18      pipe construction of the size recommended by the pipe support  
19      manufacturer. Each flange shall be secured to the concrete floor by a  
20      minimum of two (2) expansion bolts per flange. Adjustable saddle  
21      supports shall be equal to Grinnell Fig. No. 259. Where used under  
22      base fittings, a suitable flange shall be substituted for the saddle. Floor  
23      supported pipes less than 3-inches shall be supported by fabricated  
24      steel supports.  
25  
26      C. Vertical piping shall be supported as follows:  
27  
28      1. Where pipes change from horizontal to vertical, the pipes shall be  
29      supported on the horizontal runs within 2 feet of the change in direction  
30      by pipe supports as previously specified herein.  
31  
32      2. For vertical runs exceeding 15 feet pipes and greater than eight-inches  
33      in diameter shall be supported by the fabricated pipe support as shown  
34      in the drawings.  
35  
36      3. Where vertical piping passes through a steel floor sleeve, the pipe shall  
37      be supported by a friction type pipe clamp which is supported by the  
38      pipe sleeve. Pipe clamps shall be equal to Grinnell Fig. 262. Anchor  
39      bolts shall be equal to Kwik-Bolt as manufactured by the McCulloch  
40      Industries, Minneapolis, Minnesota or Wej-it manufactured by Wej-it  
41      Expansion Products, Inc., Bloomfield, Colorado.  
42  
43      D. All rods, hangers, inserts, brackets, and components shall be 304 Stainless  
44      Steel.

45  
46      **2.03 PIPE HANGERS AND SUPPORTS FOR PLASTIC PIPE**  
47

- 1           A. Single plastic pipes shall be supported by pipe supports as previously  
2           specified herein.
- 3
- 4           B. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber  
5           hose shall be supported by ladder type cable trays such as the Electray  
6           Ladder by Husky-Burndy, the Globetray by the Metal Products Division of  
7           United States Gypsum, or equal. Ladder shall be of mild steel construction.  
8           Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches  
9           for rubber hose. Tray width shall be approximately 6 inches for single runs of  
10          rubber hose and 12 inches for double runs of rubber hose. Ladder type cable  
11          trays shall be furnished complete with all hanger rods, rod couplings, concrete  
12          inserts, hanger clips, etc., required for a complete support system. Individual  
13          plastic pipes shall be secured to the rungs of the cable tray by strap clamps  
14          fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or equal.  
15          Spacing between clamps shall not exceed 9 feet. The cable shall provide  
16          continuous support along the length of the pipe.
- 17
- 18           C. Individual clamps, hangers, and supports in contact plastic pipe shall provide  
19          firm support, but not so firm as to prevent longitudinal due to thermal  
20          expansion and contraction.

22          2.04 SPECIAL SUPPORTS

- 24           A. Pipes, requiring special supports as defined in this specification or shown on  
25          the drawing, shall be supported by means of a supporting framework anchored  
26          into the floor or curbing. The vertical piping shall be suitably secured to  
27          horizontal support members connected at each end vertical support members  
28          and spaced as required to provide a rigid installation.
- 29
- 30           1. The complete supporting system shall be as manufactured by the  
31           Unistrut Corporation, Globe-Strut as manufactured by the Metal  
32           Products Division of U.S. Gypsum, or equal. Vertical and horizontal  
33           supporting members shall be U-shaped channels similar to Unistrut  
34           Series P1000.
- 35
- 36           2. Vertical piping shall be secured to the horizontal members by pipe  
37           clamps or pipe straps equal to Unistrut Series P1100M and Series  
38           P2558. All components shall be of 304 stainless steel.
- 39
- 40           3. The assemblies shall be furnished complete with all nuts, bolts, and  
41           fittings required for a complete assembly.
- 42
- 43           4. The design of each individual framing system shall be the responsibility  
44           of the Contractor. Shop drawings shall be submitted and shall show all  
45           details of the installation including dimensions and types of supports.

1           B. Any required pipe supports for which the supports specified in this Section are  
2           not applicable, including pipe supports for above 30-inch diameter pipe; high  
3           temperature and high pressure (greater than 150 psi) shall be fabricated or  
4           constructed from standard aluminum shapes in accordance with  
5           Specifications, concrete and anchor hardware similar to items previously  
6           specified herein and shall meet the minimum requirements listed below and be  
7           subject to review by the Engineer.

- 8
- 9           1. Pipe support systems shall meet all requirements of this Section and all  
10          related Sections of this Specification.
- 11
- 12          2. Complete design details of the entire pipe support systems shall be  
13          provided, for review by the Engineer.
- 14
- 15          3. The pipe support system shall not impose loads on the supporting  
16          structures, in excess of the loads for which the supporting structure is  
17          designed.

18

19          Hanger rods for above 30-inch pipe shall be a minimum of 1-1/2-inch diameter  
20          and shall not exceed the Manufacturer's standard maximum recommended  
21          safe load.

22

23        **2.05 PIPE HANGER AND SUPPORT SPACING**

24

25          Pipe hanger and support spacing shall be in accordance with ANSI B31.1.1.0 and  
26          MSS SP-69. In no case shall the spacing of hangers or supports exceed the  
27          following:

28

29        Maximum Unsupported Pipe Span (feet)

Nominal Pipe Size - Inches	Ductile Iron	Steel	PVC-1 and PVC-2 (Sch. 80)
1/2	N/A	5	3.5
3/4	N/A	6	3.5
1	N/A	7	3.8
1-1/4	N/A	7	4.0
1-1/2 - 3	N/A	9	4.0
4	7	10	5.5
5-10	10	10	10
12-48	10	per manufacturer or as shown on drawings	10

30

31        **PART 3 – EXECUTION**

32

33        **3.01 INSTALLATION**

- 1           A. All pipes, horizontal and vertical, shall be rigidly supported from the building  
2           structure with supports. Supports shall be provided at changes in direction  
3           and elsewhere as shown in the Drawings or specified herein. No piping shall  
4           be supported from other piping or from metal stairs, ladders and walkways,  
5           unless it is so indicated on the Drawings, or specifically directed or authorized  
6           by the Engineer.
- 7           B. All pipe supports shall be designed with liberal strength and stiffness to  
8           support the respective pipes under the maximum combination of peak loading  
9           conditions to include pipe weight, liquid weight, liquid movement, and pressure  
10          forces, thermal expansion and contraction, vibrations and all probable  
11          externally applied forces. Prior to installation, all pipe supports shall be  
12          reviewed by the Engineer.
- 13          C. Pipe supports shall be provided to minimize lateral forces through valves, both  
14          sides of split type couplings, and sleeve type couplings and to minimize all  
15          pipe forces on pump housings. Pump housings shall not be utilized to support  
16          connecting pipes.
- 17          D. Pipe supports shall be provided as follows:
- 18           1. Cast iron and ductile iron shall be supported at a maximum support  
19           spacing of 10 feet-0-inches with a minimum of one support per pipe  
20           section at the joints.
- 21           2. Supports for multiple PVC pipes shall be continuous wherever possible.  
22           Individually supported PVC pipes shall be supported as recommended  
23           by the manufacturer except that support spacing shall not exceed five  
24           (5) feet.
- 25           3. Support spacing for galvanized steel pipe and copper tubing shall not  
26           exceed five (5) feet.
- 27           4. All vertical pipes shall be supported at each floor or at intervals of at  
28           least 15 feet by pipe collars, clamps, brackets or wall rests, and at all  
29           points necessary to insure rigid construction.
- 30          E. Pipe supports shall not result in point loadings, but shall distribute pipe loads  
31          evenly along the pipe circumference.
- 32          F. Effects of thermal expansion and contraction of the pipe shall be accounted for  
33          in pipe support selection and installation.
- 34          G. Inserts for pipe hangers and supports shall be installed on forms before  
35          concrete is poured. Before setting these items, all Drawings and figures shall  
36          be checked which have a direct bearing on the pipe location. Responsibility  
37          for the proper location of pipe supports is included under this Section.

H. Continuous metal inserts shall be embedded flush with the concrete surface.

### **3.02 PRIME COATING**

- A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.
  - B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or equal. All other pipe supports shall be prime coated with Rust-Inhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa. or equal.
  - C. Finish coating shall be compatible with the prime coating used and shall be applied, as specified in Section 09900.

### 3.03 PROTECTION AGAINST ELECTROLYSIS

- A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces to eliminate direct contact and any resulting electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers.

**END OF SECTION**

1 SECTION 15100  
2

3 VALVES AND APPURTENANCES  
4

5 PART 1 - GENERAL  
6

7 1.01 SCOPE OF WORK  
8

- 9       A. Furnish all labor, materials, equipment and incidentals required for complete  
10      and ready operation of all valves and appurtenances shown on the Construction  
11      Drawings and as specified herein.  
12  
13       B. All valves and appurtenances shall be of the size shown on the Construction  
14      Drawings. All equipment of the same type shall be from one manufacturer.  
15  
16       C. All valves and appurtenances shall have the name of the maker and the  
17      pressure for which they are designed cast in raised letters some appropriate  
18      part of the body.  
19  
20       D. The equipment shall include, but not be limited to, the following:  
21  
22           1. Resilient seated and resilient wedge gate valves  
23           2. Ball valves  
24           3. Butterfly valves for water service  
25           4. Eccentric plug valves  
26           5. Valve Actuators  
27           6. Air release valves  
28           7. Air and vacuum valves  
29           8. Valve boxes  
30           9. Corporation stops and ballcorps  
31           10. Flexible Type Expansion joints  
32           11. Flange adapter coupling  
33           12. Compression Type Flexible couplings  
34           13. Unions  
35           14. Hose bibbs  
36           15. Pressure and vacuum gauges  
37           16. Quick connect couplings  
38           17. Hydrants  
39           18. Tapping saddles, sleeves and valves  
40           19. Hydraulic control valves  
41           20. Cushioned Swing Check Valve with Bottom Mounted Oil Buffer  
42           21. Slanting Disk Check Valve  
43           22. Mud Valves  
44           23. Telescoping Valves  
45           24. Butterfly valves for air service  
46  
47

1    1.02 DESCRIPTION OF SYSTEMS

- 3            A. All of the equipment and materials specified herein are intended to be standard  
4            for use in controlling the flow of potable water, wastewater, reclaimed water,  
5            chemicals, etc., depending on the applications.
- 7            B. Unless otherwise specified herein or on the drawings all resilient seats, seals,  
8            and other sealing components of valves and flexible fittings shall be EPDM.
- 10          C. All valves are to be provided with an operator mounted such that the valve can  
11          be operated from the nearest normal working surface.

13    1.03 QUALIFICATIONS

- 15          A. All of the types of valves and appurtenances shall be products of well-  
16          established reputable firms, who are fully experienced and qualified in the  
17          manufacture of the particular equipment to be furnished. The equipment shall  
18          be designed, constructed and installed in accordance with the best practices  
19          and methods and shall comply with these Specifications, as applicable.
- 21          B. For warranty and service purposes all products shall be supplied by  
22          Manufacturer's authorized municipal sales representative unless otherwise  
23          stated herein.

25    1.04 SUBMITTALS

- 27          A. Complete shop drawings of all valves and appurtenances shall be submitted to  
28          the Engineer for review, in accordance with the requirements of Section 01340,  
29          01300 and the General Conditions.
- 31          B. Electric actuated valves shall have information on closing times submitted to the  
32          Engineer for review.

34    1.05 TOOLS

- 36          A. Special tools, if required for normal operation and maintenance, shall be  
37          supplied with the equipment.
- 39          B. Three (3) sets of spare valve seals or packing materials shall be provided for  
40          each valve. The seals/packing materials shall be in individual containers clearly  
41          marked showing the contents and the intended application.
- 43          C. Four (4) tee-handled gate wrenches of various lengths shall be furnished to  
44          operate all valves with valve boxes.

46    1.06 VALVE INDICES

- 1           A. The Contractor shall be responsible for furnishing tags for all valves required on  
2           the work and installing the tags required for his own work. Tags on above  
3           ground valves shall be noncorrosive metal or plastic, 2 inches in diameter, 19  
4           gauge thick. Tags for buried valves shall be secured to a concrete base as  
5           shown on the Construction Drawings. Submit to the Engineer for approval, two  
6           (2) samples of each type of tag proposed and manufacturer's standard color  
7           chart and letter styles. Tags shall have stamped on them the information shown  
8           on the Construction Drawings and/or the data described herein. The Contractor  
9           shall submit to the Engineer, for approval no less than 120 days before start-up,  
10          a valve schedule containing all valves required for the work. The schedule shall  
11          contain for each valve, the location, type, a number, words to identify the valve's  
12          function, and the normal operating position. The information contained in the  
13          valve schedules shall be coded on the tags in a system approved by the Owner.  
14          Above ground valve tags shall be furnished with noncorrosive metal wire for  
15          attachment thereof.

16

## PART 2 - PRODUCTS

17

### 2.01 RESILIENT SEATED AND RESILIENT WEDGE GATE VALVES

- 18
- 19           A. All gate valves 4 inches to 24 inches in diameter shall be resilient seated or  
20           resilient wedge, manufactured to meet or exceed the requirements of AWWA  
21           C515 of latest revision and in accordance with the following Specifications.  
22           Valves shall have an unobstructed waterway equal to or greater than the full  
23           nominal diameter of the valve.
- 24
- 25           B. The valves are to be non-rising stem with the stem made of cast, forged or rolled  
26           bronze shown in AWWA C515. Two stem seals shall be provided and shall be  
27           EPDM of the O-ring type, one above and one below the thrust collar.
- 28
- 29           C. The sealing mechanism shall consist of a cast iron gate having an EPDM  
30           coating. The resilient sealing mechanism shall provide zero leakage at the valve  
31           design pressure when installed with the line flow in either direction.
- 32
- 33           D. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class  
34           B. All ferrous surfaces inside and outside shall have a minimum 10 mil  
35           fusion-bonded epoxy coating. A handwheel or wrench nut shall be provided for  
36           operating the valve. All Valves are to be tested in strict accordance with AWWA  
37           C515.
- 38
- 39           E. Handwheels or chain wheels shall be turned left or counterclockwise to open  
40           the valves. Handwheels shall be of ample size and shall have an arrow and the  
41           word OPEN cast thereon to indicate the direction of opening.
- 42
- 43           F. Valves shall have a factory-applied, internal and external, fusion bonded epoxy  
44           resin coating with a minimum thickness of 8 mils, conforming to all applicable  
45           requirements of the American Water Works Association Standard C550-90

entitled "Protective Interior Coatings for Valves and Hydrants".

- G. Valves shall be equal to those as manufactured by American, M&H, Mueller, Kennedy, Clow, or equal.

## 2.02 BALL VALVES

- A. PVC ball valves shall be of Type 1, Grade 1 PVC with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with Teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Spears, Plastiline, or equal.
  - B. Vented PVC ball valves shall be manufactured to ASTM F 1970 and constructed from PVC Type I, ASTM D 1784 Cell Classification 1245. All O-rings shall be Latharge Viton. All valves shall have stem with double O-ring seals. All valve handles shall be polypropylene with built-in lockout mechanism. All valve union nuts shall have Buttress threads. All seal carriers shall be Safe-T-Blocked. All valve components shall be replaceable. All valves shall be certified by NSF International for use in potable water service. All 1/2-inch through 2-inch valves shall be pressure rated to 235 psi, all 2-1/2-inch through 6-inch, 8-inch Venturied and all flanged valves shall be pressure rated to 150 psi for water at 73° F. Valve shall have a 1/8-inch vent hole in the ball to equalize internal fluid pressures. Install valve with ball vent on the pressure (upstream) side when in closed position. Vented ball valves shall be True Union 2000 Industrial Ball Valves as manufactured by Spears or approved equal.
  - C. Bronze, brass or stainless steel ball valves shall be of 2-piece (1-inch and smaller) or 3-piece (1-1/2-inch and larger) construction. Valves shall be rated for 150 psi saturated steam pressure and 400 psi WOG pressure. Valves shall have stainless steel, bronze or brass body, stainless steel or chrome plated brass ball, replaceable Teflon or TFE seats and seals, blowout proof stem and vinyl covered steel handle. All end connections shall be threaded.
  - D. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

## 2.03 BUTTERFLY VALVES

- A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, American, Kennedy, Mueller or equal. The valve discs shall be constructed of cast iron conforming to ASTM A-48, Class 40, ASTM A-126, Class B or ductile iron conforming ASTM A536, Grade 65-45-12 for Class 150 or less. Ductile iron conforming to ASTM A536, Grade 65-45-12 shall be provided for all Class 250 valves.

- 1           B. The face-to-face dimensions of flanged end valves shall be in accordance with  
2           Table 2 of above-mentioned AWWA Specification for short-body valve.  
3           Adequate two-way thrust bearings shall be provided. Flange drilling shall be in  
4           accordance with ANSI B16.1.
- 5           C. Valve seats shall be EPDM synthetic rubber compound. Valve seats 24 inches  
6           and larger shall be field adjustable and replaceable without dismounting  
7           operator disc or shaft and without removing the valve from the line. All retaining  
8           segments and adjusting devices shall be of corrosion resistant material with  
9           stainless Nylock screws and be capable of a 1/8-inch adjustment. Valves 20  
10          inches and smaller shall have bonded or mechanically restrained seats as  
11          outlined in AWWA C504. Where elastomer seat is mounted on the valve body,  
12          the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome,  
13          80-20%. Where elastomer seat is mounted on the valve disc, the valve body  
14          shall be fitted with an 18-8 stainless steel seat offset from the shaft,  
15          mechanically restrained and covering 360 degrees of the peripheral opening or  
16          seating surface.
- 17           D. The valve body shall be constructed of ductile iron or close grain cast iron per  
18           ASTM A-126, Class B with integrally cast hubs for shaft bearing housings of the  
19           through boss-type. Butterfly valves for water service of the "wafer" or "spool"  
20          type will not be accepted.
- 21           E. The valve shaft shall be turned, ground, and polished constructed of 18-8,  
22           ASTM A-276, Type 304 stainless steel and designed for both torsional and  
23           shearing stresses when the valve is operated under its greatest dynamic or  
24           seating torque. Shaft shall be of either a one-piece unit extending full size  
25           through the valve disc and valve bearing or it may be of a stub shaft design.  
26           Shaft bearings shall be Teflon or nylon, self-lubricated type.
- 27           F. All valves shall be subject to hydrostatic and leakage tests at the point of  
28           manufacture. The valves shall be tested in conformance with AWWA C-504.
- 29           G. Gearing for the operators shall be totally enclosed in a gear case in accordance  
30           with Paragraph 3.8 of the above-mentioned AWWA Standard Specification.
- 31           H. The manufacturer shall certify that the required tests on the various materials  
32           and on the completed valves have been satisfactory and that the valves conform  
33           with all requirements of the Specification and the AWWA standard.
- 34           I. Where indicated on the Construction Drawings extension stems, floor stands,  
35           couplings, stem guides and floor boxes, as required, shall be furnished and  
36           installed.
- 37           J. Valves shall have a factory-applied, internal and external, fusion bonded epoxy  
38           resin coating with a minimum thickness of 8 mils, conforming to all applicable  
39           requirements of the American Water Works Association Standard C550-90

entitled "Protective Interior Coatings for Valves and Hydrants".

## 2.04 ECCENTRIC PLUG VALVES

- A. All plug valves shall be manufactured and installed in accordance with standard ANSI/AWWA C517 Table 1, Resilient-Seated Cast-Iron Eccentric Plug Valves, of the latest revision unless otherwise specified. Manufacturer shall provide affidavit of compliance with AWWA Standard. Valves shall be as manufactured by DeZurik, Val-Matic, Homestead or approved equal.
  - B. Plug valves shall be tested in accordance with AWWA C517, latest edition. Each valve shall be performance tested in accordance with Paragraph 5.2 of the above reference and shall be given a leakage test and hydrostatic test as described in Paragraphs 5.2.2 and 5.2.3 of the above reference. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.2.4 of the above reference.
  - C. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI B16.1 125/150 lb. standard. Mechanical joint ends shall be in full compliance with ANSI/ AWWA C111/A21.11. Screwed ends shall be to the NPT standard.
  - D. Valve bodies shall be of ASTM A126 Class B or ASTM A48, Class 40 cast iron.
  - E. Port areas for valves 20 inches and smaller shall be a minimum of 80 percent of full pipe area. Valves 24-inch and larger shall have a minimum port area of 100 percent of full nominal pipe area.
  - F. All exposed nuts, bolts, springs, washers, etc., shall be zinc or cadmium plated. Valve plugs shall be constructed of ASTM A-48, Class 40 cast iron or ASTM A-536 ductile iron. Resilient plug facings shall be of Neoprene.
  - G. Valves shall be furnished with permanently lubricated stainless steel, oil-impregnated bronze or non-metallic upper and lower plug stem bearings.
  - H. Valve seats shall be either nickel or stainless steel. Epoxy seats are not acceptable.
  - I. Plug valves greater than 6 inches in diameter shall be supplied with manual gear actuators unless otherwise shown on the Drawings.
  - J. Shaft seals shall be of the multiple V-ring type with a packing gland follower. Shaft seals shall be externally adjustable and repackable without removing the actuator or bonnet from the valve.
  - K. Valves shall have a factory-applied, internal and external, fusion bonded epoxy

1 resin coating with a minimum thickness of 8 mils, conforming to all applicable  
2 requirements of the American Water Works Association Standard C550-90  
3 entitled "Protective Interior Coatings for Valves and Hydrants".  
4

5 **2.05 VALVE ACTUATORS**

6       A. General

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1. All gate and plug valve actuators shall conform to AWWA C541 for Hydraulic and Pneumatic Actuators and to AWWA C542 for Electric Actuators.
  2. Butterfly valve actuators shall conform to AWWA C504.
  3. All actuators shall be capable of seating and unseating the disc or plug against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.
  4. The valve or gate manufacturer is responsible for installation and setup of the actuator that is properly sized for the rated valve pressure.
  5. The Contractor is responsible for handling and installing the valve and actuator in strict accordance with manufacturer's instructions. The Contractor shall replace any actuator damaged, including voiding of warranty, without cost to the Owner.

28       B. Manual Actuators

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1. Manual actuators shall have permanently lubricated, totally enclosed gearing with hand wheel and gear ratio sized on the basis of rated valve pressures and actual velocities. Actuators shall be equipped with hand wheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves and have an arrow and the word OPEN cast thereon to indicate the direction of opening.
  2. Manual actuators for eccentric plug valves shall be a worm gear type with self-locking features designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.
  3. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the hand wheel or chain wheel. Actuator components shall withstand an input of 450-foot pounds for 30-inch and smaller and 300-foot pounds for larger than 30-inch size valves at extreme actuator positions without damage.

- 1           4. Valves located above grade shall have hand wheel or chain wheel and  
2           position indicators.
- 3
- 4           5. Valves located below grade shall be equipped with an extension to raise  
5           the 2-inch square AWWA operating nut to ground level and with a cast  
6           iron extension type valve box.
- 7
- 8           6. Manually operated valves located six (6) feet or more above the floor  
9           level shall be equipped with a chain wheel actuator that allows operation  
10          of the valve from the floor without the use of a ladder or steps.

11

12          C. Electric Motor-Operated Actuators

13

- 14           1. Motor-Operated actuators shall be provided as indicated and in  
15           accordance with AWWA C542. Each actuator shall include the electric  
16           motor, reduction gearing, valve stem drive nut/bushing, position sensor,  
17           overload torque sensor, ductile iron gear case, automatic de-clutchable  
18           handwheel, local control & mechanical position indication, and remote  
19           control & position indication.
- 20
- 21           2. All actuators that are installed greater than five (5) feet above the finished  
22           floor surface shall be provided with a remote control unit, such that the  
23           valve can be operated while standing at floor grade. The remote control  
24           unit shall be hardwired to the actuator and be equipped with all the  
25           controls/functionality as on the face of the actuator. Remote controllers  
26           shall be mounted between 3 feet and 5 feet from the nearest operator  
27           accessible floor surface.
- 28
- 29           3. Motors shall be totally enclosed, non-ventilated 480 volt, 3 phase and  
30           specifically designed for high torque, non-continuous, low inertia duty.  
31           Motors for actuators shall also be specifically designed and rated for 15-  
32           minute duty operation at 104°F (40°C). Output capacity shall be  
33           sufficient to open or close the valve against the maximum differential  
34           pressure when the voltage is 10% above or below normal at the specified  
35           service conditions. Motors shall have Class F insulation. Motors must  
36           be protected by 3 thermal contacts, which are embedded in the motor  
37           windings. The actuator shall be suitable for up to 60 starts per hour for  
38           open/close service and 1200 starts per hour for modulating service.
- 39
- 40           4. The actuators shall be suitable for use on nominal 3 phase power supply  
41           and must include motor, integral reversing starters, local controls and  
42           terminals for remote control and indication housed within a self-  
43           contained, sealed enclosure. The actuator gearing shall be totally  
44           enclosed in a lubricant filled cast iron gearcase suitable for operation in  
45           any orientation. Non-metallic gearing is not acceptable. For rising stem  
46           valves the output shaft shall be hollow to accept a rising stem, and  
47           incorporate thrust bearings of the roller type at the base of the actuator.

1           All gearing and bearings shall be oil or grease lubricated and suitable for  
2           year-round service based on prevailing ambient temperature conditions.  
3

- 4           5. The actuator shall be furnished with a handwheel with a maximum rim  
5           pull requirement of 60 pounds for valve travel loads. An external manual  
6           declutch lever shall be included to place actuator in the manual mode.  
7           The lever shall not require more than 10 pounds of force to engage even  
8           when the valve has been tightly seated. The lever is to be padlockable  
9           in either handwheel or motor mode.
- 10          6. Operation by motor shall not cause the handwheel to rotate, or operation  
11         of the handwheel shall not cause the motor to rotate. Handwheel shall  
12         operate in the clockwise direction to close.
- 13          7. Manual operation shall be by handwheel. Manual operation will be via  
14         power gearing to minimize required rimpull and facilitate easy  
15         changeover from motor to manual operation when the actuator is under  
16         load. A seized or inoperable motor shall not prevent manual operation.
- 17          8. Two nameplates, made of stainless steel, shall be attached to each  
18         actuator; one on the motor housing, showing all relevant motor data, one  
19         on the actuator housing showing all relevant actuator data. Special  
20         information, such as the valve tag no., shall be shown if required. The  
21         nameplates shall be securely fixed to the actuator and motor, so that they  
22         cannot be removed or scratched off during shipment, installation,  
23         operation or maintenance.
- 24          9. The rated output torque of the motor actuator shall be at least 1.5 times  
25         the maximum torque required to open or close the valve at any position  
26         including seating and unseating conditions when subjected to the most  
27         severe operating condition including any mechanical friction and/or other  
28         restrictive conditions that are inherent in the valve assembly. Do not  
29         include hammer-blow effect in sizing the actuator to comply with this  
30         torque requirement.
- 31          10. The valve manufacturer is responsible to assure that the motor actuator  
32         stall torque output does not exceed the torque limits of the valve  
33         operating stem or shaft. Maximum torque shall include seating or  
34         unseating torque, bearing torque, dynamic torque, and hydrostatic  
35         torque. Assume that the differential pressure across the valve is equal  
36         to the pressure or head rating of the valve.
- 37          11. Actuator housings, supports, and connections to the valve shall have a  
38         minimum safety factor of five based on the ultimate strength or three  
39         based on the yield strength of the material used. Actuators shall be O-  
40         ring sealed, watertight to NEMA 4/6 (6 feet for 30 minutes). All external  
41         fasteners shall be of stainless steel. Gear case shall be cast iron.
- 42

- 1  
2     12. Torque switch bypass to be provided for the torque sensing system to  
3       inhibit torque switch trip during unseating or during starting in mid travel  
4       against high inertia loads.  
5  
6     13. Test each actuator prior to shipment in accordance with AWWA C542.  
7       The application torque shall be the maximum torque required to open or  
8       close the valve at any position including seating and unseating  
9       conditions.  
10  
11    14. The operator face plate shall include as a minimum:  
12  
13      a. Buttons for OPEN - STOP – CLOSE – RESET.  
14      b. Backlit LCD display showing the actuator status in plain English  
15       text.  
16      c. Lockable selector switch with LOCAL - OFF - REMOTE function.  
17      d. Indication lights for CLOSED, OPEN, RUNNING, and FAULT.  
18  
19    15. The terminal compartment shall provide sufficient space to  
20       accommodate the possible maximum number of incoming wires. A  
21       minimum of three cable entries must be provided. Each cable entry shall  
22       be properly sealed by cable glands during site installation. The cable  
23       glands size shall be chosen by the Contractor, responsible for wiring  
24       during the commissioning phase.  
25  
26    16. Liquid Crystal Display (LCD) – back-lit for setting menu showing status  
27       indication and diagnostic information. The actuator shall include a digital  
28       position indicator with a display from fully open to fully closed in 1%  
29       increments. For all actuators that utilize a battery, the actuator  
30       manufacturer shall furnish one (1) spare battery for each actuator  
31       furnished.  
32  
33    17. Setting of all actuator parameters including the torque levels, position  
34       limits, configuration of the indication contacts, and positioner functionality  
35       shall be accomplished without removing covers from the actuator control  
36       assemblies or housing.  
37  
38    18. Actuators shall be suitable for indoor and outdoor use. The actuator shall  
39       be capable of functioning in an ambient temperature ranging from -20 °F  
40       to +140°F, up to 100% relative humidity. In order to prevent  
41       condensation, a space heater shall be installed inside the actuator,  
42       suitable for continuous operation. The actuator shall be stored according  
43       to the Manufacturer's instructions. If the Contractor voids the actuator  
44       warranty in any way, he shall replace the actuator at no cost to the  
45       Owner.  
46  
47    19. Actuators are to receive remote input commands for OPEN, CLOSE, and

1 POSITION (as required). Actuators are to provide remote indication as  
2 listed above.  
3  
4

- 5 20. Contractor is to provide startup, inspection, and instruction services from  
6 the Manufacturer's authorized technical representative. Startup and  
7 inspection shall not be less than one (1) day for each actuator and one  
8 (1) additional day to provide training for plant personnel in the proper  
9 operation and maintenance of all electric actuators.  
10  
11 21. The Contractor shall provide digital interface hardware compatible with  
12 an Allen Bradley SLC 5/05 PLC for the actuators. Digital control protocol  
13 shall be non-proprietary Modbus. Contractor shall submit the Modbus  
14 digital protocol with information supporting compatibility with an AB SLC  
15 5/05 and details for programming and interfacing. The actuator  
16 manufacturer shall provide all hardware, communication modules for the  
17 actuator and software required for commissioning, operation, and  
18 maintenance of the actuators and digital control system. The Contractor  
19 shall furnish and install sufficient quantities of a Modbus communication  
20 module as manufactured by ProSoft Technology or equal, in the AB SLC  
21 5/05 to which the valves are connected. The Contractor shall be  
22 responsible for furnishing and installing transient surge protection on all  
23 Modbus communication wiring both ends of termination.  
24  
25 22. The Contractor shall furnish all programming of the PLC and the SCADA  
26 HMI and HMI graphics (specified in Division 13) so as to display all  
27 available signals/I/O from the actuator through Modbus (such as all  
28 torque information, valve position, etc.) whether shown on Table 13640-  
29 1 or not.  
30  
31 23. All electric actuators for this project shall be provided by one  
32 Manufacturer. Contractor shall coordinate installation on valves and  
33 gates with valve and gate manufacturers. Electric actuators shall be as  
34 manufactured by EIM Tec 2000, Auma Matic, Rotork IQ, Limitorque or  
35 approved equal.  
36  
37 24. Each actuator shall be warranted for a minimum of 24 months from the  
38 date of system acceptance by the Owner.  
39

40 2.06 AIR RELEASE VALVES  
41

- 42 A. The air release valves shall be installed as shown on the Drawings or as  
43 required elsewhere in these specifications. The valves shall have a cast iron or  
44 ductile iron body cover and baffle, stainless steel float, EPDM seat and stainless  
45 steel trim. The fittings shall be threaded. Air release valves shall be equipped  
46 with a vacuum ball or check feature in order to prevent air from entering the  
47 valve during vacuum conditions. The valves for wastewater and sludge

1 applications shall be Model D-025 as manufactured by A.R.I., Model ASR  
2 Series 400 as manufactured by DeZurik, or equal. Air release valves for  
3 reclaimed and potable water service shall be A.R.I. Model D-040-C-VAC or  
4 equal.

- 5
- 6 B. Sewage Air Release Valves shall have an elongated body and be designed to  
7 operate automatically (open) while pressurized allowing accumulated air in the  
8 pipeline, sewage pump or wastewater system to escape through the air release  
9 orifice without spillage.
- 10
- 11 C. After accumulated air escapes through the air release orifice, the valve orifice  
12 shall be closed by a needle mounted on a compound lever mechanism. The  
13 lever mechanism is energized by a concave float. The air release orifice will  
14 then remain closed until more air accumulates and the opening cycle repeats  
15 automatically.
- 16
- 17 D. Valve internal linkage shall be fitted with a stem having a stainless steel concave  
18 float threaded onto the opposite end. The internal compound lever mechanism  
19 shall be stainless steel to prevent corrosion.
- 20
- 21 E. Valve concave float shall hang inside the valve body, slightly above the inlet and  
22 maintain an air gap between the lever mechanism and the waste media.
- 23
- 24 F. If specified, optional Backflushing attachments shall include Blowoff valves, with  
25 quick disconnect couplings, and minimum 5' (1.5m) hose for flushing.
- 26
- 27 G. Two Year Warranty shall be provided for all valves.
- 28
- 29 H. A stainless steel or brass ball valve shall be provided on the inlet of all air release  
30 valves. Stainless steel or brass piping shall be provided for air release valves  
31 on pumps.
- 32

## 33 2.07 AIR AND VACUUM VALVES

- 34
- 35 A. The air and vacuum valves for the transfer pump discharge lines shall be  
36 installed as shown on the Construction Drawings. The valves shall have a cast  
37 iron body cover and baffle, stainless steel float, and an EPDM seat. The valves  
38 shall be 2-inch threaded connection. Air and vacuum valves shall be equipped  
39 with a baffle to protect the float from direct contact with the rushing air and water  
40 and to prevent the float from closing prematurely in the valve. The valves shall  
41 be Model D-040-C as manufactured by A.R.I. or equal.
- 42
- 43 B. A stainless steel ball valve shall be provided on the inlet of all air and vacuum  
44 valves.

## 45 2.08 TELESCOPING VALVES

- 1           A. Furnish and install new 6-inch telescopic valve assembly at the location shown  
2           on the Drawings. .
- 3           B. Each valve assembly shall be of the rising stem type and shall be complete and  
4           include but not be limited to the following components:  
5  
6                 ■ Cast iron or ductile iron floor mounting pedestal  
7                 ■ Manual, rack and pinion style lifting mechanism with a cast hand wheel  
8                 ■ A clear acrylic rack cover with a calibrated Mylar strip position indicator  
9                 shall be provided.  
10                ■ Stem Guide (brass, bronze or UHMW polyethylene)  
11                ■ Bail (304L ASTM A240 stainless steel)  
12                ■ Slip Tube with v-notch (304L ASTM A240 Stainless Steel)  
13                ■ Gasket Retainer and Flange (stainless steel)
- 14  
15           C. The slip tube shall be of 304 stainless steel and manufactured from seamless  
16           pipe minimum 1/8-inch wall thickness. The finish O.D. of the tube shall be within  
17           + 0.04 inches runout, cylindrical within 0.100 TIR and have a smooth 125 micro-  
18           inch or better surface. The slip tube shall have two opposing v-notch weirs at  
19           the top and penetrate the existing riser pipe a minimum of 3-inches in the up  
20           position and have a 12-inch minimum travel as shown on the drawings.
- 21  
22           D. The bail shall be of the same material as the slip tube and shall be rigidly welded  
23           to the slip tube and shall be connected to the rack stem with a flanged type  
24           connection and multiple fasteners. A connection with the stem penetrating a  
25           single hole in the bail with jamb nuts on either side of the bail is not acceptable.
- 26  
27           E. A stainless steel companion flange and Buna-N wiper gasket shall be installed  
28           and attached to the top of the riser pipe. The gasket shall be of split design,  
29           sandwiched between the riser pipe flange and the companion flange, and  
30           replaceable without removing the slip tube from the riser pipe or any of the lifting  
31           mechanism components.
- 32  
33           F. Lifts shall be rack and pinion type with a hand wheel and a worm type gearbox  
34           mechanism with bronze bushings. The valve assembly shall be mounted to a  
35           floor stand pedestal. The lifting mechanism shall be self-locking and able to  
36           secure the rack in any infinite position throughout the travel range. All moving  
37           components of the worm type gearbox shall be replaceable without removing  
38           the rack assembly from the valve body.
- 39  
40           G. The valve manufacturer shall select the proper size handwheel to ensure that  
41           the valve can be operated with no more than a 40 lb effort and shall be a  
42           minimum of 16-inches in diameter of cast aluminum, cast iron, or stainless steel.  
43           An arrow with the word "OPEN" shall be permanently attached or cast onto the  
44           wheel to indicate the direction or rotation to open the valve. The handwheel  
45           shall be removable.
- 46  
47

- 1           H. Stainless steel anchor bolts shall be used to mount the floor stand assembly to  
2           the support. Cleaning, shop prime coating, and finish painting of the floor stand  
3           assembly shall be as specified in Section 09865 and Section 09900.
- 4
- 5           I. The telescoping valve shall be machined, assembled, and tested in the USA for  
6           quality assurance.
- 7
- 8           J. Manufacturer shall show proof of ISO 9001:2008 certification.
- 9
- 10          K. The telescoping valve assemblies shall be manufactured by Troy Valve or  
11           approved equal.

12

13          **2.09 VALVE BOXES**

14

- 15          A. All new buried valves shall have cast-iron three-piece valve boxes. Valve boxes  
16           disturbed by construction shall be replaced with new valve boxes. Valve boxes  
17           shall be provided with suitable heavy bonnets and to extend to such elevation  
18           at or slightly above the finished grade surface, as shown on the details of the  
19           drawings. The barrel shall be two-piece, sliding type, having 5-1/4-inch shaft.  
20           The upper section shall have a flange at the bottom having sufficient bearing  
21           area to prevent settling and shall be complete with cast iron covers.
- 22
- 23          B. All valves shall have actuating nuts extended within 12 inches of the top of the  
24           valve boxes. Valve boxes shall be provided with concrete base and valve  
25           nameplate engraved with lettering 1/8-inch deep as shown on the Construction  
26           Drawings.

27

28          **2.10 CORPORATION STOPS AND BALLCORPS**

29

- 30          A. Corporation stops for connections to ductile iron piping or service saddles shall  
31           be all brass or bronze suitable for 150 psi operating pressure and shall be of  
32           sizes required and/or noted on the Construction Drawings.
- 33
- 34          B. Corporation stops shall be manufactured to conform to AWWA Standard C800  
35           and shall be Ford Ballcorp Corporation Stop or equal.

36

37          **2.11 FLEXIBLE TYPE EXPANSION JOINTS**

38

- 39          A. Expansion joints shall be manufactured of molded EPDM rubber with filled  
40           arches and wire reinforcement. Joints shall be reinforced with baked enamel  
41           ductile iron or split galvanized steel retaining rings placed directly against the  
42           inside of the flange to prevent damage to the rubber surface when the bolts are  
43           tightened. Flanges shall be drilled to ANSI 150#. Rated working pressure shall  
44           be 150 psi. Retaining rings, control rods, bolts, nuts, and washers shall be  
45           coated according to Section 09900 or shall be 304 or 316 stainless steel.
- 46
- 47          B. Joints shall be rated for a minimum operating temperature of 180°F.

- 1           C. Tapered expansion joints shall be eccentric, single arch, and shall be capable  
2           of a 1/2-inch maximum lateral deflection. Double arch expansion joints shall be  
3           required where called out on the drawings.  
4
- 5           D. Joints shall be provided and installed with the manufacturer's standard control  
6           rods. Total joint deflection shall not exceed the manufacturer's recommended  
7           maximum. Joints shall be installed in neutral position. Manufacturer shall  
8           recommend pressure and spring rates for pipe expansion joints.  
9
- 10          E. Expansion joints shall be Flexicraft, Mercer Series FER, Proco, Red Valve  
11           Redflex, or equal.

12          **2.12 FLANGE ADAPTER COUPLINGS**

- 13           A. Flange adapter couplings shall be of the sizes shown on the Construction  
14           Drawings.  
15
- 16           B. Flange adapter couplings shall have a 150 psi minimum pressure rating.  
17
- 18           C. All couplings shall be restrained and shall have a sufficient number of anchor  
19           studs to meet or exceed the test pressure rating for this project, 150 psi  
20           minimum.  
21
- 22           D. Couplings shall be JCM Model 301R, Ebba Iron Series 2100 Megaflange, or  
23           equal.  
24

25          **2.13 COMPRESSION TYPE FLEXIBLE COUPLINGS**

- 26           A. Flexible couplings shall be either the split type or the sleeve type as shown on  
27           the Construction Drawings.  
28
- 29           B. Split type coupling shall be used with all interior piping and with exterior piping  
30           as noted on the Construction Drawings. The couplings shall be mechanical type  
31           for radius groove piping. The couplings shall mechanically engage and lock  
32           grooved pipe ends in a positive couple and allow for angular deflection and  
33           contraction and expansion.  
34
- 35           C. Couplings shall consist of malleable iron, ASTM Specification A47, Grade  
36           32510 housing clamps in two or more parts, a single chlorinated butyl  
37           composition sealing gasket with a "C" shaped cross-section and internal sealing  
38           lips projecting diagonally inward, and two or more oval track head type bolts  
39           with hexagonal heavy nuts conforming to ASTM Specification A183 and A194  
40           to assemble the housing clamps. Bolts and nuts shall be hot-dipped galvanized  
41           after fabrication.  
42
- 43           D. Victaulic type couplings and fittings may be used in lieu of flanged joints. Pipes  
44

shall be radius grooved as specified for use with the Victaulic couplings. Flanged adapter connections at fittings, valves, and equipment shall be Victaulic Vic Flange Style 741, equal by Gustin-Bacon Group, Division of Certain-Teed Products, Kansas City, Kansas or equal.

- E. Sleeve type couplings shall be of ductile iron and shall be Dresser Style 38 or 40, ROMAC 501RC, as shown on the Construction Drawings, or equal. The coupling shall be provided with 316 SS hardware unless indicated otherwise.
  - F. All couplings shall be furnished with the pipe stop removed.
  - G. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.
  - H. If the Contractor decides to use victaulic couplings in lieu of flanged joints, he shall be responsible for supplying supports for the joints.

## 2.14 UNIONS

- A. Unions on ferrous pipe 2 inches in diameter and smaller shall be 150 pounds malleable iron, zinc-coated. Unions on water piping 2-1/2 inches in diameter and larger shall be flange pattern, 125-pound class, zinc-coated. Gaskets for flanged unions shall be of the best quality EPDM. Unions shall not be concealed in walls, ceilings, or partitions.

## 2.15 HOSE BIBBS

- A. Hose bibbs shall be brass, polished chromium plated, as manufactured by Chicago Faucet Company or equal. Contractor shall install a nonpotable water sign over every hose bibb connected to a nonpotable water line. Such signs shall be as shown in the Construction Drawings and shall read:

**BIOHAZARD  
NONPOTABLE WATER  
DO NOT DRINK / NO BEBER**

## 2.16 PRESSURE AND VACUUM GAUGES

- A. All pumps furnished under this contract shall have pressure/vacuum gauges installed on their respective suction lines and pressure gauges installed on their discharge lines. All pressure and vacuum gauges furnished under this Contract shall be mounted per manufacturer requirements using tapping saddles and sleeves specified in Section 15100, 2.19.
  - B. Each gauge shall be silicone filled direct mounted, 316 stainless steel case with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window, and 1/2-inch shut-off valve. Provide stainless steel diaphragm seals between

1 shut-off valve and pressure gauge on all lines with nonclear matter in  
2 suspension of solution. All gauges shall be weatherproofed.  
3

- 4 C. Pressure gauge shall be bourdon tube type with 270 degrees pointer travel.  
5 Dials shall be white finished aluminum with black graduations and figures, and  
6 size shall be 4-1/2 inches diameter. The face dial shall read in units of both  
7 pounds per square inch and feet of head.  
8
- 9 D. A piston or porous type snubber to suppress and dampen pressure pulses and  
10 spikes shall be installed immediately upstream of all gauges. The snubbers  
11 shall be 316 stainless steel or brass as recommended by the gauge  
12 manufacturer. All internal components of the snubber shall be compatible with  
13 the media being measured.  
14
- 15 C. Suction gauges shall read from 10 inches of mercury vacuum to 50 feet of head.  
16 Discharge gauges shall read from zero feet of head to 130 percent of maximum  
17 range pressure without damage to gauge or sensing element.  
18
- 19 D. Pressure gauges shall be as manufactured by Ashcroft, Wika, Ametek, U.S.  
20 Gauge or approved equal.  
21

22 2.17 QUICK CONNECT COUPLINGS  
23

- 24 A. Quick connect couplings shall be Model 633-E hose shank adapter and Model  
25 633-C hose shank coupler as manufactured by Dover Corporation OPW  
26 Division, Cincinnati, Ohio, Ever-tite Coupling Co., Inc., New York, New York, or  
27 equal.  
28

29 2.18 HYDRANTS  
30

- 31 A. Fire hydrants shall be for 6-inch pipe connections with 5-1/4 inch valve opening  
32 and two 2-1/2 inch and one 4-1/2 inch steamer connections. Hydrants shall be  
33 designed for 150 pounds working pressure and shall conform to the  
34 requirements of AWWA Specification C502, "Standards for Dry Barrel Hydrants"  
35 (latest revision) for post type used in public water supply systems.  
36
- 37 B. All working parts shall be of cast iron and high-grade bronze. All hose threads  
38 shall be National Standard threads. The 2-1/2 inch nozzles shall have 60'  
39 V-threads, 7-1/2 threads per inch and 3-1/16 inch outside diameter of the male  
40 thread. The 4-1/2 inch steamer nozzle shall have four threads per inch and 5-  
41 3/4 inch outside diameter of the male threads.  
42
- 43 C. Hydrant shoes shall be provided with lugs for strapping and hydrants shall be  
44 held in place with bolted rods designed to absorb all thrust.  
45
- 46 D. All fire hydrants shall be provided with an auxiliary gate valve so that the water  
47 to the hydrant may be shut off without the necessity of closing any other valve

1                   in the distribution system.  
2

- 3                   E. Hydrants shall be painted one coat of red primer paint at the factory and two  
4                   finish coats of an approved paint after installation, color as directed, all in  
5                   accordance with Division 09 Specifications.

6

7                  2.19 TAPPING SADDLES, SLEEVES AND VALVES

8

- 9                  A. Tapping saddles shall be fabricated of epoxy-coated ductile iron and suitable for  
10                 either wet or dry installation. The sealing gasket shall be the "O"-Ring type  
11                 suitable for the applicable service. Tie straps and bolts shall be 304L stainless  
12                 steel. Saddles shall be as manufactured by Mueller, or equal.
- 13
- 14                  B. Tapping sleeves shall be constructed of epoxy-coated ductile iron or 304 stainless  
15                 steel and shall provide a full circumferential seal. All tapping sleeves shall be  
16                 suitable for tapping ductile iron pipe, C-900 PVC pipe, asbestos cement pipe and  
17                 all pipe manufactured in accordance with ANSI A21 Standard. Tapping sleeves  
18                 shall be Mueller Model H-304, Ford FTSC, JCM 432, or equal.
- 19
- 20                  C. All tapping sleeves shall be split sleeve design with one half containing the outlet  
21                 half of the sleeve, the hub, and the other half completing the encompassing effect  
22                 of the sleeve, the back. A 3/4-inch NPT test plug shall be provided on the outlet  
23                 throat of the sleeve for pressure testing the sealed sleeve at 150 psi prior to  
24                 tapping the pipe. All tapping sleeves shall allow a full size cutting head to pass  
25                 through the outlet of the hub. All bolts joining the two halves of the sleeve shall  
26                 be high strength, low alloy steel in accordance with Section 11-6.5 of AWWA C-  
27                 111, latest edition.
- 28
- 29                  D. All tapping sleeve connection flanges shall be a 150 lb flange joint with a counter  
30                 bore per MSS SP-60 dimensions.
- 31
- 32                  E. Mechanical joint tapping sleeves shall, after bolting the halves together, form a  
33                 mechanical joint at each end of the sleeve. The sleeve shall then be sealed to  
34                 the pipe by assembling the mechanical joint using split gaskets and follower  
35                 glands.
- 36
- 37                  F. Service saddles shall be double strap, ductile iron, or brass full circle type  
38                 saddles, as applicable. Sealing gaskets shall be suitable for the applicable  
39                 service and straps shall be 304L stainless steel. Service saddles shall be as  
40                 manufactured by Mueller or approved equal.
- 41
- 42                  G. Tapping valves shall be gate valves satisfying the requirements for gate valves  
43                 specified herein. Tapping valves shall be comparative with the connecting sleeve  
44                 or saddle and shall be specially designed for wet tapping installation operations.

45

46                  2.20 HYDRAULIC CONTROL VALVES (HCV)

47

- 1           A. HCVs shall be full port with throttling plugs, single-seated, diaphragm-actuated  
2           globe pattern valves. V-port throttling plugs, anti-cavitation cages or orifice  
3           plates shall be provided to reduce the potential for cavitation damage. The  
4           diaphragm assembly shall be the only moving part and shall form a sealed  
5           chamber in the upper portion of the valve, separating operating pressure from  
6           line pressure. HCVs shall be either of the double chamber design, or single  
7           chamber design with a separating partition between the lower surface of the  
8           diaphragm and the main valve, or be capable of being modified to a double  
9           chamber design. Double chamber valves shall be furnished with a removable  
10          plug between the upper and lower chambers.
- 11          B. HCV body and cover shall be of a ductile iron ASTM Grade A-536, rated for a  
12           250 psi working pressure, and shall have a factory-applied, internal and  
13           external, fusion bonded epoxy resin coating with a minimum thickness of 8 mils,  
14           conforming to all applicable requirements of the American Water Works  
15           Association Standard C550-90 entitled "Protective Interior Coatings for Valves  
16           and Hydrants". HCV ends shall be Class 150 lb flanges per ANSI Standard  
17           B16.42.
- 18          C. The diaphragm assembly shall include a stainless steel shaft of sufficient  
19           diameter for the service intended, and fully guided by a bearing in the separating  
20           partition or by a bearing in the valve cover and an integral bearing in the valve  
21           seat. The seat shall be a solid, one-piece design. Valve trim and seat shall be  
22           type 304 or 316 stainless steel.
- 23          D. HCV seat, shaft and the bearing in the valve cover shall be removable. If used,  
24           the lower bearing of the valve shaft shall be contained concentrically within the  
25           seat and shall be exposed to the flow on all sides to avoid deposits. The valve  
26           body and cover shall be machined with a locating lip to insure proper alignment  
27           of the valve stem. "Pinned" covers shall be permitted. HCVs shall be furnished  
28           with stainless steel position indicators.
- 29          E. HCVs shall contain a resilient seat disc forming a tight seal against a single  
30           removable seat. The disc guide shall be contoured and shall hold the seat disc  
31           firmly in place. The diaphragm shall not be used as the seating surface. The  
32           disc retainer shall be of a one-piece design. The diaphragm shall consist of  
33           nylon fabric bonded with EPDM rubber. The diaphragm shall be fully supported  
34           in the valve body and cover by machined surfaces.
- 35          F. All necessary repairs and/or modifications other than replacement of the main  
36           valve body shall be possible without removing the valve from the pipeline.  
37           Packing glands and/or stuffing boxes shall not be permitted.
- 38          G. Pilot Systems
- 39           1. The pilot system shall be fully assembled and installed on the main valve  
40           by the manufacturer prior to shipping and shall consist of a solenoid

control, a backpressure sustaining control, a modulating level (float) control (to be provided as a separate device for installation in the tank), rate of flow control, orifice plates, pilot isolation valves, opening and closing speed controls, and all necessary tubing and fittings. Tubing shall be copper, fittings shall be brass. All rubber components in the pilot shall be EPDM.

2. The solenoid control shall be as manufactured by the ASCO Corporation. The solenoid control shall be 120 volt AC, 60 Hertz and shall have a NEMA 4 weatherproof enclosure. All rubber components in the solenoid shall be EPDM.
3. The backpressure sustaining controls shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds or falls below the adjustable spring setting. Sustaining Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked. A full range of spring settings shall be available in ranges from 0-175 psi.
4. The pressure reducing controls shall be direct acting, adjustable, spring-loaded, diaphragm valve designed to regulate control valve toward the closed position when downstream pressure exceeds the setpoint of the pilot. Reducing Pilot control sensing shall be downstream of the control valve. A full range spring setting shall be used to offer pressure reduction from 175 psi to 7 psi.
5. The float pilot shall be of the modulating type. The valve shall open when the float is at a low liquid level. The valve shall close drip tight when the float is at a high level. Float controls shall be constructed of brass with 304 stainless steel trim, and EPDM synthetic materials. Float rod length shall be as required for the application, but not less than 24-inch for 6-inch valves or 48-inch for 8-inch and larger valves. Float rod and linkage materials shall be of PVC or stainless steel, with a polypropylene float ball.
6. The rate of flow control pilot shall close when controlling differential exceeds the adjustable spring setting. The differential pressure control shall react to changes in the pressure differential sensed across the upstream orifice plate assembly and shall cause the main valve to modulate so as to maintain a constant flow rate, selectable over a 3:1 range.
7. Orifice plate assemblies, with appropriately sized orifice bore, shall be furnished by the valve manufacturer and shall be mounted by the Contractor on the inlet and outlet flanges of the main hydraulic control valve. Where recommended by the valve manufacturer for proper flow measurement and/or operation, the orifice plates shall be installed

1 between pipe flanges at locations and in a manner approved by the  
2 Engineer, at no additional cost to the Owner. The orifice plate assembly  
3 upstream of the HCV shall have a high pressure sensing port on the inlet  
4 side and a low pressure sensing port on the outlet side, and shall be  
5 furnished with copper sensing tubes with brass fittings, for connection to  
6 the differential pressure flow transmitters valve manifolds specified  
7 elsewhere in these specifications, as detailed on the drawings. The  
8 downstream orifice plate shall be sized to prevent cavitation of the HCV.  
9 The valve manufacturer shall be responsible for sizing, selecting and  
10 furnishing orifice plates, based on the specified pressures and with 7 feet  
11 per second flow rate in the piping in which the HCV is to be installed, over  
12 a 4:1 range. Orifice plates shall be of the flange type for mounting  
13 between pipe flanges, and be constructed of type 304 stainless steel.  
14 The valve manufacturer shall furnish the differential pressure-to-flow  
15 calibration data to the supplier of the differential pressure instrument  
16 furnished under Section 13610, and shall be responsible for assuring  
17 compatibility between the orifice plate and differential pressure  
18 transmitter, as applicable.

- 19
- 20 8. The surge anticipator high and low-pressure relief pilots shall be direct  
21 acting, adjustable, spring-loaded diaphragm actuated valves. The high-  
22 pressure pilot shall have a built-in needle valve to adjust the main valve  
23 closing speed. The body and cover of the pilot valves shall be of brass  
24 or bronze construction with stainless steel trim and resilient seal. The  
25 main valve shall be equipped with a mechanical or hydraulic flow-limiting  
26 device. Liquid to the pilots must be filtered by a large control canister  
27 style filter and cock valves must be provided to isolate the control loop  
28 and main valve cover.
- 29
- 30 H. Those valves noted on the drawings shall include a hydraulic check feature to  
31 close drip tight and prevent reverse flow. This feature shall also include a  
32 closing speed control to prevent water hammer.
- 33
- 34 I. The valve shall be as manufactured by Bermad, OCV, Ames, or approved equal.
- 35

Location	Size	Functions	Orifice Plate Bore Diameter (Inlet/Outlet)

36 ROF = Rate of flow  
37

38 BPS = Back pressure sustaining

PRV = Pressure reducing valve

## VALVES AND APPURTENANCES

15100-21

12/18/2020

1 SOV = Solenoid operated valve  
2 LC = Hydraulic level control  
3 CV = Equipped with hydraulic check feature  
4 \*Existing control valve to be modified and retrofitted with the functions shown in above table.  
5

- 6 J. The valve manufacturer shall warrant all hydraulic control valves supplied  
7 against defects in workmanship and materials for a period of five (5) years under  
8 normal use, operation and service. If any part of the valve should fail during the  
9 warranty period, it shall be replaced in the unit(s) and restored to service at no  
10 expense to the Owner.  
11  
12 K. All hydraulic valve control piping shall be insulated to the satisfactory of the  
13 engineer.

14  
15 2.21 CUSHIONED SWING CHECK VALVE WITH OIL BOTTOM MOUNTED BUFFER  
16

- 17 A. The body and cover of the swing check valves shall be constructed of cast iron  
18 meeting ASTM A126 Grade B, with a bronze or stainless steel seat ring, and a  
19 noncorrosive shaft for attachment of weight and lever. Flanges shall be drilled  
20 for ANSI Standard B.16.1, 125 lb. Class. Check valves shall absolutely prevent  
21 the return of water or wastewater back through the valve when the inlet pressure  
22 decreases below the delivery pressure.  
23  
24 B. The valves must be tight seating and must operate without hammer or shock.  
25 The seat ring must be renewable and shall be securely held in place by stainless  
26 steel locking screws.  
27  
28 C. The disc shall be ductile Iron, utilizing a double crevice hinge to prevent disc  
29 tipping, and be connected to a ductile Iron disc arm. The disc seat shall be  
30 Buna-N (replaceable) to provide water tight shutoff. The disc arm assembly  
31 shall be suspended from the stainless steel shaft.  
32  
33 D. The valve shall have a bottom hydraulic buffer to permit free open, but positive  
34 non-slam control closure of the disc. The hydraulic buffer shall make contact  
35 with the disc during the last 10% of closure to control the valve disc until shut-  
36 off in a manner to prevent slam and water hammer. The last 10% of closure  
37 shall be externally adjustable to suit operating conditions. The hydraulic buffer  
38 and oil system shall be removable without need to remove the entire valve and  
39 the oil system and shall be totally independent from the main line to prevent  
40 corrosion or contamination to the main line media. The buffer rod shall be  
41 stainless steel meeting ASTM A582 T303.  
42  
43 E. The valves shall be as manufactured by APCO Series 6000B with bottom  
44 mounted oil buffer or approved equal, and shall be suitable for horizontal  
45 installation.

46  
47 2.22 SLANTING DISK CHECK VALVE WITH BOTTOM MOUNTED BUFFER  
48

- 1           A. Valve body shall be heavy two-piece ASTM A126 Grade B cast iron. The two  
2           (2) body halves and body seat shall be O-ring sealed and bolted together in a  
3           manner to sandwich the body seat on a 55° angle. Each body half shall have a  
4           covered access hole for internal inspection and each body half and disc shall  
5           be fully machined to accept the attachment of a bottom buffer oil dashpot.  
6
- 7           B. The seat ring and disc ring shall permit replaceability in the field without need  
8           for special tools or machining. Disc and seat ring shall be bronze. The area  
9           throughout the valve body must be equal to full pipe area.  
10
- 11          C. The pivot pins in the body and the bushings in the disc lugs shall be stainless  
12          steel of different hardnesses to prevent galling. The bushings shall be pressfit  
13          to prevent wear.  
14
- 15          D. An indicator shall be provided to show position of the disc.  
16
- 17          E. Valve shall be Apcos slanting disc check valve or approved equal.  
18

19        **2.23 MUD VALVES**  
20

- 21          A. Mud valves shall be of the heavy-duty flanged type designed to provide a  
22          positive seal under both seating and unseating head conditions. The valves  
23          shall be rising stem style as detailed on the schedule or plans. Frame, plug and  
24          yoke shall be cast iron (ASTM126B) or 316 SS as shown on the plans. Valve  
25          operating stem and lift nut shall be bronze (B421) or 316 SS. The seat ring shall  
26          be bronze (B62) or 316 SS with a tapered, accurately machined seating face.  
27          The plug seat shall be seamless molded EPDM tapered to accurately mate with  
28          the seat ring for a positive seal.  
29
- 30          B. Where required, extension stems, floor stands, and stem guides shall be  
31          furnished by the valve manufacturer to make a complete and operable unit.  
32          Paint will be shown under Division 09 painting specifications.  
33
- 34          C. Valves and accessories shall be manufactured by Troy Valve, M&H Valve, or  
35          approved equal.  
36

37        **2.24 BUTTERFLY VALVES FOR AIR SERVICE**  
38

- 39          A. Butterfly valves shall be Class 150A or B, and equal to those manufactured by  
40          Henry Pratt Company, DeZurik, American, Kennedy, Mueller, Homestead, or  
41          equal. The valve discs shall be constructed of cast iron conforming to ASTM  
42          A-48, Class 40, ASTM A-126, Class B or ductile iron conforming ASTM A536,  
43          Grade 65-45-12 for Class 150 or less  
44
- 45          B. The face-to-face dimensions of flanged end valves shall be in accordance with  
46          Table 2 of AWWA Specification for short-body valve. Adequate two-way thrust  
47          bearings shall be provided. Flange drilling shall be in accordance with ANSI  
48

VALVES AND APPURTENANCES

1           B16.1. All air service valves shall be wafer style.  
2

- 3           C. Valve seats and sealing rings shall be EPDM synthetic rubber compound  
4           adequate for constant service at 250 degrees F. Valve seats 24 inches and  
5           larger shall be field adjustable and replaceable without dismounting operator  
6           disc or shaft and without removing the valve from the line. All retaining  
7           segments and adjusting devices shall be of corrosion resistant material with  
8           stainless Nylock screws and be capable of a 1/8-inch adjustment. Valves 20  
9           inches and smaller shall have bonded or mechanically restrained seats. Where  
10          elastomer seat is mounted on the valve body, the mating edge of the valve disc  
11          shall be 18-8 stainless steel. Where elastomer seat is mounted on the valve  
12          disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from  
13          the shaft, mechanically restrained and covering 360 degrees of the peripheral  
14          opening or seating surface.
- 15
- 16          D. The valve body shall be constructed of ductile iron or close grain cast iron per  
17          ASTM A-126, Class B with integrally cast hubs for shaft bearing housings of the  
18          through boss-type.
- 19
- 20          E. The valve shaft shall be turned, ground, and polished constructed of 18-8,  
21          ASTM A-276, Type 304 stainless steel and designed for both torsional and  
22          shearing stresses when the valve is operated under its greatest dynamic or  
23          seating torque. Shaft shall be of either a one-piece unit extending full size  
24          through the valve disc and valve bearing or it may be of a stub shaft design.  
25          Shaft bearings shall be Teflon or nylon, self-lubricated type adequate for  
26          constant service at 250 degrees
- 27
- 28          F. Gearing for the operators shall be totally enclosed in a gear case in accordance  
29          with Paragraph 3.8 of the AWWA C-504 Standard Specification.
- 30
- 31          G. Where indicated on the Construction Drawings extension stems, operators with  
32          extended handles, floor stands, couplings, stem guides and floor boxes, as  
33          required, shall be furnished and installed.
- 34
- 35          H. Valves shall have a factory-applied, internal and external, fusion bonded epoxy  
36          resin coating with a minimum thickness of 8 mils, conforming to all applicable  
37          requirements of the American Water Works Association Standard C550-90  
38          entitled "Protective Interior Coatings for Valves and Hydrants".
- 39

40          2.25 SWING CHECK VALVES – LEVER AND WEIGHT  
41

- 42          A. Swing check valves shall be constructed with heavy cast iron or ASTM A536  
43          Grade 65-45-12 ductile iron. The valve shall meet the minimum requirements  
44          of AWWA C-508. Flanges shall be drilled for ANSI Standard B.16.1, 125 lb.  
45          Class. Check valves shall absolutely prevent the turn of water back through the  
46          valve when the inlet pressure decreases below the delivery pressure.
- 47

- 1           B. The valves must be tight seating and must operate without hammer or shock.  
2           The seat ring shall be replaceable bronze or stainless steel and shall be  
3           securely held in place by a threaded joint or other mechanical fastener. The  
4           shaft shall be non-corrosive steel. The shaft seals shall be a stuffing box and  
5           packing.
- 6
- 7           C. Check valves shall be the lever and weight type with an adjustable position  
8           weight and lever arm attached to a cast or ductile iron disc assembly to allow  
9           adjustment of the closure force and include a side-mounted, corrosion-resistant,  
10           spring assist to control closing speed over the final 10% of stroke.
- 11
- 12           D. The valves shall be APCO Series 6000 CLW, Kennedy, Val-Matic Swing-Flex,  
13           or approved equal, and shall be suitable for horizontal and vertical installation.
- 14

15           PART 3 - EXECUTION

16           3.01 INSTALLATION

- 19           A. All valves and appurtenances shall be installed in the locations shown, true to  
20           alignment and rigidly supported. Any damage to the above items shall be  
21           repaired to the satisfaction of the Engineer before they are installed.
- 23           B. After installation, all valves and appurtenances shall be tested at least 2 hours  
24           at the working pressure corresponding to the class of pipe, unless a different  
25           test pressure is specified. If any joint proves to be defective, it shall be repaired  
26           to the satisfaction of the Engineer.
- 28           C. Install all floor boxes, brackets, extension rods, guides, the various types of  
29           operators and appurtenances as shown on the Construction Drawings that are  
30           in masonry floors or walls, and install concrete inserts for hangers and supports  
31           as soon as forms are erected and before concrete is poured. Before setting  
32           these items, the Contractor shall check all plans and figures which have a direct  
33           bearing on their location and he shall be responsible for the proper location of  
34           these valves and appurtenances during the construction of the structures.
- 36           D. Pipe for use with flexible couplings shall have plain ends as specified in the  
37           respective pipe sections in Division 15.
- 39           E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and  
40           washers. Mechanical joints shall be made with mild corrosion resistant alloy  
41           steel bolts and nuts. All exposed bolts shall be painted the same color as the  
42           pipe. All buried bolts and nuts shall be heavily coated with two (2) coats (14-20  
43           mils DFT) of bituminous paint comparable to Carbofine Bitumastic 300M,  
44           Tnemec Series 46H-413 Tneme-Tar, or approved equal.
- 46           F. Prior to assembly of split couplings, the grooves, as well as other parts, shall be  
47           thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be

1 moderately coated with petroleum jelly, cup grease, soft soap or graphite paste,  
2 and the gasket shall be slipped over one pipe end. After the other pipe has  
3 been brought to the correct position, the gasket shall be centered properly over  
4 the pipe ends with the lips against the pipes. The housing sections then shall  
5 be placed. After the bolts have been inserted, the nuts shall be tightened until  
6 the housing sections are firmly in contact, metal-to-metal, without excessive bolt  
7 tension.

- 8
- 9 G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned  
10 thoroughly for a distance of 8 inches. Soapy water may be used as a gasket  
11 lubricant. A follower and gasket, in that order, shall be slipped over each pipe  
12 to a distance of about 6 inches from the end, and the middle ring shall be placed  
13 on the substantial completion date unless otherwise requested by the Owner.
- 14
- 15 H. Valve boxes with concrete bases shall be installed as shown on the  
16 Construction Drawings. Mechanical joints shall be made in the standard  
17 manner. Valve stems shall be vertical in all cases. Place cast iron box over  
18 each stem with base bearing on compacted fill and top flush with final grade.  
19 Boxes shall have sufficient bracing to maintain alignment during backfilling.  
20 Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill  
21 from valve box.

22

23 3.02 SHOP PAINTING

- 24
- 25 A. Ferrous surfaces of above ground valves and appurtenances to be painted shall  
26 receive a coating of rust-inhibitive primer compatible to paint system specified  
27 in Section 09900. All pipe connection openings shall be capped to prevent the  
28 entry of foreign matter prior to installation.

29

30 3.03 FIELD PAINTING

- 31
- 32 A. All metal valves and appurtenances specified herein and exposed to view,  
33 except ball valves, shall be painted as part of the work in Section 09900.

34

35 3.04 INSPECTION AND TESTING

- 36
- 37 A. Completed pipe shall be subjected to a hydrostatic pressure and leakage in  
38 accordance with Section 01625. All leaks shall be repaired and lines retested.  
39 Prior to testing, the pipelines shall be supported in an approved manner to  
40 prevent movement during tests.

41

42

43 END OF SECTION

SECTION 15480

## ELECTRIC WATER HEATER

## PART 1 - GENERAL

## 1.01 SCOPE OF WORK

- A. Furnish and install all labor, equipment, materials, tools and incidentals required for a complete and operable installation of a hot water system as necessary to provide a complete and operational system as shown on the drawings and specified herein. The equipment shall be of the latest design and shall be fabricated of materials and in a fashion that will fully perform the functions described below. An approved Manufacturer shall supply the equipment and the Contractor shall install the equipment.
  - B. The hot water equipment shall consist of but not be limited to the following:
    1. ASME Rated Insulated Stainless Steel Water Storage Tank
    2. Heating Element(s)
    3. Power and Controls Panel
  - C. The equipment shall be installed as shown on the plans, as recommended by the manufacturer, and in compliance with all OSHA, local, state, and federal codes and regulations.
  - D. The hot water equipment shall be fully automatic. All components shall be furnished by one manufacturer who shall be responsible for the design, coordination and proper operation of the entire system.
  - E. These Specifications are intended to give a general description of the system required, but do not cover all details; which will vary in accordance with the requirements of the equipment as offered. They are, however, intended to cover the furnishing, shop testing, delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete unit as herein specified, whether specifically mentioned in these Specifications or not. The scope of work includes providing a manufacturer's authorized representative to perform startup of the equipment, and to instruct the Owner's personnel in the care, operation and maintenance of all equipment provided under this section
  - F. This equipment will be used on a potable water system and all materials of the heater that come in contact with the potable water, whether specified or not, shall be NSF-61 certified.

1    1.02 QUALIFICATIONS

- 2
- 3       A. The equipment shall be as supplied from a manufacturer specializing in the  
4           design, fabrication and supply of commercial hot water storage and heating  
5           systems.
- 6
- 7       B. Strict adherence to the standards of design, fabrication, erection, product  
8           quality, and long term performance established in this Specification will be  
9           required by the Owner and Engineer.
- 10
- 11      C. To assure unity of responsibility, all equipment specified in this Section shall  
12           be furnished and coordinated by the hot water tank manufacture. The  
13           Contractor and supplier shall assume full responsibility for the satisfactory  
14           installation and operation of the system. The equipment shall be designed,  
15           constructed and installed in accordance with the best practices and  
16           methods.
- 17
- 18      D. The hot water system shall be as manufactured by AO Smith, Rheem,  
19           Bradford White or approved equal.

21    1.03 REFERENCE STANDARDS

- 22
- 23       A. The design, products, and installation shall comply with at least, but not  
24           limited to, the following industry standards, wherever applicable:
- 25
- 26           Institute of Electrical and Electronics Engineers (IEEE) Standards  
27           National Electrical Manufacturers Association (NEMA)  
28           National Electric Code (NEC)  
29           Underwriters Laboratories, Inc. (UL)  
30           National Fire Protection Association (NFPA)  
31           American National Standards Institute (ANSI)  
32           Occupational Health and Safety Administration (OSHA)  
33           American Society for Testing and Materials (ASTM)  
34           National Electrical Contractors Association (NECA)  
35           National Electrical Testing Association (NETA)  
36           International Building Code (IBC)  
37           International Code Council (ICC)  
38           International Association of Plumbing and Mechanical Officials (IAPMO)  
39           IAPMO Backflow Prevention Reference Manual Second Edition  
40           American Society of Mechanical Engineers (ASME)

42    1.04 SUBMITTALS

- 43
- 44       A. Provide shop drawings and product data as specified in Division 1 for the  
45           equipment being furnished. The submittal information shall at minimum  
46           include the following:
- 47

- 1        1. Certified shop drawings showing all details of construction,  
2                          dimensions and anchor bolt requirements.
- 3        2. Descriptive product literature and catalog cuts
- 4        3. Complete parts and bill of materials lists for the equipment.
- 5        4. Recommended spare parts list
- 6        5. Manufacturer's installation drawings and instructions.
- 7        6. Wiring and schematic diagrams.
- 8        7. Operation and Maintenance Data as specified in Division 1.
- 9        8. Manufacturer's Certificate of Compliance certifying compliance with  
10                          the referenced Specification and standards
- 11        9. Certified copies of reports of factory tests specified in this Section  
12                          and required by the referenced standards.
- 13        10. Equipment weights and lifting points.
- 14        11. Recommendations for unloading, handling, short and long term  
15                          storage.
- 16        12. A copy of the manufacturer's warranty

18      1.05 STORAGE AND PROTECTION

- 20        A. Store products in accordance with the manufacturer's instructions, with  
21                          seals and labels intact and legible.
- 23        B. Arrange storage in a manner to provide easy access for inspection. Make  
24                          periodic inspections of stored products to assure that products are  
25                          maintained under specified conditions, and free from damage or  
26                          deterioration.

28      1.06 SPECIAL TOOLS

- 30        A. Manufacturers of equipment and machinery shall furnish any special tools  
31                          required for normal adjustment, operations and maintenance, together with  
32                          instructions for their use. The Contractor shall preserve and deliver to the  
33                          Owner these tools and instructions in good order no later than upon  
34                          completion of the Contract.

36      1.07 WARRANTY

- 38        A. The manufacturer shall warranty all components against defects in  
39                          workmanship and material for a period of one (1) year from date of start-up,  
40                          and the pressure vessel for a full five (5) years Non Pro-Rated from date of  
41                          start-up.

43      1.08 SPARE PARTS

- 45        A. Spare parts to be included with the shipment of the electric water heater  
46                          include the following:

- 1           1. One (1) of each type and size of heating elements  
2           2. All consumables used for changing the elements  
3           3. 10 spares of each size fuse used in the control panel

4

## 5       PART 2 – PRODUCTS

6

7       2.01 PRODUCT DESCRIPTION:

- 8
- 9           A. Electric hot water heater, constructed in accordance with Section IV of the  
10          ASME Code for 150 psi working pressure.

11

12          The hot water system design criteria is as listed:

13

Nominal Storage Capacity	160 gallons
Minimum Heating Capacity	27,800 BTU/hour
Power	480V 3 phase
Temperature Rise:	70 - 195 degrees F

18

19           B Configuration:

20

- 21
- 22           1. The entire water heating package shall be prewired to solderless  
23          terminal lugs, factory tested, complete with a CSA Certified and  
24          ASME Rated T&P relief valve and bear the Underwriters'  
25          Laboratories label.
- 26
- 27           2. The entire unit is to be complete with all operating controls and  
28          require only plumbing and electrical service connections.
- 29
- 30           3. The heater shall configured for vertical or horizontal installation as  
31          shown on the drawings and with lifting lugs and a stainless steel  
32          base.
- 33
- 34           4. Fasteners and hardware throughout system shall be stainless steel  
35          or material of equivalent corrosion resistance
- 36
- 37           5. Unprotected steel shall not to be used in any components

38

39           C. Tank Body:

40

- 41
- 42           1. The tank shall be all welded construction designed for 150 psi  
43          working pressure and contain at least 160 gallons of storage.
- 44
- 45           2. The tank is to be fabricated from 316L stainless steel, and shall not  
46          require any type of anodic protection.

1           D. Insulation: Entire tank is to be insulated with fiberglass insulation or a  
2           minimum of two (2) inches of thick polyurethane foam insulation and exceed  
3           the latest ASHRAE standard for stand-by heat loss.

4

5           E. Connections

6

- 7
- 8           1. The cold water inlet shall be 1" Female NPT and include a non-  
9           corrosive strata-flow diffuser which prevents incoming cold water  
from mixing too rapidly with hot water in the tank.
- 10
- 11          2. A  $\frac{3}{4}$ " hose connection drain shall be fitted at the bottom of the unit.
- 12
- 13          3. The hot water outlet shall be 1" Male NPT and shall include a factory  
14           installed built-in heat trap to prevent water from radiating through the  
15           piping during stand-by periods.
- 16
- 17          4. A separate 1" Female NPT tap is to be provided for relief valve  
18           installation. An ASME rated automatic reseating combination  
19           temperature and pressure safety relief valve set at 150 psi and 210°F  
20           shall be factory supplied
- 21

22           F. Heating Elements

23

- 24
- 25          1. The heating elements shall be a high quality incoloy sheath electric  
26           immersion type, and be completely replaceable.
- 27
- 28          2. Heating elements shall be 4-bolt flange mounted with prewired  
29           terminal leads.
- 30
- 31          3. A minimum of two (2) heating elements shall be installed
- 32
- 33          4. These elements will be switched by magnetic contactors which are  
34           operated by a fused control circuit protected by a manual reset high  
35           current limit trip device. The control circuit is activated by a master  
36           thermostat switch and electronic low water cutoff.
- 37
- 38           i. This control shall prevent the entire electrical load from being  
39           switched on instantaneously. The control shall have even load  
40           progressive sequencing which utilizes the "first on, first off"  
41           principle thereby equalizing the operating time of heating  
42           elements and contactors.
- 43
- 44           ii. Each magnetic contactor and heating element circuit will be  
45           protected by cartridge type fuses with a minimum of 100,000  
46           amp interrupting capacity
- 47

1           G. Electrical

- 2
- 3       1. The heater shall be designed to operate at 480 volts 3 phase 60 Hz  
4           (balanced) with all necessary operating controls factory mounted,  
5           wired and tested.
- 6
- 7       2. Each circuit is to be independently operated through a definite  
8           purpose magnetic contactor having a resistive load rating exceeding  
9           the ampere rating of that particular circuit.
- 10
- 11      3. Water temperature shall be controlled through an adjustable snap  
12           action surface thermostat. An over-temperature manual reset Hi-  
13           Limit shall be factory installed to disconnect all conductors to the  
14           heating element(s) in the event of an over-temperature condition in  
15           the pressure vessel.
- 16
- 17      4. The enclosure shall be NEMA 4x rated of stainless steel construction  
18           and have a hinged locking door over electric controls.
- 19
- 20      5. Provide electrical equipment and wiring in accordance with Division  
21           16.
- 22

23           H. The mounting base for all equipment shall be fabricated 304 stainless steel.

24

25           PART 3 – INSTALLATION

26

27           3.01 GENERAL

- 28
- 29       A. Install equipment in accordance with the approved shop drawings and the  
30           manufacturer's installation instructions.
- 31
- 32       B. Prior to initial start-up, the manufacturer's representative shall provide  
33           written certification to the Owner that the equipment has been installed,  
34           tested in accordance with the Manufacturer's approved method, and testing  
35           requirements specified herein and shall certify that the equipment is ready  
36           for permanent operation.
- 37

38           3.02 TESTING AND COMMISSIONING

- 39
- 40       A. Following completion of construction, the Contractor shall provide startup  
41           and acceptance testing as specified in Division 1.
- 42
- 43

44           END SECTION

1 SECTION 16010  
2

3 BASIC ELECTRICAL REQUIREMENTS  
4

5 PART I - GENERAL  
6

7 1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract,  
8 including General and Supplementary Conditions and Division 1 Specification  
9 sections, apply to work of this Section.  
10

11 1.02 CODES:  
12

13 A. The work shall be in conformance with the latest adopted version of the  
14 following:  
15

16 NFPA 70 National Electric Code  
17 FBC Florida Building Code  
18 NFPA National Fire Protection Association Codes  
19

20 B. The installation shall also comply with all applicable rules and regulations  
21 of local and state laws and ordinances. Include in the work, without extra  
22 cost, any labor, materials, services, apparatus and drawings required to  
23 comply with all applicable laws, ordinances, rules and regulations. Inform  
24 the engineer of any work or materials which conflict with any of the  
25 applicable codes, standards, laws, and regulations before submitting their  
26 bid.  
27

28 1.03 ROUGH-IN:  
29

30 A. Verify final locations for rough-ins with field measurements and with the  
31 requirements of the actual equipment to be connected.  
32  
33 B. Refer to equipment specifications in Divisions 2 through 15 for rough-in  
34 requirements.  
35

36 1.04 ELECTRICAL INSTALLATIONS:  
37

38 A. Existing services shall not be interrupted without prior consent of the  
39 owner's authorized representative and may be interrupted only at, and for,  
40 the specific time designated by the owner's authorized representative.  
41  
42 B. Make a thorough examination of the site and the contract documents. No  
43 claim for extra compensation will be recognized if difficulties are  
44 encountered which an examination of site conditions and contract  
45 documents prior to executing contract would have revealed.  
46

- 1           C. Coordinate electrical equipment and materials installation with other  
2           building components.
- 3
- 4           D. Verify all dimensions by field measurements.
- 5
- 6           E. Arrange for chases, slots, and openings in other building components to  
7           allow for electrical installations.
- 8
- 9           F. Coordinate the installation of required supporting devices and sleeves to  
10          be set in poured-in-place concrete and other structural components, as  
11          they are constructed. Sequence, coordinate, and integrate installations of  
12          electrical materials and equipment for efficient flow of the work. Give  
13          particular attention to large equipment requiring positioning prior to  
14          closing-in the building.
- 15
- 16          G. Coordinate the cutting and patching of building components to  
17          accommodate the installation of electrical equipment and materials.
- 18
- 19          H. Install electrical equipment to facilitate maintenance and repair or  
20          replacement of equipment components. As much as practical, connect  
21          equipment for ease of disconnecting, with minimum of interference with  
22          other installations.
- 23
- 24          I. Coordinate the installation of electrical materials and equipment above  
25          ceilings with suspension system, mechanical equipment and systems, and  
26          structural components.
- 27
- 28          J. Temporary electrical service and construction lighting shall be provided  
29          under this section. Provide all Temporary electrical equipment as shown  
30          on the drawings for the duration of the project. All Temporary electrical  
31          equipment and its installation shall not interfere with the operation of the  
32          facility and shall not interfere with access to the existing facility's  
33          equipment. Provide for all electrical service for construction period,  
34          making all connections and removal of same at job conclusion. Furnish  
35          and install temporary lighting for construction period. At job completion,  
36          all temporary lamps shall be removed and replaced with new lamps; and  
37          all temporary electrical equipment shall be disconnected and removed  
38          from the project site.
- 39
- 40          K. All existing and new conduit/raceways within the project area shall be  
41          properly (maximum of 6 feet between supports) supported. Add support  
42          to existing conduit as required to comply with the NEC.
- 43
- 44          L. All enclosures for new electrical equipment shall be NEMA 4X stainless  
45          (316) steel. All enclosures shall have internal mounting plates for  
46          components and an interior safety door.

1  
2       M. There shall be no penetrations of existing clarifier tank or process basin  
3           walls. All conduits shall be run surface mounted or on top of walls.  
4           Conduit supports or associated hardware shall NOT penetrate existing  
5           clarifier tank walls or process basin walls.

6  
7       1.05 CUTTING AND PATCHING:

- 8  
9       A. Refer to the Division 1 Section: CUTTING AND PATCHING for general  
10          requirements for cutting and patching.
- 11  
12       B. Do not endanger or damage installed work through procedures and  
13          processes of cutting and patching.
- 14  
15       C. Arrange for repairs required to restore other work because of damage  
16          caused as a result of electrical installations.
- 17  
18       D. No additional compensation will be authorized for cutting and patching  
19          work that is necessitated by ill-timed, defective, or non-conforming  
20          installations.
- 21  
22       E. Perform cutting, fitting, and patching of electrical equipment and materials  
23          required to:
- 24  
25           1. Uncover work to provide for installation of ill-timed work.
- 26  
27           2. Remove and replace defective work.
- 28  
29           3. Remove and replace work not conforming to requirements of the  
30          contract documents.
- 31  
32           4. Remove samples of installed work as specified for testing.
- 33  
34           5. Install equipment and materials in existing structures.
- 35  
36           6. Upon written instructions from the engineer, uncover and restore  
37          work to provide for engineer observation of concealed work.
- 38  
39       F. Cut, remove and legally dispose of, selected electrical equipment,  
40          components, and materials as indicated; including, but not limited to,  
41          removal of electrical items indicated to be removed and items made  
42          obsolete by the new work.
- 43  
44       G. Protect the structure, furnishings, finishes, and adjacent materials not  
45          indicated or scheduled to be removed.

- 1                   H. Provide and maintain temporary partitions or dust barriers adequate to  
2                   prevent the spread of dust and dirt to adjacent areas.  
3  
4                   I. Locate, identify, and protect electrical services passing through  
5                   remodeling or demolition area and serving other areas required to be  
6                   maintained operational. When transit services must be interrupted,  
7                   provide temporary services for the affected areas and notify the owner  
8                   prior to changeover.

9  
10          1.06 ELECTRICAL SUBMITTALS:

- 11  
12                   A. Refer to the Conditions of the Contract (General and Supplementary) and  
13                   Division 1 Section: SHOP DRAWINGS, PRODUCT DATA, AND  
14                   SAMPLES for submittal definitions, requirements, and procedures.  
15  
16                   B. Submittal of shop drawings, product data, and samples will be accepted  
17                   only when submitted by the contractor. Data submitted from  
18                   subcontractors and material suppliers directly to the engineer will not be  
19                   processed.  
20  
21                   C. Submit Operation and Maintenance Manuals with part lists as specified in  
22                   Division 1 Project Closeout; for the following electrical equipment: Panel  
23                   boards, Control Panels, Variable Frequency Drives, Soft Starters. Motor  
24                   Starters, Motors, Transformers, and Programmable Logic Controllers.  
25  
26

27          1.07 PRODUCT OPTIONS AND SUBSTITUTIONS: Refer to the Instructions to  
28                   Bidders and the Division 1 Section: PRODUCTS AND SUBSTITUTION for  
29                   requirements in selecting products and requesting substitutions.

30          1.08 PRODUCT LISTING:

- 31  
32                   A. Prepare listing of major electrical equipment and materials for the project.  
33  
34                   B. Submit this listing as a part of the submittal requirement specified in the  
35                   Division 1 Section: PRODUCTS AND SUBSTITUTIONS.  
36  
37                   C. When two or more items of the same material or equipment are required,  
38                   they shall be of the same manufacturer. Product manufacturer uniformity  
39                   does not apply to raw materials, bulk materials, wire, conduit, fittings,  
40                   sheet metal, steel bar stock, welding rods, solder, fasteners, motors for  
41                   dissimilar equipment units, and similar items used in work, except as  
42                   otherwise indicated.  
43  
44                   D. Provide products which are compatible within systems and other  
45                   connected items.

1  
2       E. No substitution will be considered unless written request has been  
3 submitted to the engineer at least ten (10) days prior to the date for  
4 receipt of bids.

5  
6       F. If the engineer approves any proposed substitutions, such approval will be  
7 set forth in an addendum.

8  
9     1.09 DELIVERY, STORAGE, AND HANDLING:

10  
11      A. Deliver products to project properly identified with names, model numbers,  
12 types, grades, compliance labels, and similar information needed for  
13 distinct identifications; adequately packaged and protected to prevent  
14 damage during shipment, storage, and handling.

15  
16      B. Store equipment and materials at the site, unless off-site storage is  
17 authorized in writing. Protect stored equipment and materials from  
18 damage.

19  
20      C. Coordinate deliveries of electrical materials and equipment to minimize  
21 construction site congestion. Limit each shipment of materials and  
22 equipment to the items and quantities needed for the smooth and efficient  
23 flow of installation.

24  
25     1.10 RECORD DOCUMENTS:

26  
27      A. Refer to the Division 1 Section: PROJECT CLOSEOUT or PROJECT  
28 RECORD DOCUMENTS for requirements. The following paragraphs  
29 supplement the requirements of Division 1.

30  
31      B. Mark drawings to indicate revisions to conduit size and location, both  
32 exterior and interior; actual equipment locations, dimensioned from  
33 column lines; concealed equipment, dimensioned to column lines;  
34 distribution and branch electrical circuitry; fuse and circuit breaker size  
35 and arrangements; support and hanger details; change orders; concealed  
36 control system devices.

37  
38      C. Mark Specifications to indicate approved substitutions; change orders;  
39 actual equipment and materials used.

40  
41      D. Contractor shall provide engineer with record drawings (AutoCAD  
42 compatible file format) and one set of blueprints.

43  
44     1.11 WARRANTIES:

45  
46      A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures

and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

- B. Compile and assemble the warranties specified in Division 16 into a separated set of vinyl- covered, three-ring binders, tabulated and indexed for easy reference.
  - C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

## 1.12 CLEANING:

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT or FINAL CLEANING for general requirements for final cleaning.

END OF SECTION 16010

1 SECTION 16050  
2

3 ELECTRICAL EQUIPMENT ENCLOSURE  
4

5 PART I - GENERAL  
6

7 1.01 SECTION INCLUDES  
8

- 9 A. Pre-fabricated, operation ready electrical equipment enclosure.  
10

11 1.02 RELATED SECTIONS:  
12

- 13 A. Section 15050 – Basic Mechanical Methods and Materials.  
14

- 15 B. Section 16050 – Basic Electrical Methods and Materials.  
16

17 1.03 REFERENCES:  
18

- 19 A. ANSI C80.1 – Standard for Electrical Rigid Steel Conduit (ERSC).  
20

- 21 B. ANSI/SDI 100 – Recommended Specifications for Standard Steel Doors and  
22 Frames.

- 23 C. ASTM A 36 – Standard Specification for Carbon Structural Steel

- 24 D. ASTM A 572 – Standard Specification for High-Strength Low-Alloy  
25 Columbium-Vanadium Structural Steel

- 26 E. ASTM C 177 – Standard Test Method for Steady-State Heat Flux  
27 Measurements and Thermal Transmission Properties by Mans of the  
28 Guarded Hot-Plate Apparatus.

- 29 F. ASTM C 518 – Standard Test Method for Steady-State Thermal  
30 Transmission Properties by Means of the Heat Flow Meter Apparatus.

- 31 G. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings  
32 in 100% Relative Humidity.

- 33 H. Federal Specifications (Fed. Spec.) – TT-C-520B – Coating Compounds,  
34 Bituminous, Solvent Type, Underbody.

- 35 I. IEEE – C37.2.2 – Guide for Protective Relay Applications to Power System  
36 Buses.

- 37 J. National Electrical Manufacturers Association (NEMA) 250 – Enclosure for  
38

- L. Electrical Equipment (1000 V Maximum).
  - M. NEC – National Electric Code
  - M. Steel Structure Painting Council (SSPC) SP3 – Surface Preparation Standards and Specifications (Power Tool Cleaning).
  - N. Steel Structure Painting Council (SSPC) SP 1 – Surface Preparation Standards and Specifications (Solvent Cleaning).
  - O. Underwriters Laboratories Inc. (UL) 50 – Enclosure for Electrical Equipment, Non-Environmental Considerations.
  - P. Underwriters Laboratories Inc. (UL) 508 – Industrial Control Equipment.

## 1.04 SYSTEM DESCRIPTION:

- A. General:
    - 1. The enclosure is a completely self-contained pre-engineered package custom designed to specific power requirements and environmental conditions. The enclosure is designed to house specified electrical equipment and any associated relay and control panels. The minimum aisle space and clearance around the equipment are designed per Section 110 (working clearances) of the latest National Electric Code.
    - 2. Provide a NEMA 3R enclosure structure with exterior walls and roof fabricated from interlocking panels to house and protect the internal equipment from the elements.
      - a. Type 3R Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain, sleet and snow; undamaged by the formation of ice on the enclosure (NEMA 250).
    - 3. Structural grid base and floor system shall be designed for applicable floor loading allowing the enclosure to be lifted and transported with the interior equipment installed.
  - B. Design and construction shall conform to the applicable sections of the latest standards as issued by the following agencies, as a minimum:
    - 1. International Building Code (IBC): Default Structural loading criteria shall be per the IBC.
    - 2. American National Standards Institute (ANSI).

- 1           3. American Society of Civil Engineers (ASCE).
- 2           4. American Institute of Steel Construction (AISC).
- 3           5. American Iron and Steel Institute (AISI) – Specification for the Design
- 4           6. Metal Building Manufacturers Association (MBMA).
- 5           7. American Society for Testing and Material (ASTM).
- 6           8. American Society for Heating, Refrigeration, and Air Conditioning
- 7           9. National Electric Manufacturers Association (NEMA).
- 8           10. National Electric Code (NEC).
- 9           11. National Fire Protection Association (NFPA).
- 10          12. Steel Door Institute.

11          C. Structural Performance

- 12          1. The enclosure shall be designed and constructed to withstand
- 13            external loading conditions as prescribed by the International Building
- 14            Code for the specified final location.
- 15          2. Building components shall be designed to withstand external loading
- 16            as prescribed by the applicable codes as a minimum, with co-lateral
- 17            considerations as follows:
- 18            a. Base and floor system shall be designed to withstand all dead
- 19              and live loads as applicable or a minimum of 250 lb/sf (1220
- 20              kg/sm) over the entire floor area, while supported at indicated
- 21              minimum locations only.
- 22            b. Maximum deflection of all base members shall not exceed
- 23              L/240 with all applicable dead and live loads applied.
- 24            c. Roof loading: Per International Building Code [30 lb/sf (146
- 25              kg/sm) minimum].
- 26            d. Wind loading: Per International Building Code3 – Exposure C
- 27              minimum.
- 28            e. Seismic: Per International Building Code.
- 29            f. Interior Walls: Interior walls shall be capable of mounting and
- 30              supporting 400 lb/lf (595 kg/m) and 200 ft-lbs (28 kg-meters) of

moment / torque at any place along the perimeter wall space, with attachment to the interlocking ribs, or metal studs, located on 16 inches (406 mm) centers behind interior walls.

- g. Each shipping piece shall be designed for lifting by lugs located along the base perimeter members at 15 feet (4.5 m) approximate intervals.
  - h. All lifting lugs shall be removable.
  - i. The ceiling shall be capable of withstanding a single continuous load of 1000 lb/lf (149 kg/meter) located at mid span of the ceiling panels, and running the entire building length. The ceiling panels shall act alone, structurally and not depend on the roof or the interior equipment for support.
  - j. All shipping splits and other penetrations shall have adequate structural reinforcement via rigid frames or other means to minimize distortion during handling and transportation.

#### D. HVAC Performance:

1. Redundacy: NONE. One or multiple units as required to meet atmospheric and internal heating and cooling requirements.
  2. Redundancy: N+1. Multiple units as required to meet atmospheric and internal heating and cooling requirements plus one additional unit for redundancy purposes.
  3. Redundancy: 100%. Two independent systems consisting of multiple units as required meeting atmospheric and internal heating and cooling requirements.

#### 4. Exterior Design Temperatures:

- a. Summer: (Per ASHRAE 2.5% design temperature).
  - b. Winter: (Per ASHRAE 97.5% design temperature).

## 5. Interior Design Temperatures:

- a. Summer: 80 degree F (27 degrees C).
  - b. Winter: 60 degree F (16 degrees C)
  - c. Occupancy: Number of Persons - \_\_\_\_\_.
  - d. Ventilation Air (cfm): \_\_\_\_\_ (L/minute).

## F Certifications:

- 1           1. The enclosure shall be Third Party certified by UL as NEC (National  
2           Electric Code) and / or CEC (Canadian Electric Code) and /or UL 3R  
3           RAIN TEST and / or IEEE C37.2.2 – 199 RAIN TEST compliant, and  
4           shall bear a UL Label.  
5           2. The enclosure design shall be accomplished under the auspices of a  
6           Professional Engineer and drawings and supporting calculations will  
7           bear the Professional Engineer's seal.

8

## 9 Part 2 - PRODUCTS

10

### 11 2.01 ACCEPTABLE MANUFACTURERS:

- 12
- 13           A. Acceptable manufacturers: Subject to compliance with requirements,  
14           manufacturers offering electrical equipment enclosures which may be  
15           incorporated in the work are limited to the following:

16

17           Schneider/Square D  
18           ABB  
19           Cutler Hammer/Eaton

- 20
- 21           B. Set of certified structural design calculations performed by a Professional  
22           Engineer registered in the state of Florida. Includes State Certification. It will  
23           include wind load calculations in accordance with the State of Florida codes  
24           for this location. Note: The "APPROVAL" drawing package will reflect  
25           preliminary calculations. Calculations sealed by a professional engineer will  
26           be furnished only after customer's final approval and release for manufacture  
27           of the Equipment Center. Extra cost will result for any changes to the  
28           Equipment Center affecting the layout and/or design after the performance of  
29           these calculations.

30

### 31 2.02 FABRICATION:

- 32
- 33           A. All facets of construction through coating and weatherproofing shall be  
34           performed indoors, protected from outdoor weather conditions. Construction  
35           prior to this stage out-of-doors is not acceptable.
- 36
- 37
- 38
- 39
- 40           B. At shipping splits (when required due to transportation restrictions), each  
41           open area shall be sealed with 2 inches (52 mm) thick wooden framing and a  
42           complete OSB wood cover for temporary protection during transportation and  
43           setting. Seams in OSB wood shall be liberally caulked at the exterior.
- 44
- 45           C. All permanent coatings and finishes shall be applied inside a dedicated paint  
46           booth with ventilation and filtration provisions in compliance with the coating

1 manufacturer's requirements. Coatings applied in outside, ambient air  
2 conditions shall not be acceptable.  
3

4 **2.03 MATERIALS AND CONSTRUCTION**  
5

- 6     A. Base members shall be ASTM A572 wide flange, ASTM A36 channel,  
7         angle and tube shapes forming a self-supporting grid. All members shall  
8         be continuously welded to adjoining members.  
9
- 10     B. Floor shall be  $\frac{1}{4}$  inch (6 mm) minimum thickness flat ASTM A36 steel  
11         plate, welded to all longitudinal and transverse base members.  
12
- 13         1. Floor plate seams shall be continuously welded at all joints, and  
14             ground smooth to minimize visibility of seams. Welding of floor  
15             plate shall be staggered to produce a flat and ripple free surface.  
16
- 17     C. Exterior walls shall be 18ga (1.214 mm) (minimum) aluminum sheet  
18         interlocking panels formed by computer numerical controlled equipment to  
19         create a tightly interlocking panel design, nominally 3 inches (152 mm)  
20         deep. Interlocking panel ribs shall repeat at a typical maximum nominal  
21         dimension of 16 inches (406 mm).  
22
- 23     D. Following assembly (and coating) of all interlocking wall panels, each  
24         exterior seam shall be neatly caulked using a high-modulus, silicone base  
25         product.  
26
- 27     E. Roof material shall be 18ga (1.214 mm) (minimum) aluminum sheet  
28         interlocking panels formed by computer numerical controlled equipment to  
29         create a tightly interlocking panel design with vertical standing ribs  
30
- 31
- 32     F. Interior walls shall be 18ga (1.214 mm) (minimum) aluminum sheet firmly  
33         attached to interlocking ribs of exterior wall panels utilizing ASTM shear  
34         and pull out rated self tapping screws on 24 inches (610 mm) maximum  
35         centers. Each interior wall panel shall be formed to receive adjacent  
36         panels at overlaps.  
37
- 38     G. Ceiling panels shall be 18ga (1.214 mm) (minimum) aluminum sheet  
39         interlocking panels formed by computer numerical controlled equipment to  
40         create a tightly interlocking panel design with vertical standing ribs.  
41
- 42     H. Wall insulation shall be secured to exterior wall panels by glue pins, straps  
43         or other means prior to assembly of interior wall (liner) panels. Ceiling  
44         insulation shall be laid between interlocking ceiling panels. Floor  
45         insulation shall be sprayed urethane foam.  
46

- 1           I.     Insulation levels:
- 2
- 3        1.     Ceiling: Fiberglass batt (R15).
- 4
- 5        2.     Walls: Fiberglass batt (R15).
- 6
- 7        3.     Floor: 1 inch (25mm) Spray Applied Polyurethane insulation (R6).
- 8        4.     Equipment Access Doors: 1 inch (25 mm) urethane board (R 7.2)  
9                  with welded metal cover.
- 10      5.     Personnel Doors: (R2.4).
- 11
- 12     J.     The entire roof perimeter shall be trimmed with a fascia that aesthetically  
13                  hides the standing rib roof edges, prevents high velocity rainwater run-off,  
14                  and prevents built-up ice from sliding off the roof in large sheets.
- 15
- 16     K.     All permanent components shall consist of materials that do not freely  
17                  support combustion. Use of wood or any other materials that freely  
18                  support combustion shall not be allowed as permanent components.

20    **2.04 PERSONNEL AND EQUIPMENT ACCESS DOORS**

- 21
- 22    A.     Personnel Doors: #4080 Single leaf, double wall, honeycomb reinforced  
23                  personnel door, aluminum, #18ga (1.214 mm), 1-3/4 inches (44 mm) thick.  
24                  Required as shown with hardware as indicated.
- 25
- 26        1.     Panic Hardware: Thumb latch with keyed cylinder lock. Button  
27                  type aluminum (Magnokrom #N1550-5XOT53-US28). ANSI/SDI  
28                  100 compliant.
- 29
- 30        2.     Closer with stopping arm (Yale series #50).
- 31
- 32        3.     Wind safety chain.
- 33
- 34        4.     Drip shield.
- 35
- 36        5.     Threshold: Aluminum.
- 37
- 38        6.     Factory frame.
- 39
- 40        7.     Caps in top.
- 41
- 42        8.     Weather stripping.
- 43
- 44        9.     Stainless steel hinges.
- 45
- 46        10.    R2.4 thermal resistance rating.

- 1           11. Fire resistance rating and label (1.5 hour minimum rating).  
2  
3           12. "Danger High Voltage / Keep Out" signs.  
4  
5  
6           B. Equipment Rear-Access Doors in Exterior Walls: 12ga (1.214 mm)  
7           Aluminum.:  
8           :  
9           1. Posts (mullions) shall be easily removable (allowing total door and  
10          post removal) providing full open access, of (at least) any four  
11          continuous doors without temporary structural reinforcement, for  
12          potential equipment replacement or the addition of future  
13          equipment.  
14  
15          2. NEMA 3R rating.  
16  
17          3. Stainless steel continuous piano type hinge.  
18  
19          4. Stainless steel pad lockable vault handle.  
20  
21          5. Three point latching system.  
22  
23          6. Full gasketing and drip shield.  
24  
25          7. Signage as appropriate for internal equipment.  
26  
27          8. Hold open device.  
28  
29          9. Metal inner skin over insulation welded to door.  
30  
31          10. "Danger High Voltage / Keep Out" signs.

32        2.05 FINISH

- 33  
34  
35  
36  
37  
38        A. All coatings shall be applied using an electrostatic application process as  
39          indicated. Unless specified differently the enclosure standard colors are  
40          as follows:  
41  
42          1. Interior and Exterior – ANSI 61  
43  
44  
45

- B. All exterior and interior surfaces shall be thoroughly cleaned prior to coating application per the coating manufacturer's recommended practice.
  - C. Exterior surfaces:
    - 1. Cleaning:
      - a. Clean exterior base surface to SSPC-SP3 (Standard of the Society for Protective Coatings for Power Tool Cleaning).
      - b. Clean all other surfaces to SSPC-SP1 (Solvent Cleaning).
    - 2. Primer:
      - a. Base: Apply epoxy mastic primer 2.0 Mils (0.05 mm) dry film thickness (DFT).
      - b. Walls, Roof and Fascia: Apply epoxy primer 1.5 Mils (0.04 mm) DFT.
    - 3. Finish: Apply DuPont Imron 3.5 HG high solids polyurethane enamel 1.8 Mils (0.045 mm) DFT.
    - 4. Field Touch-up Paint: One quart (ships inside structure).
  - D. Interior surfaces:
    - 1. Cleaning: Clean all surfaces to SSPC-SP1 (Solvent Cleaning).
    - 2. Primer: Apply epoxy primer 1.5 Mils (0.04 mm) DFT\*\*.
    - 3. Finish: Apply DuPont Imron 3.5 HG high solids polyurethane enamel 1.8 Mils (0.045 mm) DFT\*\*.
    - 4. Field Touch-up Paint: One quart (ships inside structure).
  - E. Floor (Top Side):
    - 1. Cleaning: Clean all surfaces to SSPC-SP1 (Solvent Cleaning).
    - 2. Primer: Apply epoxy mastic primer 1.5 Mils (0.04 mm) DFT\*.
    - 3. Finish: Apply DuPont Imron 3.5 HG high solids polyurethane enamel 1.8 Mils (0.045 mm) DFT\* with non-skid additive.
    - 4. Field Touch-up Paint: One quart (ships inside structure).
  - F. Base and Floor (Underside):

- 1
- 2       1. Cleaning:
- 3
- 4           a. Clean all surfaces to SSPC-SP3 (Power Tool Cleaning).
- 5
- 6           b. Clean to remove oil, dirt, water, and loose rust.
- 7
- 8       2. Undercoat: Apply Transcoat #101 10 Mils (0.025 mm) DFT.
- 9
- 10           a. VOC: 0.0 g/l.
- 11
- 12           b. Federal Specification TT-C-520B.
- 13
- 14           c. Asbestos Free.
- 15
- 16           d. Flame Spread Rating: 0.
- 17
- 18       G. All wall mounted HVAC units shall be aluminum exterior and painted the
- 19           same color as the enclosure's exterior walls.

1  
2 2.06 ELECTRICAL UTILITIES  
3

- 4 A. Conduit:
- 5     1. Interior Conduit: Exposed EMT Conduit (set screw fittings) as required  
6         by NEC. 3/4 inch (19 mm) diameter minimum ANSI C80.3.  
7
- 8     2. Exterior Conduit: Exposed Rigid Aluminum Conduit as required by  
9         NEC. 3/4 inch (19 mm) diameter minimum ANSI C80.1  
10
- 11 B. All utilities shall be UL listed and recognized devices.  
12
- 13 C. All utilities shall be functionally tested prior to completion.  
14
- 15 D. Interior Lights: 48 inches LED as required meeting lighting requirements of  
16         30 foot candles at 3 foot above floor.  
17
- 18     1. LED Wrap Around Acrylic Lens, Surface Mount.  
19
- 20 E. Emergency Light(s): LED Combination Emergency Light / Exit Sign (Red).  
21
- 22     1. Power Rating: 15W, AC Input Voltage 120/277 Volts DC Output  
23         Voltage 6 Volts, Lead Calcium Battery, Lamp LED / Color Red.  
24
- 25 F. Exterior Lights: LED lighting where indicated or required.  
26
- 27     1. UL 1598 for Wet Locations.  
28
- 29     2. Internal photocell.  
30
- 31     3. Lamp (included w/fixture).  
32
- 33     4. HOA switch specification grade, as indicated.  
34
- 35 G. Light Switch: 3-way, specification grade 20A 125V, where indicated.  
36
- 37 H. Duplex Receptacles: Specification grade 20A 125V GFCI duplex receptacle,  
38         where indicated or required.  
39
- 40 I. Wire Type "XHHW"  
41
- 42     1. Power Wiring: #12 AWG minimum (sized as required for load).  
43
- 44     2. HVAC Control Wiring: #18 AWG thermostat cable.  
45
- 46

1           J. AC Distribution Panel: 480V Primary – 208Y/120V secondary 45kVA rated  
2           176 degree F (80 degree C) rise.

4           L. AC Distribution Panel: 208Y/120VV, 3 phase, 4 wire, 42 circuit bolt in  
5           breakers, surface mount, 10kAIC rated with 225A main breaker.

7           M. Wiring Circuits:

- 9           1. 480V AC panel to customer equipment.
- 10          2. Transformer to 480V panel.
- 12          3. AC Distribution panel to Transformer.
- 14          4. AC distribution panel to interior lighting.
- 16          5. AC distribution panel to exterior lighting.
- 18          6. AC distribution panel to emergency lighting.
- 20          7. AC distribution panel to receptacles.
- 22          8. 480 or 208V AC distribution panel to HVAC units.

25          N. Grounding:

- 27          1. Ground pads: 4-hole Stainless Steel Welded to base.
- 29          2. 2-Hole Copper Ground Lug #4/0.

### 33        2.07 CONTROL SYSTEM EQUIPMENT:

35          A. Equipment listed shall be supplied and installed, unless noted otherwise.

### 37        2.08 CUSTOMER FURNISHED ELECTRICAL EQUIPMENT:

39          A. Equipment listed shall be supplied by Customer and installed, unless  
40          noted otherwise.

### 43        2.09 HVAC SYSTEM

- 1           A. HVAC system shall maintain the maximum interior temperature required  
2           with consideration to ambient conditions and the specified internal  
3           equipment total heat load.
- 4           B. HVAC Unit(s): Size and quantity as required to maintain interior design  
5           temperatures and redundancy requirements. Industrial quality, vertical,  
6           self-contained, wall mounted unit(s) with aluminum fin, ruffle tube copper  
7           coil:  
8
- 9           1. Cooling capacity: \_\_\_\_ tons capacity as required to meet design  
10          temperatures as specified in section 1.4 D.  
11          2. Heating capacity: \_\_\_\_ Kw as required to meet design  
12          temperatures as specified in section 1.4 D.  
13          3. Thermostat, Auto Change Over, Digital, F or C Display:  
14
- 15           a. Smart recovery (heating mode).  
16           b. Droopless control, 4 cycles/hr.  
17           c. Backlit display.  
18           d. Settings never lost during power failure.  
19           e. 5 minute compressor protection.  
20           f. Separate set points for heating and cooling.  
21           g. Battery-less operation.  
22           h. Electro-Mechanical relay design.  
23
- 24           4. Low Pressure Switch.  
25           5. High Pressure Switch.  
26           6. Low Ambient Control.  
27           7. Compressor anti-cycle relay.  
28           8. Alarm Relay.  
29           9. Barometric Damper.  
30           10. Supply and Return Grills.  
31           11. Pleated Filter 2 inches (51 mm) MERV 8.  
32           12. R410A Refrigerant.

34           2.10 ACCESSORIES

- 35           A. Removable Lift Lugs: Spaced along base length at approximate 15 feet  
36           (4.6 m) centers per shipping piece.
- 37           B. Floor Cutouts: Under equipment for cable entry and exit from below floor  
38           with gasketed 12ga (1.214 mm) galvanized top cover plates attached to  
39           the floor by screws.
- 40           C. Wall penetrations as required.
- 41           D. Option accessories:

- 1
- 2       1. Removable End Wall: Provide demountable end wall across the  
3           entire width to allow for future expansion and aisle. Main structural  
4           reinforcing post located in the removable wall may remain following  
5           expansion; however, it shall be located not to interfere with the  
6           equipment line-up extension.
- 7       2. Stairs and Platforms.
- 8       3. Computer or sub floors.
- 9       4. Bulk heads (wall cutouts) for top entry/exit of power cables.
- 10      5. Gutters and downspouts.
- 11      6. Many more, please consult for available options.
- 12

13     **2.11 FACTORY TESTING**

14

- 15       A. Finish: The following minimum finish system test results shall be certified  
16           (from in process, manufacturer's samples) by independent laboratory tests  
17           performed under ASTM criteria. Copies of the test results and certification  
18           shall be submitted for review:
- 19
- 20       1. Substrate: Prepared Aluminum sheet: Corrosion Resistance (Salt spray):  
21           Passes 2500 hours per ASTM B117.
- 22
- 23
- 24       B. Control systems: As recommended by the manufacturer.
- 25

26     **PART 3 - EXECUTION**

27

28     **3.01 EXAMINATION**

29

- 30       A. Do not begin installation until supporting foundation or building pad has  
31           been properly prepared.
- 32

33     **3.02 PREPARATION**

34

- 35       A. Locate and verify utility services and structural foundation prior to  
36           installation.
- 37
- 38       B. Prepare foundation using the methods recommended by the  
39           manufacturer.
- 40

41     **3.03 INSTALLATION**

42

- 43       A. enclosure can be installed by manufacturer installation services team.
- 44

45     **3.04 PROTECTION**

46

1           A. Protect delivered units, accessories and installed products until completion  
2           of project.

3  
4           B. Touch-up, repair or replace damaged products before Substantial  
5           Completion.

6  
7  
8  
9  
10  
11           END OF SECTION 16050  
12  
13  
14  
15  
16  
17

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## SECTION 16110

### RACEWAYS

## PART 1 – GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this Section.
  - B. This Section is a Division 16 Basic Electrical Materials and Methods section and is part of each Division 16 section making reference to electrical raceways specified herein.

## 1.02 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules.
  - B. Types of raceways specified in this section include the following:

**Heavy Wall Aluminum  
PVC Schedule 80  
Liquid-tight flexible PVC coated metal conduit**

## 1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
  - B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.
  - C. Codes and Standards:
    - 1. UL Compliance Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

1      PART 2 – PRODUCTS

2      2.01 METAL CONDUIT AND TUBING

- 5            A. General: Provide aluminum conduit, tubing and fittings of types, grades,  
6            sizes and weights (wall thickness) for each service indicated.
- 8            B. Where types and grades are not indicated, provide proper selection  
9            determined by installer to fulfill wiring requirements and comply with  
10          applicable portions of NEC for raceways.
- 12          C. Rigid aluminum Conduit: Provide rigid aluminum, heavy wall, threaded  
13          type.
- 15          D. Liquid-Tight Flexible Non-metallic Conduit: Provide liquid-tight flexible  
16          non-metallic conduit for all motor connections.
- 18          E. Conduit Fittings: Couplings and connectors for conduit sizes 2" and  
19          smaller shall be aluminum hex-nut, expansion-gland type. Aluminum set  
20          screw type fittings may be used for conduit sizes 2½" and larger.

22      2.02 NONMETALLIC CONDUIT AND DUCTS

- 24            A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes  
25          and weights for each service indicated. Where types and grades are not  
26          indicated, provide proper selection determined by installer to fulfill wiring  
27          requirements which comply with provisions for NEC for raceways.
- 29            B. Electrical Plastic Conduit:
  - 31            1. Heavy Wall Conduit: Schedule 80, 90°C, UL-rated, constructed of  
32            Schedule 80, 90 polyvinyl chloride. For direct burial, UL listed and in  
33            conformity with NEC Article 347.
  - 34            2. Standard Wall Conduit: PVC UL rated, constructed of Schedule 40  
35            polyvinyl chloride. For exterior above grade exposure, direct exposure  
36            to sunlight, UL listed for direct sunlight and in conformity with NEC  
37            Article 352.
- 39            C. Conduit and Tubing Accessories: Provide conduit, tubing and duct  
40          accessories of types, sizes and materials, complying with manufacturer's  
41          published product information, which mate and match conduit and tubing.
- 43            D. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types,  
44          shapes and sizes as required to fulfill job requirements and NEC  
45          requirements. Construct conduit bodies with threaded conduit-entrance

1           ends, removable covers, either cast or galvanized steel and corrosion-  
2           resistant screws.

3           PART 3 – EXECUTION

5           3.01   OBSERVATION

- 7           A.     Examine areas and conditions under which raceways are to be installed  
8           and substrate which will support raceways. Notify contractor in wiring of  
9           conditions detrimental to proper completion of the work. Do not proceed  
10          with work until unsatisfactory conditions have been corrected in manner  
11          acceptable to installer.

13          3.02   INSTALLATION OF RACEWAYS

- 15          A.     General: Raceways run below grade, under floors on grade or in concrete  
16          shall be PVC heavy wall type (Schedule 80) conduit, provided rigid  
17          aluminum conduit is used on elbows and risers to boxes, cabinets, etc.
- 19          B.     Sizes of raceways shall be not less than NEC requirements and shall not  
20          in any case be less than indicated on drawings. Larger size raceways  
21          and/or pull boxes shall be installed if there is excessive length unbroken  
22          run or excessive number of bends. Combining of circuits other than those  
23          indicated on the drawings will not be permitted.
- 25          C.     Coordinate with other work, including wires/cables, boxes and panel work  
26          as necessary to interface installation of electrical raceways and  
27          components with other work.
- 29          1.     Avoid use of similar metals throughout system to eliminate  
30          possibility of electrolysis. Where dissimilar metals are in contact,  
31          coat surfaces with corrosion inhibiting compound before  
32          assembling.
- 34          2.     Use roughing-in dimensions of electrically operated unit furnished  
35          by supplier. Set conduit and boxes for connection to units only  
36          after receiving review of dimensions and after checking location  
37          with other trades.
- 39          3.     Provide nylon pullcord in empty conduits where indicated. Test all  
40          empty conduits with ball mandrel. Clear any conduit which rejects  
41          ball mandrel. Pay costs involved for restoration of conduit and  
42          surrounding surfaces to original condition.
- 44          4.     Use liquid-tight flexible conduit where subjected to one or more of  
45          the following conditions:

- 1                   a.     Exterior location.  
2                   b.     Moist or humid atmosphere where condensate can be  
3                   expected to accumulate.  
4                   c.     Corrosive atmosphere.  
5                   d.     Subjected to water spray or dripping oil, water or grease.  
6
- 7                   D.     Cut conduits straight, ream properly and cut threads for heavy wall conduit  
8                   deep and clean.  
9
- 10                  E.     Field-bend conduit with benders designed for purpose so as not to distort  
11                  nor vary internal diameter.  
12
- 13                  F.     Fasten conduit terminations in sheet metal enclosures by two (2) locknuts  
14                  and terminate with bushing. Install lock nuts inside and outside enclosure.  
15
- 16                  G.     Conduits are not to cross pipe shafts or ventilating duct openings.  
17
- 18                  H.     Keep conduits a minimum distance of 6" from parallel runs of flues, hot  
19                  water pipes or other sources of heat. Do not install horizontal raceway  
20                  runs below water and steam piping.  
21
- 22                  I.     Support riser conduit at each floor level with clamp hangers.  
23
- 24                  J.     Use of running threads at conduit joints and terminations is prohibited.  
25                  Where required, use 3-piece union or split couplings.  
26
- 27                  K.     Complete installation of electrical raceways before starting installation of  
28                  cables/wires within raceways.  
29
- 30                  L.     Concealed Conduits:  
31
- 32                  1.     Metallic raceways installed underground or in floors below grade, or  
33                  outside are to have conduit threads painted with corrosion-inhibiting  
34                  compound before couplings are assembled. Draw up coupling and  
35                  conduit sufficiently tight to ensure water tightness.  
36
- 37                  2.     For floors-on-grade, install conduits under concrete slab.  
38
- 39                  3.     Install underground conduits a minimum of 24" below finished  
40                  grade.  
41
- 42                  4.     All conduits installed below grade or under concrete slab to be  
43                  minimum of 3/4 inch.  
44
- 45                  M.     Conduits in Concrete Slab:  
46

- 1        1. Place conduits between bottom reinforcing steel and top reinforcing  
2                  steel. Place conduits either parallel or at 90° to main reinforcing  
3                  steel.
- 4        2. Separate conduits by not less than diameter of largest conduit to  
5                  ensure proper concrete bond.
- 6        3. Conduits crossing in slab must be reviewed for proper cover by  
7                  engineer.
- 8        4. Embedded conduit diameter is not to exceed one-third (1/3) of slab  
9                  thickness.
- 10      N. Install conduits as not to damage or run through structural members.  
11                  Avoid horizontal or cross runs in building partitions or side walls.
- 12      O. Exposed Conduits:
  - 13                  1. Install exposed conduits and extensions from concealed conduit  
14                  systems neatly, parallel with or at right angles to walls of building.
  - 15                  2. Install exposed conduit work as not to interfere with ceiling inserts,  
16                  lights or ventilation ducts or outlets.
  - 17                  3. Support exposed conduits by use of hangers, clamps or clips.  
18                  Support conduits minimum of 18" on each side of bends and outlet  
19                  boxes and on spacing not to exceed 6'-0".
  - 20                  4. Run conduits for outlets on waterproof walls exposed. Set anchors  
21                  for supporting conduit on waterproof wall in waterproof cement.
  - 22                  5. Above requirements for exposed conduits also apply to conduits  
23                  installed in space above hung ceilings and in crawl spaces.
- 24      P. Non-Metallic Conduits:
  - 25                  1. Make solvent cemented joints in accordance with recommendations  
26                  of manufacturer.
  - 27                  2. Install PVC conduits in accordance with NEC and in compliance  
28                  with local utility practices.
- 29      Q. Conduit Fittings:

- 1        1. Construct locknuts for securing conduit to metal enclosure with  
2              sharp edge for digging into metal and ridged outside circumference  
3              for proper fastening.
- 4        2. Bushings for terminating conduits smaller than 1" and are to have  
5              flared bottom and ribbed sides, with smooth upper edges to prevent  
6              injury to cable insulation.
- 7        3. Install insulated type bushings for terminating conduits 1" and  
8              larger. Bushings are to have flared bottom and ribbed sides.  
9              Upper edge to have phenolic insulating ring molded into bushing.
- 10      4. Bushing of standard or insulated type to have screw type grounding  
11              terminal.
- 12      5. Miscellaneous fittings such as reducers, chase nipples, 3-piece  
13              unions, split couplings and plugs to be specifically designed for  
14              their particular application.

### 20      3.03 FIELD QUALITY CONTROL

- 21      A. General: Mechanically assemble metal enclosures and raceways for  
22              conductors to form continuous electrical conductor and connect to  
23              electrical boxes, fittings and cabinets as to provide effective electrical  
24              continuity and rigid mechanical assembly.
- 25      B. Avoid use of dissimilar metals throughout system to eliminate possibility of  
26              electrolysis. Where dissimilar metals are in contact, coat all surfaces with  
27              corrosion-inhibiting compound before assembling.
- 28      C. Install expansion fittings in all raceways wherever structural expansion  
29              joints are crossed.
- 30      D. Make changes in direction of raceway run with proper fittings supplied by  
31              raceway manufacturer. No field bends of raceway sections will be  
32              permitted.
- 33      E. Properly support and anchor raceways for their entire length by structural  
34              materials. Raceways are not to span any space unsupported.
- 35      F. Use boxes as supplied by raceway manufacturer wherever junction, pull,  
36              or device boxes are required. Standard electrical "handy" boxes, etc. shall  
37              not be permitted for use with surface raceway installations.
- 38      G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to  
39              maintain integrity of construction. All products, materials and methods of  
40              installation shall be UL approved and meet NFPA requirements.

- H. Unless otherwise noted on drawings, notified by engineer and/or authorities having jurisdiction, the following materials may be used:
    - 1. Rock Wool: Minimum four pound cubit foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.
    - 2. Concrete and masonry are also approved fire stop materials by NFPA 90A.
    - 3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturer's recommendations shall be strictly followed.
  - I. Submit complete data on fire-stopping materials and construction methods for review by engineer before proceeding with work.

END OF SECTION 16110

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1 SECTION 16120  
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3 WIRES AND CABLES  
4

5 PART 1 - GENERAL  
6

7 1.01 RELATED DOCUMENTS:  
8

- 9       A. Drawings and general provisions of Contract, including General and  
10      Supplementary Conditions and Division 1 Specification sections, apply to  
11      work of this Section.  
12  
13       B. This Section is a Division 16 Basic Electrical Materials and Methods  
14      section, and is part of each Division 16 section making reference to wires  
15      and cables specified herein.  
16

17 1.02 DESCRIPTION OF WORK:  
18

- 19       A. Extent of electrical wire and cable work is indicated by drawings and  
20      schedules.  
21  
22       B. Types of electrical wire, cable, and connectors specified in this Section  
23      include the following:  
24  
25          Copper conductors  
26          Split-bolt connectors  
27          WIRENUT connectors  
28  
29       C. Applications of electrical wire, cable, and connectors required for project  
30      are as follows:  
31  
32           1. For power distribution circuits  
33           2. For lighting circuits  
34           3. For motor-branch circuits  
35           4. For control circuits  
36

37 1.03 QUALITY ASSURANCE:  
38

- 39       A. Manufacturers: Firms regularly engaged in manufacture of electrical wire  
40      and cable products of types, sizes, and ratings required, whose products  
41      have been in satisfactory use in similar service for not less than five years.  
42  
43       B. Installer's Qualifications: Firm with at least three years of successful  
44      installation experience with projects utilizing electrical wiring and cabling  
45      work similar to that required for this project.  
46

- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color-coding of electrical wires and cables.
  - D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
  - E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
  - F. The following systems of color-coding shall be strictly adhered to:

Grounded Leads	Green
Grounded Neutral Leads	White
277/480 Volt, Ungrounded Phase Wires	Brown, Orange and Yellow
120/208 Volt, Ungrounded Phase Wires	Red, Blue, Black
  - G. The color code assigned to each phase wire shall be consistently followed throughout.
  - H. Where existing base building color-coding differs from color-coding assigned herein. Contractor shall use existing color coding as required to maintain consistency. Advise engineer in writing of color-coding to be used.

#### **1.04 DELIVERY, STORAGE, AND HANDLING:**

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.
  - B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
  - C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

## PART 2 - PRODUCTS

## 2.01 Building Wires:

- A. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.

- 1           B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for  
2           dry, damp, and wet locations. Conductor insulation with single type  
3           marking THHN 90°C (194°F) may be used for dry locations only.  
4

5           **PART 3 – EXECUTION**  
6

7           **3.01 INSTALLATION OF WIRES AND CABLES:**  
8

- 9           A. General: Install electrical cables, wires and wiring connectors as  
10          indicated, in compliance with applicable requirements of NEC, NEMA, UL,  
11          and NECA's "Standard of Installation" and in accordance with recognized  
12          industry practices.  
13
- 14           B. Unless otherwise noted, all branch circuit conductors shall be No. 12  
15          AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless  
16          noted otherwise.  
17
- 18           C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch  
19          circuits.  
20
- 21           D. Pull conductors simultaneously where more than one is being installed in  
22          same raceway.  
23
- 24           E. Use pulling compound or lubricant, where necessary. Compound used  
25          must not deteriorate conductor or insulation.  
26
- 27           F. Use pulling means including, fish tape, cable, rope, and basket weave  
28          wire/cable grips which will not damage cables or raceway.  
29
- 30           G. Keep conductor splices to minimum.  
31
- 32           H. Install splices and tapes which possess equivalent-or-better mechanical  
33          strength and insulation ratings than conductors being spliced. Use splices  
34          and tap connectors which are compatible with conductor material.  
35

36           **3.02 FIELD QUALITY CONTROL:**  
37

- 38           A. Prior to energization of circuitry, check installed feeder wires and cables  
39          with megohm meter to determine insulation resistance levels to ensure  
40          requirements are fulfilled. A list of feeders tested shall be submitted to the  
41          engineer indicating the insulation resistance level for each cable.  
42
- 43           B. Prior to energization, test wires and cables for electrical continuity and for  
44          short-circuits.  
45

1           C. Subsequent to wire and cable hook-ups, energize circuitry and  
2           demonstrate functioning in accordance with requirements. Where  
3           necessary, correct malfunctioning units, and then retest to demonstrate  
4           compliance.

5

6           END OF SECTION 16120

1 SECTION 16135

2  
3 ELECTRICAL BOXES & FITTINGS

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12  
13 B. This Section is a Division 16 Basic Electrical Materials and Methods  
14 section, and is a part of each Division 16 section making reference to  
15 electrical wiring boxes and fittings specified herein.

16  
17 1.02 DESCRIPTION OF WORK:

- 18  
19 A. Extent of electrical box and associated fitting work is indicated by  
20 drawings and schedules.
- 21  
22 B. Types of electrical boxes and fittings specified in this Section include the  
23 following:  
Control Panels  
Outlet boxes.  
Junction boxes.  
Pull boxes.

24  
25 1.03 QUALITY ASSURANCE:

- 26  
27 A. Manufacturers: Firms regularly engaged in the manufacture of electrical  
28 boxes and fittings of types, sizes, and capacities required, whose products  
29 have been in satisfactory use in similar service for not less than three (3)  
30 years.
- 31  
32 B. Installer's Qualifications: Firms with at least three (3) years of successful  
33 installation experience on projects utilizing electrical boxes and fittings  
34 similar to those required for this project.
- 35  
36 C. NEC Compliance: Comply with NEC as applicable to construction and  
37 installation of electrical wiring boxes and fittings.
- 38  
39 D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-  
40 Series, and UL 886 pertaining to electrical boxes and fittings. Provide  
41 electrical boxes and fittings which are UL listed and labeled.

1  
2 PART 2 - PRODUCTS  
3

4 2.01 FABRICATED MATERIALS:  
5

- 6       A. Outlet Boxes: Provide aluminum outlet wiring boxes, of shapes, cubic inch  
7       capacities, and sizes (including box depths as indicated), suitable for  
8       installation at respective locations. Construct outlet boxes with mounting  
9       holes and with cable and conduit-size knockout openings in bottom and  
10      sides.
- 11      1. Outlet Box Accessories: Provide outlet box accessories as required  
12      for each installation; including box supports, mounting ears and  
13      brackets, wallboard hangers, box extension rings, fixture studs,  
14      cable clamps and metal straps for supporting outlet boxes, which  
15      are compatible with outlet boxes being used to fulfill installation  
16      requirements for individual wiring situations.
- 17       B. Device Boxes: Provide aluminum, non-gangable device boxes, of shapes,  
18       cubic inch capacities, and sizes (including box depths as indicated),  
19       suitable for installation at respective locations. Construct device boxes for  
20       flush mounting with mounting holes, and with cable-size knockout  
21       openings in bottom and ends and with threaded screw holes in end plates  
22       for fastening devices. Provide cable clamps and corrosion-resistant  
23       screws for fastening cable clamps and for equipment type grounding.
- 24      1. Device Box Accessories: Provide device box accessories as  
25      required for each installation; including mounting brackets, device  
26      box extensions, switch box supports, plaster ears, and plaster  
27      board expandable grip fasteners, which are compatible with device  
28      boxes being utilized to fulfill installation requirements for individual  
29      wiring situations.
- 30      2. Flush mounted wall outlets shall be 4" square boxes or gang  
31      boxes, not less than 1½" deep. Boxes shall be provided with  
32      extension rings and/or covers with sufficient depth to bring the  
33      covers flush with the finished wall.
- 34      3. Boxes for flush mounting in concrete block work with one or two  
35      devices shall have covers with square corners on the raised portion  
36      of the cover. The covers shall have a sufficient amount of depth to  
37      be flush with the face of the block. The bottom side of the covers  
38      or boxes shall be installed at the masonry course nearest to the  
39      dimension specified or noted.
- 40      4. Boxes for surface mounting in concrete block work with one or two  
41      devices shall have covers with square corners on the raised portion  
42      of the cover. The covers shall have a sufficient amount of depth to  
43      be flush with the face of the block. The bottom side of the covers  
44      or boxes shall be installed at the masonry course nearest to the  
45      dimension specified or noted.
- 46

1           4. Outlet boxes for exposed wall mounting and outdoor installation  
2           shall be cast aluminum boxes with suitable cast aluminum covers.  
3           Weatherproof receptacle covers shall have spring hinged lids.

4           C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-aluminum, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, cast-aluminum face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

5           D. Junction and Pull Boxes: Provide aluminum junction and pull boxes, with  
6           screw-on covers; of types, shapes and sizes, to suit each respective  
7           location and installation; with welded seams and equipped with stainless  
8           steel nuts, bolts, screws and washers. All junction boxes shall be  
9           designated with permanent marker circuit numbers and panelboard  
10          numbers of circuits contained within.

11          E. Control Panels/Enclosures:

12           1. The control panel/enclosures shall contain, as a minimum, devices  
13           and equipment indicated on the drawings or other sections of these  
14           specifications. All control panel/enclosures shall contain interior  
15           mounting plate.

16           2. The control panel enclosure shall be NEMA 4X stainless steel,  
17           Underwriters Laboratories (UL) 50 type 4 listed.

18           3. The control panel enclosure shall be NEMA 9 (Explosion Proof) for  
19           Class 1, Div. 1 & 2 environment.

20           4. There shall be permanently affixed to the interior side of the  
21           exterior enclosure door both a nameplate and a 10" x 12" pocket  
22           for drawing storage. The nameplate shall contain the following  
23           information: voltage, phase, date manufactured and intended use  
24           – equipment service or function.

25           5. Inner safety door (dead front) shall be aluminum.

26           6. Provide surge arrestor per county requirements.

27           7. Contractor shall furnish shop drawings for control panel. Include  
28           dimension, mounting and material requirements of control panel.  
29           Furnish wiring diagrams of all internal components and devices.  
30           Schematic diagram of system and PLC connection diagrams and  
31           data sheet and programming functions. Furnish operating and  
32           maintenance and programming manuals.

1      PART 3 - EXECUTION

2      3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

- 5      A. General: Install electrical boxes and fittings as indicated, in accordance  
6      with manufacturer's written instructions, applicable requirements of NEC,  
7      and in accordance with recognized industry practices to fulfill project  
8      requirements.
- 9      B. Coordinate installation of electrical boxes and fittings with wire/cable,  
10     wiring devices, and raceway installation work.
- 11     C. Provide weather-tight outlets for interior and exterior locations exposed to  
12     weather or moisture.
- 13     D. Provide knockout closures to cap unused knockout holes where blanks  
14     have been removed.
- 15     E. Install electrical boxes in those locations which ensure ready accessibility  
16     to enclosed electrical wiring. All existing and new junction boxes within  
17     the project area shall be made accessible. Relocate existing junction  
18     boxes as required to comply with the NEC.
- 19     F. Metallic and approved nonmetallic electrical outlet boxes may be installed  
20     in vertical fire resistive assemblies classified as 2-hour or less without  
21     affecting the fire classification, provided such openings occur on one side  
22     only in each framing space and that openings do not exceed 16 square  
23     inches. Boxes located opposite sides of walls or partitions shall be  
24     separated by a horizontal distance of 24".
- 25     G. In openings larger than 16 square inches, the wall shall be built around  
26     openings so as not to interfere with the integrity of the wall rating.
- 27     H. All clearances between such boxes and the gypsum board shall be  
28     completely filled with joint compound or other approved material.
- 29     I. Position recessed outlet boxes accurately to allow for surface finish  
30     thickness.
- 31     J. Set floor boxes level and flush with finish flooring material.
- 32     K. Fasten electrical boxes firmly and rigidly to substrates, or structural  
33     surfaces to which attached, or solidly embed electrical boxes in concrete  
34     or masonry.

1  
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3       L. Subsequent to installation of boxes, protect boxes from construction  
4                   debris and damage.

END OF SECTION 16135

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1 SECTION 16142

2  
3 ELECTRICAL CONNECTIONS FOR EQUIPMENT

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12  
13 B. This Section is a Division 16 Basic Electrical Materials and Methods  
14 section, and is part of each Division 16 section making reference to  
15 electrical connections for equipment specified herein.

16  
17 1.02 DESCRIPTION OF WORK:

- 18  
19 A. Extent of electrical connections for equipment is indicated by drawings  
20 and schedules. Electrical connections are hereby defined to include  
21 connections used for providing electrical power to equipment.
- 22  
23 B. Electrical connections for equipment, not furnished as integral part of  
24 equipment, are specified in other Division 16 sections, and are work of  
25 this Section.
- 26  
27 C. Motor starters and controllers not furnished as integral part of equipment  
28 are specified in applicable Division 16 sections and are work of this  
29 Section.
- 30  
31 D. Junction boxes and disconnect switches required for connecting motors  
32 and other electrical units of equipment are specified in applicable Division  
33 16 sections, and are work of this Section.
- 34  
35 E. Electrical identification for wire/cable conductors is specified in Division 16  
36 section, "Electrical Identification", and is work of this Section.
- 37  
38 F. Raceways and wires/cables required for connecting motors and other  
39 electrical units of equipment are specified in applicable Division 16  
40 sections, and are work of this Section.

41  
42 1.03 QUALITY ASSURANCE:

- 43  
44 A. Manufacturers: Firms regularly engaged in manufacture of electrical  
45 connectors and terminals, of types and ratings required, and ancillary  
46 connection materials, including electrical insulating tape, soldering fluxes,

1 and cable ties; whose products have been in satisfactory use in similar  
2 service for not less than five (5) years.

- 3
- 4 B. Installer's Qualifications: Firms with at least two (2) years of successful  
5 installation experience with projects utilizing electrical connections for  
6 equipment similar to that required for this project.
- 7
- 8 C. NEC Compliance: Comply with applicable requirements of NEC as to  
9 type products used and installation of electrical power connections  
10 (terminals and splices) for junction boxes, motor starters, and disconnect  
11 switches.
- 12
- 13 D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and  
14 Soldering Lugs for Use With Copper Conductors" including, but not limited  
15 to, tightening of electrical connectors to torque values indicated. Provide  
16 electrical connection products and materials which are UL listed and  
17 labeled.

18

## PART 2 - PRODUCTS

19

### 2.01 MATERIALS AND COMPONENTS:

- 20
- 21 A. General: For each electrical connection indicated, provide complete  
22 assembly of materials; including, but not necessarily limited to, pressure  
23 connectors, terminals (lugs), electrical insulating tape, cable ties,  
24 solderless wirenuts, and other items and accessories as needed to  
25 complete splices and terminations of types indicated. Metal shall not be  
26 used for outdoor applications. The contractor shall use aluminum for  
27 outdoor installations.

- 28
- 29 B. Metal Conduit, Tubing and Fittings, General: Provide metal conduit,  
30 tubing and fittings of types, grades, sizes and weights (wall thicknesses)  
31 indicated for each type service. Where types and grades are not  
32 indicated, provide proper selection as determined by installer to fulfill  
33 wiring requirements and comply with NEC requirements for raceways.  
34 Provide products complying with Division 16 Basic Electrical and in  
35 accordance with the following listing of metal conduit, tubing and fittings:

36

37 Rigid aluminum conduit.  
38 Rigid metal conduit fittings.  
39 Electrical metallic tubing.  
40 EMT fittings.  
41 Flexible metal conduit.  
42 Flexible metal conduit fittings.  
43 Liquid-tight flexible metal conduit.  
44 Liquid-tight flexible metal conduit fittings.

1  
2       C. Wires, Cables, and Connectors:

- 3  
4       1. General: Provide wires, cables, and connectors complying with  
5           Division 16 Basic Electrical Materials And Methods section "Wires  
6           and Cables".  
7  
8       2. Wires/Cables: Unless otherwise indicated, provide wires/cables  
9           (conductors) for electrical connections which match (including sizes  
10          and ratings) wires/cables which are supplying electrical power.  
11          Provide copper conductors with conductivity of not less than 98% at  
12          20°C (68°F).  
13  
14       D. Connectors and Terminals: Provide electrical connectors and terminals  
15          which mate and match (including sizes and ratings) with equipment  
16          terminals, and are recommended by equipment manufacturer for intended  
17          applications.

18  
19       **PART 3 - EXECUTION**

20       **3.01 OBSERVATION:**

- 21  
22       A. Observe area and conditions under which electrical connections for  
23          equipment are to be installed and notify contractor in writing of conditions  
24          detrimental to proper completion of the work. Do not proceed with the  
25          work until unsatisfactory conditions have been corrected in a manner  
26          acceptable to installer.

27  
28       **3.02 INSTALLATION OF ELECTRICAL CONNECTIONS:**

- 29  
30       A. Install electrical connections as indicated; in accordance with equipment  
31          manufacturer's written instructions, with recognized industry practices, and  
32          complying with applicable requirements of UL and NEC to ensure that  
33          products fulfill requirements.  
34  
35       B. Coordinate with other work, including wires/cables, raceway, and  
36          equipment installation as necessary to properly interface installation of  
37          electrical connections for equipment with other work.  
38  
39       C. Connect electrical power supply conductors to equipment conductors in  
40          accordance with equipment manufacturer's written instructions and wiring  
41          diagrams. Mate and match conductors of electrical connections for proper  
42          interface between electrical power supplies and installed equipment.

- 1           D. Maintain existing electrical service and feeders to occupied areas and  
2           operational facilities unless otherwise indicated, or when authorized  
3           otherwise in writing by owner or engineer. Provide temporary service  
4           during interruptions to existing facilities. When necessary, schedule  
5           momentary outages for replacing existing wiring systems with new wiring  
6           systems. When that "cutting-over" has been successfully accomplished,  
7           remove, relocate, or abandon existing wiring as indicated.
- 8           E. Cover splices with electrical insulating material equivalent to, or of greater  
9           insulation resistivity rating, than electrical insulation rating of those  
10          conductors being spliced.
- 11          F. Prepare cables and wires by cutting and stripping covering armor, jacket,  
12          and insulation properly to ensure uniform and neat appearance where  
13          cables and wires are terminated. Exercise care to avoid cutting through  
14          tapes which will remain on conductors. Also avoid "ringing" copper  
15          conductors while skinning wire.
- 16          G. Trim cables and wires as short as practicable and arrange routing to  
17          facilitate inspection, testing, and maintenance.
- 18          H. Provide flexible conduit for motor connections and other electrical  
19          equipment connections where subject to movement and vibration.
- 20          I. Provide liquid-tight flexible conduit for connection of motors and other  
21          electrical equipment where subject to movement and vibration; and also  
22          where connections are subjected to one or more of the following  
23          conditions:
- 24              1. Exterior location.  
25              2. Moist or humid atmosphere where condensate can be expected to  
26                 accumulate.  
27              3. Corrosive atmosphere.  
28              4. Water spray.  
29              5. Dripping oil, grease, or water.

30           **3.03 FIELD QUALITY CONTROL:**

- 31           A. Upon completion of installation of electrical connections, and after circuitry  
32          has been energized with rated power source, test connections to  
33          demonstrate capability and compliance with requirements. Ensure that  
34          direction of rotation of each motor fulfills requirement. Correct  
35          malfunctioning units at site, then retest to demonstrate compliance.

36           **END OF SECTION 16142**

SECTION 16143

## WIRING DEVICES

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
  - B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wiring devices specified herein.

## 1.02 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
  - B. Types of electrical wiring devices in this section include the following:
    - Receptacles.
    - Ground-fault circuit interrupters.
    - Switches.
    - Wallplates.

## 1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
  - B. Installer's Qualifications: Firm with at least two (2) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
  - C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
  - D. UL Compliance: Provide wiring devices which are UL listed and labeled.

## 1.04 SUBMITTALS:

1           A. Product Data: Submit manufacturer's data on electrical wiring devices.  
2

3           **PART 2 - PRODUCTS**

4           **2.01 ACCEPTABLE MANUFACTURERS:**

5           A. Manufacturers: Subject to compliance with requirements, manufacturers  
6           providing wiring devices which may be incorporated in the work include;  
7           but are not limited to, the following (for each type and rating of wiring  
8           device):  
9

10           Arrow-Hart, Cooper Industries  
11           Eagle Electric Manufacturing Co., Inc.  
12           Harvey Hubbell Inc.  
13           Pass and Seymour Inc.

14           **2.02 FABRICATED WIRING DEVICES:**

15           A. General: Provide factory-fabricated wiring devices, in types, colors, and  
16           electrical ratings for applications indicated and which comply with NEMA  
17           Standards. Pub/No. WD1. Provide ivory color devices except as otherwise  
18           indicated.

19           B. Receptacles:

- 20           1. All receptacles shall be the grounding type with ground connection  
21           made through an extra pole that shall be permanently connected to  
22           the green grounding conductor.  
23
- 24           2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole,  
25           three-wire receptacles, rated 20 amperes at 125 volts.  
26           Receptacles shall be Harvey Hubbell, Inc., Catalog No. 5362-I.  
27
- 28           3. Single receptacles for 20 amps, 120 volts service shall be two-pole,  
29           three-wire rated 20 amperes at 125 volts. Receptacles shall be  
30           Harvey Hubbell Inc., Catalog No. 5361-I.

31           C. Switches:

- 32           1. Snap: Provide toggle switches, rated 20 amperes at 120/277 volts,  
33           quiet type, and shall be UL approved without derating for tungsten  
34           lamp loads or inductive loads. All switches shall have a grounding  
35           terminal which shall be connected to the green grounding  
36           conductor. The following catalog numbers are Harvey Hubbell, Inc.  
37

1  
2                   Type                   Catalog No.  
3

4                   Single Pole           HBL 1221-I  
5  
6

7     **2.03 WIRING DEVICE ACCESSORIES:**  
8

- 9       A.     'In Use' covers for exterior receptacles.  
10  
11      B.     Weatherproof caps for switches.  
12

13     **PART 3 - EXECUTION**  
14

15     **3.01 INSTALLATION OF WIRING DEVICES:**  
16

- 17       A.     Install wiring devices as indicated, in accordance with manufacturer's  
18           written instructions, applicable requirements of NEC, NECA's "Standard of  
19           Installation", and in accordance with recognized industry practices to fulfill  
20           project requirements.  
21  
22       B.     Install wiring devices only in electrical boxes which are clean; free from  
23           excess building materials, dirt, and debris.  
24  
25       C.     Install wiring devices after wiring work is completed.  
26  
27       D.     Install wallplates after painting work is completed.  
28

29     **3.02 PROTECTION OF WALLPLATES AND RECEPTACLES:**  
30

- 31       A.     Upon installation of wallplates and receptacles, advise contractor  
32           regarding proper and cautious use of convenience outlets. At time of  
33           substantial completion, replace those items which have been damaged,  
34           including those burned and scored by faulty plugs.  
35

36     **3.03 GROUNDING:**  
37

- 38       A.     Provide equipment grounding connections for all wiring devices, unless  
39           otherwise indicated.  
40

41     **3.04 TESTING:**  
42

- 43       A.     Prior to energizing circuitry, test wiring for electrical continuity and for  
44           short-circuits. Ensure proper polarity of connections is maintained.  
45           Subsequent to energization, test wiring devices to demonstrate  
46           compliance with requirements.

1  
2  
3

END OF SECTION 16143

1 SECTION 16170

2  
3 CIRCUIT AND MOTOR DISCONNECTS

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12  
13 B. This Section is a Division 16 Basic Electrical Materials and Methods  
14 section, and is part of each Division 16 section making reference to circuit  
15 and motor disconnects specified herein.

16  
17 1.02 DESCRIPTION OF WORK:

- 18  
19 A. Extent of circuit and motor disconnect switch work is indicated on  
20 drawings and schedules.
- 21  
22 B. Types of circuit and motor disconnect switches in this Section include the  
23 following:  
24  
25 Equipment disconnects.  
26 Appliance disconnects.  
27 Motor-circuit disconnects.
- 28  
29 C. Wires/cables, raceways, and electrical boxes and fittings required in  
30 connection with circuit and motor disconnect work are specified in other  
31 Division 16 Basic Electrical Materials and Methods sections.

32  
33 1.03 QUALITY ASSURANCE:

- 34  
35 A. Manufacturers: Firms regularly engaged in manufacture of circuit and  
36 motor disconnect switches of types and capacities required, whose  
37 products have been in satisfactory use in similar service for not less than  
38 three (3) years.
- 39  
40 B. Installer's Qualifications: Firm with at least three (3) years of successful  
41 installation experience with projects utilizing circuit and motor disconnect  
42 work similar to that required for this project.
- 43  
44 C. NEC Compliance: Comply with NEC requirements pertaining to  
45 construction and installation of electrical circuit and motor disconnect  
46 devices.

- 1           D. UL Compliance: Comply with requirements of UL 98, "Enclosed and  
2           Dead-Front Switches." Provide circuit and motor disconnect switches  
3           which have been UL listed and labeled.
- 4           E. NEMA Compliance: Comply with applicable requirements of NEMA Stds.  
5           Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical  
6           Equipment (1000 Volts Maximum)."

7

8       **1.04 SUBMITTALS:**

- 9
- 10      A. Product Data: Submit manufacturer's data on circuit and motor  
11           disconnect switches.
- 12
- 13      B. Submit shop drawings in booklet form with separate sheet for each circuit  
14           and motor disconnect with proposed switch and accessories clearly  
15           identified on each sheet. Identify each device with corresponding names,  
16           abbreviations (numbers and lettering) to match terminology of contract  
17           documents.

18

19       **PART 2 - PRODUCTS**

20

21       **2.01 ACCEPTABLE MANUFACTURERS:**

- 22
- 23      A. Available Manufacturers: Subject to compliance with requirements,  
24           manufacturers offering circuit and motor disconnects which may be  
25           incorporated in the work are limited to the following:

26

27           Schneider/Square D  
28           ABB  
29           Cutler Hammer/Eaton

30

31       **2.02 FABRICATED SWITCHES:**

- 32
- 33      A. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type,  
34           NEMA 4X stainless steel enclosed safety switches, of types, sizes and  
35           electrical characteristics indicated; incorporating quick-make, quick-break  
36           type switches. Construct so that switch blades are visible in OFF position  
37           with door open. Equip with operating handle which is integral part of  
38           enclosure base and whose operating position is easily recognizable, and  
39           is padlockable in OFF position. Construct current carrying parts of high-  
40           conductivity copper, with silver-tungsten type switch contacts and positive  
41           pressure type reinforced fuse clips.
- 42
- 43      1. All fuses for safety switches shall be dual element, cartridge type.  
44           Fuses shall be Bussman "Fusetron" or Chase-Shawmut "Trionic."  
45           The contractor shall furnish and install proper size fuses where

1 required for all fusible equipment and shall furnish to the owner one  
2 spare fuse for each fuse installed.  
3

4 **PART 3 - EXECUTION**

5 **3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES:**

- 6
- 7 A. Install circuit and motor disconnect switches as indicated, complying with  
8 manufacturer's written instructions, applicable requirements of NEC,  
9 NEMA, NECA's "Standard of Installation", and in accordance with  
10 recognized industry practices.  
11
- 12 B. Install disconnect switches for use with motor-driven appliances and  
13 motors and controllers within sight of controller position unless otherwise  
14 indicated.  
15
- 16 C. Unless otherwise indicated, protective devices shall be mounted with top  
17 of cabinet or enclosure 6'-6" above finished floor; shall be properly  
18 aligned; and shall be adequately supported independently of the  
19 connecting raceways and other equipment. All steel shapes, etc.,  
20 necessary for the support of the equipment shall be furnished and  
21 installed where the building structure is not suitable for mounting the  
22 equipment directly thereon. Unless otherwise indicated, all branch circuit  
23 protective devices enclosures shall be NEMA type I, general purpose  
24 type. Branch circuit protective devices installed outdoors or exposed to  
25 the weather shall have weatherproof enclosures, NEMA Type 4X.  
26

27 **3.02 GROUNDING:**

- 28
- 29 A. Provide equipment grounding connections sufficiently tight to assure a  
30 permanent and effective ground for electrical disconnect switches where  
31 indicated.  
32

33 **3.03 FIELD QUALITY CONTROL:**

- 34
- 35 A. Subsequent to completion of installation of electrical disconnect switches,  
36 energize circuitry and demonstrate capability and compliance with  
37 requirements. Where possible, correct malfunctioning units at project site,  
38 then retest to demonstrate compliance. Otherwise remove and replace  
39 with new units and retest.  
40

41

42

43

44

45

END OF SECTION 16170

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2  
3  
4  
5

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1 SECTION 16190  
2  
3 SUPPORTING DEVICES  
4

5 PART 1 - GENERAL  
6

7 1.01 RELATED DOCUMENTS:  
8

- 9       A. Drawings and general provisions of Contract, including General and  
10      Supplementary Conditions and Division 1 Specification sections, apply to  
11      work of this Section.  
12  
13       B. This Section is a Division 16 Basic Electrical Materials and Methods  
14      section, and is a part of each Division 16 section making reference to  
15      electrical supporting devices specified herein.

16 1.02 DESCRIPTION OF WORK:  
17

- 18       A. Extent of supports, anchors, sleeves, and seals is indicated by drawings  
19      and schedules and/or specified in other Division 16 sections.  
20  
21       B. Types of supports, anchors, sleeves, and seals specified in this Section  
22      include the following:  
23  
24           Clevis hangers.  
25           One-hole conduit straps.  
26           Two-hole conduit straps.  
27           Round steel rods.  
28           Expansion anchors.  
29           Toggle bolts.  
30           Wall and floor seals.  
31           Corn Clamps.  
32  
33  
34       C. Supports, anchors, sleeves, and seals furnished as part of factory  
35      fabricated equipment are specified as part of that equipment assembly in  
36      other Division 16 sections.

37 1.03 QUALITY ASSURANCE:  
38

- 39       A. Manufacturers: Firms regularly engaged in manufacture of supporting  
40      devices, of types, sizes, and ratings required, whose products have been  
41      in satisfactory use in similar service for not less than three (3) years.  
42  
43       B. Installer's Qualifications: Firm with at least three (3) years of successful  
44      installation experience with projects utilizing electrical supporting device  
45      work similar to that required for this project.  
46

1           C. NECA Compliance: Comply with National Electrical Contractors  
2           Association's "Standard of Installation", pertaining to anchors, fasteners,  
3           hangers, supports, and equipment mounting.

4           D. UL Compliance: Provide electrical components which are UL listed and  
5           labeled.

6

7        **1.04 SUBMITTALS:**

8

9

10          A. Product Data: Submit manufacturer's data on supporting devices,  
11           including catalog cuts, specifications, and installation instructions for each  
12           type of support, anchor, sleeve, and seal.

13

14        **PART 2 - PRODUCTS**

15

16        **2.01 MANUFACTURED SUPPORTING DEVICES:**

17

18          A. General: Provide supporting devices which comply with manufacturer's  
19           standard materials, design and construction, in accordance with published  
20           product information and as required for complete installation and as  
21           herein specified. Where more than one type of supporting device meets  
22           indicated requirements, selection is installer's option.

23

24          B. Supports: Provide supporting devices of types, sizes, and materials  
25           indicated and having the following construction features:

- 26
- 27           1. Clevis Hangers: For supporting conduit; aluminum with  $\frac{1}{2}$ "  
28           diameter hole for round steel rod, approximately 54 pounds per 100  
29           units.
- 30
- 31           2. Reducing Couplings: Aluminum rod reducing coupling,  $\frac{1}{2}$ " by  $\frac{5}{8}$ ",  
32           approximately 16 pounds per hundred 100 units.
- 33
- 34           3. One-Hole Conduit Straps: For supporting conduit; aluminum.
- 35
- 36           4. Two-Hole Conduit Straps: For supporting conduit; aluminum.
- 37
- 38           5. Hexagon Nuts: For  $\frac{1}{2}$ " rod size, aluminum.
- 39
- 40           6. Round Aluminum Rod:  $\frac{1}{2}$ " diameter.
- 41
- 42           7. Offset Conduit Clamps: For supporting 2" rigid metal conduit;  
43           aluminum.

44

45          C. Anchors: Provide anchors of types, sizes, and materials indicated with  
46           the following construction features: (all aluminum).

- 1           1. Expansion Anchors:  $\frac{1}{2}$ ".  
2  
3           2. Toggle Bolts: Springhead, 3/16" by 4".  
4  
5       D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and  
6       materials indicated, with the following construction features:  
7  
8           1. Wall and Floor Seals: Provide factory-assembled watertight wall  
9       and floor seals, of types and sizes indicated, suitable for sealing  
10      around conduit, pipe, or tubing passing through concrete floors and  
11      walls. Construct seals with steel sleeves, malleable iron body,  
12      neoprene sealing grommets and rings, metal pressure rings,  
13      pressure clamps, and cap screws. Seals shall be fire-rated where  
14      required.  
15  
16       E. U-Channel Strut Systems: Provide U-channel strut system for supporting  
17      electrical equipment; aluminum of types and sizes indicated. Construct  
18      with 3/16" diameter holes, 8" O.C. on top surface, and with the following  
19      fittings which mate and match with U-channel:  
20  
21          Fixture hangers.  
22          Channel hangers.  
23          End caps.  
24          Beam clamps.  
25          Wiring studs.  
26          Thinwall conduit clamps.  
27          Rigid conduit clamps.  
28          Conduit hangers.

29  
30     **2.02 FABRICATED SUPPORTING DEVICES:**

- 31  
32       A. Pipe Sleeves: Provide pipe sleeves of Aluminum Pipe: Fabricate from  
33      schedule 40 galvanized aluminum pipe. Remove burrs.  
34  
35       B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls  
36      below grade or exterior walls. Caulk between sleeve and pipe with  
37      nontoxic, UL classified caulking material to ensure watertight seal. Seals  
38      shall be fire-rated where required.

39  
40     **PART 3 - EXECUTION**

41  
42     **3.01 INSTALLATION OF SUPPORTING DEVICES:**

- 43  
44       A. Install hangers, anchors, sleeves, and seals as indicated, in accordance  
45      with manufacturer's written instructions and with recognized industry  
46      practices to insure supporting devices comply with requirements. Comply  
47      with requirements of NECA and NEC for installation of supporting devices.

- 1           B. Coordinate with other electrical work, including raceway and wiring work,  
2           as necessary to interface installation of supporting devices with other  
3           work.  
4  
5           C. Install hangers, supports and attachments to support piping properly from  
6           building structure. Arrange for grouping of parallel runs of horizontal  
7           conduits to be supported together on trapeze type hangers where  
8           possible. Install supports with spacings indicated and in compliance with  
9           NEC requirements.  
10

END OF SECTION 16190

1 SECTION 16195

2  
3 ELECTRICAL IDENTIFICATION

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12 B. This Section is a Division 16 Basic Electrical Materials and Methods  
13 section, and is part of each Division 16 section making reference to  
14 electrical identification specified herein.

15  
16 1.02 DESCRIPTION OF WORK:

- 17  
18 A. Extent of electrical identification work is indicated by drawings and  
19 schedules.
- 20 B. Types of electrical identification work specified in this Section include the  
21 following:  
22  
23 Equipment/system identification signs.

24  
25 PART 2 - PRODUCTS

26  
27 2.01 ELECTRICAL IDENTIFICATION MATERIALS:

- 28  
29 A. Engraved Plastic-Laminate Signs:
- 30  
31 1. General: Provide engraving stock melamine plastic laminate in  
32 sizes and thicknesses indicated, engraved with engraver's standard  
33 letter style of sizes and wording indicated; black face and white  
34 core plies (letter color) except as otherwise indicated, punched for  
35 mechanical fastening except where adhesive mounting is  
36 necessary because of substrate.
- 37  
38 2. Signs shall be black face with white core plies (letter color).
- 39  
40 a. Thickness:  $1/16$ ", except as otherwise indicated.  
41 b. Fasteners: Self-tapping stainless steel screws, except  
42 contact-type permanent adhesive where screws cannot, or  
43 should not, penetrate substrate.  
44 c. Nameplates for essential electrical systems shall be red with  
45 white letters.

1  
2 2.02 LETTERING AND GRAPHICS:

3  
4 A. General: Coordinate names, abbreviations, and other designations used  
5 in electrical identification work with corresponding designations shown,  
6 specified, or scheduled. Provide numbers, lettering and wording as  
7 indicated or, if not otherwise indicated, as recommended by manufacturer  
8 or as required for proper identification and operation/maintenance of  
9 electrical systems and equipment.

10  
11 PART 3 - EXECUTION

12  
13 3.01 APPLICATION AND INSTALLATION:

14  
15 A. General Installation Requirements:

- 16  
17 1. Install electrical identification products as indicated, in accordance  
18 with manufacturer's written instructions and requirements of NEC.  
19  
20 2. Coordination: Where identification is to be applied to surfaces  
21 which require finish, install identification after completion of  
22 painting.  
23  
24 3. Regulations: Comply with governing regulations and requests of  
25 governing authorities for identification of electrical work.

26  
27 B. Equipment/System Identification:

- 28  
29 1. General: Install engraved plastic-laminate sign on each major unit  
30 of electrical equipment in building; including central or master unit  
31 of each electrical system including communication/ control/signal  
32 systems, unless unit is specified with its own self-explanatory  
33 identification or signal system. Provide text matching terminology  
34 and numbering of the contract documents and shop drawings.  
35 Provide signs for each unit of the following categories of electrical  
36 work:  
37  
38 a. Panelboards, electrical cabinets and enclosures.  
39 b. Access panels/doors to electrical facilities.  
40 c. Transformers.  
41 d. Fire alarm equipment cabinets.  
42 e. Disconnect switches, motor starters, contactors, including  
43 current origination.  
44  
45 2. Install signs at locations indicated or, where not otherwise  
46 indicated, at location for best convenience of viewing without

1                   interference with operation and maintenance of equipment. Secure  
2                   to substrate with fasteners, except use adhesive where fasteners  
3                   should not, or cannot, penetrate substrate.

4  
5                   END OF SECTION 16195

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SECTION 16452

## GROUNDING

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
  - B. This Section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 Section making reference to grounding specified herein.

## 1.02 SUMMARY:

- A. The extent of electrical grounding and bonding work is indicated by drawings and schedules, and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment. All new grounding electrodes (rods) and new ground conductors shall be bonded to the existing grounding grid at four locations, minimum. All new control panels, VFDs and electrical panels and cabinets shall be grounded with new ground rods and shall also be bonded to the existing grounding grid. All new connections to the existing grounding grid shall be made by exothermic weld process. Contractor shall obtain approval the grounding connections from owner before installation. Contractor shall furnish and install one grounding test station at each Polymer control Panel and at each VFD sample pump Panel. Test station shall include in grade box with removable lid to exposed top of ground rod and grounding conductor; all connections in test station shall be mechanical type – not exothermic weld.

### Solidly grounded

- C. Applications of electrical grounding and bonding work in this Section includes the following:
    - Electrical power systems
    - Grounding electrodes
    - Separately derived systems
    - Raceways

1                   Service equipment  
2                   Enclosures/Control Panels  
3                   Equipment

- 4
- 5                   D. Refer to other Division 16 sections for wires/cables, electrical raceways,  
6                   boxes and fittings, and wiring devices which are required in conjunction  
7                   with electrical grounding and bonding work; not work of this section.

8

9                  1.03 SUBMITTALS:

- 10
- 11                 A. Product Data: Submit manufacturer's data on grounding and bonding  
12                 products and associated accessories.

13

14                  1.04 QUALITY ASSURANCE:

- 15
- 16                 A. Manufacturer's Qualifications: Firms regularly engaged in the  
17                 manufacture of grounding and bonding products, of types and ratings  
18                 required, and ancillary grounding materials; including stranded cable,  
19                 copper braid and bus, grounding electrodes and plate electrodes, and  
20                 bonding jumpers; whose products have been in satisfactory use in similar  
21                 service for not less than five (5) years.

- 22
- 23                 B. Installer's Qualifications: Firm with at least three (3) years of successful  
24                 installation experience on projects with electrical grounding work similar to  
25                 that required for project.

- 26
- 27                 C. Codes and Standards:

- 28
- 29                 1. Electrical Code Compliance: Comply with applicable local electrical  
30                 code requirements of the authority having jurisdiction and NEC as  
31                 applicable to electrical grounding and bonding, pertaining to  
32                 systems, circuits, and equipment.

- 33
- 34                 2. UL Compliance: Comply with applicable requirements of UL  
35                 Standards No.'s 467, "Electrical Grounding and Bonding  
36                 Equipment", and 869, "Electrical Service Equipment", pertaining to  
37                 grounding and bonding of systems, circuits, and equipment. In  
38                 addition, comply with UL Std. 486A, "Wire Connectors and  
39                 Soldering Lugs for Use with Copper Conductors." Provide  
40                 grounding and bonding products that are UL listed and labeled for  
41                 their intended usage.

42

43                  PART 2 - PRODUCTS

44

45                  2.01 GROUNDING AND BONDING:

- 1           A. Materials and Components, General: Except as otherwise indicated,  
2           provide electrical grounding and bonding systems indicated; with  
3           assembly of materials, including, but not limited to, cables/wires,  
4           connectors, solderless lug terminals, grounding electrodes and plate  
5           electrodes, bonding jumper braid, surge arresters, and additional  
6           accessories needed for a complete installation. Where more than one  
7           type component product meets indicated requirements, selection is  
8           installer's option. Where materials or components are not indicated,  
9           provide products that comply with NEC and UL, requirements, and with  
10          established industry standards for those applications indicated.  
11
- 12          B. Conductors: Unless otherwise indicated, provide electrical grounding  
13          conductors for grounding system connections that match power supply  
14          wiring materials and are sized according to NEC.  
15
- 16          C. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical  
17          bonding plates, connectors, terminals, lugs, and clamps as recommended  
18          by bonding plate, connector, terminal, and clamp manufacturers for  
19          indicated applications.  
20
- 21          D. Ground Electrodes: Solid copper, 5 Ohms, three-quarter inch ( $\frac{3}{4}$ ")  
22          diameter by twenty feet (20').  
23

24          **PART 3 - EXECUTION**

25          **3.01 EXAMINATION:**

- 26           A. Examine areas and conditions under which electrical grounding and  
27           bonding connections are to be made, and notify contractor in writing of  
28           conditions detrimental to proper completion of work. Do not proceed with  
29           work until unsatisfactory conditions have been corrected in a manner  
30           acceptable to installer.  
31

32          **3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:**

- 33           A. General: Install electrical grounding and bonding systems as indicated, in  
34           accordance with manufacturer's instructions; applicable portions of NEC,  
35           NECA's "Standard of Installation", and in accordance with recognized  
36           industry practices, to ensure that products comply with requirements.  
37
- 38           B. Coordinate with other electrical work as necessary to interface installation  
39           of electrical grounding and bonding system work with other work.  
40
- 41           C. Ground electrical service system neutral at service entrance to the  
42           building cold water line and to three (3) three-fourths inch ( $\frac{3}{4}$ ") diameter,  
43           twenty feet (20') long ground rods spaced ten feet (10') apart.  
44

- 1           D. Ground each separately-derived system neutral to separate grounding  
2           electrode.
- 3
- 4           E. Connect together system neutral, service equipment enclosures, exposed  
5           noncurrent carrying metal parts of electrical equipment, metal raceway  
6           systems, grounding conductor in raceways and cables, receptacle ground  
7           connectors, and plumbing systems.
- 8
- 9           F. All raceways with No. 10 or 12 AWG phase conductors for receptacles,  
10          lighting fixtures, and similar circuits shall be provided with a parity-sized  
11          green equipment ground conductor. Ground conductor shall be installed  
12          in entire raceway system, including wall switches and flexible conduit to  
13          light fixtures. Equipment ground conductor sizes for circuits with phase  
14          conductors larger than No. 12 AWG are indicated on drawings. Ground  
15          conductors shall be connected to ground buss in panelboards. All power,  
16          lighting, control circuits shall have a fully sized insulated copper conductor  
17          run the entire length of the circuit. The raceway/conduit system shall not  
18          be used as a means of the grounding system.
- 19
- 20          G. Terminate feeder and branch circuit insulated equipment-grounding  
21          conductors with grounding lug, bus, or bushing. Conductors looped under  
22          screw or bolt heads will not be permitted.
- 23
- 24          H. Connect grounding electrode conductors to one inch (1") diameter or  
25          greater metallic cold water pipe, using a suitably sized ground clamp.  
26          Provide connections to flanged piping at street side of flange.
- 27
- 28          I. Install clamp-on connectors on clean metal contact surfaces to ensure  
29          electrical conductivity and circuit integrity.
- 30
- 31          J. Provide a grounding bushing and a continuous copper bonding jumper  
32          from the bushing to the equipment ground bus in all feeders. The bonding  
33          jumper shall be the same size as the equipment ground conductor.

34

### 3.03 FIELD QUALITY CONTROL

- 35
- 36          A. Upon completion of installation of electrical grounding and bonding  
37          systems, test ground resistance with ground resistance tester. Where tests  
38          show resistance-to-ground is over twenty-five (25) ohms, take appropriate  
39          action to reduce resistance to twenty-five (25) ohms or less by driving  
40          additional ground rods then retest to demonstrate compliance.
- 41
- 42          B. Submit test results (3 copies) to engineer of record. Test results shall  
43          include grounding test method used, equipment used (manufacturer and  
44          model number) with certification of calibration and data results.
- 45

46

47           END OF SECTION 16452

1 SECTION 16460  
2

3 TRANSFORMERS  
4

5 PART 1 - GENERAL  
6

7 1.01 RELATED DOCUMENTS:  
8

- 9       A. Drawings and general provisions of Contract, including General and  
10      Supplementary Conditions and Division 1 Specification sections, apply to  
11      work of this Section.  
12  
13       B. This is a Division 16 Basic Electrical Materials and Methods section, and  
14      is part of each Division 16 Section making reference to transformers  
15      specified herein.

16 1.02 DESCRIPTION OF WORK:  
17

- 18       A. Extent of transformer work is indicated by drawings and schedules.  
19  
20       B. Types of transformers specified in this Section include the following:  
21  
22           Dry-Type Transformers  
23  
24       C. Electrical wiring connections for transformers are specified in applicable  
25      Division 16 sections.  
26

27 1.03 QUALITY ASSURANCE:  
28

- 29       A. Manufacturers: Firms regularly engaged in the manufacture of  
30      power/distribution transformers of types and ratings required; whose  
31      products have been in satisfactory use in similar service for not less than  
32      five (5) years.  
33  
34       B. Installer's Qualifications: Firm with at least five (5) years of successful  
35      installation experience on projects utilizing electrical power and  
36      distribution transformers similar to those required for this project.  
37  
38       C. NEC Compliance: Comply with NEC as applicable to installation and  
39      construction of electrical power/distribution transformers.  
40  
41       D. ANSI Compliance: Comply with applicable requirements of ANSI  
42      Standards C57-Series pertaining to power/distribution transformers.  
43  
44       E. NEMA Compliance: Comply with requirements of NEMA Std Pub/No.'s  
45      ST 20; "Dry-Type Transformers for General Applications", TR 1, and TR  
46

- 1                   27.
- 3                   F. UL Compliance: Comply with applicable requirements of ANSI/UL 506;  
4                    "Safety Standard for Specialty Transformers".
- 5                   G. NESC Compliance: Comply with applicable requirements of National  
6                    Electrical Safety Code (ANSI Std C2) pertaining to indoor and outdoor  
7                    installation of transformers.
- 8

9

10          **1.04 SUBMITTALS:**

- 11
- 12          A. Product Data: Submit manufacturer's technical product data; including  
13              rated kVA, frequency, primary and secondary voltages, and percent taps.

14

15          **PART 2 - PRODUCTS**

16

17          **2.01 ACCEPTABLE MANUFACTURERS:**

- 18
- 19          A. Available Manufacturers: Subject to compliance with requirements,  
20              manufacturers offering products which may be incorporated in the work  
21              are limited to the following:

22

23              Schneider/Square D

24              ABB

25              Cutler Hammer/Eaton

26

27          **2.02 POWER/DISTRIBUTION TRANSFORMERS:**

- 28
- 29          A. General: Except as otherwise indicated, provide manufacturer's standard  
30              materials and components as indicated by published product information,  
31              designed and constructed as recommended by manufacturer, and as  
32              required for complete installation.

33

34          B. Dry-Type Distribution Transformers:

- 35
- 36          1. Transformers sized 15 kVA and below shall have two (2) – 2 ½  
37              percent taps above and below rated primary voltage.
- 38
- 39          2. Transformers 15 kVA and below shall be 115°C temperature rise  
40              above 40°C ambient, unless noted otherwise.
- 41
- 42          3. Limit transformer surface temperature rise to maximum of 50°C rise  
43              above a 40°C ambient. Provide wiring connectors suitable for  
44              copper or aluminum wiring. Cushion-mount transformers with  
45              external vibration isolation supports; sound-level ratings not to  
46              exceed 45 dB for transformers 15 to 45 kVA and 50 dB for 50 to

1                   150 kVA as determined in accordance with ANSI/NEMA standards.  
2                   Electrically ground core and coils to transformer enclosure by  
3                   means of flexible metal grounding strap. Provide transformers with  
4                   fully-enclosed sheet-steel enclosures. Provide transformers  
5                   suitable for wall mounting.  
6

- 7                   C. Equipment/System Identification: Provide equipment/system identification  
8                   nameplates complying with Division 16 Basic Electrical Materials and  
9                   Methods section "Electrical Identification" in accordance with the following  
10                  listing: Equipment/System Identification.
- 11                  D. Finishes: Coat interior and exterior surfaces of transformer, including  
12                  bolted joints, with manufacturer's standard color baked-on enamel.  
13

14

### PART 3 - EXECUTION

15

16

17                  3.01 INSPECTION: Installer must examine areas and conditions under which  
18                  power/distribution transformers and ancillary equipment are to be installed, and  
19                  notify contractor in writing of conditions detrimental to proper completion of the  
20                  work. Do not proceed with the work until satisfactory conditions have been  
21                  corrected in a manner acceptable to installer.

22

23                  3.02 INSTALLATION OF TRANSFORMERS: Install transformers as indicated,  
24                  complying with manufacturer's written instructions, applicable requirements of  
25                  NEC, NESC, NEMA, ANSI, and IEEE standards, and in accordance with  
26                  recognized industry practices to ensure that products fulfill requirements.

27

28                  3.03 GROUNDING: Provide equipment grounding connections for power/distribution  
29                  transformers as indicated.

30

31                  3.04 TESTING:

32

- 33                  A. Prior to energization of transformers, check all accessible connections for  
34                  compliance with manufacturer's torque tightening specifications.
- 35                  B. Prior to energization, check circuitry for electrical continuity and for short-  
36                  circuits
- 37                  C. Upon completion of installation of transformers, energize primary circuitry  
38                  at rated voltage and frequency from normal power source, and test  
39                  transformers; including (but not limited to) audible sound levels, to  
40                  demonstrate capability and compliance with requirements.
- 41
- 42                  D. Where possible, correct malfunctioning units at site, then retest to  
43                  demonstrate compliance; otherwise, remove and replace with new units or  
44                  components, and proceed with retesting.
- 45
- 46

1  
2

END OF SECTION 16460

1 SECTION 16470  
2

3 PANELBOARDS  
4

5 PART 1 - GENERAL  
6

7 1.01 RELATED DOCUMENTS:  
8

- 9       A. Drawings and general provisions of Contract, including General and  
10      Supplementary Conditions and Division 1 Specification Sections, apply to  
11      work of this Section.  
12  
13       B. This Section is a Division 16 Basic Electrical Materials and Methods  
14      section, and is a part of each Division 16 section making reference to  
15      panelboards specified herein.

16 1.02 SUMMARY:  
17

- 18       A. Extent of panelboard and enclosure work, including cabinets and cutout  
19      boxes, is indicated by drawings and schedules and as specified herein.  
20  
21       B. Types of panelboards and enclosures required for the project include the  
22      following:

23  
24           Power Distribution Panelboards  
25           Lighting and Appliance Panelboards  
26

- 27  
28       C. Refer to other Division 16 Sections for wires/cables, electrical boxes and  
29      fittings and raceway work required in conjunction with installation of  
30      panelboards and enclosures.

31 1.03 SUBMITTALS:  
32

- 33  
34       A. Product Data: Submit manufacturer's data on panelboards and  
35      enclosures. Shop drawings shall indicate arrangement of busses, branch  
36      circuits, enclosures, dimensions, etc.

37 1.04 QUALITY ASSURANCE:  
38

- 39  
40       A. Manufacturer's Qualifications: Firms regularly engaged in the  
41      manufacture of panelboards and enclosures, of types, sizes, and ratings  
42      required; whose products have been in satisfactory use in similar service  
43      for not less than five (5) years.  
44  
45       B. Installer's Qualifications: A firm with at least three (3) years of successful  
46      installation experience on projects utilizing panelboards similar to those

1 required for this project.  
2

3 C. Codes and Standards:  
4

- 5     1. Electrical Code Compliance: Comply with applicable local code  
6       requirements of the authority having jurisdiction and NEC Article  
7       384 as applicable to the installation and construction of electrical  
8       panelboards and enclosures.  
9     2. UL Compliance: Comply with applicable requirements of UL 67,  
10      "Electric Panelboards", and UL codes 50, 869, and 1053 pertaining  
11      to panelboards, accessories and enclosures. Provide panelboard  
12      units that are UL listed and labeled.

13     **PART 2 - PRODUCTS**

14     **2.01 MANUFACTURERS:**

- 15       A. Available Manufacturers: Subject to compliance with requirements,  
16       manufacturers offering electrical panelboard products that may be  
17       incorporated in the work are limited to the following:

18           Schneider/Square D  
19           ABB  
20           Cutler Hammer/Eaton

21     **2.02 PANELBOARDS:**

- 22       A. General: Except as otherwise indicated, provide panelboards,  
23       enclosures, and ancillary components, of types, sizes, and ratings  
24       indicated, which comply with manufacturer's standard materials; with the  
25       design and construction in accordance with published product information.  
26       Equip with proper number of unit panelboard devices as required for  
27       complete installation. Where types, sizes, or ratings are not indicated,  
28       comply with NEC, UL, and established industry standards for those  
29       applications indicated.

- 30       B. Power Distribution Panelboards: Provide dead-front, safety-type power  
31       distribution panelboards as indicated; with panelboard switching and  
32       protective devices in quantities, ratings, types, and with arrangement  
33       shown; with anti-turn, solderless pressure type main lug connectors  
34       approved for use with copper conductors. Select unit with feeders  
35       connecting at top of panel. Equip with copper bus bars with not less than  
36       98 percent conductivity, and with full-sized neutral bus. Provide suitable  
37       lugs on neutral bus for outgoing feeders requiring neutral connections.  
38       Provide bolt-on, molded-case circuit breaker types for each circuit, with  
39       toggle handles that indicate when tripped. Provide panelboards with bare  
40       conductors.

1           uninsulated grounding bars suitable for bolting to enclosures. Select  
2           enclosures fabricated by same manufacturer as panelboards which mate  
3           and match properly with panelboards.

4  
5           1. Power panelboards shall be General Electric type 'Spectra', Square  
6           D type 'I Line', or Cutler-Hammer type 'PRL3a'. Voltage shall be as  
7           indicated.

8  
9           C. Lighting and Appliance Panelboards: Provide dead-front safety type  
10          lighting and appliance panelboards as indicated; with switching and  
11          protective devices in quantities, ratings, types and arrangements shown;  
12          with anti-burn solderless pressure type lug connectors approved for use  
13          with copper conductors. Construct unit for connecting feeders at top of  
14          panel. Equip with copper bus bars, full-sized neutral bar, with bolt-in type  
15          heavy-duty, quick-make, quick-break, circuit breakers, with toggle handles  
16          that indicate when tripped. Provide suitable lugs on neutral bus for each  
17          outgoing feeder required, and provide bare uninsulated grounding bars  
18          suitable for bolting to enclosures. Select enclosures fabricated by same  
19          manufacturer as panelboards that mate and match properly with  
20          panelboards.

21  
22          1. Panelboards shall be General Electric A-Series, Square D type  
23           "NQ", or Cutler-Hammer type PRL2. Panelboard boxes shall be  
24           five and three-fourths inches (5  $\frac{3}{4}$ ) deep. Voltage shall be as  
25           indicated.

26  
27          D. Panelboard Enclosures: Provide galvanized sheet steel cabinet-type  
28          enclosures, in sizes and NEMA types as indicated; code-gauge, minimum  
29          16-gauge thickness. Cabinets shall be furnished without knockouts and  
30          all holes for raceways shall be drilled and punched on the job.  
31          Panelboard enclosures shall be five and three-fourths inches (5  $\frac{3}{4}$ ) deep.  
32          Provide fronts with adjustable trim clamps and doors with flush locks and  
33          keys; all panelboard enclosures keyed alike, with concealed piano door  
34          hinges and door swings as indicated. Provide baked gray enamel finish  
35          over a rust inhibitor coating. Design enclosures for recessed mounting.  
36          Provide enclosures that are fabricated by same manufacturer as  
37          panelboards that mate and match properly with panelboards to be  
38          enclosed.

39  
40          E. All panelboards shall be connected distributed phase with circuit  
41          numbering as indicated on the drawings. Panelboards shall be numbered  
42          with odd numbers on the left side of the panel and even numbers on the  
43          right side of the panel. Panelboards shall have a circuit directory card  
44          mounted in a frame with plastic cover, mounted on the inside of the door,  
45          and directory cards shall be completed with a typewriter to indicated areas  
46          and/or devices served by each circuit. All new and existing panelboards

1 being used for this project shall have new typed directories.  
2

3 F. Molded-Case Circuit Breakers: Provide factory-assembled, bolt-on,  
4 molded-case circuit breakers of frame sizes, characteristics, and ratings,  
5 including RMS symmetrical interrupting ratings indicated. Select breakers  
6 with permanent thermal and instantaneous magnetic trip, and with fault-  
7 current limiting protection; ampere ratings as indicated. Multi-pole  
8 breakers shall have a common trip bar so that the tripping of one pole will  
9 automatically trip all poles of the breaker. Construct with over-center, trip-  
10 free, toggle-type operating mechanisms with quick-make, quick-break  
11 action, and positive handle trip indication. Construct breakers for  
12 mounting and operating in any physical position and operating in an  
13 ambient temperature of 40°C. Provide breakers with mechanical screw  
14 type removable connector lugs; AL/CU rated.

15  
16 1. Individual Enclosed Circuit Breakers: Circuit breakers shall be  
17 molded case type. Breakers shall have thermal-magnetic trip units  
18 and magnetic trip shall be adjustable. Breakers shall have a  
19 common trip bar so that the tripping of one pole will automatically  
20 trip all poles of the breaker. Breakers shall be trip free and trip  
21 indicating and shall have quick-make, quick-break contacts.  
22 Enclosure shall have insulated, groundable neutral.

23  
24 G. Panelboards shall be installed complete with connectors and associated  
25 hardware for all circuit breakers and circuit breaker spaces listed in the  
26 panelboard schedule.

27  
28 H. When connecting equipment to existing panelboards, the new and  
29 existing circuit breakers shall be identified. A new circuit directory card  
30 shall be provided.

31  
32 PART 3 - EXECUTION

33  
34 3.01 EXAMINATION:

35  
36 Examine areas and conditions under which panelboards and enclosures are to  
37 be installed and notify contractor in writing of conditions detrimental to proper  
38 completion of work. Do not proceed with work until unsatisfactory conditions  
39 have been corrected in a manner acceptable to installer.

40  
41 3.02 INSTALLATION OF PANELBOARDS:

42  
43 A. Install panelboards and enclosures as indicated, in accordance with  
44 manufacturer's written instruction, applicable requirements of NEC  
45 standards, NECA's "Standards of Installation", and in compliance with  
46 recognized industry practices to ensure that products fulfill requirements.

- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors.
  - C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

### 3.03 GROUNDING:

- A. Provide equipment grounding connections for panelboard enclosures as indicated.
  - B. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

### 3.04 ADJUSTING AND CLEANING:

- A. Adjust operating mechanisms for free mechanical movement.
  - B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION 16470

1  
2  
3  
4  
5  
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## SECTION 16480

## MOTORS

## PART 1 – GENERAL

## 1.01 DESCRIPTION

Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

## **1.02 QUALIFICATIONS**

Motor shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity.

## 1.03 SUBMITTALS

- A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.
  - B. Submit Operation and Maintenance Manual and parts lists as specified in Division 1 PROJECT CLOSEOUT.
  - C. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of eighteen month from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the CONTRACTOR at no expense to the Owner.
  - D. Provide equipment warranty in accordance with Division 1 SPECIFIC WARRANTIES.

## PART 2 - PRODUCTS

## 2.01 RATING

- A. Unless otherwise noted, all motors shall be of the low voltage type. All motors 2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 300 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

1  
2    2.02 THREE PHASE INDUCTION MOTORS  
3

- 4       A. Motors 25 HP and larger shall have a 120-volt space heater for moisture  
5       control.  
6  
7       B. Unless specifically noted in other sections of these Specifications, all  
8       motors shall have an efficiency as indicated in the table below. Motors  
9       shall be "premium efficiency" type.

10  
11                   TABLE 1  
12

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102

- 13  
14       C. Motors operating with variable frequency drives shall indicate on the  
15       nameplate that they are suitable for their intended applications (Inverter  
16       duty Rated) and they shall be provided with an integral temperature switch  
17       that opens on high temperature. Motors operating with Variable  
18       Frequency Drives (VFD's) shall meet the requirements of NEMA MG1  
19       Part 31.

20  
21    2.03 CONSTRUCTION  
22

- 23       A. General:

- 24  
25       1. All dripproof and weather protected Type I motors shall have epoxy  
26       encapsulated windings. Totally enclosed motors shall not be  
27       encapsulated. Motors not readily available with encapsulated  
28       windings may be standard type. Motors exposed to the outside  
29       atmosphere shall be totally enclosed fan cooled (TEFC) unless  
30       otherwise specified.  
31  
32       2. Squirrel-cage rotors shall be made from high-grade steel  
33       laminations adequately fastened together and to the shaft, or shall  
34       be cast aluminum or bar-type construction with brazed end rings.  
35

1           B. Low Voltage, Three Phase Motors:

- 2
- 3       1. Motors shall be of the squirrel-cage induction type, NEMA design
- 4           B. Horizontal, vertical solid shaft, vertical hollow shaft, normal
- 5           thrust and high thrust types shall be furnished as specified herein.
- 6           All motors shall be built in accordance with current NEMA, IEEE,
- 7           ANSI and AFBMA standards where applicable. Motors shall be of
- 8           the type and quality described by these Specifications, fully
- 9           capable of performing in accordance with manufacturer's
- 10          nameplate rating, and free from defective material and
- 11          workmanship.
- 12
- 13       2. Motors shall have normal or high starting torque (as required), low
- 14          starting current (not to exceed 600 percent full load current), and
- 15          low slip.
- 16
- 17       3. Outdoor motors shall be totally enclosed fan-cooled construction
- 18          with 1.15 service factor unless otherwise noted. Indoor motors
- 19          shall be ODP unless otherwise noted.
- 20
- 21       4. Outdoor motors shall be mill and chemical duty suitable for
- 22          operation in moist air with hydrogen sulphide gas present.
- 23
- 24       5. The output shaft shall be suitable for direct connection or belt drive
- 25          as required.
- 26
- 27       6. Motors shall have a Class B nonhygroscopic insulation system.
- 28          Class F insulation may be used but shall be limited to Class B
- 29          temperature rise.
- 30
- 31       7. All motors shall have a final coating of chemical resistant corrosion
- 32          and fungus protective epoxy fortified enamel finish sprayed over
- 33          red primer over all interior and exterior surfaces. Stator bore and
- 34          rotor of all motors shall be epoxy coated.
- 35
- 36       8. All fittings, bolts, nuts, and screws shall be 316 stainless steel.
- 37          Bolts and nuts shall have hex heads.
- 38
- 39       9. All machine surfaces shall be coated with rust inhibitor for easy
- 40          disassembly.
- 41
- 42       10. Conduit boxes shall be gasketed. Lead wires between motor frame
- 43          and conduit box shall be gasketed.
- 44
- 45       11. Totally enclosed motors shall be provided with condensate drain
- 46          hole and epoxy coated motor windings to protect against moisture.

- 1  
2      12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts  
3            shall be supplied on all frames 254T and larger. Enclosures will  
4            have stainless steel screen and motors shall be protected for  
5            corrosion, fungus and insects.  
6  
7      13. Low voltage, three phase motors shall be manufactured by General  
8            Electric, U.S. Motors, Westinghouse or approved equal.  
9  
10     14. Fractional Horsepower:  
11  
12        a. Fractional horsepower motors shall be rigid, welded-steel,  
13            designed to maintain accurate alignment of motor  
14            components and provide adequate protection. End shields  
15            shall be reinforced, lightweight die-cast aluminum. Windings  
16            shall be of varnish-insulated wire with slot insulation of  
17            polyester film, baked-on bonding treatment to make the  
18            stator winding strongly resistant to heat, aging, moisture,  
19            electrical stresses and other hazards.  
20        b. Motor shaft shall be made from high-grade, cold-rolled shaft  
21            steel with drive-shaft extensions carefully machined to  
22            standard NEMA dimensions for the particular drive  
23            connection.  
24        c. All motors shall be equipped with vacuum-degassed  
25            (sealed) antifriction bearings made to AFBMA Standards,  
26            and be of ample capacity for the motor rating. The bearing  
27            housing shall be large enough to hold sufficient lubricant to  
28            minimize the need for frequent lubrication, but facilities shall  
29            be provided for adding new lubricant and draining out old  
30            lubricant without motor disassembly. The bearing housing  
31            shall have long, tight, running fits or rotating seals to protect  
32            against the entrance of foreign matter into the bearings, or  
33            leakage of lubricant out of the bearing cavity.  
34  
35     15. Integral Horsepower:  
36  
37        a. Motor frames and end shields shall be cast iron or heavy  
38            fabricated steel of such design and proportions as to hold all  
39            motor components rigidly in proper position and provide  
40            adequate protection for the type of enclosure employed.  
41        b. Windings shall be adequately insulated and securely braced  
42            to resist failure due to electrical stresses and vibrations.  
43        c. The shaft shall be made of high-grade machine steel or steel  
44            forging of size and design adequate to withstand the load  
45            stresses normally encountered in motors of the particular  
46            rating. Bearing journals shall be ground and polished.

- 1                   d. Rotors shall be made from high-grade steel laminations  
2                   adequately fastened together, and to the shaft. Rotor  
3                   squirrel-cage windings may be copper or bar-type  
4                   construction with brazed end rings.  
5                   e. All motors shall be equipped with vacuum-degassed  
6                   (sealed) antifriction bearings made to AFBMA Standards,  
7                   and be of ample capacity for the motor rating. The bearing  
8                   housing shall be large enough to hold sufficient lubricant to  
9                   minimize the need for frequent lubrication, but facilities shall  
10                  be provided for adding new lubricant and draining out old  
11                  lubricant without motor disassembly. The bearing housing  
12                  shall have long, tight, running fits or rotating seals to protect  
13                  against the entrance of foreign matter into the bearings, or  
14                  leakage of lubricant out of the bearing cavity.  
15                  f. Bearings of high thrust motors will be locked for momentary  
16                  up thrust of 30% down thrust. All bearings shall have a  
17                  minimum B10 life rating of 100,000 hours in accordance with  
18                  AFBMA life and thrust values.  
19                  g. Vertical hollow-shaft motors will have nonreverse ratchets to  
20                  prevent backspin.

21

22                  C. Low Voltage, Single Phase Motors:

23

- 24                  1. Single phase motors shall be split-phase and capacitor-start  
25                  induction types rated for continuous horsepower at the rpm called  
26                  for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz,  
27                  single phase, open drip proof, or totally enclosed fan cooled as  
28                  called for on the Drawings, with temperature rise in accordance  
29                  with NEMA Standards for Class B insulation.
- 30
- 31                  2. Totally enclosed fan cooled motors shall be designed for  
32                  severe-duty.
- 33
- 34                  3. Motors shall have corrosion and fungus protective finish on internal  
35                  and external surfaces. All fittings shall have a corrosion protective  
36                  plating.
- 37
- 38                  4. Mechanical characteristics shall be the same as specified for  
39                  polyphase fractional horsepower motors.

40

41                  PART 3 - EXECUTION

42

43                  3.01 INSTALLATION

44

- 45                  A. Motor Connections: All motors shall be connected to the conduit system  
46                  by means of a short section of flexible conduit, 18 inch minimum and 60

1           inches maximum, unless otherwise indicated. For all motor connections,  
2           the CONTRACTOR shall install a grounding conductor in the conduit and  
3           terminate at the motor control center with an approved grounding clamp.  
4

- 5           B. Connection to motor leads shall be compression type with 3M brand heat  
6           shrink boot.

7

## 8       3.02 TESTS AND CHECKS

9

- 10          A. The following tests shall be performed on all motors after installation but  
11          before putting motors into service.

- 13          1. The CONTRACTOR shall megger each motor winding before  
14           energizing the motor, and, if insulation resistance is found to be  
15           low, shall notify the Engineer and shall not energize the motor. The  
16           CONTRACTOR shall check direction of rotation of all motors and  
17           reverse connections if necessary. The following table gives  
18           minimum acceptable insulation resistance in megohms at various  
19           temperatures and for various voltages with readings being taken  
20           after one minute of megger test run.

21

22           TABLE 2

23

Degree Winding Temperature	Voltage				
	°F	°C	115V	230V	460V
37	3.9	60	108	210	
50	10	32	60	120	
68	20	13	26	50	
86	30	5.6	11	21	
104	45	2.4	4.5	8.8	
122	50	1	2	3.7	
140	60	.5	.85	1.6	

- 24
- 25          2. The CONTRACTOR shall check each motor for correct clearances  
26           and alignment and for correct lubrication, and shall lubricate if  
27           required in accordance with manufacturer's instructions.
- 28

29           END OF SECTION 16481

1 SECTION 16481

2  
3 MOTOR CONTROL CENTER

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12  
13 B. This Section is a Division 16 Basic Electrical Materials and Methods  
14 section, and is a part of each Division 16 section making reference to  
15 motor control centers specified herein.

16  
17 1.02 DESCRIPTION OF WORK:

- 18  
19 A. Extent of alternating-current motor control center (MCC) work is indicated  
20 by drawings and schedules. The motor control center shall contain all  
21 equipment shown on the drawings to provide complete control and  
22 protection for the motors and feeders indicated.

23  
24 1.03 QUALITY ASSURANCE:

- 25  
26 A. Manufacturers: Firms regularly engaged in the manufacture of motor  
27 control centers of types, sizes, and ratings required; whose products have  
28 been in satisfactory use in similar service for not less than five years.

- 29  
30 B. Installer's Qualifications: Firms with at least three years of successful  
31 installation experience on projects with motor control center installation  
32 work similar to that required for project.

- 33  
34 C. Codes and Standards:

- 35  
36 1. NEMA Compliance: Comply with NEMA Stds. Pub/No. ICS-2,  
37 pertaining to construction, testing, and installation of motor control  
38 centers and with applicable NEMA standards for circuit breakers  
39 and fuses.

- 40  
41 2. UL Compliance: Comply with applicable requirements of UL Std.  
42 486A, "Wire Connectors and Soldering Lugs for Use with Copper  
43 Conductors", and UL Std. 845, "Electric Motor Control Centers".  
44 Provide MCC's and ancillary equipment which are UL listed and  
45 labeled.

1           3.    NEC Compliance: Comply with requirements of NEC as applicable  
2           to motor control center equipment and components.

3

4   **1.04 SUBMITTALS:**

- 5
- 6       A.   Shop Drawings: Submit layout drawings of motor control centers showing  
7           accurately scaled basic equipment sections; including but not limited to,  
8           motor starters, controllers, device panels, and circuit breakers. Show  
9           spatial relationships of MCC components to proximate electrical  
10          equipment. Clearly differentiate on wiring diagrams those conductors  
11          which are factory-installed and those which are field-installed.
- 12
- 13      B.   Maintenance Data: Submit maintenance data and parts list for each  
14          motor control center, including "trouble-shooting" maintenance guide.  
15          Include that data, product data, and shop drawings in a maintenance  
16          manual in accordance with requirements of Division 1.

17

18   **1.05 DELIVERY, STORAGE, AND HANDLING:**

- 19
- 20       A.   Handle motor control centers carefully to prevent damage, breaking, and  
21           scoring. Do not install damaged sections or components; replace with  
22           new.
- 23
- 24       B.   Store motor control center equipment in clean dry place. Protect from  
25           weather, dirt, fumes, water, construction debris, and physical damage.

26

27   **PART 2 - PRODUCTS**

28

29   **2.01       ACCEPTABLE MANUFACTURERS:**

- 30
- 31       A.   Acceptable Manufacturers: Subject to compliance with requirements,  
32           manufacturers offering motor control centers which may be incorporated  
33           in the work include are limited to the following:

34

35           Schneider/Square D  
36           ABB  
37           Cutler Hammer/Eaton

38

39   **2.02       MOTOR CONTROL CENTERS AND COMPONENTS:**

- 40
- 41       A.   General: Provide motor control centers and ancillary components of  
42           sizes, ratings, classes, types, and characteristics indicated; which comply  
43           with manufacturer's standard design, materials, components, and  
44           construction in accordance with published product information, as  
45           required for complete installation, and as specified herein.

- 1           B. Motor Control Centers: The motor control center shall be for operation on  
2           480 volts, three phase, four wire, 60 cycle service and shall be furnished  
3           in accordance with NEMA Class I, Type B construction. All busses shall  
4           be braced for 42,000 amperes RMS symmetrical.
- 5           C. The Motor Control Center shall be housed in a NEMA 1. Construct each  
6           section 90 inches high with 9 inch horizontal wireways at top and bottom,  
7           24 or 20 inches wide, and with 20 inch section depth for front-of-board  
8           unit arrangement. The entire Motor Control Center shall be provided as  
9           part of a completely pre-assembled Equipment & Control Enclosure as  
10          described in specification 16650.
- 11          D. Each vertical section shall have a separate continuous vertical wireway.  
12          All equipment in the control center shall be easily accessible for  
13          maintenance. The doors for access to starters, compartments, etc., shall  
14          be formed of steel sheet sections mounted on concealed hinges with  
15          thumb screws of similar type latches. Doors of compartments containing  
16          circuit breakers shall be mechanically interlocked to prevent opening of  
17          the door unless breaker is in the "OFF" position. All steel work after  
18          fabrication shall be cleaned and given a rust resisting prime coat of paint.  
19          The entire structure, inside and out, shall be finished with the  
20          manufacturer's standard color of synthetic enamel.
- 21          E. Combination Circuit Breaker Magnetic Starters:
- 22           1. Combination circuit breaker magnetic starter shall be 480-volt, 3-  
23           phase, 60 hertz across-the-line units. The starters shall be for full  
24           voltage, non-reversing operation (FVNR), or as indicated in the  
25           drawings.
- 26           2. Circuit breakers for combination starter shall be of the molded  
27           case, designed for 480-volt, 60 hertz service. Breakers shall be 3-  
28           pole units with magnetic adjustable trip units actuating a common  
29           tripping bar to open all poles when short circuit occurs. The  
30           breakers shall not have thermal elements. Each entire breaker/  
31           starter combination shall be rated for fault interruption of 42,000  
32           RMS amperes symmetrical. Equipment shall be General Electric  
33           Company "Mag-Break" motor circuit protectors with limiter,  
34           Westinghouse Type MCP with limiter, or equal.
- 35           3. Provide necessary interface for PLC Control System. Coordinate  
36           with PCL system's contractor. Provide Tesys T overload protective  
37           and metering relay with Ethernet I/P communications on all  
38           Starters. Provide Front Door Display and Programming Port.  
39           Include Two Hand Held Programming Terminals.

1           4. Specific Requirements for the Intelligent Motor Protection Relay  
2           (IMPR)

- 3           a. Metering: The IMPR shall include as a minimum the  
4           following features:  
5           b. Measurements including line currents, ground fault current,  
6           average line current, current phase imbalance, thermal  
7           capacity level, motor temperature sensor and, as an option,  
8           frequency, line to line voltage, line voltage imbalance,  
9           average voltage, power factor, active power, reactive power,  
10          active power consumption and reactive power consumption.  
11         For line current measurements, the IMPR shall have  
12         integrated Current Transformers rated up to 100 A. For  
13         motors larger than 100 A, the connection of external current  
14         transformers shall be possible. For ground current, it shall be  
15         possible either to calculate from line currents or, without  
16         need of any additional component, to connect on the IMPR  
17         an external ground Current Transformer. The motor  
18         temperature measurement must be possible through several  
19         types of sensors including PTC binary, PTC analog, NTC  
20         analog and PT100. Without any additional component, the  
21         IMPR shall allow the connection of the temperature sensor.  
22         Voltage measurement shall allow for line voltage up to 690V.  
23         c. Statistics including protection fault counts, protection  
24         warning counts, diagnostic fault counts, motor control  
25         function counts and fault history.  
26         d. Diagnostics including internal watchdog results, controller  
27         internal temperature, temperature sensor connections,  
28         current connections, control commands (start, stop, run  
29         check back and stop check back), control configuration  
30         checksum, communication loss and, as an option, voltage  
31         connections.  
32         e. Motor control states (motor starter/LO1 starts/ LO2 starts,  
33         operating time, motor starts per hour, last start max current,  
34         last start time, time to trip and time to reset).  
35         f. Motor Protection Functions: As a minimum, the IMPR shall  
36         allow the selection of the following protection functions :  
37         thermal overload, current phase imbalance, current phase  
38         loss, current phase reversal, long start, jam, undercurrent,  
39         overcurrent, ground current, motor temperature sensor,  
40         rapid cycle lockout and, as an option, voltage phase  
41         imbalance, voltage phase loss, voltage phase reversal,  
42         undervoltage, overvoltage, voltage dip management  
43         (autorestart and load shedding), power limits and power  
44         factor limits.  
45           i. The thermal overload trip curve shall be selectable  
46           between inverse ( $I^2t$ ) and definite time ( $Ixt$ ) curves.

- ii. The Auxiliary Fan Cooling application shall be also selectable.

#### **F. Feeder Circuit Breaker:**

1. Circuit breakers shall be molded plastic case, bolt-on or draw-out, molded case circuit breaker type. Breakers shall have the thermal-magnetic trip units, and minimum of 65kaic rating as for combination starters.

G. Equipment/System Identification: Provide equipment/system identification nameplates complying with Division 16 Basic Materials and Methods section "Electrical Identification" in accordance with Motor Control Schedule on drawings. All MCC control wiring to be labeled with permanent wire labels at each end. Wire labels to be plastic sleeve type.

H. Variable Frequency Drives – All drives in MCC's must Yaskawa model iQ1000 by ICON technologies as referenced in VFD Specification.

## PART 3 - EXECUTION

### **3.01 INSPECTION:**

- A. Examine areas and conditions under which motor control centers are to be installed, and substrate which will support motor control centers. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

### 3.02 INSTALLATION OF MOTOR CONTROL CENTERS:

- A. Motor control centers shall be installed in pre-assembled electrical and Control enclosure as indicated, in accordance with equipment manufacturer's written instructions, with recognized industry practices; and complying with applicable requirements of NEC, NEMA's Std. Pub/No. ICS-2, and NECA's "Standard of Installation."
  - B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

### 3.03 ADJUSTING AND CLEANING:

- A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

### 3.04 GROUNDING:

A. Provide equipment grounding connections for motor control centers as indicated.

### 3.05 FIELD QUALITY CONTROL:

A. Prior to energization of motor control centers, check with insulation resistance tester for proper values of phase-to-phase and phase-to-ground insulation resistances. Log that data, and submit to engineer.

B. Prior to energization of circuitry, check control center electrical circuits for continuity and for short-circuits.

C. Subsequent to wire/cable and raceway hook-ups, energize motor control center circuitry, check each motor for proper phase rotation, and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance. Otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 16481

1 SECTION 16482

2  
3 MOTOR STARTERS

4  
5 PART 1 - GENERAL

6  
7 1.01 RELATED DOCUMENTS:

- 8  
9 A. Drawings and general provisions of Contract, including General and  
10 Supplementary Conditions and Division 1 Specification sections, apply to  
11 work of this Section.
- 12 B. This is a Division 16 Basic Electrical Materials and Methods section, and  
13 is part of each Division 16 Section making reference to motor starters  
14 herein.

15  
16 1.02 DESCRIPTION OF WORK:

- 17 A. Extent of motor starter work is indicated by drawings and schedules.

18  
19 1.03 QUALITY ASSURANCE:

- 20  
21 A. Manufacturers: Firms regularly engaged in the manufacture of motor  
22 starters of types, ratings, and characteristics required; whose products  
23 have been in satisfactory use in similar service for not less than five (5)  
24 years.
- 25 B. Installer's Qualifications: Firm with at least three (3) years of successful  
26 installation experience on projects utilizing motor starters similar to that  
27 required for this project.
- 28 C. NEC Compliance: Comply with NEC as applicable to wiring methods,  
29 construction, and installation of motor starters.
- 30 D. UL Compliance: Provide motor starters and components which are UL  
31 listed and labeled.

32  
33 1.04 SUBMITTALS:

- 34 A. Product Data: Submit manufacturer's data on motor starters.

35  
36 PART 2 - PRODUCTS

37  
38 2.01 ACCEPTABLE MANUFACTURERS:

- 1           A. Available Manufacturers: Subject to compliance with requirements,  
2 manufacturers offering motor starters which may be incorporated in the  
3 work are limited to the following:  
4

5           Schneider/Square D  
6           ABB  
7           Cutler Hammer/Eaton  
8

9           **2.02 MOTOR STARTERS:**

- 10          A. General: Except as otherwise indicated, provide motor starters and  
11 ancillary components which comply with manufacturer's standard  
12 materials, design, and construction in accordance with published product  
13 information, and as required for complete installation.  
14
- 15          B. Manual motor starters for 115 volts, single phase motors one horsepower  
16 and smaller shall be single pole, horsepower rated switches with thermal  
17 overload units and heaters. Starters shall be Square D Class 2510, with  
18 stainless steel cover plates.  
19
- 20          C. Magnetic full voltage starters for three phase motors shall be three pole,  
21 horsepower- rated, magnetically operated, with three thermal overload  
22 units and four extra auxiliary contacts. Control voltage shall be 120 volts  
23 supplied from a control power transformer. A Hand-Off-Automatic, HOA  
24 switch shall be mounted in front cover. Starters shall be Square D Class  
25 8536.  
26
- 27          D. Combination magnetic, full voltage starters for three phase motors shall  
28 be three pole horsepower-rated, magnetically operated switches, with  
29 three thermal overload units and four extra auxiliary contacts. Control  
30 voltage shall be 120 volts supplied from a control power transformer. A  
31 three pole horsepower-rated, non-fusible disconnect switch shall also be  
32 included in the enclosure. An HOA switch shall be mounted in front cover.  
33 Starters shall be Square D Class 8538.  
34
- 35          E. Phase loss protection shall be provided on all starters serving motors 15  
36 horsepower or larger.  
37
- 38          F. Provide 0-15 minute on-delay auto restart function on each starter.  
39
- 40          G. Provide PLC contact. Coordinate with PLC controls contractor.  
41

42           **PART 3 - EXECUTION**

43           **3.01 INSTALLATION OF MOTOR STARTERS:**

- A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards to insure that products fulfill requirements.
  - B. Motor starters or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.
  - C. Unless otherwise indicated, motor starters shown on the drawing shall be furnished and installed under this Section. The full load current and starting characteristics of each motor shall be verified for proper selection of motor over load devices.
  - D. Furnish and install all steel shapes, etc., necessary for a support of all motor starters.
  - E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

### 3.02 ADJUSTING AND CLEANING:

- A. Inspect electrical starter's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
  - B. Touch-up scratched or marred surfaces to match original finish.

### 3.03 FIELD QUALITY CONTROL:

- A. Subsequent to connecting wires/cables, energize motor starter circuitry and demonstrate functioning of equipment in accordance with requirements. Where necessary correct malfunctioning units, and then retest to demonstrate compliance. Ensure that direction of rotation of each motor fulfills requirements.

END OF SECTION 16482

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1 SECTION 16620

2  
3 SURGE SUPPRESSION

4  
5 SECTION 16620 - SURGE SUPPRESSION

6  
7 PART I - GENERAL

8  
9 1.01 RELATED DOCUMENTS

- 10  
11 A. Drawings and general provisions of Contract, including General and  
12 Supplementary Conditions and Division 1 Specification sections, apply to  
13 work of this Section.
- 14  
15 B. This Section is a Division 16 Basic Electrical Materials and Methods  
16 section, and is a part of each Division 16 section making reference to  
17 electrical surge suppression specified herein.

18  
19 1.02 DESCRIPTION OF WORK

- 20  
21 A. The work required under this division shall include all materials, labor, and  
22 auxiliaries required to furnish and install complete surge suppression for  
23 the protection of building electrical and electronics systems from the  
24 effects of line-induced transient voltage surge and lightning discharge, as  
25 indicated on drawings or specified in this section.
- 26  
27 B. Types of surge suppression specified in this section include the following:  
28 Service entrance type.  
29 Distribution and branch circuit panels.  
30 Point of use type (receptacle and plug-in units).

31  
32 1.03 QUALITY ASSURANCE

- 33  
34 A. All surge suppression devices shall be manufactured by a company  
35 normally engaged in the design, development, and manufacture of such  
36 devices for electrical and electronics systems equipment.
- 37  
38 B. The surge suppressor manufacturer shall offer technical assistance  
39 through support by a factory representative and local stocking distributor.
- 40  
41 C. Obtain suppression devices and accessories through one source, from a  
42 single manufacturer.

43  
44 1.04 WARRANTY

- 45  
46 A. Manufacturer shall provide a product warranty for a period of not less than

1               five (5) years from date of installation. Warranty shall cover unlimited  
2 replacement of suppressor's modules during the warranty period. Those  
3 firms responding to this specification shall provide proof that they have  
4 regularly engaged in the design, manufacturing and testing of suppressors  
5 for not less than twenty five (25) years.

6

## 7     1.05 CODES AND STANDARDS

8

- 9               A. The following standards and publications are referenced in various parts  
10 of this specification and shall apply:

11               UL 1449-2009 (Third Edition):  
12                      Standard for Safety, Transient Voltage Surge Suppressors.

13               UL 1283- (listed as an electromagnetic interference filter that provides  
14 noise attenuation)

15               IEEE C62.41-2002 (IEEE 587):  
16                      Guide for Surge Voltages in Low-Voltage AC Power Circuits.

17               IEEE C62.33-2002:  
18                      Standard Test Specifications for Varistor Surge Protection Devices.

19               IEEE C62.45-2002:  
20                      IEEE Guide for Surge Testing for Equipment Connected to Low-  
21                              Voltage AC Power Circuits.

22               NEC 285, 250.56 – 2008

23               NFPA 780 and CSA – (National Fire Protection Association and Canadian  
24                      Standards Associations)

25               ISO 9001:2000 – Quality standard / Military Standards (MIL-STD 220A)

26               UL 96A – Lightning Protection Master Label

- 27               B. The fusing element must be capable of allowing the suppressor's rated  
28 single impulse current to pass through the suppressor at least one time  
29 without failure. The system shall be tested to 1,000 sequential per  
30 C62.45-2002 section B.38 referencing C62.41.1 and C62.41.2 Category  
31 C3 combination wave transients. The Category C3 combination wave is  
32 defined as a 1.2 x 50 $\mu$ s wave at 20,000 volt open circuit voltage waveform  
33 and 8 x 20 $\mu$ s wave at 10,000 amperes short circuit current waveform. In  
34 addition, the system components shall be tested repetitively 1,000 times  
35 testing based on IEEE C62.33 (MOV test) and C62.35 (SAD test) without  
36 failure or degradation exceeding  $\pm 10\%$ .

- 1  
2       C. All manufacturers must comply with above listed standards and any  
3           additions current revisions of industry standards. All products that do not  
4           comply with current industry standards will not be accepted.  
5

6       **1.06 SUBMITTALS**  
7

- 8       A. Must have ten day prior approval to bid on project. Request for submittal  
9           must be in writing and attached with independent documentation of the  
10          following items.  
11  
12       B. Drawings: Electrical and mechanical drawings shall be provided by the  
13           manufacturer which show unit dimensions, weights, mounting provisions,  
14           connection notes, wire size and wiring diagram.  
15  
16       C. Equipment manual: The manufacturer shall furnish an installation manual  
17           with installation notes, start-up and operating instructions for the specified  
18           system. Installation instructions shall clearly state whether the system  
19           requires an external overcurrent device to maintain the system's UL 1449  
20           listing.  
21  
22       D. Independent Testing:  
23  
24           1. High exposure with the 10 x 1,000 $\mu$ s tests per IEEE C62.41.2  
25            Section 7.2  
26  
27           2. Life Cycle/Repetitive Testing per C62.45-2002 section B.38  
28            minimum of 1,000 to 2,000 times.  
29  
30       E. UL 1449 stipulation for fused TVSS – The manufacturer's authorized  
31           representative is required to submit the following:  
32  
33           1. Certify that the TVSS system is UL 1449 listed (UL Card) with UL  
34            Card.  
35  
36           2. Indicate the type of internal or external fusing that is incorporated in  
37            the TVSS system and what impact the fusing has on the  
38            performance of the device with respect to surge capacity and  
39            clamping levels.

40  
41       **1.07 REQUIRED SUPPRESSORS**  
42

- 43       A. Provide surge suppression for the equipment described herein:  
44  
45           1. On main electrical service entrance panels as shown in the project  
46            drawings.

- 1
2. On distribution and branch circuit panels as shown in the project  
3 drawings.
- 4
5. On all equipment identified in the project drawings.
- 6

7 **PART 2 - PRODUCTS**

8

9 **2.01 SERVICE ENTRANCE SUPPRESSORS**

10

11 **A. ACCEPTABLE MANUFACTURERS**

12

13 LEA International – PV200  
14 Current Technology – TG100-L2  
15 Liebert – SI-025-ANCE

16

- 17 B. The surge suppressor manufacturer shall offer a complete line of surge  
18 suppression products to support the required suppressors listed in Part 1.
- 19 C. The surge suppressor's minimum surge current capacity shall be 200kA  
20 per phase (L-N plus L-G) and 100kA per mode (L-N, L-G, L-L and N-G).
- 21 D. The system protection modules shall contain a technology that utilizes a  
22 symmetrical array of balanced metal oxide varistors (MOV). Each MOV  
23 will be individually coordinated to pass UL 1449.
- 24 E. The service entrance surge suppressors shall be designed with  
25 replaceable modules for purposes of in-service replacement. The unit  
26 suppressor shall be designed with redundant back-up surge protection in  
27 the event of a module failure.
- 28 F. Module status indicators shall be provided to indicate individual module  
29 status. When a module has failed, the module LED status indicator shall  
30 indicate said failure.
- 31 G. Each protection module shall have a capacitive filtering system connected  
32 in each Line to Neutral (L-N)(Wye) mode or Line to Line (L-L)(Delta) mode  
33 to provide EMI/RFI noise attenuation (UL 1283)
- 34 H. Service entrance suppressors shall utilize normal and common modes of  
35 protection - each phase line to neutral, each phase line to ground and  
36 neutral to ground.
- 37 I. Surge suppressor shall provide the following monitoring features: dry  
38 contacts, digital surge counter, and audible alarm with alarm disable  
39 switch. Suppressor shall utilize a NEMA 4 or NEMA 12 enclosure.
- 40
- 41
- 42
- 43
- 44
- 45
- 46

- 1           J. Service entrance and panel type suppressors shall be installed with a  
2           means of disconnecting the suppressor. If no dedicated circuit breaker is  
3           included in panel, manufacturer shall provide an integral fused disconnect.  
4
- 5
- 6           K. Suppressors shall be of a hybrid design and include circuitry with tight,  
7           wave-tracking clamping characteristics.  
8
- 9
- 10          L. Suppressors shall be designed to withstand a maximum continuous  
11          operating voltage of not less than 115% of nominal RMS line voltage.  
12
- 13          M. Each suppressor shall have an internal disconnect switch when not  
14          connected to a separate circuit breaker or fused disconnect switch which  
15          is dedicated specifically for the suppressor.  
16
- 17          N. Suppressors shall be failsafe, shall allow no follow-through current, shall  
18          have repeated surge capability, shall be solid state, shall be self-restoring,  
19          and shall be fully automatic.  
20
- 21          O. Suppressors shall have an operating temperature range of -40°C to  
22          +85°C.  
23

24      **2.02 DISTRIBUTION BRANCH PANEL SUPPRESSORS**

25      A. **ACCEPTABLE MANUFACTURERS**

26           LEA International – SP200  
27           Current Technology – CG100  
28           Liebert – All-111-RKE  
29

30      B. Suppressors shall meet all specification requirements in section 2.1  
31      except as follows:  
32

- 33           1. The suppressor's minimum surge current capacity shall be 200kA  
34           per phase (L-N plus L-G) and 100kA per mode (L-N, L-G, L-L and  
35           N-G).  
36
- 37           2. The suppressor protection modules shall contain a technology that  
38           utilizes a symmetrical array of balanced metal oxide varistors  
39           (MOV). Each MOV will be individually coordinated to pass UL  
40           1449. The suppressor is non-modular.  
41
- 42           3. The suppressor shall provide the following monitoring features: dry  
43           contacts, audible alarm and utilize a NEMA 4X enclosure.  
44

1    2.03 BRANCH PANEL SUPPRESSORS

2            A. ACCEPTABLE MANUFACTURERS

5            LEA International – SP100  
6            Current Technology – CG060  
7            Liebert –ACV-111-RKE

9            B. Suppressors shall meet all specification requirements in section 2.1  
10          except as follows:

- 12            1. The suppressor's minimum surge current capacity shall be 100kA  
13          per phase (L-N plus L-G) and 50kA per mode (L-N, L-G, L-L and N-  
14          G).
- 16            2. The suppressor protection modules shall contain a technology that  
17          utilizes a symmetrical array of balanced metal oxide varistors  
18          (MOV). Each MOV will be individually coordinated to pass UL  
19          1449. The suppressor is non-modular.
- 21            3. The suppressor shall provide the following monitoring features: dry  
22          contacts, audible alarm and utilize a NEMA 4X enclosure.

24          PART 3 - EXECUTION

26          3.01 INSTALLATION OF SUPPRESSORS

- 28            A. Suppressors shall be installed as close as practical to the electric panel or  
29          electronic equipment to be protected, consistent with available space.  
30          Suppressors shall be close nipped to the device being protected in a  
31          position near the point of connections, which will minimize lead length  
32          between suppressor and the buses or control breaker to which the  
33          suppressor connects. Must have a grounding of 25 Ohms (NEC 250.56)  
34          or less and avoid any unnecessary or sharp bends.
- 36            B. For service entrance suppressors the lead length shall not exceed 36" from  
37          power it is protecting and use a 3 pole 60 amp breaker for  
38          disconnection means. For distribution and sub panels, the lead length  
39          shall not exceed 18" from the power it is protecting and use a 3 pole 30  
40          amp breaker for disconnection means.

41            END OF SECTION 16620

1 SECTION 16670  
2

3 LIGHTNING PROTECTION SYSTEMS  
4

5 PART 1 - GENERAL  
6

7 1.01 RELATED DOCUMENTS:  
8

- 9       A. Drawings and general provisions of Contract, including General and  
10      Supplementary Conditions and Division 1 Specification sections, apply to  
11      work of this Section.  
12  
13       B. This Section is a Division 16 Basic Electrical Materials and Methods  
14      section, and is part of each Division 16 Section making reference to  
15      lightning protection systems specified herein.

16  
17 1.02 DESCRIPTION OF WORK: Extent of lightning protection system work is  
18 indicated on the project drawings.  
19

20 1.03 QUALITY ASSURANCE:  
21

- 22       A. Manufacturers: Firms regularly engaged in the manufacture of early  
23      streamer emission lightning protection system components of types, sizes,  
24      and ratings required; whose products have been in satisfactory use in  
25      similar service for not less than three (3) years, and who are certified with  
26      ETL and listed with UL.  
27  
28       B. NEC Compliance: Comply with NEC requirements pertaining to lightning  
29      (surge) arresters, grounding, grounding electrodes, and down conductor  
30      clearances.  
31  
32       C. The lightning protection manufacturer shall provide a \$10,000,000.00, 100  
33      year guarantee to the original building owner to provide lightning  
34      protection for the protected area as shown and installed per the  
35      manufacturer's shop drawings.

36  
37 1.04 SUBMITTALS:  
38

- 39       A. Product Data: Submit manufacturer's data on lightning protection systems  
40      and associated components.  
41  
42       B. Shop Drawings: Submit layout drawings of lightning protection system  
43      equipment and components including, but not limited to, air terminals,  
44      mounting details, conductor routing, connections, and grounding.

1      PART 2 - PRODUCTS

2  
3    2.01 ACCEPTABLE MANUFACTURERS: Subject to compliance with requirements,  
4       the manufacturer of lightning protection components shall be Lightning Preventor  
5       of America.

6  
7    2.03 LIGHTNING PROTECTION SYSTEM COMPONENTS:

- 8  
9       A. General: Provide material and components, of types, sizes, ratings, for  
10       early streamer emission (ESE) lightning protection of buildings and  
11       property, which comply with manufacturer's standard materials, design,  
12       and construction in accordance with published product information, and as  
13       required for complete installation. Where type components or materials  
14       are not otherwise indicated, comply with proposed NFPA 781 standards.  
15       Unless noted otherwise, all air terminals, conductors, connectors, and  
16       ground rods shall be copper.
- 17  
18       B. ESE Air Terminal: The complete assembly shall consist of a stainless  
19       steel air terminal, 5/8" diameter minimum, stainless steel housing, with the  
20       ESE initiator, sensing mechanism, triggering mechanism, to be completely  
21       sealed. Provide threaded base for connection to mast and nameplate.
- 22  
23       C. Copper conductors shall be 28 strands of 14 gauge wire rope lay, with a  
24       net weight of 375 pounds per 1,000 feet, minimum, or copper strip of  
25       equivalent capacity.
- 26  
27       D. Aluminum mast height to be determined by the area of protection, with  
28       threaded connections for the ESE air terminal and bonding plate for cable  
29       connection. Wind and safety factors shall be engineered to comply with  
30       geographic location, to determine the size and structure of mast. All  
31       masts are to be ETL listed.
- 32  
33       E. Ground rods shall be copper-clad 3/4" x 20' minimum. One set of tripod  
34       (DELTA) grounds shall be installed for each down conductor, two (2)  
35       minimum per system with allowed exceptions.
- 36  
37       F. Provide all connectors, fittings, fasteners, hardware, clamps, lugs, crimps,  
38       etc. as required to connect and install all parts of the system. All material  
39       to be ESE system certified by ETL and listed.
- 40  
41       G. All equipment shall be fabricated from copper and/or bronze, stainless  
42       steel, and be ESE system certified by ETL for the type of installation.
- 43  
44       H. All connections between dissimilar metals shall have connectors that are  
45       ESE system certified by ETL for the type of installation.

1      PART 3 - EXECUTION  
2

3      3.01    INSTALLATION OF LIGHTNING PROTECTION SYSTEMS:  
4

- 5            A. Installation of equipment shall be done under the direct supervision of a  
6            manufacturer's certified installer and in accordance with equipment  
7            manufacturer's written instructions.  
8
- 9            B. All work shall be installed in accessible locations and properly guarded  
10          and protected.  
11
- 12          C. All material shall be installed in a manner to prevent electrolytic action  
13          under presence of moisture.  
14
- 15          D. All wall or other building penetrations shall be made in a manner to  
16          prevent the ingress of water or moisture.  
17
- 18          E. PVC sleeves shall be provided where conductors pass through all floors.  
19
- 20          F. All conductors shall be secured every 3'0" maximum. Fasteners and clips  
21          utilized shall be of equal corrosion resistance as the material being  
22          secured to.  
23
- 24          G. Bonding of all conductive material within six (6) feet of the conductor shall  
25          be accomplished via secondary conductors no smaller than #6 copper.  
26
- 27          H. Bare copper material shall not be installed on dissimilar metals. Corrosion  
28          resistant copper or bronze equipment shall be utilized where these  
29          conditions exist. Corrosion resistant copper conductors and fittings shall  
30          be utilized where corrosive atmospheres are present.  
31
- 32          I. Conductors shall be installed so that a conductor shall always have a  
33          horizontal or downward path, free of "U" or "V" pockets, with the exception  
34          that an eight (8) inch maximum rise or a rise of three (3) inches maximum  
35          from every twelve (12) inches of conductor length shall be permitted in a  
36          main conductor run.  
37
- 38          J. Each ESE terminal shall have two (2) paths to ground from the base plate  
39          of the mast.  
40
- 41          K. The electrical contractor shall furnish and install all necessary PVC  
42          conduit (1") for concealed down conductors.  
43
- 44          L. No bend of a conductor shall be less than ninety (90) degrees and shall  
45          not have a radius of bend of less than eight (8) inches. Exceptions are  
46          through roof and wall assemblies and "T" connections.

- 1           M. Notify architect/engineer prior to installation if lightning protection  
2           equipment and/or installation will conflict with other building materials.  
3  
4           N. Coordinate with other work, including electrical wiring and roofing work, as  
5           necessary to interface installation of lightning protection system with other  
6           work.  
7  
8           O. The complete lightning protection system shall be fully tested in the  
9           presence of the engineer, and a certified ground test is to be performed  
10          and witnessed by the engineer with all documents to be completed and  
11          forwarded to the ESE manufacturer and engineer for evaluation,  
12          certification, archiving, and documentation.  
13  
14          P. The completed system shall be videotaped and documented during  
15          installation. Documentation and videotape is to be returned to  
16          manufacturer for certification and issuance of manufacturer's guarantees  
17          and warranties, and for archiving and system documentation.  
18  
19

20        **3.02 GROUNDING AND BONDING:**

- 21          A. Provide equipment grounding and bonding connections, sufficiently tight to  
22          assure permanent and effective grounds and bonds, for lightning  
23          protection connection devices as indicated.  
24  
25          B. Ground rods, ground plates and ground loop conductors shall be installed  
26          a minimum of two (2) feet below grade and a minimum of two (2) feet  
27          away from the foundation.  
28  
29          C. A minimum of one (1) inspection and test well, rated for the traffic of the  
30          installation area, shall be installed for each down conductor or two (2)  
31          minimum per ground loop.  
32  
33          D. Bonding of grounded systems shall be via main size conductors. The  
34          bonding shall be accomplished to achieve equal potential of all grounds.  
35          All grounding connections shall be via Burndy high compression crimps, or  
36          Cadweld, or via a pre-approved connection suitable for direct burial.  
37  
38          E. All ground grids are to have a ground resistance of ten (10) ohms or less.  
39          Testing method shall be of the "Fall of Potential Method" as described by  
40          IEEE. Delta grids shall be tested without the service ground connection,  
41          and documented as such, then connection to the service ground can be  
42          made, and retested and documented for future testing and trends.  
43  
44

F. The ground resistance of the completed system shall be tested in the presence of the engineer and shall be so noted on a Certified Ground Test document.

END OF SECTION 16670

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2  
3  
4  
5

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1

## SECTION 16775

2

### VARIABLE FREQUENCY MOTOR CONTROLLERS

4

#### PART 1 - GENERAL

6

##### 1.01 SUMMARY

8

- 9       A. Scope: Provide labor, material, equipment, related services, and  
10      supervision required, including, but not limited to, manufacturing,  
11      fabrication, erection, and installation for adjustable or variable frequency  
12      motor controllers (identified as VFDs or Variable Frequency Drives) as  
13      required for the complete performance of the work, and as shown on the  
14      Drawings and as herein specified.
- 15      B. Section Includes: The work specified in this Section includes, but shall not  
16      be limited to, Variable Frequency Drives (VFDs) rated 600 V and less for  
17      the speed control of three-phase squirrel-cage induction motors, and  
18      synchronous motors as specified herein and where shown on the  
19      associated schedules and the Drawings.
- 20      C. Related Sections: Related sections include, but shall not be limited to, the  
21      following:
  - 22       1. Drawings and general provisions of the Contract, including General  
23          and Supplementary Conditions and Division 01 Specification  
24          Sections, apply to this Section.
  - 25       2. Applicable general requirements for electrical Work specified within  
26          Division 26 Specification Sections, apply to this Section.
  - 27       3. Refer to the specifications sections for the VFD driven equipment  
28          for additional requirements.
  - 29       4. [Section 26 24 19 – Motor Control Centers, for VFDs installed in  
30          motor-control centers.]
- 31      D. [The system supplier of the motor driven equipment shall be responsible  
32          for furnishing the Variable Frequency Drive.]

37

##### 1.02 REFERENCES

42

- 43       A. General, Publications: The publications listed below form a part of this  
44          Specification to the extent referenced. The publications are referred to in  
45          the text by the basic designation only. The edition/revision of the

1 referenced publications shall be the latest date as of the date of the  
2 Contract Documents, unless otherwise specified.  
3

- 4       1. ANSI®/NFPA® 70 – National Electrical Code® (NEC®)  
5       2. CSA® C22.2 No. 14-M91 – Industrial Control Equipment  
6       3. IEC 61000 – Electromagnetic Compatibility  
7       4.  
8           a. NEMA 250 – Enclosures for Electrical Equipment  
9           b. NEMA ICS7 – Industrial Control and Systems Adjustable  
10           Speed Drives  
11           c. NEMA ICS 7.1 – Safety Standards for Construction and  
12           Guide for Selection Installation and Operation of Adjustable  
13           Speed Drives  
14       5.  
15           a. UL® 50 – Enclosures for Electrical Equipment  
16           b. UL 98 – Disconnect Switches  
17           c. UL 507 – Electric Fans  
18           d. UL 508 – Industrial Control Equipment  
19           e. UL 508C or UL 61800-5-1 – Power Conversion Equipment  
20           f. UL 991 – Safety Tests for Safety Related Controls  
21           Employing Solid State Devices  
22       6. OSHA® 1910.95 – AC Drive Controller Acoustical Noise  
23       7. IBC® – International Building Code®  
24       8. ASCE/SEI 7® – Seismic Performance Requirements  
25       9. ICC ES AC156 – Shake-Table Test Acceptance Criteria  
26       10. IEEE519 – “IEEE Recommended Practices and Requirements for  
27           Harmonic Control in Electrical Power Systems”  
28

- 29       B. General, Definitions: Unless specifically defined within the Contract  
30           Documents, the words or acronyms contained within this specification  
31           shall be as defined by the references listed within this specification, the  
32           Contract Documents, or, if not listed by either, by common industry  
33           practice.  
34

35       1.03 SUBMITTALS  
36

- 37       A. General: Submit sufficient information to determine compliance with the  
38           Contract Documents. Identify submittal data with the specific equipment  
39

1 tags and/or service descriptions to which they pertain. Submittal data shall  
2 be clearly marked to identify the specific model numbers, options, and  
3 features of equipment and Work proposed.

- 4
- 5     1. Refer to [Section 01 33 00 - Submittal Procedures] [Section 01300  
6         - Submittals].
  - 7     2. All deviations from the Contract Documents shall be indicated  
8         within a submittal. Each deviation shall reference the  
9         corresponding drawing or specification number, show the contract  
10        document requirement text and/or illustration, and shall be  
11        accompanied by a detailed written justification for the deviation.

- 12
- 13   B. Product Data: Submit product data specific to each type and rating of VFD  
14   proposed to include the following:

- 15
- 16     1. Manufacturer, supplier, and proposal specific contact information.
  - 17     2. Manufacturer's catalog data indicating model numbers, equipment  
18         specifications and construction features including all furnished  
19         options, and accessories.
  - 20
  - 21     3. VFD assembly rated input KVA and output KVA, percent efficiency,  
22         operating characteristics, and electrical characteristics.
  - 23
  - 24     4. Maximum [Btu] [kJ] heat release data and ambient cooling  
25         requirements.
  - 26
  - 27     5. Enclosure type, [NEMA][IEC] rating, material and finishes.
  - 28
  - 29     6. Certification of UL conformity
  - 30
  - 31     7. Electronic 2D dimensional drawing and 3D model CAD files for  
32         standard units shall be provided upon request if not available from  
33         the manufacturer's website.
  - 34

- 35
- 36   C. Shop Drawings: Submit shop drawings for each product and accessory  
37   required. Include information not fully detailed in manufacturer's standard  
38   product data. Shop drawings shall include, but not be limited to the  
39   following:

- 40
- 41     1. Equipment assembly. Indicate dimensions, shipping section  
42         dimensions, weights, foundation requirements, required  
43         clearances, location and size of each field connection, and  
44         mounting and installation instructions.
  - 45

1           2. Include elementary and interconnection diagrams for power, signal,  
2           control, and communications wiring. Diagrams shall provide the  
3           minimum detail as shown for drawings in the appendix of NFPA 79.  
4           All field terminals shall be identified and updated later within the  
5           O&M data to include actual field connection information. Drawings  
6           shall not be typical, but be provided for each VFD furnished.  
7

8           D. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned  
9           layout on which the following items are shown and coordinated with each  
10          other, using input from installers of the items involved:

- 11           1. Required working clearances and required area above and around  
12           VFDs.
- 13           2. Show VFD layout and relationships between electrical components  
14           and adjacent structural and mechanical elements.
- 15           3. Show support locations, type of support, and weight on each  
16           support.
- 17           4. Indicate field measurements.

18           E. Harmonic Analysis Report: Provide project-specific calculations and  
19           manufacturer's statement of compliance with IEEE 519, latest revision.  
20           Owner shall supply detailed electrical power system characteristics to  
21           support harmonic calculations.

22           F. Operation & Maintenance (O&M) Manuals: Submit installation, operation  
23           and maintenance data to be included within operation and maintenance  
24           manuals. In addition to items specified in Section [01 78 23] "Operation  
25           and Maintenance Data", O&M data shall include but not be limited to the  
26           following:

- 27           1. O&M manuals shall be submitted prior to arrival of equipment on  
28           site.
- 29           2. Manufacturer, supplier, support, and repair center specific contact  
30           information.
- 31           3. Manufacturer's standard operation and maintenance data  
32           assembled for each size and type of equipment furnished.
- 33           4. [All construction, installation, schematic, and wiring diagrams  
34           updated to an as-installed and commissioned state.] [All submittal  
35           information updated to an as-installed and commissioned state.]

- 1           5. All configured settings/parameters for adjustable components  
2           updated to an as-installed and commissioned stated if different  
3           from the factory default. Electronic copies of configuration files  
4           shall be provided, on media acceptable to the Owner (e.g. CD,  
5           USB stick, etc.), where these configurations can be saved as an  
6           electronic file for future upload into replaced or repaired  
7           components.
- 8           6. List of furnished and recommended spare parts.
- 9           7. Statement of standard Warranty. [Statement of extended warranty  
10          options and costs.]

14         1.04 QUALITY ASSURANCE

- 16         A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the  
17           manufacture of VFDs of types and sizes required, and whose products  
18           have been in satisfactory use in similar service for a minimum of five  
19           years.
- 21         1. The VFD manufacturer shall have a valid ISO 9001 certification  
22           and an applicable quality assurance system.
- 24         2. The VFD manufacturer shall have the Environment Certification  
25           ISO 14001 for EcoDesign.
- 27         B. Commissioning and Training: VFDs shall be inspected and commissioned  
28           by a factory trained representative of the VFD manufacturer. VFD  
29           operation and maintenance training shall be conducted by a factory-by a  
30           factory-trained representative of the VFD manufacturer trained in the  
31           installation, operation, and maintenance of the VFD.
- 33         C. Regulatory Requirements: Comply with applicable requirements of the  
34           laws, codes, ordinances, and regulations of Federal, State, and local  
35           authorities having jurisdiction. Obtain necessary approvals from such  
36           authorities.
- 38         1. Without limiting the generality of other requirements of this Section,  
39           all work specified herein shall conform to or exceed the applicable  
40           requirements of the following standards; provided, that wherever  
41           the provisions of said publications are in conflict with the  
42           requirements specified herein, the more stringent requirements  
43           shall apply:
- 45           a. ANSI/NFPA 70: National Electrical Code

- 1                   b. EN61800-5: Electronic equipment for use in power  
2                    installation  
3                   c. CSA C22.2 No. 14-M91: Industrial Control Equipment  
4                   d. IEC 68 Part 2-3: Basis Environmental Testing Procedures  
5                    Part 2: Tests – Test Ca: Damp Heat  
6                   e. IEC 146.1: Semiconductor Converters – General  
7                    Requirements and Line Commutated Converters Part 1-1: -  
8                    Specifications of Basic Requirements  
9                   f. IEC 664: Insulation Co-ordination for Equipment within Low-  
10                  Voltage Systems  
11                  g. IEC 447: Man-Machine Interface Actuating Principles  
12                  h. IEC 439 Part 1: Low Voltage Switch gear and Control gear  
13                  Components  
14                  i. IEC 364: Electrical Installation of Buildings  
15                  j. IEC 204/NFPA 79: Electrical Equipment of Industrial  
16                  Machines/Industrial Machinery  
17                  k. IEC 106: Guide for Specifying Environmental Conditions for  
18                  Equipment Performance Rating  
19                  l. IEC 529: Degrees of protection provided by enclosure  
20                  m. IEC 1000: Electromagnetic Compatibility  
21                  n. IEC 1800: Adjustable speed Electrical power drive systems  
22                  o. IEC 721: Classification of Environmental Conditions  
23                  p. IEC 255-8: Overload Relays  
24                  q. IEC 801-2,-3,-4,-5: Immunity Tests  
25                  r. NEMA ICS Part 4: Overload Relays  
26                  s. NEMA ICS7: Industrial Control and Systems Variable Speed  
27                  Drives  
28                  t. UL 508C, UL 61800-5-1: UL Standard for Safety Power  
29                  Conversion Equipment

30  
31                  D. Single Source Responsibility: Obtain VFDs and required accessories from  
32                  a single source with resources to produce products of consistent quality in  
33                  appearance and physical properties without delaying the work. Any  
34                  materials which are not produced by the manufacturer shall be acceptable  
35                  to and approved by the manufacturer.

36  
37                  E. All VFDs shall be functionally tested by the manufacturer

38  
39                  **1.05 SPECIAL TOOLS AND SPARE PARTS**

- 40  
41                  A. A replacement VFD shall be provided for 1-125 HP 460V, and 1-60 HP  
42                  230V, in lieu of replacement components.  
43  
44                  B. Spare parts shall be provided for each type and size of VFD furnished  
45                  greater than 125 HP 460V, and 60 HP 230V. [Provide the minimum spare  
46                  parts recommended by the manufacturer.][Provide at least one complete

1 set of all plug-in replaceable components of each size and type used.] At  
2 a minimum the following shall be provided:  
3

- 4       1. Power and control fuses  
5       2. Non-LED type indicating lights  
6       3. Rectifier power semiconductors  
7       4. Inverter power semiconductors  
8       5. One of each type of printed circuit board and gate firing board  
9       6. Other field replaceable components]

10      C. Any manufacturer specific special tool, not normally found in an  
11       electrician's toolbox, required to remove and install recommended or  
12       furnished spare parts shall be furnished. At a minimum the following shall  
13       be provided:

- 14       1. PC-based configuration software tool.  
15       2. Electronic configuration files, in a media format acceptable by the  
16       Owner (e.g. CD, USB stick, etc.), updated to an as-installed and  
17       commissioned state.

## 27 1.06 DELIVERY, STORAGE, AND HANDLING

- 28      A. Prior to delivery to the Project site, ensure that suitable storage space is  
29       available to store materials in a well ventilated area protected from  
30       weather, moisture, soiling, extreme temperatures, humidity, and corrosive  
31       atmospheres. Materials shall be protected during delivery and storage and  
32       shall not exceed the manufacturer stated storage requirements.  
33
- 34      B. Deliver materials to the Project site in supplier's or manufacturer's original  
35       wrappings and containers, labeled with supplier's or manufacturer's name,  
36       material or product brand name, and lot number, if any.  
37
- 38      C. Inspect and report any concealed damage or violation of delivery storage,  
39       and handling requirements to the [Engineer/Contract Manager].

## 42 1.07 WARRANTY

- 43      A. Warranty on drives shall be at a minimum 18 months from commissioning  
44       or as specified in the

1           B. Additional Owner Rights: The warranty shall not deprive the Owner of  
2 other rights the Owner may have under other provisions of the Contract  
3 Documents and shall be in addition to and run concurrent with other  
4 warranties made by the Contractor under requirements of the Contract  
5 Documents.

6

## 7 PART 2 - PRODUCTS

8

9

### 2.01 MANUFACTURERS

- 10
- 11       A. Yaskawa Model IQ1000 by ICON Technologies, no equal.

12

  - 13       B. Acceptable Products: VFDs specified herein shall be the product of a  
14 single manufacturer. All VFD's provided In MCC must meet UL 845. Note:  
UL 508 will be accepted. Provide Yaskawa Model iQ1000, no equal.

15

  - 16       C. The VFD manufacturer shall provide for repair and service of the drive  
17 components with worldwide support. The VFD manufacturer shall provide  
18 remote diagnostic services in conjunction with the VFD's user interface to  
19 provide QR code, or equivalent, linked access to worldwide web based  
20 enhanced diagnostics, documentation, and customer service.

21

22

### 2.02 SYSTEM REQUIREMENTS

- 23
- 24       A. Variable Frequency Drives (VFDs) shall provide for the starting and speed  
25 control of standard IEC or NEMA A design AC inverter duty asynchronous  
26 motors and synchronous motors with permanent magnets by the  
27 adjustment of output voltage and frequency.

28

  - 29       B. The VFD manufacturer shall design the device with more than 70% of  
30 recyclability rate.

31

  - 32       C. The VFD Manufacturer shall design the device according to the IEC  
33 62635 guidelines to reduce the carbon footprint. The materials used in the  
34 VFD shall be recyclable, non-toxic and flame retardant. The VFD  
35 manufacturer shall provide the carbon foot print of the devices.

36

  - 37       D. The VFDs shall be built to comply with the UL standard and shall be  
38 marked in accordance with to UL 508 or UL 61800-5-1.

39

  - 40       E. The VFD shall be compliant with the "Green" Premium label (REACH,  
41 RoHS-2, EOL, and PEP).

42

43

### 2.03 Variable Frequency Drives

1           A. The VFD shall be a digitally controlled drive, using Pulse Width  
2           Modulation (PWM). All VFDs above 75HP shall be 12-pulse low harmonic  
3           type. 6-pulse technology shall be provided for all VFDs 75HP and below.  
4

5           B. Environment and Construction  
6

- 7           1. The VFD shall be rated to withstand the following environmental  
8           conditions while able to give a 100% output current continuously.  
9           Where derating is necessary to meet on site environmental  
10          conditions, the manufacturer shall submit the VFDs derated  
11          performance. The derating factor shall be specified so that neither  
12          the lifetime of the VFD nor the unit's performance, overload  
13          capability included, nor the reliability of the VFD shall suffer.  
14
- 15           a. Storage Temperature: -40°C to 70°C,  
16
- 17           b. Operating Temperature for UL Type 1 VFDs: -15°C to 50°C  
18          without derating, up to 60°C with derating of power stage  
19          (UL Type 1)  
20
- 21           c. Operating Temperature for enclosed VFDs: 0°C to 40°C  
22          without derating, down to -10°C with enclosure heater, up to  
23          55°C with derating of power stage  
24
- 25           d. Relative Humidity: ≤95% relative humidity without  
26          condensation per IEC 60068-2-3  
27
- 28           e. f. Operating Altitude: ≤1000m without derating, up to 4800m  
29          with derating.  
30
- 31           g. Corrosion Protection Level: Class 3C3 according to IEC  
32          60721-3-3 for cooling air and chemical gases  
33
- 34           h. Biological Protection Level: Class 3B1 according IEC  
35          60721-3-3  
36
- 37           i. Dust Protection Level: Class 3S3 according to IEC 60721-3-  
38          3  
39
- 40           j. Vibration and Shock Protection Level: Class 3M3 according  
41          to IEC 60721-3-3  
42
- 43
- 44           2. The VFDs shall have an integral enclosure that shall protect from  
45          ingress of dirt and water in accordance with UL Type 1 or as shown  
46          on drawings. The user interface terminal shall be rated UL Type 12,

1                   mounted on front face of enclosure, and accessible for  
2                   programming and controls with the main door closed.  
3

- 4                   3. VFD enclosures shall be front cabinet accessible and constructed  
5                   in conformance with IEC 60439-1. Conduit entry shall be bottom  
6                   entry as standard to allow for top mounted cooling components.  
7                   The VFD enclosure shall have a forced air and heat sink cooling  
8                   system that does not require liquid or air condition cooling  
9                   components for ambient temperatures within the drives stated  
10                  ambient temperature operating range.

11

12                  C. Application Requirements

13

- 14                  1. The VFD shall be able to control motors using the following motor  
15                  control types in accordance with the applications needs and energy  
16                  savings: Volts per hertz VC Standard,
- 17
- 18                  2. The VFD shall provide a Real Time Clock management with battery  
19                  backup.
- 20
- 21                  3. The VFD shall be capable of automatic tuning of motor parameters  
22                  through measurement of the motor without rotation, and without the  
23                  need to disconnect the load from the motor.
- 24
- 25                  4. The VFD shall provide functionality adjustable within the drive  
26                  parameters to reduce voltage surges on motor cables.
- 27
- 28                  5. The Contractor shall provide AC chokes and filters to fit installation  
29                  and motor requirements per the following guidelines:
- 30
- 31                   a. Voltage reflection suppression for motors compliant to  
32                   IEC60034-25 or NEMA MG1 Part 31
- 33
- 34                   i. Unshielded motor cable length up to 500 feet (150  
35                   meters) shall be managed with the VFD functionality  
36                   ii. Unshielded motor cable length up to 1000 feet (300  
37                   meters) an AC choke shall be required  
38                   iii. Unshielded motor cable length up to 1640 feet (500  
39                   meters) a dV/dt filter shall be required  
40                   iv. Unshielded motor cable length up to 3280 feet (1000  
41                   meters) a Sinus filter shall be required
- 42
- 43                   b. Voltage reflection suppression with motors not compliant to  
44                   IEC60034-25 or NEMA MG1 Part 31
- 45

- 1                   i.     Unshielded motor cable length up to 50 meters a  
2                   dV/dt filter shall be required  
3                   ii.    Unshielded motor cable length up to 1000 meters a  
4                   Sinus filter shall be required

5

6                  D.    Performance Requirements

7

- 8                  1.    The VFD shall be rated for the nominal input voltage specified or  
9                   shown on the drawings. The VFD shall have an input voltage  
10                  tolerance within the following range of the corresponding nominal  
11                  input voltage:
- 12
- 13                a.    Standard product, three phases power supply:
- 14
- 15                i.    200V -15% 240V +10%, three-phase up to 100 HP /  
16                   75 KW  
17                ii.    380V -15% 480V +10%, three-phase up to 250 HP /  
18                   160 KW  
19                iii.    500 to 690V -15% / +10%, three-phase up to 250 HP  
20                   / 160 KW
- 21
- 22                b.    Enclosed Drive System, three phases power supply:
- 23
- 24                i.    200V -15% 240V +10%, three-phase up to 60 HP / 45  
25                   KW  
26                ii.    380V -15% 480V +10%, three-phase up to 1,100 HP /  
27                   800 KW  
28                iii.    500 to 600V -15% / +10%, three-phase up to 1,500  
29                   HP / 1,500 KW
- 30
- 31                2.    The VFD shall meet the following minimum operating requirements:
- 32                a.    Rated Frequency: 50 Hz -5% to 60 Hz + 5%, [The VFD shall  
33                   operate from 40 to 72 Hz when powered by standby or  
34                   emergency generators]
- 35
- 36                b.    Displacement Power Factor: ≥0.97
- 37
- 38                c.    Efficiency:
- 39
- 40                i.    >98 % at nominal load for VFD (IP 21 / UL Type 1)  
41                ii.   >97.5 % at nominal load for enclosed VFD systems.  
42                iii.   >96 % at nominal load for low harmonic VFD (IP 21 /  
43                   UL Type 1)  
44                iv.   >95.5 % at nominal load for low harmonic enclosed  
45                   VFD systems.
- 46

- 1                   d. Overload Capability: [Normal duty at 110%] [Heavy Duty at  
2                   150%] nominal current for 1 min
- 3
- 4                   e. Harmonics Mitigation: [<48% THDi according to IEC/EN  
5                   61000-3-12][<5% at VFD input terminals] at 80-100% load
- 6
- 7                   f. Surge immunity according to IEC/EN 61000-4-5         Level  
8                   3
- 9
- 10                  g. [The VFD shall be compliant with SEMI F47: degraded  
11                  running operation under voltage conditions.]
- 12
- 13                  3. The VFD shall provide a speed range in the motor quadrant 1:100  
14                  in sensor less vector control and in the generator quadrant 1:50 in  
15                  sensor less vector control.
- 16
- 17                  4. The VFD shall provide an over torque capability better than [110%  
18                  of the rated motor torque for normal duty applications] [150% of the  
19                  rated motor torque for heavy duty applications] during 60s, every  
20                  10 minutes.
- 21
- 22                  5. The VFD shall provide a speed accuracy  $\pm 10\%$  of the nominal slip  
23                  of the motor in sensor less vector control
- 24
- 25                  6. The VFD shall provide a torque control accuracy  $\pm 15\%$  in sensor  
26                  less vector control for AC motors
- 27

28                  E. Protection

29

- 30                  1. The VFD shall have coordinated short circuit rating designed to UL  
31                  508C or UL 61800-5-1 and NEMA ICS 7.1 Short Circuit Rating: 65  
32                  kAIC
- 33
- 34                  2. Micro-short voltage sag immunity per SEMI F47.
- 35
- 36                  3. Upon power-up the VFD shall automatically test for valid operation  
37                  of memory, option module, loss of analogue reference input, loss of  
38                  communication, DC to DC power supply, control power and the  
39                  pre-charge circuit.
- 40
- 41                  4. The VFD shall be protected against short circuits, between output  
42                  phases and ground and the logic and analogue outputs.
- 43
- 44                  5. The VFD shall have a selectable ride through function that will  
45                  allow the logic to maintain control for a minimum of one second  
46                  without tripping.

- 1
- 2       6. The deceleration mode of the VFD shall be programmable for  
3           normal and trip conditions. The stop modes shall include freewheel  
4           stop, fast stop.
- 5
- 6       7. Upon loss of the analog process follower reference signal, the VFD  
7           shall trip and/or operate at a user-defined speed set by a software  
8           programmed speed settings or last speed.
- 9
- 10      8. The VFD shall integrate a protection against IGBT and heat sink  
11           over temperature.
- 12
- 13      9. The VFD shall have solid state thermal protection that is UL Listed  
14           and meets UL 508C as a Class 10 overload protection and meets  
15           IEC 947.
- 16
- 17      10. The VFD shall have a motor thermal memory retention function per  
18           UL requirements.
- 19
- 20      11. The VFD shall be able to protect the motor when temperature  
21           probes are connected.
- 22
- 23      12. The VFD shall be able to limit the motor surge (  $I \text{ dv/dt}$  ) at twice  
24           the DC bus voltage
- 25
- 26      13. The VFD shall provide IGBT protection
- 27
- 28       a. IGBT overcurrent protection  
29       b. IGBT check up sequence  
30       c. IGBT check up sequence before PWM enable sequence  
31       d. IGBT over-heat protection
- 32
- 33      14. The VFD shall provide VFD Current protection
- 34
- 35       a. Phase short circuit protection  
36       b. Ground protection  
37       c. Over-current protection
- 38
- 39      15. The VFD shall provide VFD Voltage error protection
- 40
- 41       a. Mains over-voltage protection  
42       b. Mains under-voltage protection  
43       c. DC Bus over-voltage protection  
44       d. DC Bus pre-charge protection
- 45
- 46      16. The VFD shall provide VFD Thermal protection

- 1                   a. VFD over-temperature protection  
2                   b. FAN management  
3                   c. Switching Frequency management  
4  
5                 17. The VFD shall provide internal error detection.  
6  
7                 18. The VFD shall provide Motor protection functions  
8  
9                   a. Motor output phase detection  
10                  b. Motor surge voltage  
11                  c. Motor over load detection  
12                  d. Motor stall protection  
13  
14                 19. The VFD shall provide Application protection functions  
15  
16                   a. Catch on fly function  
17                  b. Mains input phase lost protection  
18                  c. Motor over-speed input protection  
19                  d. Current limitation  
20                  e. Power limitation  
21                  f. Reverse inhibition  
22                  g. Under-load protection  
23                  h. Over-load protection  
24                  i. External error management  
25                  j. Loss of follower signal  
26                  k. Thermal Sensor management  
27                  l. PID Feedback  
28                  m. Customer defined input  
29  
30

31                 F. Indicators  
32

- 33                 1. The VFD shall display a signal by LED near the connection point of  
34                 the device when a hazardous voltage is present.  
35  
36                 2. The VFD shall have 3 LEDs for local diagnostics.  
37  
38                 3. The VFD shall have 3 dual color LEDs for embedded  
39                 communication status.  
40  
41                 4. The VFD shall have 4 dual color LEDs for optional communication  
42                 status  
43

44                 G. User Interface  
45

- 1       1. A detachable UL Type 12/IP65 rated bi-color backlit graphical user  
2       interface terminal with keypad and capacitive wheel shall be  
3       provided for monitoring, annunciation, and configuration. The  
4       graphical display shall change to a red backlit color when an alarm  
5       occurs. The door mounting for the user interface shall be done  
6       with a 22 mm hole.
- 7       2. A "Simply Start "menu for fast and easy commissioning shall be  
8       provided and parameter setting shall be easily accessible and user  
9       friendly with plain text messaging and actual setting range.
- 10      3. The keypad shall be capable of providing password protection.
- 11      4. The user interface shall be capable of saving and downloading  
12       configurations of the VFDs, as well as porting them to other VFDs.
- 13      5. The user interface shall offer a Mini-USB port for mass storage or  
14       PC device connection.
- 15      6. The mechanical mounting for the user interface on the cabinet shall  
16       be done with a 22 mm hole.
- 17      7. The VFD shall have self-diagnostic capabilities to display alarms,  
18       errors, and warnings as they occur and be able to store at least 15  
19       last messages into the memory. These shall be accessible by PC  
20       maintenance tools or web server with flash record for data logging  
21       expertise
- 22      8. The user interface shall be identical throughout the power range to  
23       avoid confusion amongst the users and need for training in several  
24       different units.
- 25      9. The displayed messages shall be in plain text English, [French],  
26       [Spanish].

27           H. Control Interface:

- 28       1. VFD shall interface with automation systems to monitor, control,  
29       display, and record data for use in processing reports. VFD settings  
30       shall be retained within VFD's nonvolatile memory.
- 31       2. The speed command and reference may come from different  
32       control sources:  
33           a. I/O terminals  
34           b. Communication network  
35           c. Web server

- d. Remote graphic display terminal

3. A minimum of the following standard inputs / outputs shall be provided to interface with control systems and instrumentation:

  - a. Analog Inputs: [3][5] programmable 0(4)-20 mA or 0-10 vdc
    - i. 2 analog inputs shall also be programmable for temperature sensors (PTC, PT100, PT1000, KTY84)
  - b. Analog Outputs: 2 programmable 0(4)-20 mA or 0-10 vdc
  - c. Discrete Inputs: [6][12] programmable isolated logic inputs as either sink or source
    - i. 2 discrete inputs shall also be programmable as 0-30 kHz pulse inputs
    - ii. 2 discrete inputs shall be dedicated Safe Torque Off safety function in accordance with IEC/EN 61508-1 SIL3
  - d. Discrete Outputs: [3][6] programmable relay contacts [and 1 open collector output]
    - i. 1 discrete output shall be dedicated to product watchdog logic

4. Programmable analog inputs shall be able to be assigned the following parameters:

  - a. Speed reference
  - b. Summing reference
  - c. Subtracting reference
  - d. Multiplying reference
  - e. Torque reference
  - f. Torque limitation
  - g. PID feedback
  - h. Manual PID reference
  - i. PID speed reference
  - j. Forced local reference

5. Programmable analog outputs shall be able to be assigned the following parameters:

  - a. Motor current

- 1                   b. Motor frequency  
2                   c. Motor torque (signed or unsigned)  
3                   d. Motor power  
4                   e. Motor voltage  
5                   f. Output frequency (signed or unsigned)  
6                   g. PID error  
7                   h. PID feedback  
8                   i. PID output  
9                   j. PID reference  
10                  k. Ramp output  
11                  l. Signed ramp  
12                  m. Drive thermal state  
13                  n. Motor thermal state  
14                  o. Pressure sensor  
15                  p. Flow sensor
- 16
- 17                 6. Programmable discrete inputs shall be able to be assigned the  
18                 following parameters:
- 19
- 20                 a. Run  
21                 b. Forward  
22                 c. Reverse  
23                 d. Jog  
24                 e. Preset speeds  
25                 f. Reference switching  
26                 g. Ramp switching  
27                 h. Error reset  
28                 i. Error inhibition  
29                 j. Product reset  
30                 k. PID regulation mode (auto)  
31                 l. PID speed regulation mode (manual)  
32                 m. PID integral reset  
33                 n. Preset PID reference  
34                 o. Sleep/wake-up  
35                 p. Activate sleep mode by flow detection  
36                 q. Analogue torque limitation activation  
37                 r. Torque reference sign  
38                 s. Command switching  
39                 t. Parameter sets selection  
40                 u. Fast stop  
41                 v. DC injection  
42                 w. Freewheel stop  
43                 x. + speed  
44                 y. - speed  
45                 z. External error  
46                 aa. Pre Fluxing

- 1                   bb.   Forced local control  
2                   cc.   Current limitation activation  
3                   dd.   Output contactor feedback  
4                   ee.   Reference memorization  
5                   ff.   Auto-tuning  
6                   gg.   Forced operation  
7                   hh.   Under load detection  
8                   ii.   Overload detection  
9                   jj.   Limiting low speed operating time  
10                  kk.   Switching frequency, noise reduction  
11                  ll.   Drive lock assignment  
12                  mm.   Outlet pressure switch select  
13                  nn.   Pipe fill  
14                  oo.   External anti jam trigger  
15                  pp.   Dry running no flow switch select  
16                  qq.   Pump low flow no flow switch select
- 17
- 18                 7.   Programmable discrete outputs shall be able to be assigned the  
19                 following parameters:
- 20
- 21                 a.   Ready  
22                 b.   Drive running  
23                 c.   Frequency reference attained  
24                 d.   Current attained  
25                 e.   High speed attained  
26                 f.   Drive error  
27                 g.   Frequency threshold attained  
28                 h.   Torque sign  
29                 i.   Motor thermal state attained  
30                 j.   Drive thermal state attained  
31                 k.   Torque or current limitation attained  
32                 l.   Output contactor command  
33                 m.   Input contactor command  
34                 n.   Current present  
35                 o.   Power removed  
36                 p.   Alarm Groups  
37                 q.   Alarms: load slipping, 4-20mA loss, brake control, external  
38                 error, PTC, PID error, PID feedback, IGBT temperature,  
39                 under voltage, torque control, drive temperature, braking  
40                 resistor, fan counter, fan feedback, customer warning, power  
41                 threshold, electrical power drift  
42                 r.   Active configuration  
43                 s.   Active parameter set  
44                 t.   Active channel  
45                 u.   DC bus charged  
46                 v.   DC bus charging

- 1                   w. Water Command: jockey pump, priming pump  
2                   x. Water running: anti-jam, pipe fill, priming pump, jockey pump  
3                   y. Water warning: dry running, flow, inlet pressure, outlet  
4                   pressure, pump cycling, anti-jam, outlet pressure switch,  
5

6                   8. Safety Inputs  
7

- 8                   a. The VFD shall provide 2 inputs dedicated to Safe Torque Off  
9                   (STO) safety function, which prohibits unintended equipment  
10                  operation, in accordance with IEC/EN 61508-1 SIL3.  
11                  b. The VFD shall be compliant with EN13849 (PL e).  
12                  c. The VFD shall be compliant with safety of machinery EN  
13                  954-1  
14                  d. The VFD manufacturer shall provide the certified schematics  
15                  and the list of devices in order to comply with IEC/EN 60204-  
16                  1 stopping category 0 and 1.  
17                  e. The VFD shall integrate the safety contacts in compliance  
18                  with EN-81 13.2.2.3  
19

20                  I. Communications  
21

- 22                  1. The VFD shall provide at a minimum 1 Modbus and 1 Ethernet  
23                  Modbus TCP communications ports. [In addition, the following  
24                  communications options shall be provided as necessary for  
25                  communications. Refer to communication requirements specified  
26                  elsewhere within the Contract Documents.]  
27  
28                  f. [Ethernet IP or Modbus TCP, RJ45 dual port for daisy chain]  
29                  g. [Profibus DP V2, SUB-D9 connection, compliant with Drive  
30                  Profile networking]  
31                  h. [Profinet, RJ45 dual port for daisy chain]  
32                  i. [DeviceNet, 5 terminal points]  
33                  j. [CanOpen daisy Chain, RJ45 dual port for daisy chain]  
34                  k. [CanOpen SUB-D9 connection]  
35                  l. [CanOpen Open terminals, 5 terminal points]  
36  
37                  2. VFD Ethernet ports shall be IPv6 compliant, allow for web server  
38                  access and provide network management via SNMP and clock  
39                  synchronization.  
40  
41                  3. The VFD shall provide an embedded web server for enhanced  
42                  diagnostic, configuration, parameter access, and energy  
43                  management. There shall be the capability to create a user-defined  
44                  custom dashboard for viewing drive and process status through  
45                  tables, charts, and graphical views. It shall be possible to export

- 1 data in standard table format using the webserver, for information  
2 around energy consumption as well as error and warning history.  
3
- 4 4. The VFD shall be compliant with the Cyber Security Management  
5 ISA Secure /Achilles.  
6
- 7 5. The VFD shall be capable of providing Wi-Fi connectivity via option  
8 for wireless diagnostic, configuration, and parameter access.  
9
- 10 6. VFD communications modules shall be [capable of being] remotely  
11 powered by a separate external 24 VDC to allow for continued  
12 communications when the drive power supply is off.  
13

- 1           7. The VFD shall provide integration connectivity via  
2  
3            a.     DHCP protocol for Fast Device Replacement  
4            b.     DTM library in compliance with standard FDT technology  
5

6           J. Configuration  
7

- 8           1. The VFD shall be capable of accepting independent command and  
9            speed reference signals from:  
10  
11            a.    Terminals  
12            b.    Modbus port  
13            c.    Ethernet port  
14            d.    Communication option card  
15            e.    Keypad display.  
16  
17           2. The VFD shall provide a Speed set-point function capable of:  
18  
19            a.    Maximum output frequency function  
20            b.    Low and High speed scaling and limitation function  
21            c.    Jump frequency  
22            d.    Speed summing references function  
23            e.    Preset-speed references function  
24            f.    Jog function  
25            g.    Up-Down speed references  
26  
27           3. The VFD shall provide a Stop function capable of:  
28  
29            a.    Deceleration ramp on power loss  
30            b.    Freewheel stop  
31            c.    Stop by DC injection at motor stop detection  
32            d.    Stop by DC injection by Logic Input  
33            e.    Stop on deceleration ramp adaptation  
34  
35           4. The VFD shall have an acceleration/deceleration, time adjustable  
36           ramp function capable of:  
37  
38            a.    Ramp type: linear ramp, S shape ramp, with U or  
39            customized profile.  
40            b.    Ramp Deceleration adaptation  
41            c.    Ramp switching  
42  
43           5. Application programming dedicated to pumps  
44  
45            a.    The VFD shall provide Pump Control & Monitoring Functions  
46              i.      Centrifugal pump characteristics and configurations.

- 1                   ii. Pump monitoring function in order to define data  
2                   relevant for pump (acceleration, low speed, high  
3                   speed, etc.)  
4                   iii. Application Units function in order to define units used  
5                   in applications  
6                   iv. Pump Cyclic Start Protection in order to protect the  
7                   pump against too many restarts in a dedicated time  
8                   period.  
9                   v. Multi-pump functions.
- 10                  b. The VFD shall provide Pump Protection Functions  
11                   i. Anti-Jam function in order to remove automatically  
12                   clogging substances from the pump impellers.  
13                   ii. Pipe Cleaning function in order to start pump regularly to  
14                   avoid sedimentation in pump impeller  
15                   iii. Cavitation Pump Protection  
16                   iv. Inlet protection in order to avoid system dry running.
- 17                  c. The VFD shall provide Application control functions  
18                   i. Stop and Go function in order to reduce consumption  
19                   of VFD in case of pump doesn't work  
20                   ii. Pulse input in order to connect a flow meter.  
21                   iii. Process control (PID) function in order to maintain a  
22                   process at a given pressure or flow reference.  
23                   iv. Flow limitation function in order to allow limiting the  
24                   consumption of water.  
25                   v. Friction loss compensation function in order to  
26                   compensate pressure losses in pipes due to friction.  
27                   vi. Pipe Fill function in order to manage a smooth control  
28                   during pipe filling and to lessen the affects of water  
29                   hammer.  
30                   vii. Sleep wake-up function in order to manage periods of  
31                   the application when process demand is low and  
32                   when it is not needed.  
33                   viii. Low demand function in order to define periods of the  
34                   application when process demand is low in order to  
35                   save energy.  
36                   ix. Jockey pump control function in order to start a jockey  
37                   pump, during sleep period, to maintain emergency  
38                   service pressure or demand such as low water.  
39                   x. Sensor management in order to define how will be  
40                   used drive inputs to manage Pressure sensor or flow  
41                   sensor
- 42                  d. The VFD shall provide Application protection functions
- 43
- 44
- 45
- 46

- i. High flow protection function in order to detect pipe burst or detect running outside normal working area
  - ii. Outlet pressure protection function in order to fix minimum and maximum pressure.

e. The VFD shall provide Pump curve input to help optimize pump performance.

  - i. Input and storage of the pump characteristics including 5 points of the pump curve.
  - ii. A best efficiency point (BEP) function in order to run in optimum conditions and detect deviation from this point.

## K. Diagnostics and Configuration

1. The VFD Supplier shall have Windows based PC software for configuring and diagnosing the VFD. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software. The PC-tools may be connected to the VFD by wired or wireless connection.
  - ii. The VFD shall display all faults in plain text and help screens shall be available to guide the user in the troubleshooting. Codes are not acceptable.
  - iii. The VFD shall provide a Real Time Clock management for time stamping of detected errors.
  - v. The VFD shall display detected errors with QR codes to guide the user in the troubleshooting.
  - v. The VFDs must provide LED lights to indicate the status of the VFD.
  - vi. The VFD must have the ability to dynamically display I/O status.

## L. Energy Management

1. The VFD shall provide a data logging function in order to keep files ready for maintenance or user.
  2. The VFD shall provide information related to Energy management through different ways such as: web server, keypad, facet for SCADA, communication networks.

- 1           3. The user interface shall be able to display a chart relative to energy  
2           efficiency and energy management.  
3  
4           a. Report in KW  
5           b. Display energy history for instant, weekly, monthly, and  
6           yearly.  
7           c. Trend base on variation /time  
8           d. All power measurement precision must be less than 5 % of  
9           deviation.  
10  
11          4. The user interface shall be able to display the "efficient" set point  
12          for pump based on pump characteristics.  
13  
14          5. The user interface shall be able to display the "efficiency board"  
15          including CO2 savings, Savings viewer, and Return of Investment.  
16  
17

18        **PART 3 - EXECUTION**  
19

20        **3.01 EXAMINATION**  
21

- 22           A. Examine VFD exterior and interior prior to installation. Report any damage  
23           and do not install any VFDs that are structurally, moisture, or mildew  
24           damaged.  
25  
26           B. Prior to locating the VFD at the planned installation site, ensure that the  
27           location is prepared for the installation and that the storage or operating  
28           condition requirements can be maintained. Verify installation space  
29           requirements are satisfied. Report any conditions that are detrimental to  
30           performance of the work. Proceed with installation only after detrimental  
31           conditions have been corrected.  
32  
33           C. Before, during, and after installation ensure that the VFD is protected from  
34           area construction activities and site contaminants.  
35

36        **3.02 INSTALLATION**  
37

- 38           A. In addition to the requirements specified herein the installation shall be in  
39           accordance with Specification Section 16010 and Drawings.  
40  
41           B. Installation shall comply with manufacturer's instructions, drawings, and  
42           recommendations.  
43

44        **3.03 FIELD QUALITY CONTROL**  
45

- 1           A. Configuration and Startup: Provide the services of a qualified factory-  
2           trained manufacturer's representative to assist the installing contractor  
3           with the installation, configuration and startup of each VFD. The  
4           manufacturer's representative shall inspect the installation of each VFD  
5           prior to energizing and configure each VFD for operation under the  
6           specified conditions. The manufacturer's representative shall conduct the  
7           initial startup and operation of each VFD. The manufacturer's  
8           representative shall revisit the project site as often as necessary to ensure  
9           that all issues are corrected and that the installation and operation are the  
10          VFD are satisfactory.
- 11           B. Certification: The Contractor shall submit a written report certifying that  
12          each VFD has been installed, configured, and tested under load in  
13          accordance with the manufacturer's recommendations. This report shall  
14          be signed by a factory-trained manufacturer's representative and shall  
15          include a listing of all modifications and adjustments made onsite to  
16          include any settings / parameters not are not identified as factory defaults  
17          within the equipment's O&M documentation.
- 18           C. Specified products shall be tested as a system for conformance to  
19          specification requirements prior to scheduling the acceptance tests.  
20          Contractor shall conduct performance verification tests in the presence of  
21          Government representative, observing and documenting complete  
22          compliance of the system to the specifications. Contractor shall submit a  
23          signed copy of the test results, certifying proper system operation before  
24          scheduling tests.

25           3.04 TRAINING

- 26           A. The services of a factor-trained instructor shall be provided for the  
27          purpose of training the Owner's staff in the proper operation and  
28          maintenance of the VFDs. Training shall consist of not less than [1][2]  
29          repeated] session(s) with [6][4][2] hours of onsite classroom and hands-on  
30          instruction for a minimum of [4] attendees per session. The instructor shall  
31          provide sufficient time and detail in each session to cover the following as  
32          a minimum:
- 33           1. Theory of operation
- 34           2. Operation of VFDs furnished
- 35           3. Maintenance and configuration
- 36           4. Configurations of VFDs furnished
- 37           5. Troubleshooting and repair

## 6. Replacement of component level parts

### 3.05 TESTING AND COMMISSIONING

- A. General: VFDs and related equipment shall be tested and commissioned in accordance with Specification Section [26 08 00][16080].
  - B. Field Harmonic Testing: When 75HP and above VFDs are supplied, the Contractor shall record and provide in a report the harmonic line distortion for ac voltage and current to include individual harmonic values up to the 50<sup>th</sup> harmonic as well as the total harmonic distortion (THD) and total demand distortion (TDD) for all drives furnished above [90] KW. Testing shall be in accordance with IEEE 519.

END OF SECTION 16775

**SECTION IVC**

**NORTHEAST WRF BLEND TANK IMPROVEMENTS**

**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

**(PROJECT No. 19-0029-UT)**

**PREPARED FOR:**



CITY OF CLEARWATER  
ENGINEERING DEPARTMENT  
100 SOUTH MYRTLE AVENUE  
CLEARWATER, FL 33756

**PREPARED BY:**



**Bid Documents**

**January 2021**

**SECTION IVC**  
**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

**DIVISION 2—SITE CONSTRUCTION**

- 02220 DEMOLITION AND MODIFICATIONS
- 02225 BLEND TANK CLEANING
- 02230 SITE PREPARATION
- 02240 DEWATERING
- 02305 EARTHWORK FOR UTILITIES
- 02370 EROSION AND SEDIMENTATION CONTROL
- 02700 PAVING
- 02920 SEEDING AND SODDING

**DIVISION 3—CONCRETE**

- 03100 CONCRETE FORMWORK
- 03180 CONCRETE COATING SYSTEM
- 03200 CONCRETE REINFORCEMENT
- 03250 CONCRETE JOINTS AND JOINT ACCESSORIES
- 03300 CAST-IN-PLACE CONCRETE
- 03360 CONCRETE FINISHES
- 03600 GROUT
- 03930 MODIFICATIONS AND REPAIR TO CONCRETE

**DIVISION 5—METALS**

- 05500 METAL FABRICATIONS

**DIVISION 9—FINISHES**

- 09900 PAINTING AND COATING

**DIVISION 11—EQUIPMENT**

- 11000 GENERAL EQUIPMENT REQUIREMENTS
- 11228 MIXERS
- 11330 IN-LINE GRINDER
- 11356 PROGRESSIVE CAVITY PUMPS

**DIVISION 13—SPECIAL CONSTRUCTION**

- 13232 ALUMINUM FLAT COVERS

13316 SOFTWARE CONTROL BLOCK DESCRIPTIONS  
13401 PROCESS INSTRUMENTATION AND CONTROLS (PICS)

DIVISION 15—MECHANICAL

15055 PIPING SYSTEMS—GENERAL  
15060 PIPE HANGERS AND SUPPORTS  
15075 PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION  
15110 MANUAL, CHECK, AND PROCESS VALVES  
15120 POWER-OPERATED VALVE ASSEMBLIES  
15121 MISCELLANEOUS PIPE FITTINGS AND ACCESSORIES  
15122 FLEXIBLE PIPE COUPLINGS  
15125 PIPING APPURTENANCES  
15144 PRESSURE TESTING OF PIPING  
15155 DUCTILE IRON PIPE AND FITTINGS  
15290 PVC PIPE, 3 INCHES AND SMALLER  
15860 ODOR CONTROL SYSTEM EQUIPMENT

DIVISION 16—ELECTRICAL

16050 ELECTRICAL—GENERAL PROVISIONS  
16110 RACEWAYS AND FITTINGS  
16120 WIRES AND CABLES  
16130 BOXES  
16140 WIRING DEVICES  
16150 MOTORS  
16160 PANELBOARDS  
16170 SAFETY SWITCHES  
16370 VARIABLE-SPEED DRIVES  
16402 UNDERGROUND SYSTEM  
16450 GROUNDING SYSTEM  
16460 GENERAL PURPOSE TRANSFORMERS  
16500 LIGHTING SYSTEM  
16601 LIGHTNING PROTECTION SYSTEM  
16921 480-VOLT MOTOR CONTROL CENTERS

**DIVISION 2**

**SITE CONSTRUCTION**

**SECTION 02220**  
**DEMOLITION AND MODIFICATIONS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and demolish, modify, remove, and dispose of work shown on the Drawings and as specified in this Section.
- B. The work includes but is not limited to demolishing, modifying, and removing existing materials, equipment, or work necessary to install the new work as shown on the Drawings and as specified in this Section and to connect with existing work in an approved manner.
- C. Demolition, modifications, and removals which may be specified under other Sections shall conform to requirements of this Section.
- D. Demolition and modifications include, but not be limited to, the following:
  - 1. Removal and disposal of existing FRP Sludge Storage and Blend Tank covers, associated hardware, and appurtenances, while storing and protecting FRP ducts for future reconnection.
  - 2. Removal and disposal of the contents of the Sludge Storage and Blend Tanks to clean them in preparation for painting and coating in accordance with Section 02225, Blend Tank Cleaning.
  - 3. Removal and disposal of the existing radial sludge agitator with associated diffusers and appurtenances in accordance with Section 02225, Blend Tank Cleaning.
  - 4. Removal and disposal of the existing dewatering pumps, with associated canopy, concrete floor, pads, piping, valves, supports, and miscellaneous items as shown on the Drawings.
  - 5. Removal and disposal of the piping from the Sludge Storage and Blending Tanks where indicated on the Contract Documents.
  - 6. Removal and Replacement of the existing fiberglass stair treads and landing.
  - 7. Miscellaneous demolition as shown on the Contract Documents including, but not limited to, the 6-inch-high concrete curb and concrete pad to the extents shown, process air piping above and below grade, grating on the pipe header trench and piping to the extents shown, and hose babb.
  - 8. Off-site disposal of excess and unacceptable materials as described below and in Section 02225, Blend Tank Cleaning.

## **1.02 RELATED WORK**

- A. Section 01100, Summary of Work.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01350, Environmental Protection Procedures.
- D. Section 01650, Delivery, Storage, and Handling.
- E. Section 01780, Warranties and Bonds.
- F. Section 01815, Maintenance of Plant Operation and Sequence of Construction.
- G. Section 02225, Blend Tank Cleaning.

## **1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer six copies of proposed methods and operations of demolition of the structures and modifications before beginning work. Include in the schedule the coordination of shutoff, capping, and continuation of utility service as required.
- B. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations. The sequence shall be compatible with sequence of construction and shutdown coordination requirements.
- C. Before beginning demolition work, the Contractor shall complete all modifications necessary to bypass the affected structure. Actual work shall not begin until the Engineer has observed and approved the modifications and authorized beginning the demolition work in writing.

## **1.04 WORK SEQUENCE (NOT USED)**

## **1.05 REFERENCE STANDARDS (NOT USED)**

## **1.06 QUALITY ASSURANCE (NOT USED)**

## **1.07 WARRANTIES**

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

**1.09 QUALIFICATIONS (NOT USED)**

**1.10 TESTING REQUIREMENTS (NOT USED)**

**1.11 MAINTENANCE (NOT USED)**

**1.12 RECORD DRAWINGS (NOT USED)**

**1.13 JOB CONDITIONS**

- A. Protection: The Contractor shall conduct the demolition and removal work to prevent damage or injury to structures, equipment, piping, instrumentation, conduit, light fixtures, etc., and occupants of the structures and to adjacent features which might result from falling debris or other causes, and so as not to interfere with the use and free and safe passage to and from adjacent structures.
- B. Scheduling: Carry out operations so as to avoid interference with operations and work in the existing facilities.
- C. Notification: At least 48 hours before beginning demolition or removal, notify the Engineer in writing of the proposed schedule of the demolition or removal. The Owner shall inspect the existing equipment and identify and mark those items which are to remain the property of the Owner. No removals shall be started without the permission of the Engineer.
- D. Conditions of Structures:
1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.
  2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur before the start of demolition work.
- E. Repairs to Damage: The Contractor shall promptly repair damage caused to adjacent facilities by demolition operation when directed by the Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed before construction.

F. Traffic Access:

1. The Contractor shall conduct demolition and modification operations and remove equipment and debris to ensure minimum interference with roads onsite and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by plant personnel and plant associated vehicles.

1.14 RULES AND REGULATIONS

- A. When applicable and as deemed required, the Florida Building Code (latest edition) or the City shall control the demolition, modification or alteration of the existing buildings or structures.
- B. No building or structure or any part thereof shall be demolished until any required applicable application has been filed with the Building Inspector and a permit issued. The fee for this permit shall be the Contractor's responsibility.

1.15 DISPOSAL OF MATERIAL

- A. Salvageable material and equipment shall become the property of the Owner. The Contractor shall dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.
- B. All other material and items of equipment shall become the Contractor's property and must be removed from the site and disposed of in accordance with the Federal, State, and local rules and regulations.
- C. Storing or selling removed items on the site will not be allowed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. All materials and equipment removed from existing work shall become the property of the Contractor, except for those which the Owner has identified and marked for the Owner's use. All materials and equipment marked by the Owner to remain shall be carefully removed so as not to be damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.

- B. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items—except those marked by the Owner to remain—off the site and in conformance with all existing applicable laws and regulations.
- C. Pollution Controls
  - 1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
    - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
    - b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing before starting the work.

### 3.02 STRUCTURAL REMOVALS

- A. The Contractor shall remove structures to the lines and grades shown unless otherwise directed by the Engineer.
- B. All demolition debris shall be removed and taken from the site, unless otherwise approved by the Engineer.
- C. After parts or all of slabs and like work which tie into new work or existing work are removed, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.

### 3.03 DEMOLITION, REPLACEMENT, AND REPAIR

- A. Structural elements shall not be overstressed. The Contractor shall be responsible for shoring and/or bracing as required and indicated on the Contract Drawings for adequate structural support as a result of work performed.
- B. The shoring and/or bracing shall remain in place until the repair mortar and/or concrete in each stage has attained design strength.

### 3.04 CLEAN-UP

- A. The Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, the Contractor shall

remove all materials, equipment, waste, and debris of every sort and shall leave the premises clean, neat, and orderly.

END OF SECTION

**SECTION 02225**  
**BLEND TANK CLEANING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Section includes the work necessary for the removal and disposal of tank contents. This task includes but is not limited to removing, loading, transporting, and properly disposing of the tank contents including liquid, sludge, scum, rags, grit, hair, grease, solids and semi-solids off site in accordance with applicable federal, state, and local regulations.
- B. The Section also covers the work necessary to complete the tank cleaning activities including pressure washing, scraping, rinsing and drying of tank internals to otherwise prepare the tank for structural inspection.
- C. Demolition and removal of the tank aeration and mixing equipment including aeration grid piping, diffusers, and associated supports, stirring pickets, center guide shaft and bracket, and electrical wiring and conduit related to the mixers.

**1.02 RELATED WORK**

- A. Section III – General Conditions.
- B. Section IV – Technical Specifications.
- C. Section IVa – Supplemental Technical Specifications.
- D. Section 01815, Maintenance of Plant Operation and Sequence of Construction.

**1.03 SUBMITTALS**

The Contractor shall submit the following items in accordance with Section III – General Conditions Article 6.11.1:

- A. Before the issuance of the Notice to Proceed, the Contractor shall submit, to the Engineer for review, a suitable work plan. The work plan shall include, but is not limited to, the following:
  - 1. Written procedure and time schedule for shut down, cleaning and startup, including a description of the activities to be performed for each tank and estimated dates from start and finish of required work on each facility.
  - 2. The proposed procedures for; dewatering; odor control; layout of equipment and piping; determining partial payment amounts; general housekeeping; a site health and safety plan; providing needed manpower

and equipment to complete the work in a timely manner; and disposal of dewatered contents at the disposal site of their choice in accordance with State and Federal rules.

3. The spill containment plans for both the on-site activities and hauling to the disposal site. Spills of any nature caused by the Contractor shall be controlled and cleaned immediately. All spills onsite must be recorded with volume and actions taken to clean area and reported to the Owner, Engineer, and FDEP.
  4. Photos or videos of the site to document existing condition prior to this work and after the project is completed.
- B. The Contractor or Subcontractor shall submit to the Engineer upon request certificates signed and dated by each employee certifying that the employee who will enter the tank has: received training in Confined Space Entry Procedure, understands the health implications and risks involved, understands the use and limits of the equipment to be used; and understands engineering and other hazard control techniques and procedures.
- C. Submit to the Owner two copies of proposed methods and operations of demolition of the structures and modifications before beginning work. Include in the schedule the coordination of shutoff, capping, and continuation of utility service as required.
- D. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations. The sequence shall be compatible with the sequence of construction and shutdown coordination requirements. Additionally, sequence of construction shall be coordinated with other current projects to avoid conflict.
- E. Before beginning demolition work, the Contractor shall coordinate the demolition work with the Owner, and shall coordinate the modifications necessary to divert the flow from the affected structure and to maintain plant operations to meet discharge permit requirements and to the satisfaction of the Owner. Actual work shall not begin until the Owner has inspected and approved the modifications and authorized beginning the demolition work in writing.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS

- A. Contractor shall have been in the business of cleaning tanks (and demolishing) for at least 5 years.
- B. Contractor shall be a licensed General Contractor in the state of Florida and Pinellas County.
- C. Contractor shall demonstrate that all employees working on the site have been trained in Confined Space Entry and have had the requisite refresher training.

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 JOB CONDITIONS

A. Protection

- 1. The Contractor shall perform the work in accordance with Section III – General Conditions Article 6.9 Safety and Protection.
- 2. The Contractor shall conduct the demolition and removal work to prevent damage or injury to structures, equipment, piping, instrumentation, conduit, light fixtures, etc., and occupants of the structures and to adjacent features that might result from falling debris or other causes, and not interfere with the use and free and safe passage to and from adjacent structures.

B. Notification

- 1. At least 10 business days before beginning demolition or removal, the Contractor shall notify the Engineer in writing of the proposed schedule of the demolition or removal. The Owner shall inspect the existing equipment and identify and mark those items that are to remain on the property of the Owner. No removals shall be started without the permission of the Owner and the Engineer.

C. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be repaired or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur before the start of demolition work.

D. Repairs to Damage

1. The Contractor shall notify the Owner and the Engineer immediately following any damages to existing facilities.
2. The Contractor shall promptly repair damage caused to adjacent facilities by demolition operations when directed by the Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed before construction.
3. All materials used for repairs shall match existing materials and be of equal quality or better.

E. Traffic Access

1. The Contractor shall conduct cleaning, demolition and modification operations and remove equipment and debris to ensure minimum interference with roads on site and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed toward maintaining safe and convenient access to the existing facilities by plant personnel and plant-associated vehicles.

**1.14 RULES AND REGULATIONS**

- A. The City of Clearwater Public Works shall control the cleaning, demolition, modification, or alteration of the existing buildings or structures.
- B. No building or structure or any part thereof shall be demolished until the Contractor has obtained a Demolition Permit from the City Building Department. The City will waive the permit fee.

**1.15 DISPOSAL OF MATERIAL**

- A. All material and equipment removed from existing work shall become the property of the Contractor and must be removed from the site, except for those that the Owner has identified and marked for its use. All materials and equipment marked by the Owner to remain shall be carefully removed so as not to be

- damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.
- B. All demolition debris that is not marked by the Owner shall be removed and hauled off the site unless otherwise approved by the Owner.
  - C. Salvageable material and equipment shall become the property of the Owner unless otherwise as directed by the Engineer or Owner. The Contractor shall dismantle all such items to a size that can be easily handled and deliver them to a designated storage area.
  - D. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items—except those marked by the Owner to remain—off the site and in conformance with all existing applicable laws and regulations.
  - E. Storing or selling removed items on the site shall not be allowed.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 GENERAL

- A. The Contractor shall coordinate all activities with the Engineer and Owner personnel before proceeding with work. In situations where the operation of the plant conflicts with the Contractor's work, the operation of the plant shall take precedence.
- B. The work shall be performed in accordance with the schedule submitted by the Contractor and approved by the Owner and Engineer.
- C. The Contractor shall place his equipment, vehicles, and temporary piping so that it does not interfere with plant operations or the ongoing construction activities at the plant.
- D. All piping, wiring, adapters, and switches required to connect to the Owner's water and electric power supply shall be provided by the Contractor. Before connecting, the Contractor shall coordinate with the Owner. The Contractor shall provide his own source of electrical power to operate all equipment for the completion of the work if commercial utility power is not available.
- E. Contractor shall conduct work in a way as to minimize odors 24-hours a day while emptying and cleaning each tank. Owner and Engineer reserve the right to stop or postpone the work if odors become objectionable. No additional compensation

will be paid the Contractor because the cleaning work was postponed for objectionable odors.

- F. The Contractor shall use the existing manways and access points in the tank to perform cleaning and follow confined space entry procedures as required to comply with local and state requirements.
- G. The Contractor shall cover and isolate all work areas with disposable plastic sheeting and strategically place drip pans at pumps, joints, disconnected piping, tank manholes, clean-outs, drops, etc. to prevent possible contamination and minimize spills.

#### H. Pollution Controls

- 1. The Contractor shall perform the Work in accordance with Section IV – Technical Specifications – 207 Erosion and Sediment Control. The Contractor shall prevent any of the storage tank contents from reaching the storm drains.
- 2. The Contractor shall use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. The Contractor shall comply with governing regulations pertaining to environmental protection.
  - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
  - b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing before starting the work.
- 3. If it is necessary to remove any abandoned Asbestos Cement (AC) pipe and/or appurtenances to accommodate the Work, the Contractor must furnish all permits, labor, material, services, insurance, tools, equipment, and notifications in accordance with EPA, OSHA, State, and all other applicable agencies to handle and remove asbestos material.

### 3.02 SAFETY CONSIDERATIONS

- A. The Contractor shall perform the work in accordance with Section III – General Conditions Article 6.9 Safety and Protection.
- B. The Contractor is responsible, at all times, for protecting the health and safety of his workers. Neither the Engineer nor the Owner will be responsible for any injury occurring to the Contractor's workers. Neither the Engineer nor the Owner will be

responsible for enforcing the Contractor's construction ways and means nor will they be responsible for enforcing OSHA standards. While conducting cleaning operations, the Contractor shall always have a superintendent in responsible charge at the site. This person shall have the authority to make management decisions pertaining to the project.

- C. All Contractors and subcontractors performing work under this Contract must utilize appropriate protective clothing, equipment, goggles, gloves, face masks, etc., as necessary to undertake the work in a safe manner.
- D. The Contractor shall isolate close, secure, divert, de-energize, lockout and apply tags-plus applications to all valves, piping and associated equipment as found in 29 CFR 1915.89.
- E. Each tank is a confined space and the Contractor is responsible for compliance with OSHA Confined Space Entry Procedures, as found in 29 CFR Part 1910.146 and 29 CFR 1926 Subpart AA.
- F. The Contractor is responsible for providing forced fresh air ventilation and continuously monitoring the atmosphere inside each confined space to determine the appropriate level of protection for his personnel during cleaning operations or Engineer's personnel during an inspection.

### 3.03 DEWATERING, CLEANING AND DISPOSAL

- A. The removal of all contents inside the designated tank including water, sludge, scum, grit, grease, rags, solids, and semi-solids shall be removed by the Contractor, whether or not the material is pump-able. The methods necessary to remove all of the material in the tank shall be determined by the Contractor.
- B. The Contractor is responsible for provided inert gas purging, ventilation, supplies, supervision, electrical power, temporary lighting, backflow prevention devices, safety equipment, storage, temporary scaffolding, and incidentals required to conduct the work.
- C. The Contractor is responsible for purging each tank with inert gases before the tank is accessed or contents removed (when applicable).
- D. The Contractor is responsible for dewatering the materials removed from the tank and adding chemicals, as necessary, for odor control to the tank contents to meet all Federal, State, and Local regulatory requirements.

- E. Dewatered sludge shall be stored in a fully covered container or be disposed of within 24 hours. In no case shall material that is dewatered during the day and not stored properly remain on site past the end of the same day, defined as 4:00 p.m.
- F. The Contractor shall coordinate the location of temporary dewatering facilities with the Owner.
- G. The Contractor is responsible for transportation and disposal of the tank contents in accordance with local and state regulations. The Contractor shall verify with City, County, and State officials any load limitations, required by these agencies, on bridges and access roads to the disposal site. The Contractor shall be responsible for all costs associated with traffic violations or other claims incurred as a result of the hauling operations for the duration of the Contract. This includes ensuring that all loads are within legal limits.
- H. The Contractor shall supply copies of weight tickets, waste manifests and bill of ladings to the Owner in a clear and comprehensive manner.
- I. The Contractor is responsible for pressure washing the interior tank walls and interior mechanical equipment. The Contractor shall also isolate the sludge withdrawal pipes to prevent debris from entering downstream systems. During power-washing operations, the Contractor shall be careful not to erode the concrete surfaces of the existing structure. Any damage caused to the tank by the cleaning and removal of contents shall be the responsibility of the Contractor.
- J. Water required for dilution, wash down and related purposes will be available from the Owner's reclaimed water system and provided at current system pressure. The Owner may also provide the Contractor potable water for cleaning and wash water applications. If potable water is used, the Contractor is required to obtain a water meter from the Owner's customer service department.
- K. Tank cleaning shall be completed to the satisfaction of the Owner and Engineer including removing all hardened or calcified deposits and otherwise preparing the tank for structural inspection.
- L. The Contractor is responsible for collecting and disposing of sewage, contaminated liquids, sludge, scum, grit, grease, rags, solids, and semi-solids, at local or state-approved treatment facilities.
- M. The Contractor is responsible for collecting and disposing of filtrate, wash water from cleaning, and other refuse material that is produced during the cleaning operations. The filtrate and wash water may be piped to the head end of the treatment plant for disposal at a concentration and rate approved by the Owner if cleaning chemicals are not harmful to the treatment process. The Owner will

require an analysis of the filtrate or wash water prior to approving its introduction into the plant process.

- N. The Contractor is responsible for preventing and/or abating any spills of tank contents, cleaning water or other liquids onto the Owner's facility site.
- O. The Owner shall approve all cleaning products used by the contractor in cleaning the tanks and equipment prior to usage. The Owner, at its sole discretion, has the right to disapprove any cleaning product that it deems harmful to the facility.
- P. Contractor shall not allow any residuals, free liquids from the tank, or filtrate from the dewatering operations to enter storm drains, roadways, waterways, or any other land, either public or private. In the event that a spill occurs, the Contractor shall immediately notify the Owner, take the necessary steps to control and clean the spill under Owner direction, and shall pay any fines levied against the Owner as a result of the spill. The Contractor shall be responsible for satisfying state reporting requirements to the Owner, Engineer, and FDEP, and include the Owner on correspondence related to any onsite spills to ensure proper reporting.

### 3.04 REMOVAL, REPLACEMENT, AND REPAIR

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to remove and dispose of the materials shown in the Drawings and specified herein:
  1. Tank aeration equipment including aeration grid piping, diffusers, and associated supports.
  2. Tank mixing equipment including stirring pickets, center guide shaft and bracket, supports, and mixer motor.
- B. All electrical wiring and conduit related to the mixers shall be removed.
- C. The aeration piping penetrating the tank wall shall be cut and capped inside the tank.
- D. Before removing tank cover, the Contractor shall provide engineered temporary shoring and/or bracing of the hung utilities as regulated.
- E. The walkway/bridge must remain in place for the duration of the Work.
- F. The Contractor shall remove structures to the lines and grades shown on the Drawings, unless otherwise directed by the Owner.

- G. After parts or all slabs and like work that tie into new work or existing work are removed, the point of junction shall be neatly repaired so as to leave only finished edges and surfaces exposed.
- H. Structural elements shall not be overstressed. The Contractor shall be responsible for shoring and/or bracing as required and indicated on the Drawings for adequate structural support resulting from the work performed.

### 3.05 CLEAN-UP

- A. The Contractor shall remove from the site all debris resulting from cleaning and demolition operations as it accumulates. Upon completion of the work, the Contractor shall remove all materials, equipment, waste, and debris of every sort and shall leave the premises clean, neat, and orderly in a similar or better condition than what existed prior to start of this work.
- B. Contractor shall return any laydown or other work areas to pre-construction conditions.

END OF SECTION

**SECTION 02230**  
**SITE PREPARATION**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, and equipment required and perform all site preparation, complete as shown on the Contract Drawings and as specified in this Section.
- B. The Contractor shall obtain all permits required for site preparation before proceeding with the work, including clearing and tree removal.
- C. The areas to be cleared, grubbed, and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of pipeline work and in consideration of the actual means and methods of construction used. No unnecessary site preparation shall be performed within these areas.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01350, Environmental Protection Procedures.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Section 02305, Earthwork for Utilities.
- F. Section 02920, Seeding and Sodding.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Engineer copies of all permits required before clearing, grubbing, and stripping work.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS (NOT USED)**

**1.06 QUALITY ASSURANCE (NOT USED)**

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 RECORD DRAWINGS (NOT USED)

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 CLEARING

- A. The Contractor shall cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and any other objectionable material resting on or protruding through the surface of the ground.
- B. The Contractor shall preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer to remain as specified below.

### 3.02 GRUBBING

- A. The Contractor shall grub and remove all stumps, roots in excess of 1-1/2 inches in diameter, matted roots, brush, timber, logs, concrete rubble, and other debris encountered to a depth of 18 inches below original grade or 18 inches beneath the bottom of foundations, whichever is deeper.
- B. The Contractor shall refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density conforming to the surrounding ground surface in accordance with Section 02305, Earthwork for Utilities.

### 3.03 STRIPPING

- A. The Contractor shall strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.
- B. Topsoil shall be free from brush, trash, large stones, and other extraneous material. Avoid mixing topsoil with subsoil.
- C. The Contractor shall stockpile and protect topsoil until it is used in landscaping, loaming, and seeding operations and dispose of surplus topsoil after all work is completed.

### 3.04 DISPOSAL

- A. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area in accordance with Federal, State, and local rules and regulations. No rubbish or debris of any kind shall be buried on the site.
- B. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

### 3.05 PROTECTION

- A. Trees and other vegetation designated on the Contract Drawings or directed by the Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards, and enclosures, or by other approved means. The Contractor shall conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed. The Contractor shall provide for the safety of employees and others.
- B. The Contractor shall maintain protection until all work in the vicinity of the work being protected has been completed.
- C. The Contractor shall not operate heavy equipment or stockpile materials within the branch spread of existing trees.
- D. The Contractor shall immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.

- E. When work is completed the Contractor shall remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1 inch in diameter shall be treated with an acceptable tree wound paint.
- F. The Contractor shall restrict construction activities to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements on these properties, public or private, which become damaged by construction operations shall be promptly restored to their original condition to the full satisfaction of the property owner.
- G. The Contractor shall remove trees damaged beyond saving, through no fault of the Contractor, as directed by the Engineer.

END OF SECTION

**SECTION 02240  
DEWATERING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section covers the work necessary to complete the dewatering activities. All work in this Section shall be done in accordance with the requirements of the Environmental Resource Permit and Water Use Permit (if required) as issued by the Southwest Florida Water Management District (SWFWMD).
- B. In addition to the requirements listed in this Section, the Contractor shall obtain, if required, and comply with all requirements of the Generic Permit for the Discharge of Ground Water From Any Non-Contaminated Site Activity as described in FAC 62-621-300.
- C. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations and permit construction to proceed on dry, stable subgrades.
  - 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Remove dewatering system if no longer needed.
- D. The Contractor shall dewater so as to prevent damage to existing work. The Contractor shall repair or replace damage resulting from the dewatering activities promptly, remedy environmental damage as approved by the Engineer, and pay any and all fines levied to Contractor at no additional cost or time to the Owner.
- E. The Dewatering Plan shall be signed and sealed by the licensed professional engineer responsible for its preparation.
- F. The Contractor shall design the dewatering system. The Contractor shall be responsible for obtaining whatever investigations are necessary, before bidding, to design the dewatering system.

## 1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01350, Environmental Protection Procedures.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.

## 1.03 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. Before construction, the Contractor shall obtain a dewatering permit from the SWFWMD as required. At a minimum, the dewatering plan submitted with the dewatering application shall include the following:
  - 1. Duration of dewatering for each area.
  - 2. Number and size of pumps.
  - 3. Method of dewatering each area.
  - 4. Methods for routing/containing the discharge.
  - 5. Methods of isolating dewatering areas.
  - 6. Time dewatering structure will be in place.
  - 7. Proposed discharge points.

Five copies of the plan shall be submitted to the Engineer for record purposes only.

- B. The Contractor shall be responsible for determining if a Water Use Permit will be required. If a Water Use Permit is required, it is the Contractor's responsibility to obtain the required information from the Engineer and Owner to complete the Water Use Permit application to submit with the Dewatering Plan. If a Water Use Permit is required, the Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.
- C. The Contractor shall be responsible for obtaining a Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity as set forth in FDEP Rule 62-621.300(2), FAC. The Contractor shall obtain the required permit form 62-621.300(2) and the required information from the Engineer and Owner to complete the Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity application to submit with the Dewatering Plan. The Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.

- D. Provide photographs or videotape, sufficiently detailed, of existing conditions of adjoining properties, facilities, and other construction and site improvements that might be later misconstrued as damage caused by dewatering operations.
- E. Submit Record Drawings at Project closeout identifying and locating utilities and other subsurface structural, electrical, or mechanical items encountered during dewatering.
  - 1. Note locations and capping depth of wells and well points.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Pre-installation Conference: Conduct conference at the Project site to present and discuss dewatering means, methods, and monitoring program.
- C. Identify a person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed for this Project, the referenced standards, environmental and permit requirements, the requirements of this Work, and who shall direct all work performed under this Section.
- D. It shall be the responsibility of the Contractor to determine the water levels before and during the dewatering work.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS

- A. The Contractor shall provide at least one person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed, the referenced standards, the requirements of this Work, and who shall direct all work performed under this Section.
- B. The Contractor shall be responsible for determining the water level before beginning excavation and construction.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 RECORD DRAWINGS (NOT USED)

## 1.13 PRE-BID INSPECTION AND TESTING

- A. Before bidding, the Contractor shall perform a detailed site inspection and, if desired, obtain the Owner's permission to perform site-specific testing as he deems necessary to obtain all required information relative to project dewatering requirements.
- B. The Contractor shall include as part of his Bid the total cost of all surface and subsurface dewatering as required to construct the Project in complete compliance with the Drawings and these Specifications.

## 1.14 PROJECT CONDITIONS

- A. The Contractor shall not interrupt utilities serving facilities occupied by Owner or others unless approved by the Owner and Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Survey adjacent structures and improvements, employing a professional land surveyor licensed in Florida to establish exact elevations at fixed points to monitor settlement. Clearly identify monitoring points and reference vertical datum, and benchmarks. Monitor and record existing initial elevations.
  - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction and existing structures.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 DEWATERING SYSTEM

- A. The dewatering system shall be adequate to drain the soils to be excavated to the extent that the piezometric water level in the construction area is a minimum of 2 feet below the bottom of the excavation, side slopes of excavations, or bottom of the footings at all times, or as otherwise required to obtain the specified compaction and installation conditions. Pipeline trenches must be dewatered at least 18 inches below the trench bottom.
- B. If layered soils are encountered, the hydrostatic head in the zone below the subgrade elevation shall be relieved to prevent uplift.
- C. Unless otherwise noted and before any excavating below or within 2 feet above the groundwater level, a dewatering system shall be placed into operation to lower water levels to the extent specified previously and then shall be operated continuously 24 hours a day, 7 days a week, throughout the excavation to maintain and protect all work until the work has been completed to the satisfaction of the Engineer.
- D. Where used, well points shall be installed in an Engineer-approved manner and in sufficient numbers to provide the necessary removal of water as stated previously. Well points and header piping shall be installed so that traffic on public thoroughfares and site access roads will not be impeded.
- E. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the specified work. The dewatering system shall stay in full operation until not less than 90% of the total building load is applied, as will be determined by the Engineer, or until excavations and trenches have been backfilled and compacted.
- F. To prevent excessive noise, exhaust from all pumps and engines shall be silenced and muffled.
- G. Wellpoint or surface water pump discharge shall be controlled to prevent erosion, undermining, and all other damage and be piped to approved locations.
- H. With the Engineer's assistance, the Contractor is responsible for determining what approvals and permits are required to comply with any and all applicable regulations and permitting requirements relating to dewatering activities. With the

Engineer's assistance the Contractor shall obtain all necessary approvals and permits and comply with any and all applicable regulations and permitting requirements concerning all dewatering activities, including pumpage and discharge. The Contractor is solely responsible for all costs associated with the proper implementation of dewatering activities.

- I. The Contractor shall perform all dewatering work in strict compliance with Section 01350, Environmental Protection Procedures, and the Contract Drawings.
- J. Excavations shall be kept free from water during the placing of concrete and for 36 hours after or until concrete forms are removed.
- K. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 1. Prevent surface water and subsurface or groundwater from entering excavations, ponding on prepared subgrades, or flooding the site and surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- L. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- M. Install sufficient dewatering equipment to drain water-bearing strata above and below the bottom of foundations. If excavating through layered soils, relieve any potential groundwater hydrostatic head in the zones below to prevent uplift.
  - 1. Open-sump pumping which leads to loss of fines, subgrade softening, and slope instability shall not be permitted.
- N. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids flooding or accumulation on private property. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

### **3.02 OBSERVATION WELLS**

- A. The Contractor shall install observation wells as may be required to record accurate water levels.
- B. The Contractor shall be responsible for maintaining all observation wells and observing and recording the elevation of the piezometric water levels daily.
- C. Wells damaged or destroyed shall be replaced at no additional cost to the Owner.

### **3.03 CLEANUP**

- A. Upon completing dewatering elsewhere on the Project, the Contractor shall remove all equipment and leave the project site in a neat, clean, and acceptable condition satisfactory to the Owner. Wellpoint holes and excavations shall be adequately backfilled and compacted to prevent settlement.

**END OF SECTION**

**SECTION 02305**  
**EARTHWORK FOR UTILITIES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall provide all materials, equipment, labor, and work necessary to completely construct the project in accordance with the Contract Documents. This work includes but is not limited to the following:
  - 1. Excavating and removing unsatisfactory materials.
  - 2. Preparing trench foundations.
  - 3. Providing satisfactory material for all trenches as specified and as required.
  - 4. Obtaining, storing, maintaining, and disposing of materials.
  - 5. Dewatering, shoring, and sheeting.
  - 6. Placing, compacting, testing, final grading, and demolishing subgrade.
  - 7. Performing all other work required by the Contract Documents.
- B. The Contractor is responsible for performing all work so as not to damage existing roadways, facilities, utilities, structures, etc. and shall repair and replace such damage to equal or better than its original undamaged condition without cost to the Owner.
- C. The Contractor shall examine the site before submitting a bid, taking into consideration all conditions that may affect the work.
- D. The Contractor shall coordinate all additional subsurface investigations and testing included with this work with the Engineer before performing the excavation and foundation preparation work. In general, if the Contractor finds different and unsuitable/unsatisfactory soil conditions during the work, the Contractor shall notify the Engineer and the Owner immediately.

**1.02 RELATED WORK**

- A. Section 01350, Environmental Protection Procedures.
- B. Section 02230, Site Preparation.
- C. Section 02240, Dewatering.

## 1.03 SUBMITTALS

The Contractor shall submit the following shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  1. Classification according to ASTM D2487 of each on-site and borrow soil material proposed for fill and backfill.
  2. Laboratory compaction curve according to ASTM D1557 for each onsite and borrow soil material proposed for fill and backfill.
- B. The Contractor shall submit records before the start of this work. The Contractor shall verify that the existing conditions are correct as shown on the plans and mentioned in these Specifications. The Contractor shall note any discrepancies found immediately and notify the Owner and Engineer.

The records shall include the following:

1. Location of all existing underground utilities, structures, etc. surrounding the areas to be excavated that may be impacted by the work.
2. Location of test excavations.
3. Location of inspections.

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply:

- A. OSHA Excavation Safety Standards, 29 CFR 1926, Subpart P
- B. Florida Trench Safety Act (90-96, Laws of Florida)
- C. American Society for Testing and Materials (ASTM)
  1. ASTM D1556/D1556M—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
3. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
5. ASTM D3282—Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
6. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
7. ASTM D6938—Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
8. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

D. American Wood Protection Association (AWPA)

1. AWPA C1—All Timber Products—Preservative Treatment by Pressure Processes.
2. AWPA C3—Piles – Preservative Treatment by Pressure Processes.

## 1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and definition testing, as documented according to ASTM D3740.
- B. The Contractor shall do the following:
1. Ensure that excavations provide adequate working space and clearance for the work to be performed and for installing piping and buried utilities. In no case shall excavation faces be undercut.
  2. Ensure that foundation surfaces are clean and free of loose material of any kind when pipelines and buried utilities are placed on them.
  3. Excavate, trench, and backfill in compliance with applicable requirements of governing authorities having jurisdiction.
  4. Ensure that shoring and sheeting for excavations are designed by a Florida-registered Professional Engineer and are in accordance with the Occupational Safety and Health Administration (OSHA) Document 2226, *Safe Working Practices—Excavating and Trenching*.
  5. Before beginning any excavation or grading, ensure the accuracy of all survey data indicated on the Contract Drawings and in these Specifications

and/or as provided. If the Contractor discovers any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Owner so that proper adjustments can be anticipated or ordered. If the Contractor begins any excavation or grading, this shall be considered an acceptance of the survey data by the Contractor, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.

6. Ensure that tolerances for excavation are  $\pm 0.10$  foot to the required line and to the required grade. Tolerance for compaction of in-place material shall be  $\pm 0.10$  foot to the required grade.
7. Ensure that all trench materials derived from the project site and imported to this site are examined, tested, and classified by an Engineer-approved soils testing laboratory.
8. Remove unsatisfactory materials and unsuitable materials including muck, silts, peat, and other loose and very loose compressible soils from excavations before placing pipe foundation, bedding, and buried utilities.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 PROJECT CONDITIONS

- A. Existing Utilities: The Contractor shall not interrupt utilities serving facilities occupied by the Owner or others unless permitted to do so in writing by the Engineer and then only after arranging to provide temporary utility services according to the requirements indicated.
  1. Notify the Engineer not less than 2 days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without the Engineer's written permission.
  3. Contact utility-locator service and obtain utility locations for the Project Area before excavating.

- B. The Contractor shall demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## 1.11 DEFINITIONS

- A. *Backfill*: Soil material or controlled low-strength material used to fill an excavation.
1. *Initial Backfill*: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. *Final Backfill*: Backfill placed over initial backfill to fill a trench.
- B. *Base Course*: The course placed between the subbase course and hot-mix asphalt paving.
- C. *Bedding Course*: The course placed over the excavated subgrade in a trench before laying pipe.
- D. *Borrow Soil*: Satisfactory soil imported from off-site for use as fill or backfill.
- E. *Drainage Course*: The course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. *Excavation*: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  1. *Authorized Additional Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to the Contract provisions for unit prices.
  2. *Bulk Excavation*: Excavation more than 10 feet in width and more than 30 feet in length.
  3. *Unauthorized Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be without additional compensation.
- G. *Fill*: Soil materials used to raise existing grades.
- H. *Structures*: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- I. *Subgrade*: The surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- J. *Utilities*: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.12 TESTING REQUIREMENTS

- A. The Contractor shall furnish a soil survey for satisfactory material and samples of materials.
- B. Testing for source material, for classification, and for prequalification of material (on or off site) shall be performed by an independent testing agency retained by the Contractor and approved by the Engineer.
- C. Testing for in-place compacted fill shall be performed by the same independent testing agency as approved by the Engineer and retained by the Contractor.
- D. The number and location of the tests shall be as specified in these Specifications and as directed by the Engineer during construction.
- E. The Contractor shall coordinate activity with the Engineer and the testing agency to permit testing as directed in the presence of the Engineer.
- F. The cost of all testing to achieve specified requirements shall be borne by the Contractor.
- G. The costs of any and all retests due to failure to achieve specified requirements shall be solely borne by the Contractor and are not reimbursable under this contract.
- H. All materials proposed for use shall be tested as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Materials	Soil Classification using ASTM D2487 (including all tests contained therein)	One per source of materials to determine conformance with materials specified in these Specifications; additional tests whenever there is any apparent change.
	Soil moisture-density relationship using Modified Proctor ASTM D1557	One per source of material or apparent change in material.

- I. Soil materials shall be tested during construction as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Material in-place after compaction	Field Density ASTM D1556/D1556M – Sand Cone Method, or ASTM D6938-Nuclear Density Method, or ASTM D2937-Drive Cylinder Method	For each layer of trench bottom subgrade before addition of soil materials, refill, bedding, and backfill, and for each 400 lineal feet of trench or fraction thereof, whichever is greater; two tests for each drainage, manhole, or wet well structure; additional test whenever there is any change in native soil, groundwater, or soil moisture conditions.

- J. The approved testing agency shall transmit copies of required laboratory test results as follows:

1. One copy to the Owner.
2. Two copies to the Engineer.
3. Two copies to the Contractor.

The laboratory test reports shall include, at a minimum, project title; project location; location of sample; source, time, and date of testing; testing agency's name, address, and telephone number; and test results. Each test report shall be signed and sealed by the Professional Engineer representing the testing agency as specified in these Specifications.

- K. The approved testing agency shall transmit copies of field testing results as follows:

1. One copy to the Owner.
2. Two copies to the Engineer.
3. Two copies to the Contractor.

The field test reports shall include, at a minimum, project title; project location; location of sample(s) tested; time of testing; date of testing; testing person's full name; testing agency name, address, and telephone number; and test results.

- L. No soil material shall be used until 1) the Engineer has reviewed and approved test reports and 2) the Contractor submits certification that the soil material proposed for construction is clean and meets gradation and other parameters specified in these Specifications.

- M. At no cost to the Owner, the Contractor shall remove and replace or correct all materials and work which tests indicate do not conform, in the opinion of the Engineer, to the requirements of these Specifications.
- N. The results of in-place density tests shall be considered satisfactory if the density in each instance is equal to or greater than the specified density. Soil moisture content at the time of testing shall conform to requirements of these Specifications.
- O. Where the tests reveal unsatisfactory compaction, the Contractor shall re-excavate, backfill, recompact, and/or rework the backfill as required to obtain the required degree of compaction over the entire depth of the excavation.
- P. The testing agency shall transmit to the Engineer copies of all testing agency invoices submitted to the Contractor for payment. Invoices shall clearly indicate specific services and date and time services are rendered and shall indicate if the invoiced testing cost is an initial test of the Contractor's work or is a re-test required due to the Contractor's failure to initially achieve the specified requirements.

#### 1.13 MAINTENANCE (NOT USED)

#### 1.14 RECORD DRAWINGS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 STRUCTURAL MATERIALS

- A. Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and crossbraces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.

#### 2.02 TRENCH SOIL MATERIALS

- A. Materials used for trench construction shall be free of clumps of clay, rock or gravel, debris, waste, frozen materials, and other deleterious matter as determined by the Engineer and shall be satisfactory soil materials as follows:

Area Classification	Soil Materials
In excavations and trenches	Excavated and borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material."

## B. Satisfactory Soil Materials

### 1. Soil Classification Groups

Satisfactory soil materials for each trench shall be as follows:

Satisfactory Soil Material (ASTM D3282, Soil Classification Groups)		
In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
SW SP	SW SP	SW SP

### 2. Maximum Particle Size Limitations for Satisfactory Soil Materials

The maximum allowable particle size for satisfactory soil materials within each trench for each type of utility shall be as follows:

Conduit	Maximum Allowable Particle Size		
	In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
Plastic Pipe (PVC, CPVC, HDPE, etc.) less than 6-inch-diameter	See Note 1	1/2 inch	3 inches
Plastic Pipe (PVC, CPVC, HDPE, etc.) 6-inch-diameter and Larger	See Note 1	3/4 inch	3 inches
Concrete Pipe			
Steel Pipe			
Ductile Iron Pipe			
Fiberglass Pipe	See Note 1	3/4 inch or three times the wall thickness, whichever is less	3 inches
Other Conduit Materials	See Note 2	See Note 2	See Note 2

- (1) There is no requirement when satisfactory undisturbed native soil material is used. Disturbed portions of the foundation and/or unsatisfactory native soil material shall be replaced with satisfactory soil materials meeting all the requirements for Bedding.
- (2) The maximum allowable particle size shall be in accordance with the manufacturer's written recommendation.

### 3. Additional Requirements of Satisfactory Materials

Satisfactory soil materials shall be free of debris, waste, frozen materials, vegetation, or other deleterious matter. Soils within 4 inches of the exterior surface of the pipe shall be free of gravel, stones, or other materials which may abrade the pipe surface.

### C. Unsatisfactory Materials

Unsatisfactory soil materials shall mean ASTM D2487, Soil Classification Groups GW, GP, GM, GC, SC, CL, ML, OL, CH, MH, OH, and PT and other highly organic soils and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

## PART 3 EXECUTION

### 3.01 GENERAL REQUIREMENTS

The Contractor shall do the following:

- A. Carefully verify by hand methods the location of all surrounding underground utilities before performing utility excavations and trenches.
- B. Protect utilities to be left in place from damage.
- C. Do not interrupt existing utilities serving facilities occupied and used by the Owner, except when permitted in writing by the Owner.
- D. Protect bench marks, survey points, and existing structures, roads, sidewalks, monitoring wells, paving, curbs, etc. against damage from equipment, vehicular or foot traffic, settlement, lateral movement, undermining, washout, and all construction-related activities.
- E. Repair and replace damage to existing facilities to equal or better than their original undamaged condition without cost to the Owner and to the approval of the Engineer.
- F. Excavate and trench in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.
- G. Protect excavations and trenching by shoring, bracing, sheet piling, underpinning, or other methods as required to prevent cave-ins or loose dirt from falling into excavations and trenches.
- H. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for depositing or compacting backfill material.
- I. Compact the backfill material placed next to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.

- J. Excavate, fill, backfill, and grade to elevations required by the Contract Documents.
- K. Pile excavated materials suitable for backfill in an orderly manner a sufficient distance from excavations to prevent overloading, slides, and cave-ins.
- L. Do not obstruct access ways, roadways, and plant facilities.
- M. Dewater excavations and trenches in accordance with Section 02240, Dewatering.
- N. Refer to the Contract Drawings for additional requirements related to earthwork and protection of existing features.

### 3.02 TRENCH EXCAVATION

- A. Before excavating the trench, the Contractor shall prepare the surface including clearing and grubbing as specified in Section 206 of the City's Standard Technical Specifications.
- B. The Contractor shall be required to fully comply with all applicable OSHA Excavation Safety Standards and to abide by them as covered by the most current version of the Florida Trench Safety Act (90-96, Laws of Florida).
- C. The Contractor shall ensure that mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be so operated that conduit/utility, when accurately laid to specified alignment, will be centered in the trench with adequate clearance between the conduit/utility and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.
- D. The Contractor shall not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, other existing property, utilities, structures, etc. above or below ground. In all such locations, the Contractor shall use hand excavating methods.
- E. The Contractor shall not use blasting.
- F. The Contractor shall cut trenches sufficiently wide to enable proper installation of services and to allow for testing and inspection. The Contractor shall also trim and shape trench bottoms and leave them free of irregularities, lumps, and projections. Trench width shall be excavated as specified on the Contract Drawings.

- G. The Contractor shall construct trench walls so as to avoid side wall collapse or sloughing. Trenches shall be either braced or open construction in accordance with the Contract Documents. No separate payment will be made for any special procedure used in connection with the excavation.
- H. Where sheeting and bracing are not required, the Contractor shall construct trench walls in the bottom of the excavation as vertical as possible to the maximum height allowable by OSHA. Trench walls above this height shall be sloped to guard against side wall collapse or sloughing as specified on the Contract Drawings.
- I. Where sheeting and bracing are required, the sheeting and bracing system shall meet the requirements in these Specifications.
- J. Excavations shall be to the design elevations shown on the Contract Drawings or as specified, unless unsatisfactory or unsuitable foundation materials are encountered in the bottom of the excavation. Where unsatisfactory or unsuitable foundation materials are encountered, this material shall be undercut and removed as indicated on the Contract Drawings and replaced with satisfactory soil material meeting all the requirements for Bedding. The lift thicknesses and compaction requirements for the replacement soil shall also meet the requirements for Bedding.
- K. The Contractor shall be careful not to overexcavate except where necessary to remove unsatisfactory or unsuitable materials, irregularities, lumps, rock, and projections. Unnecessary overexcavation shall be replaced as specified in these Specifications at the Contractor's sole expense.
- L. The Contractor shall accurately grade bedding soil materials at the bottoms of the trenches to provide uniform bearing and support for each section of conduit/utility at every point along its entire length except where it is necessary to excavate the bedding for conduit/utility bells (e.g., pipe bells), etc. or for proper sealing of conduit/utility joints. Abrupt changes in grade of the trench bottom shall be avoided.
- M. The Contractor shall dig bell holes and depressions after the bedding has been graded to ensure that the conduit/utility rests on the prepared bedding for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint.
- N. The Contractor shall do the following:
  - 1. Pile all excavated material in a manner that will not endanger the work or erode the stormwater management facilities or water courses.
  - 2. Avoid obstructing sidewalks, driveways, and plant facilities.

- 3. Leave hydrants, valve pit covers, valve boxes, or other utility controls unobstructed and accessible.
  - 4. Keep gutters, drainage inlets, natural water courses, and miscellaneous drainage structures clear or make other satisfactory provisions for their proper operation.
- O. The Contractor shall keep all satisfactory materials that are suitable for use/reuse in the trench construction separated from unsatisfactory materials.
- P. Except where otherwise authorized, indicated, or specified, the Contractor shall replace, at the Contractor's own expense, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations with concrete or flowable fill, as directed by the Engineer.
- Q. The Contractor shall adhere to these Additional Excavation Requirements for piping:
1. Excavate trenches so that the piping can be laid to the lines, grades, and elevations indicated on the Contract Drawings.
  2. For piping designated to be laid to a minimum cover requirement, grade trenches to avoid high and low points to the extent practical. Record Drawings of such pipes shall present top-of-pipe and grade elevations at all high and low points along each pipe segment, at the end points of each pipe segments, and at intervals not to exceed 100 feet along each pipe segment. If, in the opinion of the Engineer, additional air release and/or vacuum relief valves are required, the Contractor shall install the additional items as directed by the Engineer.
  3. Except at locations specifically indicated otherwise on the Contract Drawings, the required minimum cover over the top of the pipe from finished grade for various pipe diameters shall be as follows:

	Pipe Diameter			
	48 inch or less	66 inch	72 inch	96 inch
Minimum Cover	3 feet	4 feet	4.5 feet	5 feet

Continue dewatering operations along each pipe segment until the required minimum cover is provided. During the dewatering operations, the ground water level in the trench shall remain at all times a minimum of 1 foot below bottom of trench excavations.

R. The Contractor shall adhere to these Additional Excavation Requirements for Electrical Utilities:

1. Avoid abrupt changes in grade of the trench bottom.
2. The required minimum cover over the top of electrical conduits from finished grade shall be as follows:

	Electrical Conduits (Lines less than 5 kV)	Electrical Conduits (Lines 5 kV and up)
Minimum Cover	2 feet	3 feet
3. The required minimum clearance from the bottom of mat foundations and/or footings shall be 2 feet. Provide additional cover where necessary to satisfy the minimum clearance requirement.
4. Provide additional cover depth if necessary to avoid interference of other cables, ducts, piping, structures, and other utilities.

S. The Contractor shall adhere to this Additional Excavation Requirement for Appurtenances:

1. Ensure that excavations for valves and similar appurtenances shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls.

### 3.03 PROTECTION OF PERSONS AND PROPERTY

A. The Contractor shall do the following:

1. Barricade and post excavations with warning signs for the safety of persons. Provide warning lights during hours of darkness.
2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations against damage including loading, settlement, lateral movement, undermining, and washout.

B. Conduct topsoil removal operations to ensure the safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

### 3.04 SHEETING AND BRACING

A. Where sheeting and bracing are required to support the side walls of the excavation, the Contractor shall retain a Professional Engineer, registered in

Florida, to design sheeting and bracing. The design shall establish requirements for sheeting and bracing and shall comply with all applicable codes; authorities having jurisdiction; and federal, state, and local regulations.

- B. The sole responsibility for the design, methods of installation, and adequacy of sheeting and bracing shall be and shall remain that of the Contractor and the Contractor's Professional Engineer. The Contractor shall provide all necessary sheeting and bracing or other procedures as required to ensure safe working conditions and to protect the excavations.
- C. Sheetинг and bracing shall consist of braced steel sheet piling, trench box, braced wood lagging, and soldier beams or other approved methods.
- D. The Contractor shall immediately fill and compact voids formed outside the sheeting. Where soil cannot be properly compacted to fill the void, the Contractor shall use Class B concrete as backfill at no additional cost to the Owner.
- E. The Contractor shall install sheeting outside the required clearances and dimensions. Sheetинг shall be plumb, securely braced, and tied in position. Sheetинг shall be adequate to withstand all pressure to which it may be subjected. The Contractor shall correct any movement or bulging at no expense to the Owner so as to provide the necessary clearances and dimensions.
- F. The Contractor shall maintain sheeting and bracing in excavations and trenches for the entire time excavations will be open.
- G. The Contractor shall not brace sheeting against pipe being laid. Sheetинг shall be braced so that no concentrated load of horizontal thrust is transmitted to the pipe.
- H. Sheetинг shall not be withdrawn if driven below the spring line of any pipe. The Contractor shall cut off tops as indicated on the Contract Drawings and leave bottoms permanently in place.

### 3.05 BACKFILLING AND COMPACTION

- A. The Contractor shall not backfill trenches until required tests are performed.
- B. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

- C. The Contractor shall perform the following steps to ensure compaction at the bottom of the trench or excavation before bedding:
  - 1. Remove disturbed native soil material and/or any soils not meeting the requirement of satisfactory soil material as indicated on the Contract Drawings.
  - 2. Compact the bottom of the trench excavation (undisturbed native subsurface soil) to no less than 95% of the Modified Proctor maximum dry density in accordance with ASTM D1557, before placement of foundation, bedding, piping, and backfill.
- D. To backfill below and around pipe to the spring line of the pipe, the Contractor shall do the following:
  - 1. Construct foundation and bedding as indicated on the Contract Drawings before placement of pipe.
  - 2. Install each pipe at proper grade, alignment, and final position.
  - 3. Deposit satisfactory soil material uniformly and simultaneously on each side of pipe in completed course layers to prevent lateral displacement.
  - 4. Compact under pipe haunches and on each side of pipe to the pipe spring line as shown on the Contract Drawings to hold the pipe in the proper position during subsequent pipe backfilling and compaction operations.
  - 5. Construct haunching as indicated on the Contract Drawings.
- E. To trench backfill above pipe spring line to finished grade, the Contractor shall do the following:
  - 1. Deposit satisfactory soil material around and above pipe in uniform layers as shown on the Contract Drawings.
  - 2. Backfill and compact trenches from the spring line of the pipe to the top of the trench in completed course layers as shown on the Contract Drawings.
  - 3. Use material previously defined in these Specifications as satisfactory soil material.
  - 4. Compact by hand or mechanical tampers.

### 3.06 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. The Contractor shall remove and legally dispose of waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris from the property at no additional cost to the Owner.

END OF SECTION

**SECTION 02370**  
**EROSION AND SEDIMENTATION CONTROL**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.
- B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 02920, Seeding and Sodding.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. Florida Department of Transportation (FDOT)
  - 1. FDOT Section 103—Temporary Work Structures.

2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
3. FDOT Section 530—Riprap.
4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geotextile Fabrics.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 REGULATORY REQUIREMENTS

- A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

## **1.14 PRACTICES**

The Contractor shall adhere to the following:

- A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.
- B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.
- C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

## **1.15 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES**

- A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.
- B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.
- C. Filter fabric, hay bales, or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.
- D. The Contractor shall use silt fences, hay bales, and floating turbidity barriers as shown on the plans or as directed by the Owner or Owner's Representative to restrict movement of sediment from the site.
- E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Open-mesh biodegradable mulching cloth.
- B. Fertilizer shall be in accordance with Section 02920, Seeding and Sodding.
- C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.

- D. Grass shall be in accordance with Section 02920, Seeding and Sodding.
- E. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.
- F. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Standard Index 103.
- G. Erosion Stone: FDOT Section 530:
  - 1. Sand-Cement Riprap.
  - 2. Concrete Block.
  - 3. Rubble 20 to 300 pounds each.
- H. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.
- I. Baled hay or straw in accordance with FDOT Section 104.

### PART 3 EXECUTION

#### 3.01 CLEARING

- A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

#### 3.02 STABILIZING

- A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

#### 3.03 REGULATORY REQUIREMENTS

- A. Whenever land-disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within

30 working days on that portion of the tract upon which further active construction is to be undertaken.

- B. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

### 3.04 VEGETATIVE COVER

- A. Preparation of Seedbed shall be in accordance with Section 02920, Seeding and Sodding.
- B. Disturbed areas along embankments shall be permanently seeded with mix specified in Section 02920, Seeding and Sodding.
- C. The Contractor shall mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified previously in this Section.

### 3.05 MAINTENANCE

- A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.
- B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

### 3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

- A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established. The Contractor shall seed areas around devices and mulch after removing or filling temporary control devices.

B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

**SECTION 02700**  
**PAVING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section covers the work necessary to provide for the construction of all pavement where indicated on the Drawings.

**1.02 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Limerock material submittal is to be made to include liquid limit, plastic index, gradation, certification regarding deleterious material, limerock bearing ratio (LBR), Florida Department of Transportation (FDOT) pit number, and other information as required to indicate performance in accordance with the specifications.
- B. Information regarding asphaltic and Portland cement concrete materials and mix shall be submitted as required by the referenced FDOT specifications.

**1.03 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time, unless otherwise noted. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. The 2017 editions of the FDOT Standard Specifications for Road and Bridge Construction (Standard Specifications) and Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified with exceptions as noted in this Section.
1. Where the referenced FDOT Specifications cite "the Department," this shall be modified to "the Owner and/or Engineer" by this contract.
  2. The Contractor shall retain an independent testing agency, as approved by the Engineer, to perform all tests, including tests referenced to be performed by the Engineer.

3. Payment for this project is on a Lump-Sum Basis if defined as Lump Sum on the Bid Form. The FDOT sections defining the Basis of Payment shall be applied only when unit price work is defined on the Bid Form.
- B. American Society of Testing and Materials (ASTM)
  1. ASTM D1556/D1556M—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
  2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN·m/m<sup>3</sup>)).
  3. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
  4. ASTM D6938—Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

## 1.04 QUALITY ASSURANCE

- A. The Contractor shall perform field-density tests along the centerline of construction or as directed by the Engineer and in accordance with the FDOT's *Standard Specifications for Road and Bridge Construction*, latest edition.
- B. The Contractor shall field check the depth of stabilization and/or limerock at each road crossing with a pipeline.
- C. The Engineer may require additional testing as deemed necessary. The Engineer shall interpret test results and the Contractor shall perform remedial work as directed by the Engineer. The Contractor shall provide labor to the Engineer for help in performing tests and/or checking line and grade at no additional cost to the Owner.
- D. Laboratory maximum dry density of soil mixtures at optimum moisture shall be determined by ASTM D1557 for subgrade, stabilized subgrade, and limerock base course.
- E. Field density of stabilized subgrade and soils or soil mixtures in fill or backfill shall be determined by ASTM D1556/D1556M, ASTM D2167, or ASTM D6938 for limerock base course.
- F. Bearing value of stabilized subgrade shall be determined by the methods required for determining LBR according to the FDOT, Standard Specification FM 5-515.
- G. Field density of stabilized subbase shall be 98% or greater of the Modified Proctor maximum dry density, ASTM D1557.

- H. The Engineer shall have sole responsibility for interpreting all test results. The Contractor shall bear the cost of all retests due to failure to achieve specified requirements.

## PART 2 PRODUCTS

### 2.01 GENERAL (NOT USED)

### 2.02 ROCK BASE

- A. The following sections of the Standard Specifications shall apply:

1. Section 200-1, Description.
2. Section 200-2, Materials.

### 2.03 STABILIZING MATERIALS

- A. The following sections of the Standard Specifications shall apply:

1. Section 160-1, Description.
2. Section 160-2, Materials.

### 2.04 PRIME AND TACK COATS FOR BASE COURSES

- A. The following sections of the Standard Specifications shall apply:

1. Section 300-1, Description.
2. Section 300-2, Materials.

### 2.05 ASPHALT

- A. The following sections of the Standard Specifications shall apply:

1. Section 334-1, Description.
2. Section 334-2, Materials.
3. Section 334-3, General Composition of Mixture.
4. Section 334-5, Acceptance of the Mixture.

## 2.06 CEMENT CONCRETE PAVEMENT

A. The following sections of the Standard Specifications shall apply:

1. Section 350-1, Description.
2. Section 350-2, Materials.

## 2.07 TRAFFIC STRIPES AND MARKINGS

A. The following sections of the Standard Specifications shall apply:

1. Section 711-1, Description.
2. Section 711-2, Materials.

## PART 3 EXECUTION

### 3.01 EXCAVATION AND EMBANKMENT

A. The following sections of the Standard Specifications shall apply:

1. Section 120-1, Description.
2. Section 120-2, Classifications of Excavation.
3. Section 120-3, Preliminary Soils Investigation.
4. Section 120-4, Removal of Unsuitable Materials and Existing Roads.
5. Section 120-5, Disposal of Surplus and Unsuitable Material.
6. Section 120-6.1, Materials for Borrow.
7. Section 120-7, Materials for Embankment.
8. Section 120-8, Embankment Construction.
9. Section 120-9, Compaction Requirements.
10. Section 120-10, Acceptance Program.
11. Section 120-11, Maintenance and Protection of Work.
12. Section 120-12, Construction.

B. Exceptions

1. Section 120-4.1, Subsoil Excavation: Unsuitable soils shall be those in Classifications A-6, A-7, or A-8 in the American Association of State Highway and Transportation Officials (AASHTO) System.
2. Section 120-4.2, Construction Over Existing Old Road: Where removal of existing pavement is called for, it shall be removed to the full depth as indicated in the cross-sections and replaced with new limerock and paving or other treatment in accordance with the Drawings and details.
3. Section 120-5.3, Disposal of Paving Materials: Disposing of muck on side slopes shall not apply.

4. Section 120-9.2.1, General: Laboratory maximum dry density shall be determined by Modified Proctor, ASTM D1557. Field densities shall be determined by ASTM D1556/D1556M, ASTM D2167, or ASTM D6938. All embankments shall be compacted to not less than 95% of the maximum dry density, as determined by modified Proctor, ASTM D1557.
5. Section 120-12.1, Construction Tolerances: No tolerance greater than 0.1 foot above or below the plan cross-section will be allowed.

### 3.02 STABILIZING

- A. The following sections of the Standard Specifications shall apply:
  1. Section 160-3, Construction Methods.
  2. Section 160-4, Acceptance Program.
- B. Exceptions
  1. Section 160-2.4, Granular Subbase: Contractor may not substitute 6 inches of Granular Subbase for 12 inches of Stabilization unless such substitution is specifically indicated on the Drawings.
  2. Section 160-4.2.1.2, Undertolerance in Bearing Value Requirements: no undertolerance will be acceptable.

### 3.03 LIMEROCK BEARING RATIO AND DENSITIES

- A. Stabilized finish grade and stabilized shoulders shall have a minimum LBR value of 40 unless indicated otherwise on the Contract Drawings.
- B. Field density of stabilized finished grade shall be a minimum of 98% of the Modified Proctor maximum dry density as specified in ASTM D1557 to a minimum depth of 12 inches as shown on the Drawings.

### 3.04 PRIME AND TACK COATS

- A. The following sections of the Standard Specifications shall apply:
  1. Section 300-3.1, Pressure Distributor.
  2. Section 300-3.2, Sampling Device.
  3. Section 300-3.3. Temperature Sensing Device.
  4. Section 300-5, Cleaning Base and Protection of Adjacent Work.
  5. Section 300-6, Weather Limitations.
  6. Section 300-7, Application of Prime Coat.
  7. Section 300-8, Application of Tack Coat.

### **3.05 ROCK BASE**

A. The following sections of the Standard Specifications shall apply:

1. Section 200-3, Equipment.
2. Section 200-4, Transporting Rock.
3. Section 200-5, Spreading Rock.
4. Section 200-6, Compacting and Finishing Base.
5. Section 200-7, Acceptance Program.
6. Section 200-8, Priming and Maintaining.

B. Exceptions

1. Section 200-7.2.1, Density: The minimum density that will be acceptable for paved areas will be 98% of the maximum dry density as determined by Modified Proctor, ASTM D1557.
2. Section 200-7.3.1.2, Depth and Surface Testing Requirements: Thickness of base shall be measured at intervals not to exceed 200 feet.

### **3.06 ASPHALT**

A. The following sections of the Standard Specifications shall apply:

1. Section 320-6, Preparation of the Mixture.
2. Section 320-7, Transportation of the Mixture.
3. Section 330-1, Description.
4. Section 330-2, Quality Control (QC) Requirements.
5. Section 330-3, Limitations of Operations.
6. Section 330-4, Surface Preparation.
7. Section 330-5, Paving Equipment.
8. Section 330-6, Placing Mixture.
9. Section 330-7, Compacting Mixture.
10. Section 330-8, Joints.
11. Section 330-9, Surface Requirements.
12. Section 330-10, Protection of Finished Surface.

### **3.07 CEMENT CONCRETE PAVEMENTS**

A. The following sections of the Standard Specifications shall apply:

1. Section 350-3, Equipment.
2. Section 350-4, Subgrade Preparation.
3. Section 350-5, Setting Forms.
4. Section 350-6, Protection from Weather.

5. Section 350-7, Placement of Reinforcement.
6. Section 350-8, Placing Concrete.
7. Section 350-9, Striking-off, Consolidating, and Finishing Concrete.
8. Section 350-10, Final Finish.
9. Section 350-11, Curing.
10. Section 350-12, Joints.
11. Section 350-13, Surface Requirements.
12. Section 350-14, Thickness Determinations.

### 3.08 PAVEMENT REPAIR

- A. At his own expense the Contractor shall repair all damage to pavement as a result of work under this Contract in a manner satisfactory to the Engineer. Pavement shall be repaired to match the original surface material thickness and original grade. However, the asphalt concrete thickness shall not be less than 2 inches. The repair shall include preparing the subgrade, placing and compacting the applicable base, priming the limerock base, and placing and maintaining the surface treatment as specified in this Section.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage and as shown on the Contract Drawings. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

### 3.09 JOINTS

- A. General pavement joints within asphalt or concrete driveways and roadways and where specified or directed by the Engineer, shall be mechanically sawed butt joints. The edges of asphalt pavement shall be trimmed to straight lines which a roller can follow or formed.

### 3.10 TRAFFIC STRIPES AND MARKINGS

- A. The following sections of the Standard Specifications shall apply:
  1. Section 711-3, Equipment.
  2. Section 711-4, Application.
  3. Section 711-5, Contractor's Responsibility for Notification.
  4. Section 711-6, Protection of Newly Applied Traffic Stripes and Markings.

END OF SECTION

**SECTION 02920**  
**SEEDING AND SODDING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

A. This Section includes requirements for the following areas of work:

1. Fine grading.
2. Preparation of areas to receive seeding and sodding.
3. Fertilizing of areas to receive seeding and sodding.
4. Maintenance.
5. Seeding.
6. Hydroseeding.
7. Sodding of new areas to receive seeding and sodding.
8. Mulching.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 02370, Erosion and Sedimentation Control.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Certificates:
  1. Fertilizer, seed, hydroseed, and sod shall be accompanied by certificate from vendors certifying these items meet the requirements of these Specifications, stating botanical name, percentage by weight, and percentage of purity.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. FS O-F-241—Fertilizers, Mixed, Commercial.
- B. American Society for Testing and Materials (ASTM)—Equivalent AASHTO standards may be substituted as approved.
- C. The Florida Department of Transportation (DOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section with exceptions, as noted herein. Note that any reference in the Standard Specifications to the terms “Department” or “District Materials Engineer” shall be replaced by the term “Owner.”
- D. Section IV, Technical Specifications.

## 1.06 QUALITY ASSURANCE

- A. The Contractor shall provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver, store, protect, and handle products to the site and prevent damage from wetness and weather conditions.
- C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- D. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.

- E. No sod that has been cut for more than 72 hours may be used unless specifically authorized. A letter of certification from the grassing Contractor as to when the sod was cut and what type shall be provided to the Engineer upon delivery of the sod to the job site.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE

- A. Maintenance shall be as indicated under Part 3, Execution, of this Section.

1.12 RECORD DRAWINGS (NOT USED)

1.13 DEFINITIONS

- A. *Weeds:* Weeds include but are not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.14 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with regulatory agencies for fertilizer and herbicide composition.

PART 2 PRODUCTS

2.01 TOPSOIL

- A. The Contractor shall provide topsoil from off-site borrow or from project on-site excavation as approved by the Engineer.

2.02 SEED MIXTURE

- A. The Contractor shall comply with the City requirements in Section IV Item 902 and as follows:

1. For sod and seeded areas, fertilize with a complete granular fertilizer on Bahia and St. Augustine grasses at the rate of 1 pound of nitrogen per 1,000 square feet. Fertilizer shall be commercial grade, mixed granules, with 30% to 50% of the nitrogen being in slow or controlled release form.

The ratio of nitrogen to potash will be 1:1 or 2:1 for complete fertilizer formulations. Phosphorus shall be no more than one-quarter the nitrogen level. They shall also contain magnesium and micronutrients (i.e. manganese, iron, zinc, copper, etc.).

#### 2.03 FERTILIZER FOR SOD

- A. The Contractor shall comply with the City requirements in Section IV Item 902.
- B. The Contractor shall provide commercial fertilizer of neutral character, with some elements derived from organic sources, containing not less than 8% phosphoric acid, 8% potassium, and percentage of nitrogen required to provide less than 1.0 pound of actual nitrogen per 1,000 square feet of area. Provide nitrogen in form that will be available to the seeded and sodded area during initial period of growth. The chemical designation shall be 5-10-10.
- C. The Contractor shall ensure that the fertilizer is delivered to the site in labeled bags or containers.

#### 2.04 FERTILIZER FOR SEED

- A. The Contractor shall comply with the City requirements in Section IV Item 902.
- B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with 50% of the elements derived from organic sources, of a proportion necessary to eliminate any deficiencies of topsoil to the following proportions:
  1. Seeded Areas – 5% nitrogen, 10% phosphoric acid, 10% soluble potash.

#### 2.05 WATER FOR SEEDING AND SODDING

- A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 8.5. The Contractor shall provide all water needed for grassing by providing permanent or temporary piping valves and temporary trucks to convey water from the source to the point of use. The Contractor shall provide any meters required and pay for water used if the water is taken from a public water system. Water shall be free of petroleum products, pesticides, and any other deleterious impurities.

#### 2.06 EROSION-CONTROL FABRIC

- A. The Contractor shall provide 70% agricultural straw with 30% coconut fiber matrix stitches with degradable nettings designed to degrade within 18 months. Erosion-control anchors shall be as recommended by the manufacturer.

## 2.07 STRAW MULCH

- A. Straw mulch shall be used on all newly graded and top-soiled areas sloped 3:1 or steeper to protect areas against washouts and erosion. Straw mulch shall consist of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50% by weight of material that is 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

## 2.08 TACKIFIER

- A. Latex acrylic copolymer shall be Soil Sealant with coalescing agent as manufactured by Soil Stabilization Products Company, Inc., Merced, CA, or equal and shall be used as straw mulch tackifier.

# PART 3 EXECUTION

## 3.01 COORDINATION OF WORK

- A. The Contractor shall coordinate all work activities to provide for establishing grass cover at the earliest possible time in the construction schedule to minimize erosion of topsoil.

## 3.02 SOIL PREPARATION

Concerning soil preparation, the Contractor shall do the following:

- A. Dispose of any existing sod, growth, rocks, or other obstructions which might interfere with tilling, seeding, sodding, or later maintenance operations. Remove stones over 1-1/2 inches in any dimensions and sticks, roots, rubbish, and other extraneous matter. Remove from work area or site: do not stockpile.
- B. Till to a depth of not less than 6 inches. Thoroughly loosen and pulverize topsoil.
- C. Grade areas to be seeded and sodded to a smooth, even surface with loose, uniformly firm texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas which can be planted in the immediate future.
- D. Moisten prepared areas to be seeded and sodded before planting if the soil is dry. Water thoroughly and allow the surface to dry off before seeding and sodding. Do not create a muddy soil condition.

- E. Restore prepared areas to specified condition if eroded or otherwise disturbed after the fine grading and before planting.
- F. Spread the planting soil mixture to depth required to meet thickness, grades, and elevations indicated after light rolling and natural settlement. Do not spread if the material is frozen or if the subgrade is frozen.
- G. Preparing Unchanged Grades:
  - 1. Where seeding and sodding in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil as follows:
    - a. Till to a depth of not less than 12 inches.
    - b. Apply soil amendments and initial fertilizers.
    - c. Remove high areas and fill in depressions.
    - d. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
- H. Allow for a 3-inch sod thickness in areas to be added next to paving.
- I. Before preparing unchanged areas, remove existing grass, vegetation, and turf. Dispose of such material outside of the Owner's property: do not turn over into soil being prepared for seeding and sodding.
- J. Place approximately one-half of the total amount of planting soil required. Work into the top of the loosened subgrade to create a transition layer and then place the remainder of the planting soil.

### 3.03 FERTILIZING FOR SEEDING

- A. Seeding: The Contractor shall spread fertilizer uniformly at a rate of 10 pounds per 1,000 square feet.
- B. Apply after smooth raking of topsoil and before roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### 3.04 SEEDING

- A. Apply seed at the rate designated on the schedule evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on the same day.
- C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- D. Roll seeded area with appropriate equipment to achieve seed embedment and soil compaction.
- E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

### 3.05 HYDRO-SEEDING

- A. Apply seeded slurry with a hydraulic seeder at the rate designated on schedule evenly in two intersecting directions.
- B. Do not hydro-seed area in excess of that which can be mulched on the same day.
- C. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

### 3.06 SEED PROTECTION

- A. When seeding is complete, apply straw mulch at a rate of 4,000 pounds/acre. Apply tackifier as required.
- B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- C. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Provide a 2- to 4-inch overlap of adjacent rolls. Backfill the trench and rake smooth, level with the adjacent soil.
- D. Secure outside edges and overlaps in accordance with the manufacturer's recommendations.
- E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

- F. At the sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges a minimum of 6 inches.

### 3.07 SODDING NEW AREAS

When sodding new areas, the Contractor shall do the following:

- A. Before laying sod, contact the Engineer to observe soil preparation work. Lay sod within 24 hours of the time of stripping. Do not plant dormant sod or if the ground is frozen.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger to offset joints in adjacent courses. Employ installation methods to avoid damage to subgrade or sod. On slopes install the sod with an overlap that allows water to flow over the adjacent strip and not under it. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering adjacent grass.
- C. Anchor sod on slopes greater than 3:1 with wood pegs as required to prevent slippage.
- D. Water sod thoroughly with a fine spray immediately after planting.

### 3.08 RECONDITIONING SEEDED AND SODDED AREAS

The Contractor shall ensure that seeded and sodded areas are properly reconditioned by doing the following:

- A. Recondition seeded and sodded areas that are damaged by work operations, including storage of materials or equipment and movement of vehicles. Also recondition seeded and sodded areas where settlement or washouts occur or where minor regrading is required. Recondition other existing seeded and sodded areas where indicated.
- B. Provide fertilizer, topsoil, seed, or sod amendments as specified for new seeded and sodded areas and as required to provide satisfactory reconditioning. Provide new planting soil as required to fill low spots and meet new finish grades.
- C. Cultivate bare and compacted areas thoroughly to provide a good deep planting bed.
- D. Remove diseased or unsatisfactory seeded and sodded areas; do not bury into soil. Remove topsoil containing foreign materials resulting from operations including

- oil drippings, stone, gravel, and other construction materials. Replace with new topsoil.
- E. Where substantial seeding and sodding remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or, if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.
  - F. Water newly planted areas and keep moist until new grass is established.

### 3.09 PROTECTION

- A. The Contractor shall erect barricades, warning signs, and fencing to protect newly planted areas from traffic. Maintain barricade fencing and warning signs throughout the maintenance period until project is substantially completed.

### 3.10 MAINTENANCE

To maintain the seeded and sodded area, the Contractor shall do the following:

- A. Mow sod to a height of 2 inches as soon as there is enough top growth to cut with a mower. Remove no more than 40% of grass leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted.
- B. Maintain grass growth by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, re-grading, and replanting as required to establish a smooth, acceptable seeding and sodding, free from eroded or bare areas.
- C. Remove weeds by pulling or chemical treatment.
- D. Perform maintenance until the date of final completion of project.
- E. Apply the second fertilizer application after the first mowing and when grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1,000 square feet of seeded and sodded areas.
- F. Replant bare areas using the same materials specified for seeded and sodded areas.
- G. Watering: Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep seeded and sodded areas uniformly moist as required for proper growth. Do not apply more than 1 inch of water per week to sustain grass growth.

- H. Lay out temporary watering system and arrange watering schedule to avoid walking over muddy areas. Use equipment and water to prevent puddling and water erosion and displacing seed or mulch (if any).
- I. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist.
- J. Provide supplemental water and irrigation to sod areas when the rainfall is not adequate to maintain soil moisture necessary for growth of the grass. The Contractor is responsible for determining the quantities of water required and when to irrigate. This obligation shall remain in full force and effect until final acceptance of the work by the Owner and shall be provided at no additional cost to the Owner.

The Owner, at its discretion, may relieve the Contractor of this obligation at such time as the Owner is able to provide irrigation if available. This action, however, does not relieve the Contractor of the provisions and guarantees set forth in the Contract Documents.

### 3.11 ACCEPTANCE OF SEEDED OR SODDED AREAS

- A. When seeding or sodding work, including maintenance, is substantially complete, the Engineer and the Owner will, upon request, observe to determine satisfactory growth and acceptability:
  1. The term "Satisfactory Growth" as used in this Section is defined as even plant growth in healthy condition without bare spots larger than 1 square foot in seeded areas and without bare spots in sodded areas. Bare spots in sodded areas shall be resodded. The Contractor shall maintain all grassed and sodded areas until satisfactory growth has been demonstrated at project final completion. If the subsequent stand of grass is found contaminated with weeds or other obnoxious or undesirable growth, the Contractor shall eliminate such undesirable growth at the Contractor's own expense.
- B. The Contractor shall re-plant rejected work and continue specified maintenance until the work is accepted by the Engineer and the Owner and found to be acceptable.
- C. Sodded areas will be acceptable provided requirements, including maintenance, have been complied with and a healthy, well-rooted, even-colored, viable seeded or sodded area is established, free of weeds, open joints, bare areas, and surface irregularities.

### 3.12 CLEANUP

- A. The Contractor shall promptly remove soil and debris created by seeding and sodding work from paved areas. Clean wheels of vehicles before they leave the site to avoid tracking soil onto surfacing of roads, walks, or other paved areas.

END OF SECTION

**DIVISION 3**

**CONCRETE**

**SECTION 03100**  
**CONCRETE FORMWORK**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to design, install, and remove formwork for cast-in-place concrete as shown on the Drawings and as specified in this Section.
- B. Secure to forms as required or set for embedment as required all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, and other items furnished under other sections and required to be cast into concrete or approved in advance by the Engineer.

**1.02 RELATED WORK**

- A. Section 03200, Concrete Reinforcement.
- B. Section 03250, Concrete Joints and Joint Accessories.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03600, Grout.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
  - 1. Form release agent.
  - 2. Form ties.
- B. Samples
  - 1. Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated, or otherwise finished and will not affect the forming materials.
  - 2. Certify that the form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

**1.04 WORK SEQUENCE (NOT USED)**

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.
2. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
3. ACI 347R—Guide to Formwork for Concrete.

B. American Plywood Association (APA)

1. Material grades and designations as specified.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES (NOT USED)

## 1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 WEATHER CONSTRAINTS (NOT USED)

## 1.12 SYSTEM DESCRIPTION

A. General: Architectural Concrete is wall, slab, beam, or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water-containment structures from the top of walls to 2 feet below the normal water surface in open tanks and basins.

B. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347R and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is to establish the standard of quality and general configurations desired.

### 2.02 MATERIALS

- A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.
- B. Wall Forms
  - 1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior-grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group or an equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.
  - 2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging or creating surface patterns.
- C. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface, and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Column Forms

1. Rectangular columns shall be formed as specified for wall forms. All corners shall have a 3/4-inch chamfer unless otherwise noted on the Drawings.

E. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water-based, bond-breaking form coating unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non toxic and free of taste or odor.

F. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that after removal of the projecting part no metal shall remain within 1-1/2 inches of the face of the concrete. The part of the tie to be removed shall be at least 1/2 inch diameter or be provided with a wood or metal cone at least 1/2 inch diameter and 1-1/2 inches long. Form ties in concrete exposed to view shall be the cone washer type.
2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.
3. Flat bar ties for panel forms, if used, shall have plastic or rubber inserts having a minimum depth of 1-1/2 inches and sufficient dimensions to permit proper patching of the tie hole.
4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.
5. Common wire shall not be used for form ties.
6. Alternate form ties consisting of tapered-through bolts at least 1 inch diameter at the smallest end or through bolts that use a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain the Engineer's acceptance of the system and spacing of ties before ordering or purchase forming. Clean, fill, and seal the form tie hole with non-shrink cement grout. The Contractor shall be responsible for watertightness of the form ties and any repairs needed.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Forms shall be used for all cast-in-place concrete, including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings.
- B. Forms for walls shall have removable panels at the bottom for cleaning, inspection, and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, prevent segregation, and prevent the accumulation of hardened concrete on the forms above the fresh concrete.
- C. Molding, bevels, or other types of chamfer strips shall be placed to produce blockouts, rustications, or chamfers as shown on the Drawings or as specified in this Section. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-inch chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealant manufacturer's recommendations.
- D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.
- E. Before form material is reused, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

### 3.02 FORM TOLERANCES

- A. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 347R and shall meet the following additional requirements for the specified finishes:
  1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16 inch and forms for plane surfaces shall be such that the concrete will be planed within 3/16 inch in 4 feet. Forms shall be tight to prevent the passage of mortar, water, and grout. The maximum deviation of the finish wall surface at any point shall not

exceed 1/4 inch from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347R.
3. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1 inch.

### 3.03 FORM PREPARATION

- A. Wood forms in contact with the concrete shall be coated with an effective release agent before the forms are installed.
- B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those used for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

### 3.04 REMOVAL OF FORMS

- A. The Contractor shall be responsible for all damage resulting from removing the forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347R. Form removal shall conform to the requirements specified in Section 03300, Cast-In-Place Concrete, and a curing compound applied.

### 3.05 INSPECTION

- A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours before the proposed concrete placement.
- B. Failure of the forms to comply with the requirements specified in this Section or to produce concrete complying with requirements of this Section shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

**SECTION 03180**  
**CONCRETE COATING SYSTEM**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish and install all labor, materials, equipment, and incidentals required to supply and install the concrete coating system on the interior surfaces of the Sludge Storage and Blend Tanks as indicated in the Contract Documents.

**1.02 10-YEAR LIMITED WARRANTY**

- A. Manufacturer shall provide a 10-year limited warranty for coating system.

**1.03 REFERENCES**

- A. American Society for Testing and Materials (ASTM)

1. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
2. ASTM D4259—Standard Practice for Abrading Concrete.
3. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
4. ASTM D4414—Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
5. ASTM D4541—Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
6. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.

- B. NACE International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

- C. Steel Structures Painting Council (SSPC)

1. SSPC PA-9—Measurement of Dry Coating Thickness Using Ultrasonic Gages.
2. SSPC SP-1—Solvent Cleaning.
3. SSPC SP-7/NACE No. 4—Brush-Off Blast Cleaning.
4. SSPC SP-10/NACE No. 2—Near-White Blast Cleaning.

5. SSPC SP-12/NACE No. 5—Surface Preparation and Cleaning of Metals.
  6. SSPC SP-13/NACE No. 6—Surface Preparation of Concrete.
- D. International Concrete Repair Institute (ICRI)
1. ICRI CSP-2—Standard Guidelines – Grinding.
  2. ICRI CSP-6—Standard Guidelines – Medium Scarification.

#### 1.04 SUBMITTALS

- A. Submit for review, complete detailed shop drawings for all materials furnished under this Section.
- B. The manufacturer of the coating system shall furnish an affidavit attesting to the successful use of its material as a coating for concrete structures for a minimum period of 5 years in wastewater conditions recognized as corrosive or otherwise detrimental to concrete.
- C. Name, address, and detailed qualifications of the applicator to which the Contractor intends to award the work under this Section. Qualifications shall include, but not be limited to, a list of installations that are currently in service and documentation that the firm is currently a qualified applicator of the proposed materials by the supplier or manufacturer.

### PART 2 PRODUCTS

#### 2.01 COATING SYSTEMS

- A. The coating system shall be one of the systems as described in the Contract Documents and outlined below.
  1. Green Monster Liner
    - a. Cementitious Surfacer shall be Green Monster Liner 30 and shall be applied at a minimum of 1/2 inch thickness and as required to bring the existing structure up to original thickness.
    - b. Apply primer in accordance with the manufacturer's requirements.
    - c. Apply one coating of Green Monster Liner 30 at a minimum DFT of 125 mils.
  2. Sauereisen – Sewergard 210
    - a. Cementitious Surfacer shall be Sauereisen Underlayment No. F-121 and shall be applied at a minimum of 1/2 inch thickness

- and as required to bring the existing structure up to original thickness.
- b. Apply one coating of Sewergard 210T on surfaces at a minimum DFT of 125 mils.
  - c. Apply one coating of Sewergard 210G on surfaces at a minimum DFT of 20 mils.
3. SpectraShield
- a. Apply SpectraShield at a minimum of 1/2 inch thickness and as required to bring the existing structure up to original thickness.
  - b. Apply coating of SpectraShield in accordance with the manufacturer's requirements.
- B. The coating system shall be applied by a qualified applicator trained in handling, mixing and application of the material including the required surface cleaning and preparation. The applicator shall have a minimum of 5 years of experience installing the product and shall be approved for installation by the manufacturer. A list of references of projects in Florida using the specified coating system shall be provided to the City and Engineer for review.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Before any work being performed the Contractor shall notify the owners of any property that may be affected by the construction.
- B. Surface preparation shall be performed in accordance with Manufacturer's requirements and at a minimum shall remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. - sandblasting, grinding, etc, as approved by the Engineer.
- C. Where existing reinforcement is exposed the reinforcement shall be cleaned of all rust and coated with a corrosion inhibitor as recommended by the coating Manufacturer.
- D. Installation, curing and testing shall be performed in accordance with the Manufacturer's specifications and requirements.
- E. In all cases where coating work must be performed in a non-flow condition the Contractor shall be responsible for coordinating and facilitating all flow diversion and bypass pumping during the coating operation.

- F. New Portland cement concrete structures shall have endured a minimum of 28 days since manufacture before commencing coating installation. Should earlier coating be required, coating product manufacturer shall recommend specifications including appropriate cure assessment testing and use of specialty primers and sealers.

### 3.02 REPAIRS AND SURFACE PREPARATION

- A. Excessive debris, sediment, root intrusion or other foreign materials which may impact the effectiveness of the surface preparation process shall be removed before the commencement thereof.
- B. Offset structural components, lids, covers, frames, etc. shall be repaired, replaced, or reset before the commencement of surface preparation.
- C. External soil/fill voids shall be remediated and/or stabilized by replacement or injection of stabilizing grout as determined appropriate by the Engineer.
- D. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be removed in accordance with SSPC-SP 1 – Solvent Cleaning.
- E. Choice of surface preparation method(s) should be per the coating manufacturer's recommendation which shall be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and the required cleanliness and profile of the prepared surface to receive the repair and/or coating product(s).
- F. Surface preparation method shall be abrasive blasting.
  1. SSPC SP-13/NACE No. 6 Surface Preparation of Concrete.
  2. ASTM D4258, Standard Practice for Surface Cleaning Concrete for Coating, and ASTM D4259, Standard Practice for Abrading Concrete.
  3. ICRI Technical Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
  4. NACE/SSPC Standards for the surface preparation of steel.

- G. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound, clean, and neutralized surface suitable for the specified coating product(s).
1. Resulting surface profile of the prepared concrete substrate shall be (as described in ICRI Technical Guideline No. 03732):
    - a. For application of cementitious materials: At least an ICRI CSP-2.
    - b. For application of coating products: At least an ICRI CSP-2.
  2. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that sound substrate remains:
    - a. In conditions where severe chemical/microbiological attack has occurred the prepared substrate shall exhibit a pH of 8-12. Additional cleaning and/or contaminated substrate removal may be required to achieve the specified pH level.
- H. At the time of the recoating, the amount of flash rust shall be no greater than “No Flash Rust” as defined in SSPC-SP 12.
- I. Before the application of the coating product repairs shall be completed to ensure the following:
1. All inflow and infiltration shall be eliminated by use of appropriate repair material(s), such as hydraulic cements and/or chemical grouts.
  2. All repairs to joints, pipe seals, steps, mechanical penetrations, benches, invert, pipes or other appurtenances to be coated shall be completed and repaired surfaces prepared according to this Section.
    - a. Benches or other horizontal surfaces shall have adequate slope (1 inch rise per lineal foot minimum) to minimize the retention of debris following surcharge.
    - b. Inverts or flow channels shall be smooth without lips, rough edges, or other features which may cause debris to collect; contoured to minimize turbulent flow; and be sloped to promote adequate flow from the inlet(s) to the outlet pipe.
    - c. All joints, pipe seals, steps, or other penetrations shall be sealed against inflow, infiltration, and exfiltration and be adequately filled, smoothed, and contoured to promote monolithic coating application.

- J. Areas where reinforcing steel has been exposed shall be repaired in accordance with the Project Engineer's recommendations, as shown on the Drawings and at the minimum all exposed steel shall be prepared before coating with the coating product specified or other approved primer as specified by the coating product manufacturer.

### 3.03 FIELD QUALITY CONTROL AND TESTING

- A. The Contractor shall give the City and Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any surface preparation work.
- B. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the City's and Engineer's use at all times while coating is being done, until final acceptance of such coatings. The Contractor shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.
- C. Coating system thickness shall be inspected to ensure compliance with the specifications herein.
  1. During application a wet film thickness gauge, meeting ASTM D4414, Standard Practice for Measurement of Wet Film Thickness by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by the Contractor for submission to the Owner.
  2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9, Measurement of Dry Coating Thickness Using Ultrasonic Gages.
- D. High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates, or ASTM D4787, Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked

and repaired according to the coating product(s) manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
  2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
  3. All areas repaired shall be retested following cure of the repair material(s).
  4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted, and all possible holidays shall be marked and repaired as described above.
  5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the Owner/Engineer by the Contractor.
- E. Visual inspection shall be made by the City, the Engineer, or their representative. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.
- F. Inspection by the City, the Engineer, their representative, or the waiver of inspection of any particular portion of the Work, shall not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.
- G. Before demobilization from the site, the Contractor shall remove all construction debris, stabilize any spill areas and wash roadway areas affected by the work.
- H. Inspection by the Owner shall be scheduled after the work is complete, and again within the warranty period.

END OF SECTION

**SECTION 03200**  
**CONCRETE REINFORCEMENT**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified in this Section.
- B. Furnish only all deformed steel reinforcement required to be entirely built into concrete masonry unit construction.

**1.02 RELATED WORK**

- A. Section 03100, Concrete Formwork.
- B. Section 03250, Concrete Joints and Joint Accessories.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03600, Grout.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
  - 1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI SP-66. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc.) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.
  - 2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.
  - 3. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. The Contractor shall submit test reports, in accordance with Section 01330, Submittals and Acceptance, of each of the following items:

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.
2. Welder's certification. The certification shall be in accordance with AWS D1.4/D1.4M when welding of reinforcement is required.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A615/A615M—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM A704/A704M—Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
3. ASTM A706/A706M—Standard Specification for Deformed and Plan Low-Alloy Steel Bars for Concrete Reinforcement.
4. ASTM A767/A767M—Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
5. ASTM A775/A775M—Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
6. ASTM A884/A884M—Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
7. ASTM A934/A934M—Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
8. ASTM A996/A996M—Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
9. ASTM A1064/A1064M—Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed for Concrete.

B. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.
2. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
3. ACI SP-66—ACI Detailing Manual.

- C. Concrete Reinforcing Steel Institute (CRSI)
  - 1. Manual of Standard Practice.
- D. American Welding Society (AWS)
  - 1. AWS D1.4/A1.4M—Structural Welding Code – Reinforcing Steel.

## 1.06 QUALITY ASSURANCE

- A. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.
- C. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.
- D. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 WEATHER CONSTRAINTS (NOT USED)

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Materials shall be new, of domestic manufacture, and shall comply with the following material specifications.
- B. Deformed Concrete Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.
- C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706/A706M.
- D. Welded Steel Wire Fabric: ASTM A1064/A1064M. Provide in flat sheets.
- E. Welded Deformed Steel Wire Fabric: ASTM A1064/A1064M.
- F. Welded Plain Bar Mats: ASTM A704/A704M and ASTM A615/A615M Grade 60 plain bars.
- G. Fabricated Deformed Steel Bar Mats: ASTM A1064/A1064M and ASTM A615/A615M Grade 60 deformed bars.
- H. The following alternate materials are allowed:
  - 1. ASTM A615/A615M Grade 60 may be used for ASTM A706/A706M provided the following requirements are satisfied:
    - a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3,000 psi.
    - b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.
    - c. The carbon equivalency (CE) of bars shall be 0.55 or less.
- I. Reinforcing Steel Accessories
  - 1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 Maximum Protection.
  - 2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 Moderate Protection.

3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.
4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

J. Tie Wire

1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire, or stranded wire.

K. Mechanical reinforcing steel butt splices shall be positive connecting taper threaded-type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH, or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to the manufacturer's recommended value.

1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or compression of not less than 125% of the ASTM-specified minimum yield strength of the rebar.
2. Compression-type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.

L. Fiber Reinforcement

1. Synthetic reinforcing fiber for concrete shall be 100% polypropylene collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic Industries Inc., Chattanooga, TN, Fibermesh or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

## 2.02 FABRICATION

- A. Fabrication of reinforcement shall be in compliance with the CRSI *Manual of Standard Practice*.
- B. Bars shall be cold bent. Bars shall not be straightened or rebent.
- C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the ACI 318.

- D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded shall have the applicable end(s) saw cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the *CRSI Manual of Standard Practice*. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.
- B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:
1. Concrete cast against and permanently exposed to earth: 3 inches.
  2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2 inches (including bottom cover of slabs over water or sewage).
  3. Concrete not exposed to soil, water, sewage, sludge, and/or weather:
    - a. Slabs (top and bottom cover), walls, joists, shells, and folded plate members: 1 inch.
    - b. Beams and columns (principal reinforcement, ties, spirals, and stirrups): 1-1/2 inches.
- C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.
- D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified in this Section or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4/D1.4M.
- E. Reinforcing steel interfering with the location of other reinforcing steel, conduits, or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to

install inserts, conduits, mechanical openings, or other items without the prior approval of the Engineer.

- F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.
- G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld, or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

### 3.02 REINFORCEMENT AROUND OPENINGS

- A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

### 3.03 SPLICING OF REINFORCEMENT

- A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters but not less than 12 inches. The lap splice length for column vertical bars shall be based on the bar size in the column above.
- B. Tension lap splices shall be provided at all laps in compliance with ACI 318. Splices in adjacent bars shall be staggered. Class A splices may be used when 50% or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.
- C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125% of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.
- D. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded-wire fabric shall be lapped in accordance with the requirements of ACI 318 but not less than 12 inches. The spliced fabrics shall be tied together with wire ties spaced not more than 24 inches on center and laced with wire of the same diameter as the welded wire fabric. Do

- not position laps midway between supporting beams or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.
- E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

### 3.04 ACCESSORIES

- A. Determine, provide, and install accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless-steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid-containing areas). Use of galvanized or plastic-tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified in this Section.
- D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

### 3.05 INSPECTION

- A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing, and position of the reinforcement has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

**SECTION 03250**  
**CONCRETE JOINTS AND JOINT ACCESSORIES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified in this Section.

**1.02 RELATED WORK**

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03360, Concrete Finishes.
- E. Section 03600, Grout.
- F. Section 05500, Metal Fabrications.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
  - 1. Standard waterstops: Product data, including catalogue cut, technical data, storage requirements, splicing methods, and conformity to ASTM standards.
  - 2. Special waterstops: Product data, including catalogue cut, technical data, location of use, storage requirements, splicing methods, installation instructions, and conformity to ASTM standards.
  - 3. Premolded joint fillers: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
  - 4. Bond breaker: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
  - 5. Expansion joint dowels: Product data on the complete assembly, including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformity to ASTM standards.
  - 6. Compressible joint filler: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.

7. Bonding agents: Product data, including catalogue cut, technical data, storage requirements, product life, application requirements, and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system are compatible with each other.
2. Certification that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A675/A675M—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
2. ASTM C881/C881M—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
3. ASTM C1059/C1059M—Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
4. ASTM D1751—Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
5. ASTM D1752—Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. US Army Corps of Engineers (CRD)

1. CRD C572—Specifications for Polyvinylchloride Waterstop.

1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 WEATHER CONSTRAINTS (NOT USED)

# PART 2 PRODUCTS

## 2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is to establish the standard of quality and general configuration desired.
- B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.
- C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than 5 years.

## 2.02 MATERIALS

### A. Premolded Joint Filler

- 1. Premolded joint filler structures: Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type III. The thickness shall be 3/4 inch unless shown otherwise on the Drawings.
- 2. Premolded joint filler sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings: The joint filler shall be asphalt impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4 inch unless otherwise shown on the Drawings.

B. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
2. Except where tape is specifically called for on the Drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories, or equal.

C. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture-insensitive, epoxy-resin material conforming to ASTM C881/C881M, Type II. The bonding agent shall be Sikadur 32 Hi Mod by Sika Corporation of Lyndhurst, NJ; Concessive Liquid (LPL) by Master Builders of Cleveland, OH; or equal. Acrylic may be used if approved by the Engineer.

D. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material use to fill expansion joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68°F and subsequently recovering at least 20% of its original thickness in the first half hour after unloading. Compressible joint filler shall be Evasote 380 E.S.P., by E Poxy Industries, Inc., Ravana, NY, Sikaflex 1a by Sika, or equal.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor must be submitted to the Engineer for written approval.
2. Additional or relocated joints should be located where they least impair the strength of the member. In general, locate joints within the middle third of spans of slabs, beams, and girders. However, if a beam intersects a

girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

3. All joints shall be perpendicular to the main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.
4. Provide sealant grooves for joint sealant where indicated on the Drawings.
5. At all construction joints and at concrete joints designated on the Drawings to be "roughened," uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately 1/4 inch to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding.
6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.
7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

## B. Expansion Joints

1. Do not extend through expansion joints, reinforcement, or other embedded metal items that are continuously bonded to concrete on each side of joint.
2. Position premolded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.
3. Expansion joints shall be 3/4 inch wide unless otherwise noted on the Drawings.
4. Where indicated on the Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.
5. Provide center-bulb-type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

C. Contraction Joints

1. Provide sealant grooves, sealants, and waterstops at contraction joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab contraction joints in water containment structures and at other locations shown on the Drawings.
2. Contraction joints may be sawed if specifically approved by the Engineer. If contraction joint grooves are sawed, properly time the saw cutting with the time of the concrete set. Start cutting as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking. No reinforcing shall be cut during sawcutting.
3. Extend every other bar of reinforcing steel through contraction joints or as indicated on the Drawings. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker before placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION

**SECTION 03300**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified in this Section.

**1.02 RELATED WORK**

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03250, Concrete Joints and Joint Accessories.
- D. Section 03360, Concrete Finishes.
- E. Section 03600, Grout.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
  1. Sources of cement, pozzolan, and aggregates.
  2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
  3. Air entraining admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
  4. Water-reducing admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
  5. High-range water-reducing admixture (plasticizer). Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range, and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use, including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type, and manufacturer of cement. Provide either a. or b. below for each mix proposed:
  - a. Standard deviation data for each proposed concrete mix based on statistical records.
  - b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28-day cylinder strength test results for each mix. Provide results of 7- and 14-day tests if available.
7. Sheet curing material. Product data, including catalogue cut, technical data, and conformity to ASTM standard.
8. Liquid curing compound. Product data, including catalogue cut, technical data, storage requirements, product life, application rate, and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates—sieve analysis, physical properties, and deleterious substance.
2. Coarse aggregates—sieve analysis, physical properties, and deleterious substances.
3. Cements—chemical analysis and physical properties for each type.
4. Pozzolans—chemical analysis and physical properties.
5. Proposed concrete mixes—compressive strength, slump, and air content.

D. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and with the aggregates.
2. Certify that admixtures are suitable for use in contact with potable water after 30 days of concrete curing.
3. Certify that the curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### A. American Society for Testing and Materials (ASTM)

1. ASTM C31/C31M—Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33/33M—Standard Specification for Concrete Aggregates.
3. ASTM C39/C39M—Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42/C42M—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94/C94M—Standard Specification for Ready-Mixed Concrete.
6. ASTM C143/C143M—Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150/C150M—Standard Specification for Portland Cement.
8. ASTM C171—Standard Specification for Sheet Materials for Curing Concrete.
9. ASTM C173/C173M—Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
10. ASTM C231/C231M—Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260/C260M—Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C309—Standard Specification for Liquid-Membrane Forming Compounds for Curing Concrete.
13. ASTM C494/C494M—Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C618—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C1017/C1017M—Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

### B. American Concrete Institute (ACI)

1. ACI 304R—Guide for Measuring, Mixing, Transporting, and Placing Concrete.
2. ACI 305R—Guide to Hot Weather Concreting.

3. ACI 306.1—Standard Specification for Cold Weather Concreting.
4. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
5. ACI 350—Code Requirements for Environmental Engineering Concrete Structures and Commentary.

## 1.06 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with ACI 318; the recommendations of ACI 350; and other stated requirements, codes, and standards. The most stringent requirement of the codes, standards, and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Thirty days before placing concrete, the Contractor shall discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops, and curing. Propose methods of hot and cold weather concreting as required. Before placing any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss with the Engineer the properties and techniques of batching and placing plasticized concrete.
- D. If, during the progress of the work, it is impossible to obtain concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to obtain the desired properties. All changes so ordered shall be made at the Contractor's expense.
- E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.
- F. The Contractor shall furnish testing of the following materials to verify conformity with this Section and the stated ASTM Standards:
  1. Fine aggregates for conformity with ASTM C33/C33M—sieve analysis, physical properties, and deleterious substances.
  2. Coarse aggregates for conformity with ASTM C33/C33M—sieve analysis, physical properties, and deleterious substances.
  3. Cements for conformity with ASTM C150/C150M—chemical analysis and physical properties.

4. Pozzolans for conformity with ASTM C618—chemical analysis and physical properties.
  5. Proposed concrete mix designs—compressive strength, slump, and air content.
- G. A firm providing field testing and inspection services will be approved by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid by the Contractor and reimbursed by the Owner under the Concrete Testing Allowance. The following items shall be tested by the Owner to verify conformity with this Section:
1. Concrete placements—compressive strength (cylinders), compressive strength (cores), slump, and air content.
  2. Other materials or products that may come under question.
- H. All materials incorporated in the work shall conform to accepted samples.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section:

- A. Cement: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination and to minimize warehouse set.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.
- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to ensure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid

- admixtures from freezing and other temperature changes which could adversely affect their characteristics.
- E. Pozzolan: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination.
  - F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
  - G. Liquid Curing Compounds: Store in closed containers.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance, and manufacturer's service.

#### 2.02 MATERIALS

- A. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: Domestic Portland cement complying with ASTM C150/C150M. Air entraining cements shall not be used. The brand of cement shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:
  - 1. Class A,B,C,D Concrete Type II with the addition of fly ash resulting in C3A being below 5% of total cementitious content, Type III limited to 5% C3A or Type V.
- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33/C33M.

- D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33/C33M. Grading requirements shall be as listed in ASTM C33/C33M Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33/C33M Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 in this Section.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix, including other admixtures, and shall be suitable for use in contact with potable water after 30 days of concrete curing.
1. Air-Entraining Admixture: The admixture shall comply with ASTM C260/C260M. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
  2. Water-Reducing Agent: The admixture shall comply with ASTM C494/C494M, Type A. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
  3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494/C494M, Type F, and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
  4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water-reducing or high-range water-reducing admixtures.
- G. Pozzolan (Fly Ash) shall be Class F fly ash complying with ASTM C618 except that the Loss on Ignition (LOI) shall be limited to 3% maximum.
- H. Sheet Curing Materials. Waterproof paper, polyethylene film, or white burlap polyethylene sheeting all complying with ASTM C171.
- I. Liquid Curing Compound. Liquid membrane forming curing compound shall comply with the requirements of ASTM C309, Type 1 D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. The curing compound shall be approved for use in contact with potable water after 30 days according to NSF 61 (non-toxic and free of taste or odor).

## 2.03 MIXES

- A. An independent testing laboratory acceptable to the Owner engaged by and at the expense of the Contractor shall develop mix designs and testing.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance, and other required properties. Proportion ingredients to produce a homogenous mixture that will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data are not available, be developed by a testing laboratory acceptable to the Engineer and engaged by and at the expense of the Contractor. Mixes based on standard deviation shall be accepted based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7- and 28-day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16% greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.
- D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the paragraph above.
- E. Entrained air, as measured by ASTM C231/C231M, shall be as shown in Table 1.
  - 1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231/C231M to accurately determine air content, make special note of this requirement in the admixture submittal.
- F. Slump of the concrete as measured by ASTM C143/C143M shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated

shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10 inches.

- G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1  
CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)	
A	2,500	C150/C150M Type II	C33/C33M	57	440 min.	
B	3,000	C150/C150M Type II	C33/C33M	57	480 min.	
C	4,000	C150/C150M Type II	C33/C33M	57	560 min.	
D	5,000	C150/C150M Type II	C33/C33M	57	600 min.	
Class	W/C Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range (inches)
A	0.62 max.	--	3.5 to 5	Yes	*	1 to 4
B	0.54 max.	--	3.5 to 5	Yes	*	1 to 3
C	0.44 max.	20 to 25%	3.5 to 5	Yes	*	3 to 5
D	0.40 max.	--	3.5 to 5	Yes	*	3 to 5

NOTES:

- (1) Minimum compressive strength in psi at 28 days.
- (2) ASTM designation.
- (3) Size Number in ASTM C33/C33M.
- (4) Cementitious content in lbs/cu yd.
- (5) W/C is Water-Cementitious ratio by weight.
- (6) AE is percent air-entrainment.
- (7) WR is water-reducer admixture.
- (8) HRWR is high-range water-reducer admixture.
- \* HRWR used at the Contractor's option.

## PART 3 EXECUTION

### 3.01 MEASURING MATERIALS

- A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, and admixtures as specified and shall be produced by a plant acceptable to

the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.

- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94/C94M except as otherwise specified. Scales shall have been certified by the local Weights and Measures official within 1 year of use.
- C. Measure the amount of free water in fine aggregates within 0.3% with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as batched on printed batching tickets.
- D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks or by an automatic dispenser approved by the manufacturer of the specific admixture.
  - 1. Charge air entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
  - 2. Inject multiple admixtures separately during the batching sequence.

### 3.02 MIXING AND TRANSPORTING

- A. Concrete shall be ready mixed concrete produced by equipment acceptable to the Engineer. No hand mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- B. Ready mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.
- D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94/C94M.
- E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting

slope requirements may be used if concrete is discharged into a hopper before distribution.

- F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- H. Furnish a delivery ticket for ready-mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- I. Temperature and Mixing Time Control
  - 1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40°F.
  - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90°F.
  - 3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90°F. If necessary, substitute well-crushed ice for all or part of the mixing water.

4. The maximum time interval between adding mixing water and/or cement to the batch and placing concrete in the forms shall not exceed the values shown in Table 2.

**TABLE 2**  
**MAXIMUM TIME TO DISCHARGE OF CONCRETE**

Air or Concrete Temperature (whichever is higher)	Maximum Time
80 to 90°F (27 to 32°C)	45 minutes
70 to 79°F (21 to 26°C)	60 minutes
40 to 69°F (5 to 20°C)	90 minutes

- J. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

### 3.03 CONCRETE APPEARANCE

- A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:
1. The gradation of aggregate.
  2. The proportion of fine and coarse aggregate.
  3. The percentage of entrained air within the allowable limits.
- B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability, and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10 feet away, shall be pleasing in appearance and at 20 feet shall show no visible defects.

### 3.04 PLACING AND COMPACTING

- A. Placing
1. The Contractor shall verify that all formwork completely encloses concrete to be placed and is securely braced before placing concrete. Remove ice, excess water, dirt, and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can ensure that reinforcing steel and embedded items remain in designated

locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete that has partially hardened or has been contaminated by foreign materials or on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs, and/or walls) has reached adequate strength.
6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
7. Slabs
  - a. After suitable bulkheads, screeds, and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
  - b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottoms of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4 feet. Place concrete for walls in 12- to 24-inch lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7 feet and the maximum free fall of concrete shall not exceed 15 feet.

9. Underwater concreting shall be performed in conformity with the recommendations of ACI 304R. The tremie system shall be used to place underwater concrete. Tremie pipes shall be in the range of 8 to 12 inches in diameter and be spaced at not more than 16 feet on centers nor more than 8 feet from an end form. Where concrete is being placed around a pipe, there shall be at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system, including details, by the Engineer.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding, or forking so that concrete is thoroughly worked around reinforcement, embedded items, and openings and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to eliminate air or stone pockets that may cause honeycombing, pitting, or planes of weakness.
2. All concrete shall be placed and compacted with mechanical vibrators. The number, type, and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.
3. A minimum frequency of 7,000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30 inches apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to

15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8 inches thick shall be consolidated with vibrating screeds; slabs 8 to 12 inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.
5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to consolidate the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize, and perfect the surface. The vibrators shall be inserted vertically at regular intervals through the fresh concrete and slightly into the previous lift, if any.
6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
  - a. Frequency returns to normal.
  - b. Surface appears liquefied, flattened, and glistening.
  - c. Trapped air ceases to rise.
  - d. Coarse aggregate has blended into the surface but has not disappeared.

### 3.05 CURING AND PROTECTION

- A. The Contractor shall protect all concrete work against injury from the elements and defacements of any nature during construction operations.
- B. Curing Methods
  1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:
    - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or by covering with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
    - b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the

- sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
- c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.
2. Specified applications of curing methods.
- a. Slabs for Water Containment Structures: Water curing only.
- b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing, or liquid membrane curing.
- c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
- d. Horizontal Surfaces that Will Receive Additional Concrete, Coatings, Grout, or Other Material that Requires Bond to the Substrate: Water curing.
- e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed before 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete.
- f. Concrete Joints: Water cured or sheet material cured.
- C. Finished surfaces and slabs shall be protected from the direct sunlight to prevent checking and crazing.
- D. Cold Weather Concreting:
1. *Cold weather* is defined as a period when the average daily outdoor temperature drops below 40°F for more than 3 successive days. The average daily temperature shall be calculated as the average of the highest and the lowest temperature from midnight to midnight.
  2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified in this Section. Temperatures at the concrete placement shall be recorded at 12-hour intervals (minimum).

3. The Contractor shall discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather, including producing, transporting, placing, protecting, curing, and monitoring the temperature of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.
4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
  - a. *Degree-days* are defined as the total number of 24-hour periods multiplied by the average daily air temperature at the surface of the concrete (e.g., 5 days at an average 70°F = 350 degree-days).
  - b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50°F as 0°F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
5. Salt, manure, or other chemicals shall not be used for protection.
6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

#### E. Hot Weather Concreting

1. *Hot weather* is defined as any combination of high air temperatures, low relative humidity, and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lb/sq ft/hr).
2. Concrete placed during hot weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 305R and the additional requirements specified in this Section.
  - a. Temperature of concrete being placed shall not exceed 90°F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set, or cold joints.

- b. All necessary precautions shall be taken to deliver the concrete promptly, to place the concrete promptly upon its arrival at the job, and to provide vibration immediately after placement.
  - c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.
3. The Contractor shall discuss with the Engineer a work plan describing the methods and procedures proposed for concrete placement and curing during hot weather. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

### 3.06 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30% of its specified design strength, nor before reaching the following number of degree-days of curing (whichever is longer):

TABLE 3  
MINIMUM TIME TO FORM REMOVAL

Forms for:	Degree-Days:
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of *degree-days* in Paragraph 3.05D.)

- B. Shores shall not be removed until the concrete has attained at least 70% of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

### 3.07 INSPECTION AND FIELD TESTING

- A. The batching, mixing, transporting, placing, and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours before each concrete placement. The Engineer will inspect the preparations for concreting, including the preparation of previously placed concrete, the reinforcing steel and the alignment, and the cleanliness and tightness of formwork. No placement shall be made without inspection and acceptance by the Engineer.
- B. In compliance with ASTM C31/C31M, the Engineer (or inspector) will take sets of field-control cylinder specimens during the work. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be

less than one set per day, nor less than one set for each 150 cu yd of concrete, nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if the 28-day test results are low.
  2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between 7- and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- C. The Contractor shall cooperate in testing by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations, and furnishing material and labor required for taking concrete cylinder samples. The cost of taking and shipping specimens will be paid for by the Contractor and reimbursed by the Owner under the Concrete Testing Allowance. Curing boxes shall be acceptable to the Engineer.
- D. In accordance with ASTM C143/C143M, slump tests will be made in the field immediately before placing the concrete. If the slump is greater than the specified range, the concrete shall be rejected.
- E. Air Content: Air content shall be tested for on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be tested for in compliance with either the pressure method complying with ASTM C231/C231M or by the volumetric method complying with ASTM C173/C173M. If lightweight aggregates or aggregates with high absorptions are used, the latter test method shall be used.
- F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determining concrete quality. The results of tests on such cores shall be the basis for accepting, rejecting, or determining the continuation of concrete work.
- G. The Contractor shall cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Contractor. Work found to be acceptable will be reimbursed under the Concrete Testing Allowance.

### 3.08 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. If such additional curing does not give the strength required as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacing those portions of the structure that fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below those specified shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements, the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94/C94M. The "purchaser" referred to in ASTM C94/C94M is the Contractor in this Section.
- B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42/C42M and ASTM C39/C39M. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be conducted until concrete has aged 60 days.
- C. Should the strength of test cylinders fall below 60% of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

### 3.09 PATCHING AND REPAIRS

- A. This Section is intended to require quality work, including adequate forming and proper mixing, placing, and curing of concrete so completed concrete surfaces will require no patching.
- B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.
- C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be

repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete to the approval of the Engineer.

- D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100, Concrete Formwork. Promptly fill holes upon stripping as follows: moisten the hole with water, followed by a 1/16-inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1-to-1.5-mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.
- E. When patching exposed surfaces, employ the same source of cement and sand as used in the parent concrete. Adjust color if necessary by adding proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

### 3.10 SCHEDULE

- A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4  
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams, and all other structural concrete
D	5,000	Prestressed concrete

END OF SECTION

**SECTION 03360  
CONCRETE FINISHES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified in this Section.

**1.02 RELATED WORK**

- A. Section 03100, Concrete Formwork.
- B. Section 03300, Cast-In-Place Concrete.
- C. Section 03600, Grout.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.

## 1.06 QUALITY ASSURANCE

### A. Finishes

1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.
2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

### B. Services of Manufacturer's Representative

1. Upon 72 hours notification, make available at no extra cost to the Owner the services of a qualified field representative of the manufacturer of the curing compound, sealer, or hardener to instruct the user on the proper application of the product under prevailing job conditions.

## 1.07 WARRANTIES

### A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

### A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 WEATHER CONSTRAINTS (NOT USED)

## PART 2 PRODUCTS

## 2.01 MATERIALS

### A. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn; Penolith by W.R. Meadows or equal fluosilicate base material.

- B. Concrete sealer shall be "MasterKure CC 180 WB", by Master Builders Solutions, Shakopee, MN or equal.

## PART 3 EXECUTION

### 3.01 FORMED SURFACES

- A. Forms shall not be removed before the requirements of Section 03300, Cast-In-Place Concrete, have been satisfied.
- B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustics, or corners when removing the forms or performing any other work adjacent to such chamfers, rustics, or corners.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- D. Rough Form Finish
  1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.
  2. Promptly fill holes left by tie cones and defects as specified in Section 03300, Cast-In-Place Concrete.
- E. Rubbed Finish
  1. Immediately upon stripping forms and before the concrete has changed color, carefully remove all fins. While the wall is still damp, apply a thin coat of medium-consistency neat cement slurry by bristle brushes to provide a bonding coat within all pits, air holes, or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.
  2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33/C33M for such a material. Grout shall be uniformly applied by damp pads of coarse burlap approximately 6-inch square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.
  3. Allow the mortar to partially harden for 1 or 2 hours depending on the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without

damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cut off with the trowel so it can be wiped off clean with the burlap.
5. On the day after the repair of pits, air holes, and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.
6. A thorough wash down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

#### F. Abrasive Blast Finish

1. Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on the Drawings.
2. Prepare a sample area a minimum of 4 feet high by 16 feet wide. Blast Finish as directed by the Engineer on a portion of new wall construction which will not be exposed in the final work. The sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials, and blasting techniques for selection by the Engineer. Final accepted sample shall remain exposed until all Blast Finish operations are complete.
3. The Blast Finish operation shall meet all regulatory agency requirements. The Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.

4. Perform abrasive blast finishing in as continuous an operation as possible, using the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.
5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:
  - a. Medium: Generally expose coarse aggregate 1/4-inch to 3/8-inch reveal.
6. Abrade blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match the Architect's samples.
7. Upon completing the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.
8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by the manufacturer.

### 3.02 FLOORS AND SLABS

#### A. Floated Finish

1. Machine Floating
  - a. Screeed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding sprinkle a dry cement/sand shake in the proportion of two sacks of Portland cement to 350 lb of coarse natural concrete sand evenly over the surface at the rate of approximately 500 lb/1,000 square feet of floor. Do not sprinkle neat, dry cement on the surface.
  - b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated. When the concrete has hardened sufficiently to support the weight of a power float without the float's digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc-type power compacting machine capable of providing a 200-lb compaction force distributed over a 24-inch-diameter disc.

- c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.
- d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA, or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

- a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screeed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-inch indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

- a. Level floors and slabs to a tolerance of plus or minus 1/8 inch when checked with a 10-foot straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that no low spots are left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

- 1. Screeed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Article 3.04. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

D. Concrete Sealer

1. Prepare and seal surfaces indicated on the room finish schedule to receive a sealer as follows:
  - a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule in Article 3.05.
  - b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application ready when it is damp but not wet and can no longer be marred by walking workmen.
  - c. Newly Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt, and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that the surface is no more than damp and not wet.
  - d. Aged Concrete: Restore surface soundness by patching, grouting, filling cracks and holes, etc. Surface must also be free of any dust, dirt, and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required following the procedure indicated under cured concrete.
  - e. Methods: Apply sealer to form a continuous, uniform film by spray, soft bristle pushbroom, long nap roller, or lambswool applicator. Ordinary garden-type sprayers, using neoprene hose, are recommended for best results.
  - f. Applications: For curing only, apply the first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 square feet per gallon. Apply the second coat when all trades are completed and the structure is ready for occupancy at the rate of 400 to 600 square feet per gallon.
  - g. To meet guarantee and to seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full strength. On aged concrete, when renovating, dustproofing, and sealing, the first coat should be thinned 10 to 15% with reducer in accordance with the manufacturer's directions.

### 3.03 CONCRETE RECEIVING CHEMICAL HARDENER

- A. After 28 days minimum concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 square feet per gallon and in accordance with the manufacturer's recommendations as reviewed.

### 3.04 APPROVAL OF FINISHES

- A. All concrete surfaces, when finished, will be inspected by the Engineer.
- B. Surfaces which in the opinion of the Engineer are unsatisfactory shall be refinished or reworked.
- C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300, Cast-In-Place Concrete, unless otherwise directed by the Engineer.

### 3.05 SCHEDULE OF FINISHES

- A. Concrete shall be finished as specified either to remain as natural concrete or to receive an additional applied finish or material under another section.
- B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified in this Section:
  1. Concrete to Receive Damproofing: Rough form finish. See Paragraph 3.01D.
  2. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough form finish. See Paragraph 3.01D.
  3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E.
  4. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E.
  5. Vertical Concrete in Water Containment Areas. Rubbed finish on exposed surfaces and extending to 2 feet below normal operating water level: Rough form finish on the remainder of submerged areas. See Paragraphs 3.01E and 3.01D.
  6. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E.
  7. Exterior surfaces exposed to view and indicated to have an abrasive blast finish. See Paragraph 3.01F.

8. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A.
9. Concrete for Exterior Walks and Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B.
10. Concrete Slabs On Which Process Liquids Flow or In Contact with Sludge: Steel trowel finish. See Paragraph 3.02C.
11. Concrete to Receive Hardener: See Paragraph 3.02D.
12. Concrete tank bottoms to be covered with grout: See Section 03600, Grout.

END OF SECTION

**SECTION 03600**  
**GROUT**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified in this Section.

**1.02 RELATED WORK**

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03250, Concrete Joints and Joint Accessories.
- D. Section 03300, Cast-In-Place Concrete.
- E. Section 05500, Metal Fabrications.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:
  1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
  2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
  3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
  4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300, Cast-In-Place Concrete, and for fiber reinforcement as delineated in Section 03200, Concrete Reinforcement. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.
- B. Laboratory Test Reports: Submit laboratory test data as required under Section 03300, Cast-In-Place Concrete, for concrete to be used as concrete grout.

- C. Certifications: Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.
- D. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
  - 2. ASTM C150/C150M—Standard Specification for Portland Cement.
  - 3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
  - 4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
  - 5. ASTM C827/C827M—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
  - 6. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
  - 7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
- B. US Army Corps of Engineers Standard (CRD)
  - 1. CRD C-621—Corps of Engineers Specification for Non-Shrink Grout.

## 1.06 QUALITY ASSURANCE

### A. Pre-installation Conference

1. Well in advance of grouting, the Contractor shall hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.

### B. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in installing the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided as required to correct installation problems.

### C. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of concrete grout shall be as specified for concrete in Section 03300, Cast-In-Place Concrete.

## 1.07 WARRANTIES

- ### A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- ### A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- ### B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.
- ### C. Store materials in full compliance with the manufacturer's recommendations. Total storage time from the date of manufacture to the date of installation shall be

- limited to 6 months or the manufacturer's recommended storage time, whichever is less.
- D. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

- E. Nonshrink-cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
- F. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

## 1.09 QUALIFICATIONS

- A. The grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 WEATHER CONSTRAINTS (NOT USED)

## 1.12 DEFINITIONS

- A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

# PART 2 PRODUCTS

## 2.01 GENERAL

- A. The use of a manufacturer's name and product or catalog number is to establish the standard of quality desired.
- B. To standardize appearance, like materials shall be the products of one manufacturer or supplier.

## 2.02 MATERIALS

- A. Nonshrink Cementitious Grout

- 1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107/C1107M, Grades B or C and CRD C-621. Grouts shall be

Portland-cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents, and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827/C827M.

- a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp.; or equal.
- b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp.; or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of  $30 \times 10^{-6}$  when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by US Grout Corp.; Sikadur 42 Grout Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co.; or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150/C150M, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33/C33M with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300, Cast-In-Place Concrete, except as specified in this Section. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and an air-entraining agent to produce a mix having an average strength of 2,900 psi at 28 days, or 2,500 psi nominal strength. Coarse aggregate size shall be 3/8 inch maximum. Slump should not exceed

- 5 inches and should be as low as practical yet still retain sufficient workability.
2. Synthetic reinforcing fibers as specified in Section 03200, Concrete Reinforcement, shall be added to the concrete grout mix at the rate of 1.5 lb of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound, free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose material or foreign matter which may affect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.
  1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before installing the grout.
- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placing of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, using a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. An adhesive bonding agent should only be used in lieu of surface saturation when approved by the Engineer for each specific location of grout installation.

- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Construct grout forms or other leak-proof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.
  - 1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.
- I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

### 3.02 INSTALLATION—GENERAL

- A. The Contractor shall mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.
- B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.
- C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90°F during grouting and for at least 24 hours after or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.
- D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90°F range.
- E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or contraction joint.

- F. Reflect all existing underlying expansion, contraction, and construction joints through the grout.

3.03 INSTALLATION—CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

- A. Mix in accordance with the manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.
- B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.
- C. Placements greater than 3 inches deep shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.
- D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
- F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45° angle from the lower edge of the bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.
- G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

### 3.04 INSTALLATION—NONSHRINK EPOXY GROUTS

- A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90°F.
- C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

### 3.05 INSTALLATION—CONCRETE GROUT

- A. Screeed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.
- B. Remove the debris and clean the surface by sweeping and vacuuming all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing debris into tank drain lines will not be permitted.
- C. Saturate the concrete surface for at least 24 hours before placing the concrete grout. Saturation may be maintained by ponding, by the use of soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placing the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch-thick cement paste.

- D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure that high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.
- E. Provide grout contraction joints as indicated on the Drawings.
- F. Finish and cure the concrete grout as specified for cast-in-place concrete.

### 3.06 SCHEDULE

- A. The following list indicates where the particular types of grout are to be used:
  - 1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater than 3 feet wide by 3 feet long and, except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
  - 2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
  - 3. Nonshrink epoxy grout: Use for setting anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
  - 4. Cement grout: Cement grout may be used for grouting incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting primary structural steel members such as columns and girders.
  - 5. Concrete grout: Use for overlaying the base concrete under scraper mechanisms of clarifiers to allow more control in placing the surface grade.

END OF SECTION

**SECTION 03930**  
**MODIFICATIONS AND REPAIR TO CONCRETE**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and cut, remove, repair, or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified in this Section. Work under this Section shall also include bonding new concrete to existing concrete.

**1.02 RELATED WORK**

- A. Section 02220, Demolition and Modifications.
- B. Section 03100, Concrete Formwork.
- C. Section 03200, Concrete Reinforcement.
- D. Section 03250, Concrete Joints and Joint Accessories.
- E. Section 03300, Cast-In-Place Concrete.
- F. Section 03600, Grout.
- G. Section 05500, Metal Fabrications.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Engineer, in accordance with Section 01330, Submittals and Acceptance, a Schedule of Demolition and the detailed methods of demolition to be used at each location.
- C. Submit the manufacturer's technical literature on all product brands proposed for use to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.
- D. When substitutions for acceptable brands of materials specified in this Section are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

**1.04 WORK SEQUENCE (NOT USED)**

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### A. American Society for Testing and Materials (ASTM)

1. ASTM C881/C881M—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
2. ASTM C882/C882M—Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.
3. ASTM D570—Standard Test Method for Water Absorption of Plastics.
4. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
5. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
6. ASTM D732—Standard Test Method for Shear Strength of Plastics by Punch Tool.
7. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
8. ASTM G3—Standard Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing.

## 1.06 QUALITY ASSURANCE

- A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until the Engineer so authorizes.
- B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing, and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust, and prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown, or specified, line drilling will be required in cutting existing concrete.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.
- B. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years experience in the manufacture of such products and

- shall have an ongoing program of training, certifying, and technically supporting the Contractor's personnel.
- C. Contractor Qualifications: The Contractor shall complete a program of instruction in the application of the approved manufacturer's material specified in this Section and provide certification from the manufacturer attesting to their training and status as an approved applicator.
  - D. Furnish a notarized certificate stating that the materials meet the requirements of this Section and have the manufacturer's current printed literature on a specified product.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- C. Store and condition the specified product as recommended by the manufacturer.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. General
  - 1. Materials shall comply with this Section and any state or local regulations.
- B. Epoxy Bonding Agent
  - 1. General
    - a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture-insensitive epoxy-resin material used to bond plastic concrete to hardened concrete complying with the

requirements of ASTM C881/C881M, Type II, and the additional requirements specified in this Section.

2. Material

a. Properties of the cured material:

- (1) Compressive Strength (ASTM D695): 8,500 psi minimum at 28 days.
- (2) Tensile Strength (ASTM D638): 4,000 psi minimum at 14 days.
- (3) Flexural Strength (ASTM D790 Modulus of Rupture): 6,300 psi minimum at 14 days.
- (4) Shear Strength (ASTM D732): 5,000 psi minimum at 14 days.
- (5) Water Absorption (ASTM D570 2-hour boil): 1.0% maximum at 14 days.
- (6) Bond Strength (ASTM C882/C882M) Hardened to Plastic: 1,500 psi minimum at 14 days moist cure.
- (7) Effective Shrinkage: Passes Test.
- (8) Color: Gray.

3. Approved manufacturers include Sika Corporation, Lyndhurst, NJ, Sikadur 32, Hi Mod; Master Builder's, Cleveland, OH, Concresive Liquid (LPL); or equal.

C. Epoxy Paste

1. General

- a. Epoxy Paste shall be a two-component, solvent-free, asbestos-free, moisture-insensitive epoxy-resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts, and all threads into hardened concrete and shall comply with the requirements of ASTM C881/C881M, Type I, Grade 3 and the additional requirements specified in this Section. It may also be used to patch existing surfaces where the glue line is 1/8 inch or less.

2. Material

a. Properties of the cured material:

- (1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
- (2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break 0.3% minimum.
- (3) Flexural Strength (ASTM D790 Modulus of Rupture): 3,700 psi minimum at 14 days.
- (4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.
- (5) Water Absorption (ASTM D570): 1.0% maximum at 7 days.
- (6) Bond Strength (ASTM C882/C882M): 2,000 psi at 14 days moist cure.
- (7) Color: Concrete grey.

3. Approved manufacturers include:

- a. Overhead applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV 31; Master Builders, Inc., Cleveland, OH, Concresive 1438; or equal.
  - b. Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV 32; Master Builders, Inc., Cleveland, OH, Concresive 1438; or equal.
- D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600, Grout.
- E. Adhesive-capsule-type anchor system shall be equal to the HVA adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of a polyester or vinylester resin, quartz sand aggregate, and a hardener contained in a separate vial in the capsule.
- F. Acrylic Latex Bonding Agent
- G. Crack Repair Epoxy Adhesive

1. General

- a. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture-insensitive epoxy-resin material suitable for crack

- grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.
- b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating approved by the FDA for use in contact with potable water.

2. Material

- a. Properties of the cured material
- (1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
  - (2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break 2 to 5%.
  - (3) Flexural Strength (ASTM D790 Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)
  - (4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.
  - (5) Water Absorption (ASTM D570 2-hour boil): 1.5% maximum at 7 days.
  - (6) Bond Strength (ASTM C882/C882M): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.
  - (7) Effective Shrinkage: Passes Test.

3. Approved manufacturers include:

- a. For standard applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod; BASF, MasterInject 1500, or equal.
- b. For very thin applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV; Master Builders Inc., Cleveland, OH, Concresive 1468 or equal.

H. Polymer-Modified Portland Cement Mortar (Vertical and Overhead Surfaces)

1. The polymer-modified Portland cement mortar shall be a two-component, polymer-modified, Portland cement fast-setting, non-sag mortar with a migrating corrosion inhibitor.
2. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives. It shall have a particle size of less than 0.1 micron.
3. Component A shall contain an organic, migrating corrosion inhibitor, which has been independently proven to reduce corrosion in concrete via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be

- calcium nitrate and shall have a minimum of 7 years of independent field testing to document performance on actual construction projects.
4. Component B shall be a blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and accelerators.
  5. The ratio of Component A: Component B shall be 1:5:2 by weight.
  6. The polymer-modified Portland cement mortar shall be placeable from 1/8- to 1-1/2-inch depth per lift.
  7. Aggregate to extend the polymer-modified Portland cement mortar shall be a minus 1/2- or 3/8-inch clean, well-graded, saturated surface dry material having low absorption and high density in conformance with the manufacturer's requirements.
  8. Approved manufacturers include Sika Corporation, Lyndhurst, NJ – Sikatop 123 plus.

I. Polymer-Modified Portland Cement Mortar (Horizontal Surfaces)

1. The polymer-modified Portland cement mortar shall be a two-component, polymer-modified, Portland cement fast-setting, non-sag mortar with a migrating corrosion inhibitor.
2. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives. It shall have a particle size of less than 0.1 micron.
3. Component A shall contain an organic, migrating corrosion inhibitor, which has been independently proven to reduce corrosion in concrete via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be calcium nitrate and shall have a minimum of seven tests. The corrosion inhibitor shall not be calcium nitrate and shall have a minimum of 7 years of independent field testing to document performance on actual construction projects.
4. Component B shall be a blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and accelerators.
5. The ratio of Component A: Component B shall be 1:7:2 by weight.
6. The polymer-modified Portland cement mortar shall be placeable from a 1/8-inch to 1-inch depth per lift.
7. Aggregate to extend the polymer-modified Portland cement mortar shall be a minus 1/2- or 3/8-inch clean, well-graded, saturated surface dry material having low absorption and high density in conformance with the manufacturer's requirements.
8. Approved manufacturers include Sika Corporation, Lyndhurst, NJ, Sikatop 122 plus.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. In all cases where concrete is repaired in the vicinity of an expansion joint or contraction joint the repairs shall be made to preserve the isolation between components on either side of the joint.
- B. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified before drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

### 3.02 CONCRETE REMOVAL

- A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer shall be done by line drilling at limits followed by chipping or jack hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in-place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings or after obtaining written approval from the Engineer.
- B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4 inch.
- C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-inch-deep saw cut on each exposed surface of the existing concrete.
- D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.
- E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

### 3.03 CONNECTION SURFACE PREPARATION

- A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs, or modifications as shown on the Drawings, specified in this Section, or as directed by the Engineer.
- B. Remove all deteriorated materials, dirt, oil, grease, and all other bond-inhibiting materials from the surface by dry mechanical means, i.e. sandblasting, grinding, etc., as approved by the Engineer. Be sure the areas are not less than 1/2 inch deep. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.
- C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc., as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2 inch. Reinforcing to be saved shall not be damaged during the demolition operation.
- D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent, or lapped to new reinforcing as shown on the Drawings and provided with 1-inch minimum cover all around.
- E. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified in this Section, or as directed by the Engineer.
  - 1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-inch layer of cement and water mixed to the consistency of a heavy paste. Immediately after applying the cement paste, place new concrete or grout mixture as detailed on the Drawings.
  - 2. Method B: After the concrete surface has been roughened and cleaned, apply an epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.
  - 3. Method C: Drill a hole 1/4 inch larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just before installing epoxy. The drilled hole shall first be filled with [epoxy paste], then dowels/bolts shall be buttered with paste and inserted by tapping. Unless

otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of 10 bar diameters and smooth bars shall be drilled and set to a depth of 15 bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

4. Method D: Combination of Methods B and C.
5. Method E: The capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed according to the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar, or other embedment item shall be tipped with a double 45° chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule-filled hole. The anchor may be installed in horizontal, vertical, and overhead positions.

### 3.04 GROUTING

- A. Grouting shall be as specified in Section 03600, Grout.

### 3.05 CRACK REPAIR

- A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks according to the manufacturer's recommendations. If cracks are less than 1/16-inch thick they shall be pressure injected.
- B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to the surface with crack repair epoxy adhesive according to the manufacturer's recommendations.

### 3.06 CONCRETE SURFACE REPAIR AND/OR EXPOSED REINFORCING REPAIR

- A. All loose, unsound (delaminated), and deteriorated concrete shall be removed by mechanical means.
- B. Saw cut the perimeter of unsound (delaminated) concrete to form a rectangle with straight edges to a depth of 3/4 inch or to the top of the reinforcing, whichever is shallower. Do not cut reinforcing unless otherwise noted.
- C. Chip concrete substrate to obtain a surface profile with new fractured-aggregate surface.
- D. The depth of repair shall be not less than the performance criteria of the specific product used.

- E. Where reinforcing steel with active corrosion is encountered, the procedure shall be as follows:
  - 1. Remove all contaminants and rust from exposed reinforcing steel.
  - 2. When half of the diameter of the rebar is exposed, chip out behind the reinforcing steel, 1 inch minimum.
  - 3. The distance chipped behind the rebar shall be equal to or exceed the minimum placement depth of the material to be used or as indicated on the Drawings.
  - 4. Bars shown to remain in place which are found to have lost more than 15% class sectional area due to corrosion or which are damaged by the concrete removal process so that their cross-sectional area has been reduced by more than 15% shall be replaced with new bars.
- F. Cracks encountered in the substrate in the area of the patch area shall be treated as approved by the Engineer.
- G. Substrate may be dry or damp but free of standing water.
- H. Remove dust, laitance, and any foreign particles.
- I. Spray apply mixed epoxy resin adhesive on the prepared area to receive the Portland cement mortar or concrete in strict compliance with the manufacturer's recommendations.
- J. While the adhesive coat is still wet (before it is tack-free to the touch) apply polymer-modified cement. The edges shall be vertical and straight.
- K. For applications greater than 1 inch in depth, apply polymer-modified cement in lifts. Score the top lifts of each lift to produce a roughened surface before applying the next lift. Allow the lift to reach final set before proceeding with the next lift. Adhesive coat shall be applied between each lift.

### 3.07 INSPECTION

- A. At the completion of all repairs, the Contractor, Engineer, and Installers of the material used on the repairs shall inspect the work.

END OF SECTION

## **DIVISION 5**

### **METALS**

**SECTION 05500**  
**METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

A. This Section includes the following:

1. Loose bearing and leveling plates.
2. Shelf and relieving angles.
3. Miscellaneous framing and supports.
4. Stair nosings.
5. Gratings.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For the following:

1. Non-slip aggregates and non-slip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

2. Provide templates for anchors and bolts specified for installation under other sections.
  3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type and finish of extruded nosing.
- D. Mill Certificates: Signed by the manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: Florida Professional Engineering Registration certificate.

#### 1.04 WORK SEQUENCE

- A. The Contractor shall coordinate the installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the Project site in time for installation.
- B. The Contractor shall coordinate the installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another section. Deliver such items to the Project site in time for installation.

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
  1. ANSI/ASC A14.3—Ladders – Fixed – Safety Requirements.
- B. American Society for Testing and Materials (ASTM)
  1. ASTM A27/A27M—Standard Specification for Steel Castings, Carbon, for General Application.
  2. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.

3. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
4. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
5. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
6. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
7. ASTM A153/A153M—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
8. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
10. ASTM A489—Standard Specification for Carbon Steel Eyebolts.
11. ASTM A500/A500M—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
13. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
15. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
16. ASTM A786/A786M—Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
17. ASTM B108/B108M—Standard Specification for Aluminum-Alloy Permanent Mold Castings.
18. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
19. ASTM B221—Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
20. ASTM B633—Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
21. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
22. ASTM D1187/D1187M—Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
23. ASTM E488/E488M—Standard Test Methods for Strength of Anchors in Concrete Elements.
24. ASTM F436/F436M—Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
25. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

26. ASTM F594—Standard Specification for Stainless Steel Nuts.
27. ASTM F836M—Standard Specification for Style 1 Stainless Steel Metric Nuts (Metric).
28. ASTM F879—Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
29. ASTM F1554—Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
30. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1,040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

C. American Society of Mechanical Engineers (ASME)

1. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
2. ASME B18.6.1—Wood Screws (Inch Series).
3. ASME B18.6.3—Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
4. ASME B18.6.7M—Metric Machine Screws.
5. ASME B18.21.1—Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).
6. ASME B18.21.2M—Lock Washers (Metric Series).
7. ASME B18.22M—Metric Plain Washers.

D. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.
2. AWS D1.2/D1.2M—Structural Welding Code – Aluminum.
3. AWS D1.3/D1.3M—Structural Welding Code – Sheet Steel.
4. AWS D1.6/D1.6M—Structural Welding Code – Stainless Steel.

E. Environmental Protection Agency (EPA)

1. EPA Method 24—Surface Coatings.

F. Federal Regulations (FR)

1. 40 CFR 59—National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

G. National Association of Architectural Metal Manufacturers (NAAMM)

1. NAAMM MBG 531—Metal Bar Grating Manual.

H. Society for Protection Coatings (SSPC)

1. SSPC-PA1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC-SP6/NACE No. 3—Commercial Blast Cleaning.
3. SSPC-SP10/NACE No. 2—Near-White Blast Cleaning.
4. SSPC-Paint 20—Zinc-Rich Coating Inorganic and Organic.
5. SSPC-Paint 29—Zinc Dust Sacrificial Primer, Performance-Based.
6. SSPC-Zone 1A—Interior, Normally Dry.
7. SSPC-Zone 1B—Exterior, Normally Dry.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, Structural Welding Code – Steel.
2. AWS D1.2/D1.2M, Structural Welding Code – Aluminum.
3. AWS D1.3/D1.3M, Structural Welding Code – Sheet Steel.
4. AWS D1.6/D1.6M, Structural Welding Code – Stainless Steel.

1.07 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 PROJECT REQUIREMENTS

- A. Structural Performance of Ladders: The Contractor shall provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base

engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.

## 1.11 PROJECT CONDITIONS

- A. Field Measurements: The Contractor shall verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on shop drawings.
  1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  2. Provide allowance for trimming and fitting at site.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include but are not limited to products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to manufacturers specified.
  4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.02 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.03 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
  - 1. Unless noted otherwise, steel that is not stainless steel shall be galvanized with a G90 coating conforming to ASTM A123/A123M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 316L.
- C. Stainless-Steel Bars and Shapes: ASTM A276/A276M, Type 316L.
- D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

## 2.04 ALUMINUM ALLOY PRODUCTS

- A. Aluminum Sheet Plates: Conforming to ASTM B209.
- B. Aluminum Extrusions: Conforming to ASTM B221.
- C. Aluminum Castings: Conforming to ASTM B108/B108M.

## 2.05 FASTENERS

- A. General: For all exterior applications and where fastening aluminum, provide Type 304 stainless-steel fasteners. Provide hot-dipped galvanized fasteners in all other applications in accordance with ASTM A153/A153M unless noted otherwise on the Project Specifications or Contract Drawings. Select fasteners for type, grade, and class required.
- B. High-Strength Bolts and Nuts: ASTM F3125/F3125M with heavy hex nuts ASTM A563 and hardened carbon-steel washers ASTM F436/F436M.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group A4.
- E. Stainless Steel Socket Button and Flat Countersunk Head Cap Screws: ASTM F879.
- F. Anchor Bolts: ASTM F 1554, Grade 36.

- G. Eyebolts: ASTM A489.
- H. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- I. Lag Bolts: ASME B18.2.1.
- J. Wood Screws: Flat head, ASME B18.6.1.
- K. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- L. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- M. Expansion Anchors: Anchor bolt and sleeve assembly with ability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
  - 2. Material for Anchors in Exterior Locations: Alloy Group (A4) stainless-steel bolts complying with ASTM F593 and nuts complying with ASTM F594 (ASTM F836M).

## 2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
  - 1. Use primer with a VOC content of 3.5 lb/gal or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Available Products:
    - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
    - b. CarboLine Company; Carbozinc 621.
    - c. ICI Devoe Coatings; Catha-Coat 313.

- d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
  - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
  - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
  - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107/C1107M, specifically recommended by the manufacturer for heavy-duty loading applications.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

## 2.07 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles, surfaces, and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather so as to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of the type indicated and coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.08 GRATINGS

Floor gratings shall be designed to withstand a live load of 250 pounds per square foot for the span indicated, with a maximum deflection of L/240 in locations as shown in the Contract Drawings.

- A. Gray Cast Iron-Gratings: Conforming to ASTM A48/A48M.
- B. Metal Plank Gratings: Non-slip type, aluminum conforming to ASTM B209, 6061 T6, and steel conforming to ASTM A653/A653M, G90 galvanized.
- C. Metal Bar Gratings: Conforming to NAAMM MBG 531.
- D. Aluminum grating material shall be aluminum alloy 6063-T6 with a mill finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; Type 19S4 by Seidelhuber Metal Products, San Carlos, CA; or equal.

## 2.09 PATTERNED FLOOR PLATES

Floor plates shall be designed to withstand a live load of 250 pounds per square foot for the span indicated with a maximum deflection of L/240 in locations shown in the Contract Drawings.

- A. Steel floor plates conforming to ASTM A786/A786M, minimum 14 gauge, and with G90 galvanized coating.
- B. Aluminum Flood Plate: Conforming to ASTM B209, 6061 T6.

## 2.10 MISCELLANEOUS METAL FABRICATIONS

- A. Loose Bearing and Leveling Plates: Flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.
- B. Shelf and Relieving Angles:
  1. Fabricate from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.
  2. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.
  3. Galvanize shelf angles.
  4. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete or masonry.
- C. Miscellaneous Framing and Supports:
  1. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
  2. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  3. Galvanize miscellaneous framing and supports in all locations.

- D. Cast-Metal Nosings:
1. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with an integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.
    - a. Cast units with an integral abrasive grit consisting of silicon carbide.
  2. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.
  3. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.

E. Corner Guards: Stainless steel; Thickness: Minimum 1/16 inch.

## 2.11 FINISHES, GENERAL

- A. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  1. ASTM A123/A123M, for galvanizing steel and iron products.
  2. ASTM A153/A153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
  2. Interiors (SSPC Zone 1A): SSPC-SP 10/NACE No. 2.
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with

SSPC-PA 1, *Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel*, for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.13 STAINLESS STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Dull Satin Finish: No. 6.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.02 INSTALLING BEARING AND LEVELING PLATES

- A. The Contractor shall clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if they are protruding cut off flush with the edge of the bearing plate before packing with grout.
  - 1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.03 ADJUSTING AND CLEANING

The Contractor shall do the following:

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA-1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry-film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9, Finishes.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

**DIVISION 9**

**FINISHES**

**SECTION 09900**  
**PAINTING AND COATING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

A. This Section includes materials for and application of painting and coating systems for the following surfaces:

1. Submerged metal.
2. Exposed metal.
3. Buried metal.
4. Exposed PVC.
5. Concrete and masonry.
6. Metal in contact with concrete.

B. It does not include coating steel water tanks and reservoirs.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Division 3, Concrete.
- E. Division 11, Equipment.
- F. Section 15075, Process Equipment, Piping, and Valve Identification.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit manufacturer's data sheets showing the following information:
  1. Percent solids by volume.
  2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
  3. Recommended surface preparation.
  4. Recommended thinners.
  5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.
  7. Curing requirements and instructions.
- C. Submit color swatches.
- D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.
- E. Submit material safety data sheets for each coating.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
1. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  2. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
  3. ASTM D520—Standard Specification for Zinc Dust Pigment.
  4. ASTM D522/D522M—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
  5. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
  6. ASTM D2240—Standard Test Method for Rubber Property – Durometer Hardness.
  7. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
  8. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
  9. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  10. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.

11. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
  12. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.
  13. ASTM D4261—Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.
  14. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
  15. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
  16. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
  17. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
  18. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Association of Corrosion Engineers International (NACE)
1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- C. Steel Structure Painting Council (SSPC)
1. SSPC PA-1—Shop, Field, and Maintenance Painting of Steel.
  2. SSPC PA-2—Procedure for Determining Conformance to Dry Coatings Thickness.
  3. SSPC SP-1—Solvent Cleaning.
  4. SSPC SP-2—Hand Tool Cleaning.
  5. SSPC SP-3—Power Tool Cleaning.
  6. SSPC SP-5/NACE No. 1—White Metal Blast Cleaning.
  7. SSPC SP-6/NACE No. 3—Commercial Blast Cleaning.
  8. SSPC SP-7/NACE No. 4—Brush-Off Blast Cleaning.
  9. SSPC SP-10/NACE No. 2—Near-White Blast Cleaning.
  10. SSPC SP-11—Power Tool Cleaning to Bare Metal.
  11. SSPC SP-13/NACE No. 6—Surface Preparation of Concrete.
- D. U.S. Department of Defense (MIL)
1. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair (Metric).

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS (NOT USED)

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Submerged Metal Coating Systems		
6.	Submerged Metal, Raw Sewage or Grit Slurries	Epoxy resin/ceramic
7.	Submerged Metal, Potable or Nonpotable Water	Epoxy
Exposed or Submerged Metal Coating Systems (NOT USED)		
Exposed Metal Coating Systems		
10.	Exposed Metal, Corrosive Environment	High-build epoxy (two-coat with polyurethane topcoat)
14.	Exposed Metal, Atmospheric Environment	Urethane
18.	Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up	Organic zinc

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Buried Metal Coating Systems		
21.	Buried Metal	Epoxy
24.	Buried Metal	Corrosion-resisting grease
Concrete and Masonry Coating Systems		
31.	Exposed Concrete and Masonry, Corrosive Environment	Epoxy
32.	Exposed Concrete and Masonry, Atmospheric Weathering Environment	Acrylic
33.	Submerged Concrete, Raw Water or Raw Sewage	Vinyl ester
34.	Concrete Floors, Wet Environment	Epoxy
PVC, CPVC, and FRP Coating Systems		
41.	PVC, Ultraviolet Exposure, and Color Coding	Polyurethane
Coating Systems for Miscellaneous Metals		
51.	Insulate Aluminum (Insulation) from Concrete and Carbon Steel	Bituminous
52.	Exposed Metal, Galvanized Steel and Aluminum	Synthetic resin
54.	Aluminum Insulation from Concrete and Carbon Steel	Epoxy
55.	Repair of Galvanized Steel Surfaces	Cold galvanizing compound
Plaster, Wood, Masonry, and Drywall Coating Systems (NOT USED)		
Coating System for Fusion Epoxy-Coated Steel Surfaces (NOT USED)		
Exterior Architectural Coatings and Finishes (NOT USED)		
Interior Architectural Coatings and Finishes (NOT USED)		
High-Temperature Coatings (NOT USED)		

These systems are specified in detail in the following Paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

#### A. Submerged Metal Coating Systems

##### 1. System No. 6—Submerged Metal, Raw Sewage or Grit Slurries:

- a. Type: Two-component epoxy resin/ceramic having 100% volume solids and having the following characteristics:

Tensile shear adhesion (ASTM D1002):	2,500 psi (min)
Shore D hardness (minimum):	85
Abrasion resistance (ASTM D4060):	0.8 mg (max) loss per 1,000 cycles

- b. Service Conditions: For use as a lining for pump volutes, pump impellers, piping, valves, and heat exchanger tubes subject to severe abrasion service.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
  - d. Coating System: Apply two coats (each a different color) to a minimum thickness of 10 mils per coat. Minimum total coating thickness shall be 20 mils. Product: THORTEX Cerami-Tech C.R. as applied by Western Industrial Technology, Inc., Fullerton, California, or Paragon Industries, Horsham, Pennsylvania; Belzona 1341; or equal.
2. System No. 7—Submerged Metal, Potable or Nonpotable Water:
  - a. Type: Epoxy: 100% sbv Polyamine Epoxy with near “0” VOC.
  - b. Service Conditions: For use with structures, valves, piping, or equipment immersed in potable or nonpotable water.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC SP-10, Near Abrasive White Metal Blast Cleaning.
  - d. Coating System: Apply the manufacturer’s recommended number of coats to attain the specified minimum coating thickness. Products: Devoe Bar-Rust 233H; Tnemec N140; Sherwin-Williams Tank Clad HS B62-80 Series/B60V80; PPG AQUAPON® LT NSF Low Temperature Epoxy Coatings 95-172; CarboLine Super Hi-Gard 891; Ameron 395; International Interline 785HS; Wisconsin Protective Coating Corp. Plasite 7133 or 9133, Keysite 740, Scotchkote 306, or equal; 20 mils total. Color of topcoat: white. Each coat shall be a different color than the one preceding it. Tnemec Series N140 Pota-Pox Plus Polyamidoamine epoxy at 6.0 to 8.0 mils/coat. Apply two coats. Total system should not exceed 17 mils.

## B. Exposed Metal Coating Systems

1. System No. 10—Exposed Metal, Corrosive Environment:
  - a. Type: High-build epoxy finish coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum 52% sbv.

- b. Service Conditions: For use with metal structures or pipes subjected to water condensation, chemical fumes such as hydrogen sulfide, salt spray, and chemical contact.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
  - d. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec Series 90-97; Devoe Catha-Coat 304 or 304V; International Interzinc 180HS; Ameron 9HS; CarboLine 11 HS; Sherwin-Williams Zinc-Clad II Plus, B69VZ12/B69VZ13/B69D11 at 2.5 to 4.0 mils DFT; PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97 – 672, or equal.
  - e. Intermediate Coat: Tnemec Series 104; ICI Devoe Devran 224 HS; International Interguard 760HS; Ameron 385; CarboLine 888 or 890; Sherwin-Williams Macropoxy 646 B58-600/B58V600 at 4.0 to 8.0 mils DFT; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series, or equal; 5 mils. Film thickness 5.0 to 8.0 mils/coat. Minimum solids by volume should be 82%.
  - f. Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane, minimum 70% sbv recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075; ICI Devoe Devthane 379; International Interline 990HS; Ameron 450 HS; CarboLine 134 HG; Sherwin-Williams Hi-Solids Polyurethane B65-300 Series/B60V30 at 2.5 to 4.0 mils DFT; PPG PITTHANE® Ultra-Gloss Urethane Enamel 95-812 Series; or equal.

2. System No. 14—Exposed Metal, Atmospheric Environment:

- a. Type: Single component, moisture-cured, micaceous iron oxide (MIO), urethane having a minimum volume solids of 61% and having a minimum MIO content of 4 pounds per gallon, with a zinc-rich primer and a moisture cured, MIO, aliphatic acrylic urethane topcoat.
- b. Service Conditions: For use with exposed metal structures or piping subjected to continuous water condensation, salt spray, and chemical fumes, such as moist hydrogen sulfide.
- c. Prime Coat: Single-component, zinc-rich, moisture cured urethane having a minimum zinc content of 80% in the dry film. Apply one coat of Wasser MC-Zinc or Sherwin-Williams Corothane I Galva

- Pac Zinc Primer B65A11 at 3.0 to 4.0 mils DFT to a minimum thickness of 3 mils. Tnemec Series 1 Aromatic Polyurethane primer.
- d. Intermediate Coats: Apply one coat of Wasser MC-Ferrox B or Sherwin-Williams Corothane I Ironox B B65A11 at 3.0 to 5.0 mils DFT and one coat of Wasser MC-CR or Sherwin-Williams Corothane I MIO-Aluminum B65S14 at 2.0 to 3.0 mils DFT to a minimum dry-film thickness of 4 mils per coat. Color of first coat: brown/gray. Color of second coat: white.
  - e. Finish Coat: Single-component, moisture-cured, MIO, aliphatic urethane having a minimum volume solids of 50%. Apply one coat of Wasser MC-Shieldcoat or Sherwin-Williams Aliphatic, B65-10 Series at 2.5 to 3.5 mils DFT. Ferrox A to a minimum thickness of 3 mils. Tnemec Series 1074 or Tnemec Series 1075, catalyzed Aliphatic Acrylic polyurethane.
3. System No. 18—Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up:
- a. Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon.
  - b. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
  - d. Coating: Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97; International Interzinc 308; Ameron 68HS; ICI Devoe 313; CarboLine 859; Sherwin-Williams Zinc-Clad III HS B69A100/B69D11/B69D11 at 3.0 to 5.0 mils DFT; PPG Durethane™ MCZ 97-679; or equal. Applied to a minimum dry-film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.

## C. Buried Metal Coating Systems

1. System No. 21—Buried Metal:
- a. Type: High solids Cycloaliphatic Amine epoxy or phenolic epoxy having minimum volume solids of 80% (ASTM D2697).
  - b. Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.

- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
- d. Coating System: Apply three or more coats of Ameron 400; Tnemec 104 HS (6.0 to 8.0 mils per coat); ICI Devoe Bar-Rust 233H; CarboLine 890LT; Sherwin-Williams Tank Clad HS B62-80 Series/B60V80 Series at 5.0 to 8.0 mils/coat or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

2. System No. 24—Buried Metal:

- a. Type: Corrosion-resisting grease.
- b. Service Conditions: Buried metal, such as bolts, bolt threads, tie rods, and nuts.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Power Tool Clean per SSPC-SP3 as a minimum. Abrasive blasting per SSPC-SP-6, Commercial Blast Cleaning is preferred.
- d. Coating: NO-OX-ID GG-2 as manufactured by Sanchem, Inc. Apply to a minimum thickness of 1/4 inch.

D. Concrete and Masonry Coating Systems

1. System No. 31—Exposed Concrete and Masonry, Corrosive Environment:

- a. Type: Polyamide-cured epoxy having a minimum volume solids of 53%. If the service is splash and spillage then use the existing updated system.
- b. Service Conditions: Concrete and masonry exposed to corrosive atmospheres, such as hydrogen sulfide gas, chlorine gas, or chlorinated effluent sprays in wastewater treatment plants.
- c. Surface Preparation: In accordance with Article 3.04. Clean to an ICRI CSP 5 standard. If using for splash and spillage surface, preparation can be brush off abrasive blasting.
- d. Prime Coat: Epoxy filler compound or epoxy masonry filler having a minimum solids volume of 60%. Apply one coat to fill voids, pores, and cracks. Products: Tnemec 54-660, International Intercryl 320WB, Amerlock 400 BF, ICI Devoe Devran 265 BHF, Sentry 610, Sherwin-Williams Kem Cati-Coat HS B42W400/B42V401 at 10.0 to 20.0 mils DFT, or equal. For surfacing, use Tnemec Series 218 MortarClad applied to 1/4-inch. For greater depressions use Tnemec Series 63-1500 or Tnemec Series 219 MortarCast.

- e. Intermediate Coat: One coat of Tnemec 104 (6.0 to 8.0 mils per coat); International Interguard 760HS; Amerlock 400; ICI Devoe Bar-Rust 233 H; CarboLine 890; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; or equal.
- f. Finish Coat: Two coats of Tnemec 104 (use 6.0 to 8.0 mils per coat); International Interguard 760HS; Amerlock 400; ICI Devoe Bar-Rust 233 H; CarboLine 890; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 4.0 to 8.0 mils DFT; or equal.

2. System No. 32—Exposed Concrete and Masonry, Atmospheric Weathering Environment:

- a. Type: Acrylic enamel or acrylic latex having a minimum volume solids of 36%.
- b. Service Conditions: Exposed concrete or masonry exposed to normal sunlight and weathering.
- c. Surface Preparation: In accordance with Article 3.04.
- d. Prime Coat: Water-borne acrylic or cementitious acrylic emulsion having a minimum solids volume of 40%. Apply one coat of CarboLine “Flexide” Masonry Block Filler to fill all voids, pores, and cracks; ICI Devoe Bloxfill 4000; Amerlock 400 BF; Tnemec 54-562 Masonry Filler single component epoxy; International Intercryl 320WB; Sherwin-Williams Heavy Duty Block Filler B42W46 at 10.0 to 18.0 mils DFT; PPG SPEEDHIDE® Int/Ext Acrylic Masonry Block Filler 6-15; or equal.
- e. Finish Coat: Two coats of CarboLine 3350, two coats of ICI Devoe 4208; two coats of Ameron 220; two coats Tnemec Series 6 at 2.0 to 3.0 mils per coat; two coats of International Intercryl 530WB 520; Sherwin-Williams Metalatex Semi-Gloss B42 series at 2.0 to 4.0 mils DFT/coat; two coats of PPG Int/Ext Semi-Gloss Acrylic Metal Finish 7-374 Series; or equal. Apply to a thickness of 2 mils per coat.

3. System No. 33—Submerged Concrete, Raw Water or Raw Sewage:

- a. Type: Vinyl-ester-finish coat system. Minimum resin content in the finish coat system shall be 29% by weight. The vinyl-ester-finish coat system shall be formulated with an abrasion-resistant pigment to provide no more than an average 60-mg weight loss when run on a Taber Abraser using a CS-17 wheel, 1,000-gram weight on 1,000 cycles.

- b. Service Conditions: Concrete submerged in raw water or raw sewage and structures containing moist hydrogen sulfide such as manholes and sewage pumping station wet wells.
- c. Surface Preparation: In accordance with Article 3.04.
- d. Prime Coat – Surfacer:
  - (1) Apply epoxy or vinyl ester filler and surfacer to fill in depressions. Products: Plasite 9029; Tnemec Series 120-5003 (apply Tnemec 120-5002 primer at 10 to 15 mils wet to facilitate application of the 120-5003 surfacer); or Sherwin Williams Corobond Vinyl Ester Primer, B88C10/B88R99 at 3.5 to 4.5 mils DFT.
  - (2) Apply prime coat with trowel or squeegee so that exposed aggregate is covered and the surface is level with the surrounding concrete.
- e. Finish Coats: Apply three or more coats to a total thickness of 40 mils minimum. Maximum thickness of any single coat shall not exceed 15 mils. Observe manufacturer's recommended recoating time between coats. Products: Plasite 4007; Tnemec 120-5001 Vinester; or Sherwin-Williams Magnalux 304, 921-W-304/531-0-006/970-C-949 at 14.0 to 16.0 DFT.

4. System No. 34—Concrete Floors, Wet Environment:

- a. Type: Cycloaliphatic Amine Epoxy higher solids material of no less than 80% sbv.
- b. Service Conditions: Concrete floors subject to pedestrian traffic or exposure to water splashing from pump seal water, cleaning, etc.
- c. Surface Preparation: In accordance with Article 3.04.
- d. Coating System: Two coats of Ameron 400; two coats of ICI Devoe 233 H; two coats of Tnemec Series 104; two coats of International Interguard 760HS; two coats of CarboLine 890; two coats of Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; PPG PITT-GUARD® Rapid Coat Direct-to-Rust Epoxy Coating 95-2400; or equal. Apply to a minimum dry-film thickness of 5 mils per coat. Broadcast glass beads, Tnemec Series 211-0212, into a finish for a non-slip finish.

E. PVC, CPVC, and FRP Coating System

1. System No. 41—PVC, Ultraviolet Exposure, and Color Coding:
  - a. Type: Epoxy primer with minimum volume solids of 54% and a pigmented polyurethane enamel having a minimum volume solids of 66%.
  - b. Service Conditions: Color coding of PVC exposed to sunlight.
  - c. Surface Preparation: Clean the surface per SSPC SP-1, Solvent Cleaning. Then, lightly abrade the surface with medium-grain sandpaper.
  - d. Prime Coat: One coat of Tnemec Series N69 Epoxoline; International 7510; Ameron 385; ICI Devoe Devran 224 HS; Sherwin-Williams Macropoxy 646 B58 Series/B58V600 at 5.0 to 8.0 mils DFT; CarboLine 888 or 890; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series; or equal. Apply to a minimum dry-film thickness of 4 mils.
  - e. Finish Coat: One coat of Tnemec Series 1075; International Interthane 990HS; Ameron 450 HS; ICI Devoe Devran 379; CarboLine 134 HG; Sherwin-Williams Hi-Solids Polyurethane B65-300 Series/B60V30 at 3.0 to 4.0 mils DFT; PPG PITTHANE® Ultra-Gloss Urethane Enamel 95-812 Series; or equal. Apply to a minimum dry-film thickness of 3 mils.

F. Coating Systems for Miscellaneous Metals

1. System No. 51—Insulate Aluminum (Insulation) from Concrete and Carbon Steel:
  - a. Type: Bituminous paint having a minimum volume solids of 68% coal-tar pitch based.
  - b. Service Conditions: Coat areas of aluminum grating, stairs, structural members, or aluminum fabrications, in contact with concrete or carbon steel with this system.
  - c. Surface Preparation: Solvent or steam clean in accordance with SSPC SP-1; do not use alkali cleaning. Then dust blast. Option to hand or power scarify.
  - d. Prime Coat: Apply synthetic resin or epoxy primer to metal surface before finish coats. Products: International Intervinux VTA528/529, or equal. No primer required for CarboLine or Tnemec.
  - e. Finish Coat: CarboLine Super Service Black; Tnemec 46-465; International Intertuf 100; or equal. Apply two coats to a minimum dry-film thickness of 8.0 to 12.0 mils/coat.

2. System No. 52—Exposed Metal, Galvanized Steel and Aluminum:
  - a. Type: Synthetic resin or epoxy primer.
  - b. Service Conditions: Coat galvanized steel and aluminum surfaces with this system before applying topcoat.
  - c. Surface Preparation of Galvanized Steel: Surfaces shall be flat with no protrusions. Remove high spots and tears in the galvanizing with hand and power grinders. Comply with ASTM D6386, Paragraph 5.2.1. Do not remove the galvanized coating below the specified thickness. Solvent clean galvanized surfaces in accordance with ASTM D6386, Paragraph 5.3.2. Then sweep blast as in ASTM D6386, Paragraph 5.4.1. Use one of the abrasive materials described in ASTM D6386, Paragraph 5.4.1. Surface preparation for weathered and partially weathered galvanized steel shall be in accordance with ASTM D6386, Paragraphs 6 and 7. Apply prime coating within 1 hour of the surface preparation.
  - d. Surface Preparation of Aluminum: Solvent clean or steam clean aluminum surfaces as specified in SSPC SP-1; do not use alkali cleaning. Then dust blast and follow with a chemical conversion coating per MIL-C-5541, Class 1A.
  - e. Prime Coat: Tnemec Series N69 2.5 to 3.5 mils; Ameron 385; ICI Devoe Devran 224 HS; Carboline Rustbond Penetrating Sealer SG; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series; or equal. Apply to a minimum thickness of 4 mils.
  - f. Intermediate and Finish Coats: Epoxy polyurethane as described in System No. 10. Do not include the inorganic zinc prime coat described in that system.
3. System No. 54—Aluminum Insulation from Concrete and Carbon Steel:
  - a. Type: High-solids epoxy or phenolic epoxy having minimum volume solids of 80% (ASTM D2697).
  - b. Service Conditions: Coat areas of aluminum grating, stairs, structural members, or aluminum fabrications in contact with concrete or carbon steel with this system.
  - c. Surface Preparation: Solvent or steam cleaning as specified in SSPC SP-1; do not use alkali cleaning. Then dust blast.
  - d. Coating System: Apply three or more coats of Ameron 400; Tnemec 135; ICI Devoe Bar-Rust 233H; Sherwin-Williams Macropoxy B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145

Series; or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

4. System No. 55—Repair of Galvanized Steel Surfaces:

- a. Type: Cold galvanizing compound consisting of paint containing oils, solvents, and zinc dust and complying with MIL-P-21035. Minimum metallic zinc content in the cured coating shall be 90%.
- b. Service Conditions: Repair of damaged galvanized coatings on steel surfaces.
- c. Surface Preparation: Clean damaged surfaces in accordance with SSPC SP-1, Solvent Cleaning and SP-11, Power Tool Cleaning to Bare Metal.
- d. Coating System: Apply Z.R.C. Galvanizing Compound; RAMCO Specialty Products "Zinckit"; NuWave "Galv-Match-Plus"; Devcon "Cold Galvanizing"; Clearco "Cold Galvanizing Spray"; Tnemec Series 90-1K97; or equal; to a minimum dry-film thickness of 3 mils. Apply as specified in ASTM A780/A780M, Annex A2.

G. Abrasives for Surface Preparation

1. Abrasives used for preparation of ferrous (excluding stainless steel) surfaces shall be one of the following:
  - a. 16- to 30- or 16- to 40-mesh silica sand or mineral grit.
  - b. 20- to 40-mesh garnet.
  - c. Crushed iron slag, 100% retained on No. 80 mesh.
  - d. SAE Grade G-40 or G-50 iron or steel grit.
2. Abrasives used for preparation of stainless steel surfaces shall be 20- to 40-mesh silicon carbide or aluminum oxide.
3. Abrasives used for preparation of copper and aluminum surfaces shall be one of the following:
  - a. Crushed slag, 80 to 100 mesh.
  - b. Very fine silica sand, 80 to 100 mesh.
4. Abrasives used for preparation of concrete and masonry surfaces shall be 16- to 30- or 16- to 40-mesh silica sand.

5. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.
- H. Organic Zinc Primer for Field Touch-Up and Shop Coating
  1. Where shop-applied inorganic zinc primers cannot be used because of volatile organic compound (VOC) regulations, the organic zinc primer described in System No. 18 may be substituted for the specified inorganic zinc primers.

## PART 3 EXECUTION

### 3.01 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.
- B. Do not apply paint when the relative humidity is above 85%.
- C. Do not paint when temperature of metal to be painted is above 120°F.
- D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.
- E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

### 3.02 SURFACE PREPARATION PROCEDURES

- A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.
- B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

- C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter. Prime all areas before rust bloom forms and within the same day.
- D. Do not abrasive blast PVC, CPVC, or FRP piping or equipment. Do not abrasive blast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.
- E. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within 2 hours of blasting or before any rust bloom forms.
- F. Surface preparation shall conform to the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Before Recoating	SP-12
Surface Preparation of Concrete	SP-13

- G. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these Specifications or in the paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC (Steel Structure Painting Council), surface preparation specifications listed above.
- H. *Dust blasting* is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.
- I. *Brush-off blasting* of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

- J. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner's Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner's Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner's Representative.
- K. Do not apply any part of a coating system before the Owner's Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner's Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

### 3.03 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.
- B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating.
- C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.
- D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

### 3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

- A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE 6, Division 3, Concrete, and the following.
- B. Do not apply coating until concrete has cured at least 30 days at 75°F and a minimum 50%. Finish concrete surfaces in accordance with Section 03360, Concrete Finishes. Do not use curing compound on surfaces that are to be coated.
- C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or

sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.

- D. Detergent clean the concrete or masonry surface with Trisodium Phosphate in accordance with ASTM D4258. Then sandblast surfaces (brush-off blast). Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or D4261. The grain of the concrete surface to touch shall not be rougher than that of No. 10 mesh sand. Use International Concrete Repair Institute (ICRI) standards for concrete and masonry surface preparation.
- E. Before coating concrete, plaster, and masonry with System No. 31, 33, or 34 determine the presence of capillary moisture in accordance with ASTM D4263, except as modified below. Tape a 4-foot-by-4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 500 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.
- F. Acceptance criteria for concrete surfaces shall be in accordance with SSPC SP-13/NACE No. 6, Table 1, "Severe Service."
- G. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

### 3.05 COATING STAINLESS STEEL

- A. Solvent clean in accordance with SSPC SP-1. Solvents and cleaning solutions shall contain less than 200 mg/L of halogens. Then abrasive blast to give a surface profile of 2.0 to 3.0 mils. Refer to the coatings for the correct surface profile. Use coatings that are low in chloride content.
- B. Do not apply inorganic zinc primers to stainless steel if such primers are specified in the painting system required. Apply only the intermediate and finish coats in such cases.

### 3.06 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.
- B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.
- C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.
- D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

### 3.07 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

- A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of Trisodium Phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.
- C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7/NACE No. 4. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.
- D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10/NACE No. 2. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller

than 1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

- E. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.
- F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.
- G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer as specified in System No. 18 to cover scratches or abraded areas.
- H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

### 3.08 PAINTING SYSTEMS

- A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- B. Deliver paints to the jobsite in the original, unopened containers.

### 3.09 PAINT STORAGE AND MIXING

- A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.
- B. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

### 3.10 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
- C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
- D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.
- E. Apply coating systems to the specified minimum dry-film thicknesses as determined in accordance with SSPC PA-2.
- F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.
- G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the primer and finish coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.
- H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

- I. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.
- J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.
- K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

### 3.11 SURFACES NOT TO BE COATED

- A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other sections. Protect the following surfaces during the painting of adjacent areas:
  - 1. Concrete walkways.
  - 2. Mortar-coated pipe and fittings.
  - 3. Stainless steel.
  - 4. Metal letters.
  - 5. Glass.
  - 6. Roofing.
  - 7. Fencing.
  - 8. Copper tubing, red brass piping, and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.
  - 9. Electrical fixtures except for factory coatings.
  - 10. Nameplates.
  - 11. Grease fittings.
  - 12. Brass and copper, submerged.
  - 13. Fiberglass items, unless specifically required in the FRP specifications.
  - 14. Aluminum handrail, stairs, and grating.
  - 15. Insulated pipe.

### 3.12 PROTECTION OF SURFACES NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

### **3.13 SURFACES TO BE COATED**

- A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as "corrosive environment," "buried metal," or "submerged metal." Coat surfaces with the specific coating systems as described below:
1. Coat mechanical equipment, such as pumps and mixers, as described in the various mechanical equipment specifications. The color of the finish coat shall match the color of the connecting piping.
  2. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications and as shown in the piping schedule in the Contract Drawings. The color of the finish coat shall be as shown in the Piping Schedule in the Contract Drawings.
  3. Coat submerged steel and ductile iron piping as specified in System No. 7.
  4. Paint pumps, gear reducers, and motors the same color as the connected piping.
  5. Coat valves as described the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping.
  6. Coat Sludge Storage and Blend Tank Interiors in accordance with Specification 03180, Concrete Coating Systems
  7. Paint Sludge Storage and Blend Tank Exteriors as specified in System No. 32.
  8. Coat concrete surfaces where shown in the drawings. System No. 33 on submerged concrete surfaces unless otherwise shown in the drawings.
  9. Coat aluminum surfaces in contact with concrete as specified in System No. 54.
  10. Coat buried flanges, nuts, and bolts unless they are stainless steel, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in System No. 21 or as specified in the particular specifications for the above items. Coat buried bolt threads, tie bolt threads, and nuts as specified in System No. 24.
  11. Coat exposed indoor galvanized electrical conduit as specified in System No. 52. Color of finish coat shall be OSHA Safety Orange unless specified elsewhere.

### **3.14 DRY-FILM THICKNESS TESTING**

- A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge in accordance with ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the

past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

- B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog.
- C. Measure coating thickness specified for concrete or masonry surfaces in accordance with ASTM D4138. Test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.
- D. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.
- E. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.
- F. For concrete surfaces, make five separate spot measurements spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness.
- G. Perform tests in the presence of the Owner's Representative.

### 3.15 REPAIR OF IMPROPERLY COATED SURFACES

- A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance

with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

### 3.16 CLEANING

- A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.
- B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.
- C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

## **DIVISION 11**

### **EQUIPMENT**

## SECTION 11000

### GENERAL EQUIPMENT REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. This Section specifies general work requirements regarding the products and execution services that are specified in the Division 11 Sections incorporated in the Contract Documents. The requirements specified shall apply to all of the Division 11 Sections, unless noted otherwise.

##### 1.02 RELATED WORK

- A. Other sections in the Contract Documents contain work that is related to the general work requirements specified in this Section. This related work includes but is not limited to the following sections:
1. Division III, General Conditions.
  2. Section 01330, Submittals and Acceptance.
  3. Section 01650, Delivery, Storage, and Handling.
  4. Section 01755, Equipment Testing and Startup.
  5. Section 01820, Training.
  6. Section 09900, Painting and Coating.
  7. Division 11, Equipment.
  8. Division 13, Special Construction.
  9. Section 15125, Piping Appurtenances.
  10. Division 16, Electrical.

##### 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The submittal contents for equipment, instrumentation, controls, and appurtenances specified in the Division 11 Sections shall contain the general information listed below. Additional submittal requirements are contained in the Division 11 Sections.
1. A list and description of all deviations from the Contract Documents.
  2. A list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.

3. Completely dimensioned plan, elevations and cross-sections of system equipment and sub-assemblies.
4. Shop and erection drawings showing details, anchor bolt locations, and field connections.
5. Manufacturer's equipment installation instructions.
6. Descriptive literature, technical bulletins, and catalog data sheets for all equipment and purchased sub-components.
7. Installation, operation, maintenance and start-up procedures.
8. Total equipment weight (while operating).
9. Drive mechanism torque rating and bearing life rating.
10. Motor data and catalog information.
11. Submit complete electrical drawings, schematics, and interconnecting wiring diagrams and schedules for the equipment control system, instrumentation, and control panel(s) showing numbered wiring terminals in the control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
12. Control panel construction and panel layout drawings.
13. Complete technical literature for all factory-applied paint systems. Clearly indicate the components to be coated and the corresponding paint system.
14. Manufacturers' descriptive literature, product specifications, and published details.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The Contractor shall comply with construction requirements of State, County, and other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced in this Section.
  1. NFPA Standards: The Contractor shall comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections and as directly appropriate to the work and workmanship.
  2. Electrical Requirements: The Contractor shall comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the National Electrical Manufacturers' Associations (NEMA) Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

- B. Certificates and Permits: Upon completion of work and before final payment, the Contractor shall furnish to the Engineer formal certification of final inspections from authorities having jurisdiction over the work in this project and secure required permits, if any, from such authorities. Additionally, the Contractor shall prepare any detailed diagrams and drawings that are required by those authorities having jurisdiction over the work of this project at no additional cost to the Owner.
- C. Source Quality Control: Products used throughout these Specifications and as indicated on the Drawings shall be from companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make or products of others for which they assume full responsibility when used in finished products which are not manufactured completely by them and with replacement parts available.
- D. Products: The equipment specified in the Division 11 Sections was based on the latest models that were available from the specified equipment manufacturers at the time the Contract Documents were developed. If any equipment models specified in the Division 11 Sections have been discontinued or will be discontinued within 1 year after the bid date, the Contractor shall furnish and install the latest and most recent equipment model at no additional cost to the Owner.
- E. For each category of materials and equipment (Products) specified in the Division 11 Sections, the Contractor shall provide Products of the same manufacturer and type.
- F. Equipment Selection: The Contractor may furnish equipment of higher electrical characteristics, physical dimensions, capacities, and ratings provided such proposed equipment is approved by the Engineer in writing. Upon receiving the Engineer's approval to provide such equipment, the Contractor shall furnish the connecting mechanical and electrical services including but not limited to circuit breakers, conduit, increased control panel enclosure size, motors, bases, and any other electrical equipment needed to accommodate the higher electrical characteristics at no additional cost to the Owner.
- G. If minimum energy ratings or efficiencies of equipment are specified in Division 11, Equipment, the Contractor shall furnish and install equipment that meets or exceeds the specified design and commissioning requirements (no exceptions) as determined by the Engineer.
- H. All the equipment specified in the Contract Documents shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be

furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS

- A. The manufacturer of each piece of equipment described in the Division 11 Sections shall meet the following requirements, unless noted otherwise:
  1. Have a record of operation, manufacturing and servicing the items specified in the Division 11 Sections for a minimum of 10 years before the Bid Date.
  2. Have a minimum of five installations of equipment similar to that specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.
  3. Have been in business for at least the 10 consecutive years before the Bid Date.
- B. If the equipment manufacturer that the Contractor proposes to furnish and install the equipment described in the Division 11 Sections does not meet these qualifications and is not specified in the Contract Documents, the Engineer reserves the right to reject the equipment from this manufacturer for use on this project. Any costs incurred by the Contractor as a result of providing equipment from a manufacturer that does not meet the qualifications described in this Section shall not be incurred by the Owner.
- C. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE

### A. Spare Parts

1. The Contractor shall furnish the spare parts specified in the Division 11 Sections. The Contractor shall also submit a list of recommended spare parts, special tools, and lubricants for each equipment item. The list shall include contact information for local sources for supply of all parts and professional service.

## 1.12 SYSTEM DESCRIPTION (NOT USED)

## 1.13 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

## 1.14 PATENTS AND LICENSES (NOT USED)

## PART 2 PRODUCTS

### 2.01 MOTORS

- A. All motors identified in Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

### 2.02 CONTROLS

#### A. General

1. All control panels specified in the Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Divisions 13, Special Construction, and 16, Electrical.
2. The Contractor shall furnish and install controls designed to operate on 120-volt, single-phase, 60 Hertz electric service unless otherwise specified. The Contractor shall furnish and install 120-volt step-down voltage transformers as specified in Division 16, Electrical, in each control panel as required.
3. The Contractor shall furnish and install elapsed time meters in each control panel for each piece of motor-driven equipment being controlled by that control panel. All elapsed-time meters shall be furnished and installed in accordance with Division 16, Electrical.

4. All control panels shall be furnished with a main circuit breaker to enable/disable electric service to the panelboard.
5. All control panels that will annunciate a local and/or remote alarm shall be furnished with an ALARM ACKNOWLEDGE reset pushbutton switch (momentary contact) wired to each alarm contact.
6. All indicating lamps in each control panel shall be furnished in accordance with the color-coded scheme:
  - a. ON indicating lamps: Red.
  - b. OFF indicating lamps: Green.
  - c. Alarm indicating lamps: Amber.
  - d. POWER ON indicating lamp: White.
7. Provide a heater inside of each control panel enclosure to prevent condensation. Heater size shall be in accordance with the equipment manufacturer's recommendations.
8. The face of each control panel shall be installed so it is facing north whenever possible or provided with a sunshield when not possible.

## 2.03 FLOAT SWITCHES

- A. Float switches shall be of the suspended type with polypropylene or PVC body. Units shall have an integral electrical cable with two #19 AWG stranded conductors. Switches shall be pilot duty, normally open or normally closed, as required for application. Switches shall be suitable for use with intrinsically safe circuits. Each switch shall be supported from an AISI Type 316 stainless steel cable support bracket with individual stainless steel Kellems grip strain relief supports. Each switch shall be provided with sufficient cable length to extend from the float switch to the final termination point at the pump control panel with an additional 18 inches of looped cable. The float switch cables shall be bundled to an AISI Type 316 stainless steel cable with heavy-duty nylon strap wire ties. The upper end of the stainless steel cable shall be attached to the cable support bracket and the lower end attached to a 5-pound (minimum) cable weight. The cable weight shall be firmly attached to the cable and shall be constructed of noncorrosive metal and/or materials. Float switches and cables shall be intrinsically safe when used in classified locations.

## 2.04 EQUIPMENT ANCHORING SYSTEMS

- A. All anchoring systems including, but not limited to, expansion anchors, adhesive anchors, anchor bolts, cinch anchors, and screws that are required to install the equipment and appurtenances specified in the Division 11 Sections shall be AISI Type 316 stainless steel unless noted otherwise. The Contractor shall furnish and install all equipment anchoring systems in accordance with Section 05500, Metal Fabrications.

## 2.05 EQUIPMENT NAMEPLATES

- A. The Contractor shall provide engraved laminated phenolic nameplates with white legend and black field that provides the following information for each piece of equipment described in the Division 11 Sections.
  1. Equipment Description (i.e., Mixer, Truck Off-Loading Pump No 1, etc).
  2. Equipment Identification Label No. as shown on the Contract Drawings.
- B. Letter height on each nameplate shall not be less than 3/4-inch. Nameplates shall be factory drilled for fasteners. Secure nameplates to equipment or nearby wall using AISI Type 304 stainless steel fasteners. The locations of each nameplate shall be coordinated with the Owner and approved by the Owner before their installation.
- C. The Contractor shall obtain the Engineer's approval for the nameplate information for each equipment item described in the Division 11 Sections before ordering these nameplates from the manufacturer.

## 2.06 PRESSURE GAUGE ASSEMBLIES - PUMPING UNITS

- A. General: The Contractor shall provide a pressure gauge assembly as specified in Section 15125, Piping Appurtenances, on the suction and discharge piping of the pumping units specified in the Division 11 Sections. The intent of the Drawings is not to show the locations of every pumping unit pressure gauge. Rather, the Contractor shall mount each pressure gauge as close to the pump suction and discharge connections as possible, but so as not to impede the operation and maintenance of the pressure gauge assembly, pumping unit, and valves installed on the pumping unit suction and discharge piping. Coordinate the location of all pressure gauge assemblies with the Owner before installation.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall immediately notify the Owner and Engineer before they relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.
- B. The Contractor shall install equipment, slabs, walls level and plumb, parallel and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.
- C. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.
- D. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.
- E. Provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:
  - 1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings or guards, or without creating safety hazards at installed equipment elevations.
  - 2. The Contractor shall exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
  - 3. The Contractor shall extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.
- F. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the

equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

- G. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade), as possible. In such an instance, the Contractor shall obtain the Engineer's approval for this mounting location before installing that piece of equipment in the field.
- H. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

### 3.02 FIELD TESTING

- A. General: The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Sections and the final mechanical performance test specified in this Section. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Sections regarding equipment shop testing requirements.
- B. The Contractor shall adhere to the following requirements regarding the field testing to be provided for this project:
  1. The service representative shall be employed by the manufacturer of the equipment specified at the time field testing is being performed. The service representative shall be authorized by the factory to perform the field testing specified in Division 11, Equipment. Upon request by the Engineer, the Contractor shall submit a letter from a company officer of the equipment manufacturer stating that the service representative performing the field testing is authorized by the manufacturer.
  2. Before scheduling each field test with the equipment manufacturer, the Contractor shall coordinate with the Owner and Engineer to obtain a list of dates that both parties would be available to attend the testing. The Contractor shall notify the Owner and Engineer of the field testing dates no less than 14 calendar days before the date of the field test.
  3. If directed by the Engineer, the Contractor shall perform a second pre-startup and/or startup test, in accordance with the procedures specified in the Division 11 Sections, at no additional cost to the Owner if the original

pre-startup and/or startup test did not pass because of any work that was deemed by the Engineer to be non-compliant with the Contract Documents and/or manufacturer's recommendations.

4. The Contractor shall only perform startup testing after the Contractor has reached Substantial Completion for the project as defined in the Agreement and General Conditions.
5. The Contractor shall furnish, install, and remove any temporary piping, valves, appurtenances, and equipment necessary to perform the pre-startup and startup testing to the Engineer's satisfaction.
6. All field testing shall be performed Monday through Friday at the project site, unless otherwise approved by the Owner.
7. The duration that the manufacturer's representative is required to be onsite to perform the pre-startup and startup training is specified in the Table 11000-1, Equipment Testing and Training Requirements.

#### C. Operating Costs

1. Costs for Pre-startup and Startup Testing: The Contractor shall include in the Contract Price the following operating costs for satisfactorily completing the Initial Mechanical Performance Tests on equipment being tested:
    - a. Lubricating grease.
    - b. Lubricating oils.
    - c. Such other materials or utilities not specifically identified in this Section but required to conduct the pre-startup and startup testing.
    - d. Portable diesel power generation sets and diesel fuel as needed for lighting, portable tools, and furnishing electrical to any temporary pumping units used to transfer reclaimed water to each treatment or storage structure for startup testing. The Owner will provide reclaimed water for testing at their discretion.
  2. Costs for Final Mechanical Performance Tests: The Owner will pay for the operating costs for the Final Mechanical Performance Test, except for the Contractor's personnel needed to perform and supervise this testing as specified in this Section.
- D. The intent of the field testing for each equipment item specified in the Division 11 Sections is provided in this Section. If the individual equipment field testing procedures specified in the Division 11 Sections are not sufficient to obtain a Manufacturer's Certification or to demonstrate compliance with the Contract

Documents, the Contractor shall perform these additional field test procedures at no additional cost to the Owner.

1. Pre-startup Testing: Upon the Contractor's completion of the installation and adjustment of the equipment; the Contractor, with his own forces and with the manufacturer's representative(s), shall demonstrate to the Engineer's satisfaction that the equipment has been furnished and installed in accordance with the Contract Documents and the manufacturer's recommendations.
  - a. The Contractor shall repair any equipment items that do not pass the pre-startup test, as identified by the Engineer and/or manufacturer's representative, to the satisfaction of the Engineer before performing the startup testing for that equipment.
2. Startup Testing: Upon successful completion of the pre-startup testing, the Contractor shall demonstrate that the mechanical performance and controls of each equipment item, when operated in accordance with the design intent indicated by the Contract Documents, are satisfactory to the Owner and Engineer.
  - a. Startup testing shall be performed with each equipment item and associated treatment structure simulated under similar operating conditions as the final mechanical performance testing specified in this Section. For equipment that will operate while being submerged as shown on the Drawings, the Contractor shall fill the respective treatment structure to its maximum water surface with reclaimed water for wastewater systems and perform startup testing while that equipment is submerged. The Contractor shall not use wastewater to fill any treatment structures for startup testing.
  - b. After the startup testing procedures specified in the Division 11 Sections have been completed to the satisfaction of the Engineer, the Contractor shall operate that equipment for one successful continuous 72-hour period without assistance from the Owner as a condition of startup testing. If the equipment needs to be taken out of service for repair during this 72-hour period because it is not operating in accordance with the intent of the Contract Documents, this operating period shall cease. A new operating period will not begin until the equipment has been operating in accordance with the Contract Documents and manufacturer's recommendations for at least 72 consecutive hours. The Contractor shall furnish any additional supervision or provisions necessary to verify that each

- equipment item was successfully operated during this 72-hour operating period.
- c. Upon completion of the startup test, the Contractor shall dewater each treatment and storage structure in accordance with local and State regulations and in a manner that is satisfactory to the Owner and Engineer.
3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of the equipment specified in the Division 11 Sections once the following conditions have been satisfied:
- a. The Contractor has successfully completed the pre-startup and startup testing requirements specified in the Division 11 Sections.
  - b. The Contractor has performed the training services specified in this Section.
  - c. The Contractor has procured all of the required permits for each building and treatment structure within the project site.
  - d. The Engineer has received and approved all of the manufacturer's certifications of compliance, warranties, and operation and maintenance manuals for all required items as specified in the Contract Documents.
  - e. The intent of the final mechanical performance test is for the entire facility to be operated by the Owner for a continuous 30-day period while the facility is receiving and treating raw sewage or raw water. During this 30-day testing period the Contractor shall furnish personnel who shall be on-site as needed and available at all times 24 hours per day during the final mechanical performance test. Personnel shall be competent in the troubleshooting and repair of the equipment and related electrical and mechanical systems specified in the Contract Documents. The Contractor's electricians and mechanical technicians shall be on-site as needed (minimum 8 hours/week) and available 24 hours per day to assist with this testing. If the final mechanical performance testing needs to be stopped and suspended due to equipment not operating in accordance with the design intent of the Contract Documents as determined by the Engineer, the following conditions shall apply:
    - (1) The Contractor shall repair and troubleshoot these items immediately at no additional cost to the Owner.

- (2) The 30-day period for the final mechanical performance testing will start over (i.e., be reset to zero hours).
- f. Upon restarting the final mechanical performance testing, the Contractor shall furnish the appropriate personnel defined above on-site as needed and available (minimum 8 hours/week) for 24 hours per day during the 30-day period at no additional cost to the Owner even though the total duration of the final mechanical performance testing (including restarts), may exceed 30 days.
- g. The final mechanical performance test shall end when the Engineer determines that all of the equipment and related systems are operating in accordance with the design intent of the Contract Documents and all deficiencies that hinder the normal day-to-day operation of the facility have been corrected to the satisfaction of the Engineer. The Engineer shall notify the Contractor in writing when the final mechanical performance testing has been successfully completed.

### 3.03 TRAINING SERVICES

- A. Upon completion of the pre-startup and startup testing and before the final mechanical performance testing, the manufacturer of the equipment specified in the Divisions 11, Equipment, 13, Special Construction, 15, Mechanical, and 16, Electrical, shall provide an authorized representative to train the Owner's personnel in the operation and maintenance of the equipment. Training shall be provided in accordance with Section 01820, Training, and as specified in each section. The representative shall provide additional onsite startup and troubleshooting services during this training upon request by the Engineer or Owner while performing these training services. The duration of the training services for each equipment item are specified in the Table 11000-1, Equipment Testing and Training.
- B. The Contractor shall conduct two separate training sessions for all items discussed in this document: one for the morning staff (7:00 A.M.) and one for the afternoon staff (2:00 P.M.).

### 3.04 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

- A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, as required in Table 11000-1, Equipment Testing and Training Requirements, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with

the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

**Table 11000-1      Equipment Testing and Training Requirements**

(Hours below stipulate the duration the manufacturer's representative is required be on site to perform the required pre-startup and starting testing, final mechanical performance testing, and training services specified in the listed sections. See Note 1.)

Section	Equipment Name	Pre-Startup Testing <sup>(3)</sup>	Startup Testing <sup>(3)</sup>	Final Mechanical Performance Testing <sup>(4)</sup>	Training <sup>(4) (5)</sup>
11228	Mixers	4 hours	4 hours	4 hours	8 hours
11330	In-Line Grinder	4 hours	4 hours	4 hours	8 hours
11356	Progressive Cavity Pumps	8 hours	8 hours	8 hours	16 hours
13232	Aluminum Flat Covers	2 hours	2 hours	2 hours	4 hours

Notes:

1. If difficulties occur in operating the equipment due to the manufacturer's fabrication or the Contractor's installation, additional service shall be provided at no change in Contract Price or Time.
2. All times listed above exclude travel time to and from the project site.
3. The Pre-Startup and Startup testing may be combined within a single trip if the manufacturer's representative determines that the equipment is properly installed by the Contractor in accordance with the Contract Documents and the manufacturer's recommendations. However, these services shall not be combined with the Final Mechanical Performance Testing and Training; a separate trip(s) shall be conducted to accomplish these services.
4. The Final Mechanical Performance Testing and Training may be combined within a single trip but shall not be combined with the Pre-Startup and Startup testing. Training shall be conducted in accordance with Section 01820, Training.
5. The Contractor shall conduct two separate training sessions for all items discussed in this document: one for the morning staff (7:00 A.M.) and one for the afternoon staff (2:00 P.M.). The reflected training hours are the total combined between both of these sessions.

## MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER \_\_\_\_\_

EQPT SERIAL NO: \_\_\_\_\_

EQPT TAG NO: \_\_\_\_\_

EQPT/SYSTEM: \_\_\_\_\_

PROJECT NO: \_\_\_\_\_

SPEC. SECTION: \_\_\_\_\_

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- Installed in accordance with Manufacturer's recommendations.
- Inspected, checked, and adjusted.
- Serviced with proper initial lubricants.
- Electrical and mechanical connection meet quality and safety standards.
- All applicable safety equipment has been properly installed.
- System has been performance tested, and meets or exceeds specified performance requirements (when complete system of one manufacturer).

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment, and (iii) authorize the make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: \_\_\_\_\_, 20\_\_\_\_

Manufacturer: \_\_\_\_\_

By Manufacturer's Authorized Representative: \_\_\_\_\_

(Authorized Signature)

**EQUIPMENT MANUFACTURER'S CERTIFICATE OF  
INSTALLATION TESTING AND INSTRUCTION**

OWNER \_\_\_\_\_

PROJECT \_\_\_\_\_

CONTRACT NO. \_\_\_\_\_

Jones Edmunds No. \_\_\_\_\_

EQUIPMENT SPECIFICATION SECTION \_\_\_\_\_

EQUIPMENT DESCRIPTION \_\_\_\_\_

I \_\_\_\_\_, Authorized representative of  
(Print Name)

\_\_\_\_\_ (Print Manufacturer's Name)

hereby CERTIFY that \_\_\_\_\_  
(Print equipment name and model with serial No.)

Installed for the subject project has have been installed in a satisfactory manner, has have been satisfactorily tested, is/are ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the units on Date:

\_\_\_\_\_ Time: \_\_\_\_\_.

CERTIFIED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
(Signature of Manufacturer's Representative)

**OWNER'S ACKNOWLEDGEMENT OF MANUFACTURER'S INSTRUCTION**

I/We the undersigned, authorized representatives of the \_\_\_\_\_  
and/or Plant Operating Personnel have received classroom and hands on instruction on the  
operation, lubrication, and maintenance of the subject equipment and am are prepared to assume  
normal operational responsibility for the equipment:

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

**END OF SECTION**

## SECTION 11228

### MIXERS

#### PART 1 GENERAL

##### 1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidents required and unload, install, place in operation, and field test mixers, motors, gearboxes, local control panels and isolator in the Sludge Storage and Blend Tanks. Each mixer unit shall be specifically designed to provide sufficient mixing to the Sludge Storage and Blend Tanks.
- B. All mixers for the Sludge Storage and Blend Tanks shall be provided from one manufacturer.
- C. These Specifications are intended to generally describe what is required but do not cover all details, which will vary with the requirements of the equipment application. The Specifications are, however, intended to cover furnishing, shop testing, delivery, unloading, on-site storage, complete installation, and field testing of all materials, equipment, and appurtenances for the complete mixing system as specified in this Section, whether specifically mentioned in these Specifications or not.

##### 1.02 RELATED WORK

Other Specifications in the Contract Documents contain work related to the general work requirements specified in this Section. This related work includes but is not limited to the following sections:

- A. Section 01330, Submittal and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01755, Equipment Testing and Startup.
- D. Section 01780, Warranties and Bonds.
- E. Section 01785, Record Documents.
- F. Section 01815, Maintenance of Plant Operation and Sequence of Construction.
- G. Section 01820, Training.
- H. Section 01830, Operations and Maintenance Manuals.
- I. Section 09900, Painting and Coating.
- J. Division 3, Concrete Work.
- K. Division 16, Electrical.
- L. Section 16150, Motors.

## 1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:
  1. Descriptive literature, bulletins, catalog cuts, and drawings for the equipment including minimum submergence requirements.
  2. Materials of construction, specifications, grade, or type.
  3. Coating information.
  4. Identify each mixer by tag number to which the catalog data and detail sheets pertain.
  5. Certified shop and installation drawings showing all details of construction, dimensions, and anchor bolt requirements.
  6. Shaft size and material.
  7. Mixer body size, type, and material.
  8. Complete bill of materials for the equipment.
  9. Description of surface preparation and shop prime painting, including certification that the paint to be used to shop prime the equipment is compatible with the finish coat paint to be applied to the equipment.
  10. The weight of each component: motor, gearbox, shafting, and impeller.
  11. The total weight of the complete assembled mixer.
  12. Dynamic torque and moment.
  13. Complete motor data including size, make, type, and characteristics of the electric motor along with wiring diagram.
  14. A list of manufacturer's recommended spare parts to be supplied
  15. Design calculation demonstrating that specified performance requirements are met.
  16. Control panel drawing and wiring diagrams.
- C. Test Reports to be Submitted:
  1. Description of test procedures and equipment.
  2. Copies of all test results, as specified in Parts 2 and 3 of this Section.
- D. Complete operation and maintenance instructions shall be furnished for all equipment specified in this Section in accordance with Division 1, General Requirements.
- E. The Contractor shall submit the manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1, General Requirements.

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Iron and Steel Institute (AISI)
- B. American Bearing Manufacturers Association (ABMA)
- C. American Gear Manufacturers Associations, Inc. (AGMA), where applicable or equivalent DIN-ISO standards.
  - 1. AGMA 6013—Standard for Industrial Enclosed Gear Drives.
- D. American Society for Testing and Materials (ASTM)
- E. American Welding Society (AWS)
- F. Anti-friction Bearing Manufacturer's Association (AFBMA)
- G. International Organization for Standardization (ISO), where applicable
- H. National Electrical Code (NEC)
- I. National Electrical Manufacturers Association (NEMA)
- J. Occupational Safety and Health Administration (OSHA)
- K. The Society of Protective Coatings (SSPC)
- L. Underwriter's Laboratory (UL)

## 1.06 QUALITY ASSURANCE

- A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with this Section and Section 11000, General Equipment Requirements.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with Section 01780, Warranties and Bonds, and as specified herein.
- B. Warranty Period: All equipment supplied under this Section shall be warranted by the manufacturer for at least 3 years, 6 months, following initial shipments from its factory or 3 years following start-up and testing, whichever occurs first.
- C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment fails during the warranty period, the failed component shall be replaced and the unit(s) restored to service at no expense to the Owner.
- D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

## 1.08 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall adhere to the requirements specified in the Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- C. The equipment shall be delivered on site as fully assembled as transportation allows. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- E. Each box or package shall be properly marked to show its net weight in addition to its contents.
- F. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.
- G. Finished iron or steel surfaces shall be painted in accordance with Section 09900, Painting and Coating.

- H. Care shall be taken to avoid supporting or lifting the mixers in a manner that will place excessive stress on parts or shafts that are not designed to support the weight of the unit. The mixer assembly shall be lifted by eyebolts provided in the top of motor drive or by slings.

## 1.09 QUALIFICATIONS

- A. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire mixers, gearboxes, and motors as specified.
- B. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and shall operate satisfactory when installed.
- C. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers with a successful record of manufacturing and servicing the similar equipment for a minimum of 5 years.
- D. The manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components of the assembled mixer unit to ensure that neither harmful nor damaging vibration occurs during operation. The design shall include all supporting frames and fabrication steel base plate for mounting the unit to the existing structure.
- E. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed.

## 1.10 TESTING REQUIREMENTS

- A. Testing shall be performed as specified in Part 2 and Part 3 of these Specifications.

## 1.11 MAINTENANCE

- A. Spare Parts
  - 1. The Contractor shall furnish the following spare parts in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in humid environment.

2. For the two mixers, provide each:
  - a. One service kit with lip seals, O-rings, and shim sets.
  - b. One spare motor per mixer.
  - c. One spare gearbox per mixer.
  - d. Additional spare parts shall be provided in accordance with the recommendations of equipment manufacturers.

B. Special Tools

1. One shaft clamp for each shaft size.
2. The Contractor shall furnish one set of all special tools required for normal operation and maintenance of the equipment.

C. Tools shall be furnished in a suitable steel case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.

## 1.12 SYSTEM DESCRIPTION

- A. The Contractor shall provide two mixers at the Northeast Water Reclamation Facility (NEWRF). The mixers should be installed in each of the two Sludge Storage and Blend Tanks (one mixer in the North Sludge Storage and Blend Tank and one mixer in the South Sludge Storage and Blend Tank) as shown on the Contract Drawings.
- B. The mixer shall be adequately designed to mix sludge completely within the Sludge Storage and Blend Tanks with geometry, volume, and side-water depth shown in the Contract Drawing and as specified herein. Variation in the blended sludge shall be less than 10% over the range of the side-water depth. The mixer shall consist of a complete assembly of drive unit, gear box, shaft, seals, impeller, base plate, and all other necessary components and accessories. The mixer shall be specifically designed and furnished to meet the requirements specified herein these Project Specifications and as shown in the Contract Documents.
- C. All equipment specified and to be furnished and installed in this Section is intended to be standard for mixing based on this application.
- D. The mixer units required under this Section shall be complete, including the motor, speed reducer, shaft, impeller, and base plate with proper alignment of the unit. All parts shall be so designed and proportioned as to have lateral strength, stability, and stiffness and to be especially adapted for the operational conditions and the properties of the sludge to be mixed.

- E. Equipment furnished under this Section shall be designed for a municipal wastewater treatment plant environment in which the equipment is exposed to the atmosphere. The equipment shall be designed for humid atmospheric conditions in West-Central Florida and shall be designed for continuous operation; 24 hours per day, 365 days per year.

## 1.13 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The manufacturer shall provide Operation and Maintenance manuals for the specific equipment with appropriate model numbers and motor data specific for this project. Operations and Maintenance Manuals shall be in accordance Section III – General Conditions, and Section 01830, Operations and Maintenance Manuals.

## 1.14 PATENTS AND LICENSES (NOT USED)

## PART 2 PRODUCTS

### 2.01 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The mixing equipment is used to mix the contents of the Sludge Storage and Blend Tanks with mixers as shown on the Contract Drawings.
- B. Each mixer shall operate independently and shall be controlled from the as shown in the Contract Documents and specified in these Project Specifications. The mixers shall be constant speed units designed to operate continuously.
- C. Northeast Water Reclamation Facility

#### 1. Tank Volumes

Number of Sludge Storage and Blend Tanks	2
Tank Dimensions	40 ft diameter x 18 ft height
Side Water Depth	4 ft – 16 ft
Sludge % TS	4-6%
Tank Finished Floor (Elevation)	57.73 ft
Minimum Operating Level (Elevation)	58.73 ft
Maximum Operating Level (Elevation)	74.23 ft
Normal Sludge Level (Elevation varies)	62.73 to 68.73 ft
Tank Volume-Full	150,000 gallons
Tank Volume – Normal Operation	35,000 to 95,000 gallons

2. Performance Criteria

Sludge Storage and Blend Tank Mixer Design	
Rotational Speed	<45 rpm
Average Bottom Velocity	≥3.0 ft/s
Motor	40 hp
Voltage/Ph/Hz	460/3/60
Nominal Motor Speed	1,800 rpm
Service Factor	<2
Bearing Life	≥100,000 L10

D. The mixer manufacturer and model shall be the following:

1. Invent Environmental Technologies, Inc., Model HCM/2500-44-40.0hp.

## 2.02 MATERIALS AND EQUIPMENT

A. Invent Environmental Technologies

1. Mixer Design and Construction:

- a. Each mixer assembly shall consist of a dry installed heavy-duty speed reducer with hollow stainless steel shaft, electric motor, base plate, and hyperbolic mixing body.
- b. Mixers shall be capable of handling biological activated sludge with a solids concentration from 4 to 6%, with a Sludge Volume Index (SVI) of 80 mL/g or greater and shall be designed to prevent settlement in the tanks and to re-suspend biological material on the tank bottom. The mixer shall be capable of mixing the mixed liquor without introduction of air.
- c. The mixer shall be designed as a vertical shaft mixer, with a dry installed motor. During operation the mixer shall not generate any upward forces on the bridge construction.
- d. The mixer shall have a steady stationary flow pointed downward parallel to the mixer shaft, the highest speeds and turbulent fluctuations shall be produced in the bottom area. No separation vortex shall appear on the water surface.
- e. Mixer shall be equipped with a bottom guide to allow the mixer to operate at tank-empty-to-full operating condition.

2. Gear Drive:

- a. The drives for the mixers shall be SEW Eurodrive (or approved equal), parallel shaft helical geared motors and have a high-quality

corrosion protection coating, robust weather protective hood and filled with synthetic oil.

- b. The gear shall be rated for a long bearing service life and for adverse operating conditions. The driving shaft shall be mounted in a hollow shaft and secured by means of a nut. The torque shall be transmitted by a feather key connection. The hollow shaft shall be capped.
- c. The gearbox shall be built as a parallel helical gear shaft with the following requirements:
  - (1) A calculated lifetime L10 of the bearings of approximately 100,000 hours.
  - (2) High quality protection against corrosion.
  - (3) Covered hollow shaft.
  - (4) Service factor of greater 1.5.
- d. The gearbox housing shall be cast iron covered with a high-quality Standard 053 coating having a thickness of at least 6 mils. The gear box shall be connected to the mounting base using a flange connection with stainless steel nuts and bolts.

3. Motor:

- a. Unless otherwise noted in this Section motors shall be in accordance with Section 16150, Motors.
- b. Motor shall be a three-phase squirrel cage motor with helical gear having the following specifications:
  - (1) The motor shall be SEW or approved equal.
  - (2) Squirrel cage induction for operation on 460 volt, three-phase, 60 Hz current. Synchronous speed shall not exceed 1,800 rpm. The motor shall be of the totally enclosed, fan-cooled type suitable for outdoor operation having NEMA Class F insulation and Class B temperature rise at full load, a service factor of 1.5, rated for 40°C ambient temperature.
  - (3) Motors shall have a weather protection hood and be suitable for operation in a moisture-laden atmosphere. The conduit boxes shall be gasketed with neoprene or equivalent material, so as to prevent moisture from entering the stator through the conduit box. Condensation drains shall be suitable positioned in the lower external surface, so

- that may accumulation of moisture can drain from the complete motor housing.
- (4) Increased protection of the winding against humidity and acid.
  - (5) Inner corrosion protection of motor.
  - (6) High-quality protective varnishing against corrosion.
  - (7) Protection type IP66.
  - (8) ISO-Class F.
  - (9) Provide 120VAC motor space heaters and motor bi-metallic thermostats.
4. Mounting Base: The mounting base of the mixer shall consist of a gear base plate mounted on rubber buffers connected permanently to the bridge by AISI Type 316 stainless steel bolted connection. The gear plate shall be designed as a distortion-proof steel structure with an impact-proof powder-coated surface. The plate shall be able to be leveled using threaded bolts which adjust in height. The rubber buffers/isolator shall absorb starting-up jolts, prevent any transfer of vibrations to the bridge and constitute the galvanic separation of the mixer from its surroundings. The mounting base shall be supplied with a fastening set with AISI Type 316 stainless steel anchor bolts for connecting to the bridge as shown in the Contract Drawings.
  5. Shaft: The drive shaft of the mixer shall be made from AISI Type 316 and resistant to most chemicals and wastewater. The top end of the shaft shall be a steel tappet for the connection to the gear hollow shaft. At the lower end there shall be a flange. The mixer body shall include a flanged screwed connection. The manufacturer shall field verify shaft length with the Contractor during shop drawing submittal.
  6. Hyperboloid Mixer Body: The hyperboloid mixer body shall be a streamlined stress-free body without any mounted or fitted parts. The transport ribs which accelerate the flow shall be integrated in the mixer body and be made of top quality, fiberglass reinforced plastic. The mixer body shall be coated with a gel coat and polished surface.
  7. Bolts and Hardware: All base plates, assembly bolts, nuts, washers, fasteners shall be AISI Type 316 stainless steel as specified.

## 2.03 SHOP PAINTING

- A. Before exposure to weather and shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill scale, rust, grease, dirt, and other foreign matter.

- B. The mixers, base plates, and gear boxes shall be prepared and shop-primed in accordance with Division 9. Primer shall be compatible with the finish paint specified in Section 09900, Painting and Coating.
- C. All nameplates shall be properly protected during painting.
- D. Gears and other similar surfaces not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

## 2.04 SHOP TESTING

- A. The Engineer shall have the right to inspect, test, or witness tests of all materials or equipment to be furnished under this Section before shipment from the point of manufacture.
- B. The Engineer shall be notified in writing before initial shipment in ample time so that arrangement can be made for an inspection.
- C. The mixers shall be factory/shop tested in accordance with the approved testing procedures to ensure that the quality of materials used in the manufacture of the mixers and workmanship conforms to the specified requirements.

## 2.05 CONTROL PANELS

- A. A NEMA 4X, 316 stainless control panel shall be provided for each mixer. The panels shall be deadfront construction with inner door, 3-point door latch and include a, UL 508a label as an assembly with a SCCR rating of 14 kA minimum.
- B. Panels shall include a main circuit breaker and branch breaker for controls and receptacle. Panels will include a solid-state soft type starter rated for 50°C, manufactured by either Square-D or Allen-Bradley. All internal wiring shall be copper, rated at 600V and identified at each end.
- C. The panels will include an inner door with the following NEMA 4X rated devices:
  1. Lockable Safety Disconnect Switch.
  2. Hand-off-Auto.
  3. Elapse Time Meter.
  4. Running Indicator.
  5. Stop Indicator.

6. Mixer Trouble Indicator (high amperage/motor overload).
  7. Alarm Reset.
- D. The panels shall include dry contacts for use by the remote SCADA system as follows:
1. Mixer Run.
  2. Mixer Fail (high amperage/motor overload).
  3. Mixer in Hand.
  4. Mixer in Auto.
  5. Reset Position.
- E. The panels shall include an internal 480-volt surge protection rated a minimum of 50kA/mode.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Installation of the mixer, motor, shaft, associated equipment and accessories, and supports shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Contract Drawings. The required grade lubricant for initial operation shall be furnished in accordance with the manufacturer's recommendations. Mounting, leveling, any required calibration, and anchor bolting shall be installed in accordance with the manufacturer's recommendations.
- B. The Contractor shall submit a certificate from the manufacturer stating that the installation of the equipment is satisfactory; that the equipment is ready for operation; and that the operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.
- C. The Contractor shall make all adjustments to each unit as directed by the equipment manufacturer before placing the unit in operation.

#### 3.02 FIELD PAINTING

- A. Field painting is specified in Division 9. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to ensure compatibility.
- B. All nameplates shall be properly protected during painting.

### 3.03 FIELD TESTING

- A. Before testing, each mixer shall be checked by the manufacturer's technical representative for lubrication, alignment, and rotation. The manufacturer's technical representative shall notify the Contractor and the Engineer of anything in the installation that affects the manufacturer's guarantee. The Contractor shall make the adjustment based on manufacturer's recommendation. The manufacturer's representative shall provide certification that each mixer is rotating in the right direction and is ready for testing.
- B. The test runs of the mixers shall be undertaken with water in the tanks filled to the peak water elevations shown on the Drawings. The test runs on the mixers shall determine acceptable running noise, speed, and rotational direction.
- C. In the event of improper installation, the Contractor shall correct the Work and re-test the mixers at no additional cost to the Owner. The manufacturer will provide certification that the improper installation has been corrected.
- D. The Contractor shall perform testing on blended sludge concentration after the installation is complete and the plant is in operation. The Contractor shall furnish all labor, materials, laboratory testing, and equipment required for the test. The cost of the testing shall be included in the Contract Price. The blended sludge test shall be conducted as follows in the tank when it is full and without additional sludge flowing into the tank:
  1. Sludge concentration test shall be conducted at blended sludge concentrations of 4 to 6% in the tanks. The SVI shall be greater than 80 mL/g.
  2. The test shall be conducted in both tanks, and the tests shall demonstrate that a uniform concentration of the blended Sludge is achieved. Uniformity shall be defined as plus or minus 10% of the arithmetic average of blended sludge total suspended solids concentration for all samples taken.
  3. Nine samples shall be taken in each tank. The sample location shall be selected by the Engineer and shall be spaced horizontally based on the location of the access hatches on the tank covers and equally spaced vertically within the tank. The maximum depth at which any sample shall be taken shall be a minimum of 6 inches above the floor level. In addition, samples shall be taken a minimum of 12 inches from the tank wall. Samples shall be tested at an independent laboratory approved by the Engineer. The tests will be conducted without flow into the tank. The cost for the laboratory shall be borne by the Contractor.
  4. If requested by the Engineer, the Contractor shall collect additional samples to be tested by the Owner's laboratory for verification.

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5. If the average of the samples fail to meet the specified requirements, the Contractor and the manufacturer shall make all necessary modifications to correct the problem and re-test at no additional cost to the Owner. If necessary, the Contractor shall replace the non-performing mixer(s) at no additional cost to the Owner.

### 3.04 TRAINING SERVICES

- A. The manufacturer technical representative shall be on site to perform training services in accordance with Section 01820, Training, and Table 11000-1, Equipment Testing and Training Requirements, in Section 11000, General Equipment Requirements.

### 3.05 CERTIFICATION

- A. The Contractor shall provide a written certification from the manufacturer certifying that the equipment has been properly installed according to the Contract Drawings, Project Specifications, and manufacturer's instructions and that the equipment is operating normally.

### 3.06 MANUFACTURER'S SERVICES

- A. The equipment manufacturer shall furnish the services of a competent and experienced factory representative who has complete knowledge of proper installation, operation, and maintenance of the equipment for not less than what is specified in Table 11000-1, Equipment Testing and Training Requirements, in Section 11000, General Equipment Requirements, to inspect the installed equipment, perform an initial test run and startup testing, conduct final performance testing, and provide operation and maintenance instructions to the plant personnel. The number of trips is determined by the construction schedule and as necessary to meet the requirements of these Project Specifications.
- B. If there are difficulties in operating the equipment due to manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

END OF SECTION

**SECTION 11330**  
**IN-LINE GRINDER**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish and install inline electric grinders. The equipment shall be as described in this Section and as shown on the Drawings. The Contractor shall be responsible for equipment installation according to the recommendations of the supplier and in compliance with all OSHA, local, state, and federal codes and requirements.
- B. These Specifications are intended to give a general description of what is required but do not cover all details in installing, testing, and operating the equipment.

**1.02 RELATED WORK**

- A. Division 3, Concrete.
- B. Section 09900, Painting and Coating.
- C. Division 15, Mechanical.
- D. Division 16, Electrical.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:
  1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
  2. Descriptive literature, bulletins, and /or catalogs of the equipment.
  3. Data on the characteristics and performance of the equipment.
  4. Complete wiring diagrams and elementary or control schematics, including coordination with other electrical control devices.
  5. A complete total bill of materials of all equipment.
  6. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Article 1.07, with the manufacturer's current price for each item.
  7. Complete motor data.

- C. Test reports to be submitted shall include at least the following:
  - 1. Description of test procedures and equipment.
  - 2. Copies of all test results, as may be specified in this Section.
- D. Complete operating and maintenance instructions shall be furnished for all equipment specified in this Section and in accordance with the General Conditions and Division 1, General Requirements.
- E. The Contractor shall submit the manufacturer's certificate of installation, testing, and instruction.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

- A. Design, manufacturing, and assembly of elements of the products specified in this Section shall be in accordance with the standards listed below:
  - 1. American Gear Manufacturing Association (AGMA)
  - 2. American Society for Testing and Materials (ASTM)
    - a. ASTM A36—Standard Specification for Carbon Steel Plate.
    - b. ASTM A536-84—Standard Specification for Ferritic Ductile Iron Castings.
    - c. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
    - d. ASTM B.16—Standard Specification for Class 40 Grey Iron Castings.
    - e. ASTM D429—Standard Test Methods for Rubber Property—Adhesion to Rigid Substrates.
  - 3. American Iron and Steel Institute (AISI)
    - a. AISI 316—Stainless Steel.
    - b. AISI 304—Stainless Steel.

- c. AISI 4130—Heat Treated Alloy Steel.
  - d. AISI 4140—Heat Treated Hexagon Steel.
- B. Controllers shall, as applicable, meet the requirements of the following Regulatory Agencies:
  - 1. National Electrical Manufacturer's Association (NEMA) Standards
  - 2. National Electrical Code (NEC)
  - 3. Occupational Health and Safety Administration (OSHA)
  - 4. Underwriters Laboratory (UL and cUL)

## 1.06 QUALITY ASSURANCE

- A. Qualified suppliers shall have a minimum of 5 years' experience at manufacturing two-shafted grinding equipment, inclined augers, and motor controls with a minimum of 25 installations with similar equipment. The supplier shall provide a list of names and dates of installations for verification by the Engineer or the Owner's Representative.
- B. The supplier shall provide the services of factory-trained representative to check the installation and to start up the electric grinder. The factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. The representative shall inspect the final installation and supervise a start-up test of the equipment.
- C. If there are difficulties in operating the equipment due to the manufacturer's fabrication or the Contractor's installation, additional services shall be provided at no change in contract price or time.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All parts shall be properly protected so that no damage or deterioration will occur during the delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

- C. All equipment and parts must be properly protected against any damage during storage at the site.
- D. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- E. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.
- F. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

## 1.09 QUALIFICATIONS

- A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization which is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
- B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

## 1.10 TESTING REQUIREMENTS

- A. Testing shall be in accordance with Part 3, Execution.

## 1.11 MAINTENANCE

- A. The Contractor shall furnish the following spare parts in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in humid environment. At a minimum, the spare parts shall include:
  - B. For the two grinders provide each:
    1. Three cutters.
    2. Three spacers.
    3. One gasket kit.
    4. One set of fuses for each fuse type.

5. Additional spare parts shall be provided in accordance with the recommendations of equipment manufacturers.
- C. Furnish one set of all special tools required for normal operation and maintenance of the equipment. Tools shall be furnished in a suitable case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.
- D. Furnish lubrication in accordance with Section 11000, General Equipment Requirements.

## 1.12 SYSTEM DESCRIPTION

- A. The Contractor shall provide two in-line grinders at the Northeast Water Reclamation Facility (NEWRF). The grinders should be installed near the two Sludge Storage and Blend Tanks (one grinder south of the Blend Tank on the 6-inch blended sludge line upstream of the anaerobic digester feed pumps and one grinder east of the Blend Tank on the 6-inch thickened primary sludge and thickened waste activated sludge – combined thickened sludge – upstream of the tee that enters the Blend Tank) as shown on the Contract Drawings.
- B. The grinder shall be adequately designed to grind sludge completely within the blended sludge and combined thickened sludge lines with the layout, pipe size, and distances from pumps and fittings as shown in the Contract Drawings and as specified herein.
- C. The pumps which feed the sludge into the grinder may operate intermittently throughout the day (i.e. 45 minutes on, 15 minutes off, every hour). Grinder shall be capable of running without positive flow through the pipe during these periods.
- D. The grinder shall consist of motor, cutting stack with tooth cutters, mechanical seals, and motor controller. The grinder shall be specifically designed and furnished to meet the requirements specified herein these Project Specifications and as shown in the Contract Documents.
- E. All equipment specified and to be furnished and installed in this Section is intended to be standard for grinding based on this application.
- F. The grinder units required under this Section shall be complete, including the motor, cutting stack with tooth cutters, mechanical seals, and motor controller. All parts shall be so designed and proportioned as to have strength, stability, and endurance to be especially adapted for the operational conditions and the properties of the sludge to be grinded.

- G. Equipment furnished under this Section shall be designed for a municipal wastewater treatment plant environment in which the equipment is exposed to the atmosphere. The equipment shall be designed for humid atmospheric conditions in West-Central Florida and shall be designed for intermittent operation; 365 days per year.

## 1.13 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The Contractor shall provide O&M Manuals for the electric grinder that are tailored to fit the training during start-up. The submittal shall reflect data that match the equipment provided and shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## 1.14 PATENTS AND LICENSES (NOT USED)

## PART 2 PRODUCTS

### 2.01 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The grinder equipment is used to grind the contents within the line carrying thickened primary sludge and thickened waste activated sludge (combined thickened sludge) as well as the line carrying blended sludge as shown on the contract Drawings.
- B. Each grinder shall operate independently and shall be controlled as shown in the Contract Documents and specified in these Project Specifications. The grinder shall be constant speed units designed to operate intermittently, 365 days/year.
- C. Performance Criteria

Number of Grinders	2
Pipe Size	6-inch
Flow Rate	50-150 gpm
Pressure Drop	0.1 psi – 0.2 psi
Sludge % Total Solids Maximum	4-6%
Motor	3 HP (2.2 KW)
Voltage/Ph/Hz	460/3/60
Nominal Motor Speed	1,800 rpm
Service Factor	1.15
Minimum Efficiency at Full Load	87.5%
Power Factor at Full Load	78%

- D. The grinder manufacturer and model shall be the following:

1. JWC Muffin Monster Model 30004T-1206

## 2.02 MATERIALS AND EQUIPMENT

### A. GENERAL

1. The equipment covered by these Specifications is intended to be equipment of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.
  2. All parts shall be so designed and proportioned as to have liberal strength and stiffness and to be especially adapted for the work to be done. Ample room and facilities shall be provided for inspection, repairs, and equipment.
- B. Each unit of equipment shall be identified with stainless steel nameplates giving the name of the manufacturer. Name plate information shall include equipment model number, serial number, supplier's name, and location.

## 2.03 GRINDERS

- A. The grinders shall be Model No. 30004T-1206 by JWC Environmental or Engineer-approved equal.
- B. The grinder shall be provided in an in-line assembly.
- C. The grinder shall include cutters, spacers, shafts, bearings and seals, cutter stack adjustment port, reducer, and motor.
- D. The grinder shall be of two-shaft design and be capable of continuous operation, processing wet or dry. Grinders designed with cutter and spacer cartridges rather than individual cutters and spacers shall not be acceptable.
- E. Two-shaft design shall consist of two parallel shafts alternately stacked with individual intermeshing cutters and spacers positioned on the shaft to form a helical pattern. The two shafts shall counter-rotate with the driven shaft operating at a portion of the drive shaft speed.
- F. Grinder construction shall be as follows:
  1. Individual Cutters and Spacers:
    - a. The cutting chamber shall be sized appropriately for a 6-inch pipe.

- b. Individual cutters and spacers shall be AISI 4130 heat-treated alloy steel, surface ground for uniformity and through-hardened to a minimum 45 to 50 Rockwell C.
- c. The inside configuration of both the individual cutters and the individual spacers shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.015 inch (0.38 mm) across the flats to ensure positive drive and minimize wear on the cutters.
- d. Cutter configuration shall consist of 13-tooth cam cutters. To maintain particle size, the height of the tooth shall not exceed 1/2 inch (13 mm) above the root diameter. Cutter to cutter root diameter overlap shall be not less than 1/16 inch (1.6 mm) or greater than 1/4 inch (6 mm) to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.
- e. The cutters shall exert a minimum force at the tooth tip of 1,830 lb/hp (10,921 N/kW) during momentary load peaks.

2. Shafts:

- a. Grinder drive and drive shafts shall be made of AISI 4140 heat-treated hexagon steel with a tensile strength rating of not less than 149,000 psi (1,027 kPa).
- b. Each hexagonal shaft shall measure a nominal 2 inches (51 mm) across parallel surfaces.

3. Main Housing and Covers:

- a. Grinder end housings shall be cast of A536-84 ductile iron with a cast-in-place flow deflector, designed to protect the bushings while guiding particles directly into the cutting chamber.

4. Shaft Bearings and Seals:

- a. The radial and axial loads of the cutter shafts shall be borne by sealed, oversized, deep-groove ball bearings at each end.
- b. The bearings shall be protected by a combination of a replaceable and independent tortuous path device and mechanical seals.
- c. Face materials shall be of tungsten carbide to tungsten carbide.
- d. O-rings shall be made of Buna-N elastomers.
- e. Products requiring continuous or occasional lubrication or flushing shall not be accepted.
- f. The mechanical seal shall be rated at 90 psi (620 kPa) continuous duty by the seal supplier.
- g. The bearings shall be housed in a replaceable cartridge that supports and aligns the bearings and seals and protects the shafts

and end housings. The seal elements shall be independent of the stack height; therefore, cutter stack tightness shall not affect seal performance. The seal elements shall maintain their factory-set preload independent of the cutter stack tightness.

- h. Seals shall meet required pressure rating regardless of cutter stack fit. The seal cartridge shall provide seal protection against axial loading on shafts and bearings during shaft deflection.
- i. Each seal element shall be positively locked to its corresponding rotating or static cartridge element. This positive lock on the seal elements is critical to long seal life in applications where grit or other abrasive materials are present.

5. Reducer:

- a. The speed reducer shall be a grease-filled planetary-type of reducer with a 500% shock load capability. The reduction ratio shall be 29:1.
- b. The input shaft of the reducer shall be directly coupled to the motor using a three-piece coupling, and the output shaft of the reducer shall be directly coupled with the grinder using a two-piece coupling.

6. Motor:

- a. The motor shall be 3 hp (2.2 kW), TEFC 1, 1,750 rpm, 208-230/460 volts, three phase, 60 Hz.
- b. Motor service factor shall be 1.15, the efficiency factor not less than 87.5% at full load, and the power factor not less than 78% at full load.
- c. The motor shall provide two terminals for the connection of positive temperature coefficient (PTC) thermistor sensors. PTC sensors shall be embedded in the motor stator windings to monitor winding temperature.

## 2.04 CONTROL PANEL

- A. The controller shall provide independent control of the grinder; it shall be Standard UL/cUL listed Model PC2200 and shall be rated for 3 hp, 460 volts, three phase, 60 Hz. It shall include an IEC starter with over-current protection, jam-sensing current transformer and micro-PLC. The panel shall be UL rated for 14 kAIC fault current.

B. The controller shall be equipped with ON-OFF/RESET-REMOTE three position selector switch.

1. In the ON position, the grinder will run.
2. In the OFF/RESET position the grinder will not run.
3. In the REMOTE position the grinder will start and stop as controlled by a remotely-located dry contact.
4. The grinder will only be reset by switching the ON-OFF/RESET-REMOTE selector switch to the OFF/RESET position.
5. Provide incoming power lighting and surge protection at a minimum of 50kA/mode.

C. Control Devices

1. NEMA 4X pilot devices will be mounted on the enclosure front panel door.
2. The controller will have indicator lights for POWER ON, RUN, and FAIL.
3. Indicator lights will be LED type pilot lights. Lights and the selector switch will be heavy duty NEMA 4X type.
4. Control transformer will be protected by two primary fuses and one secondary fuse. The 120-volt secondary fuse shall have one leg grounded.
5. Contacts will be included for grinder RUN and FAIL signal outputs. The contracts will be rated two amperes.
6. Provide alarm and equipment status for remote monitoring by the SCADA system.

D. Motor Starter

1. Starter will be a full-voltage reversing type with 120-volt operating coils.
2. Forward and reverse contactors on the starters will have both mechanical and electrical interlocks.
3. Overload relays will be adjustable so that the range selected includes the full load amperes rating and service factor.

E. Safety Features

1. When a grinder jam condition occurs in the grinder ON or REMOTE mode, the controller shall stop the grinder, reverse the grinder rotation, and clear the obstruction. If the jam is cleared, the controller will return the grinder to normal operation.
  - a. Up to two additional reversing cycles may occur within 30 seconds.

- b. After three total reversing cycles, the controller shall automatically de-energize the grinder motor and activate a fail indicator and fail contact.
2. If a power failure occurs while the grinder is running, operation will resume when power is restored.
3. If a power failure occurs while the grinder is in a fail condition, the fail indicator will reactivate when power is restored.
4. The controller shall provide overload protection for the motor through an overload relay mounted directly on the grinder motor starter.
5. Short-circuit protection shall be provided by a properly-sized circuit breaker or set of fuses installed with the equipment.
6. Controller reset will only be available from the local panel controls.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendation and in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.
- B. Supply all anchor bolts, temporary lift equipment, power, water, labor, and all other incidentals required for the proper installation of the grinder.

### 3.02 PAINTING

- A. Painting and coating of all equipment, motors, and associated appurtenances shall be in accordance with Section 09900, Painting and Coating, and Section 11000, General Equipment Requirements, and as described herein.
- B. Before exposure to weather and before shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill/scale, rust, grease, dirt, and other foreign matter.
- C. Gears, bearing surfaces, and other similar surfaces not referenced in Section 09900, Painting and Coating, painted shall be given a suitable rust-

resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and installation up to the time of the final acceptance.

- D. All nameplates shall be properly protected during painting.

### 3.03 TESTING

- A. Equipment testing shall be in accordance with Section 01450, Testing, Section 11000, General Equipment Requirements, and as described herein.
- B. After equipment has been completely installed and working under the direction of the manufacturer, the Contractor shall conduct, in the presence of the Owner and Engineer, such tests as are necessary to indicate that the installation is performing to the standards indicated in the Specifications.
- C. If the equipment performance does not meet the Specifications, corrective measures shall be taken, or defective equipment shall be removed and replaced with equipment that satisfies the conditions specified.
- D. Submit six copies of certified test results upon satisfactory completion of testing.

END OF SECTION

**SECTION 11356**  
**PROGRESSIVE CAVITY PUMPS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, and incidentals required to provide the self-priming, positive displacement progressive cavity pumping units and appurtenances specified in this Section and shown on the Contract Drawings.
  - 1. Truck Off-Loading Station: Two progressive cavity pumps.
  - 2. Anaerobic Digester Feed Pump Station: Two progressive cavity pumps.
  - 3. Dewatering Feed Pump Station: Four progressive cavity pumps.
- B. All equipment shall be installed, adjusted, tested, and placed in operation in strict accordance with this Section and the manufacturer's recommendations.
- C. Each pumping unit shall be designed and constructed to operate satisfactorily with minimum noise, vibration, and cavitation, and reasonable long service life when operated continuously or intermittently for waste activated sludge in an outdoor environment.
- D. Each unit shall be furnished with motor of adequate size to start each progressive cavity pump that has not been in service for 90 days.
- E. Only one pump manufacturer shall be selected for the three pump stations.

**1.02 RELATED WORK**

- A. Section 01000, Project Requirements.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01755, Equipment Testing and Startup.
- E. Section 01780, Warranties and Bonds.
- F. Section 01820, Training.
- G. Section 01830, Operations and Maintenance Manuals.
- H. Section 03600, Grout.
- I. Section 09900, Painting and Coating.
- J. Section 11000, General Equipment Requirements.
- K. Division 13, Special Construction: Instrumentation work, unless as otherwise specified in this Section.
- L. Section 15125, Piping Appurtenances.

- M. Division 16, Electrical.
- N. Section 16150, Motors.

## 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
- B. Descriptive literature, bulletins, and/or catalogs of the equipment.
- C. Complete master wiring diagrams and elementary or control schematics drawings, including coordination with other electrical control devices such as the pump control system, shall be furnished for approval before proceeding with manufacturing. Drawings should show such details that are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable. Refer to the Electrical and Instrumentation Drawings for the control wiring diagrams for the pump motors.
- D. A complete bill of materials of all equipment.
- E. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in this Section, with the manufacturer's current price for each recommended spare part item. Include gaskets, packing, etc. on the list. If bearings are applicable, list bearings by the bearing manufacturer's name and corresponding numbers.
- F. Complete motor data.
- G. Test reports to be submitted: Tests shall be conducted at a minimum of five points along the pump performance curve on the actual pumping units to be furnished. All equipment tested by the pump manufacturer shall certify to its compliance with the project requirements. Curves and other information shall be submitted on 8-1/2-inch-by-11-inch sheets at as large a scale as is practical. Curves shall be plotted from zero flow at shut-off head to pump capacity at minimum specified head:
  - 1. Certified factory test results of each pumping unit in accordance with the standards of the Hydraulic Institute.
  - 2. Factory-tested, certified, and guaranteed pump performance curves showing the specified requirements for head/capacity, brake horsepower,

pump efficiency, speed of rotation, and NPSHR for each pumping unit. Characteristics of pumps furnished may have a tolerance of 1% percent below or 5% above the head and capacity of the specified requirements.

- H. The Contractor shall submit the Manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1.
- I. If it is not possible to comply with certain requirements of this Specification, include in submittals a complete description of all requirements not complied with.
- J. The Contractor shall submit a signed letter from an authorized representative of the pump manufacturer certifying that each pumping unit will not clog or bind on the solids typically found in the application specified in this Section.
- K. If the Contractor deviates from the piping layout as shown on the Contract Drawings, the Contractor shall submit scaled piping drawings showing locations and dimensions to and from fittings, valves, tanks, equipment, structures, and related appurtenances. Provide scaled drawings to a minimum scale of 1 inch equals 10 feet. Provide details to minimum scale of 1/8 inch equals 1 foot. Elevations shall correspond to reference vertical elevation datum shown or provided for this project.
- L. Provide wiring and control panel drawings related to the alarming systems.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Bearing Manufacturers Association (ABMA)
- B. American Gear Manufacturers' Association (AGMA)
- C. American Iron and Steel Institute (AISI)
- D. American National Standards Institute (ANSI)

- E. American Society for Testing and Materials (ASTM)
  - 1. ASTM A48—Standard Specification for Gray Iron Castings.
- F. American Society of Mechanical Engineers (ASME)
  - 1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
  - 2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.
- G. American Welding Society (AWS)
- H. National Electrical Manufacturer's Association (NEMA)
  - 1. NEMA MG 1—Motors and Generators.
  - 2. NEMA MG 1-12.58.1—Standardized Method for Testing.
- I. Institute of Electrical and Electronics Engineers (IEEE)
  - 1. IEEE 112—Standard Test Procedure for Polyphase Induction Motors and Generators.
  - 2. IEEE 117—Standard Test Procedure for Thermal Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery.

## 1.06 QUALITY ASSURANCE

- A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with this Section and Section 11000, General Equipment Requirements.
- B. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the mechanical, electrical, and material integrity established by these Specifications will not be acceptable as determined by the Engineer.
- C. All of the equipment, accessories, and controls specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and in this Section for storing and protecting the equipment specified in this Section.
- B. The pumps shall be shipped to the jobsite complete with the motor, local wiring, control, equipment base, and anchor bolts and other appurtenances as specified pre-installed. Spare parts shall be shipped loose and ready for installation at the location shown on the Contract Drawings.

## 1.09 QUALIFICATIONS

- A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements. Additionally, the pump manufacturer shall meet the following qualifications that supersede the requirements specified in Section 11000, General Equipment Requirements:
  1. The manufacturer shall have a minimum of five installations in Florida that are similar to the pumping equipment specified in this Section. The Engineer shall reserve the right to determine if previous installations by the manufacturer are similar to the pumping equipment specified in this Section.
  2. The Contractor shall submit a list of no fewer than 10 reference installations of pumps in identical service applications to those specified in this Section. At least five of the reference installations provided shall be of the exact model pump specified in this Section. References shall be pumps that have been in continuous service for at least 3 years from the Bid Date.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE

- A. The Contractor shall furnish the following spare parts for each pump in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.

B. For the eight progressive cavity pumps, provide each:

1. One stator assembly with TSE sensor sleeves.
2. One set of universal joint assemblies.
3. One of each set of mechanical seals.
4. One rotor.

## 1.12 SYSTEM DESCRIPTION

A. The pumping equipment specified in this Section shall be designed to pump activated sludge from three stations to their respectively locations:

1. Truck Off-Loading Pumps
  - a. Shall be used to pump sludge from the Truck Off-Loading Station to the Sludge Storage and Blend Tanks.
2. Anaerobic Digester Feed Pumps
  - a. Shall be used to pump sludge from the Sludge Storage and Blend Tanks to the Anaerobic Digester.
3. Dewatering Feed Pumps
  - a. Shall be used to pump sludge from the Sludge Storage and Blend Tanks to the Dewatering Building.

B. Equipment furnished under this Section shall be designed for a municipal wastewater treatment plant environment in which the equipment is exposed to the atmosphere. The equipment shall be designed for humid atmospheric conditions in West-Central Florida.

## 1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

## 1.14 PATENTS AND LICENSES (NOT USED)

## 1.15 SPECIAL CONSIDERATIONS (NOT USED)

## PART 2 PRODUCTS

### 2.01 PERFORMANCE AND DESIGN REQUIREMENTS

#### A. Equipment Identification Labels (Number)

1. Truck Off-Load Pumps: 101-P-1 and 101-P-2.
2. Anaerobic Digester Feed Pumps: 102-P-1, 102-P-2, and (future) 102-P-3.
3. Dewatering Feed Pumps: 103-P-1, 103-P-2, 103-P-3, and 103-P-4.

#### B. Service Conditions

1. Percent Solids: 6%.
2. Design Specific Gravity: 1.00-1.02.
3. Apparent Viscosity: 300-1000 CP.
4. Average Solids Size: 0.25 inch.
5. pH: 5-9.
6. Design Pumping Temperature: 68°F-84°F.

Unit Designation	Truck Off-Loading Pumping Station	Anaerobic Digester Feed Pumping Station	Dewatering Feed Pumping Station
Number of Units	2	2	4
Total Head at Primary Design Condition (feet)	28	88	100
Capacity at Primary Design Condition (gpm)	500	100	150
Total Head at Secondary Design Condition (feet)	-	67	57
Capacity at Secondary Design Condition (gpm)	-	20	50
Discharge Diameter	6-inch	6-inch	6-inch
Maximum RPM at Design Point	350	175	125
Drive	Constant-Speed	VFD	VFD

#### C. Acceptable Manufacturers:

1. Seepex, Inc.
2. Moyno, Inc.
3. Engineer approved equal.

## 2.02 EQUIPMENT

A. The pumping equipment specified in this Section shall in general consist of the following components:

1. Pump Case.
2. Rotor.
3. Stator.
4. Drive Train:
  - a. Universal Joint.
  - b. Drive Shafts.
5. Motor.
6. Isolation Ring with Pressure Switch and Gauge.

B. Pump Casing:

1. The pump body shall be thick-walled ASTM A48 cast iron. All cast parts will be smooth and free of sandholes, blowholes, and other defects.

C. Rotor and Stator:

1. Each pump shall employ a single-helix convoluted rotor operating in a double-helix convoluted stator.
2. The convolutions shall be configured to form a cavity between the rotor and stator progressing from the pump inlet to pump discharge outlet with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form sufficient sealing to prevent leakage of sludge.
3. The rotor shall be provided with the following coating or plating systems:
  - a. Chrome Plating or Ductile Coating: a minimum of 0.010-inch thickness with a minimum Rockwell hardness of 57-60 Rc.
4. The stator material shall be a single piece medium-high acrylonitrile Buna-N rubber with a minimum Durometer hardness (Shore A) of 70-76.

5. The stator seals shall be designed to prevent the material being pumped from contacting the stator metal tube or bonding adhesive.

D. Drive Train

1. Rotor shall be driven by heavy duty drive train. Rotor shall be joined by means of connecting rod with sealed pin type universal joints at each end. U-joints shall be factory lubricated with oil and completely sealed from abrasive fluids being pumped.
2. Drive shaft shall be of solid drive shaft design.

E. Motor:

1. Unless otherwise noted in this Section motors shall be in accordance with Section 16150, Motors.
2. The motors shall meet the following:

Unit Designation	Truck Off-Loading Pumping Station	Anaerobic Digester Feed Pumping Station	Dewatering Feed Pumping Station
Max. Motor Power (HP)	25	10	15
Voltage	230/460	230/460	230/460
Phase	3	3	3
Hz	60	60	60

3. All motors shall be adequately sized to start each progressive cavity pump that has not been in service for 90 days.
4. Each pump motor shall be designed to withstand up to 15 separate pump starts per hour.
5. Acceptable manufacturers:
  - a. Baldor.
  - b. US Motors.
  - c. WEG.
  - d. Engineer Approved Equal.

F. Accessories

1. Run Dry Protection: The stator shall be fitted with a temperature sensor sleeve and thermistor sensor with relay. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the

stator temperature reaches the adjustable limit on the controller. The controller shall include a manual local and remote reset function. Input to the controller shall be 1x115VAC/60 Hz. The panel shall be NEMA 4X 316 stainless steel, UL labeled as an assembly. Panel minimum size shall be 12 inches x 12 inches x 6 inches. The controller shall relay to the remote SCADA system a “high temperature alarm”.

2. Over Pressure Protection: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual-mounted gauge and dual-point pressure switch (high pressure alarm, and high-high pressure shut-down). The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the Drawings and be constructed with a carbon steel body and fittings with a Buna N sleeve. The switch shall be SPDT, NEMA 4 with 316 stainless steel enclosure.

## 2.03 PAINTING

- A. Equipment shall be provided with the manufacturer's recommended shop and field coating systems for severe-duty services rated for outdoor exposure in the State of Florida.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall install the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements, and in accordance with the manufacturer's recommendations.
- B. Install the equipment in the locations as shown on the Contract Drawings and in accordance with the manufacturer's published instructions and recommendations and the approved shop drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- C. All anchor bolts and fasteners shall be AISI Type 316 stainless steel and shall be furnished by the pump manufacturer.
- D. Adjust pump assemblies so that the motors are properly aligned, plumb, and level with the pumps and all interconnecting shafts and couplings.
- E. Provide non-shrink grout for pump installation in accordance with Section 03600, Grout.

- F. All strain from the attached piping shall be eliminated from the pumps, and any evidence of pump or motor misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor using the means specified in this Section at no additional cost to the Owner. Care during storage, installation, and lubrication shall be in strict accordance with the manufacturer's recommendations.

### 3.02 FIELD TESTING

- A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.
1. The factory-authorized service representative shall be onsite to perform the field-testing services specified for one 8-hour day, excluding travel time.
  2. Pre-Startup Testing: The factory-authorized service representative shall perform the pre-startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.
  3. Startup Testing: The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.
  4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

### 3.03 TRAINING SERVICES

- A. The manufacturer technical representative shall be on site to perform training services in accordance with Section 01820, Training, and Table 11000-1, Equipment Testing and Training Requirements.
- B. An authorized representative of the pump manufacturer shall instruct representatives of the Owner in startup, operation, and maintenance procedures. The Contractor shall procure the services of the pump manufacturer's representative for on the project site training service in accordance with Table 11000-1 in Section 11000, General Equipment Requirements. The manufacturer's services specified represent an absolute minimum acceptable level of service and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall

procure, at no additional cost to the Owner, all services required to comply with these requirements, including additional or extended trips to the job site by the manufacturer's representative.

### 3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

- A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

**DIVISION 13**

**SPECIAL CONSTRUCTION**

**SECTION 13232**  
**ALUMINUM FLAT COVERS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, and equipment to provide a complete, installed system of fixed and removable, custom fit, flat aluminum cover over the Sludge Storage Tank. The Tank Cover System includes cover panels, structural supports, and attaching hardware. The cover shall be fully engineered, substantially airtight, aluminum cover structure comprised of panels and beams.
- B. All equipment shall be installed, adjusted, and tested in strict accordance with this Section and the manufacturer's recommendations.
- C. The manufacturer shall field-verify all dimensions before fabrication of components.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01785, Record Documents.
- E. Section 01830, Operations and Maintenance Manuals.
- F. Section 11000, General Equipment Requirements.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Shop Drawings: Submit for approval the following:
  - 1. Manufacturer's literature, illustrations, specifications, and engineering data.
  - 2. Dimensioned drawings showing layout, final installation, fabrication methods, assembly, accessories, and installation details.
  - 3. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.

4. Deviations from Drawings and Specifications.
  5. Proof of qualifications (See Article 1.06A).
- B. Computations and Certifications:
1. Complete structural calculations showing the governing stresses in all members and connections and detailed shop drawings. Preliminary drawings shall be stamped by the cover Manufacturer's Professional Engineer. Final Drawings and calculations shall bear the stamp of Professional Engineer registered in the State of Florida.
  2. Manufacturer's standard guarantee (see Article 1.06A).
  3. A letter of certification signed and sealed by a Professional Engineer registered in the State of Florida confirming that the aluminum cover is in full compliance with the Contract Drawings and Project Specifications including any testing provisions included therein.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. Aluminum Association
- B. American Welding Society (AWS)
  1. AWS D1.2/D1.2M—Structural Welding Code – Aluminum.
- C. Florida Building Code
- D. National Environmental Balancing Bureau (NEBB)
  1. Procedural Standards for Testing, Adjusting and Balancing of Environment System.
- E. Uniform Building Code (UBC)

## **1.06 QUALITY ASSURANCE**

### **A. Fabrication and Workmanship**

1. Workmanship: The quality of workmanship shall be equal to the best general practice in modern structural fabrication shops. Workmanship, fabrication, and shop connections shall be in accordance with the latest edition of AWS D1.2/D1.2M.
  2. Preparation for Welding: All components to be welded shall be free of dirt, grease, and other contaminants and shall fit up properly for sound welding. Surfaces to be welded may not be cut with oxygen. Sawing, shearing, or machining may be used.
  3. Welding Procedures: All welding shall be with an inert gas shield arc process. Machine settings shall be developed with test welds of the same material, alloy, and geometry as the work pieces, and samples will be tested destructively.
- B. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with this Section and Section 11000, General Equipment Requirements.
- C. All of the equipment, accessories, and other appurtenances specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

## **1.07 WARRANTIES (NOT USED)**

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section and in strict accordance with the manufacturer's instructions and recommendations.

## **1.09 QUALIFICATIONS**

- A. Manufacturer's Qualifications: Manufacturer shall be a company specialized in providing engineered aluminum covers for wastewater treatment tanks/troughs for at least 10 years with a minimum of five successful and similar installations in Florida. These installations shall be similar in square footage and design to this project. When requested by the Engineer, submit written evidence to show

- experience qualifications and adequacy of plant capability and facilities for performance of contract requirements.
- B. Erector: Regularly engaged for at least 10 years in the erection of aluminum covers for wastewater treatment tanks.
  - C. Welders: Qualified and licensed within the past 2 years in accordance with AWS.

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 SYSTEM DESCRIPTION (NOT USED)

#### 1.13 OPERATION AND MAINTENANCE (O&M) MANUALS (NOT USED)

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

#### 1.14 PATENTS AND LICENSES (NOT USED)

#### 1.15 SPECIAL CONSIDERATOINS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 DESIGN CRITERIA

- A. Except as otherwise specified or shown, all design, materials, joints, connections, and workmanship shall conform to the Uniform Building Code (UBC), the Florida Building Code, and the Aluminum Association.
- B. Design a flat cover to withstand the cover dead load plus equipment dead load plus the following live load conditions:
  1. The structure is in a hurricane-prone region. Wind loading shall be in accordance with the applicable Florida Building Code:
    - a. Base wind speed shall be 155 mph.
    - b. Importance factor shall be in accordance with Industrial Standards.
  2. Span: The clear span length of the cover shall be as noted on the Contract Drawings.

3. Radius: The radius of the cover shall be as noted on the Contract Drawings
4. The flat cover shall be a clear span structure, designed to be self-supporting from its periphery on the concrete tank walls. The cover shall span under the existing bridge structure and must stay within the 4 3/4-inch spacing between the top of the tank and the bottom of the existing bridge structure. The cover shall not be designed to bear any structural weight on the existing bridge nor flash to the bridge structure.
5. The flat cover shall not have any support beams below the decking that exceed the 2-foot-6-inch freeboard (from the top of the tank wall to the liquid level) inside the tankage placing any cover support beams in direct contact with the liquid inside the tank.
6. The flat cover shall provide a means to remove four panel sections as shown on the Contract Drawings for ease of maintenance and removal of the mixers and impellers. The overall clear and unobstructed opening after panel and beam removal shall accommodate the direct dead lift of a 10-foot-6-inch-diameter impeller on the mixer shaft without tilting or turning the angle of the shaft or impeller. The cover system surrounding this opening shall maintain the design stress, concentrated live load, distributed design live load, and deflection requirements of this specification when these panels and beams are removed for mixer maintenance.
7. The removable panel sections shall be labeled to clearly indicate how to remove and reinstall the sections during maintenance and removal of the mixer and impellers.
8. Concentrated Live Load: The structural components shall be designed to support a 400-pound load on a 6-inch-x-6-inch area located anywhere on the surface of the structure without permanently deforming the tested area.
9. Distributed Design Live Load and Deflection: All structural components shall be designed to support the dead weight of the structure, plus a live load of 50 pounds per square foot of surface. The maximum deflection of any component under this load shall not exceed L/240 of the span of that component. In no event shall the dead load deflection exceed the rise of any component to avoid surface ponding.
10. Design Stresses: All allowable design stresses in structural aluminum shall be in accordance with the *Specifications for Aluminum Structures* for building-type structures by the Aluminum Association.

11. Skid Resistance: The cover shall possess an integral non-skid surface, and no exposed area of cover system wider than 1 inch shall be without ribs/non-skid surface. The aluminum-decking surface of the structure shall be Hallsten's Deck Slat or Engineer-approved equal, which is ribbed to provide an aggressively non-skid surface. The edges of adjacent deck slats shall double interlock so that the slats shall act together. The decking surface shall be manufactured from alloy 6061-T6. The manufacturer of the non-skid surface shall demonstrate in writing satisfactory performance for a minimum of 10 years in the wastewater industry for the intended purpose. This surface shall not be achieved by the use of paint, adhesive tapes, sand blasting, or any other means other than an extruded process.
12. Chemical Resistance: Panels shall be fabricated entirely of 6061-T6 corrosion-resistant aluminum extrusions. Every panel to beam connection shall be chemical resistant and will not weaken or corrode and will interlock. A mechanical and replaceable Santoprene seal shall isolate the cover perimeter from the concrete wall. No foam tape or caulk shall be allowed.
13. Configuration: The surface-mount aluminum cover shall land on the surface of the existing concrete as shown on the Contract Drawings and on ledger angle where applicable. The cover shall be composed of panels and beams. All panels shall interlock with the adjoining beam and panels without the use of threaded fasteners. Uplift of each panel will be resisted with the use of an integral latch system. The weight of an individual panel shall not exceed 150 pounds. Each removable panel shall be easy to remove without disruption of adjacent panels, and the lifting force required shall not exceed the dead weight of the panel.

## 2.02 DETAILS OF CONSTRUCTION

- A. Manufacturer: Provide a flat cover as designed and fabricated by one of the following:
  1. Hallsten.
  2. Or Engineer-approved equal per Article 2.03 of this Section.
- B. Flat Coved Dimensions: The flat cover shall conform to the dimensions shown on the Contract Drawings.

C. General:

1. The flat cover shall be a clear span structure, designed to be self-supporting from its periphery on concrete tank walls.
2. The edges of each panel shall be interconnected as to prevent slippage or disengagement under design conditions.
3. Provide gasket material such that all connections to the concrete structure are substantially airtight. Provide gasket material such that all connections between adjacent aluminum cover panels are substantially airtight. Gasket material shall be as specified below.
4. Provide the flat cover with access hatches, as shown on the Contract Drawings.
5. Provide openings for odor control ductwork and air piping inlet for each tank cover in accordance with the details of the Contract Drawing and at locations shown on the Contract Drawings.
6. No welding or thermal cutting of aluminum structural members, supports, or connections will be permitted in the field.

D. Materials:

1. Aluminum: All aluminum used in the fabrication of the cover shall be alloy 6061-T6. All plate shall be alloy 6061-T6. Material shall be new and of top quality.
2. Welding Electrodes: Welding shall be with electrodes of an alloy, which shall produce welds with strength and corrosion-resistant characteristics compatible to the base metal.
3. Fasteners: All fasteners between aluminum components shall be stainless steel or structural plastic. Aluminum shall be isolated from dissimilar materials by means of a stainless steel spacer or an elastomeric isolator. Beams and panels shall be fastened to concrete using stainless steel drill in place anchor bolts.
4. Steel Accessories: No carbon steel components shall be used.
5. Seals: A mechanical and replaceable Santoprene seal shall isolate the cover perimeter from dissimilar materials such as concrete and steel. No foam tape or caulk shall be allowed for isolation of cover system.
6. Access Hatch Panels: Access to any location under the cover shall be gained through integral gear hinged access hatches. The Access Hatch Panels shall have the identical properties as the rest of the aluminum cover including loads, deflection, and slip resistance specifications. The access-hinged panels shall be the full panel width. The length of the access panel shall be clearly indicated on the submittal drawings and in accordance with the Contract Drawings. Hinged panel components including hinges, decking, and lifting handles shall be extruded 6061-T6. While in the closed position, the hatches will be completely flush and therefore pose no

- tripping hazard. In the open position, the panel shall lie flat on the cover and will not need a hold-open device.
7. Pipe penetration kits shall be provided as shown on the Drawings for all locations where liquid piping penetrates the plane of the cover.
  8. Duct penetration kits shall be provided as shown on the Drawings for the location on each tank where the odor-control ducting intersects with the cover.
  9. A small 18-inch square hatch shall be provided on each tank cover to facilitate the Contractor-provided float switch and transducer for liquid level sensing.
  10. A penetration kit shall be provided on each tank cover to accommodate the level transducer for liquid level sensing.
  11. Handles: Handles shall be an integral flush-mounted aluminum and incorporated into the non-skid deck slat.
  12. Anchor Bolts: Furnish anchor bolts and nuts of Series 316 stainless steel, of ample size and strength for the purpose intended, sized by the equipment manufacturer.

## 2.03 ENGINEER'S PRE-APPROVAL OF ALTERNATE COVERS

- A. The Manufacturer of an alternate cover system shall submit a pre-approval submittal package to the Engineer at least 14 days before the Bid Date. Only approved alternates listed by addendum will be acceptable. The following information and supporting documentation shall be provided to the Engineer.
  - B. Shop Drawings: Submit for approval the following:
    1. Manufacturer's literature, illustrations, specifications, and engineering data.
    2. Complete detailed drawings showing the proposed cover system, fabrication methods, assembly, accessories, and installation details.
    3. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
    4. Deviations from Drawings and Specifications.
    5. Proof of qualifications (see Paragraph 1.09A).
  - C. Computations:
    1. Complete structural calculations showing the governing stresses in all members and connections, and detailed shop drawings. Preliminary drawings shall be stamped by a Professional Engineer registered in Florida.
    2. Manufacturer's standard guarantee.

3. A letter of certification signed and sealed by a Professional Engineer registered in Florida confirming that the aluminum cover is in full compliance with the Plans and Specifications including any testing provisions included therein.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. All preparation to the existing concrete tank for installation of the cover shall be in strict accordance with the manufacturer's recommendations so as not to damage the existing concrete tank and to allow for proper install of the cover.
- B. The flat cover shall be erected in strict accordance with the manufacturer's instructions by the manufacturer skilled and experienced in the erection of aluminum structures and covers.
- C. The manufacturer shall field-verify all dimensions before fabrication of components.
- D. Ensure an initial substantially airtight/watertight installation of the structure by establishing and adhering to a uniform method of applying the prescribed torque to the strut cover bolt fasteners.
- E. Properly align the cover, ensuring that they are plumb and level. Field re-fabrication of structural components of panels will not be accepted. Forcing of the structure to make it fit during construction is expressly forbidden and not acceptable.
- F. The cover manufacturer shall install the aluminum cover with certified crews from the factory who regularly install tank covers. Installation shall not be subcontracted nor handled by the Contractor. Installation by the manufacturer shall ensure installation of the cover according to the required windload standards according to the Florida Building Code. The manufacturer shall certify the installation in writing after the installation is completed and the certification shall be signed and sealed by a Professional Engineer in Florida.

### 3.02 TESTING

- A. The manufacturer technical representative shall be on site to perform training services in accordance with Section 01820, Training, and Table 11000-1, Equipment Testing and Training Requirements.

- B. Loads: After installation, the cover structure shall be tested for conformance with the deflection limits. A load of 400 pounds shall be placed as directed by the Engineer, and the maximum deflection created by the load shall be measured.
- C. Prequalified Shop Testing:
  - 1. The manufacturer shall perform a prequalified shop air tightness test and certification for the cover components proposed. This test shall be performed in accordance with the "Procedural Standards for Testing, Adjusting and Balancing of Environment System" as published by the National Environmental Balancing Bureau (NEBB) on cover components of no less than 80 square feet. Said test shall be conducted and witnessed by a NEBB-certified technician.
  - 2. A report of the test shall be prepared by the certified technician and shall be sealed with the NEBB seal. The report shall include a description and illustration of the test components and test apparatus and a report of the results.
  - 3. The cover shall maintain an air intrusion leakage rate not to exceed 0.2 cfm per square foot at an applied negative pressure of 0.2 inch of water column for 5 minutes.

END OF SECTION

**SECTION 13316**  
**SOFTWARE CONTROL BLOCK DESCRIPTIONS**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Section provides functional descriptions of the computer software requirements for the Process and Instrumentation and Control System (PICS) as indicated in specifications and on the drawings. These descriptions are intended to provide an overview of the operating concept of the plant process equipment rather than describing in detail every operating feature, I/O point, or required set-point.
- B. The Supplier shall provide all PLC and Human Machine Interface (HMI) programming, and graphic configuration as required for completely functional system in accordance with the contract documents.
  1. Programming: The PICS Supplier shall configure and program all hardware and network and communications devices required for an operating system plus any testing software required for the factory test. The PICS Supplier is responsible for programming the Plant SCADA System and Plant Control Work Station (PCWS) and all other plant systems PLCs.
  2. Control Hierarchy: Several levels and modes of operational control will exist for the system. Operators will have the ability to monitor and control equipment via local manual controls at the equipment, or via the local PLC Operator Interface Terminal (OIT) and through the SCADA computers. The selection of these operational modes will be made available through the use of hardwired and/or software selector switches.
    - a. Manual Control (Local): Hardwired local switches Local-Off-Remote (LOR) (or as shown on plans and noted in detailed loop descriptions) provide selection of Local Manual control, or Remote Manual control (via PLCOIT or via SCADA) control of the equipment. All equipment equipped with Local Manual LOCAL/OFF/REMOTE (LOR) switches in LOCAL will override all Remote PLC and SCADA control. This mode is intended primarily for maintenance functions and is not intended for normal process control operation. When the local switch is in REMOTE, the device is under computer (PLC and/or SCADA) control.

- b. Computer Control: When the equipment LORswitch is placed in the REMOTEposition, equipment will be controlled by the PLC in either the REMOTE AUTO or REMOTE MANUAL mode (via a software switch on the PLCOIT or SCADA screen).
  - c. REMOTE MANUAL: The Operator can remotely control equipment through software Start/Stop commands and where applicable, speed control using software switching on the PLC OIT or via SCADA screen. The Start/Stop Command shall be wired as one discrete output and programmed as maintained RUN command.
  - d. REMOTE AUTO: Control is accomplished via PLC or SCADA automatic control logic strategy.
  - e. While in the REMOTE AUTO mode, SCADA and PLCOIT MANUAL commands are not executed by the PLC control logic.
- C. Programming of control logic and configuration of the EXISTING CONTROL SYSTEM with new process graphical screens – HMI software is part of the Work and shall be the responsibility of the PICS Supplier.
- D. Control System: The Instrumentation and Control System shall apply to all systems described in this Section. Attached PLC I/O tabulations are for reference. The PICS Supplier and CONTRACTOR shall confirm in the field the existing physical PLC wiring before adding or removing wiring.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The descriptions are applicable to the software specified in Section 13401, Process Instrumentation and Controls (PICS).

## PART 3 EXECUTION

### 3.01 PLC PROGRAMMING FUNCTIONAL REQUIREMENTS

- A. The following paragraphs describe general configuration tasks that are required for the system PLC(s). These tasks shall be programmed in the applicable PLC. Each PLC may have multiple instances of each of these tasks or may have no instances of some or all of these tasks. The input/output lists (located in these documents as specified in Section 13401, Process Instrumentation and Controls [PICS]) and detailed equipment control descriptions (included herein) should be referenced to determine the requirements for each PLC.

- B. PLC or HMI requirements detailed here will not be repeated in the individual control loop descriptions but are required.
- C. The following paragraphs cover functional requirements of the software, which are generic and may or may not be related to any specific control loop. The requirements apply to both the local OITs and SCADA computers. Control functionality will be identical for all sites.
- D. Abbreviations: The following abbreviations are used in the control descriptions:

1.	AM	Auto-Manual
2.	HOA	Hand-Off-Auto
3.	LR	Local-Remote
4.	LOR	Local-Off-Remote
5.	RS	Run-Stop
6.	OC	Open-Close
7.	OSC	Open-Stop-Close
8.	OO	On-Off
9.	PV	Process Variable
10.	SP	Set Point (variable)

- E. Available Process Values: All generated process alarm, equipment status, and process variable values associated with a particular PLC shall be available at its OIT and also on SCADA HMI including remote displays (PCWS). Refer to HMI specification for additional requirements.
- F. Flow Totalized Values: Flow values shall be integrated, totalized, and stored in the PLC registers so the values displayed on the OIT and SCADA computers will be identical.
  - 1. For each flow meter whose analog “flow” signal is monitored by a PLC or for any calculated flow signal utilized for process control and monitoring, internal flow totalization shall be accumulated by the respective PLC. The flow totalization routine shall utilize floating point variables to accomplish the flow integration.
  - 2. Two flow totals shall be accumulated and accessible from the PLC. The current 24-hour period total, the previous 24-hour period total shall be calculated and stored. The 24-hour total shall reset at midnight.
  - 3. The flow total values shall be displayed on the OIT.
- G. System Failure: Failure of a PLC shall result in safe shutdown of associated process equipment. Interposing relays shall be provided where required to assure that equipment will revert to its fail-safe condition. Failure of any PLC or its communication shall be alarmed.

- H. Rack/Module Configuration: The rack and module definitions for each PLC, as well as the PLC communications configuration shall be completely configured to allow proper addressing of all field connected I/O points. This shall include configuration of any remote input/output (RIO) racks.
- I. PLC Database Definition: The PLC database will include both field I/O points and internally generated points required for programming. All field I/O points and internal programming points shall be fully defined according to database naming conventions approved by ENGINEER and OWNER. As a minimum, each database point shall be provided with a tag name, engineering unit, alarm parameters, and description. Internally generated points (calculations) and set-point variables shall be provided as required whether specified in the control descriptions or not. All process and timer set points shall be Operator adjustable from the OIT.
- J. Analog Scaling: Each analog input and output will be appropriately scaled in engineering units for use in internal PLC programming and monitoring by the OIT and remote SCADA computers.
- K. Equipment Runtimes: For each equipment item whose "run" status is monitored by a PLC, an internal equipment runtime shall be accumulated by the respective PLC. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software timer that maintains equipment runtime to within a one-minute resolution. The timer shall stop incrementing, but not reset, when the "run" contact indicates that the equipment is not running. The timer value shall increment an hour counter that maintains a floating-point value representing the equipment run time in hours and tenths of hours. The counter value shall be available for display on the OIT and SCADA computer. A manual reset of the runtime value shall be available at the OIT for personnel at the supervisor level and above.
- L. Equipment Starts: For each equipment item whose "run" status is monitored by a PLC, an internal equipment number of 'Starts' shall be accumulated by the respective PLC. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software counter that maintains equipment 'starts'. The counter value shall be available for display on the OIT and SCADA computer. A manual reset of the value shall be available at the HMI for personnel at the supervisor level and above.
- M. Change-of-State Alarms: While equipment is controllable from the PLC (IN REMOTE), discrete output commands shall be compared to their respective process feedback status signal (where available) to verify proper execution. If the feedback status does not match the most recent output command (after an

adjustable time delay), an alarm message shall be displayed on the HMI computer and transmitted to SCADA. The alarm shall remain energized until the proper discrete condition is sensed and until the operator resets the alarm.

N. Equipment Availability: In general, equipment with PLC control has been provided with a local HOA, HOR, LR, or LOR selector switch that transfers control to the PLC. The PLC shall monitor the position of this local selector switch to determine if the equipment is available for PLC control. If more than one ‘switch’ or availability condition exists, the ‘switches’ shall be series hard-wired such that a single signal shall indicate that the equipment is available for PLC control. If the equipment is not available, the PLC program shall not attempt to implement remote manual or automatic status changes for the equipment. The PLC program may, however, need to implement special routines if equipment unavailability affects a sequence (as described in the detailed equipment descriptions).

1. Upon:

- a. Transmitter Failure: Analog signal less than 2 mA or greater than 22 mA.
- b. Pump/Motor Failure: The PLC shall automatically remove its Call-to-Run and if applicable, set its analog set-point value to a minimum value.
- c. An alarm shall be generated on any failure.

O. Maintained/Momentary Outputs: The need for maintained or momentary control outputs shall be determined from the input/output listing and the electrical schematics. In general, equipment with only one PLC control output point indicated in the I/O list shall be programmed for a maintained control output. Equipment with two (or more) control outputs shall be programmed for momentary outputs as required. Provisions shall be made, in either case, to remove the active state (start, open, forward, initiate, etc.) control output when an equipment failure is sensed or when the equipment transitions from available to unavailable (local switch change).

P. Power Failure: A utility power failure is detected by the PLC UPS running from battery power.

1. Upon detection of utility power failure:

- a. A power failure alarm is generated.
2. All PLC controlled equipment is turned off until main power has been restored for 30 seconds.

3. Upon power restoration for 30 seconds:
  - a. A power restored alarm is generated.
  - b. Devices will remain in their current configuration. Note that an equipment REMOTE AUTO / REMOTE MANUAL mode may be altered during the power outage if designated in the detailed control strategy.
  - c. All devices will require Operator intervention (via OIT or SCADA) to restart the equipment when not in REMOTE AUTO mode.
  - d. All devices over 20 HP shall be stagger-started according to control strategy details.
  - e. Control strategy details shall provide additional (if required) actions to occur upon power restoration.
- Q. Manual/Auto Bumpless Transfer: Unless otherwise indicated in the equipment control descriptions, equipment changes from automatic to manual control shall be bumpless. Equipment running or stopped in automatic mode shall remain running or stopped when manual mode is selected.
- R. PLC Peer to Peer Ethernet Communications: Each PLC shall monitor peer-peer PLC communications required for process control of an equipment system distributed among multiple RTUs/PLCs. Communications failures shall be detected, alarmed, and acted upon in accordance with detailed strategy requirements.
- S. PLC Low Battery: An alarm shall be generated on PLC low memory low battery detection.
- T. PLC Generated Alarms: Alarms from each PLC shall be logged into the OIT alarm log table and displayed as described below. This requirement will not be restated in the individual control loop descriptions.
- U. Instrument Calibration: Provide the ability to place all field instruments in a CALIBRATE mode at the SCADA system or OIT. The PLC will hold last value of the field instrument to allow the plant to operate.
- V. PLC Out of Service mode: An alarm shall be generated on SCADA system when the PLC is taken out of service.

### 3.02 OIT FUNCTIONAL REQUIREMENTS

- A. The following paragraphs describe general configuration tasks that are required for the OIT and related software.
  - 1. Database: The system database, including field I/O and internal points shall be established according to the database point naming conventions approved by OWNER. Database generation for field I/O shall include all required coordination with PLC level addresses. All calculated totals, averages, daily totals, etc. calculated by the PLC in Section 3.01 of this Section shall be displayed on the OIT.
  - 2. Alarms: Complete system alarming shall be configured. This shall include configuration of graphical alarm displays, and configuration of audible alarms as available. All process or system alarms shall appear on a dedicated alarm summary screen.
    - a. For LOW or LOW-LOW analog or discrete alarms which do not apply if the associated equipment is not operating, provisions shall be made to prevent generation of these alarms. This shall include alarms such as low amperage alarms for pumps that are not running. This may also include low flows or pressures when associated pumps are not operating (this will only apply if periodic operation of the equipment is considered normal).
    - b. All alarms/events shall be time stamped when displayed or printed. Unacknowledged alarms shall not automatically clear from the alarm summary if they return to normal before being acknowledged.
- B. Manual Entry of Data: The OIT shall allow manual entry data of all ENGINEER and OWNER designated set-points, and process control variables. These variables shall be password protected as indicated in the control descriptions.

### 3.03 EQUIPMENT CONTROL AND CONTROL MODE OVERVIEW

- A. The following paragraphs explain the general format and control modes that are used in the detailed equipment descriptions. These paragraphs apply to the attached, project specific, equipment control descriptions included herein.
- B. Descriptions for control are included in the detailed equipment control descriptions. They are provided primarily for overview information and guidance to show intent for the PICS Supplier. The PICS Supplier are responsible for all

detailed programming requirements for safe and proper operation of the equipment provided by them under all conditions.

1. PICS Supplier and ultimately the CONTRACTOR shall be responsible for all coordination issues between their systems to insure they work together in a seamless operation.

### 3.04 DETAILED EQUIPMENT CONTROL DESCRIPTIONS

- A. The following paragraphs describe functional requirements for various software control blocks in the control system. These descriptions are intended to provide an overview of the operational concept for the facilities, rather than describing in detail every operating feature, requirement, or interlock. The programmer is to provide a functioning system, including failure recovery, whether completely or explicitly stated in the control descriptions.
- B. Introduction: The purpose of the control strategy is to provide a detailed description of the control, monitoring and alarm functional requirements associated with each process loop for the plant control system (PCS) to operate all the processes associated for the operation of the facility.
- C. The process loop number is determined by the ISA tag name. The Control Strategy Description Table in Section 3.04.G of this Section provides a cross-reference between the process loop and the associated control strategy.
- D. Each control strategy is divided into sections:
  1. Overview: This Section provides a basic performance description as an introductory guide.
  2. Monitoring and Control: This Section provides required equipment operation status, current process variable measurements, totaling process variable measurements, and active equipment control mode status that are to be monitored ('Monitor' does not include alarms):
    - a. Equipment operation status includes OPEN or CLOSED position; ON or OFF; and LOW, HIGH or OFF. (OFF is also referred to 'READY' in the electrical schematics wiring diagrams.)
    - b. Current process variable measurements include level, pressure,
    - c. Totaling process variable measurements include daily, monthly, and annual total measurements; as well as, equipment (pumps) cumulative runtimes for daily, weekly, monthly and yearly runtimes.

- d. Active equipment control mode status includes REMOTE selected in the field; MANUAL or AUTO selected from the control system interface; PID controller's set point and output; operator entered parameters for control algorithms (such as dosage, timers, etc.); current sequence steps.
- e. Local (Manual) Display/Control: For equipment and valves that have Local Control Stations (LCS), Local Control Panels (LCP) or Motor Control Panels (MCPs), the Local/Off/Remote (L/O/R) hand switches dictates where the equipment or valves are controlled. In LOCAL Mode, the control is from the LCS, LCP or MCP via Open/Close pushbuttons or Start/Stop pushbuttons and also speed potentiometers.

3. Remote Control:

- a. Manual: In this mode the LCS or LCP must be in REMOTE Mode REMOTE MANUAL Mode – control is forwarded to the OIT. Equipment and valves do not operate automatically but must be “pulsed” open/close (for valves and slide gates) or equipment started/stopped manually. Typical POP-UP graphic templates shall be utilized for all valves, slide gates, pumps, equipment, etc.
- b. Auto: Same as Remote Manual Control except: In REMOTE AUTO Mode – control of equipment and valves are controlled automatically from the PLC as defined below:
  - (1) Control: This Section provides required modes of equipment operation, mathematical algorithms, proportional-integral-derivative (PID) controller, and sequencing steps. This Section assumes the equipment is placed in AUTO or REMOTE (from the field). If the equipment is not in REMOTE then the described controls are disabled and the equipment is not available for the OIT. The OIT shall alert the operator defining the problem area or piece of equipment Not-In-Auto Mode or that is not functioning properly.

4. Transfer: This Section provides the functional requirements of transferring from one control mode to another control mode. For example, bumpless transfer is the ability to seamlessly go from one mode to another mode without interrupting the equipment operation.

- a. Active equipment control mode status includes AUTO or REMOTE selected in the field; MANUAL or AUTO selected from

the control system interface; PID controller's set point and output; operator entered parameters for control algorithms (such as dosage, timers, etc.); current sequence steps.

5. Interlock: This Section provides required control interaction between two or more devices and override functions to protect equipment and process performance under normal operations. It also provides the necessary action to be taken if E-STOP is activated. ‘Interlocks’ do not include override actions caused by field generated alarms, equipment or instrument failure, and total plant or area power outage.
6. Alarms:
  - a. Alarm: This Section provides required annunciation, control action and priority of field generated alarms, logic generated alarms, and logic generated warnings. Logic generated alarms and warnings are identified in the control strategy. These alarms include:
    - (1) OOR Analog Input: For all analog inputs, issue an Out of Range (OOR) alarm if an analog input is outside of the 4 to 20 mA range for 30 seconds.
    - (2) FAIL-to-CLOSE: If a CLOSE command is issued and there is no CLOSE status feedback to indicate valve has reached full closed position within 45 seconds or the CLOSE status is not present while valve is commanded to CLOSED position, then issue a FAIL-to-CLOSE alarm.
    - (3) FAIL-to-OPEN: If an OPEN command is issued and there is no OPEN status feedback to indicate valve has reached full open position within 45 seconds or the OPEN status is not present while valve is commanded to OPEN position, then issue a FAIL-to-OPEN alarm.
    - (4) FAIL-to-RUN: If a START command is issued and there is no ON status feedback to indicate device has started within 45 seconds or the ON status is not present while device is running, then issue a FAIL-to-RUN alarm.
    - (5) FAIL-to-STOP: If a STOP command is issued and there is still an ON status feedback after 45 seconds from issuing a STOP command, then issue a FAIL-to-STOP alarm.
    - (6) FEEDBACK FAILURE: A PID controller modulates a valve position or pump speed to maintain a process set point under AUTO mode and the controller's feedback used to determine off set from set point is  $\pm 5\%$  from the

- set point for 45 seconds then issue a FEEDBACK FAILURE alarm.
- (7) FORCE OVERRIDE: A failure condition occurs that requires the control logic to override a calculated value used for controlling a device such as valve position or pump speed, etc.
- (8) NO STANDBY AVAILABLE: The control strategy has a ‘duty’ and ‘standby’ or Lead/Lag service operation under AUTO mode and there is only one pump available for AUTO control then issue a NO STANDBY AVAILABLE warning.
- (9) TRACKING FAILURE: A variable speed device or modulating valve is commanded to a speed or position percentage and the feedback from the drive tachometer or actuator positioner is  $\pm 5\%$  from the commanded speed or position for 45 seconds then issue a TRACKING FAILURE alarm.
- (10) POWER OUTAGE FORCED STOP: The equipment was running under PLC control in MANUAL mode prior to loss of power and due to the power outage, the equipment was stopped. Issue a POWER OUTAGE FORCED STOP alarm upon this condition.
7. Fault Mode: This Section provides the functional control requirements in the event that there is an equipment or instrument failure. An equipment failure is defined as the inability to control or monitor a device placed under REMOTE control due to an alarm condition. An instrument failure is defined as the inability to monitor a device due to an alarm condition.
8. Power Outage: This Section provides functional control requirements in the event of a loss of power and the functional control requirements upon power restoration. This Section assumes a power outage to be detected by the transfer of normal to generator power for all processes.
- E. HMI Generated Alarms: In addition, alarm priority levels are assigned a number from 1 to 4. The numbers are categorized by the urgency of the alarm condition and are as follows:

Priority	Description
1	Human safety in Danger/Chemical Spill Potential/Toxic Gas Leak.
2	Equipment or system failure; or interlock to shutdown equipment to prevent mechanical damage.

Priority	Description
3	Control override to prevent jeopardizing process performance or possible mechanical damage.
4	Warning of potential problem effecting process performance or possible mechanical damage.

F. Control System Overview:

1. Tanks

- a. Name: North Biosolids Blending Tank.
- b. Name: South Dewatering Storage Tank.
- c. Name: Primary Anaerobic Digester.

2. Sludge Valve Station

- a. Name: Thickened Primary Sludge Valve to Digester Equipment No. 102-AC-3.
- b. Name: Thickened Waste Activated Sludge Valve to Digester Equipment No. 102-AC-1.
- c. Name: Thickened Primary Sludge Valve to Combined Thickened Sludge Equipment No. 102-AC-4.
- d. Name: Thickened Waste Activated Sludge Valve to Combined Thickened Sludge Equipment No. 102-AC-2.

3. Pumps

- a. Name: Truck Off-Loading Pumps Equipment No. 101-P-1 and 101-P-2.
- b. Name: Digester Feed Pumps Equipment No. 102-P-1 and 102-P-2.
- c. Name: Dewatering Feed Pumps Equipment No. 103-P-1, 103-P-2, 103-P-3, and 103-P-4.
- d. Name: Existing Truck Off-Loading Pump Station (Backup Operations).

4. System Description – Normal Operation

- a. Tank Status: Normal Operation will utilize the North Tank for Biosolids Blending and the South Tank for Dewatering Storage. The North Biosolids Blending Tank will receive the following for blending and discharge to the Primary Anerobic Digester:
  - (1) East Plant WRF thickened WAS sludge loads using the Truck Off-Loading Pump Station (101-P-1 and 101-P-2).

- (2) Existing WRF scum pump station and feed piping.
  - (3) Combined Thickened Sludge Piping (Thickened WAS and Thickened Primary Sludge).
- b. The South Dewatering Storage Tank will receive daily discharge of anaerobic digested sludge from the Primary Anaerobic Digester for temporary storage and mixing prior to dewatering by centrifuge and/or belt filter presses.
5. Sludge Valve Station Status: The Sludge Valve Station actuators will be set by the operator as follows:
- a. Normally close the valve actuators to the Digester (102-AC-3 and 102-AC-1) and normally open the valves to the Combined Thickened Sludge (102-AC-4 and 102-AC-2). This will direct the Thickened Primary Sludge from the new Salnes Filters and the Thickened Waste Activated Sludge from the existing WAS Thickeners into a single Combined Thickened Sludge Line that feeds to the North Biosolids Blend Tank.
6. Pump Logic Status and Alarm Annunciation:
- a. The Truck Off-Loading Pumps will receive the following alarms:
    - (1) The North Biosolids Blending Tank High Level.
  - b. The Digester Feed Pumps will receive the following alarms:
    - (1) The North Biosolids Blending Tank Low Level.
    - (2) The Primary Anaerobic Digester High Level.
  - c. The Dewatering Feed Pumps will receive the following alarms:
    - (1) The South Dewatering Storage Tank Low Level.
  - d. The Dewatering Equipment (Centrifuge and/or Belt Filter Press – Shutdown Alarm).
7. System Description – South Dewatering Tank Maintenance (Backup Operation Mode):
- a. Tank Status: The Operator will select the North Tank for operation as the Dewatering Storage Tank. There will be no Biosolids Blending Tank in operation under this mode and Thickened

Primary and Thickened WAS biosolids will be sent to the primary anaerobic digester using the Sludge Valve Station. The East Plant WRF Thickened WAS truck off-loading will be done at the Existing East WRF Thickened WAS Pump Station will pump thickened WAS from the East WRF tanker trucks directly into the Primary Anaerobic Digester.

- b. Sludge Valve Station Status: The Sludge Valve Station actuators will be set by the operator to open position for the valves to the Digester (102-AC-3 and 102-AC-1) and the operator will set to close position for the valves to the Combined Thickened Sludge (102-AC-4 and 102-AC-2) piping to the North Sludge Blend Tank. These valve settings will direct the Thickened Primary Sludge and the Thickened Waste Activated Sludge directly into the Primary Anerobic Digester.
- c. Pump Logic Status:
  - (1) The Truck Off-Loading Pump Station at the Blend Tanks will not operate while in Maintenance Operation with the North Tank used as the Dewatered Sludge Storage Tank.
  - (2) The Existing East WRF Thickened WAS Pump Station will be used for East Plant WRF thickened WAS truck off-loading to feed directly into the Digester and will receive the following alarms:
    - (a) The Primary Anaerobic Digester High Level.
    - (b) Shut-down the Existing East WRF Thickened WAS Pump Station.
  - (3) The Digester Feed Pumps will not operate while the North Tank is used for the Dewatering Storage Tank, and the South Tank is out of service for maintenance.
  - (4) The Dewatering Feed Pumps will receive the following alarms:
    - (a) North Tank Low Level to protect the Dewatering Feed Pumps from pumping dry.
    - (b) The Dewatering Equipment (centrifuge and belt filter press) – Shut Down Alarm.

8. System Description – North Blend Tank Maintenance (Backup Operation Mode):

- a. Tank Status: The Operator will select the South Tank for operation as the Biosolids Blend Tank. The North Biosolids Blend Tank will be out of service for maintenance and there will be no Sludge Dewatering Tank in operation under this mode and anaerobic digested sludge will be sent directly from the Primary Anaerobic Digester directly to the suction side of the Dewatering Feed Pumps. The South Biosolids Blending Tank will receive the following for blending and discharge to the Primary Anerobic Digester: East Plant WRF thickened WAS sludge loads using the Truck Off-Loading Pump Station (101-P-1 and 101-P-2), the existing WRF scum pump station and feed piping, and the Combined Thickened Sludge Piping (Thickened WAS and Thickened Primary Sludge).
- b. Sludge Valve Station Status: The Sludge Valve Station actuators will be set by the operator as follows: normally close the valve actuators to the Digester (102-AC-3 and 102-AC-1) and normally open the valves to the Combined Thickened Sludge (102-AC-4 and 102-AC-2). This will direct the Thickened Primary Sludge from the new Salnes Filters and the Thickened Waste Activated Sludge from the existing WAS Thickeners into a single Combined Thickened Sludge Line that feeds to the South Biosolids Blend Tank.
- c. Primary Anaerobic Digester – Manual Valve Adjustments: Operators will open and close the following valves located in the lower level gallery of the Anaerobic Digester to feed anaerobic digested sludge directly to the suction piping of the Dewatering Feed Pump Station: Open 6-inch Plug Valve (107-V-1) and Close 6-inch Plug Valves (107-V-2) and (107-V-4) to allow digested sludge to be transferred from the existing digester supernatant transfer (6-DTS) line into the 6-inch waste sludge (6-WS) line. The existing 6-WS line becomes the new 8-inch anaerobic sludge pipe (8-inch-ADIG-1) that feeds the Storage and Blend Tanks.

9. Pump Logic Status and Alarm Annunciation:

- a. The Truck Off-Loading Pumps will receive the following alarms:
  - (1) The South Biosolids Blending Tank High Level.

- b. The Digester Feed Pumps will receive the following alarms:
  - (1) The South Biosolids Blending Tank Low Level.
  - (2) The Primary Anaerobic Digester High Level.
  
- c. The Dewatering Feed Pumps will receive the following alarms:
  - (1) Primary Anaerobic Digester Low Level.
  - (2) The Dewatering Equipment (Centrifuge and/or Belt Filter Press – Shutdown Alarm).

- G. Introduction to Control Description: The purpose of the control strategy is to provide a detailed description of the control, monitoring and alarm functional requirements associated with each process loop for the Plant's control system (PCS) to operate the following processes:

No.	Control Strategy Description
100	Diversion Valves
200	Sludge Storage
300	Sludge Dewatering Feed System
400	Digester Feed System
500	Truck Loading

- 1. Diversion Valves:
  - a. The four (4) diversion valves 102-AC-1, 2, 3, and 4 shall be controlled manually from the SCADA system or locally. The sequence of operations shall be as follows:
    - (1) Local Control:
      - (a) The operator sets the LOCAL/REMOTE selector switch at the respective actuator to the LOCAL position.
      - (b) The operator sets the OPEN/OFF/CLOSED in the desired position.
      - (c) Status:
        - i. Open.
        - ii. Closed.

(d) Alarms:

i. Actuator High Torque.

(e) Interlocks:

i. None.

(f) Historical:

i. Record position, time stamp all status and alarms.

(2) Remote Control:

(a) The operator sets the LOCAL/REMOTE selector switch at the respective actuator to the REMOTE position.

(b) The operator sets the HMI actuator to the desired position.

(c) Status:

i. Open.  
ii. Closed.

(d) Alarms:

i. Actuator High Torque.  
ii. No Flow.

(e) Interlocks:

i. Confirm Tank Levels.  
ii. Confirm Grinder 110-G-1 Operation.  
iii. Confirm Flow.

(f) Historical:

i. Record position, time stamp all status and alarms.

2. Sludge Storage:

- a. One vertical Hyperboloid-body ragless type impeller mixer will be located in each of the North Biosolids Blend Tank and South Sludge Dewatering Tanks. The mixers will be controlled by Manufacturer's Control Panel located at each unit. Tank mixers are single speed with continual operation. Each mixer will have a local panel with H/O/A switch. In Automatic (A) the mixer runs based on input from SCADA. In Hand the unit is operated locally by Operations Staff.
- b. The two sludge storage tanks 110-T-1 and 110-T-2 with mixers 110-M-1 and 110-M-2 shall be monitored and controlled from the SCADA system or locally. The sequence of operations shall be as follows:

(1) Mixer Local Manual:

- (a) The operator sets the HAND/OFF/REMOTE selector switch at the respective mixer to the HAND position.
- (b) Status:
  - i. Mixer Run.
  - ii. Mixer in Hand.
- (c) Alarms:
  - i. Mixer Trouble.
- (d) Interlocks:
  - i. None.
- (e) Historical:
  - i. Record run time, status, and alarms.

(2) Mixer Remote Control:

- (a) The operator sets the HAND/OFF/REMOTE selector switch at the respective mixer to the REMOTE position.

- (b) The operator sets the HMI, ON/OFF selector switch to the desired position.
  - (c) Status:
    - i. Mixer Run.
    - ii. Mixer in Remote.
  - (d) Alarms:
    - i. Mixer Trouble.
  - (e) Interlocks:
    - i. Confirm Tank Levels.
  - (f) Historical:
    - i. Record run time, status, and alarms.
- (3) Storage Tanks:
- (a) The SCADA system shall monitor each sludge storage tank.
  - (b) Status:
    - i. Tank Level.
  - (c) Alarms:
    - i. Tank Impeding High Level (Operator Adjustable).
    - ii. Tank Impeding Low Level (Operator Adjustable).
    - iii. Tank Emergency High Level (Float).
    - iv. Tank Impeding Low Level (Float).
  - (d) Interlocks:
    - i. Close Fill Valve on High Level.
    - ii. Shut Down Pumps on Low Level.

- (e) Historical:
- i. Record level, status, and alarms.
3. Sludge Dewatering Feed System:
- a. A total of four progressing cavity pumps, three dedicated and one back-up, are proposed. The pumps will be controlled with Variable Frequency Drives (VFDs) to allow the pump to handle variations in sludge flows. The VFD will be controlled by the selected dewatering system chosen for that pump (Centrifuge Control Panel (CP); Belt Filter Press No. 1 CP or Belt Filter Press No. 2 CP). The Operators Staff will manually select and operate which pumps will be used with which dewatering system. Any of the progressing cavity pumps will be capable of pumping to any of the dewatering processes (Belt Filter Press No. 1, Belt Filter Press No. 2, or Centrifuge) through manual manipulation of the valves and selection on the HMIs of each dewatering system control panel. The four (4) sludge dewatering feed pumps 103-P-1,2,3,4 shall be monitored and controlled from the SCADA system or locally. The sequence of operations shall be as follows:
- (1) Local VFD Manual:
    - (a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the LOCAL position.
    - (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the REMOTE position.
    - (c) The operator at the VFD sets the ON/OFF selector switch in the desired position.
    - (d) Status:
      - i. Pump Run.
      - ii. Pump in REMOTE.
      - iii. Pump Speed.
      - iv. Pump in HAND.

(e) Alarms:

- i. VFD Trouble.
- ii. Motor High Temp.
- iii. Pump High Temp.
- iv. Pump High Pressure.

(f) Interlocks:

- i. Off position at motor HOA will not allow pump to start.

(g) Historical:

- i. Record run time, status, and alarms.

(2) Local Manual at Motor:

(a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the REMOTE position.

(b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the HAND position. Pump will start a preset speed programed at the VFD.

(c) Status:

- i. Pump Run.
- ii. Pump in REMOTE.
- iii. Pump Speed.
- iv. Pump in HAND.

(d) Alarms:

- i. VFD Trouble.
- ii. Motor High Temp.
- iii. Pump High Temp.
- iv. Pump High Pressure.

(e) Interlocks:

- i. In REMOTE at VFD.

(f) Historical:

- i. Record run time, status, and alarms.

(3) Remote Control at Dewatering Equipment:

(a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the REMOTE position.

(b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the REMOTE position.

(c) Status:

- i. Pump Run.
- ii. Pump in REMOTE.
- iii. Pump Speed.
- iv. Pump in REMOTE.

(d) Alarms:

- i. VFD Trouble.
- ii. Motor High Temp.
- iii. Pump High Temp.
- iv. Pump High Pressure.

(e) Interlocks:

- i. OFF position of field selector switches will not allow pump to start.
- ii. If the liquid level in the Sludge Storage (Primary) and Blend Tank is at the Low Level the pump will be turned off and a signal will be initiated indicating that the pump was turned off due to the low liquid level in the Sludge Storage and Blend Tank. This will signal an alarm to the selected dewatering system control panel to shutdown due to low tank level.
- iii. The dewatering feed pumps will only be controlled as called for by the selected and

- associated dewatering equipment specific for each pump (Belt Filter Press No. 1, Belt Filter Press No. 2, and Centrifuge).
- iv. If there is a failure at the respective belt filter press or centrifuge: the pumps will immediately turn-off.
- v. The dry running protection devices or high pressure equipped by the manufacturer will also be able to turn the pumps off.

(f) Historical:

- i. Record run time, status, and alarms.

4. Digester Feed System:

- a. The Anaerobic Digester Feed Pump Station consists of two progressing cavity pumps, one primary and one back-up, with space for one additional pump in the future. The pumps will be controlled with SCADA and Variable Frequency Drives (VFDs) to allow the operations staff to set the daily blended sludge volume and flow (gpm) to feed to the Primary Anaerobic Digester. The blended sludge flow and rate feed to the Digester will be measured by a magnetic flow meter. The goal is to provide continuous feed of blended sludge to the anaerobic digester over a 24-hour period to eliminate foaming, improve volatile solids destruction / stabilization, and increase digester gas production. The operations staff will choose the daily volume of blended sludge to be pumped the Primary Anaerobic Digestor and select the corresponding 24-hour Digester Feed Pump flow rate and operating times to be set and then the pump will be automatically controlled by the SCADA system. The SCADA will record the flow rate (gpm), daily volume of blended sludge pumped (gallons) and shut-off the pump when the selected daily volume is reached. The pump will automatically re-start and stop each day to pump the selected sludge volume. The two sludge dewatering feed pumps 102-P-1 and 2 shall be monitored and controlled from the SCADA system or locally. The sequence of operations shall be as follows:

(1) Local VFD Manual:

- (a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the LOCAL position.

- (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the REMOTE position.
  - (c) The operator at the VFD sets the ON/OFF selector switch in the desired position.
  - (d) Status:
    - i. Pump Run.
    - ii. Pump in REMOTE.
    - iii. Pump Speed.
    - iv. Pump in HAND.
  - (e) Alarms:
    - i. VFD Trouble.
    - ii. Motor High Temp.
    - iii. Pump High Temp.
    - iv. Pump High Pressure.
  - (f) Interlocks:
    - i. Off position at motor HOA will not allow pump to start.
  - (g) Historical:
    - i. Record run time, status, and alarms.
- (2) Local Manual at Motor:
- (a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the REMOTE position.
  - (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the HAND position. Pump will start a preset speed programed at the VFD.

- (c) Status:
    - i. Pump Run.
    - ii. Pump in REMOTE.
    - iii. Pump Speed.
    - iv. Pump in HAND.
  - (d) Alarms:
    - i. VFD Trouble.
    - ii. Motor High Temp.
    - iii. Pump High Temp.
    - iv. Pump High Pressure.
  - (e) Interlocks:
    - i. In REMOTE at VFD.
  - (f) Historical:
    - i. Record run time, status, and alarms.
- (3) Remote Control from SCADA:
- (a) The operator sets the LOCAL/REMOTE selector switch at the respective VFD to the REMOTE position.
  - (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the REMOTE position.
  - (c) Operations staff selects which Tank (North Biosolids Blend Tank (Primary) or South Dewatering Storage Tank (Backup) will act as the Biosolids Blank Tank).
  - (d) Operations staff selects which pump will operate and number of pumps in-service.
  - (e) Operations staff inputs/ selects daily volume of blended sludge to pump to Primary Anaerobic Digester (gallons/day) – Range: 40,000 to 100,000 gals/day.

- (f) SCADA calculates a 24-hour pump flow rate (gpm) – e.g.: 60,000 gals/day ÷ 1,440 min/day = 42 gals/min.
- (g) Based on pump curve and allowable minimum pump speed input during integrations, SCADA calculates pump speed (rpm) and selected drive speed (Hz). Operator accepts or giving option to select a set a different operating speed (rpm).
- (h) Status:
  - i. Pump Run.
  - ii. Pump in REMOTE.
  - iii. Pump Speed.
  - iv. Pump in REMOTE.
- (i) Alarms:
  - i. VFD Trouble.
  - ii. Motor High Temp.
  - iii. Pump High Temp.
  - iv. Pump High Pressure.
  - v. Anaerobic Digester High Level..
- (j) Interlocks:
  - i. OFF position of any field selector switches will not allow pump to start.
  - ii. Low Level Sludge Storage and Blend Tank Shut Off (Depending on Tank In-Service).
  - iii. The dry running protection devices or high pressure equipped by the manufacturer will also be able to turn the pumps off.
  - iv. High or High-High Primary Anaerobic Digester Tank Level Shut Off (Existing SCADA monitoring and recording signal).
- (k) Historical:
  - i. Record run time, status, and alarms.

ii. Flow from Flow Meter:

- a. Total Gallons per Day (gpm/day) – Blended Sludge Pumped to Primary Anaerobic Digester.
- b. Flow rate set in SCADA and flow rate measured (gpm).
- c. Pump start / stop times to pump selected daily sludge volume (as applicable if pump needs to start and stop every hour to pump low flow volumes at allowable minimum pump speed).
- d. Continuously monitor and record tank level (feet) and volume (gallons) in the North Biosolids Blend Tank and South Dewatering Tank.

5. Truck Loading:

- a. A total of two progressing cavity pumps, one primary and one back-up, are proposed. Pumps are constant speed and will have a local control station at the pumps to allow truck haulers to Start/Stop pumps. The local station will be integrated into the SCADA system for monitoring, alarm annunciation and recording. The pump will be operated based on Start/Stop push buttons at the local control station. An HMI installed at the local control station will allow monitoring of a magnetic flow meter integrated into the SCADA system will record total volume, in gallons per event (date and time) discharged from the trucks. The total volume, time, and date of each off-loading will be recorded and saved in the SCADA system as well as displayed at the HMI. If Sludge Blend Tank is at high level as determined by the ultrasonic level control in the tank, the off-loading authorization will not be granted, and the pump will not be able to be turned on and the HMI will display “Tank at High Level Contact Operations Staff”. The sequence of operation is as follows:

(1) Local MCC Manual:

- (a) The operator sets the HAND/OFF/REMOTE selector switch at the motor control center to the HAND position.

- (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the HAND position.
  - (c) Status:
    - i. Pump Run.
    - ii. Pump in REMOTE.
  - (d) Alarms:
    - i. Motor High Temp.
  - (e) Historical:
    - i. Record run time, status, and alarms.
- (2) Local Manual at Motor:
- (a) The operator sets the HAND/OFF/REMOTE selector switch at the motor control center to the HAND position.
  - (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the HAND position.
  - (c) Status:
    - i. Pump Run.
    - ii. Pump in REMOTE.
  - (d) Alarms:
    - i. Motor High Temp.
  - (e) Historical:
    - i. Record run time, status, and alarms.
- (3) Remote Control at Truck Loading:
- (a) The operator sets the HAND/OFF/REMOTE selector switch at the motor control center to the REMOTE position.

- (b) The operator sets the HAND/OFF/REMOTE selector switch at the motor to the REMOTE position.
- (c) Operations staff selects which pump is in-service.
- (d) Operations staff selects which Tank is in-service (Primary-North Blend Tank).
- (e) Status:
  - i. Pump Run.
  - ii. Pump in MCC REMOTE.
  - iii. Pump Speed.
  - iv. Pump in Motor REMOTE.
- (f) Alarms:
  - i. Motor High Temp.
  - ii. Pump High Temp.
  - iii. Pump High Pressure.
- (g) Interlocks:
  - i. OFF position of field selector switches will not allow pump to start.
  - ii. Start /Stop push button to be controlled by Truck Hauler for pump start operation and stop button to be pushed when truck is empty.
  - iii. Lock-out if Sludge Storage and Blend Tank has insufficient volume based on tank high level annunciation and notification on HMI Screen.
  - iv. Locks-out after a specified elapse time (adjustable by plant staff only).
  - v. Pump off and lock-out if liquid level reaches the high-high level in the Sludge Storage and Blend Tank.

- vi. Magnetic Flow Meter and Indicating Transmitter (FE/FIT 500) to read the following:
  - a. Truck Off-Load Event: Event No. / Gallons Per Truck Off-Load (Gals)/ Date/Time.
  - b. Totalizer: Gallons.
- vii. Tank Levels for North Blend and South Dewatering Storage Tanks (LIT 201 and LIT 202).

(h) Historical:

- i. Record run time, status, and alarms
- ii. Flow Gallons Per Truck Off-Load (Gals)/ Date/Time.

### 3.05 ATTACHMENTS

A. Attachments listed below, following “END OF SECTION,” are part of this Section.

- 1. Table 13316-1, PLC-PB I/O Schedule.
- 2. Table 13316-2, PLC-DG I/O Schedule.

END OF SECTION

**Table 13316-1**  
**PLC-PB I/O Schedule**

Table 13316-1  
PLC-PB I/O SCHEDULE

Description	ISA Tag	Type	Signal	Range/ N.O. Status	Units/ N.C. Status	Field Wiring		Specification Section	Remarks
						ISA Signal Source Design.	Signal Source Device		
<b>Process 200 Blend Tanks</b>									
Mixer #1 Run Status	YIQR-201	DI	Form C	Stopped	Running	YS-201	200-LCP-1	11228	EVT, CRT, DRT,DSC
Mixer #1 Trouble	YAR-201B	DI	Form C	Normal	Alarm	YS-201B	200-LCP-1	11228	EVT
Mixer #1 In Auto	ZS-201	DI	Form C	Normal	Auto	ZS-201	200-LCP-1	11228	EVT
Mixer #1 In Hand	ZS-201B	DI	Form C	Normal	Hand	ZS-201B	200-LCP-1	11228	EVT
Mixer #1 Motor Fail	EUIR-201	DI	Form C	Normal	Alarm	ES-201	200-LCP-1	11228	EVT
Mixer #1 Command	YCC-201	DO	Form C	Normal	Open	YS-201	PLC-PB	13401	
North Blend Tank Level	LI-201	AI	4-20mA	0-30	ft.in	LT-201	LIT-201	13401	EVT
North Blend Tank High Level	LAH-201	DI	Form C	Normal	Alarm	LSH-201	LSH-201	13401	EVT
North Blend Tank Low Level	LAL-201	DI	Form C	Normal	Alarm	LSL-201	LSL-201	13401	EVT
<b>Mixer #2 Run Status</b>									
Mixer #2 Trouble	YIQR-202	DI	Form C	Stopped	Running	YS-202	200-LCP-1	11228	EVT, CRT, DRT,DSC
Mixer #2 Motor Fail	YAR-202B	DI	Form C	Normal	Alarm	YS-202B	200-LCP-1	11228	EVT
Mixer #2 In Auto	ZS-202	DI	Form C	Normal	Auto	ZS-202	200-LCP-1	11228	EVT
Mixer #2 In Hand	ZS-202B	DI	Form C	Normal	Hand	ZS-202B	200-LCP-1	11228	EVT
Mixer #2 Command	EUIR-202	DI	Form C	Normal	Alarm	ES-202	200-LCP-1	11228	EVT
Mixer #2 Run Status	YCC-202	DO	Form C	Normal	Open	YS-202	PLC-PB	13401	
South Blend Tank Level	LI-202	AI	4-20mA	0-30	ft.in	LT-202	LIT-202	13401	EVT
South Blend Tank High Level	LAH-202	DI	Form C	Normal	Alarm	LSH-202	LSH-202	13401	EVT
South Blend Tank Low Level	LAL-202	DI	Form C	Normal	Alarm	LSL-202	LSL-202	13401	EVT
Grinder #1 Run Status	YIQR-110A	ENET	ENET	Stopped	Running	YS-110A	110-LCP-1	11330	EVT, CRT, DRT,DSC
Grinder #1 Trouble	YAR-110B	ENET	ENET	Normal	Alarm	YS-110B	110-LCP-1	11330	EVT
Grinder #1 In Auto	ZS-110A	ENET	ENET	Normal	Auto	ZS-110A	110-LCP-1	11330	EVT
Grinder #1 In Hand	ZS-110B	ENET	ENET	Normal	Hand	ZS-110B	110-LCP-1	11330	EVT
Grinder #1 Motor Fail	EUIR-110A	ENET	ENET	Normal	Alarm	ES-110A	110-LCP-1	11330	EVT
<b>Process 300 Dewatering Feed Pumps</b>									
Feed Pump #1 Run Status	YIQR-301	ENET	ENET	Stopped	Running	YS-301	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #1 VFD Manual	ZS-301A	ENET	ENET	Normal	Manual	ZS-301A	VFD	16370	EVT
Feed Pump #1 VFD Remote	ZS-301B	ENET	ENET	Normal	Remote	ZS-301B	VFD	16370	EVT
Feed Pump #1 VFD Trouble	YA-301A	ENET	ENET	Normal	Alarm	YS-301A	VFD	16370	EVT
Feed Pump #1 Motor High Temperature	TAH-301	ENET	ENET	Normal	Alarm	TS-301	VFD	11356	EVT
Feed Pump #1 Motor Overload	EUA-301	ENET	ENET	Normal	Alarm	ES-301	VFD	16370	EVT
Feed Pump #1 Speed Feedback	SI-301	ENET	ENET	0-100	%	SR-301	VFD	16370	MN, MX,MA
Feed Pump #1 Speed Control	SC-301	ENET	ENET	0-100	%	ST-301	VFD	13401	MN, MX,MA
Feed Pump #1 Run Command	YC-301	ENET	ENET	Start	Stop	YS-301	VFD	13401	EVT
Feed Pump #1 Pressure	PA-301	ENET	ENET	0-25	psi	PS-301	VFD	11356	MN, MX,MA
Feed Pump #1 Temperature	TI-301	ENET	ENET	0-200	F	TS-301	VFD	11356	MN, MX,MA
Feed Pump #1 Local Em. Stop	ZS-301C	DI	Form C	Normal	Stop	ZS-301C	HS-301	16050	EVT
Feed Pump #1 Local Remote	ZS-301D	DI	Form C	Normal	Remote	ZS-301D	HS-301	16050	EVT
Feed Pump #2 Run Status	YIQR-302	ENET	ENET	Stopped	Running	YS-302	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #2 VFD Manual	ZS-302A	ENET	ENET	Normal	Manual	ZS-302A	VFD	16370	EVT
Feed Pump #2 VFD Remote	ZS-302B	ENET	ENET	Normal	Remote	ZS-302B	VFD	16370	EVT
Feed Pump #2 VFD Trouble	YA-302A	ENET	ENET	Normal	Alarm	YS-302A	VFD	16370	EVT
Feed Pump #2 Motor High Temperature	TAH-302	ENET	ENET	Normal	Alarm	TS-302	VFD	11356	EVT
Feed Pump #2 Motor Overload	EUA-302	ENET	ENET	Normal	Alarm	ES-302	VFD	16370	EVT
Feed Pump #2 Speed Feedback	SI-302	ENET	ENET	0-100	%	SR-302	VFD	16370	MN, MX,MA
Feed Pump #2 Speed Control	SC-302	ENET	ENET	0-100	%	ST-302	VFD	13401	MN, MX,MA
Feed Pump #2 Run Command	YC-302	ENET	ENET	Start	Stop	YS-302	VFD	13401	EVT
Feed Pump #2 Pressure	PA-302	ENET	ENET	0-25	psi	PS-302	VFD	11356	MN, MX,MA
Feed Pump #2 Temperature	TI-302	ENET	ENET	0-200	F	TS-302	VFD	11356	MN, MX,MA
Feed Pump #2 Local Em. Stop	ZS-302C	DI	Form C	Normal	Stop	ZS-302C	HS-302	16050	EVT
Feed Pump #2 Local Remote	ZS-302D	DI	Form C	Normal	Remote	ZS-302D	HS-302	16050	EVT
Feed Pump #3 Run Status	YIQR-303	ENET	ENET	Stopped	Running	YS-303	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #3 VFD Manual	ZS-303A	ENET	ENET	Normal	Manual	ZS-303A	VFD	16370	EVT
Feed Pump #3 VFD Remote	ZS-303B	ENET	ENET	Normal	Remote	ZS-303B	VFD	16370	EVT
Feed Pump #3 VFD Trouble	YA-303A	ENET	ENET	Normal	Alarm	YS-303A	VFD	16370	EVT
Feed Pump #3 Motor High Temperature	TAH-303	ENET	ENET	Normal	Alarm	TS-303	VFD	11356	EVT
Feed Pump #3 Motor Overload	EUA-303	ENET	ENET	Normal	Alarm	ES-303	VFD	16370	EVT
Feed Pump #3 Speed Feedback	SI-303	ENET	ENET	0-100	%	SR-303	VFD	16370	MN, MX,MA
Feed Pump #3 Speed Control	SC-303	ENET	ENET	0-100	%	ST-303	VFD	13401	MN, MX,MA
Feed Pump #3 Run Command	YC-303	ENET	ENET	Start	Stop	YS-303	VFD	13401	EVT
Feed Pump #3 Pressure	PA-303	ENET	ENET	0-25	psi	PS-303	VFD	11356	MN, MX,MA
Feed Pump #3 Temperature	TI-303	ENET	ENET	0-200	F	TS-303	VFD	11356	MN, MX,MA
Feed Pump #3 Local Em. Stop	ZS-303C	DI	Form C	Normal	Stop	ZS-303C	HS-303	16050	EVT
Feed Pump #3 Local Remote	ZS-303D	DI	Form C	Normal	Remote	ZS-303D	HS-303	16050	EVT
Feed Pump #4 Run Status	YIQR-304	ENET	ENET	Stopped	Running	YS-304	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #4 VFD Manual	ZS-304A	ENET	ENET	Normal	Manual	ZS-304A	VFD	16370	EVT
Feed Pump #4 VFD Remote	ZS-304B	ENET	ENET	Normal	Remote	ZS-304B	VFD	16370	EVT
Feed Pump #4 VFD Trouble	YA-304A	ENET	ENET	Normal	Alarm	YS-304A	VFD	16370	EVT
Feed Pump #4 Motor High Temperature	TAH-304	ENET	ENET	Normal	Alarm	TS-304	VFD	11356	EVT
Feed Pump #4 Motor Overload	EUA-304	ENET	ENET	Normal	Alarm	ES-304	VFD	16370	EVT
Feed Pump #4 Speed Feedback	SI-304	ENET	ENET	0-100	%	SR-304	VFD	16370	MN, MX,MA

Table 13615-1  
PLC-PB I/O SCHEDULE

Description	ISA Tag	Type	Signal	Range/ N.O. Status	Units/ N.C. Status	Field Wiring		Specification Section	Remarks
						ISA Signal Source Design.	Signal Source Device		
Feed Pump #4 Speed Control	SC-304	ENET	ENET	0-100	%	ST-304	VFD	13401	MN, MX, MA
Feed Pump #4 Run Command	YC-304	ENET	ENET	Start	Stop	YS-304	VFD	13401	EVT
Feed Pump #4 Pressure	PA-304	ENET	ENET	0-25	psi	PS-304	VFD	11356	MN, MX, MA
Feed Pump #4 Temperature	TI-304	ENET	ENET	0-200	F	TS-304	VFD	11356	MN, MX, MA
Feed Pump #4 Local Em. Stop	ZS-304C	DI	Form C	Normal	Stop	ZS-304C	HS-304	16050	EVT
Feed Pump #4 Local Remote	ZS-304D	DI	Form C	Normal	Remote	ZS-304D	HS-304	16050	EVT
Valve 130-ZS-1 Open Status	ZI-301	DI	Form C	Normal	Open	ZSC-301	130-ZS-1	15110	EVT
Valve 130-ZS-1 Closed Status	ZO-301	DI	Form C	Normal	Closed	ZSO-301	130-ZS-1	15110	EVT
Valve 130-ZS-2 Open Status	ZI-302	DI	Form C	Normal	Open	ZSC-302	130-ZS-2	15110	EVT
Valve 130-ZS-2 Closed Status	ZO-302	DI	Form C	Normal	Closed	ZSO-302	130-ZS-2	15110	EVT
Valve 130-ZS-3 Open Status	ZI-303	DI	Form C	Normal	Open	ZSC-303	130-ZS-3	15110	EVT
Valve 130-ZS-3 Closed Status	ZO-303	DI	Form C	Normal	Closed	ZSO-303	130-ZS-3	15110	EVT
Valve 130-ZS-4 Open Status	ZI-304	DI	Form C	Normal	Open	ZSC-304	130-ZS-4	15110	EVT
Valve 130-ZS-4 Closed Status	ZO-304	DI	Form C	Normal	Closed	ZSO-304	130-ZS-4	15110	EVT
Valve 130-ZS-5 Open Status	ZI-305	DI	Form C	Normal	Open	ZSC-305	130-ZS-5	15110	EVT
Valve 130-ZS-5 Closed Status	ZO-305	DI	Form C	Normal	Closed	ZSO-305	130-ZS-5	15110	EVT
Valve 130-ZS-6 Open Status	ZI-306	DI	Form C	Normal	Open	ZSC-306	130-ZS-6	15110	EVT
Valve 130-ZS-6 Closed Status	ZO-306	DI	Form C	Normal	Closed	ZSO-306	130-ZS-6	15110	EVT
Valve 130-ZS-7 Open Status	ZI-307	DI	Form C	Normal	Open	ZSC-307	130-ZS-7	15110	EVT
Valve 130-ZS-7 Closed Status	ZO-307	DI	Form C	Normal	Closed	ZSO-307	130-ZS-7	15110	EVT
Valve 130-ZS-8 Open Status	ZI-308	DI	Form C	Normal	Open	ZSC-308	130-ZS-8	15110	EVT
Valve 130-ZS-8 Closed Status	ZO-308	DI	Form C	Normal	Closed	ZSO-308	130-ZS-8	15110	EVT
Valve 130-ZS-9 Open Status	ZI-309	DI	Form C	Normal	Open	ZSC-309	130-ZS-9	15110	EVT
Valve 130-ZS-9 Closed Status	ZO-309	DI	Form C	Normal	Closed	ZSO-309	130-ZS-9	15110	EVT
Valve 130-ZS-9 Open Status	ZI-310	DI	Form C	Normal	Open	ZSC-310	130-ZS-10	15110	EVT
Valve 130-ZS-9 Closed Status	ZO-310	DI	Form C	Normal	Closed	ZSO-310	130-ZS-10	15110	EVT
<b>Process 400 Digester Feed Pumps</b>									
Feed Pump #1 Run Status	YIQR-401	ENET	ENET	Stopped	Running	YS-401	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #1 VFD Manual	ZS-401A	ENET	ENET	Normal	Manual	ZS-401A	VFD	16370	EVT
Feed Pump #1 VFD Remote	ZS-401B	ENET	ENET	Normal	Remote	ZS-401B	VFD	16370	EVT
Feed Pump #1 VFD Trouble	YA-401A	ENET	ENET	Normal	Alarm	YS-401A	VFD	16370	EVT
Feed Pump #1 Motor High Temperature	TAH-401	ENET	ENET	Normal	Alarm	TS-401	VFD	11356	EVT
Feed Pump #1 Motor Overload	EUA-401	ENET	ENET	Normal	Alarm	ES-401	VFD	16370	EVT
Feed Pump #1 Speed Feedback	SI-401	ENET	ENET	0-100	%	SR-401	VFD	16370	MN, MX, MA
Feed Pump #1 Speed Control	SC-401	ENET	ENET	0-100	%	ST-401	VFD	13401	MN, MX, MA
Feed Pump #1 Run Command	YC-401	ENET	ENET	Start	Stop	YS-401	VFD	13401	EVT
Feed Pump #1 Pressure	PA-401	ENET	ENET	0-25	psi	PS-401	VFD	11356	MN, MX, MA
Feed Pump #1 Temperature	TI-401	ENET	ENET	0-200	F	TS-401	VFD	11356	MN, MX, MA
Feed Pump #1 Local Em. Stop	ZS-401C	DI	Form C	Normal	Stop	ZS-401C	HS-401	16050	EVT
Feed Pump #1 Local Remote	ZS-401D	DI	Form C	Normal	Remote	ZS-401D	HS-401	16050	EVT
Feed Pump #2 Run Status	YIQR-402	ENET	ENET	Stopped	Running	YS-402	VFD	16370	EVT, CRT, DRT, DSC
Feed Pump #2 VFD Manual	ZS-402A	ENET	ENET	Normal	Manual	ZS-402A	VFD	16370	EVT
Feed Pump #2 VFD Remote	ZS-402B	ENET	ENET	Normal	Remote	ZS-402B	VFD	16370	EVT
Feed Pump #2 VFD Trouble	YA-402A	ENET	ENET	Normal	Alarm	YS-402A	VFD	16370	EVT
Feed Pump #2 Motor High Temperature	TAH-402	ENET	ENET	Normal	Alarm	TS-402	VFD	11356	EVT
Feed Pump #2 Motor Overload	EUA-402	ENET	ENET	Normal	Alarm	ES-402	VFD	16370	EVT
Feed Pump #2 Speed Feedback	SI-402	ENET	ENET	0-100	%	SR-402	VFD	16370	MN, MX, MA
Feed Pump #2 Speed Control	SC-402	ENET	ENET	0-100	%	ST-402	VFD	13401	MN, MX, MA
Feed Pump #2 Run Command	YC-402	ENET	ENET	Start	Stop	YS-402	VFD	13401	EVT
Feed Pump #2 Pressure	PA-402	ENET	ENET	0-25	psi	PS-402	VFD	11356	MN, MX, MA
Feed Pump #2 Temperature	TI-402	ENET	ENET	0-200	F	TS-402	VFD	11356	MN, MX, MA
Feed Pump #2 Local Em. Stop	ZS-402C	DI	Form C	Normal	Stop	ZS-402C	HS-402	16050	EVT
Feed Pump #2 Local Remote	ZS-402D	DI	Form C	Normal	Remote	ZS-402D	HS-402	16050	EVT
Digester Flow	FIQR-400	AI	4-20mA	0-600	gpm/MGD	FIT-400	FIT-400	13401	MN, MX, HH, LL
Grinder #2 Run Status	YIQR-410A	ENET	ENET	Stopped	Running	YS-410A	410-LCP-1	11330	EVT, CRT, DRT, DSC
Grinder #2 Trouble	YAR-410B	ENET	ENET	Normal	Alarm	YS-410B	410-LCP-1	11330	EVT
Grinder #2 In Auto	ZS-410A	ENET	ENET	Normal	Auto	ZS-410A	410-LCP-1	11330	EVT
Grinder #2 In Hand	ZS-410B	ENET	ENET	Normal	Hand	ZS-410B	410-LCP-1	11330	EVT
Grinder #2 Motor Fail	EUIR-410A	ENET	ENET	Normal	Alarm	ES-410A	410-LCP-1	11330	EVT
<b>Process 500 Truck Loading Pumps</b>									
Loading Pump #1 Run Status	YIQR-501	DI	ENET	Stopped	Running	YS-501	MCC	16921	EVT, CRT, DRT, DSC
Loading Pump #1 MCC Manual	ZS-501A	DI	ENET	Normal	Manual	ZS-501A	MCC	16921	EVT
Loading Pump #1 MCC Remote	ZS-501B	DI	ENET	Normal	Remote	ZS-501B	MCC	16921	EVT
Loading Pump #1 MCC Trouble	YA-501A	DI	ENET	Normal	Alarm	YS-501A	MCC	16921	EVT
Loading Pump #1 Run Command	YC-501	DO	ENET	Start	Stop	YS-501	MCC	13401	EVT
Loading Pump #1 Pressure	PA-501	DI	ENET	0-25	psi	PS-501	MCC	11356	MN, MX, MA
Loading Pump #1 Temperature	TI-501	DI	ENET	0-200	F	TS-501	MCC	11356	MN, MX, MA
Loading Pump #1 Local Em. Stop	ZS-501C	DI	Form C	Normal	Stop	ZS-501C	HS-501	16050	EVT
Loading Pump #1 Local Remote	ZS-501D	DI	Form C	Normal	Remote	ZS-501D	HS-501	16050	EVT
Loading Pump #2 Run Status	YIQR-502	DI	ENET	Stopped	Running	YS-502	MCC	16921	EVT, CRT, DRT, DSC
Loading Pump #2 MCC Manual	ZS-502A	DI	ENET	Normal	Manual	ZS-502A	MCC	16921	EVT
Loading Pump #2 MCC Remote	ZS-502B	DI	ENET	Normal	Remote	ZS-502B	MCC	16921	EVT
Loading Pump #2 MCC Trouble	YA-502A	DI	ENET	Normal	Alarm	YS-502A	MCC	16921	EVT
Loading Pump #2 Run Command	YC-502	DO	ENET	Start	Stop	YS-502	MCC	13401	EVT

Table 13615-1  
PLC-PB I/O SCHEDULE

Description	ISA Tag	Type	Signal	Range/ N.O. Status	Units/ N.C. Status	Field Wiring		Specification Section	Remarks
						ISA Signal Source Design.	Signal Source Device		
Loading Pump #2 Pressure	PA-502	DI	ENET	0-25	psi	PS-502	MCC	11356	MN, MX, MA
Loading Pump #2 Temperature	TI-502	DI	ENET	0-200	F	TS-502	MCC	11356	MN, MX, MA
Loading Pump #2 Local Em. Stop	ZS-502C	DI	Form C	Normal	Stop	ZS-502C	HS-502	16050	EVT
Loading Pump #2 Local Remote	ZS-502D	DI	Form C	Normal	Remote	ZS-502D	HS-502	16050	EVT
Truck Loading Flow	FIQR-500	AI	4-20mA	0-600	gpm/MGD	FIT-400	FIT-400	13401	MN, MX, HH, LL
Truck Driver Start Comand	YC-503A	DI	Form C	Normal	Start	YS-503A	101-LCP-3	13401	
Truck Driver Stop Comand	YC-503B	DI	Form C	Normal	Stop	YS-503B	101-LCP-3	13401	

**Abbreviations:**

Confirm all I/O locations with the Contractor and approved shop drawings before submitting I&C for review and approvals  
 Provide 10% spare I/O of each type including  
 programming services typical for status or alarm for all spare DI, process indication, trending and historical database  
 for typical spare AI, and typical interlocking for all spare DO, plus retransmit for all spare AO. Wire all spares to field terminal block.

MCC	Motor Control Center	MX	Daily Maximum	BTCP
MA	Daily Average	MN	Daily Minimum	GCP
DT	Daily Flow Total	HH	High Limit Alarm	EFD
CT	Continuous Flow Total	LL	Low Limit Alarm	DSC
DRT	Daily Run Time	DI	Discrete Input	PU
CRT	Continuous Run Time	DO	Discrete Output	LSW
Form C	Dry Contact Form C*	AI	Analog Input	ENET
EVT	Log Events of Status Change	AO	Analog Output	LPMR
SSS	Solid State Starter	SD	Smoke Detector	DTCP
PM	Power Meter			LCP

**Table 13316-2**  
**PLC-DG I/O Schedule**

Table 13316-2  
PLC-DG I/O SCHEDULE

Description	ISA Tag	Type	Signal	Range/ N.O. Status	Units/ N.C. Status	Field Wiring		Specification Section	Remarks
						ISA Signal Source Design.	Signal Source Device		
<b>Process 100 Flow Diversion</b>									
Control Valve 102-AC-1 Open Run Status	ZSOR-100A	DI	Form C	Normal	Open	ZS-100A	102-AC-1	15120	EVT
Control Valve 102-AC-1 Close Run Status	ZSCR-100A	DI	Form C	Normal	Closed	ZS-100A	102-AC-1	15120	EVT
Control Valve 102-AC-1 "In Remote"	ZSR-100A	DI	Form C	Normal	In Remote	ZS-100A	102-AC-1	15120	EVT
Control Valve 102-AC-1 Failure	WAIR-100A	DI	Form C	Normal	Alarm	WS-100A	102-AC-1	15120	EVT
Control Valve 102-AC-1 Command	YCO-100A	DO	Form C	Normal	Open	YS-100A	102-AC-1	13401	
Control Valve 102-AC-2 Open Run Status	ZSOR-100B	DI	Form C	Normal	Open	ZS-100B	102-AC-2	15120	EVT
Control Valve 102-AC-1 Close Run Status	ZSCR-100B	DI	Form C	Normal	Closed	ZS-100B	102-AC-2	15120	EVT
Control Valve 102-AC-2 "In Remote"	ZSR-100B	DI	Form C	Normal	In Remote	ZS-100B	102-AC-2	15120	EVT
Control Valve 102-AC-2 Failure	WAIR-100B	DI	Form C	Normal	Alarm	WS-100B	102-AC-2	15120	EVT
Control Valve 102-AC-2 Command	YCO-100B	DO	Form C	Normal	Open	YS-100B	102-AC-2	13401	
Control Valve 120-AC-3 Open Run Status	ZSOR-100C	DI	Form C	Normal	Open	ZS-100C	102-AC-3	15120	EVT
Control Valve 120-AC-3 Close Run Status	ZSCR-100C	DI	Form C	Normal	Closed	ZS-100C	102-AC-3	15120	EVT
Control Valve 120-AC-3 "In Remote"	ZSR-100C	DI	Form C	Normal	In Remote	ZS-100C	102-AC-3	15120	EVT
Control Valve 120-AC-3 Failure	WAIR-100C	DI	Form C	Normal	Alarm	WS-100C	102-AC-3	15120	EVT
Control Valve 120-AC-3 Command	YCO-100C	DO	Form C	Normal	Open	YS-100C	102-AC-3	13401	
Control Valve 120-AC-4 Open Run Status	ZSOR-100D	DI	Form C	Normal	Open	ZS-100D	102-AC-4	15120	EVT
Control Valve 120-AC-4 Close Run Status	ZSCR-100D	DI	Form C	Normal	Closed	ZS-100D	102-AC-4	15120	EVT
Control Valve 120-AC-4 "In Remote"	ZSR-100D	DI	Form C	Normal	In Remote	ZS-100D	102-AC-4	15120	EVT
Control Valve 120-AC-4 Failure	WAIR-100D	DI	Form C	Normal	Alarm	WS-100D	102-AC-4	15120	EVT
Control Valve 120-AC-4 Command	YCO-100D	DO	Form C	Normal	Open	YS-100D	102-AC-4	13401	
Diverstion #1 Flow	FIQR-100	AI	4-20mA	0-1000	gpm/MGD	FIT-100		13401	MN, MX, HH, LL

**Abbreviations:**

MC	Motor Control Center	MX	Daily Maximum
MA	Daily Average	MN	Daily Minimum
DT	Daily Flow Total	HH	High Limit Alarm
CT	Continuous Flow Total	LL	Low Limit Alarm
DRT	Daily Run Time	DI	Discrete Input
CRT	Continuous Run Time	DO	Discrete Output
Form C	Dry Contact Form C*	AI	Analog Input
EVT	Log Events of Status Change	AO	Analog Output
SSS	Solid State Starter	SD	Smoke Detector
			DTCP

Confirm all I/O locations with the Contractor and approved shop drawings before submitting I&C for review and approvals

Provide 10% spare I/O of each type including programming services typical for status or alarm for all spare DI, process indication, trending and historical database for typical spare AI, and typical interlocking for all spare DO, plus retransmit for all spare AO. Wire all spares to field terminal block.

**SECTION 13401**  
**PROCESS INSTRUMENTATION AND CONTROLS (PICS)**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall perform all work necessary to furnish, install, commission, test, document, and start up the instrumentation and control (I&C) system, including modifying the existing I&C system. The Contractor shall provide all materials, labor, equipment, incidentals, and services required for a complete and operational system.
- B. The Contractor shall acquire the services of a single, experienced I&C system provider specifically trained in the type of equipment to be provided. The provider shall assume responsibility for satisfactory operation of the process I&Cs as an integrated system.

**1.02 RELATED WORK**

- A. The provisions of all other sections of the Specifications are fully applicable to this Section as if incorporated in this Section.
- B. The Contractor shall be responsible for coordinating work with the Owner and Subcontractors.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Provide shop drawings for all equipment, field panels (FPs), and enclosures.
  - 1. At a minimum the Drawings shall show the fabrication design, internal equipment arrangement, internal wiring, and external wiring connections.
  - 2. Provide panel elementary diagrams. The diagrams shall show all control functions, power distribution, switched analog signals, and auxiliary devices such as relays, alarms, fuses, lights, fans, etc.
  - 3. Provide power requirement (voltages, currents, phases) and heat dissipation (maximum Btu/hr) summary for all panels.
  - 4. Panel connection drawings shall show ISA wire tags.
  - 5. Provide any needed installation details to adequately define the installation of panels and field components.

- B. Provide loop diagrams for each specified loop. The loop diagrams shall meet the minimum requirements of ISA 5.4. Loop diagram(s) shall show the wiring and/or piping for all major components, resistors, diodes, DC power supplies, shield terminations, tubing, piping, valving, test taps, and other appurtenances for process connections. Each analog diagram shall tabulate loop impedances. An individual loop shall be shown on a diagram divided into three areas for identifying element locations: panel face, back-of-panel, and field. Loop diagrams shall be on 8-1/2-x-11-inch or 11-x-17-inch drawings.
1. Provide an operation description for each loop.
- C. Provide electrical interconnection diagrams showing all component and panel connection/terminal identification numbers and external wire numbers. These diagrams shall include all intermediate terminations (e.g., at terminal junction blocks and motor control centers).
1. The interconnection diagrams shall be coordinated with other suppliers and the electrical subcontractor. The electrical subcontractor shall review and approve the diagrams before any submission to the Engineer.
  2. The diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.
- D. The Contractor shall submit a complete list of materials and equipment to be incorporated in the work to the Engineer within 30 days after Award of Contract.
1. The list shall include catalog numbers, cut sheets, diagrams, and other descriptive data required to demonstrate conformance with the Specifications. Partial lists will not be acceptable.
  2. The basis of acceptance will be the manufacturer's published ratings for the equipment. The manufacturer shall be regularly engaged in the manufacture of the products specified.
- E. The Contractor shall submit testing procedures, test reports, and a training program.
1. Provide a test procedure outline, example operational report, and example functional test procedures and schedules.
  2. Provide a factory test report.
  3. Provide an operational acceptance report. The report shall contain a completed status sheet for each loop. Each sheet shall be signed off on by the Contractor's field crew. The report shall be reviewed, verified, and signed off on by the Contractor.
  4. Provide a training program and schedule.

- F. Each submittal shall be complete, neat, orderly, and bound with a table of contents and section divider tabs.
- G. Each submittal shall include but not be limited to the requirements described in this Section.
- H. Or equal materials or products may be submitted for approval. Submissions shall be accompanied with adequate data to demonstrate equality. Equality of materials or products shall be the decision of the Engineer.
- I. Each submittal shall be accompanied by a cover letter describing any exceptions or deviations from the Specifications. Cover letters addressing resubmitted materials shall also describe any changes which have been made since the previous submittal and include a brief response to the Engineer's comments.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
- B. American National Standards Institute (ANSI)
  - 1. ANSI/TIA 568-C.2—Balance Twisted-Pair Telecommunications Cabling and Components.
- C. International Electrotechnical Commission (IEC)
  - 1. IEC 61935—Specification for the Testing of Balanced and Coaxial Information Technology Cabling – Part 1: Installed Balanced Cabling as specified in ISO/IEC 11810 and Related Standards.
- D. International Organization of Standardization (ISO)
  - 1. ISO/IEC TR 24750:2007—Information Technology – Assessment and Mitigation of Installed Balanced Cabling Channels in order to Support of 10GBASE-T.

- E. International Society of Automation (ISA)
  - 1. ISA 5.1—Instrumentation Symbols and Identification (NRC ADOPTED).
  - 2. ISA 5.4—Instrument Loop Diagrams.
  - 3. ISA 20—Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
  - 4. ISA 50.00.01—Compatibility of Analog Signals for Electronic Industrial Process Instruments.
  - 5. ISA RP7.1—Pneumatic Control Circuit Pressure Test.
  - 6. ISA RP55.1—Hardware Testing of Digital Process Computers.

- F. National Electrical Manufacturers Association (NEMA)
  - 1. NEMA ICS-1—Industrial Control and Systems General Requirements.

- G. National Institute of Standards and Technology (NIST)
- H. Underwriter's Laboratories, Inc. (UL)

## 1.06 QUALITY ASSURANCE

- A. SCADA Integrators shall be City approved including: McKim & Creed, Commerce Controls, Curry Controls, and Revere Controls.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.
- B. All work, equipment, and materials supplied shall be warranted against defective design, materials, and workmanship for 1 year. The warranty period shall begin at the time of project completion and acceptance by the Owner.
- C. The warranty shall cover replacement equipment and/or repair, including labor, travel time and miscellaneous expenses, at no cost to the Owner for the full warranty period.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

- B. Deliver materials and equipment with the manufacturer's tags and labels and UL labels intact. Deliver packaged material in the manufacturer's original, unopened containers bearing the manufacturer's name, brand, and UL label.
- C. Throughout this Contract the Contractor shall provide suitable protection for materials and equipment against loss or damage and the effects of weather and the construction environment. The Contractor shall be responsible for the condition of materials and equipment until the acceptance of equipment by the Owner.
- D. Before installation, store material and equipment indoors in a dry, clean location. Handle and store to avoid damage. Heat storage areas that contain items subject to corrosion under damp conditions.
- E. Turn off power to panels and equipment and close and cover CPs and equipment during any dusty construction to prevent degrading the operation or service life.
- F. Follow the manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between the manufacturer's instructions and these Contract Documents, follow the Engineer's decision at no additional cost to the Owner. Keep a copy of the manufacturer's installation instructions on the job site and available for review at all times.
- G. Keep the premises free of waste material or rubbish. Before final inspection and testing and upon completion of the work, remove materials, scraps, and debris from the premises and from the interior and exterior of all devices and equipment.
- H. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, and consistency of the original finish.

## 1.09 RECORD DRAWINGS

- A. Record Drawings shall be submitted in accordance with Section 01785, Record Documents, and this Section.
- B. The Contractor shall provide one set of Record Drawings on CD or DVD in AutoCAD "DWG" or "DXF" format, consisting of the following:
  1. Process and instrumentation diagrams.
  2. Loop diagrams.
  3. Panel elementary diagrams.
  4. Interconnecting wiring diagrams.

## 1.10 SYSTEM DESCRIPTION

- A. The general arrangement of the instruments, controls, and monitoring systems are shown on the Drawings and specified in this Section. The location of all transmitters, controllers, recorders, indicators, etc., shall be as shown on the Drawings and/or as indicated in this Section. The Contractor shall be responsible for all detail installation drawings showing wiring and shall be responsible for furnishing all devices required for a complete and functioning system.

## 1.11 OPERATION AND MAINTENANCE (O&M) MANUAL

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.
- B. Before final acceptance of this project, the Contractor shall submit an O&M Manual to the Engineer for all components provided under this Section. The manual shall comply with the following:
  1. The literature shall have sufficiently detailed descriptions and figures to facilitate the operation, removal, installation, adjustment, calibration, and maintenance of each component to the printed circuit board level.
  2. The manual shall include internal wiring and piping diagrams. Termination designations and wire and pipe numbers shall be clearly shown. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.
  3. The manual shall include an updated set of the manufacturer's literature, data sheets, loop descriptions of operations, drawings corrected in accordance with shop drawing review comments and Record Drawing modifications and components parts list.
  4. Instructions and parts lists shall have been prepared for the specific equipment furnished.
  5. List of suppliers and/or service shops that can provide parts and accessories and equipment repair for the components provided under this Section. The list shall include a contact name, telephone number, and address.
- C. The general arrangement of the instruments, controls, and monitoring systems is shown on the Drawings and specified in this Section. The location of all transmitters, controllers, recorders, indicators, totalizers, etc., shall be as shown on the Drawings and/or as indicated in this Section. The Contractor shall be responsible for all detail installation drawings showing wiring and shall be responsible for furnishing all devices required for a complete and functioning system.

**1.12 PATENTS AND LICENSES (NOT USED)**

**1.13 MANUFACTURER'S LITERATURE**

- A. The Contractor shall provide descriptive literature for all equipment provided under this Section. The literature shall include major components, electrical devices, panel materials, panel components, panel paints and colors, mechanical devices, equipment tags, tubing, valves, fittings, fasteners, and appurtenances. This descriptive literature shall include catalog information, external wiring information, dimensional data, and mounting requirements.
- B. Provide data (specification) sheets for all equipment and components. Provide a separate data sheet for each major component. The data sheets shall show the "component name," tag numbers, quantities, specific catalog/ordering numbers, specific features, and special options.
- C. Provide a components parts list with exact and complete (including options and accessories) manufacturer's part number. Group the list by the component name used in these Specifications. Group each component type by tag number used in these Specifications. Components without tag numbers shall be grouped by the manufacturer's part number.
- D. Provide a list of recommended spares, spare parts, and expendables with tag number, part number, unit pricing, and total purchase cost.
- E. Provide storage requirements for all components provided under this Section.

**1.14 CERTIFICATION/DOCUMENTATION**

- A. The instrument system supplier(s) shall verify the calibration and operation of all control, instrumentation, and telemetry components and shall present written certification of the operation.

**1.15 PERMITS AND FEES**

- A. The Contractor shall obtain all necessary permits, licenses, and inspections required for the work of this Section and pay all charges incidental to these permits, licenses, and inspections. The Contractor shall deliver to the Engineer all certificates of inspection and licenses issued by authorities having jurisdiction.

## 1.16 ABBREVIATIONS AND ACRONYMS

- A. ASD: Adjustable Speed Drive.
- B. CA: Calculated Analog.
- C. CP: Control Panel.
- D. CPU: Central Processing Unit.
- E. CS: Computer Subsystem.
- F. FDT: Factory Demonstration Test.
- G. FP: Field Panel.
- H. HMI: Human/Machine Interface.
- I. ISA: International Society of Automation.
- J. I&C: Instrumentation and Control.
- K. IPS: Instrument and Panel Subsystem.
- L. I/O: Inputs and Outputs.
- M. LAN: Local Area Network.
- N. MCC: Motor Control Center.
- O. OIU: Operator Interface Unit.
- P. OIT: Operator Interface Terminal.
- Q. O&M: Operation and Maintenance.
- R. ORT: Operational Readiness Test.
- S. PAT: Performance Acceptance Test.
- T. PC: Personal Computer.
- U. PICS: Process I&C System.
- V. P&ID: Piping and Instrument Drawing.
- W. PLC: Programmable Logic Controller.
- X. RIO: Remote Input/Output.
- Y. RTU: Remote Terminal Unit.
- Z. SCADA: Supervisory Control and Data Acquisition.
- AA. TSP: Twisted Shielded Pairs.
- BB. UPS: Uninterruptable Power Supply.
- CC. VFD: Variable Speed Drive (see ASD).
- DD. WAN: Wide Area Network.
- EE. WiFi: Wireless.

## 1.17 DEFINITIONS

- A. *Enclosure*: CP, console, cabinet, or instrument housing.
- B. *Instructor Day*: 8 hours of actual instruction time.

- C. *Software*: Programs or configuration data for digital devices, stored in read-only memory, programmable read-only memory, read/write memory, disk, tape, or other electronic storage device. Types of software are defined as follows:
1. *Standard Software*: Packages that are independent of the project on which they are used. Standard software includes Operating Systems, Office Suites, and the Process Monitoring and Control software.
  2. *Application Software*: Code or configuration of the standard software to provide functions unique to this project.
- D. *Rising/Falling*: Terms used to define actions of discrete devices about their set points.
1. *Rising*: Contacts close when an increasing process variable rises through set point.
  2. *Falling*: Contacts close when a decreasing process variable falls through set point.
- E. Analog Signals, Current Type:
1. 4 to 20 mA DC signals conforming to ISA S50.1.
  2. Unless otherwise indicated for specific PICS Subsystem components, use the following ISA 50.1 options:
    - a. Transmitter Type: Number 2, two-wire.
    - b. Transmitter Load Resistance Capacity: Class L.
    - c. Fully isolated transmitters and receivers.
- F. *Analog Signals, Voltage Type*: 1 to 5 volts DC within panels where a common high precision-dropping resistor is used.
- G. *Discrete Signals*: Two-state logic signals using 24 VDC or 120VAC sources as indicated.
- H. Pulse Frequency Signals:
1. Direct current pulses whose repetition rate is linearly proportional to process variable.
  2. Pulses generated by contact closures or solid-state switches as indicated.
  3. Power source less than 30 VDC.

- I. *Special Signals*: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.
- J. *Instrument Tag Numbers*: A shorthand tag number notation is used in the Loop Specifications. For example: 10-PI-2(A/B).

Notation	Explanation
10	Unit process/Loop designation.
PI	ISA designator for Pressure Indicator.
(2)	Unit designation; alphanumeric designation of same process types in a given loop; -1, -2 in this example.
(A/B)	Component designation; Alphanumeric designation of same component type within a process; -A, -B in this example.

In this example, 10-PI-(2)(A/B) is shorthand for:

10-PI-1-A, 10-PI-1-B, 10-PI-2-A, 10-PI-2-B.

- K. *Activity Completion*: The following is a list of key activities and their completion criteria:
  1. Administrative Submittals: Reviewed and accepted.
  2. Shop Drawings: Reviewed and approved.
  3. Quality Control Submittals: Reviewed and accepted.
  4. Tests (Except ORT): Tests have been completed and required test documentation has been accepted.
    - a. ORT: ORT has been completed and the Engineer has spot-checked associated test forms and checklists in field.
    - b. Hardware Delivery: Hardware has been delivered to site and inventoried by the Owner.
    - c. Ready for Operation: ORT has been completed.

- L. *PICS Substantial Completion*: Prerequisites for Substantial Completion for each stage of work include:
  1. PICS Submittals have been accepted or approved, as specified.
  2. PICS Subcontractor has successfully completed PAT.
  3. Owner training plan is on schedule.
  4. Spares, expendables, and test equipment have been delivered to the Owner.

- M. *PICS Acceptance*: When the Engineer issues a written notice of acceptance, the following prerequisites shall have been met:
1. PICS Certificate of Substantial Completion for both stages of work.
  2. Punch-list items completed.
  3. Final revisions to O&M manuals accepted.
  4. Maintenance service agreements for PICS accepted by the Owner.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. The manufacturer(s) and/or supplier(s) shall have regularly engaged in the manufacture of major components and/or assembly or I&C systems of the type and scope required for this project for a minimum of 5 years.
- B. It is recognized that one manufacturer may not make all the equipment required and specified under this Section. The Contractor shall be responsible for ensuring that the various manufacturers and equipment suppliers' products are coordinated and are compatible so that the equipment performs the specified functions. The Contractor shall ensure that they are fully aware and understand the requirements of the system.

### 2.02 GENERAL EQUIPMENT REQUIREMENTS

- A. All components and items of equipment that are necessary, whether indicated or not, to affect the required functions and performance shall be provided. In general, and unless otherwise noted, corrosion-resistant materials such as 316 stainless steel shall be used. Working pressures, spans, and other ratings shall be selected to best fit the application. All like equipment shall be by the same manufacturer.
- B. Whenever any material or product is indicated by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used to establish a standard of quality to expand the description of the material or product desired. Materials and products equal to the named material or product may be provided unless specifically noted otherwise.
- C. All equipment furnished under this Section shall be new and unused and shall be the standard product of a manufacturer having a minimum of 5 years successful experience in the manufacture of the equipment. Wherever possible, equipment items having the same or similar rated capacity or function shall be identical. Equipment shall be of the manufacturer's latest proven design.

- D. The design of the instrumentation and control system is based on the equipment and components specified in this Section. If more than one manufacturer is noted, the first named is the basis for design where there are differences. If the Contractor selects equipment which changes the design basis, the Contractor shall obtain approval from the Engineer and make all approved changes at no additional cost to the Owner.
- E. Electrical Transient Protection: All I&C equipment shall be equipped with suitable surge-arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines by lightning discharges or by nearby electrical devices.
1. Voltage surge and transient protectors for both power and analog field circuits shall be provided on the field end and destination end of the circuits.
    - a. Analog circuits shall be protected by DEHN or Phoenix suppressors.
    - b. All instrument 120-volt power and signal circuits shall be protected by DEHN or Phoenix suppressor.
  2. The devices shall be connected to the system ground. The total resistance of the ground circuit from the device to the driven ground rod shall not exceed 0.1 ohm.
- F. Signal Characteristics
1. Analog signals shall be 4-20 mA DC and shall conform to the compatibility requirements of ISA 50.1. Unless otherwise noted, circuits shall be Type 2 two-wire. Transmitters shall have a load-resistance capability conforming to Class L. Transmitters and receivers shall be fully isolated.
  2. Discrete signals are two-state logic signals of two types. Control signals shall use 120-VAC sources. Alarm signals that interface directly with an annunciator shall use less than 30-VDC sources. All alarm signals shall be “normally open, close to alarm” isolated contacts rated for 5 amperes at 120 VAC and 2 amperes at 30 VDC.

G. Environmental Conditions

1. Unconditioned air: 20 °F to 105 °F, 10% to 100% humidity, subject to wash down or rain, corrosive (assume marine salts and H<sub>2</sub>S as a minimum), and nonhazardous. Enclosures shall be NEMA 4X.
2. Other conditions as noted or approved.

- H. Nameplates, Name Tags, and Service Legends: All field- and panel-mounted components provided under this Section shall be provided with permanently mounted name tags bearing the entire ISA tag number of the component.
1. Panel-mounted tags shall be engraved plastic. Field-mounted tags shall be stamped 16-gauge 316 stainless steel with 3/16-inch-high characters.
  2. Nameplates shall be inscribed to identify the component listed and mounted near a panel-face-mounted instrument.
  3. Service legends shall be integrally mounted on a panel-mounted instrument. Unless otherwise noted, service legends shall be engraved with the functional explanation.
  4. Nameplates and service legends shall be engraved, rigid, laminated plastic plates attached to enclosure with stainless steel screws maintaining NEMA rating of enclosure. Unless otherwise noted, plate color shall be black with 3/16-inch-high white lettering. Panel nameplates shall have 1/2-inch-high lettering.
- I. Colors and Inscriptions: Unless otherwise noted, the following inscription and color code shall be used for all push buttons and indicating light lenses: ON, red; OFF, green; OPEN, green; CLOSED, red; AUTO, white; MANUAL, yellow; START, red; STOP, green; RESET, red; TEST, black; ACKNOWLEDGE, green; and READY, blue. All unused or non-inscribed buttons shall be black.
1. Lettering shall be black on white, amber, or yellow. Lettering shall be white on black, red, blue, or green.
- J. Relays
1. Analog signal switching relays shall be provided for switching 4-20 mA or 1-5 VDC signals. The relays shall have double-throw dry circuit contacts in a break-before-make configuration rated for 15 VA minimum. The relays shall be sealed to prevent dust, dirt, or moisture contamination. Relays shall be UL recognized and shall be Potter and Brumfield KUP or KUL Series or Struthers-Dunn Series 219.
  2. Control circuit switching relays shall be rated for not less than 2 amperes at 120 VAC or 28 VDC.
  3. All relay connections shall have a screw terminal interface with the wiring. Terminals shall have a permanent, legible identification and shall be mounted so that terminal identifications are clearly visible, and the terminals are readily accessible.
  4. Intrinsically safe relays shall be UL approved, solid state, dual channel, din rail mounted, Crouse Hinds Series MTL7700.

- K. Power Supplies: Provide DC power supplies as required to power instruments requiring external DC power.
1. Power supplies shall convert 120-VAC power to DC power of the appropriate voltage(s) with sufficient voltage regulation and ripple control to ensure that the instruments being supplied can operate within their required tolerances.
  2. Output overvoltage and overcurrent protective devices shall be provided with the power supply to protect the instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.
  3. Each power supply shall be provided with a NEMA 1 enclosure for mounting within other enclosures. Power supplies shall be mounted so that dissipated heat does not adversely affect other components.
- L. Wiring: All electrical wiring and wiring identification shall be in accordance with the applicable requirements of Division 16, Electrical.
1. Wires shall be 600-volt class, PVC insulated stranded copper.
  2. Wiring for 120-volt circuits and signals shall be sized as required for the current to be carried, but not smaller than 14 AWG if enclosed in sheet metal raceway or plastic wiring duct. Wiring for signal circuits shall be TSP not smaller than 16 AWG. Analog signals shall be separated from any power wiring by at least 6 inches.
  3. All interconnecting wires to other enclosures shall be terminated at numbered terminal blocks. All external connections shall be to numbered terminal blocks. All connections for future functions shall be wired to numbered blocks.
    - a. Terminal blocks shall be grouped to keep circuits of different voltages separate. Provide sufficient terminal blocks for all functions required, all spare annunciator points, and all spare conductors plus 15% spare.
    - b. Terminal blocks shall be one-piece molded plastic blocks with screw-type terminals and barriers rated for 300 volts. Terminals shall be double sided and supplied with removable covers that prevent accidental contact with live circuits. Terminals shall have permanent and legible identification and be clearly visible with protective cover removed.
    - c. Wires shall be terminated at the terminal blocks with crimp-type, pre-insulated, ring-tongue lugs. Lugs shall be the appropriate size

- for the size of the terminal block screws and the size and number of wires terminated.
4. All analog signal wiring shall be TSP with tie points at terminal blocks. Provide external dropping resistors or diodes to allow an instrument to be removed from the loop without opening the circuit.
  5. Shields shall be interconnected within each loop at terminals. Shield wires shall be dressed with heat-shrink tubing. Ground signal shields at CPs only (not field devices).
  6. Enclosures shall conform to the National Electrical Manufacturer's Association, NEMA-4X, unless otherwise noted. Construction shall be of 316 stainless steel unless otherwise noted. Aluminum construction shall use 5052 H-32 aluminum alloy and shall provide for noncontact of dissimilar metals. Minimum metal thickness shall be 14 gauge. Where practical, enclosures shall be manufactured by Hoffman or H.F. Cox.
    - a. Doors shall be rubber gasketed with a continuous hinge.
    - b. Panels mounted outside or in unheated areas shall be provided with thermostatically controlled heaters that will maintain the inside panel temperature above 40° F.
    - c. Panels shall be sized to adequately dissipate heat generated by equipment in or on the panel.
    - d. Provide a breaker-protected 120-volt, 15-amp duplex receptacle in the panel.

#### M. Operator Interface Terminals

1. Terminals (OIT) shall be microprocessor-based, flat panel, touchscreen type. The unit shall have data entry capabilities and shall include a password security function. The unit shall be connected to the plant network and shall display status, alarm, and diagnostic information. The OIT shall:
 

a. Display Size:	9.0-inch
b. Color Scale	65,536 colors
c. Pixels	800 x 600 (HI-Res TFT)
d. Brightness	260 cd/ m <sup>2</sup>
e. CPU	500 Hz Fanless
f. Dot Pitch	0.267 mm x 0.267 mm
g. System Memory	356 MBytes DRAM
h. Flash Memory	256 MBytes
i. RS232 & RS485 Port	Yes

j.	USB Port	Types A and B
k.	Ethernet Port	10/100 Base-T
l.	Power	24 VDC, 20W
m.	Temperature	0 to 50 Deg C
n.	Enclosure	NEMA 4/4X
o.	Manufacturer	PanelView Plus 7

#### N. Ethernet Switches

1. Ethernet switch, 6 RJ45 ports, 10/100/1000 Mbps on all RJ45 ports, two multi-mode SC-D ports, 1 Gbps full duplex, auto negotiation (RJ45), autocrossing function, with signal contact and QoS, extended temperature range.
2. Interface 1 Ethernet (RJ45) ports 6 (RJ45 ports). Connection method RJ45 Ethernet in RJ45 twisted pair Transmission speed 10/100/1000 MBit/s. Interface 2 Fiber optic interface with 2 (SC multi-mode). Connection method shall be SC Transmission physics multi-mode fiberglass. Transmission speed shall be 1000 MBit/s (full duplex). Transmission length shall be 220 m (Fiberglass 62.5/125) 550 m (Fiberglass 50/125). Wavelength 850 nm Interface 4 Potential-free signaling contact with connection method as plug-in/screw connection via COMBICON.
3. Phoenix Contact SFN 6GT/2SX.

#### O. Programmable Logic Controller (PLC)

1. The PLC CPU shall be as manufactured by Allen-Bradley CompactLogix with built-in Ethernet network.
2. Each discrete input module shall accept up to sixteen (16) 120Vac input signals received from devices such as pushbuttons, selector switches, pressure switches, temperature switches, or limit switches and converts them into voltage logic levels that can be processed by the controller. Input signals shall be wired in two groups of eight signals per module. Each group of eight points shall be protected by a .16 amp external indicating fuse block. Each input shall be optically isolated and protected with a red LED to indicate the presence of the 24Vdc power (circuit closed indication). A green LED shall be provided to indicate the presence of the I/O module supply voltage of each group. Discrete input modules shall be as manufactured by Allen-Bradley.
3. Each discrete output module shall provide eight relay switched, 120Vac output signals that can drive loads up to 1 amp such as relays, starters, and solenoid valves. The outputs shall be optically isolated from the system. Output signals shall be field wired in two groups of four outputs per module. Each group of four points shall be protected by an external .16A indicating fuse block. Each output shall be isolated and provided with a

- red LED to indicate the output is turned "on". A green LED shall be provided to indicate the presence of the required 24Vdc supply voltage. External, panel mounted, 10Amp, interposing relays shall be provided for interfacing to control devices that are external to the local control panel or to devices that exceed the rating of the output module. Where LED type status indicators are used, a loading resister shall be installed to prevent leakage current from keeping the lamps falsely lit. Discrete input modules shall be as manufactured by Allen-Bradley.
4. Analog input modules shall be eight channels with opto-isolation. Inputs shall accept 4-20mA DC signals. Input shall be set for Unipolar with Offset and Extended Resolution mode to detect loss of signal or low input indication. Resolution shall be 11-bit plus sign with a 10 ms conversion time. The four points shall be protected by an external .16A indicating fuse block. A green LED shall be provided to indicate the presence of the required 24Vdc supply voltage. A second green LED shall be provided to indicate the module is healthy. Removal of any panel-mounted devices shall not interrupt the input signals to the PLC. Analog values shall continue to function properly. Inputs shall be provided for Flow and Level. Analog input modules shall be as manufactured by Allen-Bradley
  5. Analog Output Module shall be eight channels with opto-isolation. Outputs shall drive 4-20mA DC signals. Output shall be set for Unipolar with Offset and Extended Resolution mode to detect loss of signal or low input indication. Resolution shall be 11-bit plus sign with a 10 ms conversion time. The four points shall be protected by an external .16A indicating fuse block. A green LED shall be provided to indicate the presence of the required 24Vdc supply voltage. A second green LED shall be provided to indicate the module is healthy. Removal of any panel-mounted devices shall not interrupt the input signals to the PLC. Analog values shall continue to function properly. Outputs shall be provided for VFD speed pacing. Analog output modules shall be as manufactured by Allen-Bradley.

## 2.03 INSTRUMENTATION

### A. Water meter

#### 1. Flow Element-Magnetic Meter

##### a. Tags:

ISA Designation	Line Size (Inches)	Service
FE/FIT-100	6	Sludge
FE/FIT-500	6	Sludge
FE/FIT-400	4	Sludge

- b. Flow element shall be of the electromagnetic type using the pulsed DC-type coil excitation principle with high preamp input impedance. The flow measuring system, consisting of flow element, transmitter, and appurtenances, shall have an overall accuracy of 1% of rate with a 10:1 turndown for all flows resulting from pipe velocities of 1 to 33 feet per second. The system shall operate on 120-volt (10%), 60-Hz power. The unit shall have a zero-stability feature, thereby eliminating the need to stop flow to check zero alignment.
- c. The flow element shall be of watertight, NEMA 4 construction, unless otherwise noted. The meter shall consist of a 316 stainless-steel meter tube, 150-pound ANSI carbon steel raised face flanges, Teflon liner, and 316 stainless-steel electrodes, unless otherwise noted. Electrodes shall be either flush or bullet-nose type. Meters 4 inches and smaller with Teflon liners shall be wafer-style design. Suitable covers shall be provided for flow element ends to protect the tube liner during shipment. The unit shall be furnished with grounding rings or shall be provided with built-in grounding electrodes.
- d. The remote flow transmitter shall be indicating, both flow rate and totalized flow, and suitable for pipe stand mounting, with integral indicators and totalizers furnished. The transmitter output shall be a 4 to 20mA DC signal in linear proportion to flow and shall drive loads with impedances in the range of 0 to 800 ohms without load adjustments for a 24VDC supply. Output span and zero shall be manually adjustable. Both transmitter and primary element shall be powered from the same 120-volt, 60-Hz source.
- e. Sufficient special cable(s) shall be provided for interconnection between the flow element and the transmitter. Cable(s) shall facilitate both signal and power for the flow element (120-volt, 60-Hz power will be made available at the transmitter).
- f. For each size of flow tube, provide one spool piece with identical laying length and flanges. Provide lifting rings on each spool piece to facilitate the replacement of a flow tube by the spool piece.

- g. Provide stainless steel sunshield and transient surge protection for the incoming 120VAC and DC signals as manufactured by DEHN or Phoenix series. Transient surge protection shall be mounted in a stainless steel box.
- h. The manufacturer of the flow meter shall be Rosemount, ABB or Sparling.

## B. Level Meter

### 1. Flow Element-Floats

- a. Tags:

ISA Designation	Service
LE/LSH-201	Sludge
LE/LSL-201	Sludge
LE/LSH-202	Sludge
LE/LSL-202	Sludge

### 2. Type:

- a. Tilting float actuation.
- b. SPDT non-mercury switch.
- c. Polypropylene casing.

### 3. Operation:

- a. Function: To produce a contact output at a predetermined liquid level.
- b. Operating Principle: A sealed switch encased in a weighted float freely suspended from a cable is actuated by the tilting motion of the float when it is displaced by the liquid level.

### 4. Functional:

- a. Output: Form C (SPDT) hermetically sealed non-mercury switch, rated 6 amps at 250 volts ac.

### 5. Physical:

- a. Float: Hermetically sealed, molded polypropylene casing.

- b. Cable: Three-conductor No. 19 AWG PVC-jacketed.
- c. Mounting: Cable suspended by waterproof compression connector.

6. Performance:

- a. Angular operating Differential 20 degrees.
- b. Vertical operating Differential 1/2-inch.

7. Manufacturer:

- a. Float switch shall be Roto-Float, 3- or 4-wire, or equal.

8. Accessories:

- a. Support bracket with adjustable clamp for setting switch height.
- b. NEMA 4X junction box.

C. Level Meter

ISA Designation	Service
LE/LIT-201	Sludge
LE/LIT-202	Sludge

- 1. Unit shall be ultrasonic type, continuous level measuring system consisting of level element, transmitter, and cable for connection from level element to transmitter.
- 2. Level element shall be ultrasonic type transducer. Transducer shall be of waterproof construction with operating range of -20 to +50 degrees C at 1 atmosphere, unless otherwise noted. Transducer shall be furnished with 4-inch PVC blind flange for mounting where shown or noted.
- 3. Transmitter shall contain solid state programmable controls to operate transducer provide pump controls, totalizer and to provide a 4 to 20 mA dc output signal in linear proportion to the level being sensed. Transmitter shall be provided with high contrast 4-digit 18mm LCDs display and five LEDs to indicate alarm conditions. Transmitter scale range shall be as noted. Transmitters for storage tank shall be characterized for the storage tank shape. Transmitter shall be mounted in a NEMA 4X enclosure, unless otherwise noted, suitable for mounting as noted or shown.
- 4. Level system shall have an overall accuracy of plus or minus 0.25% of full scale and shall operate on 120-volt, 50/60-Hz power.

5. Transmitter shall provide five discrete outputs, adjustable over the entire scale range. At the noted set point, unit shall transfer SPDT contacts which shall be rated for 5 amperes, continuous, at 120V ac. Set points shall be screwdriver adjustable from inside the enclosure and shall be repeatable within plus or minus 1/4 percent of full scale.
6. Interconnecting cable between transducer and transmitter shall be furnished with the unit with length as shown.
7. Provide transient surge protection for the incoming 120VAC and DC signals
8. Unit shall be Milltronics "HydroRanger".

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. The Contractor shall lay out the work and be responsible for necessary lines, levels, elevations, and measurements. Installations shall comply with the applicable requirements of Division 16, Electrical. The Drawings indicate the extent and general arrangement of the components. The Contractor shall familiarize himself with work of other trades engaged in the construction. Exact routing of raceways, piping, and locations of equipment may be governed by structural conditions and obstructions. The Contractor shall coordinate the details of equipment shop drawings for connections to equipment furnished by others. This is not to be construed to permit redesigning systems.

#### 3.02 INSTALLATION

- A. The Contractor shall comply with referenced standards, National Electrical Code (NEC), National Electrical Safety Code, local codes, and rules and regulations of local agencies having jurisdiction. The size of conductors, circuit breakers, motor controllers, and protective devices indicated or specified shall meet all requirements of the NEC.

#### 3.03 INSTALLER QUALIFICATIONS

- A. The installer shall be acceptable to the manufacturer and/or supplier of the I&C systems. The installer shall have a minimum of 5 years of experience installing I&C systems of a similar type and scope.

## 3.04 WORKMANSHIP

### A. General

1. Install materials and equipment in a workmanlike manner using craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.
2. Coordinate the work with the Owner, the Engineer, and the work of other trades to avoid conflicts, errors, delays, and unnecessary interference.

### B. Electrical Power and Signal Wiring

1. Control and signal wiring in enclosures and racks shall be restrained by plastic ties or ducts. Hinge wiring shall be secured at each end so that any bending or twisting will be around the longitudinal axis of the wire and the bend area shall be protected with a sleeve.
2. Arrange wiring neatly, cut to proper length, and remove surplus wire. Provide abrasion protection for any wire bundles which pass through holes or across edges of sheet metal.
3. Use the manufacturer's recommended tool with the proper sized anvil for all crimp terminations. No more than one wire shall be terminated in a single crimp lug and no more than two lugs shall be installed on a single-screw terminal.
4. Wiring shall not be spliced or tapped except at device terminals or terminal blocks. All devices with pig-tail wiring shall terminate on terminal blocks within or near the device.
5. All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer. The Contractor shall correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective. Corrections shall be made in a manner satisfactory to the Engineer at no additional cost to the Owner.

## 3.05 TESTING

### A. General: All elements of the I&C system shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification.

1. All testing materials and equipment shall be provided by the Contractor. Where it is not practical to test with real process variables, the Contractor shall provide a suitable means of simulation. These simulation techniques shall be acceptable to the Engineer.
2. The Contractor shall have an updated set of Drawings and Specifications, a master copy of approved test procedures, and the master copy of current test failures and solutions to test failures.

3. Testing will not be considered complete until all portions of the test have been approved by the Engineer. If a test or a portion of a test fails to the point where it needs to be rescheduled, the additional testing cost shall be borne by the Contractor.
- B. Factory Testing: The components shall be tested with simulated I/O at the factory. Factory tests shall generally conform to the applicable sections of ISA RP55.1. The Engineer and/or Owner shall be notified of when and where the testing is to take place and given the option to attend and observe the testing.
- C. Operational Acceptance Testing: The objective of these tests is to demonstrate that each portion of the I&C system is ready for operation.
  1. All components of the system shall be checked for proper installation, adjusted, and calibrated on a loop-by-loop basis.
  2. All elements shall be checked to verify that they have been properly installed and that all terminations have been made correctly. All pneumatic tubing shall be tested in accordance with ISA procedure RP7.1.
  3. All discrete elements and systems shall have their set points adjusted and shall be checked for proper operation.
  4. All continuous elements and systems shall have three-point calibrations performed. All controller tuning constants shall be adjusted to preliminary settings.
  5. The Contractor shall prepare operational acceptance test status report sheets for each loop listing the checks and adjustments performed and the calibration points actually set. Copies of completed status report sheets shall be submitted before final acceptance.
- D. Functional Acceptance Testing: The objective of these tests is to demonstrate that the I&C system is operating and complying with the specified performance requirements.
  1. Each loop function shall be demonstrated to the Engineer in accordance with approved test procedures. Each loop shall be signed off by the Contractor and the Engineer upon satisfactory completion.
  2. A test date may be set after the testing submittal has been approved and pre-test training has been completed.
  3. No modifications shall be made to the system during the functional acceptance test period except as required to maintain Owner operations. The test shall not interrupt normal operations unless approved by the Owner.
  4. If a test fails to produce the expected results, the Contractor will need to respond quickly to determine the cause and take corrective action.

- Construction shall not interfere with the tests unless approved by the Engineer.
5. All failed tests shall be retested until the result complies with the Specifications and/or is acceptable to the Engineer and Owner.
  6. At the end of the test, a punch list will be provided to the Contractor. The Contractor shall then determine the cause of the failure, correct the deficiency, and report to the Engineer why the test failed and the corrective action taken. The Engineer will then determine if the function needs to be retested and determine any other tests which may be required.
  7. Within 10 working days from the end of a test period or retest period, a formal punch list will be transmitted to the Contractor. The Contractor shall submit a single test report for the test period and reschedule retesting if needed. Retesting shall be scheduled for not less than 1 week after the Engineer receives the test report and the retest dates shall be acceptable to all.

### 3.06 ON-SITE SUPERVISION

- A. The Contractor shall provide factory-trained, onsite service engineers to supervise and coordinate installation, adjustment, testing, training, and startup of the I&C system.
- B. The Contractor shall provide startup and testing assistance by engineers and programmers as required to thoroughly check all of the equipment and perform all operational and functional tests required.
- C. The service engineer shall be specifically trained on the type of equipment specified and shall advise the Contractor in the location and method of installing special cable, mounting, pipe, and wiring of one of each type of device. The service engineer shall supervise the calibration, commissioning, and initial start-up of the I&C system. A signed and dated calibration sticker shall be affixed to each device.

### 3.07 TRAINING

- A. The Contractor shall provide a minimum of two 8-hour days on-site training for the Owner's O&M personnel at the job site before functional acceptance testing.
- B. The training program shall include classroom and field instruction by experienced and knowledgeable technicians and engineers on the O&M of the I&C elements, components, and systems provided.

### 3.08 FUNCTIONAL DESCRIPTIONS

- A. Functional Descriptions shall be in accordance with Section 13316, Software Control Block Descriptions.

END OF SECTION

**DIVISION 15**

**MECHANICAL**

**SECTION 15055**  
**PIPING SYSTEMS—GENERAL**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Specification describes responsibilities and requirements for Piping Systems including the following:
  - 1. Labor, materials, tools, equipment, and services to be furnished in accordance with the provisions of the Contract Documents. The materials to be used for the piping systems shown in the Drawings are listed by service in the Piping Schedule, included in the Contract Drawings.
  - 2. Coordination of work with other trades.
  - 3. Furnishing and installing all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, although such work is not specifically indicated.
  - 4. Furnishing Record Drawings and documents for piping systems.

**1.02 RELATED WORK**

- A. Section 01300, Contract Administration.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Section 01785, Record Documents.
- F. Section 01830, Operations and Maintenance Manuals.
- G. Section 02305, Earthwork for Utilities.
- H. Section 09900, Painting and Coating.
- I. Section 15075, Process Equipment, Piping, and Valve Identification.
- J. Section 15144, Pressure Testing of Piping.
- K. Section 15155, Ductile Iron Pipe and Fittings.
- L. Section 15290, PVC Pipe, 3 Inches and Smaller.

**1.03 SUBMITTALS**

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. If the Contractor deviates from the piping layout as shown on the Contract Drawings, the Contractor shall submit scaled piping drawings showing locations and dimensions to and from fittings, valves, tanks, equipment, structures, and related appurtenances. Provide scaled drawings to a minimum scale of 1 inch

equals 10 feet. Provide details to minimum scale of 1/8 inch equals 1 foot. Elevations shall correspond to reference vertical elevation datum shown or provided for this project.

- B. Copies of any manufacturer's written directions regarding material handling, delivery, storage, and installation.
- C. Record piping drawings shall meet the requirements of Section 01300, Contract Administration, and Section 01785, Record Documents. During the work, the Contractor shall maintain accurate, up-to-date Record Drawings of piping systems installed in the project, including pre-existing piping discovered, relocated, or at locations other than as originally shown on the Drawings. When the work is completed and accepted by the Owner and the Engineer, the Contractor shall submit Record Drawings in accordance with Section 01785, Record Documents. The Contractor shall identify complete location, elevations, and description of piping systems. Piping systems and fittings are to be identified from three points on structures and/or stationary appurtenances.
- D. Submit copies of forms documenting required field pressure testing work and results.
- E. Submit welding certificate copies.
- F. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.
- G. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.
- H. Support Systems:
  - 1. Drawings of each piping system locating each support, guide, and anchor.
  - 2. Identify support, guide, and anchor type by catalog number and shop/Contract Drawing detail number

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM A183—Specification for Carbon Steel Track Bolts and Nuts.
  - 2. ASTM A193/A193M—Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - 3. ASTM A194/A194M—Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
  - 4. ASTM A307—Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
  - 5. ASTM D1330—Standard Specification for Rubber Sheet Gaskets.
  - 6. ASTM F467—Standard Specification for Nonferrous Nuts for General Use.
- B. American Society of Mechanical Engineers (ASME)
  - 1. ASME B1.1—Unified Inch Screw Threads (UN and UNR Thread Form).
  - 2. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
  - 3. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.
  - 4. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - 5. ASME B18.2.2—Nuts for General Applications: Machine Screw Huts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
  - 6. ASME B31.1—Power Piping.
  - 7. ASME B31.3—Process Piping.
  - 8. ASME BPVC—Boiler and Pressure Vessel Code.
- C. American Water Works Association (AWWA)
  - 1. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 2. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4 Inches Through 144 Inches (100 mm Through 3,600 mm).
- D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
  - 1. MSS SP 58—Pipe Hangars and Supports – Material, Design, Manufacture, Selection, Application, and Installation.
- E. NSF International (NSF)
  - 1. NSF 61—Drinking Water System Components – Health Effects.

**1.06 QUALITY ASSURANCE (NOT USED)**

**1.07 WARRANTIES**

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. The Contractor shall protect the pipe from kinks, cuts, end damage, and other defects when transporting all piping. Binding and tie-down methods shall not damage or deflect the pipes in any way. Pipe damaged during shipment shall be rejected.
- C. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects that could damage the pipe. Stacking of any pipe shall be limited to a height that will not cause excessive deformation of the lower layers of pipe under anticipated temperature conditions. When necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to not allow deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or sub-grade work is complete and ready to receive the pipe.
- D. The joined pipe shall be handled in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped. Slings for handling joined pipe shall not be positioned at socket-welded joints. Sections of the pipes with cuts and gouges shall be removed and the ends of the pipe rejoined. In accordance with the pipe manufacturer's written instructions, the Contractor shall repair all pipe with damaged linings and pipe exterior coatings that have been damaged before the pipe is installed.
- E. The Contractor shall cover all pipe stored on the site with canvas or other opaque material to protect it from sunlight. Provide air circulation under the covering.
- F. The Contractor shall inspect all pipe, fittings, and other accessories upon delivery and during the work. Any defective or damaged materials found during field

- inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.
- G. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.

- H. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-delivered-to-site and first-to-be-installed rotation basis. Mechanical-joint glands, bolts, and washers shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

1.13 DEFINITIONS OF BURIED, EXPOSED, AND SUBMERGED PIPING

- A. Buried piping is piping buried in soil, beneath a structure and/or encased in concrete. Where an exterior pipe coating is specified to be factory- or field-applied, the Contractor shall provide the coating up to the penetration of a structure. Piping encased in concrete does not require an exterior coating other than what is factory furnished.

- B. Exposed piping is piping in any of the following conditions or locations:

1. Visible piping above ground.
2. Visible piping inside buildings, vaults, or other structures.
3. Visible piping in underground concrete trenches or galleries that are accessible.

- C. Submerged piping is considered to be all piping within a liquid holding tank.

- D. Concealed piping is piping above grade that is not visible or accessible and is contained within building walls, attics, floor spaces, pipe chases, pipe galleries, or structures.

## 1.14 SYSTEM DESIGN REQUIREMENTS

### A. General

1. The Project Specifications and Contract Drawings are not all inclusive of explicit piping details; provide piping for intended use in compliance with laws and regulations, including ASME B31.1 Code (Power Piping).
2. Pressure ratings and materials specified represent minimum acceptable standards for piping systems.
3. Piping Systems: Suitable for the services specified and intended.
4. Piping shall be color coded in accordance with the Florida Department of Environmental Protection requirements.

### B. Support Systems

1. The absence of pipe supports and details on the Contract Drawings shall not relieve the Contractor of responsibility for sizing and providing supports for this project.
2. Select and design within the specified spans and component requirements.
3. Comply with requirements of MSS SP 58, Pipe Hangers and Supports – Materials, Design, and Manufacture.
4. Criteria for structural design and selection of pipe support system components:
  - a. Dead loads imposed by the weight of the pipes filled with water, within specified spans and component requirements, plus any insulation.
  - b. Safety factor: Minimum of 5.
5. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
  - a. Piping smaller than 30 inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required and are to be provided and installed by the Contractor at no additional cost to the Owner.

C. Adapters

1. No attempt has been made to show all adapters, spool pieces, reducers, bushings, or other fittings required to accommodate the connection of pipes, fittings, and valves of various joint design and sizes throughout the project. The Contractor is completely responsible for providing, at his expense, all adapters, reducers, sleeves, spool pieces, restraints, and other fittings and appurtenances necessary for connection and restraint of pipe (for the same pipe material or a transition of pipe materials), valves, fittings, and appurtenances throughout the project, which shall be constructed of appropriate materials, coated and lined to match the materials, coatings, and linings specified for the connected components. All adapters, reducers, sleeves, spool pieces, and other fittings shall be coated and lined in accordance with the specifications for each individual pipe system.

D. Unions

1. No attempt has been made to show all unions required for the project. The Contractor shall provide unions at all connections of threaded pipe to installed equipment unless deleted by the Engineer, in writing, at certain locations. The unions shall meet or exceed the quality of materials, pressure rating, service, and painting requirements of connected piping.

## PART 2 PRODUCTS

### 2.01 PIPING SYSTEM GENERAL REQUIREMENTS SCHEDULE

- A. Unless noted otherwise in the Contract Drawings, piping system materials, fittings, and appurtenances are subject to requirements of the individual Specifications for the piping systems.

### 2.02 PIPING SCHEDULE

- A. A piping schedule (flow stream identification) listing the piping identification abbreviations, piping materials, operating pressures, field test pressures, lining systems, and color coding as identified and provided on the Contract Drawings. In project locations where the piping system material referenced on the piping schedule is not appropriate, the required piping material is indicated on the Contract Drawings. Materials called out in the Contract Drawings shall govern over materials stated in the piping schedule.

**2.03 THREAD FORMING FOR STAINLESS STEEL BOLTS**

- A. Form threads for stainless steel bolts by rolling, not by cutting or grinding.

**2.04 BOLTS AND NUTS FOR FLANGES FOR DUCTILE IRON PIPE FLANGES**

- A. Bolts, washers, and nuts for pipe installed indoors, outdoors above and below ground, and in vaults and structures shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
- B. Unless specified elsewhere, bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M (Grade B8) for bolts and ASTM A194/A194M (Grade 8) for nuts. Fit shall be Class 2A conforming to ASME B1.1 when connecting to cast-iron valves having body bolt holes.

**2.05 BOLTS AND NUTS FOR TYPE 304 STAINLESS STEEL PIPE FLANGES**

- A. Bolts, washers, and nuts for flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

**2.06 BOLTS AND NUTS FOR TYPE 316 STAINLESS-STEEL PIPE FLANGES**

- A. Bolts, washers, and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

**2.07 BOLTS AND NUTS FOR PVC, CPVC, AND PVDF PIPE FLANGES**

- A. Bolts for piping in sodium hypochlorite service shall be made of titanium, in accordance with ASTM F467, Grade Ti1, Ti2, or Ti7. Nuts and washers shall conform to ASTM F467 and shall be made of titanium.
- B. Bolts, washers, and nuts in chemical service other than sodium hypochlorite shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts, unless specified elsewhere.
- C. Unless specified elsewhere, bolts, washers, and nuts for buried and submerged flanges and flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

- D. The Contractor shall provide a washer under each nut and under each bolthead. Washers shall be of the same material as the nuts.

## 2.08 BOLTS AND NUTS FOR STEEL PIPE FLANGES

- A. Unless specified elsewhere, bolts, washers, and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, in vaults, and in structures shall be carbon steel, ASTM A307, Grade B. Bolts, washers, and nuts for buried service shall also be hot-dipped galvanized.
- B. Unless specified elsewhere, bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M (Grade B8) for bolts and ASTM A194/A194M (Grade 8) for nuts. Fit shall be Class 2A in accordance with ASME B1.1 when connecting to cast-iron valves having body bolt holes.

## 2.09 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. Anti-seize thread lubricant shall be applied to the thread portion of all (above grade and below grade) stainless steel bolts (stainless steel tie rods, etc.) during assembly. Anti-seize lubricant shall be chloride free and shall be nongalling NSF approved. Anti-seize thread lubricant shall be Jet-Lube "Nikal," John Crane "Thred Gard Nickel," Never-Seez "Pure Nickel Special," or Permatex "Nickel Anti-Seize."

## 2.10 FLANGE GASKETS FOR STEEL, DUCTILE IRON, AND STAINLESS STEEL PIPE

- A. Flange gaskets shall be in accordance with AWWA C207, except as modified in this Section. Gaskets shall be ring type. All gasket material shall be suitable for the fluid being conveyed and shall be resistant to free chlorine concentrations up to 10 mg/L. All gasket material shall be rated to the surge pressures listed in the pipe schedule. Gaskets shall be EPDM or an approved equal.

## 2.11 FLANGE GASKETS FOR DUCTILE-IRON PIPE AND FITTINGS IN RAW SEWAGE

- A. Gaskets shall be full face, 1/8 inch thick, Buna-N having a Brinell Hardness of 55 to 65 durometer. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 250°F. Gaskets shall have "nominal" pipe size inside diameters, not the inside diameters indicated in ASME B16.21. Provide Garlock Style 9122 or equal. The Contractor shall verify that the gaskets are compatible with all chemicals being used.

## 2.12 FLANGE GASKETS FOR PVC AND CPVC PIPE

- A. Gaskets for flanged joints shall be full faced, 1/8 inch thick, having a Brinell Hardness of 50 to 70 durometer A. Gasket material shall be EPR unless noted or specified otherwise. Gasket material for sodium hypochlorite service shall be Viton ETP unless noted or specified otherwise. Gaskets shall be compatible with the fluids conveyed.

## 2.13 FLANGE GASKETS FOR PVDF PIPE

- A. Gaskets for flanged joints shall be full faced, 5/64 inch thick (minimum), made of Teflon-bonded EPDM or PVDF-bonded EPDM. The EPDM shall have a Brinell Hardness of 65 to 70 Durometer "A." Gaskets shall be suitable for a fluid temperature range of -40°F to +210°F and compatible with the fluids conveyed.

## 2.14 FLANGE GASKETS FOR STAINLESS-STEEL PIPE IN CHEMICAL SERVICE (NOT USED)

## 2.15 LOCATOR WIRE AND DETECTABLE MARKING TAPE

- A. All 2-inch and larger buried piping shall be laid with two insulated, 12-gauge minimum AWG, THWN strand copper wires tied to the nonmetallic pipe at 18 inches on center for location purposes.
- B. All 2-inch and larger buried piping shall be laid with underground detectable caution tape, 2-inch tape for a maximum of 12-inch depth and 6-inch tape for a maximum of 24-inch depth. Tape shall be placed a minimum of 1 foot above the top of pipe.
- C. Marking tape shall be as detailed herein and also in accordance with Section 15075, Process Equipment, Piping, and Valve Identification.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Field Alignment:
  - 1. The piping shown on the Contract Drawings is generally indicative of the work, with symbols and notations provided for clarity. However, the Contract Drawings are not an exact representation of all conditions involved; therefore, install piping to suit actual field conditions and measurements as approved by the Engineer. No extra compensation will

- be made for work due to differences between indicated and actual dimensions.
2. The Contractor shall install all adapters, fittings, flanged connections, closures, restrained joints, etc. not specified but necessary for a complete installation acceptable to the Engineer.
  3. The Contract Drawings do not indicate all adapters, fittings, spool pieces, bushings, unions, supports, hangers, and other items required to accommodate the installing and connecting of pipe, fittings, valves, and equipment of various joint designs and sizes. Provide such required items of appropriate designs, materials, coatings, and linings acceptable to the Engineer.
  4. An extensive network of underground piping, duct, conduit, direct-buried conductors, and related structures of various sizes, materials, alignments, age, and function exist within the project site. Conclusive information concerning these facilities is not available. Consequently, the design of new piping indicated on the Contract Drawings is approximate. Adjust alignment, fitting, valve, and joint locations as required and as approved by the Engineer to accommodate and protect existing facilities and provide the intended functionality of new piping.

### 3.02 FIELD LAYOUT AND MODIFICATIONS

- A. Unless directed otherwise, the Contractor shall be responsible for setting construction layout stakes and/or offsets required to complete the designated work. The Contractor shall ensure that those stakes and/or offsets are protected and any re-staking required for any reason including work stoppage shall be included in the bid price and no additional compensation to the Contractor will be made.
- B. The Engineer has the right to make any modifications the Engineer deems necessary due to field conditions, conflicts with other utilities, or to protect other properties.

### 3.03 PIPE PRODUCTS INSPECTION

- A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe, fittings, gaskets, glands, bolts, and nuts supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer before installing the pipe materials. The Contractor shall visually inspect all pipe and fittings at delivery and before they are lowered into the trench to be installed. Pipe or fittings that do not conform to these Specifications or have been damaged in any manner will be rejected and the Contractor must remove them immediately. The entire product of any plant may be rejected when, in the opinion of the

Engineer, the methods or quality assurance and uniformity of manufacturer fail to secure acceptable and uniform pipe products or where the materials used produce inferior pipe products.

### 3.04 REMOVAL OF EXISTING PIPE AND FITTINGS

- A. Pipe, fittings, and valves specifically identified on the Contract Drawings to be removed or replaced from service shall be physically taken out of the ground. The limits of pipe to be removed shall be specifically called for in the plans or shall be approved in writing by the Engineer. Any other removal not specifically called for shall be approved in writing and shall be considered incidental to construction of other items in the contract and the Contractor will not receive compensation for such work.
- B. When removing pipe and fittings, the Contractor shall excavate a trench wide enough to dislodge the pipe from the surrounding soil and long enough to be able to handle the pipe and fittings without causing any damage to nearby utilities, structures, or adjacent property.
- C. The removed pipe, fitting, and appurtenances will become the Contractor's property unless noted otherwise in the Contract Drawings or specified elsewhere to become the property of the Owner, and the Contractor shall be responsible for proper disposal and any required permits for disposal.
- D. Regarding pipe remaining in the ground subsequent to removal of connected pipe or pipe fittings, the remaining buried pipes, openings, and fittings shall be plugged or capped as approved by the Engineer.
- E. Pipe that will be abandoned in place shall be plugged or capped as approved by the Engineer.

### 3.05 BURIED PIPING AND PIPE FITTINGS

- A. Trenching and backfilling for all pipe and fittings shall also be in accordance with Section 02305, Earthwork for Utilities.
- B. Installation:
  1. Inspect all piping for defects and remove all lumps or excess coatings before installation. The inside of the mechanical joint and outside of plain-end pipe shall be cleaned before joining pipe. Caution shall be taken to prevent damage to the pipe during lowering into the trench. Remove all foreign matter that has entered the pipe during storage and installation. The Contractor shall cover the pipe ends during installation to prevent

- debris from entering the pipe. No debris, tools, clothing, or other material shall be placed in the pipe.
2. After being placed in the trench, the pipe shall be brought to the proper line and grade by compacting the approved backfill material under it, except at the bell end. Joint deflection shall not exceed 75% of the manufacturer's limit.
  3. The Contractor shall install temporary water-tight plugs on the pipe ends during the time that the pipe is in the trench but no work is in progress. If there is water in the trench upon beginning work, this plug shall remain in place until the trench has been pumped dry, unless otherwise approved by the Engineer, the Engineer's Representative, or the Owner's Representative.
  4. Buried carbon steel bolts and nuts shall be coated in accordance with Section 09900, Painting and Coating, System No. 21.
  5. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.
  6. Restrained plugs or caps shall be inserted into all buried dead-end pipes, tees, or crosses. Provide blind flanges for all flanged exposed piping. Restrained plugs and caps installed for pressure testing shall be fully secured and blocked to withstand the test pressure.
  7. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a suitable cast-iron or ductile-iron plug/cap or blind flange with or without a blowoff cock, as shown on the Drawings. Installation or removal of such plugging shall be considered incidental to the work and the Contractor shall not be compensated by the Owner for performing this work.

### 3.06 FLANGED JOINTS FOR EXPOSED PIPE AND FITTINGS

- A. When bolting flanged joints, the Contractor shall avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate to ensure uniform compression of the gasket, in accordance with pipe and fitting manufacturer's recommendations.
- B. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.

### 3.07 PIPING CONNECTIONS TO PUMPS AND OTHER EQUIPMENT

- A. When connecting to pumps and equipment, the Contractor shall ensure that piping stresses are not transmitted to the pump and equipment. All connecting pipe shall be permanently supported and aligned so that accurate matching of bolt holes and

uniform contact over the entire surface of pump flanges are obtained before any bolts are installed in the flanges or pipe is threaded into pump and equipment. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while the bolts are being tightened.

1. Pumps and equipment shall be leveled, aligned, and wedged into a position that will fit the connecting pipe, but shall not be grouted until the initial fitting and alignment of the pump and equipment may be shifted on its foundation if necessary to properly install the connecting pipe. Each pump and piece of equipment shall, however, be grouted before final bolting of the connecting piping.
2. After final alignment and bolting, the pump and equipment connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as required and then the flanges bolted back together. The flange bolts then shall be loosened and the process repeated until no movement is observed.
3. All carbon steel bolts and nuts shall be coated with the same exterior coating applied to the piping system.

### 3.08 ANCHORING AND RESTRAINING

- A. Thrust blocks shall be used in new lines and shall be limited to areas in which a new fitting has been installed in an existing line where field restraining joints are not feasible or when directed by the Engineer.

### 3.09 FLUSHING, CLEANING, TESTING AND INSPECTION OF PIPING

- A. See Section 15144, Pressure Testing of Piping, for the requirements of pipe flushing, cleaning, pressure testing, and inspection requirements.

### 3.10 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

- A. Welding:

1. Use only certified welders meeting procedures and performance outlined in Section IX of the ASME BPVC and other codes and requirements in accordance with local building and utility requirements. Submit Welder's certificates to the Engineer for the project record before beginning any welding on the project. The Welder must be certified for all positions (flat, vertical, and overhead).

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2. Have all welds conform to highest industrial practice in accordance with ASME B31.1 and ASME B31.3 or other codes and requirements in accordance with local building and utility requirements.

### 3.11 PIPE COLOR CODING

- A. The pipe color shall be as identified on the Pipe Schedule in the Contract Drawings. The Contractor shall coordinate with the Engineer and the Owner to generate a list of acceptable pipe colors for exposed piping systems. Where color-coding is achieved by painting exterior surfaces of the piping systems, painting shall be provided in accordance with Section 09900, Painting and Coating. On applicable pipes, color shall be in accordance with FDEP color-coding requirements and Recommended Standards for Wastewater Facilities 2014 Edition.

END OF SECTION

**SECTION 15060**  
**PIPE HANGERS AND SUPPORTS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes requirements for materials and installation of pipe hangers and supports, including accessory items such as anchor bolts and screws, pipe spiders, neoprene isolation pads, cable trays for hoses, and drip guards.

**1.02 RELATED WORK**

- A. Section 01330, Submittals.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 05500, Metal Fabrications.
- E. Section 09900, Painting and Coating.
- F. Division 15, Mechanical.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Provide line drawings of each piping system to the scale shown on the Contract Drawings, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.
- B. Provide installation drawings and manufacturer's catalog information on each type of hanger and support used. Clearly indicate the actual pipe outside diameter (not just nominal pipe size) that is used for the hangers and supports.
- C. Submit layout drawings for the drip guards, showing dimensions and thicknesses. Show design of seam or joint where field connections will be made between sections and pieces of drip guards.
- D. Submit a certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, and characteristics.

**1.04 WORK SEQUENCE (NOT USED)**

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### A. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
4. ASTM A153/A153M—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A194/A194M—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
6. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
7. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
8. ASTM A575—Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
9. ASTM A576—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
10. ASTM A635/A635M—Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
11. ASTM A1011/A1011M—Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
12. ASTM D256—Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
13. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
15. ASTM F594—Standard Specification for Stainless Steel Nuts.

### B. American Society of Mechanical Engineers (ASME)

1. ASME B31.1—Power Piping.

C. Manufacturer's Standardization Society

1. MSS SP-58—Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

1.06 QUALITY ASSURANCE

- A. All hangers, supports, and appurtenances shall conform to the latest applicable requirements of ASME B31.1, except as supplemented or modified by the requirements of this Section.
- B. All hangers, supports, and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported.
- C. All pipe and appurtenances connected to equipment shall be supported so as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit certification stating that such requirements have been complied with.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All supports and hangers shall be crated, delivered, and uncrated to protect against any damage.
- C. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.
- D. Finished iron or steel surfaces not galvanized or painted shall be properly protected to prevent rust and corrosion.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

## PART 2 PRODUCTS

2.01 GENERAL

- A. Not all pipe supports or hangers required are shown on the Drawings. The Contractor shall provide pipe supports for every piping system installed. Support piping by pipe support where it connects to pumps or other mechanical equipment.
- B. The Contractor shall ensure that pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes, fittings, and valves (all filled with water) plus valve actuators and any insulation and shall have a minimum safety factor of 5 based on the material's ultimate strength.
- C. All of the equipment specified in this Section is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions. The Contractor shall develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Pipe Sections of Division 15, Mechanical.
- D. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings, and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500, Metal Fabrications, and shall be furnished and installed under this Section.
- E. Hangers and supports shall be spaced in accordance with ASME B31.1 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified in this Section.

- F. Where flexible couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported.
- G. All pipe and appurtenances connected to the equipment shall be supported so as to prevent any strain from being imposed on the equipment or piping system.
- H. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for interior pipe supports shall be furnished with galvanized finish, hot-dipped, or electro-galvanized coated, except where field welding is required. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for exterior pipe and pipe within outdoor structures shall be of AISI Type 316 stainless steel.
- I. Supports shall be sufficiently close together so that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.
- J. All un-insulated non-metallic piping such as PVC, CPVC, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180°, arc shields shall be furnished. Where 360° arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length, and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 1/2-inch wide.
- K. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide galvanized protection shields as specified in Paragraph 2.01J above at each location.
- L. Where pipe hangers and supports come in contact with copper piping, provide protection from galvanic corrosion by wrapping pipe with 1/16-inch-thick neoprene sheet material and galvanized protection shield or copper-plated or PVC-coated hangers and supports.
- M. Pipe supports shall be provided as follows:
  - 1. Cast-iron and ductile-iron piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.

2. Steel and stainless steel piping 2-1/2 inches or larger diameter shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
  3. Support spacing for steel and stainless piping 2 inches and smaller diameter and copper tubing shall not exceed 5 feet.
  4. Supports for multiple PVC plastic piping shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3 feet. Multiple, suspended, horizontal plastic PVC pipe runs shall, where possible, be supported by ladder-type cable trays such as the Electray Ladder by Husky-Burndy; Cable Tray by Enduro Composite Systems; the Globetray by the Metal Products Division of United States Gypsum or equal. Ladder shall be of FRP construction. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs. Ladder-type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps, or fasteners similar to Globe, Model M-CAC; Husky-Burndy, Model SCR; or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.
  5. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction.
  6. Pipe supports shall not induce point loadings, but shall distribute pipe loads evenly along the pipe circumference.
  7. Supports shall be provided at changes in direction and elsewhere as shown on the Drawings or as specified in this Section. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.
  8. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split-type couplings, and sleeve-type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be used to support connecting pipes.
  9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.
- N. Any required pipe support for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes and concrete and anchor hardware similar to items previously specified in this Section and shall be subject to the approval of the Engineer.

## 2.02 HANGER AND SUPPORT SYSTEMS

- A. Pipe hangers and supports shall be as manufactured by Anvil, Unistrut, Cooper B-Line, Aikinstrut, Superstrut, or equal.
- B. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced on the Drawings. The Contractor shall construct special hangers and supports if detailed in the Drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type Number	Description	Manufacturer and Model (or Equal)
1	Adjustable steel clevis	Anvil Fig. 590 or 260, B-Line B3100 or B3102
3	Steel double-bolt pipe clamp	Anvil Fig. 295A or 295H, B-Line B3144 or B3144A
4	Steel pipe clamp (pipes smaller than 3 inches)	Anvil Fig. 212, B-Line B3140
4	Steel pipe clamp (pipes 3 inches and larger)	Anvil Fig. 216, B-Line 3142
5	Pipe hanger	B-Line B6690
6	Adjustable swivel pipe ring	Anvil Superstrut 714, Anvil Fig. 104
7	Adjustable steel band hanger	B-Line B3172
8	Extension pipe or riser clamp	Anvil Fig. 261, B-Line B5573
9	Adjustable band hanger	Anvil Fig. 97
10	Adjustable swivel ring band hanger	Anvil Fig. 70, B-Line B3170 NF
11	Split pipe ring with adjustable turnbuckle	Anvil Fig. 108, B-Line B3173
13	Steel turnbuckle	Anvil Fig. 230, B-Line B3202
14	Steel clevis	Anvil Fig. 299, B-Line B3201
15	Swivel turnbuckle	Anvil Fig. 114, B-Line B3224
16	Malleable iron socket	Anvil Fig. 110R, B-Line B3222
17	Steel weldless eye nut	B-Line B3200
18	Steel or malleable iron concrete insert	Anvil Fig. 281, Superstrut 452
19	Top beam C-clamp	Anvil Fig. 92, B-Line B3033
20	Side I-beam or channel clamp	Anvil Fig. 14 or 217
21	Center I-beam clamp	Anvil Figure 134
22	Welded attachment type	Anvil Fig. 66 B-Line B3083
23	C-clamp	Anvil Fig. 86, B-Line B3036L
24	U-bolt	Anvil Fig. 137, B-Line B3188
26	Clip	Anvil Fig. 262, B-Line B3180
28	Steel I-beam clamp with eye nut	Anvil Fig. 228
29	Steel wide flange	Anvil Fig. 228 clamp with eye nut
30	Malleable iron beam clamp with extension piece	Superstrut CM-754, B-Line B3054
31	Light welded steel bracket	Anvil Fig. 194, B-Line B3063
32	Medium welded steel bracket	Anvil Fig. 195, B-Line B3066
33	Heavy welded steel bracket	Anvil Fig. 199, B-Line B3067

Type Number	Description	Manufacturer and Model (or Equal)
34	Side beam bracket	Anvil Fig. 202, B-Line B3062
36	Pipe saddle support	Anvil Fig. 258, B-Line B3095
37	Pipe stanchion saddle	Anvil Fig. 259, B-Line B3090
38	Adjustable pipe saddle support	Anvil Fig. 264, B-Line B3093/B3089
39	Steel pipe covering	Anvil Fig. 160, 161, 162, 163, 164, or 165; Superstrut A 789; B-Line B3160/B3165
40	Insulation protection shield	Anvil Fig. 167, B-Line B3151
41	Single pipe roll	Anvil Fig. 171, B-Line B3114
43	Adjustable roller hanger with swivel	Anvil Fig. 181, B-Line B3110
44	Pipe roll, complete	Anvil Fig. 271, B-Line B3117SL

- C. General: Unless specified elsewhere or shown in the Contract Drawings, pipe hangers and supports shall be 304 stainless steel and shall match the number, type, location, and capacity of the existing supports.
- D. Offset Pipe Clamp.
- E. Anvil Figure 103, Cooper B-Line B3148, or equal. Material shall be Type 316 stainless steel unless otherwise noted.

## 2.03 MISCELLANEOUS PIPE SUPPORTS AND HANGERS

- A. Pipe Anchor Chair: Anvil Figure 198 or equal.
- B. One Hole Clamp: Anvil Figure 126 or equal.
- C. Roller Chair: Anvil Figure 175 or equal.

## 2.04 STEEL CHANNEL FRAMING SYSTEM

- A. Steel channel frames shall be 1-5/8 inches wide by 1-5/8 or 3-1/4 inches high by 12-gauge metal thickness, unless otherwise shown on the Drawings. Material shall conform to ASTM A36/A36M, A1011/A1011M (Grade 33 minimum), or A653 unless stainless steel is indicated on the Drawings. Stainless steel shall be Type 304. One side of the channel shall have a continuous open slot with turned clamping ridges. Maximum allowable stress under any combination of applied uniformly distributed loads and concentrated loads shall not exceed those recommended in the AISC or AISI. Deflection shall not exceed 1/240 of span. The Contractor shall use multiple back-to-back channels to achieve these criteria if single channels are not sufficient. Products: Unistrut P1000 or P5000 Series, B-Line B11 or B22 Series, or equal.

- B. Steel channels shall be hot-dipped galvanized according to ASTM A153/A153M.
- C. Nuts shall be machined and case hardened. The Contractor shall provide rectangular nuts with the ends shaped to permit a quarter turn crosswise in the framing channel. Provide two serrated grooves in the nut to engage the inturned edges of the channel.
- D. Pipe clamps (including attachment screws and nuts) shall be Unistrut P1100 or P2000 Series, B-Line B2000 Series, or equal. Material shall be Type 304 stainless steel.
- E. Hanger rods for trapezes shall be carbon steel (ASTM A36/A36M, A575, or A576) unless stainless steel is indicated on the Contract Drawings. Stainless-steel hanger rod material shall comply with ASTM A276/A276M, Type 304.
- F. Accessory fittings and brackets shall be the same material as the channel or trapeze. Provide coating on carbon steel fittings and brackets as specified for the channels and frames.
  - 1. Flat Plate Fittings: Unistrut P1065, P1066, P1925; Superstrut AB-206, AB-207; or equal.
  - 2. Post Bases: Unistrut P2072A, Superstrut AP-232, or equal.
  - 3. 90° Brackets: Unistrut P1326, P1346; Superstrut AB-203; or equal.
  - 4. Rounded-End Flat Plate Fittings: Unistrut P2325, Superstrut X-240, or equal.
- G. Parallel pipe clamps shall be Unistrut P1563 through P1573, Superstrut AB-719, or equal. Material shall be Type 304 stainless steel.

## 2.05 FIBERGLASS-REINFORCED PLASTIC (FRP) CHANNEL FRAMING SYSTEM

- A. FRP pipe hangers and supports shall be Aickinstrut, Inc. or equal.
- B. Material properties shall be as follows:

Longitudinal Direction	
Ultimate Tensile (psi)	37,500 minimum
Ultimate Compressive (psi)	35,000 minimum
Ultimate Flexural (psi)	37,500 minimum
Tensile Modulus (psi) x 10**6	3.00 minimum
Flexural Modulus (psi) x 10**6	2.00 minimum
Ultimate Shear Strength (psi)	6,000 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact (ASTM D256) ft-lb/inch notch	30 minimum

Longitudinal Direction	
Transverse Direction	
Ultimate Tensile (psi)	10,000 minimum
Ultimate Compressive (psi)	20,000 minimum
Ultimate Flexural (psi)	14,000 minimum
Tensile Modulus (psi) x 10**6	1.0 minimum
Compressive Modulus (psi) x 10**6	1.4 minimum
Flexural Modulus (psi) x 10**6	1.0 minimum
Ultimate Shear Strength (psi)	5,500 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact, ft-lb notch	5 minimum
Hardness	
Barcol Test	50 minimum

- C. Glass-fiber-reinforced composites and plastic products shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84.
- D. Channel framing shall be 1-5/8 inches deep by 1-5/8 inches wide and shall be made using vinylester resin equal to Ashland Derakane 411, Ashland Hetron 922, or Reichhold Dion 9800. It shall have a nexus polyester surfacing veil over 100% of the surface which, along with a filler system, will protect against degradation from ultraviolet light. Channel shall be supplied with integral notches 1 inch on center. Notches shall be located on the interior flange to prevent slippage of pipe clamps and fittings after installation. In place of notched channel, unnotched channel may be used if the vertical channel sections supporting the horizontal piping are provided with stop lock hardware at each pipe clamp to prevent slippage. Channel framing shall be Aickinstrut G.R.P. Type V 2000 series or equal.
- E. Channel framing connections shall be made with vinylester glass fiber composite nuts, bolts, all threaded rods, channel fittings, bases, and hanger assemblies. Nut, bolts, and rods shall be Aickinstrut 4200 series, Strut Tech PVCG, or equal. Channel fittings shall be Aickinstrut 2800 style or equal.
- F. Load-bearing pipe clamps and nonload-bearing pipe straps shall be nonmetallic and nonconductive and shall be made by the injection-molding process using polyurethane-base resin. Pipe clamps and straps shall be Aickinstrut 3100 Series or equal.
- G. Clevis hangers shall be made with vinylester glass fiber and be Aickinstrut 1500 Series or equal.
- H. Hanger rods for trapezes shall be carbon steel (ASTM A36/A36M, A575, or A576) unless stainless steel or FRP is indicated on the Contract Drawings. Stainless steel hanger rod material shall comply with ASTM A276/A276M, Type 304. FRP hanger rod shall be by Aickinstrut, StrutTech, or equal.

## 2.06 PIPE SPIDERS

- A. Cooper B-Line B3281 to 3286, Superstrut S-794 or equal.

## 2.07 WAFFLE ISOLATION PADS

- A. Mason Type "W;" Machinery Installation Systems "Unisorb" Type S, SB, F, or FB; or equal. Provide minimum 1/4-inch thickness.

## 2.08 NEOPRENE ISOLATING SLEEVES FOR METAL PIPE 6 INCHES AND SMALLER

- A. Unistrut P2600, B-Line "Vibrocushion," or equal.

## 2.09 ANCHOR BOLTS AND SCREWS

- A. Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A276/A276M or F593. Nuts shall be Type 316 stainless steel, ASTM A194/A194M, Grade 8M, or ASTM F594, Type 316 stainless steel.

# PART 3 EXECUTION

## 3.01 PIPE HANGER AND WALL SUPPORT SPACING

- A. The Contractor shall install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed on the Contract Drawings. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed on the Contract Drawings. If no spacing or rod sizes are given on the Contract Drawings or in the Project Specifications for a particular piping system, use the following:

1. Pipe Hanger and Wall Support Spacing for Steel and Ductile-Iron Pipe (Section 15155, Ductile Iron Pipe and Fittings):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/8 and smaller	4	3/8
1/2 through 1	6	3/8
1-1/4 through 2	8	3/8
2-1/2 and 3	10	1/2
3-1/2 and 4	10	5/8
6	12	3/4
8	12	7/8
10 and 12	14	7/8

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
14 and 16	16	1
18	15	1
20 through 24	9	1
30	6	1

- B. Pipe Hanger or Wall Support Spacing for PVC Pipe (Section 15290, PVC Pipe, 3 Inches and Smaller):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/4	4	3/8
1	4	3/8
1-1/2	5	3/8
2	5	3/8
2-1/2	5	1/2
3	6	1/2

- C. For piping services not described, the Contractor shall provide hangers and supports according to MSS SP-58 and SP-69.
- D. The Contractor shall provide bracing for piping 8 inches and smaller that is installed on hangers or trapezes according to MSS SP-127, except provide lateral bracing at maximum 10-foot center-to-center spacings. Provide sway bracing for hangers for piping larger than 8 inches as detailed on the Contract Drawings.

### 3.02 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

- A. The Contractor shall install pipe supports on horizontal runs at the spacing shown or detailed on the Contract Drawings. Provide supports of the type shown or detailed on the Contract Drawings. If no spacings are given on the Contract Drawings or in the Project Specifications for a particular piping system, use the following:
1. Pipe Support Spacing for Steel and Ductile-Iron Pipe (Section 15155, Ductile Iron Pipe and Fittings):

Pipe Size (inches)	Maximum Support Spacing (feet)
3/8 and smaller	4
1/2 through 1	6
1-1/4 through 2	8
2-1/2 and 3	10
3-1/2 and 4	10
6	12

Pipe Size (inches)	Maximum Support Spacing (feet)
8	12
10 and 12	14
14 and 16	16
18	16
20 through 24	18
30	18

- B. Pipe support spacing for other pipe materials shall be the same as described in Article 3.01 of this Section.

### 3.03 INSTALLING PIPE HANGERS AND SUPPORTS

The Contractor shall do the following:

- A. Provide separate hangers or supports at each valve. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end. Provide additional hangers or supports to relieve eccentric loadings imposed by offset valve actuators.
- B. Provide separate hangers or supports at each pipe elbow, tee, or fitting. Provide separate hangers or supports on both sides of each nonrigid joint or flexible pipe coupling.
- C. Adjust pipe hangers according to MSS SP-89, Paragraph 10.6.
- D. Install leveling bolts beneath support baseplates. Provide 3/4-inch-thick grout pad beneath each base.
- E. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

### 3.04 INSTALLING STEEL AND FRP CHANNEL FRAMES

- A. The Contractor shall use 1-5/8-inch-high channel frames, unless 3-1/4-inch is needed, to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

### 3.05 INSTALLING NEOPRENE ISOLATING SLEEVES

- A. The Contractor shall install a sleeve around each metal pipe 6 inches and smaller at the point of bearing or contact with the pipe hanger or support.

### 3.06 PAINTING AND COATING

The Contractor shall do the following regarding painting and coating:

- A. Grind the welds of fabricated steel pipe supports smooth, prepare surface by sandblasting, and apply coating system in accordance with Section 09900, Painting and Coating.
- B. Paint exposed metallic pipe hangers and supports to match the color of the adjacent wall using System No. 52 in accordance with Section 09900, Painting and Coating. If the adjacent wall is not painted, paint the hangers and supports to match color code of the largest pipe on the support.
- C. Coat submerged pipe hangers and supports in accordance with Section 09900, Painting and Coating.
- D. Coat FRP pipe hangers and supports exposed to direct sunlight with System No. 41 in accordance with Section 09900, Painting and Coating. FRP pipe hangers and supports that are hidden from direct sunlight need not be coated.

END OF SECTION

**SECTION 15075**  
**PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes requirements for materials and installation of markers, labels, and signs for pipes, tanks, and valves; for mechanical equipment; for hazardous materials warnings; and for miscellaneous plant services.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit an ID schedule for the piping, valves, equipment, tanks, and any signs required for this project for review and acceptance by the Engineer. This schedule shall be in a formatted list that is easy to follow and categorized in a logical manner.
- C. The Contractor shall submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.
- D. The locations of each nameplate shall be coordinated with the Engineer and Owner and approved by the Engineer and Owner before their installation.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS (NOT USED)**

**1.06 QUALITY ASSURANCE (NOT USED)**

**1.07 WARRANTIES**

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

# PART 2 PRODUCTS

## 2.01 LABELS FOR PIPING

- A. The Contractor shall provide 4" stenciled labels using weather- and UV-resistant acrylic. Labels shall include the direction of flow, Pipe Size, and Pipe Abbreviation in accordance with the Pipe Schedule on the Drawings.

## 2.02 LABELS FOR VALVES

- A. The Contractor shall provide each valve listed on the Tag Number list with an identification tag. The tag shall be 3-inch diameter circular aluminum or stainless steel: W. H. Brady, Seton Name Plate Corp, or Engineer approved equal. Tags shall have 1/8-inch cast in black-filled letters. The Contractor shall provide fiberglass tags for chemical system valves. The valve identification shall be as shown in the mechanical details of the Contract Drawings and include the valve size, flow stream, valve type, and direction and number of turns to open. The Contractor shall submit the valve tag label schedule for review by the Engineer in accordance with Paragraph 1.03.B of this Specification.

## 2.03 HOSE BIBB SIGNS—UNSAFE WATER

- A. The Contractor shall provide a rigid sign labeled "DO NOT DRINK" and "NO BEBER" for each hose bibb. Size and lettering shall conform to OSHA requirements. Signs shall be Seton Nameplate Company 20-gauge baked enamel, minimum size 7 inches by 3 inches; Brady B-120 Fiber-Shield fiberglass, minimum size 7 inches by 3 inches, 1/8 inch thick; or equal.

## 2.04 LABELS FOR MECHANICAL EQUIPMENT

- A. The Contractor shall provide a label for each installed pump, mixer, grinder, flow meter, or other piece of mechanical equipment as part of this Project. The label shall show the equipment name and tag number as shown on the Tag Number list or on the Contract Drawings. Labels shall be 1-1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags.
- B. Provide fiberglass tags for chemical system equipment: Brady B-120 Fiber-Shield, Seton Style 2065, or equal. Contractor shall submit the mechanical equipment label schedule for review by the Engineer in accordance with Paragraph 1.03.B of this Specification.

## 2.05 LABELS FOR TANKS

- A. Signs shall be weather- and UV-resistant. Labels shall be Brady B-946, Seton Name Plate Corporation PSPL, or equal. Minimum size shall be 7 inches by 10 inches. Provide a sign on each quadrant of the tank bearing the tank tag number and the name and purpose of the liquid stored (e.g. "South Dewatering Storage Tank and North Biosolids Blend Tank").
- B. All applicable tanks shall be properly labeled for safety with signs stating, "Permit Required Confined Space". Signs shall be clearly visible and placed at all access points to the tank including manways and tank hatches.

## 2.06 HAZARDOUS MATERIALS WARNING AND DANGER SIGNS (NOT USED)

## 2.07 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

- A. The Contractor shall provide permanent, bright-colored, continuous-printed plastic tape intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Tape shall be as detailed herein and also in accordance with Section 15055, Piping Systems—General. Provide tape with printing that most accurately indicates the type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color	Service	Color
Cable TV	Orange	Water	Blue
Gas	Yellow	Sewer	Green
Electric	Red	Chemical	Yellow
Telephone	Orange	Reclaimed Water	Violet

## 2.08 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

- A. The Contractor shall provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Tape shall be as detailed herein and also in accordance with Section 15055, Piping Systems—General. Provide tape with printing that most accurately indicates the type of buried service. Provide the following colored tape for the various piping services:

Service	Color	Service	Color
Cable TV	Orange	Water	Blue
Gas	Yellow	Sewer	Green
Electric	Red	Chemical	Yellow
Telephone	Orange	Reclaimed Water	Violet

## PART 3 EXECUTION

### 3.01 INSTALLING PIPE LABELS

- A. The Contractor shall provide a stenciled label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.

### 3.02 INSTALLING VALVE AND EQUIPMENT LABELS

- A. The Contractor shall attach labels to the valve or piece of equipment with Type 304 or 316 stainless steel chains unless otherwise noted. For sodium hypochlorite and hydrofluosilicic acid use thermoplastic chains to attach labels.
- B. The Contractor shall attach valve labels to the valve handwheels. If the valve has no handwheel, attach the label to the valve by tying the tag wire or chain around the operating shaft or nut.
- C. Installation of the valve collar with identification disk shall be in accordance with the Contract Drawings.

### 3.03 INSTALLING MISCELLANEOUS SIGNS

- A. The Contractor shall attach miscellaneous signs according to the sign manufacturer's recommendations and in accordance with OSHA requirements.

### 3.04 INSTALLING WALL AND DOOR SIGNS

- A. Attach to walls and doors using epoxy adhesive.

**3.05 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE**

- A. During backfilling of each exterior underground piping system, the Contractor shall install continuous underground-type plastic line marker directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install a single line marker.

**3.06 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE**

- A. The Contractor shall install tape 12 to 18 inches below finished ground surface directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

**END OF SECTION**

**SECTION 15110**  
**MANUAL, CHECK, AND PROCESS VALVES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves as shown in the Drawings and as specified in this Section. All valves shall be complete with all necessary manual actuators, valve boxes, extension stems, and floor stands, which are required for proper valve operation and completion of the work.
  1. All valves shall be of the sizes shown in the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
  2. The valves shall include but not be limited to the following:
    - a. Air Valves.
    - b. Ball Valves.
    - c. Check Valves.
    - d. Gate Valves.
    - e. Globe and Angle Valves.
    - f. Plug Valves.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15055, Piping Systems—General.
- G. Section 15120, Power-Operated Valve Assemblies.
- H. Section 15144, Pressure Testing of Piping.
- I. Section 15155, Ductile Iron Pipe and Fittings.

## 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
  - 1. Acknowledgment that products submitted meet requirements of standards referenced.
  - 2. Manufacturer's installation instructions.
  - 3. Manufacturer's operation and maintenance manuals.
  - 4. Data of valves, actuators, and accessories:
    - a. Pressure and temperature rating.
    - b. Materials of construction, with ASTM reference and grade.
    - c. Linings and coatings.
    - d. Dimensions and weight.
    - e. Flow coefficient.
    - f. Actuators and accessories details.
    - g. Manufacturer's product brochure, cut-sheets, and parts diagrams.
- B. Dimensions and orientation of valve actuators as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.
- C. The following test reports: Performance Tests; Leakage Tests; Hydrostatic Tests; and Proof-of-Design Tests as applicable or required.

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Petroleum Institute (API)
  - 1. API SPEC 6D—Specification for Pipeline and Piping Valves.

2. API SPEC 6FA—Specification for Fire Test for Valves.
  3. API STD 594—Check Valves: Flanged, Lug, Wafer and Butt-Welding.
  4. API STD 607—Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats.
- B. American Society for Testing of Materials (ASTM)
1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
  2. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
  3. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
  4. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
  5. ASTM A108—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
  6. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  7. ASTM A148/A148M—Standard Specification for Steel Castings, High Strength, for Structural Purposes.
  8. ASTM A181/A181M—Standard Specification for Carbon-Steel Forgings, for General-Purpose Piping.
  9. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  10. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
  11. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  12. ASTM A216/A216M—Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
  13. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  14. ASTM A269/A269M—Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Purpose.
  15. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
  16. ASTM A313/A313M—Standard Specification for Stainless Steel Spring Wire.
  17. ASTM A322—Standard Specification for Steel Bars, Alloy, Standard Grades.

18. ASTM A351/A351M—Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
19. ASTM A395/A395M—Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
20. ASTM A436—Standard Specification for Austenitic Gray Iron Castings.
21. ASTM A439/A439M—Standard Specification for Austenitic Ductile Iron Castings.
22. ASTM A449—Standard Specification for Hex Cap Screws, Bolts and Studs, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
23. ASTM A479/A479M—Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
24. ASTM A494/A494M—Standard Specification for Castings, Nickel and Nickel Alloy.
25. ASTM A516/A516M—Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service.
26. ASTM A536—Standard Specification for Ductile Iron Castings.
27. ASTM A564/A564M—Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
28. ASTM A582/A582M—Standard Specification for Free-Machining Stainless Steel Bars.
29. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
30. ASTM A743/A743M—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
31. ASTM A744/A744M—Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
32. ASTM A890/A890M—Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.
33. ASTM B16/B16M—Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
34. ASTM B21/B21M—Standard Specification for Naval Brass Rod, Bar, and Shapes.
35. ASTM B61—Standard Specification for Steam or Valve Bronze Castings.
36. ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.
37. ASTM B98/B98M—Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
38. ASTM B99/B99M—Standard Specification for Copper-Silicon Alloy Wire for General Applications.
39. ASTM B127—Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.

40. ASTM B148—Standard Specification for Aluminum-Bronze Sand Castings.
41. ASTM B150/B150M—Standard Specification for Aluminum Bronze Rod, Bar, and Shapes.
42. ASTM B164—Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
43. ASTM B169/B169M—Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
44. ASTM B193—Standard Test Method for Resistivity of Electrical Conductor Materials.
45. ASTM B371/B371M—Standard Specification for Copper-Zinc-Silicon Alloy Rod.
46. ASTM B427—Standard Specification for Gear Bronze Alloy Castings.
47. ASTM B443—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip.
48. ASTM B446—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar.
49. ASTM B462—Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.
50. ASTM B463—Standard Specification for UNS N08020 Alloy Plate, Sheet, and Strip.
51. ASTM B472—Standard Specification for Nickel Alloy Billets and Bars for Reforging.
52. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.
53. ASTM B763/B763M—Standard Specification for Copper Alloy Sand Castings for Valve Applications.
54. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
55. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
56. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
57. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.

58. ASTM D3222—Standard Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
59. ASTM D4101—Standard Classification system and Basis for Specification for Polypropylene Injection and Extrusion Materials.
60. ASTM F441/F441M—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
61. ASTM F467—Standard Specification for Nonferrous Nuts for General Use.
62. ASTM F468—Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.

C. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B1.20.7—Hose Coupling Screw Threads (Inch).
3. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
4. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
5. ASME B16.10—Face-to-Face and End-to-End Dimensions of Valves.
6. ASME B16.11—Forged Fittings, Socket-Welding and Threaded.
7. ASME B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.
8. ASME B16.24—Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500.
9. ASME B16.34—Valves Flanged, Threaded and Welding End.
10. ASME B16.42—Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
11. ASME B16.47—Large Diameter Steel Flanges NPS 26 through NPS 60 Metric/Inch Standard.
12. ASME B36.10—Welded and Seamless Wrought Steel Pipe.

D. American Society of Safety Engineers (ASSE)

1. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.

E. American Water Works Association (AWWA)

1. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.
2. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C115/A21.15—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

4. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
5. AWWA C500—Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C504—Rubber-Sealed Butterfly Valves.
7. AWWA C507—Ball Valves 6-Inch through 60-Inch (150 mm through 1,500 mm).
8. AWWA C508—Swing-Check Valves for Waterworks Service, 2-Inch through 48-Inch (50 mm through 1,200 mm) NPS.
9. AWWA C509—Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C512—Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
11. AWWA C515—Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C550—Protective Interior Coatings for Valves and Hydrants.
13. AWWA C606—Grooved and Shouldered Joints.
14. AWWA C800—Underground Service Line Valves and Fittings.

F. Fluid Controls Institute (FCI)

1. FCI 70-2—Control Valve Seat Leakage.

G. Manufacturers Standardization Society (MSS)

1. MSS SP-61—Pressure Testing of Valves.
2. MSS SP-67—Butterfly Valves.
3. MSS SP-68—High Pressure Butterfly Valves with Offset Design.
4. MSS SP-81—Stainless-Steel or Stainless-Steel-Lined, Bonnetless, Knife Gate Valves with Flanged Ends.
5. MSS SP-83—Class 3000 and 6000 Pipe Unions, Socket Welding and Threaded (Carbon Steel, Alloy Steel, Stainless Steels, and Nickel Alloys).
6. MSS SP-108—Resilient-Seated Cast Iron Eccentric Plug Valves.

H. National Fluid Power Association (NFPA)

1. NFPA T3.6.7—Fluid Power Systems and Products – Square Head Industrial Cylinders – Mounting Dimensions.
2. NFPA T3.6.68—Fluid Power – Square Head Cylinders – Determination of the Static Failure Pressure Rating of Pressure Containing Components.

I. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

**1.06 QUALITY ASSURANCE (NOT USED)**

**1.07 WARRANTIES**

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All valves, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be stacked or placed under pipe, fittings, or other valves in such a manner that damage could result.
- C. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior linings and valve components. If any part of the coating, lining, or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer before attempting to install such valves.
- D. Only new valves will be allowed for installation and shall be stored in a manner to prevent damage and be kept free of dirt, mud, or other debris.

**1.09 QUALIFICATIONS**

- A. All of the valves shall be products of well-established firms which are fully experienced, reputable, have been selling this product for a minimum of 10 years, and are qualified in the manufacture of the particular product furnished. The valves shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

**1.10 TESTING REQUIREMENTS (NOT USED)**

**1.11 MAINTENANCE (NOT USED)**

**1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS**

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

## 1.13 VALVE TYPE CLASSIFICATIONS

- A. Air Valves (Type 100 series):
  - 1. Type 140: Air Valves for Sewage Services, Air Release.
- B. Ball Valves (Type 200 series)
  - 1. Type 220: Regular Port Threaded Stainless Steel Ball Valves, 2 Inches and Smaller.
- C. Check Valves (Type 400 series):
  - 1. Type 430: Ductile-Iron Swing-Flex Check Valves, 2 Inches through 36 Inches.
- D. Gate Valves (Type 600 series):
  - 1. Type 652: Stainless-Steel Gate Valves, 2 Inches through 6 Inches.
- E. Globe and Angle Valves (Type 700 series):
  - 1. Type 710: Bronze Angle Hose Valves, 1 Inch through 3 Inches.
  - 2. Type 720: Bronze Hose Bibbs, 1/2 Inch through 1 Inch.
- F. Plug Valves (Type 900 series):
  - 1. Type 902: Eccentric Plug Valves, 4 Inches through 12 Inches.
  - 2. Type 920: Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Valves are identified in the Drawings by size and type number. For example, a callout of 36V300 refers to a 36-inch-diameter Type 300 valve. A Type 300 valve is a flanged, rubber-seated butterfly valve that is 4 inches through 72 inches for exposed service.
- B. All valves shall be complete with all necessary geared actuators, chainwheels and chains, handwheels, levers, valve bonnets, valve boxes, extension stems, operating nuts, and T-handle wrenches, which are required for proper valve

operating and completing of the work included under this Section. Renewable parts including discs, packing, and seats shall be of types specified in this Section and acceptable by valve manufacturer for the intended service. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached stainless-steel plate in raised embossed letters. All isolation valves shall be suitable for the intended service with bubble-tight shutoff to flow in either direction.

- C. Bronze or brass components in contact with water shall comply with the following requirements:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	8% maximum
Copper + Nickel + Silicon	83% minimum

- D. Valves and valve operators shall be factory prepared and primed and field finish coated in accordance with Section 09900, Painting and Coating.

## 2.02 VALVE ACTUATORS

- A. The valve actuator shall be an integral part of a valve. The valve actuator shall be provided, installed, and adjusted by the valve manufacturer. Actuator mounting arrangements shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by the Engineer.
- B. All valves shall open counter clockwise as viewed from the top. Unless otherwise required by the Owner, the direction of rotation of the wheel or wrench nut to open each valve shall be to the left (counterclockwise). Each valve body or actuator shall have the word "Open" cast on it and an arrow indicating the direction to open.
- C. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts, and washers shall be AISI Type 304 stainless steel. Unless noted otherwise, valves shall be equipped with the following manual actuators:
1. Exposed Valves 6 Inches and Smaller: Removable lever or handwheel actuators.
  2. Exposed Valves 8 Inches and Larger: Geared actuators with handwheels.

3. Buried or Submerged Valves 6 Inches and Smaller: 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and T-handle wrench.
  4. Buried or Submerged Valves 8 Inches and Larger: Geared actuators with 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and wrench.
- D. Levers or handwheels shall be provided to actuate the valves where the valves are within 6 feet and 7 inches from finished grade or the operating floor. Handwheels shall be constructed of ductile-iron. Levers and handwheels shall be coated in accordance with Section 09900, Painting and Coating. Handwheel diameters for traveling nut actuators shall not exceed 8 inches for valves 12 inches and smaller and shall not exceed 12 inches for valves 20 inches and smaller.
- E. Chainwheel and guide actuators shall be provided for all exposed valves installed with their centerlines more than 6 feet and 9 inches above finished grade. Chainwheels shall be cast-iron with stainless-steel stem, clip, and pins. The actuating chain shall be AISI Type 304 stainless steel. Stainless-steel chain baskets shall also be provided with these units. Chainwheels shall be coated in accordance with Section 09900, Painting and Coating.

Chainwheels and guides shall be Clow Figure F-5680, DeZurik Series W or LWG, Stockham, or equal.

- F. Gear actuators for valves 8 inches through 20 inches shall be of the worm-and-gear or of the traveling-nut type. Gear actuators for valves 24 inches and larger shall be of the worm-and-gear type. Gear actuators for motorized valves shall be of the worm-and-gear type, regardless of size.
  1. Gear actuators should be designed assuming that the differential pressure across the valves is equal to the test pressure of the connecting piping and assuming a line fluid temperature range of 33°F to 125°F, unless otherwise required in the detailed valve specifications.
  2. Gear actuators shall be enclosed and oil lubricated with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves aboveground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug.
  3. Traveling nut and worm-and-gear actuators shall be of the totally enclosed design and proportioned to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 80 pounds on the handwheel or crank. Stop-limiting devices shall be provided in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator

components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.

4. The self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B584, Alloy C86200) that is accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148/A148M, Grade 105-85) with thread ground and polished. Support worm-gear shafts at each end by ball or tapered roller bearings. The reduction gearing shall run in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.
- G. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.
- H. All buried valves shall have non-rising stems. All buried valves 3 feet below grade or deeper as measured at the valve centerline shall be furnished with an operator stem extension to extend the operating nut within 6 inches from the top of the valve box cover.
- I. Motorized Valves shall be in accordance with Section 15120, Power-Operated Valve Assemblies.

## 2.03 VALVE END CONNECTIONS

- A. Provide valve end connections conforming to connected piping and as shown in the Drawings. Generally, all buried valves shall be mechanical joint type end connectors. Exposed valves shall be screwed-end, socket-weld end, or flanged to conform to adjacent exposed connected piping system.
- B. Comply with the following standards:
  1. Threaded: ASME B1.20.1.
  2. Flanged: ASME B16.1 Class 125 unless other noted or AWWA C207.
  3. Mechanical (gland) Type: AWWA C111.
  4. Soldered: ASME B16.18.

- C. Nuts, Bolts, and Washers: Wetted or internal to be bronze or stainless-steel. Exposed to be zinc or cadmium-plated.
- D. Epoxy Interior Coating: Provide epoxy coating for all interiors of ferrous valve body surfaces in accordance with AWWA C550. Coatings shall be NSF-approved for valves in all potable water piping services. Coatings shall not be required for stainless-steel valve interiors.

## 2.04 VALVE BOXES

- A. All buried valves 2-inch size and larger shall be equipped with a standard cast-iron roadway valve box. Valve boxes shall be of the slip or sliding type with a round lid marked "Sewer" for wastewater and a square lid marked "Reclaimed Water" for reclaimed water valves. The box shall be designed to prevent transfer of the surface loads directly to the valve or piping. Valve boxes must have a minimum adjustable range of 12 inches and a minimum inner diameter of 6 inches. All valve boxes and lids shall be produced from grey cast-iron conforming to the latest revision of specification for grey iron castings, ASTM A48, Class 20A-25A. All castings shall be true and free of holes and shall be cleaned according to good foundry practice, chipped and ground as needed to remove fins and rough places on castings. Valve boxes have to be rated to sustain FDOT H-20 loadings and have a minimum depth of 8 inches. The valve box lid shall fit flush in the top of the box without forcing and shall not rock, tip, or rattle.
- B. Provide debris cap as required in the Contract Drawings.
- C. Coat buried cast-iron pieces as specified in Section 09900, Painting and Coating, System No. 21 or with fusion-bonded epoxy.
- D. Valve boxes shall be as manufactured by Tyler Pipe, Geneco, Star Pipe Products, or equal.

## 2.05 EXTENSION STEMS

- A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where the valve is submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be Type 316 stainless steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall withstand without damage a pull of 300 foot-pounds.

- B. Extension stem diameters shall be as tabulated below:

Valve Size (inches)	Minimum Extension Stem Diameter (inches)
2	3/4
3, 4	7/8
6	1
8	1-1/8
10, 12	1-1/4
14	1-3/8
16, 18	1-1/2
20, 24, 30, 36	1-3/4
42, 48, 54	2

- C. Provide buried valves or valves located inside manholes or vaults with valve boxes cast in the manhole or vault roof with a valve position indicator designed to fit standard 5-1/4-inch valve boxes. The indicators shall show valve position and the direction and number of turns required to fully open (or close). All internal gearing shall be sealed. Ship each unit ready for field installation complete with valve box cast-iron adapter, capscrews, guide bushing, position indicator, flexible washer, centering plate, and 2-inch AWWA nut. Valve box and indicator shall be provided by the valve manufacturer. Indicators shall be Westran Position Indicator, Pratt Diviner, or equal.

## 2.06 FLOOR STANDS

- A. When required by the installations, provide floor stands for the operation of valves. Floor stands shall be of the nonrising stem, indicating type, complete with steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Floor stands shall be cast-iron base type: Clow, Figure F-5515; Bingham and Taylor; Stockham; or equal. Handwheels shall turn counterclockwise to open the valves.
- B. Provide Type 316 stainless-steel anchor bolts.
- C. Provide Type 316 stainless-steel extension stems for valves in exposed service. Provide Type 316 stainless-steel stems for valves in submerged service.
- D. Provide adjustable stem guide brackets for extension stems. The bracket shall allow valve stems to be set over a range of 2 to 36 inches from walls. Provide bushings drilled to accept up to 2-inch-diameter stems. Base, arm, and clamp shall be Type 316 stainless-steel. Bushing shall be bronze (ASTM B584, Alloy C86400 or C83600). Bolts, nuts, screws, and washers (including wall anchor bolts) shall

be Type 316 stainless steel. Provide slots in the bracket to accept 3/4-inch bolts for mounting the bracket to the wall. Products: Trumbull Industries, Inc., Adjustable Stem Guide or equal.

## 2.07 BOLTS, NUTS, AND GASKETS FOR FLANGED VALVES

- A. Bolts, nuts, and gaskets for flanged valves shall be as described in Section 15055, Piping Systems—General.

## 2.08 PAINTING AND COATING

- A. Coat metal valves located aboveground or in vaults and structures the same as the adjacent piping. If the adjacent piping is not coated, coat valves as specified in Section 09900, Painting and Coating, System No. 10. Apply the specified prime and finish coat at the place of manufacture. The finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.
- B. Coat buried metal valves at the place of manufacture as specified in Section 09900, Painting and Coating, System No. 21.
- C. Coat submerged metal valves, stem guides, extension stems, and bonnets at the place of manufacture as specified in Section 09900, Painting and Coating, System No. 7.
- D. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless-steel pieces, as specified in Section 09900, Painting and Coating, System No. 6. Apply lining at the place of manufacture.
- E. Coat floor stands as specified in Section 09900, Painting and Coating, System No. 10.
- F. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.
- G. Measure the thickness of the valve interior linings as specified in Section 09900, Painting and Coating. Repair areas having insufficient film thickness as specified in Section 09900, Painting and Coating.

## 2.09 AIR VALVES (TYPE 100 SERIES)

### A. General Description:

1. All valves shall meet or exceed all applicable provisions of the latest revision of AWWA C512, Standard for Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service. All valves for drinking water services shall comply with NSF 61. Design pressure is 150 psig. Valves shall be operable for water temperatures of above freezing to 125°F.
2. All valves shall consist of a float or a float assembly. Valves shall be identified properly in plates attached permanently on the valve body. The body and cover shall be cast-iron ASTM A126, Class B, or ASTM A48/A48M, Class 35. Valves 3 inches and smaller shall have threaded ends. Valves 4 inches and larger shall have flanged ends. Threaded ends shall comply with ASME B1.20.1. Flanges shall comply with ASME B16.1, Class 125. All flanges shall be flat faced.
3. The float shall be Type 304 or 316 Stainless-Steel. For valves with inlet sizes less than 4 inches, the float shall be able to withstand a collapse pressure of 1,000 psig. For inlet sizes 4 inches and larger, the float shall be capable of withstanding collapse pressures of 750 psig. Trim shall be Type 304 or 316 Stainless-Steel. The valve seat shall be of EPDM or other rubber materials applicable to wastewater and sludge. The valve seat shall be easily removed and replaced in the field.
4. Drain/test ports on all valves with inlet size 1 inch or larger shall have two 1/2-inch NPT minimum plugged ports, one near the bottom of the valve body and the other near the top of the valve. The plug shall be of bronze, ASTM B584, Alloy C83600.

### B. Type 140—Air Valves for Sewage Services, Air Release:

1. Type 140 air valves for sewage service shall have elongated cylindrical chambers. All valves shall provide the following: 1/2-inch clearance around the float in the chamber; minimum size 1/2-inch isolation valve and quick-disconnect couplings at the valve venting for back-flushing; blowoff port and valve at the bottom of the chamber; and inlet valve at the valve inlet. A back-flushing assembly shall be provided for all valves. The back-flushing assembly shall consist of an inlet shutoff valve, a flush valve, a clear water inlet valve, rubber supply hose, and quick-disconnect couplings. Type 140 valves shall be air-release valves. Valves shall be APCO 450 Series, Val-Matic Model 49ABW, or equal.

## 2.10 BALL VALVES (TYPE 200 SERIES)

- A. Type 220—Regular Port Threaded Stainless Steel Ball Valves, 2 Inches and Smaller:
1. Stainless-steel ball valves 2 inches and smaller shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100°F. Valve body, ball, and stem shall be Type 316 stainless-steel, ASTM A276/A276M or ASTM A351. Seat and seals shall be reinforced PTFE. Valves shall have plastic-coated lever actuators. Valves shall have screwed ends (ASME B1.20.1) and nonblowout stems. Valves shall be Flowserve Marpac B780 Series, Apollo 76-100 Series, or approved equal.

## 2.11 CHECK VALVES (TYPE 400 SERIES)

- A. Type 430—Ductile-Iron Swing-Flex Check Valves, 2 Inches through 36 inches:
1. The valve body and cover shall be constricted of ASTM A536 Grade 65-45-12 ductile-iron. The disc shall be precision-molded Buna-N, ASTM D2000 Class BG. A screw-type backflow actuator shall be provided to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless-steel stem in a bronze bushing. The backflow device shall be of the rising-stem type to indicate position. A stainless-steel T-handle shall be provided for ease of operation. The valve shall be designed for a minimum working pressure of 150 psi. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body. Swing check valves shall exceed the minimum requirements of AWWA C508 with a heavy-duty body of ductile-iron with integral flanges, faced and drilled in accordance with ASME B16.1 Class 125. Bolts, nuts, washers, etc., shall be 316 stainless-steel. The valve body shall be the full waterway type. The disk arm shall be ductile-iron or steel, suspended from and keyed to a stainless-steel shaft, which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable. The valve interior shall be painted with epoxy coating by the valve manufacturer in accordance with AWWA C550. The check valve shall be Val-Matic Swing-Flex check valve, or approved equal.

## 2.12 GATE VALVES (TYPE 600 SERIES)

- A. Type 652—Stainless-Steel Gate Valves, 2 inches through 6 inches:
1. Stainless-steel gate valves 2 inches through 6 inches shall be of the wedge type, Class 150 with rising stem and handwheel. The bonnet shall be of the bolted type. Ends shall be flanged in accordance with ASME B16.5. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, yoke, and wedge	Stainless-steel	ASTM A351, Grade CF8M
Stem and gland follower	Stainless-steel	ASTM A276/A276M, Type 316
Handwheel	Malleable iron	ASTM A47/A47M
Nuts and bolts	Stainless-steel	ASTM A194/A194M, Grade 818F or ASTM A193/A193M, Grade 88
Packing	Teflon	--

2. Valves shall be Powell Figure 1832, Crane/Alloyco Figure 90, or equal.

## 2.13 GLOBE AND ANGLE VALVES (TYPE 700 SERIES)

- A. Type 710—Bronze Angle Hose Valves, 1 Inch through 3 Inches:
1. Angle-type hose valves 1 inch through 3 inches shall be brass or bronze (ASTM B62 or ASTM B584, Alloy C83600) body with rising or non-rising stem, composition disc, and bronze or malleable iron handwheel. The stem shall be bronze, ASTM B62, ASTM B584 (Alloy C83600), or ASTM B584 (Alloy C87600). Valves shall have a cold-water service pressure rating of at least 150 psi. Provide cap and chain with valve. Threads on the valve outlet shall be American National Standard fire hose coupling screw thread. Valves shall be Nibco T-301-W, Powell Figure 151 with nipple adapter, Crane 17TF with hose nipple adapter, or approved equal.
- B. Type 720—Bronze Hose Bibbs, 1/2-Inch through 1 Inch:
1. Hose bibbs 1/2 inch, 3/4 inch, and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron handwheel, and bronze stem

(ASTM B99/B99M, Alloy C65100; ASTM B371/B371M, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be PTFE or graphite.

Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ASME B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Valves shall be manufactured by Nibco or approved equal.

## 2.14 PLUG (TYPE 900 SERIES)

- A. Plug and Seating Design for Eccentric Plug Valves (910 and 920): Eccentric plug valves shall comply with MSS SP-108 and the following. Provide a rectangular plug design, with an associated rectangular seat. Provide bidirectional seating design. The valve shall seat with the rated pressure upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.
- B. For Types 910 and 920 eccentric plug valves, the metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs which result in a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Nowhere in the valve or actuators shall the valve shaft be exposed to iron-on-iron contact. Sleeve bearings shall be stainless-steel in valve sizes 20 inches and smaller and bronze or stainless-steel in valve sizes 24 inches and larger. Provide enclosed worm-gear actuators for valves 6 inches and larger.
- C. Rubber compounds shall have less than 2% volume increase when tested in accordance with ASTM D471 after being immersed in distilled water at a temperature of  $73.4^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for 70 hours.
- D. Where indicated on the Contract Drawings, Plug Valves shall be equipped with valve position indicators. Indicators shall have NEMA 4X enclosures, 2 NPT conduit connections, 2 SPDT mechanical switches, and external visual indicator. Indicators shall not exceed 16 amp rating. Indicators shall be as manufactured by Assured Automation, YF Series, or engineer-approved equal.
- E. Type 902—Eccentric Plug Valves, 4 Inches through 12 Inches:
  - 1. Eccentric plug valves 4 inches through 12 inches shall be non-lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be cast-iron in accordance with ASTM A126, Class B. Ends shall be flanged, Class 125 in accordance with ANSI B16.1. Plugs shall be stainless-steel, cast-iron (ASTM A126, Class B), or ductile-iron (ASTM A536,

Grade 65-45-12) with Buna-N facing. Valve body seats shall be Type 304 or 316 stainless-steel or have a raised welded-in overlay at least 1/8-inch thick of not less than 90% nickel. Body capscrews and bolts and nuts shall be Type 316 stainless-steel. Packing shall be butadiene-filled Teflon.

Provide 100% port area. Valves shall be DeZurik PEC Note: DeZurik PET is 100% port, Clow F-5412, Val-Matic "Cam-Centric," Milliken "Millcentric" Figure 601, Pratt "Ballcentric," or approved equal.

F. Type 920—Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger:

1. Plug valves 4 inches and larger shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with flanges or mechanical-joint end connections to match connecting piping and as shown in the Drawings. Flanged valves shall be 125-lb flanges and faced and drilled to the ASME B16.1, 125-lb standard. Mechanical joint ends shall conform to AWWA C111. Valve bodies shall be of ASTM A126 Class B cast-iron. Valves shall be furnished with a welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plugs shall be resilient faced with Hycar (Acrylonitrile-Butadiene) or Buna N, formulated and constructed to be suitable for use with wastewater. Minimum port areas shall be 80% of full pipe flow area. Valves shall have sleeve-type metal bearings and shall be of sintered, oil-impregnated, permanently lubricated Type 316 ASTM. Nonmetallic bearings shall not be acceptable. Valve shaft seals shall be of the multiple V-ring type or U-cup type and shall be externally adjustable and replaceable without removing the bonnet or actuator from the valve under pressure. Valves using O-ring seals or non-adjustable packing shall not be acceptable. All exposed nuts, bolts, springs, washers, and other fasteners shall be 300-series stainless-steel. Valve working pressure ratings shall be a minimum of 150 psi. Each valve shall be given a hydrostatic and seat test with certified copies of proof-of-design test reports as outlined in AWWA C504, Section 5.5. Plug valves shall be DeZurik PEC Series, Henry Pratt Company "Ballcentric" Series, or approved equal.

## PART 3 EXECUTION

### 3.01 JOINTS

- A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
- B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).
- D. Install grooved-end couplings for valves in accordance with Section 15055, Piping Systems—General.

### 3.02 INSTALLING EXPOSED VALVES

- A. Unless otherwise indicated in the Drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.
- B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

### 3.03 INSTALLING BURIED VALVES

- A. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement as required on the Drawings, and place and compact the backfill to the height of the valve stem.
- B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.

- C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.
- D. Install debris cap as close as possible under the cast-iron cover without interfering with the cover operation. Trim flexible skirt to provide a smooth contact with the interior or the extension pipe.

### 3.04 INSTALLING EXTENSION STEM GUIDE BRACKETS

- A. Install extension stem guide brackets at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

### 3.05 FIELD COATING BURIED VALVES

- A. Coat flanges of buried valves and the flanges of the adjacent piping and the bolts and nuts of flanges and mechanical joints, as specified in Section 09900, Painting and Coating, System No. 24.
- B. Wrap buried metal valves 6 inches and larger with polyethylene sheet as specified in Section 15155, Ductile Iron Pipe and Fittings.

### 3.06 VALVE LEAKAGE AND FIELD TESTING

- A. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15144, Pressure Testing of Piping, for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.
- B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind or do not operate from full open to full closed, repair or replace the valve and repeat the tests.
- C. Test gear actuators through three full cycles from full-open to full-close without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 foot-pounds. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or

replace the actuators and repeat the tests. Operators shall be lubricated in accordance with the manufacturer's recommendations before operating.

# WATER SERVICE CARD

Date of Installation \_\_\_\_\_

Contract Drawing Number \_\_\_\_\_

Service Line Size (inches) \_\_\_\_\_

Length of Water Service Line (feet) \_\_\_\_\_

Meter Size (inches) \_\_\_\_\_

Name \_\_\_\_\_

House/Business Address or Location:

Phone # \_\_\_\_\_

GPS coordinate @ main \_\_\_\_\_

GPS coordinate @ meter \_\_\_\_\_

Confirm Photos are attached \_\_\_\_\_

Installation Foreman \_\_\_\_\_

## **Service Layout**

Provide a brief sketch of the installed configuration. Indicate lengths, depths of the water service, and show three ties to meter box and to corporation stop:

Depth @ Main (feet) \_\_\_\_\_

Depth @ stub out (feet) \_\_\_\_\_

---

Contractor Signature

(Rev 2 – 15 Oct 2006)

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Resident Observer Signature

# ISOLATION VALVE CARD

Date of Installation \_\_\_\_\_

Contract Drawing Number \_\_\_\_\_

Closest Street Address to Valve or Location of Valve  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Size of Valve (inches) \_\_\_\_\_

Circle Type of Valve:      Gate      Butterfly

GPS Coordinate @ Valve \_\_\_\_\_

Installation Foreman \_\_\_\_\_

Confirm Photos are attached \_\_\_\_\_

## **Isolation Valve Layout**

Provide a brief sketch of the installed configuration. Show depths of the water line and show three ties to the isolation valve:

Depth @ Main (feet) \_\_\_\_\_

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Contractor Signature

(Rev 2 – 15 Oct 2006)

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Resident Observer Signature

# FIRE HYDRANT CARD

Date of Installation \_\_\_\_\_

Contract Drawing Number \_\_\_\_\_

Closest Street Address to Fire Hydrant or Location of Fire Hydrant  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Length of Hydrant Line (feet) \_\_\_\_\_

List any offset fittings required. \_\_\_\_\_

List Utilities requiring offset fittings \_\_\_\_\_

GPS coordinate @ main \_\_\_\_\_

GPS coordinate @ Hydrant \_\_\_\_\_

Installation Foreman \_\_\_\_\_

Confirm Photos are attached \_\_\_\_\_

## **Fire Hydrant Layout**

Provide a brief sketch of the installed configuration. Indicate lengths, depths of the water line and hydrant, offset fittings, and show three ties to the fire hydrant isolation valve:

Depth @ Main (feet) \_\_\_\_\_

Depth @ hydrant (feet) \_\_\_\_\_

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Contractor Signature

(Rev 2 – 15 Oct 2006)

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Resident Observer Signature

END OF SECTION

**SECTION 15120**  
**POWER-OPERATED VALVE ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to install complete and ready for operation power operated valve assemblies shown in the Drawings and as specified in this Section. The power operated valve assemblies shall consist of valves with electric motor multi-turn actuators with valve-stem mounted worm-gear actuators for exposed valve actuation service, extension stems and extension bonnets with worm-gear actuators for buried valve actuation service, controls for local and remote operation, and accessories required for manual and automatic valve operation.
- B. All valves shall be of the type specified in Section 15110, Manual, Check, and Process Valves. All valve and actuator combinations of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
- C. The power operated valve assemblies shall be provided by the valve manufacturer/supplier. Valves shall be as specified in Section 15110, Manual, Check, and Process Valves. The complete power operated valve assemblies shall be assembled at the valve factory for performance testing. The completed assemblies for each valve shall be shipped to the job site completely assembled and ready for installation including actuator, actuator controls, valve with mechanical worm-gear actuator, and extension stem assemblies as required.

**1.02 RELATED WORK**

- A. Related Specifications for work required for this Section:
  - 1. Section 01330, Submittals and Acceptance.
  - 2. Section 01650, Delivery, Storage, and Handling.
  - 3. Section 01780, Warranties and Bonds.
  - 4. Section 01830, Operations and Maintenance Manuals.
  - 5. Section 09900, Painting and Coating.
  - 6. Section 13401, Process Instrumentation and Controls (PICS).
  - 7. Section 15055, Piping Systems—General.
  - 8. Section 15110, Manual, Check, and Process Valves.

## **1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with the requirements of Section 01330, Submittals and Acceptance, and Section 15110, Manual, Check, and Process Valves.
- B. The Contractor shall submit the following:
  - 1. Actuator manufacturer's catalog data showing motor actuator parts and materials of construction, referenced by AISI, ASTM, SAE, or CDA specification and grade. Indicate motor actuator dimensions, weights, and coatings.
  - 2. The minimum and maximum torque required to open and close each motor-actuated valve supplied for this project.
  - 3. Certified factory performance test records for each assembly.
  - 4. Motor data including nameplate data, insulation type, duty rating, and torque output at duty rating.
  - 5. Electrical schematic drawings and interconnecting wiring diagrams for external monitoring and controls.
  - 6. Catalog data, brochures, drawings for valves, worm-gear actuators, bonnet extensions, shaft extensions, and other accessories.
  - 7. Catalog data, drawings, diagrams for the complete assembly including drawings of each assembly, and dimensions of extension bonnets from center line of valve to center line of electric motor actuator.
  - 8. Control descriptions for local and remote controls including opening and closing (speed) times, and valve positions for open/close control duties. Control requirements are described in other sections listed in Article 1.02 of this Section.
  - 9. Site storage, protection, and installation requirements and procedures.

## **1.04 WORK SEQUENCE (NOT USED)**

## **1.05 REFERENCE STANDARDS (NOT USED)**

## **1.06 QUALITY ASSURANCE (NOT USED)**

## **1.07 WARRANTIES**

- A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15110, Manual, Check, and Process Valves, for the items specified in this Section.

## 1.09 QUALIFICATIONS

- A. All power-operated valve assemblies shall be products of well-established valve manufacturers which are fully experienced, reputable, have been furnishing power operated valve assemblies including field servicing and start-up for a minimum of 10 years. The valves shall be designed, constructed, and installed in accordance with the requirements and procedures of AWWA C540 and other applicable AWWA standards and shall comply with these Specifications as applicable.

## 1.10 MAINTENANCE

- A. The Contractor shall furnish the following spare parts for each actuator in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.
- B. For the four motorized actuators, provide each:
  1. One set of shear pins
  2. One set of gear assemblies
  3. One Set of couplings
  4. Additional spare parts shall be provided in accordance with the recommendations of equipment manufacturers.

## 1.11 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Provisions, Special Provisions, and Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. All valves furnished under this Section shall conform to the requirements specified in Section 15110, Manual, Check, and Process Valves.
- B. All worm-gear actuators shall conform to the requirements for respective valve series number (types) as specified in Section 15110, Manual, Check, and Process Valves.

- C. All power-operated valve assemblies shall be furnished with all necessary operating appurtenances which are required for the proper completion of the work specified in this Section and as specified in Section 15110, Manual, Check, and Process Valves, including but not limited to:
  - 1. Valve-Stem and Extension Bonnet Mounted Worm-Gear Type Actuators.
  - 2. Extension Stems.
  - 3. Actuator Support Floor Stands (if required).
  - 4. Extension Bonnets.
  - 5. Electric Motor Actuator Mounted to Worm-Gear Actuators with Manual Handwheel Operator and Local Control.
- D. Power operated valve assemblies designated to be furnished with bonnet extensions shall have bonnet extensions and shaft extensions lengths to provide the electric motor actuator centerline at 48 inches above the concrete maintenance slab, as shown in the Contract Drawings.

## 2.02 VALVES

- A. Process Identification Numbers:
  - 1. West TWAS Valve: 104-V-1.
  - 2. East TWAS Valve: 104-V-2.
  - 3. West TPSL Valve: 105-V-1.
  - 4. East TPSL Valve: 105-V-1.
- B. Plug Valves (Flanged-End Connection) V902: As shown in the Contract Drawings and as specified under Section 15110, Manual, Check, and Process Valves.

## 2.03 ELECTRIC MOTOR ACTUATORS

- A. Number of Electric Actuators: Four.
- B. The actuators shall be electric motor gear train type consisting of motor controls, gearbox, geared limit switches, torque switches, and manual override handwheel with declutching lever and worm-gear actuator suitable for multi-turn valve operation. The actuators shall be capable of producing no less than 1-1/2 times the required minimum operating torque. The actuators shall be of the self-locking type and shall operate the valve from fully opened to fully closed positions, or the reverse, in approximately 40 seconds.

- C. The electric motor actuators shall be sized for the following process conditions:

Valve Location/Designation	Valve Size	Duty Function
West TWAS Valve (104-V-1)	6"	Open/Close
East TWAS Valve (104-V-2)	6"	Open/Close
West TPSL Valve (105-V-1)	6"	Open/Close
East TPSL Valve (105-V-2)	6"	Open/Close

- D. The actuators shall comply with AWWA C540, except as modified herein. Output capacity of motors shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall have Class F or H insulation system. Provide motor with torque output (at duty rating) that exceeds the requirements of the following paragraphs including the safety factor.
- E. Design the actuator to move valves from fully closed to fully open in the time specified in the subsection on "Service Conditions."
- F. Provide the following integral to the actuator: reversing, magnetic starter, three overloads (one in each ungrounded leg) or two motor thermal cutouts, 120-volt control power transformer, LOCAL/STOP/REMOTE selector switch (maintained), OPEN-STOP-CLOSE selector switch (spring return to center), and OPEN/CLOSED status indicator lights.
- G. Provide dry contact for remote indication of the actuator status and alarm conditions as follows:
1. Mode of operation (LOCAL/REMOTE).
  2. Actuator FAIL.
  3. Valve FAIL.
  4. OPEN/CLOSE Status.
- H. The actuator shall operate (i.e., move full open or full closed) upon receipt of a remote contact. The actuator operation shall be mutually exclusive (i.e., operate only upon receipt of a remote OPEN or remote CLOSED command).
- I. The actuator shall include provisions for Emergency Shutdown (ESD) operation, initiated by a remote contact. ESD operation shall either maintain the existing valve position or position the valve either full OPEN or full CLOSED, as preconfigured. This command shall override any command, local or remote.

- J. Establish an Actuator FAIL alarm whenever any of the following conditions are active, as a minimum:
1. Battery LOW.
  2. Loss of Power.
  3. HIGH Motor Temp.
- K. Establish a Valve FAIL Alarm whenever any of the following conditions are active, as a minimum:
1. Valve Jammed (High torque on stops).
  2. Valve Stalled (High torque off stops).
- L. Provide a separate (remote) enclosure with local/remote selector switch, stop-open-close push buttons, and open and closed indicator lights for motor actuators over 6 feet 6 inches above the floor or deck in lieu of integral controls.
- M. Do not use external conduit for wiring any components within the actuator.
- N. Gear actuators shall be totally enclosed and factory-grease packed or oil lubricated. The power gearing shall consist of helical gears of heat-treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm shall be hardened steel alloy. Design gears for 24-hour continuous service with an AGMA rating of 1.50.
- O. Position switches shall be integrally geared to the actuator and shall be adjustable and capable of actuation at any point between fully opened and fully closed positions. The position switches shall operate while the actuator is either in manual or in motor operation. Provide motor actuators with position switches capable of being separately used to provide remote indication of end of travel in each direction and to stop motion at the end of travel in each direction.
- P. Provide two individually adjustable torque switches to protect the valve and motor against overload in the opening and closing directions. To prevent hammering, the torque switch shall not reclose until the valve is made to travel in the opposite direction.
- Q. Provide a manually operated handwheel that shall not rotate during electrical operation. If electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the valve is operated manually, the motor shall not rotate. After electrical power is restored, the handwheel shall automatically disengage. Design the handwheel diameter so that hand operation will not damage the valve.

- R. The position switch and torque switch contacts shall be capable of interrupting at least 0.2-ampere inductive load at 125-volt d-c or 6-ampere inductive load at 120-volt a-c.
- S. Provide a lost-motion device for open/close operation to permit the motor to reach full speed before the load is applied. Provide lost-motion action for manual operation also. Do not provide lost-motion device for modulating applications.
- T. Motor shall de-energize if a stall occurs when attempting to unseat a jammed valve.
- U. Provide a time delay to prevent instant reversal of the actuator motor.
- V. Provide terminal connections for external remote controls fed from an internal 24-volt or 120-volt supply.
- W. Provide a main disconnect NEMA 4X SS rated 15-ampere 3-pole, 480-volt non-fused to be mounted on the valve assembly.
- X. Acceptable Electric Motor Actuator Manufacturer
  - 1. FlowServe Limitorque L120 Series.
  - 2. Rotork Controls IQ Series (Open/Close).
  - 3. Or approved equal.

### PART 3 EXECUTION

#### 3.01 STORAGE AND/OR INCOMPLETE INSTALLATION BEFORE START-UP

- A. Power-operated valve assemblies delivered to the site, stored, and/or installed outside exposed to the weather or temperatures below 40 degrees F before permanent installation and start-up, shall be protected according to the actuator manufacturer's recommended procedures for exposure and extended storage.

#### 3.02 FACTORY ASSEMBLY

- A. Factory mount the electric motor actuator and controls on worm-gear valve operator extension bonnet with extension stem to valve and furnish and transport the completely assembled power-operated valve assembly to the site.

#### 3.03 FACTORY ADJUSTMENTS AND TESTS

- A. The valve manufacturer shall mount and adjust the electric motor actuator and accessories on each valve and operate each power-operated valve assembly before

shipment. Adjust limit switch position and torque switches. Measure and record motor current at maximum torque tripping point and actuator output speed.

### 3.04 PAINTING AND COATING

- A. Finish coat the power-operated valve assembly the same color as piping.

### 3.05 FIELD INSTALLATION

- A. Install the power operated valve assemblies in accordance with the manufacturer's instructions. Keep assemblies dry, closed, and sealed to prevent internal moisture damage during construction. Power-operated valve assemblies shall not be stored or placed in direct contact with the ground before installation. Provide additional hangers and supports for assemblies to prevent eccentric loads bearing on the valve and adjacent piping system.

### 3.06 FIELD TESTING

- A. Test shall simulate a typical valve load. Test motor actuators and record the following:
  1. Current at maximum torque setting.
  2. Torque at maximum torque setting.
  3. Flash test voltage.
  4. Actuator output speed and open to closed, and closed to open operating times.
- B. Test motor actuators as installed by measuring the current drawn (in amperes) by each motor for unseating, seating, and running conditions. The measured current shall not exceed the current measurement recorded during the factory performance test.
- C. If the measured current drawn exceeds the factory performance test value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the factory value.
- D. Ensure that limit switches are placed at their correct settings. Open and close valves twice and ensure that limit switches are functioning properly.
- E. Provide a performance test certificate with results of the tests stated above. In addition, include details of this specification including gear ratios for both manual and automatic drive, closing direction, wiring diagram code number, and all other field test measurements.

### 3.07 FIELD SERVICE

- A. The Contractor shall provide the services of the power-operated valve assembly manufacturer's representatives for the power-operated valve assemblies specified herein.
- B. The representative shall be present at the project site for the following listed services in the form of two trips to the site for an 8-hour-day of service per trip:
  - 1. Inspection of the installation of the assemblies, functional testing, and certification that the assemblies have been installed and tested in accordance with the manufacturer's recommendations and this Section. Manufacturer's certification of proper installation shall be received and acknowledged by the Engineer before the plant startup.
  - 2. Plant Startup and Training of the Owner in the operation and maintenance of the equipment.

### 3.08 CERTIFICATION

- A. Provide written certification from the power-operated valve assembly supplier that the assemblies have been properly installed and factory and field tested according to the Contract Documents and manufacturer's recommendations and that the equipment is operating normally. Make all necessary corrections and adjustments including but not limited to parts, labor, or freight at no additional cost to the Owner.

END OF SECTION

**SECTION 15121**  
**MISCELLANEOUS PIPE FITTINGS AND ACCESSORIES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section describes requirements for materials and installation of miscellaneous piping specialties, such as quick-connect couplings.

**1.02 RELATED WORK (NOT USED)**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit manufacturer's catalog data and descriptive literature showing dimensions and materials of construction by ASTM reference and grade. Show coatings.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
  - 2. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - 3. ASTM A513/A513M—Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
  - 4. ASTM A536—Standard Specification for Ductile Iron Castings.

5. ASTM A635/A635M—Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
6. ASTM C219—Standard Terminology Relating to Hydraulic Cement.
7. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.

B. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
3. ASME SA36—Carbon Steel Shapes, Plates, and Bars of Structural Quality for Use in Riveted, Bolted, or Welded Construction.
4. ASME SA675—Carbon Steel Middle Ring or Sleeve.

C. American Water Works Association (AWWA)

1. AWWA C111/A21.22—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C213—Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
3. AWWA C219—Bolted Sleeve-Type Couplings for Plain-End Pipe.

D. American Iron and Steel Institute (AISI)

1. AISI C1012—Hard-Drawn Low-Carbon Steel.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 METALLIC QUICK-CONNECT COUPLINGS

- A. Type 6: Quick-connect couplers shall be female-coupler/female-thread type with locking handles. Provide dust plug and security chain with each coupler. Bodies and locking handles shall be Type 316 stainless steel. The gasket shall be Teflon. Couplers shall be CIVACON Kamlok 633-D/634-A, Evertite, or equal.
- B. Type 8: Quick-connect couplers shall be male-adapter/150 lb ASME Flange type. Provide dust cap and security chain with each coupler. Bodies and locking handles shall be Type 316 stainless steel. The gasket shall be Teflon. Adapters shall be CIVACON Kamlock 733 LDS/634-B, Evertite, or equal.
- C. Type 10: Quick-connect couplers shall be male-adapter/hose-shank type. Provide dust cap with each coupler. Bodies and dust caps shall be Type 316 stainless steel. The gasket shall be Teflon. Adapters shall be CIVACON Kamlok 633-E/634-B, Evertite, or equal.

PART 3 EXECUTION

3.01 INSTALLING QUICK-CONNECT COUPLINGS

- A. Attach to piping in accordance with the relevant piping specification.

3.02 INSTALLING COUPLINGS

- A. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15, Mechanical.
- B. Alloy steel bolts and nut for flanged joints shall be made with high-strength, low-alloy Cor-Ten bolts, nuts, and washers. Cor-Ten for mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts

shall be painted the same color as the pipe. All joints to be wrapped with 8-mil color-coded poly wrap.

- C. Before sleeve-type couplings are installed, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.
- D. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Set cast-iron box as shown on the Drawings. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box after installation. Extend tracing wire outside of valve box extension pipe and enter at valve box.
- E. Thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket.
- F. Wipe gaskets clean before installations.
- G. Lubricate flexible couplings and flanged coupling adapter gaskets with soapy water or manufacturer's standard lubricant before installing on the pipe ends.
- H. Install couplings, service saddles, and anchor studs in accordance with the manufacturer's instruction.
- I. Tighten bolts progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness.
- J. Use torque-limiting wrenches to tighten bolts to the manufacturer's specified torque values.

#### END OF SECTION

**SECTION 15122**  
**FLEXIBLE PIPE COUPLINGS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section presents requirements for materials and installation of flexible pipe couplings.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15144, Pressure Testing of Piping.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The manufacturer's catalog data on flexible pipe couplings. Show the manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings and joints are used. Show coatings.
- B. The manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible sleeve-type pipe couplings.
- C. Materials of construction by ASTM reference and grade. Show dimensions.
- D. The number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - 2. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.
- B. American Water Works Association (AWWA)
  - 1. AWWA C219—Bolted Sleeve-Type Couplings for Plain-End Pipe.
- C. NSF International (NSF)
  - 1. NSF 61—Drinking Water Systems Components – Health Effects.

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Each flexible coupling shall be designed for the type, size, and pressure rating of the connecting piping.
- B. All wetted materials shall be suitable for use with the fluid being conveyed.
- C. Wetted materials for flexible coupling used to convey drinking water shall be resistant to free chlorine and chloramine concentrations up to 10 mg/L.
- D. All flexible couplings used in association with drinking water service shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with NSF 61.

### 2.02 BOLTED-SLEEVE-TYPE COUPLINGS (TYPE C105)

- A. Bolted-sleeve-type couplings shall be designed and manufactured conforming to AWWA C219.
- B. Type C105: Flanged Coupling Adapter:
  - 1. Adapters for ductile iron pipe 12 inches and smaller shall be ductile iron: Dresser Style 127, Smith-Blair Series 912, or equal.
  - 2. Adapters for ductile-iron pipe larger than 12 inches and steel pipe shall be steel: Dresser Style 128, Smith-Blair Type 913, or equal.
  - 3. Flange ends shall match the flange of the connecting pipe.

### 2.06 BOLTING FOR FLEXIBLE PIPE COUPLINGS

- A. Bolts and nuts for flexible pipe couplings shall be as specified for the adjacent piping.

## PART 3 EXECUTION

### 3.01 INSTALLING FLEXIBLE PIPE COUPLINGS

- A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installation.
- B. Lubricate bolt threads with graphite and oil before installation.

- C. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation.

### 3.02 PAINTING AND COATING

- A. Exterior Coating of Buried Flexible Pipe Couplings: Coat buried flexible pipe couplings (including joint harness assemblies) as specified in Section 09900, Painting and Coating, System No. 21. Coat buried bolt threads, tie bolt threads, and nuts according to Section 09900, Painting and Coating, System No. 24.
- B. Exterior Coating of Exposed Flexible Pipe Coupling (Non-Submerged): Coat flexible pipe couplings (including joint harness assemblies) located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings according to Section 09900, Painting and Coating, System No. 10. Apply prime coat at the factory.
- C. Exterior Coating of Exposed Flexible Pipe Coupling (Submerged): Coat flexible pipe couplings (including joint harness assemblies) that will be submerged according to Section 09900, Painting and Coating. Apply prime coat at the factory.
- D. Line carbon steel and iron-flexible pipe couplings according to Section 09900, Painting and Coating.

### 3.03 HYDROSTATIC TESTING

- A. Hydrostatically test flexible pipe couplings in place with the pipe being tested. Test in accordance with Section 15144, Pressure Testing of Piping.

END OF SECTION

**SECTION 15125**  
**PIPING APPURTEANCES**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all piping appurtenances as shown on the Contract Drawings and as specified in this Section.
- B. All piping appurtenances shall be of the size shown on the Contract Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
- C. All piping appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon the body.
- D. The piping appurtenances shall include, but not be limited to, the following:
  - 1. Pressure Gauge Assembly.
  - 2. Annular Diaphragm Seal and Pressure Gauge Assembly.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15055, Piping Systems—General.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
  - 1. Acknowledgment that products submitted meet requirements of standards referenced.
  - 2. Manufacturer's installation instructions.

## **1.04 WORK SEQUENCE (NOT USED)**

## **1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### **A. American Iron and Steel Institute (AISI)**

1. AISI Type 304L—Stainless Steel.
2. AISI Type 316—Stainless Steel, Annealed Sheet.

### **B. American Society for Testing and Materials (ASTM)**

1. ASTM A536—Standard Specification for Ductile Iron Castings.
2. ASTM C285—Standard Test Methods for Sieve Analysis of Wet-Milled and Dry-Milled Porcelain Enamel.

### **C. American Society of Mechanical Engineers (ASME)**

1. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.

### **D. American Water Works Association (AWWA)**

1. AWWA C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
3. AWWA C210—Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
4. AWWA C213—Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

### **E. National Sanitation Foundation (NSF)**

1. NSF 61—Drinking Water System Components – Health Effects.

## **1.06 QUALITY ASSURANCE (NOT USED)**

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, HANDLING, AND STORAGE

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All piping appurtenances, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall any piping appurtenances be dropped, skidded, or rolled.
- C. Slings, hooks, or tongs used for lifting shall be padded to prevent damage to exterior surface or interior linings of piping appurtenances. If any part of the coating, lining, or components is damaged, the Contractor shall make repairs or replacement at his expense and in a manner satisfactory to the Engineer before attempting to install such piping appurtenances.
- D. Only new piping appurtenances will be allowed for installation and shall be stored to prevent damage and be kept free of dirt, mud, or other debris.

## 1.09 QUALIFICATIONS

- A. All the piping appurtenances shall be products of well-established firms that are fully experienced, reputable, have been selling this product for a minimum of 10 years, and qualified in the manufacture of the particular product furnished. The piping appurtenances shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 PRESSURE-GAUGE ASSEMBLY

- A. Pressure-gauge assemblies shall be provided at locations listed below or as shown on the Contract Drawings. All pressure-gauge assemblies shall include a pressure gauge, AISI Type 316 stainless steel, NPT threaded ball valves for isolation and venting, and sensor piping. Sensor piping tubing and fittings shall be Type 316 stainless steel. The pressure gauge shall be constructed of Type 316 stainless-steel wetted parts and Type 304 stainless-steel case and bayonet ring, adjustable pointer, laminated safety-glass window, glycerin liquid-filled case, 1.5% span accuracy, and shall have a 2.5-inch-diameter dial size, minimum. The pressure gauge shall be as manufactured by Onyx Valve, WIKA Instrument Corporation, Type LM 233.54, or approved equal.
- B. The Contractor shall furnish and install pressure-gauge assemblies with pressure-gauge ranges as follows and/or shown on the Contract Drawings.

### 2.02 ANNULAR DIAPHRAGM SEAL AND PRESSURE GAUGE ASSEMBLY

- A. Annular diaphragm seal and pressure gauge assemblies shall be provided at locations listed in this Section, Section 11356, Progressive Cavity Pumps, or as shown on the Contract Drawings. All annular diaphragm-seal pressure gauge assemblies shall include an ethylene-glycol factory liquid-filled pressure-gauge and an annular seal assembly factory calibrated and ready for field installation. The annular seal assembly shall consist of a Buna-N diaphragm annual seal sleeve, carbon steel body, and ASME B16.5 Class 150 full-faced flanges (through bolted configuration). Pressure gauges shall be constructed with a stainless steel case with pressure ranges listed below. Annular diaphragm seal and pressure-gauge assemblies shall be as manufactured by the Red Valve Company, Incorporated, Series 48, Onyx Valve, or approved equal.
- B. The Contractor shall furnish and install annular seal and pressure-gauge assemblies with pressure gauge ranges as follows and/or shown on the Drawings:

<u>Location</u>	<u>Number of Assemblies</u>	<u>Pressure Gauge Range (psi)</u>
Truck-off Loading Pumping Station	4	30
Digester Feed Pumping Station	4	30

<u>Location</u>	<u>Number of Assemblies</u>	<u>Pressure Gauge Range (psi)</u>
Dewatering Feed Pumping Station	8	60
Blended Sludge Grinder Station	2	10
Combined Thickened Grinder Station	2	10

## 2.03 TOOLS

- A. If required for normal operation and maintenance, special tools shall be supplied with the equipment.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall install all piping appurtenances as shown on the Contract Drawings.
- B. All piping appurtenances shall be installed in the location shown, unless approved otherwise, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Owner and the Engineer.
- C. Install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and shall be responsible for the proper location of these piping appurtenances during the construction of the structures.

### 3.02 SHOP PAINTING

- A. Exterior surfaces of ferrous valves and piping appurtenances shall be painted in accordance with Section 09900, Painting and Coating, unless noted or specified otherwise.

### 3.03 INSPECTION AND TESTING

- A. Completed valves and piping appurtenances shall be subjected to hydrostatic pressure test as described in Section 15055, Piping Systems—General, and the detail pipe sections of these Specifications. All leaks in valves and piping

appurtenances shall be repaired and lines retested as approved by the Engineer. Before testing, the valves and pipelines shall be supported and thrust restrained for forces exceeding the test pressure to prevent movement during tests.

END OF SECTION

**SECTION 15144**  
**PRESSURE TESTING OF PIPING**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section specifies the hydrostatic, pneumatic, and leakage testing of pressure piping for pumping stations, wastewater treatment plants, force mains and lift stations.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01500, Temporary Facilities and Controls.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.
- B. One electronic PDF and three hard copies of the test records to the Engineer upon completion of the testing.

**1.04 WORK SEQUENCE (NOT USED)**

**1.05 REFERENCE STANDARDS**

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Water Works Association (AWWA)
  - 1. AWWA C600—Installation of Ductile-Iron Mains and Their Appurtenances.
  - 2. AWWA C605—Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TEST PRESSURES

- A. Test pressures for the various services and types of piping are shown in the Piping Schedule in the Drawings. The Engineer shall provide any pressure requirements that are not included in the Piping Schedule.

1.11 TESTING RECORDS

- A. The Contractor shall provide records of each piping installation during the testing. These records shall include the following information:
  - 1. Date and times of test.
  - 2. Identification of process, pipeline, or pipeline section tested or retested.
  - 3. Identification of pipeline material.
  - 4. Identification of pipe specification.
  - 5. Test fluid.
  - 6. Test duration.
- B. Test pressure at low point in process, pipeline, or pipeline section.
- C. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
- D. Certification by Contractor that the leakage rate measured conformed to the Specifications.

1.12 MAINTENANCE (NOT USED)

1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS (NOT USED)

## PART 2 PRODUCTS

### 2.01 VENTS AND DRAINS FOR ABOVEGROUND PIPING

- A. The Contractor shall install vents on the high points of aboveground piping, whether shown in the Contract Drawings or not. Install drains on low points of aboveground piping, whether shown in the Contract Drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4 inch for piping 3 inches and larger and 1/2 inch for piping smaller than 3 inches. Valves shall be ball or gate valves unless otherwise shown on the Contract Drawings. Valves shall be rated for the pressure of the adjacent piping and shall be suitable for use with the adjacent pipe material.

### 2.02 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

- A. The Contractor shall provide temporary manual air-release valves at test bulkheads for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and, after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

### 2.03 TEST BULKHEADS

- A. The Contractor shall design and fabricate test bulkheads in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of the code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

### 2.04 TESTING FLUID

- A. The Owner will provide a source of supply from the existing treated water distribution system for the Contractor's use in filling the lines. An air break shall be maintained at all times between the Owner's distribution system and the Contractor's equipment to prevent cross-connection. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the Contractor. Provide accurate means for measuring the quantity of water required to maintain this pressure. The amount of water required is a measure of the leakage.
- B. Testing fluid shall be potable water unless a pneumatic test is indicated on the Piping Schedule.

- C. For potable water pipelines, obtain and use only potable water for hydrostatic testing.
- D. Submit request for use of water from waterlines of Owner 48 hours in advance.
- E. The Contractor shall provide back flow prevention control for temporary connections to existing water mains.

## 2.05 TESTING EQUIPMENT

- A. The Contractor shall provide calibrated pressure gauges for the range of pressures to be tested, pipes, bulkheads, pumps, compressors, chart recorder, and meters to perform the hydrostatic testing. The Contractor shall provide any necessary assistance required for testing.

## PART 3 EXECUTION

### 3.01 TESTING PREPARATION

- A. Pipes shall be in place, backfilled, and anchored before beginning pressure testing.
- B. The Contractor shall conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.
- C. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. However, perform the final pressure test after completely backfilling and compacting the trench.
- D. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the Specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.
- E. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.

- F. Before starting the test, the Contractor shall notify the Engineer and the Owner's Representative.

### 3.02 CLEANING

- A. Before conducting hydrostatic tests, the Contractor shall flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes. Maintain a flushing velocity of at least 3 fps for water testing and at least 2,000 fpm for pneumatic testing. Flush pipes for the period given by the formula

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds).

L = pipe length (feet).

- B. For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

### 3.03 LENGTH OF TEST SECTION FOR BURIED PIPING

- A. The maximum length of test section for buried pipe of 12 inches or smaller in diameter is 3,500 feet; for buried pipe larger than 12 inches, 1 mile. Provide intermediate test bulkheads where the pipeline length exceeds these limits.

### 3.04 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

- A. The maximum rate of filling shall not cause the water velocity in the pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

### 3.05 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

- A. Before testing new pipelines that are to be connected to existing pipelines, the Contractor shall isolate the new line from the existing line by test bulkheads, spectacle flanges, or blind flanges. After the new line has been successfully tested, remove test bulkheads or flanges and connect to the existing piping.

### 3.06 HYDROSTATIC TESTING OF ABOVEGROUND OR EXPOSED PIPING

- A. Open vents at high points of the piping system to purge air while the pipe is being filled with water. Venting during system filling may also be provided by temporarily loosening flanges.
- B. Subject the piping system to the test pressure indicated on the Piping Schedule in the Contract Drawings. Maintain the test pressure for a minimum of 2 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

### 3.07 HYDROSTATIC TESTING OF BURIED PIPING

- A. Where any section of the piping contains concrete thrust blocks or encasement, the Contractor shall not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 24 hours to absorb water before conducting the pressure test.
- B. Apply and maintain the test pressure by a positive displacement hydraulic force pump.
- C. Maintain the test pressure for the 2 hours by restoring the pressure whenever it falls 5 psi.
- D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage volume is defined by the formulas:

PVC Pipe:

$$L = \frac{ND(P)^{1/2}}{C}$$

in which:

- L = allowable leakage (gallons).  
N = number of rubber-gasketed joints in the pipe tested.  
D = diameter of the pipe (inches).  
P = specified test pressure (psig).  
C = 7,400.

Ductile Iron Pipe:

$$L = \frac{SD(P)^{1/2}}{C}$$

in which:

- L = allowable leakage (gallons).
- S = length of pipe tested (feet).
- D = diameter of the pipe (inches).
- P = specified test pressure (psig).
- C = 133,200.

- E. The leakage test shall be a separate test following the pressure test and shall not be less than 2 hours long. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines that fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves, and accessories shall be removed and replaced.
- F. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.
- G. Submit plan for testing to the Engineer for review at least 10 days before starting the test.
- H. Peening shall not be used to repair pinhole leaks in welded pipes. Any leakage in welded pipes shall be repaired by appropriate welding techniques.
- I. Repair and retest any pipes showing leakage rates greater than that allowed in the criteria above.

### 3.08 REPETITION OF TEST

- A. If the actual leakage exceeds the allowable leakage, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

### 3.09 BULKHEAD AND TEST FACILITY REMOVAL

- A. After a satisfactory test, the Contractor shall remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings/linings.

END OF SECTION

**SECTION 15155**  
**DUCTILE IRON PIPE AND FITTINGS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall provide all materials and incidentals, including piping, fittings, flanged joints, mechanical joints, retainer glands, polyethylene bagging for buried ductile iron piping, fittings, valves, and appurtenances for the ductile iron piping systems required for the work shown on the Contract Drawings, in the Piping Schedule in the Contract Drawings, and described in Section 15060, Pipe Hangers and Supports.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 02240, Dewatering.
- F. Section 02305, Earthwork for Utilities.
- G. Section 09900, Painting and Coating.
- H. Section 15055, Piping Systems—General.
- I. Section 15060, Pipe Hangers and Supports.
- J. Section 15075, Process Equipment, Piping, and Valve Identification.
- K. Section 15144, Pressure Testing of Piping.

**1.03 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry where the material for this project is manufactured. The Contractor shall submit sworn certificates of such tests and their results.
- B. Shop Drawings, including layout drawings, shall be submitted as specified in Section 15055, Piping Systems—General.
- C. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### A. American Society for Testing and Materials (ASTM)

1. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both.
3. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
6. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
7. ASTM C150/C150M—Standard Specification for Portland Cement.
8. ASTM C283—Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
9. ASTM D714—Standard Test Method for Evaluating Degree of Blistering of Paints.
10. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
11. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
12. ASTM E96/E96M—Standard Test Methods for Water Vapor Transmission of Materials.
13. ASTM G95—Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

### B. American Society of Mechanical Engineers (ASME)

1. ASME B1.1—Unified Inch Screw Threads (UN and UNR Thread Form).
2. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
3. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.

- C. American Water Works Association (AWWA)
  - 1. AWWA C104/A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - 2. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.
  - 3. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - 4. AWWA C115/A21.15—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  - 5. AWWA C150/A21.50—Thickness Design of Ductile-Iron Pipe.
  - 6. AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast.
  - 7. AWWA C153/A21.53—Ductile-Iron Compact Fittings.
  - 8. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100mm through 3,600mm).
  - 9. AWWA C600—Installation of Ductile-Iron Mains and their Appurtenances.
  - 10. AWWA C651—Disinfecting Water Mains.
- D. International Organization for Standardization (ISO)
  - 1. ISO-9001—Quality Management Systems – Requirements.
- E. NSF International (NSF)
  - 1. NSF 61—Drinking Water System Components – Health Effects.

## 1.06 QUALITY ASSURANCE

- A. Source Quality Control:
  - 1. The ductile iron pipe manufacturer shall submit certification that the pipe and fitting products meet all tests required by AWWA C151/A21.51.
  - 2. All materials shall be new and have a manufacturer's certificate verifying compliance to all tests and inspections as required in this Section. The weight, class, and casting period shall be shown on each piece of pipe. The manufacturer's "mark," the year produced, and the word "Ductile" or the letters "DI" shall be cast or stamped on all pipe.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## **1.09 QUALIFICATIONS (NOT USED)**

## **1.10 TESTING REQUIREMENTS**

- A. See Section 15144, Pressure Testing of Piping, for testing requirements.

## **1.11 MAINTENANCE (NOT USED)**

## **1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS**

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

# **PART 2 PRODUCTS**

## **2.01 GENERAL**

- A. All ductile iron piping shall be designed and manufactured in accordance with AWWA C150/A21.50 and AWWA C151/A21.51 for the following minimum operating conditions:
  1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, and a safety factor of 2, for a total internal design pressure of 500 psi.
  2. The external loads design criteria shall be for the minimum cover indicated on the Drawings at 120 lb per cubic foot soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150/A21.50.
  3. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed 3% of the pipe diameter based on the trench design shown on the Drawings.

4. Pressure Class: All ductile iron piping shall meet the following minimum working pressure classes:

- a. Pipe 4 inches through 12 inches: 350 psi.
- b. Pipe greater than 12 inches: 250 psi.

## 2.02 JOINTS

A. Ductile iron fittings shall be furnished with push-on joint, mechanical joints, and flanged joints as shown on the Contract Drawings and specified in this Section:

- 1. Push-On Joints: Push-on joints shall conform to AWWA C111/A21.11. Gaskets shall be EPDM or approved equal.
- 2. Mechanical Joints: All buried ductile iron fittings shall be furnished with mechanical joint ends unless noted otherwise. Mechanical joints shall conform to AWWA C111/A21.11. Glands shall be constructed of ductile iron.
- 3. Flanged Joints: Pipe for threaded flange fabrication shall be Special Thickness Class 53 in accordance with AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C115/A21.15. Bolt circle and bolt holes shall match those of ASME B16.1 Class 125 flanges. The flanges shall be rated for a maximum working pressure of 250 psi. Threaded flanges shall be individually fitted and machine tightened on the pipe ends. Flange facing shall be smooth or with shallow serrations in accordance with AWWA C115/A21.15.

## 2.03 FITTINGS

A. General: Ductile iron pipe fittings shall be the compact type meeting the requirements of AWWA C110/A21.10 and AWWA C153/A21.53 where applicable. Ductile iron, cement lined and seal coated, glass lined, or ceramic epoxy lined. Lining of fitting shall conform to in the Piping Schedule as specified on the Contract Drawings. Fittings shall be manufactured in accordance with AWWA C110/A21.10. Where taps are shown on fittings, tapping bosses shall be provided. At a minimum, fittings shall have the same pressure rating as the connecting pipe.

- 1. Flanged Joint: AWWA C110/21.10 and ASME B16.1, faced and drilled 125-pound ANSI standard.

2. Mechanical Joint: AWWA C110/A21.10

- a. Provide mechanical joint fittings for all buried fittings as shown in the Drawings, unless noted otherwise.
- b. Provide specified gaskets.

**2.04 LINING AND COATING**

- A. The Contractor shall provide lined ductile iron piping and fittings in accordance with the Piping Schedule in the Contract Drawings. The Contractor shall perform all field measurements confirming the accuracy of the piping sizes and lengths shown on the Contract Drawings. The Contractor shall notify the Engineer immediately before deviating from or altering the lining of ductile iron piping shown on the approved layout schedule.
- B. Ceramic Epoxy Lined Pipe and Fittings: The Contractor shall notify the Engineer immediately before cutting epoxy-lined ductile iron pipe in the field. The Contractor shall repair the cut end in accordance with the pipe manufacturer's written procedures.
  - 1. General: The lining shall be an amine-cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. The lining material shall be Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Inc. The lining shall be applied by a competent pipe lining specialty firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.
  - 2. Lining Materials: Lining material shall meet the following requirements and properties:
    - a. A permeability rating of 0.00 when tested according to Method A of ASTM E96/E96M, Procedure A with a test duration of 30 days.
  - 3. Application: The lining applicator shall apply lining according to the requirements of the Protecto 401 Specification and application methods and procedures.
- C. Cement-Lined Ductile Iron Pipe and Fittings: Interior surfaces of all cement-lined ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104/A21.4. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the Contractor shall repair or replace damaged or unsatisfactory portions with lining conforming to

these Specifications at no additional cost to the Owner. Pipe linings for potable water lines shall be NSF 61 approved.

1. All ductile iron pipe and fittings cement-mortar linings shall be surface sealed with an asphaltic seal coating, 1 mil, in accordance with AWWA C104/A21.4.

## 2.05 MANUFACTURERS

- A. Acceptable ductile iron pipe manufacturers include US Pipe, American Ductile Pipe, Griffin Pipe, or approved equal.

## 2.06 BOLTS

- A. All bolts, studs, and threaded rods used in the finished work for flanges shall be of carbon steel and shall conform to ASTM A307 Grade B. All bolts and nuts intended for underground service shall be corrosion-resistant Cor-Ten ASTM A242. The ends of all bolts shall be finished to the standard radius in an acceptable manner. All screw threads shall be "American Standard, Coarse Thread (N.C.)." Stud bolts shall be hexagonal, cold-pressed, semi-finished and made of medium open-hearth steel. All dimensions shall be in accordance with "American Standard, Heavy." Nuts used shall be "Grade A Heavy Hex" in conformance with ASTM A563 and be compatible with the bolts. Bolts and nuts shall be cadmium- or zinc-plated at the point of manufacture with a plating thickness of 0.0003 to 0.0005 inch. All bolts and nuts furnished shall be delivered to the field free from grease, rust, and dirt.

## 2.07 GASKETS

- A. Gaskets for mechanical joints shall be compatible with sewage pipe service. See Section 15055, Piping System—General, for gasket requirements.
- B. Gaskets for flanged joints shall be 1/8-inch-thick, cloth-inserted rubber conforming to applicable parts of ASME B16.21 and AWWA C207. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in sewage and reclaimed water lines. Gaskets shall be full-face type for 125-pound flanges.

## 2.08 RETAINER GLANDS

- A. Retainer glands shall be provided for all buried ductile-iron mechanical joints, fitting, and ductile-iron pipe connections to buried valves. Retainer glands shall be designed for joint retaining through the use of a follower gland and set screw-anchoring devices that impart multiple wedging action against the pipe. The

mechanical joint-restraint device shall be UL listed and shall have a working pressure of at least 250 psi with a minimum safety factor of 2.

1. Gland: Manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall match AWWA C111/A21.11 and A21.53.
2. Restraining Devices: Manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Restraining devices shall incorporate a set screw/twist-off nut bolt to ensure the proper actuating of the restraining device. The twist-off nut shall be designed to come off at the torque limit desired to anchor the restraining device in place on the pipe.
3. Joint Deflection: Retainer gland joint deflection shall be limited to manufacturer's recommended maximum deflection angle. Joint deflection shall be applied before the set screws are torqued.
4. Acceptable Manufacturers:
  - a. EBAA Iron, Inc. – Megalug 1100 Series.
  - b. Or approved equal.

## 2.09 EXTERNAL PIPE RESTRAINTS

- A. Ductile iron pipe push-on (bell and spigot) joint restraint shall be provided by a restraining harness consisting of a restraint ring, connecting tie-rods, and split-ring assembly installed at all push-on joints. The restraint ring shall consist of wedging components made from 60-42-12 ductile iron conforming to ASTM A536 and wedges heat treated to minimum 370 BHN. Torque limiting twist-off nuts shall be provided on each wedge to ensure proper applied installation torque. The split ring shall be made from 60-42-12 ductile iron conforming to ASTM A536. The connecting rods shall be made of steel conforming to AWWA C111/A12.11. Sizes 4- to 16-inch-diameter restraining harnesses shall have 350-psi maximum working pressure rating and 18- to 36-inch-diameter restraining harnesses shall have 250-psi maximum working pressure rating. All harnesses shall be designed with a 2-to-1 safety factor applied to the maximum working pressure rating.
- B. Acceptable Manufacturers:
  1. EBAA Iron, Inc. – Series 1700.
  2. Or approved equal.

## **2.10 INTERNAL PIPE RESTRAINT**

### **A. Acceptable Manufacturers:**

#### **1. American Ductile Iron Pipe:**

- a. Fastite Joint with Fast-Grip® Gasket.**
- b. Flex Ring® Joint.**

#### **2. US Pipe:**

- a. Field Lok 360® Gasket.**
- b. TR Flex® Restrained Joint.**

#### **3. Or Engineer-approved equal.**

## **2.11 POLYETHYLENE BAGGING**

### **A. Polyethylene bagging for buried ductile iron pipe, fittings, and valves shall be 8 mils thickness minimum polyethylene, manufactured in accordance with ASTM D1238, Type I, Class C, Grade E1.**

## **2.12 COLOR CODING OR MARKING**

### **A. Color Coding and Marking shall be in accordance with the Pipe Schedule in the Contract Drawings and Section 15075, Process Equipment, Piping, and Valve Identification.**

## **PART 3 EXECUTION**

### **3.01 HANDLING PIPE AND FITTINGS**

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, fitting, lining, and coating. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before installation, and no piece that the Engineer finds defective shall be installed. The Contractor shall repair any damage to the pipe and fittings coating and/or lining as directed by the Engineer. If the Engineer determines that the coating and/or lining cannot be repaired, the Contractor shall replace the damaged pipe and fittings at no additional compensation.**
- B. All pipe and fittings shall be subjected to a careful inspection immediately before installation.**

- C. If any defective pipe is discovered after it has been installed, the Contractor shall remove and replace it with a pipe in satisfactory condition at no additional expense to the Owner.
- D. Ceramic epoxy and glass-lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

### 3.02 PIPE INSTALLATION

- A. The Contractor shall provide and use proper implements, tools, and facilities for the safe and convenient performance of the work. All pipe, fittings, valves, and appurtenances shall be lowered carefully into the trench and at above-grade locations to prevent damage to the pipe, protective coating, lining, and polyethylene bagging. Under no circumstances shall pipeline materials be dropped off or dumped. A trench shall be dewatered before the pipe is installed.
- B. The Contractor shall carefully examine all pipe fittings, valves, and other appurtenances for damage and other defects immediately before installation and before bagging buried ductile-iron pipe. The Contractor shall mark and hold defective materials for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
- C. The Contractor shall remove all lumps, blisters, and excess coating from the socket and plain ends of push-on joint pipe for buried service. The outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid in trench.
- D. The Contractor shall prevent foreign material from entering the pipe while the pipe is being placed in the trench. During installation, no debris, tools, clothing, or other materials shall be placed in the pipe.
- E. As each length of buried pipe is placed in the trench, the joint shall be assembled, and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
- F. When pipe is not being laid, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.
- G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

- H. Joint Assembly: Pipe joints shall be assembled in accordance with the manufacturer's instructions and the requirements of ANSI/AWWA C600.
1. Flanged Joint: Before connecting flanged pipe the Contractor shall thoroughly clean all faces of the flanges of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to ensure proper sealing of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
  2. Push-On, Restrained Joint, or Mechanical Joint: The Contractor shall joint piping in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstance.
- I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed that shown in ANSI/AWWA C600 and that recommended by the retainer gland manufacturer for mechanical joint pipe and fittings.
- J. Pipe Cutting: For inserting valves, fittings, or closure pieces; pipe shall be cut in a neat, workmanlike manner without damaging the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled.

### 3.03 ABOVE-GROUND PIPE INSTALLATION

- A. The Contractor shall install pipe in horizontal or vertical planes, parallel or perpendicular to building, flooring, and pad surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves, and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts in accordance with the pipe manufacturer's recommendations.

### 3.04 SURFACE PREPARATION AND PAINTING

- A. All exposed pipe and fittings shall be painted as specified in Section 09900, Painting and Coating.

- B. All buried steel bolts, nuts, washers, rods, harnesses, clamps, sleeves, and appurtenances shall be painted with System No. 21 as specified in Section 09900, Painting and Coating.

### 3.05 INSPECTION AND TESTING

- A. See Section 15055, Piping Systems—General, and Section 15144, Pressure Testing of Piping.

END OF SECTION

**SECTION 15290**  
**PVC PIPE, 3 INCHES AND SMALLER**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes materials, installation, and testing of PVC pipe and fittings sized 3 inches and smaller for use in process piping having a maximum design pressure of 150 psi and having a maximum design temperature of 105°F.

**1.02 RELATED WORK**

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15055, Piping Systems—General.
- G. Section 15144, Pressure Testing of Piping.

**1.03 SUBMITTALS**

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall do the following:
  - 1. Submit materials list showing materials of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM D1784, D1785, and D2467. Show wall thickness of pipe and fittings. Show fitting dimensions.
  - 2. Submit data sheets for solvent cement and demonstrating compliance with ASTM D2564 and F656.
  - 3. Submit data sheets showing that the pipe and fittings are NSF 61 listed for use in potable water service and that the pipe will bear the NSF logo for potable water use.

**1.04 WORK SEQUENCE (NOT USED)**

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

### A. American Society for Testing and Materials (ASTM)

1. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D2464—Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
4. ASTM D2467—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2774—Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
7. ASTM D2855—Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
8. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

### B. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.

### C. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

# PART 2 PRODUCTS

## 2.01 GENERAL

- A. All pipe joints and fittings shall have the same schedule, pressure ratings, thermal resistance, chemical resistance, and other pertinent properties as the pipe being joined or connected. Plastic fittings shall be manufactured of the same resin as used in the manufacture of the pipe being joined.
- B. Each pipe length shall be clearly marked with the manufacturer's name or trademark, applicable ASTM standards, size, pressure rating, and/or schedule.
- C. Provide line-size reducing tees for connecting lateral or instrumentation to pipe systems. Seal threaded fittings with Teflon™ tape or Teflon™ paste. Engage threaded fittings in accordance with ASTM A53.

## 2.02 PIPE

- A. Pipe shall be Schedule 80, Type I, Grade 1 (Class 12454-B), conforming to ASTM D1784 and D1785.

## 2.03 FITTINGS

- A. Fittings shall be Schedule 80 and shall conform to ASTM D2464 for threaded fittings and ASTM D2467 for socket-type fittings.

## 2.04 FLANGES

- A. PVC flanges shall be of the one-piece solid socket design and shall be made of the same material as the pipe. Pressure rating shall be at least 150 psi at a temperature of 73°F. Minimum burst pressure shall be 500 psi. Flanges shall match the dimensions of ASME B16.5, Class 150, steel flanges for outside diameter, bolt circle, and bolt holes. Do not use Van Stone flanges.

## 2.05 UNIONS

- A. Unions shall have socket-type ends, Viton O-rings, and shall be Schedule 80. Material shall be Type I, Grade 1 PVC, per ASTM D1784.

## 2.06 JOINTS

- A. Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to valves and equipment.

## 2.07 SOLVENT CEMENT IN OTHER THAN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE (NOT USED)

## 2.08 SOLVENT CEMENT IN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE

- A. Solvent cement shall be free of silica. Products: IPS “Weld-On 724” or Oatey “Lo V.O.C. PVC Heavy Duty Gray.”

## 2.09 GASKETS FOR FLANGES

- A. See Section 15055, Piping Systems—General.

## 2.10 BOLTS AND NUTS FOR FLANGES

- A. See Section 15055, Piping Systems—General.

## 2.11 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. See Section 15055, Piping Systems—General.

## PART 3 EXECUTION

### 3.01 GENERAL

The Contractor shall adhere to the following:

- A. Do not install PVC pipe when the temperature is below 40°F or above 90°F. Store loose pipes on racks with a maximum support spacing of 3 feet. Provide shade for pipe stored outdoors or installed outdoors until the pipe is filled with water.
- B. Store fittings indoors in their original cartons.
- C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements that have exceeded the shelf life marked on the storage container.
- D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.
- E. Do not drag PVC pipe over the ground, drop it onto the ground, or drop objects on it.

### 3.02 SOLVENT-WELDED JOINTS

- A. Before solvent welding, remove fittings and couplings from their cartons and expose them to the air at the same temperature conditions as the pipe for at least 1 hour.
- B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent-welded pipe ends as recommended by the pipe manufacturer.
- C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent cement. Clean the surfaces of both pipes and fittings that are to be solvent welded with a clean cloth moistened with acetone or methylethyl ketone. Do not apply solvent cement to wet surfaces.
- D. The pipe and fitting socket shall have an interference fit. The diametrical clearance between pipe and entrance of the fitting socket shall not exceed 0.04 inch. Check the fit at every joint before applying solvent cement.
- E. Make up solvent-welded joints in accordance with ASTM D2855. Application of cement to both surfaces to be joined and assembly of these surfaces shall produce

- a continuous bond between them with visual evidence of cement at least flush with the outer end of the fitting bore around the entire circumference.
- F. Allow at least 8 hours of drying time before moving solvent-welded joints or subjecting the joints to any internal or external loads or pressures.
- G. Acceptance criteria for solvent-welded joints shall be as follows:
1. Unfilled Areas in Joint: None permitted.
  2. Unbonded Areas in Joint: None permitted.
  3. Protrusion of Material into Pipe Bore, Percent of Pipe Wall Thickness: Cement, 50%.

### 3.03 FLANGED JOINTS

- A. Lubricate carbon steel bolt threads with graphite and oil before installation.
- B. Tighten bolts on PVC flanges by tightening the nuts diametrically opposite each other using a torque wrench. Complete tightening shall be accomplished in stages and the final torque values shall be as shown in the following table:

Pipe Size (inches)	Final Torque (foot-pounds)
1/2 to 1-1/2	10 to 15
2 to 3	20 to 30

### 3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

- A. See Section 15055, Piping Systems—General.

### 3.05 THREADED JOINTS

- A. Cut threaded ends on PVC to the dimensions of ASME B1.20.1. Ends shall be square cut. Follow the pipe manufacturer's recommendations regarding pipe hold-down methods, saw cutting blade size, and saw cutting speed.
- B. Pipe or tubing cutters shall be specifically designed for use on PVC pipe. Use cutters manufactured by Reed Manufacturing Company, Ridge Tool Company, or equal.
- C. If a hold-down vise is used when the pipe is cut, insert a rubber sheet between the vise jaws and the pipe to avoid scratching the pipe.

- D. Thread cutting dies shall be clean and sharp and shall not be used to cut materials other than plastic.
- E. Apply Teflon® thread compound or Teflon® tape lubricant to threads before screwing on the fitting.

### 3.06 INSTALLING UNIONS

- A. Provide unions on exposed (above grade and in vaults) piping 3 inches and smaller as follows:
  - 1. At every change in direction (horizontal and vertical).
  - 2. Six to 12 inches downstream of valves.
  - 3. Every 40 feet in straight pipe runs.
  - 4. Where shown on the Drawings.

### 3.07 INSTALLING BURIED PIPE

- A. Install in accordance with Section 02305, Earthwork for Utilities, and as follows.
- B. Trench bottom shall be continuous, smooth, and free of rocks. See the details on the Drawings for trench dimensions, pipe bedding, and backfill.
- C. After the pipe has been solvent-welded and the joints have set, snake the pipe in the trench according to the pipe manufacturer's recommendations to allow for thermal expansion and contraction of the pipe.
- D. Do not backfill the pipe trench until the solvent-welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable soil. Do not use blocking to change pipe grade or to support pipe in the trench.
- E. Install buried PVC pipe in accordance with ASTM D2774 and the pipe manufacturer's recommendations. Backfill materials in the pipe zone shall be imported sand as specified in Section 02305, Earthwork for Utilities. If water flooding is used, do not add successive layers unless the previous layer is compacted to 90% relative compaction.

### 3.08 INSTALLING ABOVEGROUND OR EXPOSED PIPING

- A. See Section 15055, Piping Systems—General.
- B. Fill empty piping with water, provide temporary shading, or use other means to keep the surface temperature of the pipe below 100°F.

### **3.09 PAINTING AND COATING**

- A. Coat piping that is exposed to sunlight as specified Section 09900, Painting and Coating, System No. 41.

### **3.10 PIPE LABELS AND COLOR CODING**

- A. Label and color code exposed piping and piping inside concrete pipe trenches with flow stream identification labels and banding in accordance with Section 15075, Process Equipment, Piping, and Valve Identification, and the Piping Schedule on the Drawings.

### **3.11 HYDROSTATIC TESTING**

- A. Perform hydrostatic testing for leakage in accordance with Section 15144, Pressure Testing of Piping.

**END OF SECTION**

**SECTION 15860**  
**ODOR CONTROL SYSTEM EQUIPMENT**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. The Contractor shall furnish and install all equipment and materials necessary to provide the Owner with a completely operational Biological Odor Control System. The system shall be a completely packaged two-stage, biological absorption/adsorption system. The Contractor shall be responsible for providing a complete Odor Control System that shall include but not be limited to FRP vessel, nozzles, two independent stages of inorganic treatment media, moisture controls, nutrient supply system, air supply fan, interconnecting ducting, and all necessary accessories.

**1.02 SUBMITTALS**

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Complete Shop Drawings for the System, together with all piping, ductwork, valves, and control for review by the Engineer.
- B. Shop Drawings: The following information for approval before equipment is fabricated:
  1. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the Engineer to check clearances, connections, and conformance with the Specifications.
  2. Materials of construction of all equipment.
  3. The manufacturer's catalog data and operating literature plus specifications, performance data, and calibration curves for exhaust fan and auxiliary components.
  4. Complete instrumentation, control, logic, and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and electrical components.
  5. Manuals: The manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.
  6. Reference list demonstrating minimum qualifications as required in Paragraph 1.01.A above.

- C. Pre-Approval Submittals: Each supplier submitting an alternate to the equipment defined in this Section shall provide the following submittals 20 days before the established bid date. Failure to provide a complete and thorough submittal package shall render their pre-approval request non-responsive and the request will not be considered. Approval of manufacturers will be the sole decision of the Engineer and the Owner. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence to the specified manufacturer(s). If requested by the Engineer, the supplier must be prepared to demonstrate a unit similar to the one proposed. The following information is required:
1. A complete set of drawings as described in Paragraph 1.02B. Provide a minimum of one drawing per system clearly showing how the proposed system will fit on the site.
  2. A reference list of no fewer than five two-stage installations of the type and size of system proposed. The installations must have been in service for a minimum of 5 years. The list shall include the following information: Owner name and accurate contact information, placed-in-service date, and design conditions including air flow rate and H<sub>2</sub>S loading. Provide graphical performance data from a minimum of five systems showing the inlet and outlet levels of hydrogen sulfide. Failure to submit references for non-standard units may deem the proposal “non-responsive” and the proposal will be rejected without further review.
  3. A complete summary of operating cost shall be provided. At a minimum the following information shall be provided:
    - a. Annual electrical operating cost. Show calculations and use \$0.06/kW-hr.
    - b. Media replacement cost.
    - c. Nutrient cost per year.
  4. A copy of the performance guarantee and the warranty.
  5. It shall be the supplier's responsibility to carefully examine each item of the Specifications. Failure to offer a complete proposal or failure to respond to each section of the technical specifications will cause the proposal to be rejected without further review as “non-responsive.” All exceptions and/or deviations shall be fully described in the appropriate section. The supplier must include a separate sheet listing any and all deviations to the Specifications. The Engineer understands that manufacturers design systems with different features. This listing is

therefore integral to the Engineer's determination of an equivalent product. Each deviation must reference the listed Specification, by number if necessary, and explain in full detail how the proposed system is different.

6. Provide information on service center and personnel as required by Article 3.05 below.
7. If, after review of the pre-approval submittal, the Engineer deems the alternate system acceptable, the Engineer shall notify the bidding contractors of the approved manufacturer's name and model number via an addendum. Manufacturers are not approved unless they have been listed as such by the Engineer in an addendum.

### 1.03 REFERENCES

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society of Testing and Materials (ASTM)
  1. ASTM D883—Standard Terminology Relating to Plastics.
  2. ASTM D2563—Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts.
  3. ASTM D2583—Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
  4. ASTM D3299—Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
  5. ASTM D4097—Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
- B. American Society of Mechanical Engineers (ASME)
  1. ASME RTP 1—Reinforced Thermoset Plastic Corrosion-Resistant Equipment.
- C. National Bureau of Standards (NBS)
  1. NBS PS 15-69—Voluntary Product Standard – Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment.

D. National Fire Protection Association (NFPA)

1. NFPA 820—Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

1.04 QUALITY ASSURANCE

- A. Manufacturer: The products furnished under this Section shall be manufactured by a manufacturer who has been regularly engaged in the design and manufacture of the equipment and who has a minimum of 5 years experience in design, fabrication, and testing of biological odor-control systems. The odor-control system manufacturer shall show evidence of at least five identical two-stage design installations in satisfactory operation in wastewater treatment plant facilities for at least 5 years. The odor-control system manufacturer shall have used proposed biofiltration media for a minimum of 5 years. Any proposed non-specified manufacturers shall demonstrate to the satisfaction of the Engineer and Owner that the quality of their equipment is equal to that made by those manufacturers specifically named in this Section. Any manufacturer whose main business is FRP manufacturing shall not be accepted as a supplier of the complete system.
- B. Inspection and Testing Requirements: The Engineer reserves the right to reject delivery of any or all pieces of equipment found upon inspection to have any or all of the following: blisters, chips, crazing, exposed glass, cracks, burned areas, dry spots, foreign matter, surface porosity, sharp discontinuity, or entrapped air at the surface of the laminate. Any item that does not satisfy the tolerances below shall be rejected:

Defect	Inside Surface	Outside Surface
Blister	None	Max. dimensions: 1/4 inch diameter by 1/8 inch high; Maximum density: 1 per square foot; Minimum separation: 2 inches apart
Chips	None	Maximum dimension of break: 1/4 inch and thickness no greater than 10% of wall thickness; Maximum density: 1 per square foot
Crazing	None	Maximum length: 1/2 inch; Maximum density: 5 per square foot; Minimum separation: 2 inches
Cracks	None	None
Exposed Glass	None	None
Scratches	None	Maximum length: 1 inch; Maximum depth: 0.010 inch

Defect	Inside Surface	Outside Surface
Burned Areas	None	None
Surface Porosity	None	None
Foreign Matter	None	None
Sharp Discontinuity	None	None
Pits	Maximum 1/8 inch diameter by 1/32 inch deep; Maximum: 10 per square foot	Maximum 1/8 inch diameter by 1/16 inch deep; Maximum 10 per square foot
Dry Spot	None	2 square inches per square foot
Entrapped Air	None at the surface 1/16 inches and 10 per square inch maximum	1/8 inch and 4 per square inch or 1/16 inch and 10 per square inch within laminate

- C. The Engineer reserves the right to be present at the fabricator's facility for visual inspection of equipment to be supplied.
- D. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation without excessive noise, vibration, overheating, etc. Compliance shall be based on the equipment manufacturer's specifications and all applicable costs and standards. All equipment must be adjusted and checked for misalignment, clearances, supports, and adherence to safety standards.
- E. The manufacturer shall be responsible for the successful startup and testing of each odor-control facility. The manufacturer shall provide all necessary facilities, manpower, tools, instrumentation, and laboratory testing services required during this phase of the work.

## 1.05 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.
- B. The manufacturer shall warrantee the whole system, both in material and workmanship, for 1 year from the day of beneficial occupancy. This period shall not extend beyond 18 months after delivery of equipment to the job site.

## 1.06 MAINTENANCE

### A. Manufacturer's Services

1. The system manufacturer's representative shall be present at the job site for the following period, travel time excluded:
  - a. Sixteen hours for inspection of the installation and training of Owner's staff in operation of the system.
  - b. Provide one trip for 2 days for these tasks.

### B. Service Center

1. To be an approved odor-control system supplier, the system supplier shall have complete ongoing service capability with factory-trained personnel. The service center shall be located in the southeast US. The service center shall be able to provide the following services: operational analyses consisting of field H<sub>2</sub>S measurements, airflow measurements, sampling and analysis, and operational trouble shooting.

## 1.07 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.
- B. Six manuals shall be submitted before final acceptance of the equipment.

## 1.08 DESCRIPTION

- A. Multi-Stage Package System: The manufacturer shall furnish and install a complete "once-through two-stage," pre-piped, wired, and packaged odor-control system, including two integral treatment stages, exhaust fan, valves, fittings, ductwork, and all other equipment and accessories as specified to provide a complete and functioning system. The biological treatment stage shall use an inorganic expanded clay media to facilitate absorption and adsorption of odor compounds. The polishing stage shall use a virgin activated-carbon polishing media that shall be specifically designed to adsorb odorous compounds with the ability to support biological degradation of the compounds. The first stage shall operate with an independently controlled irrigation system to maintain optimum wetted conditions to support unique microbial growth for biological destruction of the odorous compounds and removal of toxic metabolites. Systems using any type of organic media and systems using a single inorganic media shall not be acceptable.

B. Design Basis: The mechanical, structural, process, and electrical design has been based on a ZABOCS® Model 8000 odor-control system manufactured by Siemens Water Technologies, San Diego, CA.

C. Specified Manufacturer: Siemens Water Technologies, or pre-approved equal.

## PART 2 PRODUCTS

### 2.01 GENERAL

A. The manufacturer shall provide an odor-control system as specified, which shall treat in a single pass the odorous air from the contaminated areas. The system shall be designed for continuous, automatic operation and also be capable of manual operation. Access manways shall be provided to allow access to the internals of the system. The system shall be designed to withstand a temperature up to 120°F. The multi-stage packaged FRP system shall be as specified in Article 2.03. The module and all accessories shall be factory mounted, piped, and wired to the maximum extent possible. If required for NFPA 820 compliance, the Contractor shall mount the control panel remotely, at least 3 feet from the airstream. The Contractor shall interconnect the wiring between the remote-mounted control panel and the junction box on the ZABOCS. The system shall be provided by Siemens Water Technologies, San Diego, California, or pre-approved equal.

### 2.02 DESIGN AND PERFORMANCE CRITERIA

A. Design and Performance Criteria:

1. Criteria: The system shall be capable of removing foul air at a rate no lower than the rate shown on the following table.
2. Foul air removed from the facility will have an average and peak concentration of hydrogen sulfide (H<sub>2</sub>S) and design air flow rate as listed in the following table. The supplier may consider using a higher capacity fan and introducing a non-foul air upstream of the odor-treatment system to dilute the concentration of the stagnant air concentrations listed below.

System I.D.	Air Flow Rate, cfm	Ave. Inlet H <sub>2</sub> S Conc.	Peak H <sub>2</sub> S Conc.
Stagnant Conditions Six Mile Creek	0	900 ppm	1,000 ppm
Stagnant Conditions Grovewood	0	230 ppm	300 ppm
ZB-8000	1,400 cfm	90 ppm	100 ppm

3. System Performance: The odor-control system shall demonstrate the following performance when operating under the design flow conditions listed above.

<u>INLET</u>	<u>OUTLET</u>
1-10 ppm H <sub>2</sub> S	0.1 ppm H <sub>2</sub> S
Greater than 10 ppm H <sub>2</sub> S	1.0% of inlet

At no time shall the outlet air concentration from the treatment unit exceed 1.5 ppm of hydrogen sulfide

4. Maximum Pressure Drop: The pressure drop across the odor-control system shall not exceed 5.0 inches wc at the maximum air flow rate specified above.

## 2.03 MULTI-STAGE FRP PACKAGED BIOLOGICAL ABSORPTION/ADSORPTION SYSTEM

- A. General: The gas treatment system shall be a Two-Stage, Once-Through Biologically Active Odor-Removal System designed to remove a minimum of 99% of H<sub>2</sub>S vapor in a single pass. The system shall consist of one biological gas conditioning/treatment stage and one vertical gas polishing stage in series. The first stage shall facilitate biological destruction of odor compounds absorbed by the liquid in the system and adsorbed on the inorganic media. The biological section shall include a spray header to distribute liquid evenly over the media. The complete treatment vessel shall be fabricated of premium-grade FRP.
1. The first treatment stage shall contain inorganic expanded clay media, Siemens' BIOLITE, specifically designed to support biological growth for degradation of odor compounds. This stage shall absorb odors from the air stream. The second polishing stage shall contain coal-based virgin media specifically designed to adsorb odor compounds and to support biological degradation of those compounds. This stage shall remove odors to the specified level. Overall media depth shall be a minimum of 48 inches.
  2. The first stage of media shall be wetted with fresh potable or re-use make-up water.
  3. The overall system size, including the fan, controls, and appurtenances, shall not exceed the dimensions shown on the contract drawings. Access manways shall be provided to allow access to the system internals. At a minimum, access manways shall be provided between the treatment stages. A portion of the system top shall be removable for access to the top of the second stage.

4. The system shall be included with all piping, valves, and internals. The material of construction of internals shall be as follows:

Packing Media Support:	HDPE and FRP
Liquid Distributor:	PVC
Spray Nozzles:	PVC

5. The system shall have all components pre-mounted and piped on the unitary constructed system. The system shall be shipped as a single piece.

B. Material of Construction:

1. The vessel and accessories shall be contact molded manufactured in accordance with NBS PS 15-69, ASTM D4097 for contact molding. Any material of construction other than FRP with premium grade resin will not be allowed.
2. Resin used in the system liner shall be a premium vinyl ester type such as Hetron 922 by Ashland Chemicals, Derakane 411 by Dow Chemical, Vipel F010 by AOC, or approved equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010.
3. Reinforcement: Glass-fiber reinforcement used shall be commercial grade corrosion-resistance borosilicate glass.
  - a. All glass-fiber reinforcement shall be Type C, chemical grade, Type E electrical grade.
  - b. Surfacing veil shall be 10-mil Nexus 111-00010 or equal.
  - c. Mat shall be Type "E" (electrical grade) glass, 1 1/2 ounces per square foot with a nominal fiber length of  $1.25 \pm 0.25$  inches, with a silane finish and styrene soluble binder.
  - d. Continuous glass roving used in chopper gun spray-up applications shall be Type "E" grade with chrome or silane coupling agent.
  - e. Alternate layers of mat and woven roving used for reinforcement.
4. Miscellaneous:
  - a. Stainless Steel: Unless otherwise specified, all fasteners and metal attachments, such as anchors, brackets, etc., shall be ANSI 316SS.
  - b. Gaskets: Unless otherwise specified, all gaskets shall be EPDM.

C. Fabrication:

1. General: Fabrication shall be in accordance with NBS PS 15-69, ASTM D3299, and ASTM D4097. All non-molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, and secondary bonds shall be sealed with a resin coat before the final paraffinated resin coat. All voids shall be filled with a resin paste.
2. Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with one NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion layer shall consist of two layers of 1-1/2 ounces per square foot chopped strand mat. If the application is by chopper gun spray up the glass fiber shall be 1/2 to 2 inches long. The total corrosion liner thickness shall be a minimum of 100 mils and have a resin-to-glass ratio of 80/20. All edges of reinforcement to be lapped a minimum of 1 inch.
3. Structural Laminate: Structural laminates shall consist of alternating layers of 1-1/2 ounces per square foot mat or chopped glass and 24 ounces per square yard woven roving applied to reach a designed thickness. Actual laminate sequences shall be according to the laminate tables shown on fabrication drawings. The exterior surface shall be relatively smooth and shall have no glass fibers exposed. The exterior shall be surface coated with gel coat containing ultra violet light inhibitors.

- D. Accessories: Air inlet, air outlet, spray headers, baffles, media support, drain, and all connections shown on the Drawings shall be provided by the manufacturer. Tie-down lugs shall be integrally molded into the walls of the vessel. All external bolts shall be 316SS and designed for the specified loads. Interior fasteners shall be of corrosion-resistant materials such as PVC or FRP.
- E. Neoprene Pad: A 1/4-inch-thick, 60-durometer neoprene rubber sheet shall be provided and placed beneath the vessel during installation.

2.04 EXHAUST FAN

- A. The exhaust fan shall have a fiberglass-reinforced plastic centrifugal backward-inclined impeller. The wheel shall be statically and dynamically balanced. Resin shall be suitable for exposure to the specific service conditions. The shaft shall be 316SS. The shaft seal shall be Teflon or Neoprene.
- B. Bearings shall be heavy-duty, self-aligning grease-lubricated ball-type with a minimum of 100,000-hour B-10 life. An OSHA-approved weather cover shall be provided. The motor shall be TEFC, 1,800 RPM with a 1.15 service factor and suitable for 3/60/230V. The fan shall be provided with a constant V-belt drive.

The motor shall be inverter-duty, suitable for use with an adjustable speed drive ASD.

- C. Fan housing shall be constructed of fiberglass and reinforced with rigid bracing to increase structural integrity. Bearing support brackets shall be positioned to directly oppose belt tension forces. Fan housing shall be a curved scroll design. The fan inlet shall be slip type and the fan outlet shall have a flanged connection.
- D. The fan shall be designed for the following specifications:

Exhaust Fan Design Requirements	ZB-8000
Air Flow Rate, cfm	1,400
SP up to System Inlet, in WC	2.0
Total Pressure Drop, in WC	5.0
Motor, HP	3.0

- E. The fan shall be New York Blower, Hartzell, or equal. The fan shall have an AMCA seal.

## 2.05 INSTRUMENTATION AND SYSTEM CONTROLS

- A. The electrical control panel shall provide electrical control for the exhaust fan and water addition system. A 230V/3Ph/60Hz power supply shall be provided to power the system.
- B. The control panel enclosure shall be of fiberglass construction and rated NEMA 3R with ventilation fan. The panel shall be mounted to the system assembly and factory tested to full operation with all other components before shipment.
- C. The panel shall have the following components or capabilities:
  1. Fan switch (ON-OFF).
  2. Fan ASD.
  3. Push-to-test button for water valve.
  4. Timer relay for on/off control of water valve.
  5. Nutrient pump (HAND-OFF-AUTO).
- D. The water control cabinet shall be constructed from a NEMA-12 rated FRP cabinet with all internal piping SCH 80 PVC. The cabinet shall be mounted to the system assembly. The cabinet shall contain the following components:
  1. Pressure-reducing valve.
  2. Nutrient pump.

3. Irrigation solenoid valve.
  4. Irrigation system pressure gauge.
- E. Water pressure regulator, solenoid valve, and rotameter shall be provided for control of water application rates. These components shall be mounted in the water control cabinet.

## 2.06 ACCESSORIES

- A. Water Flow Control: The direct reading rotameter shall be a variable area type with a Teflon float, EPR "O" rings, and PVC fittings. The rotameter shall have a direct reading scale.
- B. Water Distribution System: The first media stage shall be equipped with an independent water distribution system. The system shall be designed to irrigate the top of the first media bed with complete and even coverage via spray nozzles.
- C. Nutrient Addition: A nutrient containment and metering system shall be provided with the system.

## 2.07 PIPING

- A. All make-up water and drain piping shall be SCH 80 PVC. The Contractor shall insulate and heat trace all external piping.

## 2.08 NUTRIENT RESERVOIR

- A. The Nutrient Reservoir shall be integrated into the system sump. Loose external tanks shall not be allowed.

## 2.09 ROUND FRP DAMPERS

- A. The Contractor shall furnish and install round FRP single-blade fiberglass dampers at locations shown on plans. The damper frame shall be of one-piece construction with a resin-rich interior corrosion barrier minimum of 100 mils. A structural lay-up shall consist of alternate layers of chopped strand mat and woven roving to conform to ASME RTP 1 and NBS PS 15-69. The glass-to-resin ratio shall be a minimum of 35% glass to 65% resin. Wall thickness, flange thickness, drilling pattern, and width shall conform to NBS PS 15-69. The exterior surface of the damper shall contain UV inhibitors and a gel-coat color to match the duct system.

- B. The damper blade shall be constructed of the same material as the damper frame and shall have a resin-rich surfacing veil on both sides. Blade stiffeners shall be FRP or FRP encapsulated as required for stiffness.
- C. The axle shall be fiberglass or 316 stainless steel, as required to meet corrosion-resistance requirements for the stagnant air conditions outlined in Paragraph 2.02A.2. Leakage shall not exceed 3 cfm per square foot at 12 inches wc or 5.25 cfm per square foot at 30 inches wc as required in this Section for isolation. A damper shall be provided with a stainless-steel hand-locking quadrant, gear operators, chain wheel operators, or other actuation devices as required in this Section. All interior metal shall be 316 stainless steel. Gaskets shall be EPDM. Other gasket materials shall be available upon request.
- D. All FRP fabrication shall meet or exceed quality requirements of NBS PS 15-69 and ASME RTP 1. The damper shall be Belco Mfg. Model 201.

## PART 3 EXECUTION

### 3.01 SITE AND UTILITIES

- A. The system shall be located on a foundation as shown on the Drawing. The following utilities shall be provided at the site and located as shown on the Drawing. Site preparation, utility service, and installation are not provided by the manufacturer under these Specifications.
  - 1. Electrical: 230-VAC, three-phase, 60-Hz, 30-A service is required.
  - 2. Water Supply: a 3/4-inch water supply with backflow preventer are required. The water supply must provide for a minimum of 30 psi continuous pressure at 8 GPM and a hardness not to exceed 200 mg/L as calcium carbonate.
  - 3. Drain: a minimum 2-inch SCH 80 PVC gravity drain to a sewer with a barometric trap is required.

### 3.02 START-UP AND TRAINING

- A. The services of a factory representative shall be provided as specified in Articles 1.04 and 1.06 to ensure proper installation and start-up of the system. The manufacturer shall make any changes to the system that may be necessary to meet the specified performance under inlet conditions as specified.

END OF SECTION

**DIVISION 16**

**ELECTRICAL**

## SECTION 16050

### ELECTRICAL – GENERAL PROVISIONS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required for a complete electrical system as hereinafter specified and shown on the Drawings, whether or not specifically shown or called for.
2. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter an/or shown on the Drawings. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, generator, lighting systems, instrumentation, wiring and control systems as indicated on the Drawings and/or as specified herein whether or not specifically shown or called for. Certain equipment will be furnished as specified in other Section of this specification which will require conduit and wire to complete the installation as required.
3. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices (surge protection), conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.
4. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
5. Provide permitting and acceptance testing.
6. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.
7. For process instrumentation furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators and receivers. Coordinate wire termination with the instrumentation supplier.
8. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material, equipment, appliances and all

work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

9. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the existing building and/or proposed site in which work will take place and be performed to inspect carefully the present installation and conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing his work.
10. All necessary temporary power requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner.
11. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

B. Codes, Inspections and Fees:

1. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.
2. Pay all fees required for permits, inspections, and connections.

C. Tests:

1. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

D. Interpretation of Drawings:

1. The Drawings are not intended to show exact location, quantity or size of conduit runs. All installation of the raceway system shall be as directed by approved shop drawing. Any installation of a raceway system before shop drawing submittal and approval will at the sole risk of the Contractor.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
4. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

5. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.
6. Verify with the Engineer exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
7. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and, in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
8. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
9. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.
10. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can be determined in advance of the purchases of the equipment.
11. All connections to equipment shall be made as shown, specified, required, and directed and in accordance with the approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

F. Size of Equipment:

1. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
2. The equipment shall be kept upright at all times. When equipment has to be tilted for each of passage through restricted areas during transportation, the

manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

G. Component Interconnections:

1. Component equipment furnished under this Specification will not be furnished as integrated systems.
2. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

H. Record Drawings:

1. As the work progresses, legibly record all field changes on a set of project Contract Drawings. When the project is complete furnish a complete set of reproducible "as-built" drawings for the Project Record Documents, Section 01720.

## 1.02 SUBMITTALS

A. Material and Shop Drawings:

1. As specified under Section 01340, shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.
2. Shop drawings shall be submitted for the following equipment:
  - a. Motor Control Centers
  - b. Disconnect Switches
  - c. Wire and Cable
  - d. Supporting Devices
  - e. Variable Frequency Drives
  - f. Test Data
  - g. Generator
3. The manufacturers' name and product designation or catalog numbers shall be submitted for the following material:
  - a. Conduit

- b. Receptacles
  - c. Boxes and Fittings
  - d. Switches
  - e. Lamps
  - f. Control Relays
4. Prior to submittal by the Contractor, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.
  5. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.
  6. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.
  7. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

## B. Manufacturer's Services

1. Provide manufacturer's services for testing and start-up of the following equipment:
  - a. Motor Control Centers
  - b. Variable Frequency Drives
  - b. 480-volt Switchgear
2. Provide manufacturer's of the above listed equipment shall provide an experienced Field Service Engineer to accomplish the following tasks:
  - a. The equipment shall be visually inspected upon completion of installation and prior to energizing to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to

check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.

- b. The Field Service Engineers shall provide engineering support during the energizing and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.
- c. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.
- d. Three (3) 4-hour training sessions (one for each system) on operation, and two (2) 4-hour training sessions (one for each system) on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The maintenance and trouble-shooting sessions shall be conducted with record "as-built" electrical drawings sufficient for a class of eight personnel.
- e. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action.

## PART 2 - PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for approval as required by the Engineer.
- B. Materials and equipment used shall be Underwriters Laboratories, Inc., listed.
- C. Electrical equipment shall, at all times during construction, be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

- D. Surface mounted raceways and boxes mounted on tanks. Tanks walkways shall be stainless steel as noted on drawings. All fasteners shall be type 316 stainless steel.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Provide and place all sleeves for conduits penetrating floors, walls, partition, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- B. All cutting and patching shall be done in a thoroughly workmanlike manner.

### 3.02 INSPECTION AND TESTING

- A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

END OF SECTION

SECTION 16110  
RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.
- B. The complete raceway system rigid aluminum above grade and PVC-40 below grade.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

B. Standards:

1. Underwriters Laboratories, Inc. (U.L.).
2. American Society for Testing and Materials, (ASTM).
3. Federal Specifications.

C. Manufacturers:

1. Non-Metallic Raceways.

- a. Carlon.
- b. Triangle Pipe and Tube Co.
- c. Phillips Petroleum Co.
- d. Indian Head Company.
- e. Or equal.

2. Metallic Raceways:

- a. Youngstown Sheet and Tube Co.
- b. Allied Tube and Conduit Corp.
- c. Wheeling-Pittsburg Steel Corp.
- d. Or equal.

## 1.03 SUBMITTALS

### A. Material and Shop Drawings:

1. Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:
  - a. Certified shop drawings with performance data and physical characteristics.
  - b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
  - c. All information required by Section 01340.
  - d. A complete total bill of materials for all equipment.
2. In the event that it is impossible to conform with certain details of the specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.
- B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

### 2.02 MATERIALS AND EQUIPMENT

#### A. Metallic Conduit:

1. ALUM conduit shall contain less than 0.1 percent copper and conform to Federal Specification WW-C-540C.

#### B. Non-Metallic Conduit and Fittings:

1. PVC conduit shall be schedule 80 composed of High Impact PVC (polyvinyl) chloride (C-200 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 PSI, at 70 degrees F,

flexural strength of 11,000 PSI, compression strength of 8600 PSI. Manufacturer shall have five years' extruding PVC experience.

2. Liquidtight Flexible Conduit and Fittings shall be for use per Article 351 of the NEC. PVC compounds shall not include fillers. Fittings shall be manufactured from high impact PVC.
- C. Liquidtight, Flexible Non-Metallic Conduit, Couplings and Fittings:
1. Liquidtight, flexible non-metallic conduit shall be all PVC conduit and manufactured by Thomas and Betts Co., K-Flex, Inc., or equal.
  2. Fittings used with Liquidtight flexible conduit shall be of the non-metallic type as manufactured by the Thomas and Betts Co., Xtraflex System, K-Flex, Inc., or equal.
- D. Flexible Couplings:
1. Flexible Couplings shall be as manufactured by the Thomas and Betts Co., K-Flex, Inc., or equal.
  - E. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco,, Div., Appleton Electric Co., or equal.
  - F. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. O., or equal.
  - G. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or equal.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendation, in the location shown on the Drawings.
- B. No conduit smaller than 1/2-inch electrical trade size shall be used, nor any have more than three 90 degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size floor conduit shall be 3/4-inch.
- C. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
- D. The ends of all conduit shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

- E. Conduit supports shall be spaced at intervals of 4 feet or less, as required to obtain rigid construction. Conduit straps shall be type as manufactured by "CLIC".
- F. Single conduits shall be supported by means of one-hole non-metallic pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with fiberglass horizontal members and fiberglass tressed hanger rods. The rods shall be not less than 3/8-inch diameter.
- G. Conduit hangers shall be attached to structural steel by means of non-metallic beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.
- H. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.
- I. No broken run shall exceed 500 feet in length. This length shall be reduced by 75 feet for each 90 degree elbow.
- J. Conduit terminating in boxes shall have sealing double lock-nuts and insulating bushings.
- K. Conduit terminating in gasketed enclosures shall be terminated with sealing conduit hubs.
- L. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.
- M. Liquidtight flexible metal conduit shall be used for all motor terminations and other outdoor equipment where vibration is present.
- N. Flexible couplings shall be used in hazardous locations for all motor termination and other equipment where vibration is present.
- O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete building structure; in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit runs above ground which is more than one hundred feet long and interval between expansion fittings in such a run shall not be greater than 100 feet.
- P. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand-held dryers are prohibited.

- Q. Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.
- R. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with the Engineer prior to installation. This includes empty raceways for future use.
- S. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls, etc., as required by NEC Article 300, whether shown on drawings or not.
- T. Paint all field cut threads and coat all aluminum conduits in contact with concrete per manufacturer's recommendations.
- U. Raceways which do not have conductors furnished under this division of specification shall be left with an approved nylon pullcord in the raceway.
- V. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings.
- W. All aluminum conduits in contact with concrete shall be coated with bitumastic paint.

END OF SECTION

## SECTION 16120

### WIRES AND CABLES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as hereinafter specified.

###### B. General Design:

1. Wire for lighting, and receptacle circuits in the administration building shall be type THHN solid.
2. Wire for all power feeder and motor circuits outside of the administration building shall be type THHN stranded.
3. Single conductor wire for control, indication and metering shall be type THHN No. 14 AWG, stranded.
4. Multi-conductor control cable shall be No. 14 AWG, stranded tinned copper.
5. Wire for process instrumentation shall be No. 16 AWG, stranded tinned copper.
6. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

##### 1.02 QUALITY ASSURANCE

###### A. Standards:

1. Insulated Cable Engineers Association (ICEA).
2. Underwriters Laboratories, Inc. (U.L.)
3. American Society for Testing and Materials (ASTM)

###### B. Manufacturers:

1. 600 volt wire and cable.
  - a. Hi-Tech Cable Corp.
  - b. Collyer Insulated Wire Co.
  - c. Okonite Co.
  - d. Rome Cable Co.
  - e. American Insulated Wire Corp.
  - f. Triangle PWC, Inc.. Or equal

2. Instrumentation and Control Cable:

- a. American Insulated Wire Corp.
- b. Rome Cable Corp.
- c. Okonite Co.
- d. Eaton Corp. "Polyset".
- e. Triangle PWC, Inc.
- f. Or Equal.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All conductors shall be carefully handled to avoid kinks or damage to the insulation.
- B. All conductors stored outdoors shall be covered.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper conductors.
- B. All conductors shall be stranded except lighting and receptacle circuits.

2.02 MATERIALS

A. 600 Volt Wire and Cable:

1. **Type THHN shall be PVC insulation with nylon jacket.**

B. Instrumentation and Control Cable:

- 1. Process instrumentation wire shall be twisted pair, 600 volt, cross linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP". Multi-conductor cables with individually shielded twisted pairs shall be installed where indicated.
- 2. Multi-conductor control cable shall be stranded, 600 volt, cross-linked polyethylene insulated with PVC jacket, type "XLP".

C. Terminations and Splices:

- 1. Unless otherwise indicated on the plans, no splices may be made in the cables without prior approval of the Engineer. Where splicing is approved, the splicing material shall be as recommended and approved by the cable manufacturer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. All conductors shall be carefully handled to avoid kinks or damage to insulation.
- B. Lubricants shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.
- C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.
- D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.
- E. Shielding on instrumentation wire shall be grounded at one end only as directed by the supplier of the instrument.
- F. Wire and cable connections to terminals, splices, and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall not be less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.
- G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or as approved by the Engineer.
- H. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.
- I. Steel fish tapes and/or steel pulling cables shall not be used in PVC raceway systems.
- J. Remove debris and moisture from the conduits, boxes, and cabinets prior to cable installation and mandrel with device of one size smaller than conduit and mandrel with wire brush one size larger than conduit.

### 3.02 TESTS

- A. All 600-volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 1000-VDC. A cable test data form shall be provided for Engineer review.

B. All service conductors shall be tested as in Paragraph A above. These tests shall be witnessed by the Engineer.

END OF SECTION

SECTION 16130  
BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all junction boxes, pull boxes, service entrance boxes and for a complete raceway system as shown on the Drawings and as specified herein.

B. General Design

1. Unless otherwise hereinafter specified or shown on the Drawings, all boxes and fasteners shall be type NEMA 4X, 316-stainless steel.
2. All boxes in air conditioning plenums above ceilings shall be pressed steel.
3. All boxes that do not receive devices are to have blank plates installed matching wiring device plates.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (U.L.)
2. Federal Specifications
3. American Society for Testing and Material, (ASTM)

B. Manufacturers

1. Hoffman, Type CHNFSS
2. Or Equal

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050 - General Provisions.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Boxes and fittings shall be stored indoors protected from damage.

## 1.05 WARRANTY AND GUARANTEES

- A. All boxes and fittings shall be warranted against defects or failure for a period of 1 year from date of acceptance.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Boxes shall be constructed as follows:

1. 14-gauge 316L stainless steel
2. Continuously welded and ground smooth, no holes or knockouts.
3. Seamless foam in-place gasket, watertight, dust-tight.
4. Stainless steel screws and clamps.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. All boxes shall be supported away from surfaces.
- B. All boxes shall be sized per the National Electrical Code (NEC)
- C. All conduit entries into boxes shall not lower or change the NEMA rating of the box.

END OF SECTION

SECTION 16140  
WIRING DEVICES

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

**A. Scope of Work:**

1. Furnish and install wiring devices and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.
2. Wiring devices shall include the following:
  - a. Wall Switches
  - b. Device Plates
  - c. Plugs
  - d. Receptacles
  - e. Lighting Control Time Clocks
  - f. Lighting Contactors
  - g. Control Stations
  - h. Ground Fault Interrupter Receptacles

**B. Related Work Described Elsewhere:**

1. General Provisions: Section 16050.
2. Raceway: Section 16110.

**1.02 QUALITY ASSURANCE**

**A. Standards:**

1. Underwriters Laboratories Inc. (UL).
2. National Electric Manufacturers Association (NEMA).
3. National Electrical Code (NEC).

**B. Manufacturers:**

1. Wall switches, device plates, plugs, and receptacles as follows:
  - a. Arrow-Hart
  - b. Bryant
  - c. Hubbell
  - d. Leviton
  - e. or Equal

2. Clocks:
  - a. Simplex
  - b. or Equal
3. Lighting Contactors:
  - a. Square-D
  - b. Cutler-Hammer
  - c. or Equal
4. Dimmer Controls:
  - a. Leviton
  - b. Prescolite
  - c. or Equal
5. Control Stations:
  - a. Hoffman Engineering Co.
  - b. Square-D
  - c. Crouse-Hinds
  - d. Or equal

#### 1.03 SUBMITTALS

- A. Material and Shop Drawings:
  1. Submit material list and catalog cut-sheets for all items covered under this section. Indicate type, ratings, material, color, and manufacturer.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All devices covered under this Section shall be stored indoors, protected from damage.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Switches:
  1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to Federal Specification W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.
  - a. Single pole - Arrow-Hart, Catalog No. 1991.
  - b. Double pole - Arrow-Hart, Catalog No. 1992.
  - c. Three way - Arrow-Hart, Catalog No. 1993.
  - d. Four way - Arrow-Hart, Catalog No. 1994.
  - e. Single pole, key operated - Arrow-Hart Catalog No. 11991-L.
  - f. Momentary contact, 2 circuit, center off - Arrow-Hart, Catalog No. 1895.
  - g. Weatherproof cover for Arrow-Hart 2900 series tap action switches - Arrow-Hart Catalog No. 2881-G.

B. Receptacles:

1. Wall receptacles shall be of the following types and manufacturer or equal.
  - a. Single, 20A, 125V, 1P, 3W; Arrow-Hart, Catalog No 5351.
  - b. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5352.
  - c. Weatherproof, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5351 and WLRD-1 cover.
  - d. Corrosion-resistant, duplex, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5351 and WLRD-1 cover.
  - e. 60A, 480V, 3P, 2W; weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
  - f. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W; Arrow-Hart Catalog No. GF5342.
  - g. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. 97061.
  - h. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart Catalog No. 4501-FS.
  - i. Clock hanger, 15A, 125V, 2P, 3W; Arrow-Hart Catalog No. 452.
  - j. Single, 20A, 125V, 2P, 3W; Arrow-Hart Catalog No. 8510BL; cover: Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
  - k. Single, 30A, 125V, 2P, 3W; Arrow-Hart Catalog No. 5716N; cover: Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
  - l. Clothes dryer, 30A, 125/250V, 3P, 3W; Arrow-Hart Catalog No. 9344N. Matching cord set shall also be included.

C. Device Plates:

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

D. Lighting Contactor:

1. Lighting contactors shall be of the electrically operated, electrically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.
2. Contactors shall be rated for 25A-600 volt contacts and be similar and equal to Automatic Switch Company bulletin 1255-166 RC.

E. Lighting Control Time Switches:

1. Time switches for the control of lighting shall have astronomic dials, reserve power and be similar and equal to the following types:
  - a. Where time switch is indicated to be for momentary contact operation it shall be similar and equal to Intermatic Inc. Catalog No. ET-70115-C.
  - b. Where time switch is indicated for SPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
  - c. Where time switch is indicated for DPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
  - d. Where time switch is indicated for roadway or equipment, lighting shall be similar or equal to Intermatic Inc. Catalog No. ET-7000 Series.

F. Control Stations:

1. Control stations for start/stop pushbutton and hand-off-automatic selector switches shall be corrosion resistant, dust-tight, watertight and weatherproof, NEMA 4X, 600 VAC, UL Standard 508 as manufactured by Crouse-Hinds Series NCS or equal.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.
- B. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.
- C. Use bolt, screws, nuts and other threaded devices having standard threads and heads so they may be installed and replaced without special tools.
- D. Check light switch locations before rough-in to avoid installing a switch behind the door swing.
- E. The Engineer and Owner reserve the right to change any switch or receptacle location within the same room, without added cost prior to rough-in.

F. Locate outlets intended for the supply of specific items such as water coolers, copying machines, fans, etc., as recommended by the item manufacturer.

END OF SECTION

## SECTION 16150

### MOTORS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

###### B. Related Work Described Elsewhere:

1. Equipment: Division 11.

##### 1.02 QUALIFICATIONS

###### A. Qualifications:

1. Motors shall be sufficient in size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.
2. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

##### 1.03 SUBMITTALS

- A. The motor manufacturer shall submit to the Engineer: Shop Drawings, Working Drawings and Samples: certified dimension prints showing nameplate data and outline dimensions.
- B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and proper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.

- B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

## 2.02 MATERIALS AND EQUIPMENT

- A. Rating:
1. Unless otherwise noted, motors 200 horsepower and below shall be of the low voltage type. Unless otherwise noted, all motors 1/2 through 200 horsepower shall be rated 230/460 volt, 3-phase, 60 Hertz A.C., premium efficient, and motors: below 1/2 horsepower shall be rated 115/230 volt, 1-phase, 60/Hertz A.C.
  2. Motor connected to variable frequency drives shall be rated as inverter duty by the motor manufacturer. The motor manufacturer shall submit in writing that the motor is suitable for the drive.
- B. All dripproof and weather protected Type 1 (WP1) motors shall have epoxy encapsulated windings. Small motors not readily available with encapsulated windings may be standard type, except non-encapsulated motors exposed to the outside atmosphere shall be totally enclosed.
- C. All motors shall include space heaters to prevent condensation on the motor windings when the motor is not operating. The space heaters shall be sized by the motor manufacturer; maximum 200 watts; 120 volts.
- D. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.
- E. Low Voltage, Three-Phase Motors:
1. Motors shall be of the squirrel-cage or wound rotor induction type as noted. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as called for on the Drawings and as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFMBA standards where applicable. Motors shall be of the type and quality described by the Specifications, and/or as shown on the schedule on the Drawings, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.
  2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.
  3. Motors shall be of drip proof or weather protected Type 1 or totally enclosed fan cooled construction as called for on the Drawings or specified in other sections of these specifications, with 1.15 service factor.
  4. Motors shall be suitable for operation in moist air with hydrogen sulfide gas present
  5. The output shaft shall be suitable for direct connection or belt drive as required.

6. Motors shall have a Class F non-hygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.
7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.
8. All fittings, bolts, nuts, screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads.
9. All machine surfaces shall be coated with rust inhibitor for each disassembly.
10. Motor terminal boxes shall be cast iron diagonally split, one size larger than the manufacturer's standard (motors above 200HP only), pipe tapped for conduit and shall be attached to the motor frame with cadmium plated hex head cap screws. The box shall be arranged for rotation so that conduit entry from either sides, or bottom is possible. Gaskets shall be supplied between the box and the motor frame and between halves of the box. Cover shall be installed with cadmium plated hex head cap screws. The box shall come completely assembled to the motor. Motor leads in the conduit box shall have the same insulation class as the windings, shall be sized in accordance with EASA suggested minimum ampacity values using 105 degree C insulated lead wire. The wiring shall be clearly identified every inch or the lead shall have a metal band in accordance with ANSI C6.1, latest revision. Nameplates shall be supplied stating the above data and permanently attached to the motor. Where the leads exit the motor frame, they shall pass through a tight fitting neoprene rubber seal to prevent foreign material or air passage and to hold the leads in a centered position. Motors shall be provided with a compression type grounding lug, mounted in the conduit box by drilling and tapping into the motor frame or by a double ended cap screw of silicon bronze.
11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.
13. Low voltage, three-phase motors shall be manufactured by, Baldor, Marathon or Relience Electric.
14. Fractional Horsepower:
  - a. Fractional horsepower motors shall be rigid, welded-steel designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

- b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.
- c. For light to moderate loading bearings shall be quiet all angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.
- d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without lubrication.

15. Integral Horsepower:

- a. Motor frames and end shield shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.
- b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.
- c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.
- d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings shall be cast-aluminum or bar-type construction with brazed end rings.
- e. Motors shall be equipped with vacuum-degassed anti-friction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.
- f. Bearings of high thrust motors will be locked for momentary up thrust or 30 percent down thrust. All bearings shall have a minimum B10 life rating of 5 years in accordance with AFBMA life and thrust values.
- g. Vertical hollow-shaft motors will have non-reverse ratchets to prevent backspin.

F. Inverter Duty Motors:

- 1. In addition to the requirements of 16150-2.02 A., B., C., D., and E., motors intended for use with variable frequency drives shall be inverter duty motors specifically designed for inverter operation, and shall be applied in accordance with NEMA, ANSI, IEEE, AFBMA AND NEC for the duty imposed by the driven and drive equipment. Inverter duty motors shall be specifically certified by the motor manufacturer to be compatible with the variable frequency drive to be used with the motor. Inverter-duty motors shall be designed to operate over a frequency range of 0 to 66 Hertz. Motor insulation for all motors operating with variable frequency drives shall be Class H with Class F temperature rise when operated with the inverter continuously at all speed and load conditions throughout the specified operating range. Insulation systems shall be

capable of withstanding a change in voltage ( $dV/dT$ ) of 1600 peak volts and rise time greater than 0.1 microseconds without damage per NEMA MG-1 Section IV, Part 31.40.4.2. Motors rated less than 200 horsepower shall be protected with two normally closed thermal protectors in the stator winding and shall be set to open when the temperature reaches 155°C.

Motors rated 200 horsepower and greater shall have platinum RTD overtemperature protection. The motor frame shall be cast iron. Inverter Duty motors shall be Baldor Inverter Drive Motors, Reliance Electric.

2. Motors shall be suitable for operation in moist air with hydrogen sulfide gas present.
3. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.
4. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
5. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

G. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open, drip proof, or totally enclosed fan cooled as called for on the Drawings or other sections of these specifications, with temperature rise in accordance with NEMA Standards for Class B insulation.
2. Totally enclosed fan cooled motors shall be designed for severe duty.
3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protecting plating.
4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Motor connections: All motors shall be connected to the conduit system by a means of a short section (18 inch maximum) of flexible conduit unless otherwise indicated. For motor connections of No. 6 AWG and smaller wire size, the Contractor shall furnish flexible conduit with an approved grounding conductor inside the flexible section. For motor connections of No. 4 AWG or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

### 3.02 INSPECTION AND TESTING

- A. The following tests shall be performed on all motors after installation but before putting motors into service.
  1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives minimum acceptance insulation resistance in megohms at various

temperatures and for various voltages with readings being taken after one minute of megger test run.

Winding Temp (F°)	115V.	230V.	460V.
37	60	108	210
50	32	60	120
68	13	26	50
86	5.6	11	21
104	2.4	4.5	8.8
122	1	2	3.7
140	.50	.85	1.6

2. The Contractor shall check all motors for correct clearances and alignment and for current lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

END OF SECTION

SECTION 16160  
PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment, and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Standards:

1. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

B. Manufacturer (NEMA 1 and NEMA4X):

1. 120/240V, single phase, 3 wire, and 120/208V three phase, 4-wire panelboards shall be as manufactured by the General Electric, Square D Co., or Cutler/Hammer.
2. 480V, three phase, 3-wire panelboards shall be as manufactured by the, Square D Co., I-Line, or Cutler/Hammer or General Electric.

C. Manufacturer (NEMA 3 and 12):

1. NEMA 3 and 12 panelboards shall be type NLP as manufactured by the Crouse-Hinds Company or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. See Section 16050, Electrical – General Provisions.

## PART 2 - PRODUCTS

### 2.01 RATING

- A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

### 2.02 CONSTRUCTION AREA (NEMA 1)

#### A. Interiors:

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.
2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
4. A nameplate shall be provided listing panel type, number of circuit breakers, ratings and source.

#### B. Buses:

1. Bus bars for the mains shall be of tin-plated copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole circuit devices shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.
2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

#### C. Boxes:

1. Recessed boxes shall be made from galvanized code gauge steel without multiple knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.
2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in Paragraph D4.
3. At least 4 interior mounting studs shall be provided.
4. All conduit entrances shall be field punched.

D. Trim:

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.
2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inches in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.
3. The trims shall be fabricated from code gauge sheet steel.
4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.
5. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

2.03 CONSTRUCTION (NEMA 4X)

A. Interiors and Buses:

1. Interiors and buses shall be as hereinbefore specified for NEMA 1 construction.
2. Interior trim shall be complete. No exposed wiring allowed.

B. Boxes and Covers:

1. Boxes and covers shall be made from 316 stainless steel.
2. Boxes and covers shall be hinged together and gasketed. All metallic parts on exterior shall be stainless steel.
3. Conduit openings shall be sealed with lock rings or sealing washers.
4. Polycarbonate or plastic enclosures or boxes are unacceptable.

2.04 CIRCUIT BREAKERS

- A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.
- B. Circuit breakers shall be molded case, bolt-in type, for NEMA 1 and plug-in for NEMA 4X.
- C. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 amperes, RMS symmetrical.
- D. Three pole breakers used in 480V panelboards shall have an interrupting capacity of not less than 25,000 amperes, RMS symmetrical.

E. GFCI:

1. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and in interrupting capacity of 10,000 amperes RMS.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.
- B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6-feet 0-inch above the floor, properly aligned and adequately supported independently of the connecting raceways.
- C. All wiring in panelboards shall be neatly formed, grouped, laced and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the card holder inside the front cover.

END OF SECTION

## SECTION 16170

### SAFETY SWITCHES

#### PART I- GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish and install all motor and circuit disconnects as hereinafter specified and as shown on the drawing.

###### B. General Design:

1. All switches shall be heavy duty and have stainless steel NEMA 4X enclosures and be horsepower rated.
2. All switches shall have metal nameplates, front cover mounted, that contain a permanent load, switch-type, catalog number and HP ratings, handle whose position is easily recognizable and is padlockable in the "off" position, visible blades, reinforced fuse clips, nonfeasible, positive, quick make-quick break mechanism, switch assembly plus operating handle as an integral part of the enclosure base.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. All switches shall have line terminal shields.
4. All current carrying parts shall be copper.
5. Auxiliary contacts rated 10 ampere at 240 volts shall be provided, for motor space heater interlock and position indication.

##### 1.02 QUALITY ASSURANCE

###### A. Standards:

1. National Electrical Manufacturer's Association (NEMA).
2. Underwriter's Laboratories (UL).
3. Federal Specifications.
4. National Electrical Code (NEC).

###### B. Manufacturer:

1. Switches shall be as manufactured by Square D Co. Class 9422, Cutler-Hammer, or equal.

## **1.03 SUBMITTALS**

### **A. Materials and Shop Drawings:**

- 1. See Section 16050 – Electrical, General Provisions.**

## **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All switches shall be stored indoors protected from damage.**

## **1.05 WARRANTY AND GUARANTEES**

- A. All switches shall be warranted against defect, rusting or failure for a period of one year from date of acceptance.**

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS AND EQUIPMENT**

- A. Where a six-pole weatherproof disconnect are called for on the Drawings, the Contractor shall provide two 600-Volt, 3-pole non-fusible switches in a single NEMA 4X stainless steel enclosure with a single operating handle mechanically interlocked to both disconnects.**
- B. All parts exposed to the weather or in hose down areas shall be stainless steel.**
- C. Short circuit rating – 10,000 RMS symmetrical amperes for non-fused switches.**
- D. Line and load lugs shall be front removable and suitable for copper, 60/75°C wire through 200A sizes, 75°C wire for 400-800A sizes.**

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. All switches shall be mounted as shown on the Drawings.**
- B. Location of disconnect switches shall be per the N.E.C. and shall be verified with the Engineer before installation.**
- C. All mounting appurtenances shall be 316 stainless steel including fasteners.**

**END OF SECTION**

**SECTION 16370**  
**VARIABLE SPEED DRIVES**

**PART 1 GENERAL**

**1.01 DESCRIPTION**

**A. Scope of Work**

1. Furnish and install variable speed drives including all appurtenances required as shown on the drawing and specified herein.
2. All equipment and accessories shall have approved manufacturer's shop drawings prior to installation and shall be tested in conformance with these Performance Specifications prior to acceptance and final payment by the Owner.

**B. Related Work Described Elsewhere**

1. Equipment: Division 11.

**1.02 QUALITY ASSURANCE**

**A. Variable speed drives shall be sufficient size for the duty to be performed and shall not exceed their full-rated capacity when the driven equipment is operating as specified. Variable speed drives driving pumps shall not be overloaded under any operating condition of the pump.**

**B. Standards**

1. National Electrical Manufacturers Association (NEMA).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
3. American National Standards Institute (ANSI).
4. National Electric Code (NEC).

**C. The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10% total harmonic voltage distortion and commutation ASDs shall meet requirements as outlined in the latest edition of IEEE-519 for total harmonic voltage and current distortion. Individual or simultaneous operation of the ASD's shall not add more than 5% total harmonic voltage distortion to the normal bus, nor more than 10% while operating from standby generator. The point of common coupling shall be the secondary side of the service transformer. Twelve-pulse (minimum) harmonic rectifier technology are required to meet these requirements, it is the responsibility of the ASD manufacturer to provide this harmonic technology within the ASD enclosure.**

- D. The controller shall be subject to, but not limited to, the following quality assurance controls, procedures and tests:
1. Power transistors, SCR's and diodes shall be tested to ensure correct function and highest reliability.
  2. All printed circuit boards shall be tested at 50 degree C for 50 hours. The ASD manufacturer shall provide certification that the tests have been completed.
  3. Every controller will be functionally tested with a motor to ensure that if the drive is started up according to the instruction manual provided, the unit will run properly.
  4. The ASD systems shall be fabricated by the same ASD manufacturer, items must not be fabricated in whole or in part by parties other than the ASD manufacturer. Third party distributor or packager modifications to a standard product will not be allowed.
  5. The ASD shall be fully designed and manufactured in the United States of America.

D. Approved Manufacturers:

1. Yaskawi.

#### 1.03 DRIVE MANUFACTURES'S RESPONSIBILITIES

- A. The ASD manufacturer shall be responsible for the installation, testing and start-up of each drive.
- B. The ASD manufacturer shall be responsible for the coordination of the drive with thier respective motor specified in other Sections of the Project Specifications.
- C. The ASD manufacturer shall be, at no additional cost to the Owner, responsible for mitigating any harmonic, and/or all RF and/or EMI and/or any electrical type noise created by the drive which adversely affect the proper operation of any and all electronic and/or electrical power and/or mechanical devices on this project.
- D. The ASD manufacturer shall provide input and/or output filters and/or any other accessories on each drive to mitigate all electrical and mechanical noise to a limit which is not detrimental to the motor winding irregardless of the motor lead length and/or type of conduit or charecteristics to this installation.
- E. The ASD manufacturer shall be responsible for all additionnal cost related to the installation of the drive that is above and beyond the scope of work shown on the drawings and specification.
- F. The ASD manufacturer shall pay for all engineering fees and Owner costs related to the services required by the Consultant and Owner to assist in the mitigation of ASD related problems.

## 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The equipment shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angles.
- B. The equipment shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by the ASD Manufacturer.
- C. Each box or package shall be properly marked to show its net weight in addition to its contents.

## PART 2 PRODUCTS

### 2.01 VARIABLE FREQUENCY ADJUSTABLE SPEED DRIVES (VARIABLE TORQUE, PWM)

#### A. General:

1. The variable frequency drive (ASD) motor controller shall convert 460 Volt, three-phase, 60 Hertz utility power to adjustable voltage (0-460V) and frequency (0-60 Hz.) three-phase, AC power for stepless motor speed control with a capability of 10:1 speed range. All general options and modifications shall mount within the standard adjustable frequency controller enclosure.
2. The adjustable frequency controller shall be a space vector sine-coded Pulse-Width Modulated (PWM) design. Modulation methods which incorporate "gear-changing" techniques are not acceptable. Distributor or packager modifications to a third-party standard product will not be allowed. All drives shall be manufactured by a single manufacturer, and shall be of the same technology.
3. The controller(s) shall be suitable for use with any standard configuration squirrel-cage induction motor(s) having a 1.05 or better service factor, or with existing standard squirrel-cage induction motor(s) with nameplate data as shown on the plans. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.
4. The Contractor shall be responsible for the erection, installation and start up on the equipment covered by this Specification.
5. Complete drawings shall be furnished for approval before proceeding with manufacture and shall consist of master wiring diagrams, elementary or control schematics including coordination with other electrical control devices operating in conjunction with the Adjustable Frequency Drive, and suitable outline drawings with sufficient details for locating conduit stub-ups and field wiring.
6. The Adjustable Frequency Drive manufacturer shall maintain and staff engineering service and repair shops throughout the United States, including the State of Florida, trained to do start up service, emergency

service calls, repair work, service contracts and training of customer personnel.

B. Construction

1. Each Adjustable Frequency Drives shall consist of a 460V, 6-pulse minimum rectifier and adjustable frequency inverter with features, functions and options as specified.
2. The controller shall produce an adjustable AC voltage/frequency output. It shall have an output voltage regulator to maintain correct output V/Hz. despite incoming voltage variations.
3. The controller shall have a continuous output current rating of 100% of motor nameplate current.
4. The ASD shall be of the Pulse-Width Modulated type and shall employ a 6-pulse (minimum) dual full-wave diode bridge converters to convert incoming fixed voltage/frequency to a fixed DC voltage, all components for 12-pulse converters must be integral to ASD enclosure and require no additional installation costs. The Pulse Width Modulation strategy shall be of the space vector type implemented in a microprocessor which generates a sine-coded output voltage.
5. The inverter output shall be generated by Insulated Gate Bipolar Transistors (IGBT) which shall be controlled by six identical base driver circuits. The ASD shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation.
6. The Adjustable Frequency Drives shall be rated for the HP, full load amperes and rpm of the motor. They shall be designed to provide continuous speed adjustment of three-phase motors. The Adjustable Frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 Hertz.
7. Controllers shall be rated for an ambient temperature of 0°C. to 40°C., an altitude of up to 3,300 feet above sea level and humidity of 0 to 95% non-condensing.
8. Controller enclosures shall be NEMA Type I floor-mounted, forced ventilated above 25 HP. The inverters shall have complete front accessibility with easily removable assemblies.
9. The door of each power unit shall include a "POWER ON light, a ASD fault light, a ASD run light, stop push-button, start push-button, a fault reset

push-button, a "HAND-OFF-AUTOMATIC" selector switch, and a manual speed control potentiometer.

10. The ASD shall be software programmable to provide automatic restart after any individual trip condition resulting from either overcurrent, overvoltage, undervoltage, or overtemperature. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function is not successful within a maximum of three attempts within a short time period.
11. A speed droop feature shall be included which reduces the speed of the drive on transient overloads. The drive is to return to set speed after transient is removed. If the acceleration or deceleration rates are too rapid for the moment of inertia of the load, the drive is to automatically compensate to prevent drive trip.
12. Automatic restart after drive trip or utility failure. Software selectable if not desired.
13. Process signal inverter. Software selectable to allow speed of drive to vary inversely with input signal.
14. Proportional and integral setpoint process controller with menu driven selection and programming via door-mounted keypad.
15. Pick up a spinning load. The ASD shall be able to determine the motor speed and resume control of a motor which is spinning in either direction without tripping.
16. A door-mounted membrane keypad with integral 2-line, 24-character LCD display shall be furnished, capable of controlling the ASD and setting drive parameters, and shall include the following features:
  17. The digital display must present all diagnostic message and parameter values in English engineering units when accessed, without the use of codes.
  18. The keypad module shall contain a "self-test" software program which can be activated to verify proper keypad operations.
  19. The digital keypad shall allow the operator to enter exact numerical settings in English engineering units. A plain English user menu shall be provided in software as a guide to parameter setting, (rather than codes). Drive parameters shall be factory set in EEPROM and resettable in the field through the keypad. Six (6) levels of password security shall be available to protect drive parameters from unauthorized personnel. The EEPROM

stored drive variables must be able to be transferred to new boards to reprogram spare boards.

a. Normally the digital display shall simultaneously display:

1. Speed demand in percent.
2. Output current in amperes.
3. Frequency in hertz.
4. Control Mode: Manual/Automatic.
5. Total three-phase KW or output volts.

20. The controller shall include the following protective features:

- a. Single phase fault or 3-phase short circuit on ASD output terminals without damage to any power component.
- b. Static instantaneous overcurrent and overvoltage trip with inverse overcurrent protection.
- c. Static overspeed (overfrequency) protection.
- d. Line or fuse loss and undervoltage protection.
- e. Power unit overtemperature protection.
- f. Electronic motor overload protection.
- g. Responsive action to motor winding temperature detectors or thermostatic switches.
- i. LED status indicators on regulator, printed circuit board face plates.
- j. Isolated operator controls.
- k. Input line fuses.
- l. Be insensitive to incoming power phase sequence.
- m. Have desaturation circuit to drive inverter section transistor base current to zero in event of controller fault.
- n. Have DC bus discharge circuit for protection of operator and service personnel with an indicator lamp.
- o. Input line noise suppression with line reactor.

21. The following system configuring settings shall be provided, without exception, field adjustable through the keypad/display unit or via the serial communication port only.

a. Motor Nameplate Data

1. Motor frequency.
2. Number of poles.
3. Full load speed.
4. Motor volts.
5. Motor full load amps.
6. Motor KW.
7. Current min.
8. Current max.

b. ASD Limits

1. Independent accel/decel rates.
2. No load boost.
3. Vmin, Vmax, V/Hz.
4. Full load boost.
5. Overload trip curve select (Inverse or Constant).
6. Min./max. speed (frequency).
7. Auto reset for load or voltage trip select.
8. Slip compensation.
9. Catch-A Spinning-Load select.
10. Overload trip time set.

c. ASD Parameters

1. Voltage loop gain.
2. Voltage loop stability.
3. Current loop stability.

d. Controller Adjustments

1. PID control enable/disable.
2. Setpoint select.
3. Proportional band select.
4. Reset time select.
5. Rate time select.
6. Input signal scaling.
7. Input signal select (4-20mA/0-5 Volts).
8. Auto start functions: On/Off, Delay On/off, Level Select On/Off.
9. Speed Profile: Entry, Exit, Point Select.
10. Min., Max. Speed Select.

22. The ASD shall include a comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions. microprocessor systems must be products of the same manufacturer as the ASD.
23. A "FAULT LOG" shall record, store, display and print upon demand, the following for the 10 most recent events:
  - a. ASD mode (Auto/Manual).
  - b. Elapsed time (since previous fault).
  - c. Type of fault.
25. The fault log record shall be accessible via a RS232 serial link as well as line by line on the keypad display.

26. The following factory installed modifications shall be furnished with the controller:
  - a. Input circuit breaker, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power. The circuit breaker shall be rated for 65,000 AIC.
  - b. Door-mounted meters or keypad display shall be provided on all units as follows:
    1. Analog or digital ammeter (0% - 110%).
    2. Analog or digital speed/frequency meter (0 - 110% speed as well as Hz).
    3. Analog or digital voltmeter (0 - 600 VAC).
    4. Analog or digital KW meter(0 - 110%).
    5. 5-digit elapsed time meter.
    6. HAND-OFF-REMOTE Selector Switch.
  - c. The drive is to be provided with isolated 4-20mA DC output signals proportional to speed and current for remote monitoring of the ASD.
  - d. Relay output auxiliary contacts to indicate the position of all selector switches, drive failures and drive status.
  - e. Ethernet/IP Interface.
  - f. Provide 120VAC and logic for motor space heater control.
  - g. Provide control of remote seal water solenoids
  - h. Provide for motor t-stat shut down.

## PART 3 EXECUTION

### 3.01. SYSTEM OPERATION

1. With the ASD H-O-R switch in the "HAND" position and the remote H-O-A in the HAND position, the drive shall be controlled by the manual speed potentiometer or keypad located on the drive door.
2. With the ASD H-O-R switch in the "OFF" position and the remote H-O-A in the OFF position, the drive shall not start under any condition.
3. With the ASD H-O-R switch in the "REMOTE" position and the remote H-O-A in the AUTO position, the drive shall be controlled via the Ethernet/IP interface.

### **3.02 INSTALLATION**

- A. Field wiring shall be per manufacturer's recommendation.
- B. The manufacturer shall include in his bid one (1) normal work day per drive of a qualified service engineer's time. This time will be used to ensure proper connection and functioning of the equipment prior to startup and to train Owner personnel in the use of the equipment.
- C. The manufacturer shall provide one spare for each type of plug-in type PC card. These spares will be color-coded or otherwise keyed to its original counterpart. In addition to the cards, the manufacturer shall provide two spares per drive all expendable items such as fuses, pilot lamps, etc.

### **3.03 INSPECTION AND TESTING**

- A. The drive manufacturer shall test the drive controller with a motor load prior to shipment.
- B. The drive manufacturer shall furnish a certified field test report demonstrating installed compliance for voltage and current distortion at the required point of common coupling under both utility power and generator power. The test shall report shall be sealed by a Florida Registered Professional Electrical Engineer.
- C. A copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Owner.

**END OF SECTION**

SECTION 16402  
UNDERGROUND SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install a complete underground system of ducts, manholes and handholes all as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Excavation and backfilling is included in Division 2.
2. All concrete and reinforcing steel shall be included under Division 3.
3. Conduit for ducts shall be as specified under Section 16110.
4. Ground rods and other grounding materials and methods shall be as specified under other sections of Division 16.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ducts shall be encased in concrete as indicated on the plans.
- B. Cable racks, supports, pulling-in irons, manhole steps, and hardware shall be galvanized steel manufactured by Cope or equal.
- C. Precast manholes and handholes shall be heavy duty type, designed for a Class H20 wheel load. Precast manholes and handholes shall be as manufactured by Brooks Products Co.
- D. Handhole covers and frames shall be as shown on the Drawings.
- E. Fireproofing tape shall be Irvington No. 7700 or be an approved equal product.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Ducts shall be installed to drain away from buildings; ducts between manholes or handholes shall drain toward the manholes or handholes. Duct slopes shall not be less than 3 inches per 100 feet.
- B. Duct banks shall be reinforced as shown on the Drawings.
- C. Duct lines shall be laid in trenches on a clean backfill bedding not less than 6 inches thick and well graded.
- D. Plastic spacers shall be used to hold ducts in place. Spacers shall provide not less than 2-inch clearance between ducts.
- E. The minimum cover for duct lines shall be 24 inches unless otherwise permitted by the Engineer.
- F. Duct entrances to buildings and structures shall be made with steel conduit not less than 10 feet long.
- G. PVC duct termination at manholes shall be with PVC end bells. Steel conduits shall be terminated with insulated, grounding-type bushings.
- H. Where bends in ducts are required, long radius elbows, sweeps and offsets shall be used.
- I. All ducts shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions which may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter 1/2 inch less than the inside diameter of the duct.
- J. Spare ducts shall be plugged and sealed watertight at all manholes, buildings, and structures.
- K. Ducts in use shall be sealed watertight at all manholes, buildings, and structures.
- L. Pulling-in irons shall be installed opposite all duct entrances to manholes, equal to Cope Catalog No. 311-9.
- M. Cable racks shall be similar and equal to Cope Catalog 324-T, cut to length for one, two, three or four vertical tiers of cables. Racks shall be mounted with 1/2-inch by 4-inch expansion bolts on manhole walls. Arms similar and equal to Cope Catalog No. 325-T4, 325-T75 and/or 325-T10 for one, two and/or three cables, respectively, shall be furnished and installed with Catalog No. 326-T22 porcelain insulators for support of cables. Lock clips shall be furnished and installed to secure hooks in position.

- N. Cables shall be trained in manholes and supported on racks and hooks at intervals not greater than 3 feet - 0 inches and supports shall be installed on each side of all splices. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation. Branch circuit conductors shall not be run in manholes.
- O. Fireproofing shall be furnished for all 5-KV cables in manholes. Each individual 5-KV cable shall be wrapped with an arc-proofing tape. The tape shall be applied in accordance with the manufacturer's recommendations. The wrapping shall extend into the end bells.
- P. Aluminum rigid conduit shall be used for risers.
- Q. All risers from underground shall be given a heavy coat of bitumastic paint from a point 1 foot - 0 inches below grade to a point not less than 6 inches above grade or surface of slab.
- R. All joints shall be made so as to prevent the passage of concrete inside the conduit to form obstructions or cause cable abrasions.
- S. Manhole covers in streets shall finish flush with finished paving and in other areas shall finish 3 inches above crown of adjacent roadway. Floor elevations of manholes shall be so set that the center line of the lowest conduit entering will be not less than 1 foot above the floor and center line of the highest conduit entering will be not less than 1 foot below the roof slab.
- T. Concrete monuments shall be provided at each stubbed conduit location. Monuments shall be as shown on the Drawings and shall be installed in the same manner outlined for manhole covers.
- U. A #6 bare copper wire (stranded) shall be installed in each 4-inch PVC conduit.
- V. A 5/8-inch by 10-foot copper clad ground rod shall be driven in the bottom of each manhole. All bond wires and galvanized steel conduits shall be bonded to the ground rod.

END OF SECTION

## SECTION 16450

### GROUNDING SYSTEM

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work

1. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

###### B. Related Work Described Elsewhere

1. Wire: Section 16120.
2. Conduit: Section 16110.

##### 1.02 QUALITY ASSURANCE

###### A. Qualifications:

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

##### 1.03 SUBMITTALS

###### A. Material and Shop Drawings:

1. Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:
  - a. Certified shop drawings with performance data and physical characteristics.
  - b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
  - c. All information required by Section 01340.
  - d. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

##### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver a complete system ready to install as job progress requires.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishings, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.
- B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

### 2.02 MATERIALS AND EQUIPMENT

- A. Ground rods: Ground rods shall be copper clad steel 3/4 inch x 20 foot, minimum depth. Ground rods shall be copperweld or equal.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. The 480 volt switchgear ground bus shall be grounded to a ground loop system. The protecting conduits shall be bonded to the grounding conductor at both ends.
- B. All steel building columns shall be bonded together and connected to the building ground grid.
- C. Motors shall be grounded as hereinafter specified.
- D. Lighting transformer neutrals shall be grounded to the nearest grounding electrode.
- E. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.
- F. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.
- G. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or

equal. All buried connections shall be made by welding process such as Cadweld or equal.

- H. For reasons of mechanical strength, grounding conductors shall be No. 10 AWG minimum copper, minimum size.
- I. All underground conductors shall be laid slack and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.
- J. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

### 3.02 INSPECTION AND TESTING

- A. The Contractor shall obtain the services of an NETA recognized testing firm to measure the ground resistance of the system. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment.

END OF SECTION

SECTION 16460  
GENERAL PURPOSE TRANSFORMERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish and install general purpose transformers and all necessary accessories and appurtenances required as here-in-after specified and shown on the drawings.

B. Related Work Described Elsewhere:

1. Raceways and Fittings Section 16110.

C. General Design:

1. General purpose transformers shall be dry type, two-winding type, self cooled, 600V class transformers.
2. Transformers shall be designed for continuous operation at rated KVA, with normal life expectancy as defined in ANSI C57.96.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electrical Manufacturers (NEMA)
2. American National Standards Institute (ANSI)
3. Underwriters Laboratories, Inc. (UL)

B. Equipment Manufacturer

1. General Electric Co.
2. Cutler-Hammer
3. Square D. Co.
4. Or Equal.

## **1.03 SUBMITTALS**

- A. Materials and Shop Drawings:**
  - 1. Copies of all materials to establish compliance with these specifications shall be submitted in accordance with the provisions of the general conditions. Submittals shall include at least the following:
    - a. Shop drawings with performance data and physical characteristics.
    - b. Complete wiring diagrams and schematics of all power connections.

## **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. General purpose transformers shall be stored indoors and protected against damage at all times.**

## **1.05 WARRANTY AND GUARANTEES:**

- A. The equipment manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of one (1) year from the date of equipment startup and acceptance. In the event that the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the owner**

## **PART 2 - PRODUCTS**

### **2.01 GENERAL:**

- A. Insulation System:**
  - 1. Transformers shall be insulated as follows:
    - a. 150°C insulation with 80°C rise for 2 KVA and below.
    - b. 185°C insulation with 15°C rise for 3 KVA to 30 KVA
    - c. 220°C insulation with 150°C rise for 45 KVA to 112.5 KVA
  - 2. All insulation materials shall be flame retardant and shall not support combustion as defined in ASTM D635.
- B. Coil Assemblies:**
  - 1. Transformer core shall be constructed with high grade, non-aging, grain-oriented silicon steel with high magnetic permeability and low hysteresis and eddy current losses. The core volume shall allow efficient transformer operation at 10% above the highest tap voltage. Coils shall be wound of electrical grade aluminum with continuous wound construction.

2. Non-ventilated unit coil assembly shall be completely encapsulated in a mixture of resin and aggregate.
3. Four full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.

C. ENCLOSURES:

1. The enclosures shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 color weather-resistant enamel.
2. All ventilation openings shall be protected against falling dirt.
3. The maximum temperature of the enclosure shall not exceed 90°C.
4. The core of the transformer shall be visibly grounded to the enclosure.
5. Enclosure for Lime Building transformer shall be non-ventilating.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. All floor mounted transformers shall be installed on 4-inch concrete housekeeping pads.
- B. All conduit entries to the transformer shall utilize sealtight flexible connectors.

3.01 INSPECTION:

- A. The transformer interior shall be cleaned and free of all foreign materials.

END OF SECTION

## SECTION 16500

### LIGHTING SYSTEM

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contractors, clocks and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

###### B. Related Work Described Elsewhere

1. Panelboards: Section 16160.
2. Transformers: Section 16108.
3. Conduit: Section 16110.
4. Wire: Section 16120.

##### 1.02 QUALITY ASSURANCE

###### A. Qualifications:

1. The equipment shall be a product of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.
2. The system shall be furnished by a single manufacturer who shall be responsible for the coordination of the system design and who shall assume complete responsibility for the proper operation of the system including equipment supplied but not of his manufacture.

###### B. Standards:

All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electrical Lighting Fixtures". All lighting fixtures shall be Underwriters Laboratories labeled.

## **1.03 SUBMITTALS**

### **A. Material and Shop Drawings:**

- 1.** Copies of all materials to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions.  
Submittals shall include at least the following:
  - a.** Certified shop drawings with performance data and physical characteristics.
  - b.** Descriptive literature, bulletins, and/or catalogs of each item of equipment.
  - c.** A complete total bill of materials for all equipment.
  - d.** Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.
- 2.** In the event that it is impossible to conform with certain details of the specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A.** The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field-testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.
- B.** The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

### **2.02 MATERIALS AND EQUIPMENT**

#### **A. Lighting Fixtures:**

- 1.** Lighting fixture types shall be as shown on the "Lighting Fixture Schedule" on the Drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable.

B. Lamps:

1. Fluorescent lamps shall be medium bi-pin and recessed double contact, rapid start, standard cool white, all as indicated on the "Fixture Schedule".
2. Fluorescent electronic ballasts shall be Class P, rapid start, high power factor, energy saving, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on 120 volts or as indicated in the "Fixture Schedule".
3. High pressure sodium or metal halide ballast shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as called for in the "Lighting Fixture Schedule" on the Drawings. All ballast shall be as manufactured by Universal Manufacturing Corp., General Electric Company, Advance Transformer Company or equal.
4. Incandescent lamps shall be inside frosted, extended service, 2500 hour life with medium base.
5. All lamps shall be of one manufacturer and shall be as manufactured by Sylvania Electric Products, Inc., General Electric Company, Westinghouse Electric Corporation or equal.

C. Flexible Fixture Hangers:

1. Flexible fixture hangers used in nonhazardous areas shall be Type ARB and flexible fixture supports used in hazardous areas shall be Type ECHF as manufactured by the Crouse-Hinds Company or equal.
2. FRP channel shall be used to span for mounting of fixtures when required by fixture location or as indicated on the Drawings.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Each fixture shall be a complete finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designation location and shall be completely wired ready for connection to the branch circuit wires at the outlet.
- B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.
- C. Flexible fixture hangers shall be used for all pendant mounted fixtures.
- D. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduit shall be supported from the structure.

### **3.02 REPLACEMENT**

- A. Lamps used during the building construction, prior to two weeks from completion of the work, shall be removed and replaced with new lamps.

### **3.03 CLEANING UP**

- A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

**END OF SECTION**

## SECTION 16601

### LIGHTNING PROTECTION SYSTEM

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work:
1. Furnish all labor, materials, equipment, and incidentals required and install a complete lightning protection system for all of the proposed above ground structures. The system shall include grounding of all handrail and platform structures as follows:
    - a. Blending Structures
  2. Material requirements shall be as listed for Class I buildings.
- B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
1. American National Standards Inst., Inc. (ANSI)  
C-135.30 Galvanized Ferrous Ground Rods.
  2. National Fire Protection Association (NFPA)  
70-1987 National Electrical Code (NEC)  
78-1986 Lightning Protection Code
  3. Underwriters Laboratories, Inc. (UL)  
UL-96 Lightning Protection Components  
UL-96A Installation Requirements for Lightning Protection Systems  
UL-467 Grounding and Bonding Equipment

##### 1.02 QUALITY ASSURANCE

- A. Equipment Manufacturer: The material furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems.
- B. Supervision: The system shall be installed under supervision of, or by, a person specifically trained for installation of lightning protection systems.

## 1.03 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be submitted in accordance with Section 01340 and shall consist of a complete list of materials, including manufacturer's descriptive and technical literature; catalog cuts; drawings; and installation instructions. Shop drawings shall contain details to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.
- B. Proof of Compliance: Where materials or equipment are specified to comply with requirements of the UL, proof of such compliance shall be submitted. The label of or listing in the UL Electrical Construction Materials Directory will be acceptable evidence. In lieu of the label or listing, a written certification may be submitted from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters' Laboratories.

## PART 2 - PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A. General Requirements:
  - 1. The system furnished shall be complete with all air terminals, fittings, clamps, supports, roof conductors, down conductors, and horizontal grounds required. The system shall be interconnected with the building ground grid. All conductors, fittings, clamps, and air terminals furnished shall be of the highest quality.
  - 2. System shall be an exposed conductor system. Care shall be taken that the materials used will not discolor roofs or walls. Down conductors shall be protected to 10 feet above grade and shall be located so that visual impact will be minimal.
  - 3. No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or non-magnetic material.
- B. Copper: Copper conductors shall not be less than #6 AWG for main conductor and #8 for secondary conductor. Below grade conductors shall be #4/0 bare copper.

- C. Air Terminals: Air terminals shall be 3/8 inch diameter stainless steel and a minimum 24 inches in length. Air terminals over 24 inches shall be supported.
- D. Ground Rods: Ground rods shall be 3/4 inch by 10 feet copper-clad steel, with the top of the rod, 12 inches below grade minimum and a minimum of 2 feet from building foundation and footings.
- E. Clamp-Type Connectors: Clamp-type connectors shall be of copper, bronze, or stainless steel. Clamps shall be secured with at least two (2) bolts or cap screws.
- F. Metal Bodies: Metal bodies of conductance shall be bonded to the system if not within the zone of protection on an air terminal. Metal bodies of inductance shall be bonded to the system at their closest point to the system if within 6 feet of the system at their closest point to the system if within 6 feet of the system main conductor or other bonded metal body. The main lightning conductor shall be bonded to the main potable service water pipe.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. General Requirements: The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground without passing through any non-conducting parts of the structure. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Exposed down conductors shall not be allowed on the outside face of the High Service Building and Chemical Building. Exposed conductors shall be installed in a PVC-80 conduit on all other structures. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.
- B. Air Terminals: Air terminal design and support shall be in accordance with NFPA 78. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints with of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inches for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 78, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured

against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof. Where nonmetallic spires, steeples, or ventilators are present, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than 10 feet above the building, the conductor between the air terminal and metal roof shall be continued to the nearest down conductor and securely connected thereto.

- C. Roof Conductors: Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 4 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.
- D. Down Conductors: Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two (2) down conductors located as widely separated as practicable, at diagonally opposite corners. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors exceeding 16 feet in length, ending at air terminals. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. All down conductors shall be protected and installed in a raceway, to prevent mechanical injury to the conductor.
- E. Interconnection of Metallic Parts: Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground

connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

- F. **Ground Connections:** Ground connections Comprising continuations of down conductors form the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.
- G. **Grounding Electrodes:** A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 2 feet, nor more than 10 feet, from the structure. The complete installation shall have a total resistance to ground of not more than 10 ohms (if a counterpoise is not used). When two of any three ground rods, driven not less than 10 feet into the perimeter, give a combined value exceeding 50 ohms immediately after driving, a counterpoise shall be used. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 2 feet nor more than 10 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors (or their equivalent in the form of metal strips or wires) are then buried in the trenches.
- H. **Interconnection of Metal Bodies:** Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. All metal bodies of conductance having an area of 400 square inches or greater or a volume of 1000 cubic inches or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inches. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

### 3.02 TESTING

- A. System shall be installed so that tests of the grounds may be performed upon completion of the installation of the system and in the future.
- B. As soon as practicable after award of contract, the Contractor shall submit for approval complete details of the system including a layout drawing so that the system furnished can be coordinated in the refurbishing of the building.

END OF SECTION

## SECTION 16921

### 480-VOLT MOTOR CONTROL CENTERS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish, install, and test the motor control centers as hereinafter specified and as shown on the Drawings.

##### 1.02 QUALITY ASSURANCE

###### A. Standards:

1. The motor control centers shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control centers.
2. All units and sections shall be U.L. labeled when possible. Motor control centers containing service entrance equipment shall be U.L. labeled "Suitable For Use As Service Equipment".
3. Motor control centers shall be built and tested in accordance with:
  - a. National Electrical Manufacturers (NEMA).
  - b. American National Standards Institute (ANSI).
  - c. Underwriters Laboratories, Inc. (U.L.).

###### B. Equipment Manufacturer:

1. The motor control centers shall be Model 6 as manufactured by the Square D. Co., Cutler/Hammer, or General Electric.

##### 1.03 SUBMITTALS

- A. Complete master wiring diagrams and elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the motor control centers and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.

- B. Submittals shall include a bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.
- C. Where it is not explicitly shown and completely obvious from the outline drawings, the following items shall be verified in a written statement accompanying the shop drawings:
  - 1. Type of terminal blocks used and that the removal of plug-in compartments can be performed without disconnecting or removing wires.
  - 2. Tin plating of bus.
  - 3. Insulation and isolation of vertical bus.
  - 4. U.L. approval.

## PART 2 - PRODUCTS

### 2.01 RATING

- A. The motor control centers shall be designed for 480 volt, 3 phase, 3 wire, 60 Hz service and shall have short-circuit rating of not less than 42,000 amperes RMS, symmetrical.

### 2.02 CONSTRUCTION

#### A. Structure:

- 1. The motor control centers shall be a standard metal-enclosed, free-standing, deadfront structure, not more than 90-inches in height, and fabricated from formed sheet steel of not less than No. 14 gauge thickness. The enclosure shall be NEMA 1. The motor control centers shall consist of vertical sections of equal height and 20 inches deep containing individual plug-in compartments. Compartments shall be isolated from each other by separate horizontal steel plates or by steel plates without openings that are a part of the compartment itself.
- 2. Plug-in compartments shall totally isolate enclosed equipment. All unused openings to the adjacent vertical wiring space shall be plugged. All openings used for wiring shall have insulating grommets.
- 3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.
- 4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.

5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door.
6. The motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.
7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.
8. The motor control centers shall provide equipment of type, capacity, trip ratings for the loads shown on the Drawings or otherwise specified.
9. Construction shall be NEMA Class 11, Type B or C. Insofar as possible, all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.
10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light gray enamel over a rust resistant primer.
11. The insulation level of the complete motor control assembly shall be such that it will meet the field tests required under PART 3.

B. Buses:

1. All buses shall be tin-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings, but shall be not less than 600 amperes.
2. Each vertical section shall have a full height vertical bus rated not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.
3. A 1/4 inch x 2 inch ground bus shall be furnished the entire length of the motor control centers.
4. Buses shall be braced for 65,000 amperes RMS, symmetrical, short circuit current.
5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.

C. Wiring

1. All wiring shall be copper.
2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartment to be withdrawn without having to remove wires from fixed terminal blocks.
3. Power wiring shall be black. Control wiring shall be red. Wiring energized from sources other than the starter control power transformer shall be yellow. All wiring shall be identified at each termination.

D. Signage:

1. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE". Letters shall be not less than 1-inch high, 114 inch stroke. Signs shall be laminated plastic, engraved red letters with a white background. Signs shall include voltage (i.e., 480v, 120v, etc.) and be fastened to with stainless steel screws and epoxy cement.
2. All compartments with voltages from sources outside of the compartment, not disconnected by the motor circuit protector, shall have a sign on the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE OF THIS UNIT". Letters shall be black on a high visibility yellow background. Background shall be laminated plastic approximately 3 inches x 5 inches.

## 2.03 COMPONENTS

A. Combination Motor Starters:

1. All motor starters shall be a combination motor circuit protector and contactor, 3-pole, 60 Hz, 600-volt, magnetically operated, of the types shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings, but shall be not less than NEMA Size 1.
2. All motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.
3. All motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.
4. Full voltage, non-reversing starters, NEMA Size 4 and smaller shall be of plug-in type design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed design.
5. Reduced-voltage starters shall be solid state type with isolation contactor and surge protection.

a. Construction

1. The power section shall be three phase, 60 hertz, and rated for the HP, current, and voltage as shown on the drawings. It shall consist of three sets of back-to-back phase controlled power semi-conductors. Maximum current-limit shall be 500% for standard units.
2. Resistor/Capacitor snubber networks shall be used to prevent false firing of SCR's due to dv/dt characteristics of the electrical system.
3. Fan cooled units shall be supplied with thermal sensors on the heat sink to trip the control protective logic for over temperature condition. Thermal sensors shall be rated 90 degree C maximum.

4. The one piece logic board shall be mounted for easy testing, service and replacement.
  5. Three-phase current sensing via current transformers for closed loop control to insure motor stability shall be provided.
  6. A contactor shall be placed on the line side of the starter to automatically isolate the solid state starter from the line when starter is not energized.
- b. The logic circuitry shall include as a minimum:
1. Short circuit electronic trip overcurrent protection. Time not to exceed 1/2 cycle.
  2. Inverse time running overcurrent protection.
  3. Auxiliary trip circuitry.
  4. Gate firing circuit lockout protection on trip.
  5. Fault relay lockout protection.
  6. 250% - 500% current limit adjustment.
  7. Minimum and maximum voltage adjustments.
  8. Voltage stability adjustment.
  9. Adjustable ramp time (0.5 to 30 seconds).
  10. HAND-OFF-REMOTE selector switch.
- c. The logic board shall include, as standard, current and voltage sensing circuitry that continually monitor motor load and regulate motor voltage to minimize motor kWh energy consumption.
- d. External interface circuitry shall include 120 volt relay logic interface capability.
- e. Tripped functions shall be designed to be cleared by removing power from the solid state logic board.
- f. The solid state logic shall provide phase sequence protection.
- g. Two ground lugs shall be furnished, one for incoming and one for outgoing ground connections.
- h. Power terminations shall consist of pressure type terminals for top or bottom entrance.
- i. Testing
1. The manufacturer shall supply certified test results, upon request, to confirm that the controller has been tested to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of the unit and integrated assembly, but also the suitability of the enclosure venting, rigidity and bus bracing. In addition, the unit shall be factory tested in accordance with ANSI standards.

2. Manufacturer shall be prepared to show proper evidence of having tested for noise immunity on both input and output power connections. Noise testing shall be performed in accordance with NEMA ICA 2-230.40.
5. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.
6. Control power transformers shall be sized for additional load where required. Transformer secondary shall be equipped with time-delay fuses.
7. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

B. Circuit Breakers:

1. Circuit breakers shall be thermal-magnetic, molded case, 480-volt, with not less than 65,000 amperes, RMS interrupting capacity. All circuit breakers with 225 amperes frame and larger shall have interchangeable trips. Circuit breakers shall have auxiliary disconnect contacts when used with starters having external control circuits.

C. Control Stations:

1. Control stations shall be standard size, heavy-duty, oiltight.

D. Indicating Lights:

1. Indicating lights shall be standard size, heavy duty, low voltage transformer operated as manufactured by Square-D type SK-Class 9001 or equal.

E. Running Time Meters:

1. Running time meters shall be 3-1/2 inch square case; non-reset, 99,999.9 hour range; Type 236 as manufactured by the General Electric Co., or equal.
2. Voltmeters, amp meters, and watt meters shall be 4-1/4-inch square, 250-degree scale, plus or minus 1-percent accuracy switchboard instruments; General Electric Co.'s Type AB-40, or equal.
3. A four-position selector switch shall be furnished and installed for selection of three phases and off.

E. Instrument Transformers:

1. Instrument transformers shall be indoor, 600-volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards.

F. Surge Protection:

1. Surge protection equipment shall be a three-phase surge capacitor and three-phase lightning arrester. The lightning arrester shall be General Electric Company's M.O.V. type, Catalog No. 9L15ECC001, or equal. Surge capacitor shall be General Electric Company Catalog No. 9L18BBB301, or equal.
2. Control Relays:
3. Control relays shall be heavy-duty, machine tool type with suitable rated convertible contacts. Time delay relays shall be pneumatic, adjustable.
4. Relays shall be CR2810 and CR2920 as manufactured by General Electric Co., or equal.

G. Nameplates:

1. Unit nameplates shall be black and white laminated plastic having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall identify equipment controlled or circuit designation as applicable.

## 2.04 SPARE PARTS

A. The following spare parts shall be furnished:

1. One (1) box of power fuses of each size furnished.
2. One (1) set of starter contacts for each NEMA size installed.
3. One (1) starter coil for each NEMA size installed.
4. One (1) box of pilot lights.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. The motor control center housings shall be bolted to angle iron sills imbedded in the concrete on the two longest sides. The sills shall be the full length of the motor control center housing and shall be installed level in all directions.
- B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit termination are not stressed.
- C. The motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.
- D. The motor control centers shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by motor control centers manufacturer.

### 3.02 TESTS AND CHECKS

- A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.
  1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.
  2. A 1,000 VDC megger shall be used for these tests.
  3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.
  4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.
  5. Test failures will be the Contractors responsibility to correct at no charge to the Owner.
- B. The following shall be done before energizing the motor control centers:
  1. Remove all current transformer shunts after completing the secondary circuit.
  2. Install overload relay heaters based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.
  3. Check all mechanical interlocks for proper operation.
  4. Vacuum clean all interior equipment.

END OF SECTION

# APPENDIX

## FORMS AND OTHER PROJECT DOCUMENTATION

### Table of Contents

VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM .....	1
OWNER DIRECT PURCHASE (ODP) DOCUMENTS.....	2
Owner Direct Purchase (ODP) Instructions .....	2
REQUEST TO REQUISITION FORM.....	3
PROJECT PERMITS .....	4
FDEP Domestic Wastewater Facility Permit Revision.....	4
SWFWMD ERP Minor ModificationGEOTECHNICAL SOIL REPORT .....	4
Driggers Engineering Services, Inc. Report of Geotechnical Investigation, dated March 23, 2017ASBESTOS REPORT.....	5

## VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM

PER FLORIDA STATUTE 448.095, CONTRACTORS AND SUBCONTRACTORS MUST REGISTER WITH AND USE THE E-VERIFY SYSTEM TO VERIFY THE WORK AUTHORIZATION STATUS OF ALL NEWLY HIRED EMPLOYEES.

THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID/PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The Contractor and its Subcontractors are aware of the requirements of Florida Statute 448.095.
2. The Contractor and its Subcontractors are registered with and using the E-Verify system to verify the work authorization status of newly hired employees.
3. The Contractor will not enter into a contract with any Subcontractor unless each party to the contract registers with and uses the E-Verify system.
4. The Subcontractor will provide the Contractor with an affidavit stating that the Subcontractor does not employ, contract with, or subcontract with unauthorized alien.
5. The Contractor must maintain a copy of such affidavit.
6. The City may terminate this Contract on the good faith belief that the Contractor or its Subcontractors knowingly violated Florida Statutes 448.09(1) or 448.095(2)(c).
7. If this Contract is terminated pursuant to Florida Statute 448.095(2)(c), the Contractor may not be awarded a public contract for at least 1 year after the date on which this Contract was terminated.
8. The Contractor is liable for any additional cost incurred by the City as a result of the termination of this Contract.

---

Authorized Signature

---

Printed Name

---

Title

---

Name of Entity/Corporation

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

The foregoing instrument was acknowledged before me by means of  physical presence or  online notarization on, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_ (name of person whose signature is being notarized) as the \_\_\_\_\_ (title) of \_\_\_\_\_ (name of corporation/entity), personally known \_\_\_\_\_, or produced \_\_\_\_\_ (type of identification) as identification, and who did/did not take an oath.

---

Notary Public

---

Printed Name

My Commission Expires: \_\_\_\_\_

NOTARY SEAL ABOVE

# OWNER DIRECT PURCHASE (ODP) DOCUMENTS

## Owner Direct Purchase (ODP) Instructions

1. Upon award and execution, a contract shall be issued to Contractor for the full amount of award.
2. Contractor shall submit a list (ODP Summary) of potential ODP vendors and estimated dollar amounts (minimum of \$10,000) to the City for consideration prior to initial pay application. Certain bid proposals will list pre-determined item(s) for ODP and the accompanying tax savings. The ODP Summary shall list: (a) item cost, (b) corresponding line item number from bid, and (c) sales tax savings associated with the item. Direct purchase shall be considered for single line items that exceed \$10,000 in value and/or items identified in Section V, Bidders Proposal.
3. Contractor shall prepare Request to Requisition forms (see attached) for each vendor to the City for review and approval, in electronic, MS Word format. The City will review, code, and process the requisition form. The City prefers that all Request to Requisitions be included in a single submittal.
4. A Change Order (CO) shall be issued to Contractor reducing their contract by the amount of the ODP purchase(s) and the sales tax savings (per Request to Requisitions). COs will be drafted by the City and will be forwarded to the Contractor for execution. Contractor shall submit two (2) originals, signed, sealed and witnessed, to the City for execution. One fully executed original CO shall be returned to the Contractor.
5. Concurrently, the City Purchasing Department shall issue ODP Purchase Orders (Pos) directly to each vendor (via email), along with an executed Certificate of Entitlement and the City's Certificate of Tax Exemption. The Contractor and City Project Manager will be copied.
6. City's Project Manager shall coordinate delivery with Contractor and Vendor. Material shall be delivered to the project site. Contractor will verify contents and check for defective materials. Vendor to send original invoice to the City as the purchaser and a copy to the Contractor. Invoices shall include the City issued ODP PO number and invoice number.
7. Contractor shall review invoice copy for accuracy and send electronic approval to the City Project Manager within fourteen (14) calendar days after date of receipt of invoice. This electronic approval shall consist of the Contractor's signature, date, and indication of approval on the scanned invoice as well as scanned copies of the delivery documentation or an explanation as to why the invoice should not be paid. These items shall be emailed to the City Project Manager and City Engineering Department's Senior Accountant, copy to Construction Inspector.
8. Contractor shall provide delivery documentation (delivery ticket, packing slips, bill of lading, etc.) in hard copy form to the City Project Manager attached to a copy of the invoice within thirty (30) calendar days after date of receipt of invoice. If these hard copy items are delivered within fourteen (14) calendar days after date of receipt of invoice, then electronic approval as noted in paragraph seven (7) above may be excused.
9. City Project Manager shall have final approval to pay invoices and City Accounting Department shall issue payment to the Vendor for materials or equipment received.
10. ODP POs must be closed out prior to closing out the Contractor contract. If material costs needed for the project exceed the ODP PO amount, the ODP PO will not be increased. Amounts in excess of the ODP PO will be paid for by the Contractor.



## REQUEST TO REQUISITION FORM

For Owner Direct Purchase Materials

City Project Name:	City Contract #:
General Item Description:	
Vendor:	Contact Name:
Street Address:	Phone No:
City/State/Zip:	Email:
Receiving Location (Ship to): <b>(Project Location)</b>	Attention:
Street Address:	Phone No:
City/State/Zip:	Phone No:
General Contractor: <b>(Company Name)</b>	Email:
Contact Name:	Expense Code: <b>(City will complete)</b>
Date Needed by:	

Line #	Quantity	Units (LS, SF, etc.)	Detailed Description (List shipping & handling charges, if applicable)	Price Per Each	Total
<i>(refer to Line Item # and details from Bidder's Proposal, Section V)</i>					
	LS	PO Total			
	LS	Sales Tax Savings to Owner (First \$5,000 x 7.0%, thereafter Sales Tax Rate is 6.0%)			

Equipment shall be in accordance with the applicable technical specifications, and all other applicable provisions (shop drawings, O&Ms, warranties, etc.,) of contract referenced above. Spare parts provided as per specifications; freight included. **Start up services and training are included in the above price, if provided for in bid.**

### Special Delivery Instructions

Send Original Invoices to:	Send Copy of Invoice to:
City of Clearwater Engineering Department Phuong Vo P.O. Box 4748 Clearwater, FL 33758	CONTRACTOR NAME Attention To: _____ Mailing Address Phone Number

### Approving Official (City of Clearwater Representative):

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

*Engineering will provide records retention according to City of Clearwater's Records Management Program and State Retention Schedules.*

## **PROJECT PERMITS**

**FDEP Domestic Wastewater Facility Permit Revision**

**SWFWMD ERP Minor Modification**

## FDEP Domestic Wastewater Facility Permit Revision



# FLORIDA DEPARTMENT OF Environmental Protection

Ron DeSantis  
Governor

Jeanette Nuñez  
Lt. Governor

Noah Valenstein  
Secretary

Southwest District  
13051 North Telecom Parkway  
Temple Terrace, FL 33637-0926

November 19, 2019

In the Matter of an  
Application for Permit by:

City of Clearwater Public Utilities Dept.  
David Porter, P.E., Public Utilities Director  
1650 North Arcturas Ave., Building C  
Clearwater, Florida 33765-1945  
[david.porter@mclearwater.com](mailto:david.porter@mclearwater.com)

File Number FL0128937-016-DW1P/RM  
Pinellas County  
City of Clearwater Northeast WRF

## NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number FL0128937 to operate the City of Clearwater Northeast WRF, issued under Chapter 403, Florida Statutes.

Monitoring requirements under this permit are effective on the first day of the second month following the effective date of the permit. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any.

## NOTICE OF RIGHTS

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the subsequent order may modify or take a different position than this action.

### Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rules 28-106.201 and 28-106.301, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;

- (b) The name, address, any e-mail address, any facsimile number, and telephone number of the petitioner, if the petitioner is not represented by an attorney or a qualified representative; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at [Agency\\_Clerk@dep.state.fl.us](mailto:Agency_Clerk@dep.state.fl.us). Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

**Time Period for Filing a Petition**

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant and persons entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of publication of the notice or within 14 days of receipt of the written notice, whichever occurs first. You cannot justifiably rely on the finality of this decision unless notice of this decision and the right of substantially affected persons to challenge this decision has been duly published or otherwise provided to all persons substantially affected by the decision. While you are not required to publish notice of this action, you may elect to do so pursuant Rule 62-110.106(10)(a), F.A.C.

The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C. If you do not publish notice of this action, this waiver may not apply to persons who have not received a clear point-of-entry.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency\_Clerk@dep.state.fl.us, before the deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Mediation

Mediation is not available in this proceeding.

Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S., by filing a Notice of Appeal pursuant to Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department in the Office of General Counsel (Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000) and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days from the date this action is filed with the Clerk of the Department.

**EXECUTION AND CLERKING**

Executed in Temple Terrace, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



Pamala Vazquez  
Program Administrator  
Permitting & Waste Cleanup Program  
Southwest District

**Attachment(s):**

1. Final Permit No. FL0128937-016-DW1P/RM
2. Final DMRs FL0128937-016-DW1P/RM
3. Final Amended Fact Sheet FL0128937-016-DW1P/RM

**CERTIFICATE OF SERVICE**

The undersigned duly designated deputy clerk hereby certifies that this document and all attachments were sent on the filing date below to the following listed persons:

**FILING AND ACKNOWLEDGMENT**

FILED, on this date, pursuant to Section 120.52, F. S., with the designated Department Clerk, receipt of which is hereby acknowledged.



---

Clerk

November 19, 2019

Date

**Copies to:**

Thomas A. Traina, P.E., Adurra Group, Inc., [ttraina@ardurra.com](mailto:ttraina@ardurra.com)

Jeffrey Elick, Adurra Group, Inc., [Jelick@ardurra.com](mailto:Jelick@ardurra.com)

Randy Barnoski, Chief Operator Clearwater Northeast AWTP, [Randy.Barnoski@MyClearwater.com](mailto:Randy.Barnoski@MyClearwater.com)

Duy Nguyen, City of Clearwater, [Duy.Nguyen@MyClearwater.com](mailto:Duy.Nguyen@MyClearwater.com)

Gerald Loesch, FDEP-SWD, [Gerald.Loesch@floridadep.gov](mailto:Gerald.Loesch@floridadep.gov)

EPA Region IV – Water Management, [r4npdespermits@epa.gov](mailto:r4npdespermits@epa.gov)

Christine Frankford, Pinellas County Dept. of Health, [Christine.Frankford@doh.state.fl.us](mailto:Christine.Frankford@doh.state.fl.us)

Belinda Oliver, FDEP-SWD, [Belinda.Oliver@floridadep.gov](mailto:Belinda.Oliver@floridadep.gov)

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Lance Kautz, FDEP-SWD, [lance.kautz@floridadep.gov](mailto:lance.kautz@floridadep.gov)

Ericka Peck, FDEP-SWD, [Erica.Peck@floridadep.gov](mailto:Erica.Peck@floridadep.gov)



# FLORIDA DEPARTMENT OF Environmental Protection

Southwest District Office  
13051 North Telecom Parkway #101  
Temple Terrace, Florida 33637-0926

Ron DeSantis  
Governor

Jeanette Nuñez  
Lt. Governor

Noah Valenstein  
Secretary

## STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

**PERMITTEE:**

City of Clearwater Public Utilities Department

**RESPONSIBLE OFFICIAL:**

David Porter, P.E., Public Utilities Director  
1650 North Arcturas Avenue, Building C

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**PERMIT NUMBER:** FL0128937 (Major)

**FILE NUMBER:** FL0128937-014-DW1P/NR

**REVISION NUMBER:** FL0128937-016-DW1P/RM

**EFFECTIVE DATE:** July 2, 2017

**REVISON DATE:** November 19, 2019

**EXPIRATION DATE:** July 1, 2022

**FACILITY:**

City of Clearwater Northeast Water Reclamation Facility (WRF)

3290 S.R. 580

Safety Harbor, FL 34695

Pinellas County

Latitude: 28°1' 41.09" N Longitude: 82°42' 17.72" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.) and constitutes authorization to discharge to waters of the state under the National Pollutant Discharge Elimination System. This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above-named permittee is hereby authorized to operate the facilities in accordance with the documents attached hereto and specifically described as follows:

**WASTEWATER TREATMENT:**

An existing 13.5 Million Gallons Per Day (MGD) Annual Average Daily Flow (AADF) Type I domestic advanced wastewater treatment facility, using the Bardenpho BNR process, consisting of the following components: preliminary treatment consisting of two mechanically cleaned fine bar screens and one fixed screen; influent flow measurement via a 48-inch Parshall flume with an ultrasonic flow meter; primary treatment consisting of sedimentation in two 75-foot diameter primary clarifiers (total surface area of 8,835 square feet); a two-unit hydrodynamic vortex grit removal system with associated grit classifier; four 18-foot diameter primary sludge gravity thickeners; a biological treatment process consisting of a convertible four (current operation) or five-stage Bardenpho BNR process that includes two 550,000 gallon fermentation basins, two 880,000 gallon first-stage anoxic reactors, a five unit Archimedes Screw pump station and a three submersible pump station, , two 1,700,000-gallon Carrousel oxidation ditch aeration basins, ten 190,740-gallon second anoxic basins, and ten 30,800-gallon reaeration basins; eight 75-foot diameter secondary clarifiers (total surface area of 35,325 square feet); polishing filtration consisting of 12 rapid sand, pulsed filtration gravity-type, automatic backwash filters with a total surface area of 4,320 square feet; an effluent disinfection system using liquid sodium hypochlorite and a 402,000-gallon, dual channel chlorine contact basin. Also on-site are a 5-million gallon (MG) reclaimed water storage tank and a 3.5 MG reject water storage tank.

Chlorinated effluent from the chlorine contact basin is directed to the on-site 5 MG reclaimed water storage tank, the Master Reuse System (R-001) or piped to Clearwater's East WRF and directed to a mixing basin and combined with chlorinated effluent from the East WRF. The combined chlorinated effluent streams then flow through a 113,616-gallon

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

blending/dechlorination basins that uses flow-paced sodium bisulfite to eliminate the remaining chlorine residual, then through a 137,840-gallon dissolved oxygen boost re-aeration basin, to an outfall junction/sampling box and finally through a 1,400-foot long, 48-inch diameter outfall pipe that discharges to Old Tampa Bay (D-001).

Waste sludge from the primary clarifiers is pumped to four 18-foot diameter gravity thickeners. The thickened primary sludge is then transferred to two anaerobic digesters with a combined capacity of 1,944,800 gallons. Waste sludge from the secondary clarifiers is pumped to two rotary drum thickeners equipped with polymer injection, then to the anaerobic digesters. Thickened sludge from the East WRF is also fed to the anaerobic digesters. Additional sludge treatment capacity is available with four 206,869-gallon aerobic digesters. Sludge from the digesters is sent to two 160,000-gallon sludge blend tanks. The blended sludge is then dewatered using a centrifuge with two belt filter presses available as backup.

#### **FIRST MODIFICATIONS:**

Construction of a new intermediate effluent channel from the chlorine contact basin to a new ultrafiltration pretreatment basin for the new City of Clearwater Advanced Water Purification Plant. The intermediate channel will decrease the current interior length of the chlorine contact basin (140 feet) by seven feet, decreasing the capacity to 383,933 gallons.

#### **AFTER FIRST MODIFICATIONS:**

An existing 13.5 Million Gallons Per Day (MGD) Annual Average Daily Flow (AADF) Type I domestic advanced wastewater treatment facility, using the Bardenpho BNR process, consisting of the following components: preliminary treatment consisting of two mechanically cleaned fine bar screens and one fixed screen; influent flow measurement via a 48-inch Parshall flume with an ultrasonic flow meter; primary treatment consisting of sedimentation in two 75-foot diameter primary clarifiers (total surface area of 8,835 square feet); a two-unit hydrodynamic vortex grit removal system with associated grit classifier; four 18-foot diameter primary sludge gravity thickeners; a biological treatment process consisting of a convertible four (current operation) or five-stage Bardenpho BNR process that includes two 550,000 gallon fermentation basins, two 880,000 gallon first-stage anoxic reactors, a five unit Archimedes Screw pump station and a three submersible pump station, , two 1,700,000-gallon Carrousel oxidation ditch aeration basins, ten 190,740-gallon second anoxic basins, and ten 30,800-gallon reaeration basins; eight 75-foot diameter secondary clarifiers (total surface area of 35,325 square feet); polishing filtration consisting of 12 rapid sand, pulsed filtration gravity-type, automatic backwash filters with a total surface area of 4,320 square feet; an effluent disinfection system using liquid sodium hypochlorite and a 383,933-gallon, dual channel chlorine contact basin. Also on-site are a 5 MG reclaimed water storage tank and a 3.5 MG reject water storage tank.

Chlorinated effluent from the chlorine contact basin is directed to the on-site 5 MG reclaimed water storage tank, the Master Reuse System (R-001), the City of Clearwater Advanced Water Purification Plant (R-002) or piped to Clearwater's East WRF and directed to a mixing basin and combined with chlorinated effluent from the East WRF. The combined chlorinated effluent streams then flow through a 113,616-gallon blending/dechlorination basins that uses flow-paced sodium bisulfite to eliminate the remaining chlorine residual, then through a 137,840-gallon dissolved oxygen boost re-aeration basin, to an outfall junction/sampling box and finally through a 1,400-foot long, 48-inch diameter outfall pipe that discharges to Old Tampa Bay (D-001).

Waste sludge from the primary clarifiers is pumped to four 18-foot diameter gravity thickeners. The thickened primary sludge is then transferred to two anaerobic digesters with a combined capacity of 1,944,800 gallons. Waste sludge from the secondary clarifiers is pumped to two rotary drum thickeners equipped with polymer injection, then to the anaerobic digesters. Thickened sludge from the East WRF is also fed to the anaerobic digesters. Additional sludge treatment capacity is available with four 206,869-gallon aerobic digesters. Sludge from the digesters is sent to two 160,000-gallon sludge blend tanks. The blended sludge is then dewatered using a centrifuge with two belt filter presses available as backup.

#### **SECOND MODIFICATIONS:**

The permittee has proposed to rehabilitate, update, construct, add to, and modify the following primary components: Temporarily bypassing the pumping and grit removal during construction; demolishing the existing one MGD Plant/irrigation tank; converting the four Pickett thickeners back to grit removal using stacked tray head cell technology and re-locating the grit removal unit process to its original configuration immediately following the screening process; rehabilitate two existing hydro-cyclones and one existing grit classifier; installing one new hydro-cyclone and one new grit classifier; installing four new grit pumps, and construction and installation of a new two million gallon equalization basin.

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

There will also be upgrades to the existing North and South sludge and blend tanks with new tank covers and mixers; installation of two new pump station and canopies (Truck Off-Loading pump station and anaerobic digester feed pump station); replacement of the dewatering feed pump station and canopies, rehabilitation of the existing truck off-loading pump stations and the replacement of the aging yard piping.

#### AFTER SECOND MODIFICATIONS:

An existing 13.5 Million Gallons Per Day (MGD) Annual Average Daily Flow (AADF) Type I domestic advanced wastewater treatment facility, using the Bardenpho BNR process, consisting of the following components: preliminary treatment consisting of two mechanically cleaned fine bar screens and one fixed screen; four cells of stacked tray grit removal equipment with four 12-foot diameter trays in each cell, three hydrocyclones, two classifier grit removal units, influent flow measurement via a 48-inch Parshall flume with an ultrasonic flow meter; primary treatment consisting of three moving belt filters (total throughput capacity 5,100 gpm); a 2.0 MG flow equalization basin with pulsed air mixing that can be taken off line; a biological treatment process consisting of a convertible four (current operation) or five-stage Bardenpho BNR process that includes two 550,000 gallon fermentation basins, two 880,000 gallon first-stage anoxic reactors, a five unit Archimedes Screw pump station and a three submersible pump station, , two 1,700,000-gallon Carrousel oxidation ditch aeration basins, ten 190,740-gallon second anoxic basins, and ten 30,800-gallon reaeration basins; eight 75-foot diameter secondary clarifiers (total surface area of 35,325 square feet); polishing filtration consisting of 12 rapid sand, pulsed filtration gravity-type, automatic backwash filters with a total surface area of 4,320 square feet; an effluent disinfection system using liquid sodium hypochlorite and a 383,933-gallon, dual channel chlorine contact basin. Also on-site are a 5 MG reclaimed water storage tank and a 3.5 MG reject water storage tank.

Chlorinated effluent from the chlorine contact basin is directed to the on-site 5 MG reclaimed water storage tank, the Master Reuse System (R-001) or piped to Clearwater's East WRF and directed to a mixing basin and combined with chlorinated effluent from the East WRF. The combined chlorinated effluent streams then flow through a 113,616-gallon blending/dechlorination basins that uses flow-paced sodium bisulfite to eliminate the remaining chlorine residual, then through a 137,840-gallon dissolved oxygen boost re-aeration basin, to an outfall junction/sampling box and finally through a 1,400-foot long, 48-inch diameter outfall pipe that discharges to Old Tampa Bay (D-001).

The thickened primary sludge will be transferred to the North 160,000-gallon Sludge Blend Tank along with thickened waste sludge from the secondary clarifiers, thickened with two rotary drum thickeners equipped with polymer injection, and combined with Thickened Waste Sludge from the East WRF that is truck hauled to the Northeast (NE) WRF for treatment and dewatering. The three thickened sludges (NE WRF Primary, NE WRF WAS and East WRF WAS) will be blended in the north tank and transferred over a 24-hour period to two anaerobic digesters with a combined capacity of 1,944,800 gallons. . Following anaerobic digestion of the blended sludge to achieve EPA Part 503 Class B Biosolids stabilization, the anaerobically digested biosolids are transferred to the South 160,000-gallon sludge blend tank, mixed for equalization and temporary storage and then dewatered using a combination of centrifuge and belt filter presses (backup) prior to reuse by land application or landfill disposal.

#### DISPOSAL:

**Surface Water Discharge D-001:** An existing 13.5 MGD AADF permitted discharge to Old Tampa Bay (Class II marine waters and Outstanding Florida Water, WBID# 1558H) at discharge location D-001, which is approximately 1400 feet in length and discharges at a depth of approximately 10 feet. The point of discharge is located approximately at latitude 27°57' 19" N, longitude 82°42' 24" W.

Outfall D-001 is shared with the Clearwater East WRF, which contributes up to 5.0 MGD and the Northeast facility contributes up to 13.5 MGD for a total permitted discharge capacity of 18.5 MGD.

**Mixing Zone:** The permittee is granted a mixing zone for Dichlorobromomethane consisting of a distance of two meters in radius from the centerline of the outfall.

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

**REUSE:**

**Land Application R-001:** An existing 12 Million Gallons Per Day (MGD) Annual Average Daily Flow (AADF) permitted capacity slow-rate public access system. The City of Clearwater Northeast WRF serves as a source plant for the City of Clearwater Master Reuse System, FL0186261.

**Reuse System R-002:** A new 4.0 MGD daily maximum flow permitted capacity reuse system, which consists of discharge of reclaimed water for additional treatment at the City of Clearwater Groundwater Replenishment Advanced Water Purification Plant, FLA009486.

**IN ACCORDANCE WITH:** The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 5 through 30 of this permit.

PERMITTEE: City of Clearwater  
 FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

## I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

### A. Surface Water Discharges

- During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to discharge effluent from Outfall D-001 to Old Tampa Bay. Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8:

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements			Notes
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	
Flow (D-001)	MGD	Max Max	13.5 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-02	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	5.0 6.25 7.5 10.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max Max Max Max	5.0 6.25 7.5 10.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFA-01	
Nitrogen, Total (as N)	mg/L	Max Max Max Max	3.0 3.75 4.5 6.0	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFA-01	
Phosphorus, Total (as P)	mg/L	Max Max Max Max	Report Report Report Report	Annual Average Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	5 Days/Week	Grab	EFB-01	See I.A.5
pH	s.u.	Min Max	6.5 8.5	Single Sample Single Sample	Continuous	Meter	EFA-01	See I.A.3
Coliform, Fecal	percent	Min	75	Monthly Minimum	Monthly	Calculated	EFA-01	See I.A.5
Coliform, Fecal	#/100mL	Max	25	Single Sample	5 Days/Week	Grab	EFA-01	See I.A.5
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter	EFA-01	See I.A.3 and I.A.6
Chlorine, Total Residual (For Dechlorination)	mg/L	Max	0.01	Single Sample	Daily; 24 hours	Grab	EFD-01	
Enterococci	#/100 mL	Max	35	Monthly Geometric Mean	Monthly	Calculated	EFA-01	See I.A.7
Enterococci	#/100 mL	Max	276	Single Sample	5/month	Grab	EFA-01	See I.A.7

PERMITTEE: City of Clearwater  
 FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

Parameter	Units	Max/Min	Effluent Limitations		Monitoring Requirements			Notes
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	
Copper, Total Recoverable	mg/L	Max	3.7	Single Sample	Monthly	Grab	EFD-01	
Dichlorobromomethane	ug/L	Max	43.0	Annual Average	Monthly	Calculated	EFD-01	See I.A.8
Dichlorobromomethane	ug/L	Max	Report	Single Sample	Monthly	Grab	EFD-01	See I.A.8
Oxygen, Dissolved (DO)	mg/L	Min	5.0	Single Sample	Daily; 24 hours	Grab	EFD-01	
Nitrogen, Total (as N)	Tons/month	Max	Report	Monthly Total	Monthly	Calculated	EFA-01	See I.A.9
Nitrogen, Total (as N)	Tons/year	Max	Report	Annual Total	Monthly	Calculated	EFA-01	See I.A.9
Nitrogen, Total (as N)	Tons/year	Max	Report	5-Year Average	Monthly	Calculated	EFA-01	See I.A.9
Chronic Whole Effluent Toxicity, 7-Day IC25 (Ceriodaphnia dubia)	percent	Min	100	Single Sample	Quarterly	24-hr FPC	EFD-01	See I.A.10
Chronic Whole Effluent Toxicity, 7-Day IC25 (Pimephales promelas)	Percent	Min	100	Single Sample	Quarterly	24-hr FPC	EFD-01	See I.A.10

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
EFA-01	After disinfection
EFB-01	After filtration and prior to disinfection
EFD-01	After dechlorination and prior to final discharge
FLW-02	Sum of three 12-inch magnetic meters

3. Hourly measurement of pH and total residual chlorine for disinfection during the period of required operator attendance may be substituted for continuous measurement. [62-600.660(1)]
4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. [62-600.200(25)]
5. Over a 30-day period, at least 75 percent of the fecal coliform values shall be below the detection limits. No sample shall exceed 25 fecal coliforms per 100 mL. No sample shall exceed 5.0 mg/L of total suspended solids (TSS) at a point before the application of the disinfectant. Note: To report the "% less than detection," count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer). [62-600.440(6)(a)]
6. A minimum of 1.0 mg/L total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. [62-600.440(5)(c), (6)(b), and (7)(c)]
7. The enterococci monthly geometric mean value shall be based on all samples of effluent collected during a period of 30 consecutive days (monthly); a minimum of 5 samples of effluent, each collected on nonconsecutive days, is required. [62-600.520(5)]
8. The permittee is granted a mixing zone for dichlorobromomethane consisting of a distance of two meters in radius from the centerline of Outfall D-001.
9. In accordance with the load allocations from the Final 2009 Reasonable Assurance Addendum: Allocation & Assessment Report, January 22, 2010, the Total Maximum Daily Load for Total Nitrogen shall be calculated from the monthly average Total Nitrogen concentrations. The Total Nitrogen loading shall be calculated as a 12-month rolling total and shall not exceed 40.65 tons/year and the five-year average of the yearly totals shall not exceed 27.1 tons/year for the combined total load from the City of Clearwater East WRF (FL0021865), and the City of Clearwater Northeast WRF (FL0128937). The City of Clearwater Northeast WRF shall report the calculated loading to Outfall D-001 from the Northeast WRF only. The total combined load from the City of Clearwater Northeast WRF and the City of Clearwater East WRF shall be reported under the City of Clearwater East WRF permit.

<b>Monthly Total (Mt)</b>
Mt = <u>(Monthly Average Total Nitrogen Concentration, mg/l)(Total Monthly Flow, MG)(8.3454)</u> 2000 lbs
Mt = Tons/Month

Mt <sub>1</sub> = Monthly Total for the 1 <sup>st</sup> Month
Mt <sub>n</sub> = Monthly Total for the n <sup>th</sup> Month

**Annual Rolling Total (At)**

Annual Total at the end of the n<sup>th</sup> Month: At = Mt<sub>n-11</sub> + Mt<sub>n-10</sub> ... Mt<sub>n</sub>

**5 Year Rolling Average (5yr)**

5yr<sub>n</sub> = (Mt<sub>n-59</sub> + Mt<sub>n-58</sub> ... Mt<sub>n</sub>) / 5

**10. Chronic Whole Effluent Toxicity Testing**

The permittee shall comply with the following requirements to evaluate chronic whole effluent toxicity of the discharge from outfall D-001.

a. **Effluent Limitation**

- (1) In any routine or additional follow-up test for chronic whole effluent toxicity, the 25 percent inhibition concentration (IC25) for reproduction or growth shall not be less than 100% effluent. [Rules 62-302.530(61) and 62-4.241(1)(b), F.A.C.]
- (2) For acute whole effluent toxicity, the 96-hour LC50 shall not be less than 100% effluent in any test. [Rule 62-302.500(1)(a)4. and 62-4.241(1)(a), F.A.C.]

b. **Monitoring Frequency**

- (1) Routine toxicity tests shall be conducted once every three months, the first starting within 60 days of the effective date of this permit and lasting for the duration of this permit.
- (2) Upon completion of four consecutive valid routine tests that demonstrate compliance with the effluent limitation in I.A.10.a.(1) above, the permittee may submit a written request to the Department for a reduction in monitoring frequency to once every six months. The request shall include a summary of the data and the complete bioassay laboratory reports for each test used to demonstrate compliance. The Department shall act on the request within 45 days of receipt. Reductions in monitoring shall only become effective upon the Department's written confirmation that the facility has completed four consecutive valid routine tests that demonstrate compliance with the effluent limitation in I.A.10.a.(1) above.
- (3) If a test within the sequence of the four is deemed invalid based on the acceptance criteria in EPA-821-R-02-013, but is replaced by a repeat valid test initiated within 21 days after the last day of the invalid test, the invalid test will not be counted against the requirement for four consecutive valid tests for the purpose of evaluating the reduction of monitoring frequency.

c. **Sampling Requirements**

- (1) For each routine test or additional follow-up test conducted, a total of three flow proportional 24-hr composite samples of final effluent shall be collected and used in accordance with the sampling protocol discussed in EPA-821-R-02-013, Section 8.
- (2) The first sample shall be used to initiate the test. The remaining two samples shall be collected according to the protocol and used as renewal solutions on Day 3 (48 hours) and Day 5 (96 hours) of the test.
- (3) Samples for routine and additional follow-up tests shall not be collected on the same day.

d. **Test Requirements**

- (1) Routine Tests: All routine tests shall be conducted using a control (0% effluent) and a minimum of five test dilutions: **100%, 50%, 25%, 12.5%, and 6.25%** final effluent.
- (2) The permittee shall conduct a daphnid, **Ceriodaphnia dubia**, Survival and Reproduction Test and a fathead minnow, **Pimephales promelas**, Larval Survival and Growth Test, concurrently.
- (3) All test species, procedures and quality assurance criteria used shall be in accordance with **Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, 4th Edition, EPA-821-R-02-013. Any deviation of the bioassay procedures outlined herein shall be submitted in writing to the Department for review and approval prior to use. In the event the above method is revised, the permittee shall conduct chronic toxicity testing in accordance with the revised method.

- (4) The control water and dilution water shall be moderately hard water as described in EPA-821-R-02-013, Section 7.2.3.

e. Quality Assurance Requirements

- (1) A standard reference toxicant (SRT) quality assurance (QA) chronic toxicity test shall be conducted with each species used in the required toxicity tests either concurrently or initiated no more than 30 days before the date of each routine or additional follow-up test conducted. Additionally, the SRT test must be conducted concurrently if the test organisms are obtained from outside the test laboratory unless the test organism supplier provides control chart data from at least the last five monthly chronic toxicity tests using the same reference toxicant and test conditions. If the organism supplier provides the required SRT data, the organism supplier's SRT data and the test laboratory's monthly SRT-QA data shall be included in the reports for each companion routine or additional follow-up test required.
- (2) If the mortality in the control (0% effluent) exceeds 20% for either species in any test or the "test acceptability criteria" are not met, the test for that species (including the control) shall be invalidated and the test repeated. Test acceptability criteria for each species are defined in EPA-821-R-02-013, Section 13.12 (*Ceriodaphnia dubia*) and Section 11.11 (*Pimephales promelas*). The repeat test shall begin within 21 days after the last day of the invalid test.
- (3) If 100% mortality occurs in all effluent concentrations for either test species prior to the end of any test and the control mortality is less than 20% at that time, the test (including the control) for that species shall be terminated with the conclusion that the test fails and constitutes non-compliance.
- (4) Routine and additional follow-up tests shall be evaluated for acceptability based on the observed dose-response relationship as required by EPA-821-R-02-013, Section 10.2.6., and the evaluation shall be included with the bioassay laboratory reports.

f. Reporting Requirements

- (1) Results from all required tests shall be reported on the Discharge Monitoring Report (DMR) as follows:
  - (a) Routine and Additional Follow-up Test Results: The calculated IC25 for reproduction or growth for each test species shall be entered on the DMR.
- (2) A bioassay laboratory report for each routine test shall be prepared according to EPA-821-R-02-013, Section 10, Report Preparation and Test Review, and mailed to the Department at the address below within 30 days after the last day of the test.
- (3) For additional follow-up tests, a single bioassay laboratory report shall be prepared according to EPA-821-R-02-013, Section 10, and mailed within 30 days after the last day of the second valid additional follow-up test.
- (4) Data for invalid tests shall be included in the bioassay laboratory report for the repeat test.
- (5) The same bioassay data shall not be reported as the results of more than one test.
- (6) All bioassay laboratory reports shall be sent to:

Florida Department of Environmental Protection  
Compliance Assurance Program  
Southwest District Office  
13051 N Telecom Parkway  
Temple Terrace, Florida 33637-0926  
[SWD\\_DW@dep.state.fl.us](mailto:SWD_DW@dep.state.fl.us)

g. Test Failures

- (1) A test fails when the test results do not meet the limits in I.A.10.a.(1).
- (2) Additional Follow-up Tests:
  - (a) If a routine test does not meet the chronic toxicity limitation in I.A.10.a.(1) above, the permittee shall notify the Department at the address above within 21 days after the last day of the failed routine test and conduct two additional follow-up tests on each species that failed the test in accordance with I.A.10.d.

- (b) The first test shall be initiated within 28 days after the last day of the failed routine test. The remaining additional follow-up tests shall be conducted weekly thereafter until a total of two valid additional follow-up tests are completed.
- (c) The first additional follow-up test shall be conducted using a control (0% effluent) and a minimum of five dilutions: 100%, 50%, 25%, 12.5%, and 6.25% effluent. The permittee may modify the dilution series in the second additional follow-up test to more accurately bracket the toxicity such that at least two dilutions above and two dilutions below the target concentration and a control (0% effluent) are run. All test results shall be analyzed according to the procedures in EPA-821-R-02-013.
- (3) In the event of three valid test failures (whether routine or additional follow-up tests) within a 12-month period, the permittee shall notify the Department within 21 days after the last day of the third test failure.
  - (a) The permittee shall submit a plan for correction of the effluent toxicity within 60 days after the last day of the third test failure.
  - (b) The Department shall review and approve the plan before initiation.
  - (c) The plan shall be initiated within 30 days following the Department's written approval of the plan.
  - (d) Progress reports shall be submitted quarterly to the Department at the address above.
  - (e) During the implementation of the plan, the permittee shall conduct quarterly routine whole effluent toxicity tests in accordance with I.A.10.d. Additional follow-up tests are not required while the plan is in progress. Following completion or termination of the plan, the frequency of monitoring for routine and additional follow-up tests shall return to the schedule established in I.A.10.b.(1). If a routine test is invalid according to the acceptance criteria in EPA-821-R-02-013, a repeat test shall be initiated within 21 days after the last day of the invalid routine test.
  - (f) Upon completion of four consecutive quarterly valid routine tests that demonstrate compliance with the effluent limitation in I.A.10.a.(1) above, the permittee may submit a written request to the Department to terminate the plan. The plan shall be terminated upon written verification by the Department that the facility has passed at least four consecutive quarterly valid routine whole effluent toxicity tests. If a test within the sequence of the four is deemed invalid, but is replaced by a repeat valid test initiated within 21 days after the last day of the invalid test, the invalid test will not be counted against the requirement for four consecutive quarterly valid routine tests for the purpose of terminating the plan.
- (4) If chronic toxicity test results indicate greater than 50% mortality within 96 hours in an effluent concentration equal to or less than the effluent concentration specified as the acute toxicity limit in I.A.10.a.(2), the Department may revise this permit to require acute definitive whole effluent toxicity testing.
- (5) The additional follow-up testing and the plan do not preclude the Department taking enforcement action for acute or chronic whole effluent toxicity failures.

[62-4.241, 62-620.620(3)]

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

## B. Reuse and Land Application Systems

- During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse Systems R-001 and R-002. Such reclaimed water shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8:

			Reclaimed Water Limitations		Monitoring Requirements			Notes
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	
Flow, to R-001	MGD	Max	12.0	Annual Average	Monthly	Calculated	FLW-05	See I.B.4
Flow, to R-001	MGD	Max	Report	Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-05	
Flow, to R-002	MGD	Max	4.0	Daily Maximum	Monthly	Calculated	FLW-06	
Flow, to R-002	MGD	Max	Report	Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-06	
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	Monthly	Calculated		
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max	30.0 45.0 60.0	Monthly Average Weekly Average Single Sample	5 Days/Week	24-hr FPC	EFA-01	
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	5 Days/Week	Grab	EFB-01	See I.B.5
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFA-01	See I.B.3
Coliform, Fecal	percent	Min	75	Monthly Minimum	Monthly	Calculated	EFA-01	See I.B.5
Coliform, Fecal	#/100mL	Max	25	Single Sample	5 Days/Week	Grab	EFA-01	See I.B.5
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter	EFA-01	See I.B.6
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter	EFB-01	See I.B.7
Giardia	cysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Filtered	EFA-01	See I.B.10
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Filtered	EFA-01	See I.B.10

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
EFA-01	After disinfection
EFB-01	After filtration and prior to disinfection
FLW-02	Sum of three 12-inch magnetic meters
FLW-03	Flow meter at East Plant prior to discharge to the MRS
FLW-04	Total Plant flow at 24-inch magnetic meter
FLW-05	Flow to R-001 = (FLW-04 – FLW-02 – FLW-06)
FLW-06	Flow to R-002-City of Clearwater Groundwater Replenishment Advanced Water Purification Plant-Magnetic flow meter in pipeline to the ultrafiltration pre-treatment basin

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. [62-600.660(1)]
4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. [62-600.200(25)]
5. Over a 30-day period, at least 75 percent of the fecal coliform values shall be below the detection limits. No sample shall exceed 25 fecal coliforms per 100 mL. No sample shall exceed 5.0 mg/L of total suspended solids (TSS) at a point before the application of the disinfectant. Note: To report the "% less than detection," count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer). [62-600.440(6)(a)]
6. The minimum total chlorine residual shall be limited as described in the approved operating protocol, such that the permit limitation for fecal coliform bacteria will be achieved. In no case shall the total chlorine residual be less than 1.0 mg/L. [62-600.440(6)(b)][62-610.460(2)][62-610.463(2)]
7. The maximum turbidity shall be limited as described in the approved operating protocol, such that the permit limitations for total suspended solids and fecal coliforms will be achieved. [62-610.463(2)]
8. The treatment facilities shall be operated in accordance with all approved operating protocols. Only reclaimed water that meets the criteria established in the approved operating protocol(s) may be released to system storage or to the reuse system. Reclaimed water that fails to meet the criteria in the approved operating protocol(s) shall be directed to the following permitted alternate discharge system: D-001 to Old Tampa Bay. [62-610.320(6) and 62-610.463(2)]
9. Instruments for continuous on-line monitoring of total residual chlorine and turbidity shall be equipped with an automated data logging or recording device. [62-610.463(2)]
10. Intervals between sampling for Giardia and Cryptosporidium shall not exceed two years. [62-610.463(4)]

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

### C. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C.8.:

Parameter	Units	Max/Min	Limitations		Monitoring Requirements			Notes
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	
Flow, Total Plant	MGD	Max Max	13.5 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-1	See I.C.4
Percent Capacity, (TMADF/Permitted Capacity) x 100	Percent	Max	Report	Monthly Maximum	Monthly	Calculation	FLW-1	
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Monthly Average	Weekly	24-hr FPC	INF-01	See I.C.3
Solids, Total Suspended (Influent)	mg/L	Max	Report	Monthly Average	Weekly	24-hr FPC	INF-01	See I.C.3

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.C.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-01	Flow measured at the Parshall Flume
INF-01	At influent pumping station wet well, before treatment and ahead of any return flows

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. [62-600.660(4)(a)]
4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. [62-600.200(25)]
5. Sampling results for giardia and cryptosporidium shall be reported on DEP Form 62-610.300(4)(a)4, Pathogen Monitoring, which is attached to this permit. This form shall be submitted to the Department's Southwest District Office and to DEP's Reuse Coordinator in Tallahassee. [62-610.300(4)(a)]
6. The sample collection, analytical test methods, and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-600, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "FAC 62-4 MDL/PQL Table (April 26, 2006)" is available at <http://www.dep.state.fl.us/labs/library/index.htm>. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:
  - a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;
  - b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and
  - c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

When the analytical results are below method detection or practical quantitation limits, the permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

Where necessary, the permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. [62-4.246, 62-160]

7. The permittee shall provide safe access points for obtaining representative samples which are required by this permit. [62-600.650(2)]
8. Monitoring requirements under this permit are effective on the first day of the second month following the effective date of the permit. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit,

the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Unless specified otherwise in this permit, monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below. DMRs shall be submitted for each required monitoring period including periods of no discharge.

REPORT Type on DMR	Monitoring Period	Mail or Electronically Submit by
Monthly	first day of month - last day of month	28 <sup>th</sup> day of following month
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 31	July 28 January 28
Annual	January 1 - December 31	January 28

The permittee shall use the electronic DMR system approved by the Department (EzDMR) and shall electronically submit the completed DMR forms using the DEP Business Portal at <http://www.fldepportal.com/go/>, unless the permittee has a waiver from the Department in accordance with 40 CFR 127.15. Reports shall be submitted to the Department by the twenty-eighth (28th) of the month following the month of operation.

[62-620.610(18)][62-600.680(1)]

9. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, total coliform, color, odor, and residual disinfectants). These monitoring results shall be reported to the Department annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted with the signed DMR in lieu of performing the analysis. When such a certification is submitted with the DMR, monitoring not required this period should be noted on the DMR. The annual reclaimed water or effluent analysis report, and certification if applicable, shall be completed and submitted in a timely manner so as to be received by the Department at the address identified on the DMR by January 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. [62-600.660(2) and (3)(d)][62-600.680(2)][62-610.300(4)]
10. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. [62-610.870(3)]
11. Operating protocol(s) shall be reviewed and updated periodically to ensure continuous compliance with the minimum treatment and disinfection requirements. Updated operating protocols shall be submitted to the Department's Southwest District Office for review and approval upon revision of the operating protocol(s) and with each permit application. [62-610.320(6)][62-610.463(2)]
12. The permittee shall maintain an inventory of storage systems. The inventory shall be submitted to the Department's Southwest District Office at least 30 days before reclaimed water will be introduced into any new storage system. The inventory of storage systems shall be attached to the annual submittal of the Annual Reuse Report. [62-610.464(5)]
13. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted to or reported to, as appropriate, the Department's Southwest District Office at the address specified below:

Florida Department of Environmental Protection  
 Southwest District Office  
 13051 N Telecom Pkwy

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

Temple Terrace, Florida 33637-926

Phone Number - (813) 470-5700  
FAX Number - (813) 470-5996  
[swd\\_dw@dep.state.fl.us](mailto:swd_dw@dep.state.fl.us)

[62-620.305]

14. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. [62-620.305]

## II. BIOSOLIDS MANAGEMENT REQUIREMENTS

### A. Basic Requirements

1. Biosolids generated by this facility may be land applied and/or transferred to Biosolids Treatment Facility (BTF) or disposed of in a Class I solid waste landfill. Transferring biosolids to an alternative biosolids treatment facility does not require a permit modification. However, use of an alternative biosolids treatment facility requires submittal of a copy of the agreement pursuant to Rule 62-640.880(1)(c), F.A.C., along with a written notification to the Department at least 30 days before transport of the biosolids. [62-620.320(6), 62-640.880(1)]
2. The permittee shall monitor and keep records of the quantities of biosolids generated, received from source facilities, treated, distributed and marketed, land applied, used as a biofuel or for bioenergy, transferred to another facility, or landfilled. These records shall be kept for a minimum of five years. [62-640.650(4)(a)]
3. Biosolids quantities shall be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report for Monitoring Group RMP-Q in accordance with Condition I.C.8.

Parameter	Units	Max/ Min	Biosolids Limitations		Monitoring Requirements		
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-02
Biosolids Quantity (Land-Applied )	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-03
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-01

[62-640.650(5)(a)]

4. Biosolids quantities shall be calculated as listed in Permit Condition II.A.3. and as described below:

Monitoring Site Number	Description of Monitoring Site Calculations
RMP-01	Biosolids Quantity (Transferred to BTF)
RMP-02	Biosolids Quantity (Landfilled)
RMP-03	Biosolids Quantity (Land-Applied)

5. The treatment, management, transportation, use, land application, or disposal of biosolids shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. [62-640.400(6)]
6. Storage of biosolids or other solids at this facility shall be in accordance with the Facility Biosolids Storage Plan. [62-640.300(4)]

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

7. Biosolids shall not be spilled from or tracked off the treatment facility site by the hauling vehicle. [62-640.400(9)]

## B. Treatment and Monitoring Requirements

8. The permittee is authorized to produce Class B biosolids.
9. The permittee shall achieve Class B pathogen reduction by meeting the pathogen reduction requirements in section 503.32(b)(3) (Use of PSRP (Processes to Significantly Reduce Pathogens)-Anaerobic Digestion) of Title 40 CFR Part 503. [62-640.600(1)(b)]
10. The permittee shall achieve vector attraction reduction for Class B biosolids by meeting the vector attraction reduction requirements in section 503.33(b)(1) (Reduce the mass of volatile solids by a minimum of 38%) of Title 40 CFR Part 503. [62-640.600(2)(a)]
11. Time and Temperature shall be routinely monitored to demonstrate compliance with pathogen reduction requirements specified in Rule 62-640.600, F.A.C. [62-640.650(3)(a)2]
12. Temperature and Time shall be routinely monitored to demonstrate compliance with vector attraction reduction requirements specified in Rule 62-640.600, F.A.C. [62-640.650(3)(a)2]
13. Treatment of liquid biosolids or septage for the purpose of meeting the pathogen reduction or vector attraction reduction requirements set forth in Rule 62-640.600, F.A.C., shall not be conducted in the tank of a hauling vehicle. Treatment of biosolids or septage for the purpose of meeting pathogen reduction or vector attraction reduction requirements shall take place at the permitted facility. [62-640.400(7)]
14. Class B biosolids shall comply with the limits and be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report in accordance with Permit Condition I.C.8. Biosolids shall not be land applied if a single sample result for any parameter exceeds the following:

Parameter	Units	Max/ Min	Biosolids Limitations		Monitoring Requirements		
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Nitrogen, Sludge, Tot, Dry Wt (as N)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Phosphorus, Sludge, Tot, Dry Wt (as P)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Potassium, Sludge, Tot, Dry Wt (as K)	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Arsenic Total, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Cadmium, Sludge, Tot, Dry Weight (as Cd)	mg/kg	Max	85.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Copper, Sludge, Tot, Dry Wt. (as Cu)	mg/kg	Max	4300.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Lead, Dry Weight, Sludge	mg/kg	Max	840.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B

PERMITTEE: City of Clearwater  
 FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

Parameter	Units	Max/ Min	Biosolids Limitations		Monitoring Requirements		
			Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Mercury, Dry Weight, Sludge	mg/kg	Max	57.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Molybdenum, Dry Weight, Sludge	mg/kg	Max	75.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Nickel, Dry Weight, Sludge	mg/kg	Max	420.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Selenium Sludge Solid	mg/kg	Max	100.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Zinc, Dry Weight, Sludge	mg/kg	Max	7500.0	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
pH	s.u.	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Solids, Total, Sludge, Percent	percent	Max	Report	Single Sample	Bi-monthly; every 2 months	Composite	RMP-B
Coliform, Fecal	CFU/g	Max	2 million	Geometric Mean	Bi-monthly; every 2 months	Grab	RMP-B
**Temperature	Degrees C	Min	Report	Single Sample	Weekly	Meter	RMP-B3
**Time	Days	Min	Report	Single Sample	Weekly	Calculated	RMP-B2

***\*\*Reported on Part B of the DMR***

*[62-640.650(3)(a)(3) and 62-640.700(5)(a)]*

15. Sampling and analysis shall be conducted in accordance with 40 CFR Part 503.8 and the U.S. Environmental Protection Agency publication - POTW Sludge Sampling and Analysis Guidance Document, August 1989. In cases where conflicts exist between 40 CFR 503.8 and the POTW Sludge Sampling and Analysis Guidance Document, the requirements in 40 CFR Part 503.8 will apply. *[62-640.650(3)(a)1]*
16. All samples shall be representative and shall be taken after final treatment of the biosolids but before land application or distribution and marketing. *[62-640.650(3)(a)5]*
17. Biosolids samples shall be taken at the monitoring site locations listed in Permit Condition II.B.14 and as described below:

Monitoring Site Number	Description of Monitoring Site
RMP-B	Class B Biosolids
RMP-B2	At the digesters influent
RMP-B3	At the transfer point between the digesters

**C. Land Application at Permitted Sites**

18. Land application of biosolids at the site shall be in accordance with the site permit, the Nutrient Management Plan, and the requirements of Chapter 62-640, F.A.C. *[62-640]*

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

19. The biosolids from this facility shall only be land applied at sites identified on the Treatment Facility Biosolids Plan, Form 62-640.210(2)(a), submitted with the permit application, or revised in accordance with condition II.C.20 below, which is incorporated as part of this permit. [62-640.300(2)]
20. The permittee shall notify the Department at least 24 hours before beginning biosolids application at a site not listed in the Treatment Facility Biosolids Plan Form 62-640.210(2)(a). The facility's Treatment Facility Biosolids Plan shall be revised to include the new site and submitted to the Department within 30 days of using the site. The revised Treatment Facility Biosolids Plan shall become part of the treatment facility permit. [62-640.300(2)(c) & 62-640.650(6)(a)]
21. Land application of "other solids" as defined in Chapter 62-640, F.A.C., is only allowed if specifically addressed in the Nutrient Management Plan(s) approved for the site where the other solids will be applied. [62-640.860]
22. The permittee shall maintain hauling records to track the transport of biosolids between the treatment facility and the application site. The hauling records for each party shall contain the following information:

Treatment Facility Permittee	Site Permittee
1. Date and time shipped and shipment ID	1. Date and time received and shipment ID
2. Amount of biosolids shipped	2. Name and ID number of treatment facility from which biosolids are received
3. Concentration of parameters & date of analysis	3. Signature of hauler
4. Name and ID number of permitted application site	4. Signature of site manager
5. Class of biosolids shipped	
6. Signature of certified operator or designee	
7. Signature of hauler and name of hauling firm	

A copy of the treatment facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids site manager. The permittee shall report to the Department within 24 hours of discovery of any discrepancy in the delivery of biosolids leaving the treatment facility and arriving at the permitted application site. Treatment facility permittees shall notify the Department, site manager, and site permittee within 24 hours of discovery of sending biosolids that did not meet the requirements of Rule 62-640.600, F.A.C., or subsection 62-640.700(5), F.A.C., to a land application site.

[62-640.650(4) & (5)]

23. The permittee shall maintain copies of the Biosolids Application Site Annual Summaries, received from site permittees in accordance with 62-640.650(5)(e), F.A.C., indefinitely. [62-640.650(4)(d)]
24. The permittee shall submit a Treatment Facility Biosolids Annual Summary to the Department's Southwest District Office on Department Form 62-640.210(2)(b). The summary shall include all biosolids shipped during the period January 1 through December 31 and shall be submitted to the Department by February 19 of the year following the year of application. [62-640.650(5)(c)]

#### D. Disposal

25. Disposal of biosolids, septage, and "other solids" in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with Chapter 62-701, F.A.C. [62-640.100(6)(b) & (c)]

## E. Transfer

26. The permittee shall not be held responsible for treatment and management violations that occur after its biosolids have been accepted by a permitted biosolids treatment facility with which the source facility has an agreement in accordance with subsection 62-640.880(1)(c), F.A.C., for further treatment, management, or disposal. [62-640.880(1)(b)]
27. The permittee shall keep hauling records to track the transport of biosolids between the facilities. The hauling records shall contain the following information:

Source Facility	Biosolids Treatment Facility or Treatment Facility
1. Date and time shipped	1. Date and time received
2. Amount of biosolids shipped	2. Amount of biosolids received
3. Degree of treatment (if applicable)	3. Name and ID number of source facility
4. Name and ID Number of treatment facility	4. Signature of hauler
5. Signature of responsible party at source facility	5. Signature of responsible party at treatment facility
6. Signature of hauler and name of hauling firm	

A copy of the source facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids treatment facility or treatment facility. The treatment facility permittee shall report to the Department within 24 hours of discovery any discrepancy in the quantity of biosolids leaving the source facility and arriving at the biosolids treatment facility or treatment facility.

[62-640.880(4)]

## F. Receipt

28. This facility receives biosolids from the Clearwater East WRF, FL0021865.
29. If the permittee intends to accept biosolids from other facilities, a permit revision is required pursuant to paragraph 62-640.880(2)(d), F.A.C. [62-640.880(2)(d)]

## III. GROUND WATER REQUIREMENTS

1. Section III is not applicable to this facility.

## IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

### A. Part III Public Access System(s)

1. The City of Clearwater Northeast WRF serves as a source plant for reclaimed water which is transferred to the City of Clearwater Master Reuse System (FL0186261) at a transfer point located immediately downstream of the distribution flow meter at the source plant. The City of Clearwater Master Reuse System is a Part III slow rate public access land application system serving the City of Clearwater, Florida under Department permit number FL0186261.
2. Cross-connections to the potable water system are prohibited. [62-610.469(7)]
3. A cross-connection control program shall be implemented and/or remain in effect within the areas where reclaimed water will be provided for use and shall be in compliance with the Rule 62-555.360, F.A.C. [62-610.469(7)]
4. The permittee shall conduct inspections within the reclaimed water service area to verify proper connections, to minimize illegal cross-connections, and to verify both the proper use of reclaimed water and that the proper backflow prevention assemblies or devices have been installed and tested. Inspections are required when a

customer first connects to the reuse distribution system. Subsequent inspections are required as specified in the cross-connection control and inspection program. [62-610.469(7)(h)]

5. If an actual or potential (e.g. no dual check device on residential connections served by a reuse system) cross-connection between the potable and reclaimed water systems is discovered, the permittee shall:
  - a. Immediately discontinue potable water and/or reclaimed water service to the affected area if an actual cross-connection is discovered.
  - b. If the potable water system is contaminated, clear the potable water lines.
  - c. Eliminate the cross-connection and install a backflow prevention device as required by the Rule 62-555.360.F.A.C.
  - d. Test the affected area for other possible cross-connections.
  - e. Within 24 hours, notify the Department's Southwest District Office's domestic wastewater and drinking water programs.
  - f. Within 5 days of discovery of an actual or potential cross-connection, submit a written report to the Department's Southwest District Office detailing: a description of the cross-connection, how the cross-connection was discovered, the exact date and time of discovery, approximate time that the cross-connection existed, the location, the cause, steps taken to eliminate the cross-connection, whether reclaimed water was consumed, and reports of possible illness, whether the drinking water system was contaminated and the steps taken to clear the drinking water system, when the cross-connection was eliminated, plan of action for testing for other possible cross-connections in the area, and an evaluation of the cross-connection control and inspection program to ensure that future cross-connections do not occur.

[62-555.350(3) and 62-555.360][62-620.610(20)]

6. Maximum obtainable separation of reclaimed water lines and potable water lines shall be provided and the minimum separation distances specified in Rule 62-610.469(7), F.A.C., shall be provided. Reuse facilities shall be color coded or marked. Underground piping which is not manufactured of metal or concrete shall be color coded using Pantone Purple 522C using light stable colorants. Underground metal and concrete pipe shall be color coded or marked using purple as the predominant color. [62-610.469(7)]
7. In constructing reclaimed water distribution piping, the permittee shall maintain a 75-foot setback distance from a reclaimed water transmission facility to public water supply wells. No setback distances are required to other potable water supply wells or to any nonpotable water supply wells. [62-610.471(3)]
8. A setback distance of 75 feet shall be maintained between the edge of the wetted area and potable water supply wells, unless the utility adopts and enforces an ordinance prohibiting potable water supply wells within the reuse service area. No setback distances are required to any nonpotable water supply well, to any surface water, to any developed areas, or to any private swimming pools, hot tubs, spas, saunas, picnic tables, barbecue pits, or barbecue grills. [62-610.471(1), (2), (5), and (7)]
9. Reclaimed water shall not be used to fill swimming pools, hot tubs, or wading pools. [62-610.469(4)]
10. Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet from outdoor public eating, drinking, or bathing facilities. [62-610.471(6)]
11. A setback distance of 100 feet shall be maintained from indoor aesthetic features using reclaimed water to adjacent indoor public eating and drinking facilities. [62-610.471(8)]
12. The public shall be notified of the use of reclaimed water. This shall be accomplished by posting of advisory signs in areas where reuse is practiced, notes on scorecards, or other methods. [62-610.468(2)]

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

13. All new advisory signs and labels on vaults, service boxes, or compartments that house hose bibbs along with all labels on hose bibbs, valves, and outlets shall bear the words "do not drink" and "no beber" along with the equivalent standard international symbol. In addition to the words "do not drink" and "no beber," advisory signs posted at storage ponds and decorative water features shall also bear the words "do not swim" and "no nadar" along with the equivalent standard international symbols. Existing advisory signs and labels shall be retrofitted, modified, or replaced in order to comply with the revised wording requirements. For existing advisory signs and labels this retrofit, modification, or replacement shall occur within 365 days after the date of this permit. For labels on existing vaults, service boxes, or compartments housing hose bibbs this retrofit, modification, or replacement shall occur within 730 days after the date of this permit. [62-610.468, 62-610.469]
14. The permittee shall ensure that users of reclaimed water are informed about the origin, nature, and characteristics of reclaimed water; the manner in which reclaimed water can be safely used; and limitations on the use of reclaimed water. Notification is required at the time of initial connection to the reclaimed water distribution system and annually after the reuse system is placed into operation. A description of on-going public notification activities shall be included in the Annual Reuse Report. [62-610.468(6)]
15. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. [62-610.414(8)]
16. Overflows from emergency discharge facilities on storage ponds shall be reported as abnormal events in accordance with Permit Condition IX.20. [62-610.800(9)]

## **V. OPERATION AND MAINTENANCE REQUIREMENTS**

### **A. Staffing Requirements**

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of one or more operators certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category I, Class A facility and, at a minimum, operators with appropriate certification must be on the site as follows:

A Class C or higher operator 24 hours/day for 7 days/week. The lead/chief operator must be a Class A operator.

[62-620.630(3)][62-699.310] [62-610.462]

2. The lead/chief operator shall be employed at the plant full time. "Full time" shall mean at least 4 days per week, working a minimum of 35 hours per week, including leave time. A licensed operator shall be on-site and in charge of each required shift for periods of required staffing time when the lead/chief operator is not on-site. An operator meeting the lead/chief operator class for the treatment plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. [62-699.311(10), (6) and (1)]

### **B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements**

1. The application to renew this permit shall include an updated capacity analysis report prepared in accordance with Rule 62-600.405, F.A.C. [62-600.405(5)]
2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. [62-600.735(1)]

### **C. Recordkeeping Requirements**

1. The permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;
- b. Copies of all reports required by the permit for at least three years from the date the report was prepared;
- c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;
- d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the residuals use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least three years from the date of sampling or measurement;
- e. A copy of the current permit;
- f. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;
- g. A copy of any required record drawings;
- h. Copies of the licenses of the current certified operators;
- i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed; and
- j. Records of biosolids quantities, treatment, monitoring, and hauling for at least five years.

[62-620.350, 62-602.650, 62-640.650(4)]

## VI. SCHEDULES

1. The permittee shall conduct and implement according to the following schedule:

Implementation Step		Completion Date
A.	Submit DEP Form 62-620.910(12), Notification of Completion of Construction for Wastewater Facilities or Activities prior to activation.	Prior to placing any unit processes into operation for any purpose other than testing.
B.	Submit DEP Form 62-620.910(13), Notification of Availability of Record Drawings and Final Operation and Maintenance Manuals for the construction.	Within six months after any unit is placed into operation.

[62-620.320(1) and (2), 62-4.070(3)]

2. Prior to placing the modifications to existing facilities into operation or any individual unit processes into operation, for any purpose other than testing for leaks and equipment operation, the permittee shall complete and submit to the Department DEP Form 62-620.910(12), Notification of Completion of Construction for Wastewater Facilities or Activities. [62-620.410(7) and 62-620.630(2)]
3. The permittee is not authorized to discharge to waters of the state after the expiration date of this permit, unless:

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- a. The permittee has applied for renewal of this permit at least 180 days before the expiration date of this permit using the appropriate forms listed in Rule 62-620.910, F.A.C., and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.; or
- b. The permittee has made complete the application for renewal of this permit before the permit expiration date.

Please note, effluent testing shall be conducted for each outfall in accordance with the instructions provided in Sections 3.A.12., 13., and 14. of the application form. A minimum of three samples shall be taken within four and one-half years prior to the date of the permit application and must be representative of the seasonal variation in the discharge from each outfall. [62-620.335(1) - (4)]

## VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

1. This facility's pretreatment program requirements are included in the City of Clearwater Marshall Street WRF permit issued by the Department under Permit Number FL0021857.
2. As required by Rules 62-625.600(8) and (12), F.A.C., the permittee shall submit DMRs for Monitoring Site Numbers PRT-I, PRT-E, and PRT-R to the City of Clearwater Marshall Street WRF (FL0021857) for inclusion in the annual report.[62-625.600(8)]
3. Samples for Monitoring Site Numbers PRT-I, PRT-E, and PRT-R shall be taken at the monitoring site locations described below:

Monitoring Location Site Number	Description of Monitoring Location
PRT-1	At headworks prior to treatment and ahead of return activated sludge.
PRT-E	After dechlorination and prior to Outfall.
PRT-R	After centrifuge/belt filter press.

## VIII. OTHER SPECIFIC CONDITIONS

1. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. [62-600.410(5) and 62-640.400(6)]
2. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. [62-604.130(3)]
3. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. [62-604.550] [62-620.610(20)]
4. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):
  - a. Which may cause fire or explosion hazards; or

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or
- c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or
- d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding 40°C or otherwise inhibiting treatment; or
- e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

[62-604.130(5)]

- 5. The treatment facility, storage ponds for Part II systems, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. [62-600.400(2)(b)]
- 6. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. [62-701.300(1)(a)]
- 7. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. [62-620.310(4)]
- 8. The permittee shall provide verbal notice to the Department's Southwest District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Southwest District Office in a written report within 7 days of the sinkhole discovery. [62-620.320(6)]
- 9. Reopener Clause:
  - a. The permit shall be revised, or alternatively, revoked and reissued in accordance with the provisions contained in Rules 62-620.325 and 62-620.345, F.A.C., if applicable, or to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act (the Act), as amended, if the effluent standards, limitations, or water quality standards so issued or approved:
    - (1) Contains different conditions or is otherwise more stringent than any condition in the permit/or;
    - (2) Controls any pollutant not addressed in the permit.
    - (3) The permit as revised or reissued under this paragraph shall also contain any other requirements of the Act then applicable.
  - b. The permit may be reopened to adjust effluent limitations or monitoring requirements should future Water Quality Based Effluent Limitation determinations, water quality studies, DEP approved changes in water quality standards, or other information show a need for a different limitation or monitoring requirement.
  - c. The Department may develop a Total Maximum Daily Load (TMDL) during the life of the permit. Once a TMDL has been established and adopted by rule, the Department shall revise this permit to incorporate the final findings of the TMDL.

[62-620.325 & 62-620.345]

## IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of

Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. [62-620.610(1)]

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. [62-620.610(2)]
3. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. [62-620.610(3)]
4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. [62-620.610(4)]
5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. [62-620.610(5)]
6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. [62-620.610(6)]
7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. [62-620.610(7)]
8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. [62-620.610(8)]
9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:
  - a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;
  - b. Have access to and copy any records that shall be kept under the conditions of this permit;
  - c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and
  - d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

[62-620.610(9)]

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. [62-620.610(10)]
11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. [62-620.610(11)]
12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. [62-620.610(12)]
13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. [62-620.610(13)]
14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. [62-620.610(14)]
15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. [62-620.610(15)]
16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. [62-620.610(16)]
17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:
  - a. A description of the anticipated noncompliance;
  - b. The period of the anticipated noncompliance, including dates and times; and
  - c. Steps being taken to prevent future occurrence of the noncompliance.[62-620.610(17)]
18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-600, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.
- b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
- c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.
- d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.
- e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.
- f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

[62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. [62-620.610(19)]
20. The permittee shall report to the Department's Southwest District Office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
  - a. The following shall be included as information which must be reported within 24 hours under this condition:
    - (1) Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
    - (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
    - (3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
    - (4) Any unauthorized discharge to surface or ground waters.
  - b. Oral reports as required by this subsection shall be provided as follows:
    - (1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph IX.20.(a)4. that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the STATE WATCH OFFICE TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Watch Office:
      - (a) Name, address, and telephone number of person reporting;
      - (b) Name, address, and telephone number of permittee or responsible person for the discharge;
      - (c) Date and time of the discharge and status of discharge (ongoing or ceased);
      - (d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater);
      - (e) Estimated amount of the discharge;

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- (f) Location or address of the discharge;
  - (g) Source and cause of the discharge;
  - (h) Whether the discharge was contained on-site, and cleanup actions taken to date;
  - (i) Description of area affected by the discharge, including name of water body affected, if any; and
  - (j) Other persons or agencies contacted.
- (2) Oral reports, not otherwise required to be provided pursuant to subparagraph IX.20.b.1 above, shall be provided to the Department's Southwest District Office within 24 hours from the time the permittee becomes aware of the circumstances.
- c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department's Southwest District Office shall waive the written report.

[62-620.610(20)]

21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. [62-620.610(21)]

22. Bypass Provisions.

- a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.
- b. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:
  - (1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
  - (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
  - (3) The permittee submitted notices as required under Permit Condition IX.22.c. of this permit.
- c. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.
- d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.b.(1) through (3) of this permit.
- e. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.b. through d. of this permit.

[62-620.610(22)]

23. Upset Provisions.

- a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee.
  - (1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.
  - (2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

PERMITTEE: City of Clearwater  
FACILITY: City of Clearwater Northeast WRF

PERMIT NUMBER: FL0128937-016-DW1P/RM

- b. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
  - (1) An upset occurred and that the permittee can identify the cause(s) of the upset;
  - (2) The permitted facility was at the time being properly operated;
  - (3) The permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and
  - (4) The permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.
- c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.
- d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in Temple Terrace, Florida.

STATE OF FLORIDA DEPARTMENT OF  
ENVIRONMENTAL PROTECTION



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Pamala Vazquez  
Program Administrator  
Permitting & Waste Cleanup Program  
Southwest District

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME:	City of Clearwater Public Utilities Department	PERMIT NUMBER:	FL0128937-016-DW1P/RM
MAILING ADDRESS:	1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	LIMIT:	Final
FACILITY:	City of Clearwater Northeast WRF	CLASS SIZE:	MA
LOCATION:	3290 SR 580 Clearwater, FL 34695	MONITORING GROUP NUMBER:	D-001
COUNTY:	Pinellas	MONITORING GROUP DESCRIPTION:	D001 SURFACE WATER DISCHARGE LOCATION, with Influent
OFFICE:	Southwest District	RE-SUBMITTED DMR:	<input type="checkbox"/>
		NO DISCHARGE FROM SITE:	<input type="checkbox"/>
		MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-02	Permit Requirement		13.5 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-02	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement				5.0 (An.Avg.)			mg/L		5 Days/Week	24-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				10.0 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-01	Permit Requirement				5.0 (An.Avg.)			mg/L		5 Days/Week	24-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-01	Permit Requirement				10.00 (Max.)	7.5 (Max.Wk.Avg.)	6.25 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		D-001		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Y Mon. Site No. EFA-01	Permit Requirement				3.0 (An.Avg.)			mg/L		5 Days/Week	24-hr FPC
Nitrogen, Total	Sample Measurement										
PARM Code 00600 A Mon. Site No. EFA-01	Permit Requirement			6.0 (Max.)	4.5 (Max.Wk.Avg.)	3.75 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC	
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 Y Mon. Site No. EFA-01	Permit Requirement				Report (An.Avg.)		mg/L		5 Days/Week	24-hr FPC	
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 A Mon. Site No. EFA-01	Permit Requirement			Report (Max.)	Report (Max.Wk.Avg.)	Report (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC	
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-01	Permit Requirement					5.0 (Max.)	mg/L		5 Days/Week	Grab	
pH	Sample Measurement										
PARM Code 00400 A Mon. Site No. EFA-01	Permit Requirement			6.5 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter	
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-01	Permit Requirement			75 (Mo.Min.)			percent		Monthly	Calculated	
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement					25 (Max.)	#/100mL		5 Days/Week	Grab	
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement			1.0 (Min.)			mg/L		Continuous	Meter	
Chlorine, Total Residual (For Dechlorination)	Sample Measurement										
PARM Code 50060 1 Mon. Site No. EFD-01	Permit Requirement					0.01 (Max.)	mg/L		Daily; 24 hours	Grab	

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		D-001		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Enterococci	Sample Measurement										
PARM Code 31639 A Mon. Site No. EFA-01	Permit Requirement						35 (Mo.Geo.Mn.)	#/100mL		Monthly	Calculated
Enterococci	Sample Measurement										
PARM Code 31639 P Mon. Site No. EFA-01	Permit Requirement						276 (Max.)	#/100mL		5/Month	Grab
Copper, Total Recoverable	Sample Measurement										
PARM Code 01119 1 Mon. Site No. EFD-01	Permit Requirement						3.7 (Max.)	mg/L		Monthly	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 Y Mon. Site No. EFD-01	Permit Requirement					43.0 (An.Avg.)		ug/L		Monthly	Calculated
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 1 Mon. Site No. EFD-01	Permit Requirement						Report (Max.)	ug/L		Monthly	Grab
Oxygen, Dissolved (DO)	Sample Measurement										
PARM Code 00300 1 Mon. Site No. EFD-01	Permit Requirement				5.0 (Min.)			mg/L		Daily; 24 hours	Grab
Nitrogen, Total	Sample Measurement										
PARM Code 00600 P Mon. Site No. EFA-01	Permit Requirement		Report (Mo.Total)	ton/mth						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Q Mon. Site No. EFA-01	Permit Requirement		Report (An.Total)	ton/yr						Monthly	Calculated
Nitrogen, Total	Sample Measurement										
PARM Code 00600 R Mon. Site No. EFA-01	Permit Requirement		Report (5Yr.Avg.)	ton/yr						Monthly	Calculated
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Routine)	Sample Measurement										
PARM Code TRP3B P Mon. Site No. EFD-01	Permit Requirement				100 (Min.)			percent		Quarterly	24-hr FPC

## **DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF

## MONITORING GROUP

D-001

PERMIT NUMBER: FL0128937-016-DW1P/RM

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Additional) PARM Code TRP3B Q Mon. Site No. EFD-01	Sample Measurement										
	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Ceriodaphnia dubia (Additional) PARM Code TRP3B R Mon. Site No. EFD-01	Sample Measurement							percent		As needed	As required by the permit
	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Pimephales promelas (Routine) PARM Code TRP6C P Mon. Site No. EFD-01	Sample Measurement										
	Permit Requirement				100 (Min.)			percent		Quarterly	24-hr FPC
7-DAY CHRONIC STATRE Pimephales promelas (Additional) PARM Code TRP6C Q Mon. Site No. EFD-01	Sample Measurement							percent			
	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
7-DAY CHRONIC STATRE Pimephales promelas (Additional) PARM Code TRP6C R Mon. Site No. EFD-01	Sample Measurement							percent			
	Permit Requirement				100 (Min.)			percent		As needed	As required by the permit
Flow	Sample Measurement										
PARM Code 50050 P Mon. Site No. FLW-1	Permit Requirement		13.5 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-1	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 1 Mon. Site No. FLW-1	Permit Requirement						Report (Mo.Max.)	percent		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C (Influent)	Sample Measurement										
PARM Code 80082 G Mon. Site No. INF-01	Permit Requirement						Report (Mo.Avg.)	mg/L		Weekly	24-hr FPC
Solids, Total Suspended (Influent)	Sample Measurement										
PARM Code 00530 G Mon. Site No. INF-01	Permit Requirement						Report (Mo.Avg.)	mg/L		Weekly	24-hr FPC

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME: MAILING ADDRESS:	City of Clearwater Public Utilities Department 1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	PERMIT NUMBER:	FL0128937-016-DW1P/RM	
FACILITY: LOCATION:	City of Clearwater Northeast WRF 3290 SR 580	LIMIT: CLASS SIZE:	Final MA	REPORT FREQUENCY: PROGRAM:
		MONITORING GROUP NUMBER: MONITORING GROUP DESCRIPTION:	R-001 & R-002 RECLAIMED TO THE MRS and/or ADVANCED WATER PURIFICATION PLANT	Monthly Domestic
COUNTY: OFFICE:	Clearwater, FL 34695 Pinellas Southwest District	RE-SUBMITTED DMR: NO DISCHARGE FROM SITE:	<input type="checkbox"/> <input type="checkbox"/>	From: _____ To: _____
		MONITORING PERIOD		

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-05	Permit Requirement		12.0 (An.Avg.)	MGD						Monthly	Calculated
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-05	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
Flow (to Advanced Water Purification Plant)	Sample Measurement										
PARM Code 50050 P Mon. Site No. FLW-06	Permit Requirement		4.0 (Day.Max.)	MGD						Monthly	Calculated
Flow (to Advanced Water Purification Plant)	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-06	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-01	Permit Requirement				20.0 (An.Avg.)			mg/L		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-01	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		5 Days/Week	24-hr FPC

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP R-001 & R-002      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:  
 MONITORING PERIOD From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-01	Permit Requirement						5.0 (Max.)	mg/L		5 Days/Week	Grab
pH	Sample Measurement										
PARM Code 00400 A Mon. Site No. EFA-01	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-01	Permit Requirement				75 (Mo.Min.)			percent		Monthly	Calculated
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-01	Permit Requirement						25 (Max.)	#/100mL		5 Days/Week	Grab
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-01	Permit Requirement				1.0 (Min.)			mg/L		Continuous	Meter
Turbidity	Sample Measurement										
PARM Code 00070 B Mon. Site No. EFB-01	Permit Requirement						Report (Max.)	NTU		Continuous	Meter

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME:	City of Clearwater Public Utilities Department	PERMIT NUMBER:	FL0128937-016-DW1P/RM
MAILING ADDRESS:	1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	LIMIT:	Final
FACILITY:	City of Clearwater Northeast WRF	CLASS SIZE:	MA
LOCATION:	3290 SR 580 Clearwater, FL 34695	MONITORING GROUP NUMBER:	RMP-B
COUNTY:	Pinellas	MONITORING GROUP DESCRIPTION:	Class B Biosolids
OFFICE:	Southwest District	RE-SUBMITTED DMR:	<input type="checkbox"/>
		NO DISCHARGE FROM SITE:	<input type="checkbox"/>
		MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nitrogen, Sludge, Tot, Dry Wt (as N) PARM Code 78470 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
Phosphorus, Sludge, Tot, Dry Wt (as P) PARM Code 78478 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
Potassium, Sludge, Tot, Dry Wt (as K) PARM Code 78472 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement		Report (Max.)	percent						Bi-monthly; every 2 months	Composite
Arsenic Total, Dry Weight, Sludge PARM Code 49565 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement						75.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Cadmium, Sludge, Tot, Dry Weight (as Cd) PARM Code 78476 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement						85.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu) PARM Code 78475 + Mon. Site No. RMP-B	Sample Measurement										
	Permit Requirement						4300.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP RMP-B      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:      MONITORING PERIOD From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Dry Weight, Sludge	Sample Measurement										
PARM Code 78468 + Mon. Site No. RMP-B	Permit Requirement						840.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Mercury, Dry Weight, Sludge	Sample Measurement										
PARM Code 78471 + Mon. Site No. RMP-B	Permit Requirement						57.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Molybdenum, Dry Weight, Sludge	Sample Measurement										
PARM Code 78465 + Mon. Site No. RMP-B	Permit Requirement						75.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Nickel, Dry Weight, Sludge	Sample Measurement										
PARM Code 78469 + Mon. Site No. RMP-B	Permit Requirement						420.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. RMP-B	Permit Requirement						100.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
Zinc, Dry Weight, Sludge	Sample Measurement										
PARM Code 78467 + Mon. Site No. RMP-B	Permit Requirement						7500.0 (Max.)	mg/kg		Bi-monthly; every 2 months	Composite
pH	Sample Measurement										
PARM Code 00400 + Mon. Site No. RMP-B	Permit Requirement						Report (Max.)	s.u.		Bi-monthly; every 2 months	Composite
Solids, Total, Sludge, Percent	Sample Measurement										
PARM Code 61553 + Mon. Site No. RMP-B	Permit Requirement						Report (Max.)	percent		Bi-monthly; every 2 months	Composite
Coliform, Fecal	Sample Measurement										
PARM Code 74055 + Mon. Site No. RMP-B	Permit Requirement		2000000 (Geo.Mn.)	CFU/g						Bi-monthly; every 2 months	Grab

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME: MAILING ADDRESS:	City of Clearwater Public Utilities Department 1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	PERMIT NUMBER:	FL0128937-016-DW1P/RM
FACILITY: LOCATION:	City of Clearwater Northeast WRF 3290 SR 580 Clearwater, FL 34695	LIMIT: CLASS SIZE: MONITORING GROUP NUMBER: MONITORING GROUP DESCRIPTION: RE-SUBMITTED DMR: NO DISCHARGE FROM SITE:	Final MA RMP-Q Biosolids Quantity <input type="checkbox"/> <input type="checkbox"/>
COUNTY: OFFICE:	Pinellas Southwest District	MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Biosolids Quantity (Transferred)	Sample Measurement										
PARM Code B0007 + Mon. Site No. RMP-01	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Landfilled)	Sample Measurement										
PARM Code B0008 + Mon. Site No. RMP-02	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Land-Applied )	Sample Measurement										
PARM Code B0006 + Mon. Site No. RMP-03	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated

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NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME:	City of Clearwater Public Utilities Department	PERMIT NUMBER:	FL0128937-016-DW1P/RM
MAILING ADDRESS:	1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	LIMIT:	Final
FACILITY:	City of Clearwater Northeast WRF	CLASS SIZE:	MA
LOCATION:	3290 SR 580 Clearwater, FL 34695	MONITORING GROUP NUMBER:	PRT-I
COUNTY:	Pinellas	MONITORING GROUP DESCRIPTION:	Influent Pretreatment
OFFICE:	Southwest District	RE-SUBMITTED DMR:	<input type="checkbox"/>
		NO DISCHARGE FROM SITE:	<input type="checkbox"/>
		MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 G Mon. Site No. PRT-I	Permit Requirement				Report (Min.)		Report (Max.)	s.u.		Annually	Grab
Oil and Grease, hexane extr method	Sample Measurement										
PARM Code 00552 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/L		Annually	Grab
Benzene	Sample Measurement										
PARM Code 34030 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Bromoform	Sample Measurement										
PARM Code 32104 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride	Sample Measurement										
PARM Code 32102 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chlorobenzene	Sample Measurement										
PARM Code 34301 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

\*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-I	PERMIT NUMBER: FL0128937-016-DW1P/RM					
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Chlorodibromomethane	Sample Measurement									
PARM Code 34306 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroethane	Sample Measurement									
PARM Code 85811 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chloroethyl vinyl ether (mixed)	Sample Measurement									
PARM Code 34576 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroform	Sample Measurement									
PARM Code 32106 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Dichlorobromomethane	Sample Measurement									
PARM Code 32101 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene	Sample Measurement									
PARM Code 34536 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichlorobenzene	Sample Measurement									
PARM Code 34566 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene	Sample Measurement									
PARM Code 34571 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1-dichloroethane	Sample Measurement									
PARM Code 34496 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane	Sample Measurement									
PARM Code 32103 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,1-dichloroethylene	Sample Measurement										
PARM Code 34501 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane	Sample Measurement										
PARM Code 34541 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichloropropene	Sample Measurement										
PARM Code 77163 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Ethylbenzene	Sample Measurement										
PARM Code 34371 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl bromide	Sample Measurement										
PARM Code 34413 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl chloride	Sample Measurement										
PARM Code 34418 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methylene chloride	Sample Measurement										
PARM Code 34423 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2,2-tetrachloroethane	Sample Measurement										
PARM Code 34516 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene	Sample Measurement										
PARM Code 34475 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Toluene	Sample Measurement										
PARM Code 34010 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-I	PERMIT NUMBER: FL0128937-016-DW1P/RM					
			From: _____	To: _____						
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,2-trans-dichloroethylene	Sample Measurement									
PARM Code 34546 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane	Sample Measurement									
PARM Code 34506 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane	Sample Measurement									
PARM Code 34511 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Trichloroethylene	Sample Measurement									
PARM Code 39180 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Vinyl chloride	Sample Measurement									
PARM Code 39175 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chlorophenol	Sample Measurement									
PARM Code 34586 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenol	Sample Measurement									
PARM Code 34601 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dimethylphenol	Sample Measurement									
PARM Code 34606 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,6-dinitro-o-cresol	Sample Measurement									
PARM Code 34657 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrophenol	Sample Measurement									
PARM Code 34616 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2-nitrophenol	Sample Measurement										
PARM Code 34591 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-nitrophenol	Sample Measurement										
PARM Code 34646 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
p-chloro-m-cresol	Sample Measurement										
PARM Code 82627 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol	Sample Measurement										
PARM Code 39032 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenol, Single Compound	Sample Measurement										
PARM Code 34694 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4,6-trichlorophenol	Sample Measurement										
PARM Code 34621 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthene	Sample Measurement										
PARM Code 34205 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthylene	Sample Measurement										
PARM Code 34200 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Anthracene	Sample Measurement										
PARM Code 34220 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzidine	Sample Measurement										
PARM Code 39120 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Benzo(a)anthracene	Sample Measurement										
PARM Code 34526 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene	Sample Measurement										
PARM Code 34247 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(b)fluoranthene (3,4-benzo)	Sample Measurement										
PARM Code 79531 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(ghi)perylene	Sample Measurement										
PARM Code 34521 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(k)fluoranthene	Sample Measurement										
PARM Code 34242 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethoxy) methane	Sample Measurement										
PARM Code 34278 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethyl) ether	Sample Measurement										
PARM Code 34273 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroisopropyl) ether	Sample Measurement										
PARM Code 34283 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate	Sample Measurement										
PARM Code 39100 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-bromophenyl phenyl ether	Sample Measurement										
PARM Code 34636 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Butyl benzyl phthalate	Sample Measurement										
PARM Code 34292 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2-chloronaphthalene	Sample Measurement										
PARM Code 34581 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-chlorophenyl phenyl ether	Sample Measurement										
PARM Code 34641 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chrysene	Sample Measurement										
PARM Code 34320 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dibenzo (a,h) anthracene	Sample Measurement										
PARM Code 34556 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
3,3'-dichlorobenzidine	Sample Measurement										
PARM Code 34631 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Diethyl phthalate	Sample Measurement										
PARM Code 34336 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dimethyl phthalate	Sample Measurement										
PARM Code 34341 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-butyl phthalate	Sample Measurement										
PARM Code 39110 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrotoluene	Sample Measurement										
PARM Code 34611 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:		City of Clearwater Northeast WRF		MONITORING GROUP		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
				NUMBER:				MONITORING PERIOD		From:	To:		
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type		
2,6-dinitrotoluene	Sample Measurement												
PARM Code 34626 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Di-n-octyl phthalate	Sample Measurement												
PARM Code 34596 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
1,2-diphenylhydrazine	Sample Measurement												
PARM Code 34346 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Fluoranthene	Sample Measurement												
PARM Code 34376 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Fluorene	Sample Measurement												
PARM Code 34381 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Hexachlorobenzene	Sample Measurement												
PARM Code 39700 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Hexachlorobutadiene	Sample Measurement												
PARM Code 39702 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Hexachlorocyclopentadiene	Sample Measurement												
PARM Code 34386 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Hexachloroethane	Sample Measurement												
PARM Code 34396 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		
Indeno (1,2,3-Cd) pyrene	Sample Measurement												
PARM Code 34403 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC		

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Isophorone	Sample Measurement										
PARM Code 34408 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Naphthalene	Sample Measurement										
PARM Code 34696 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Nitrobenzene	Sample Measurement										
PARM Code 34447 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodimethylamine	Sample Measurement										
PARM Code 34438 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodi-n-propylamine	Sample Measurement										
PARM Code 34428 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodiphenylamine	Sample Measurement										
PARM Code 34433 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenanthrene	Sample Measurement										
PARM Code 34461 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pyrene	Sample Measurement										
PARM Code 34469 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2,4-trichlorobenzene	Sample Measurement										
PARM Code 34551 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Aldrin	Sample Measurement										
PARM Code 39330 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Alpha-bhc	Sample Measurement										
PARM Code 39336 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
B-bhc-beta	Sample Measurement										
PARM Code 39338 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane)	Sample Measurement										
PARM Code 39782 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Delta benzene hexachloride	Sample Measurement										
PARM Code 34259 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)	Sample Measurement										
PARM Code 39350 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDT (p,p'-DDT)	Sample Measurement										
PARM Code 39300 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDE (p,p'-DDE)	Sample Measurement										
PARM Code 39320 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDD (p,p'-DDD)	Sample Measurement										
PARM Code 39310 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dieldrin	Sample Measurement										
PARM Code 39380 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
A-endosulfan-alpha	Sample Measurement										
PARM Code 34361 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM					
						From: _____ To: _____					
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
B-endosulfan-beta	Sample Measurement										
PARM Code 34356 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endosulfan sulfate	Sample Measurement										
PARM Code 34351 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin	Sample Measurement										
PARM Code 39390 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin aldehyde	Sample Measurement										
PARM Code 34366 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor	Sample Measurement										
PARM Code 39410 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide	Sample Measurement										
PARM Code 39420 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1242	Sample Measurement										
PARM Code 39496 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1254	Sample Measurement										
PARM Code 39504 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1221	Sample Measurement										
PARM Code 39488 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1232	Sample Measurement										
PARM Code 39492 G Mon. Site No. PRT-I	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD		PRT-I		PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading		Units	Quality or Concentration		Units	No. Ex.	Frequency of Analysis	Sample Type
PCB-1248	Sample Measurement									
PARM Code 39500 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1260	Sample Measurement									
PARM Code 39508 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1016	Sample Measurement									
PARM Code 34671 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene	Sample Measurement									
PARM Code 39400 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Antimony, Total Recoverable	Sample Measurement									
PARM Code 01268 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable	Sample Measurement									
PARM Code 00978 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable	Sample Measurement									
PARM Code 00998 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable	Sample Measurement									
PARM Code 01113 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable	Sample Measurement									
PARM Code 01118 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Copper, Total Recoverable	Sample Measurement									
PARM Code 01119 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP PRT-I      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:      MONITORING PERIOD From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Total Recoverable	Sample Measurement										
PARM Code 01114 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Mercury, Total Recoverable	Sample Measurement										
PARM Code 71901 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	
Nickel, Total Recoverable	Sample Measurement										
PARM Code 01074 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Selenium, Total Recoverable	Sample Measurement										
PARM Code 00981 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Silver, Total Recoverable	Sample Measurement										
PARM Code 01079 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Thallium, Total Recoverable	Sample Measurement										
PARM Code 00982 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Zinc, Total Recoverable	Sample Measurement										
PARM Code 01094 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Cyanide, Total Recoverable	Sample Measurement										
PARM Code 78248 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	
Phenolic Compounds, Total Recoverable	Sample Measurement										
PARM Code 70029 G Mon. Site No. PRT-I	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME:	City of Clearwater Public Utilities Department	PERMIT NUMBER:	FL0128937-016-DW1P/RM
MAILING ADDRESS:	1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	LIMIT:	Final
FACILITY:	City of Clearwater Northeast WRF	CLASS SIZE:	MA
LOCATION:	3290 SR 580 Clearwater, FL 34695	MONITORING GROUP NUMBER:	PRT-E
COUNTY:	Pinellas	MONITORING GROUP DESCRIPTION:	Effluent Pretreatment
OFFICE:	Southwest District	RE-SUBMITTED DMR:	<input type="checkbox"/>
		NO DISCHARGE FROM SITE:	<input type="checkbox"/>
		MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 1 Mon. Site No. PRT-E	Permit Requirement				Report (Min.)		Report (Max.)	s.u.		Annually	Grab
Oil and Grease, hexane extr method	Sample Measurement										
PARM Code 00552 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/L		Annually	Grab
Benzene	Sample Measurement										
PARM Code 34030 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Bromoform	Sample Measurement										
PARM Code 32104 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride	Sample Measurement										
PARM Code 32102 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chlorobenzene	Sample Measurement										
PARM Code 34301 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

\*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Chlorodibromomethane	Sample Measurement										
PARM Code 34306 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroethane	Sample Measurement										
PARM Code 85811 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chloroethyl vinyl ether (mixed)	Sample Measurement										
PARM Code 34576 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Chloroform	Sample Measurement										
PARM Code 32106 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Dichlorobromomethane	Sample Measurement										
PARM Code 32101 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene	Sample Measurement										
PARM Code 34536 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichlorobenzene	Sample Measurement										
PARM Code 34566 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene	Sample Measurement										
PARM Code 34571 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1-dichloroethane	Sample Measurement										
PARM Code 34496 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane	Sample Measurement										
PARM Code 32103 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,1-dichloroethylene	Sample Measurement										
PARM Code 34501 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane	Sample Measurement										
PARM Code 34541 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,3-dichloropropene	Sample Measurement										
PARM Code 77163 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Ethylbenzene	Sample Measurement										
PARM Code 34371 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl bromide	Sample Measurement										
PARM Code 34413 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methyl chloride	Sample Measurement										
PARM Code 34418 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Methylene chloride	Sample Measurement										
PARM Code 34423 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2,2-tetrachloroethane	Sample Measurement										
PARM Code 34516 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene	Sample Measurement										
PARM Code 34475 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Toluene	Sample Measurement										
PARM Code 34010 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-E From: _____ To: _____	PERMIT NUMBER: FL0128937-016-DW1P/RM					
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
1,2-trans-dichloroethylene	Sample Measurement									
PARM Code 34546 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane	Sample Measurement									
PARM Code 34506 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane	Sample Measurement									
PARM Code 34511 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Trichloroethylene	Sample Measurement									
PARM Code 39180 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
Vinyl chloride	Sample Measurement									
PARM Code 39175 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab
2-chlorophenol	Sample Measurement									
PARM Code 34586 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenol	Sample Measurement									
PARM Code 34601 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dimethylphenol	Sample Measurement									
PARM Code 34606 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,6-dinitro-o-cresol	Sample Measurement									
PARM Code 34657 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrophenol	Sample Measurement									
PARM Code 34616 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-E	PERMIT NUMBER: FL0128937-016-DW1P/RM					
			From: _____	To: _____						
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2-nitrophenol	Sample Measurement									
PARM Code 34591 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-nitrophenol	Sample Measurement									
PARM Code 34646 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
p-chloro-m-cresol	Sample Measurement									
PARM Code 82627 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol	Sample Measurement									
PARM Code 39032 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenol, Single Compound	Sample Measurement									
PARM Code 34694 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4,6-trichlorophenol	Sample Measurement									
PARM Code 34621 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthene	Sample Measurement									
PARM Code 34205 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Acenaphthylene	Sample Measurement									
PARM Code 34200 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Anthracene	Sample Measurement									
PARM Code 34220 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzidine	Sample Measurement									
PARM Code 39120 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-E	PERMIT NUMBER: FL0128937-016-DW1P/RM					
			From: _____	To: _____						
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Benzo(a)anthracene	Sample Measurement									
PARM Code 34526 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene	Sample Measurement									
PARM Code 34247 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(b)fluoranthene (3,4-benzo)	Sample Measurement									
PARM Code 79531 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(ghi)perylene	Sample Measurement									
PARM Code 34521 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(k)fluoranthene	Sample Measurement									
PARM Code 34242 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethoxy) methane	Sample Measurement									
PARM Code 34278 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroethyl) ether	Sample Measurement									
PARM Code 34273 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-chloroisopropyl) ether	Sample Measurement									
PARM Code 34283 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate	Sample Measurement									
PARM Code 39100 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-bromophenyl phenyl ether	Sample Measurement									
PARM Code 34636 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Butyl benzyl phthalate	Sample Measurement										
PARM Code 34292 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2-chloronaphthalene	Sample Measurement										
PARM Code 34581 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4-chlorophenyl phenyl ether	Sample Measurement										
PARM Code 34641 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chrysene	Sample Measurement										
PARM Code 34320 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dibenzo (a,h) anthracene	Sample Measurement										
PARM Code 34556 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
3,3'-dichlorobenzidine	Sample Measurement										
PARM Code 34631 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Diethyl phthalate	Sample Measurement										
PARM Code 34336 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dimethyl phthalate	Sample Measurement										
PARM Code 34341 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-butyl phthalate	Sample Measurement										
PARM Code 39110 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dinitrotoluene	Sample Measurement										
PARM Code 34611 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:	PRT-E	PERMIT NUMBER: FL0128937-016-DW1P/RM					
	MONITORING PERIOD	From:	To:							
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
2,6-dinitrotoluene	Sample Measurement									
PARM Code 34626 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Di-n-octyl phthalate	Sample Measurement									
PARM Code 34596 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2-diphenylhydrazine	Sample Measurement									
PARM Code 34346 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluoranthene	Sample Measurement									
PARM Code 34376 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Fluorene	Sample Measurement									
PARM Code 34381 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobenzene	Sample Measurement									
PARM Code 39700 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobutadiene	Sample Measurement									
PARM Code 39702 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorocyclopentadiene	Sample Measurement									
PARM Code 34386 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Hexachloroethane	Sample Measurement									
PARM Code 34396 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Indeno (1,2,3-Cd) pyrene	Sample Measurement									
PARM Code 34403 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Isophorone	Sample Measurement										
PARM Code 34408 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Naphthalene	Sample Measurement										
PARM Code 34696 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Nitrobenzene	Sample Measurement										
PARM Code 34447 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodimethylamine	Sample Measurement										
PARM Code 34438 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodi-n-propylamine	Sample Measurement										
PARM Code 34428 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
N-nitrosodiphenylamine	Sample Measurement										
PARM Code 34433 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Phenanthrene	Sample Measurement										
PARM Code 34461 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Pyrene	Sample Measurement										
PARM Code 34469 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
1,2,4-trichlorobenzene	Sample Measurement										
PARM Code 34551 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Aldrin	Sample Measurement										
PARM Code 39330 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Alpha-bhc	Sample Measurement										
PARM Code 39336 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
B-bhc-beta	Sample Measurement										
PARM Code 39338 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane)	Sample Measurement										
PARM Code 39782 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Delta benzene hexachloride	Sample Measurement										
PARM Code 34259 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)	Sample Measurement										
PARM Code 39350 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDT (p,p'-DDT)	Sample Measurement										
PARM Code 39300 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDE (p,p'-DDE)	Sample Measurement										
PARM Code 39320 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
4,4'-DDD (p,p'-DDD)	Sample Measurement										
PARM Code 39310 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Dieldrin	Sample Measurement										
PARM Code 39380 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
A-endosulfan-alpha	Sample Measurement										
PARM Code 34361 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	PRT-E	PERMIT NUMBER: FL0128937-016-DW1P/RM					
			From: _____	To: _____						
Parameter		Quantity or Loading	Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
B-endosulfan-beta	Sample Measurement									
PARM Code 34356 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endosulfan sulfate	Sample Measurement									
PARM Code 34351 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin	Sample Measurement									
PARM Code 39390 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Endrin aldehyde	Sample Measurement									
PARM Code 34366 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor	Sample Measurement									
PARM Code 39410 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide	Sample Measurement									
PARM Code 39420 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1242	Sample Measurement									
PARM Code 39496 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1254	Sample Measurement									
PARM Code 39504 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1221	Sample Measurement									
PARM Code 39488 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1232	Sample Measurement									
PARM Code 39492 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		PRT-E		PERMIT NUMBER: FL0128937-016-DW1P/RM					
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
PCB-1248	Sample Measurement										
PARM Code 39500 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1260	Sample Measurement										
PARM Code 39508 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
PCB-1016	Sample Measurement										
PARM Code 34671 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene	Sample Measurement										
PARM Code 39400 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Antimony, Total Recoverable	Sample Measurement										
PARM Code 01268 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable	Sample Measurement										
PARM Code 00978 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable	Sample Measurement										
PARM Code 00998 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable	Sample Measurement										
PARM Code 01113 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable	Sample Measurement										
PARM Code 01118 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC
Copper, Total Recoverable	Sample Measurement										
PARM Code 01119 1 Mon. Site No. PRT-E	Permit Requirement					Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP PRT-E      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:      MONITORING PERIOD From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Lead, Total Recoverable	Sample Measurement										
PARM Code 01114 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Mercury, Total Recoverable	Sample Measurement										
PARM Code 71901 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	
Nickel, Total Recoverable	Sample Measurement										
PARM Code 01074 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Selenium, Total Recoverable	Sample Measurement										
PARM Code 00981 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Silver, Total Recoverable	Sample Measurement										
PARM Code 01079 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Thallium, Total Recoverable	Sample Measurement										
PARM Code 00982 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Zinc, Total Recoverable	Sample Measurement										
PARM Code 01094 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	24-hr FPC	
Cyanide, Total Recoverable	Sample Measurement										
PARM Code 78248 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	
Phenolic Compounds, Total Recoverable	Sample Measurement										
PARM Code 70029 1 Mon. Site No. PRT-E	Permit Requirement				Report (An.Avg.)	Report (Max.)	ug/L		Annually	Grab	

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME:	City of Clearwater Public Utilities Department	PERMIT NUMBER:	FL0128937-016-DW1P/RM
MAILING ADDRESS:	1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	LIMIT:	Final
FACILITY:	City of Clearwater Northeast WRF	CLASS SIZE:	MA
LOCATION:	3290 SR 580 Clearwater, FL 34695	MONITORING GROUP NUMBER:	PRT-R
COUNTY:	Pinellas	MONITORING GROUP DESCRIPTION:	Residuals Pretreatment
OFFICE:	Southwest District	RE-SUBMITTED DMR:	<input type="checkbox"/>
		NO DISCHARGE FROM SITE:	<input type="checkbox"/>
		MONITORING PERIOD	From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Arsenic Total, Dry Weight, Sludge	Sample Measurement										
PARM Code 49565 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Cadmium, Sludge, Tot. Dry Wt. (Cd)	Sample Measurement										
PARM Code 78476 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Copper, Sludge, Tot, Dry Wt. (as Cu)	Sample Measurement										
PARM Code 78475 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Lead, Dry Weight	Sample Measurement										
PARM Code 78468 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Mercury, Dry Weight	Sample Measurement										
PARM Code 78471 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite
Molybdenum, Dry Weight	Sample Measurement										
PARM Code 78465 + Mon. Site No. PRT-R	Permit Requirement					Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite

\*FOR THOSE PARAMETERS THAT ARE SAMPLED ANNUALLY, THE MAXIMUM AND AVERAGE CONCENTRATIONS ARE EQUIVALENT AND SHALL BE REPORTED AS SUCH ON THE DMR.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP PRT-R      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:  
 MONITORING PERIOD      From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Nickel, Dry Weight	Sample Measurement										
PARM Code 78469 + Mon. Site No. PRT-R	Permit Requirement				Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite	
Selenium Sludge Solid	Sample Measurement										
PARM Code 61518 + Mon. Site No. PRT-R	Permit Requirement				Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite	
Zinc, Dry Weight	Sample Measurement										
PARM Code 78467 + Mon. Site No. PRT-R	Permit Requirement				Report (An.Avg.)	Report (Max.)	mg/kg		Annually	Composite	

**DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A**

**When Completed submit this report to:** <http://www.fldepportal.com/go/>

PERMITTEE NAME: MAILING ADDRESS:	City of Clearwater Public Utilities Department 1650 North Arcturas Ave. Building C Clearwater, Florida 33765-1945	PERMIT NUMBER:	FL0128937-016-DW1P/RM	
FACILITY: LOCATION:	City of Clearwater Northeast WRF 3290 SR 580 Clearwater, FL 34695	LIMIT: CLASS SIZE: MONITORING GROUP NUMBER: MONITORING GROUP DESCRIPTION: RE-SUBMITTED DMR: NO DISCHARGE FROM SITE: MONITORING NOT REQUIRED: <sup>*</sup>	Final MA RWS-A <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>	REPORT FREQUENCY: PROGRAM:
COUNTY: OFFICE:	Pinellas Southwest District	MONITORING PERIOD	From: _____	To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Antimony, Total Recoverable (GWS = 6)**	Sample Measurement										
PARM Code 01268 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable (GWS = 10)	Sample Measurement										
PARM Code 00978 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Barium, Total Recoverable (GWS = 2,000)	Sample Measurement										
PARM Code 01009 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable (GWS = 4)	Sample Measurement										
PARM Code 00998 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable (GWS = 5)	Sample Measurement										
PARM Code 01113 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01118 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

\*THE "MONITORING NOT REQUIRED" CHECKBOX SHOULD BE SELECTED WHEN A CERTIFICATION STATEMENT IN ACCORDANCE WITH SUBSECTION 62-600.680(2), F.A.C., IS SUBMITTED WITH THIS DMR. SEE CERTIFICATION STATEMENT IN COMMENTS SECTION BELOW.

\*\*GROUND WATER STANDARD (GWS) FOR REFERENCE AND REVIEW ONLY.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

NO NEW NON-DOMESTIC WASTEWATER DISCHARGERS HAVE BEEN ADDED TO THE COLLECTION SYSTEM SINCE THE LAST RECLAIMED WATER OR EFFLUENT ANALYSIS WAS CONDUCTED.  
SIGN AND DATE:

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	RWS-A	PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading	Units	Quality or Concentration	Units	No. Ex.	Frequency of Analysis	Sample Type	
Cyanide, Free (amen. to chlorination)(GWS = 200)	Sample Measurement								
PARM Code 00722 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	Grab
Fluoride, Total (as F) (GWS = 4.0/2.0)	Sample Measurement								
PARM Code 00951 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Lead, Total Recoverable (GWS = 15)	Sample Measurement								
PARM Code 01114 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Mercury, Total Recoverable (GWS = 2)	Sample Measurement								
PARM Code 71901 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Nickel, Total Recoverable (GWS = 100)	Sample Measurement								
PARM Code 01074 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Nitrogen, Nitrate, Total (as N) (GWS = 10)	Sample Measurement								
PARM Code 00620 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Nitrogen, Nitrite, Total (as N) (GWS = 1)	Sample Measurement								
PARM Code 00615 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Nitrite plus Nitrate, Total 1 det. (as N)(GWS = 10)	Sample Measurement								
PARM Code 00630 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Selenium, Total Recoverable (GWS =50)	Sample Measurement								
PARM Code 00981 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Sodium, Total Recoverable (GWS = 160)	Sample Measurement								
PARM Code 00923 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER:		RWS-A	PERMIT NUMBER: FL0128937-016-DW1P/RM						
		MONITORING PERIOD		From: _____ To: _____							
Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Thallium, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 00982 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
1,1-dichloroethylene (GWS = 7)	Sample Measurement										
PARM Code 34501 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane (GWS = 200)	Sample Measurement										
PARM Code 34506 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane (GWS = 5)	Sample Measurement										
PARM Code 34511 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane (GWS = 3)	Sample Measurement										
PARM Code 32103 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane (GWS = 5)	Sample Measurement										
PARM Code 34541 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2,4-trichlorobenzene (GWS = 70)	Sample Measurement										
PARM Code 34551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Benzene (GWS = 1)	Sample Measurement										
PARM Code 34030 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride (GWS = 3)	Sample Measurement										
PARM Code 32102 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Cis-1,2-dichloroethene (GWS = 70)	Sample Measurement										
PARM Code 81686 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

## **DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF

## MONITORING GROUP

RWS-A

PERMIT NUMBER: FL0128937-016-DW1P/RM

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dichloromethane (methylene chloride)(GWS = 5)	Sample Measurement										
PARM Code 03821 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Ethylbenzene (GWS = 700)	Sample Measurement										
PARM Code 34371 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Monochlorobenzene (GWS = 100)	Sample Measurement										
PARM Code 34031 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene (GWS = 600)	Sample Measurement										
PARM Code 34536 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene (GWS = 75)	Sample Measurement										
PARM Code 34571 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Styrene, Total (GWS = 100)	Sample Measurement										
PARM Code 77128 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene (GWS = 3)	Sample Measurement										
PARM Code 34475 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Toluene (GWS = 1,000)	Sample Measurement										
PARM Code 34010 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-trans-dichloroethylene (GWS = 100)	Sample Measurement										
PARM Code 34546 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Trichloroethylene (GWS = 3)	Sample Measurement										
PARM Code 39180 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD		RWS-A		PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading		Units	Quality or Concentration		Units	No. Ex.	Frequency of Analysis	Sample Type
Vinyl chloride (GWS = 1)	Sample Measurement									
PARM Code 39175 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	Grab
Xylenes (GWS = 10,000)	Sample Measurement									
PARM Code 81551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	Grab
2,3,7,8-tetrachlorodibenzo-p-dioxin(GWS = 3x10^-5)	Sample Measurement									
PARM Code 34675 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
2,4-dichlorophenoxyacetic acid (GWS = 70)	Sample Measurement									
PARM Code 39730 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Silvex (GWS = 50)	Sample Measurement									
PARM Code 39760 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Alachlor (GWS = 2)	Sample Measurement									
PARM Code 39161 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Atrazine (GWS = 3)	Sample Measurement									
PARM Code 39033 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Benzo(a)pyrene (GWS = 0.2)	Sample Measurement									
PARM Code 34247 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Carbofuran (GWS = 40)	Sample Measurement									
PARM Code 81405 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Chlordane (tech mix. and metabolites)(GWS = 2)	Sample Measurement									
PARM Code 39350 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	RWS-A	PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading	Units	Quality or Concentration	Units	No. Ex.	Frequency of Analysis	Sample Type	
Dalapon (GWS = 200)	Sample Measurement								
PARM Code 38432 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Bis(2-ethylhexyl)adipate (GWS = 400)	Sample Measurement								
PARM Code 77903 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate (GWS = 6)	Sample Measurement								
PARM Code 39100 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Dibromochloropropane (DBCP) (GWS = 0.2)	Sample Measurement								
PARM Code 82625 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	Grab
Dinoseb (GWS = 7)	Sample Measurement								
PARM Code 30191 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Diquat (GWS = 20)	Sample Measurement								
PARM Code 04443 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Endothall (GWS = 100)	Sample Measurement								
PARM Code 38926 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Endrin (GWS = 2)	Sample Measurement								
PARM Code 39390 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Ethylenedibromide (1,2-dibromoethane)(GWS = 0.02)	Sample Measurement								
PARM Code 77651 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	Grab
Glyphosate (GWS = 0.7)	Sample Measurement								
PARM Code 79743 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD		RWS-A		PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading		Units	Quality or Concentration		Units	No. Ex.	Frequency of Analysis	Sample Type
Heptachlor (GWS = 0.4)	Sample Measurement									
PARM Code 39410 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Heptachlor epoxide (GWS = 0.2)	Sample Measurement									
PARM Code 39420 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Hexachlorobenzene (GWS = 1)	Sample Measurement									
PARM Code 39700 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Hexachlorocyclopentadiene (GWS = 50)	Sample Measurement									
PARM Code 34386 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Gamma BHC (Lindane) (GWS = 0.2)	Sample Measurement									
PARM Code 39782 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Methoxychlor (GWS = 40)	Sample Measurement									
PARM Code 39480 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Oxamyl (vydate) (GWS = 200)	Sample Measurement									
PARM Code 38865 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Pentachlorophenol (GWS = 1)	Sample Measurement									
PARM Code 39032 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Picloram (GWS = 500)	Sample Measurement									
PARM Code 39720 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC
Polychlorinated Biphenyls (PCBs)(GWS = 0.5)	Sample Measurement									
PARM Code 39516 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY:	City of Clearwater Northeast WRF		MONITORING GROUP NUMBER: MONITORING PERIOD	RWS-A	PERMIT NUMBER: FL0128937-016-DW1P/RM				
Parameter		Quantity or Loading	Units	Quality or Concentration	Units	No. Ex.	Frequency of Analysis	Sample Type	
Simazine (GWS = 4)	Sample Measurement								
PARM Code 39055 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Toxaphene (GWS = 3)	Sample Measurement								
PARM Code 39400 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Trihalomethane, Total by summation(GWS = 0.080)	Sample Measurement								
PARM Code 82080 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	Grab
Radium 226 + Radium 228, Total (GWS = 5)	Sample Measurement								
PARM Code 11503 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	pCi/L	Annually	24-hr FPC
Alpha, Gross Particle Activity (GWS = 15)	Sample Measurement								
PARM Code 80045 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	pCi/L	Annually	24-hr FPC
Aluminum, Total Recoverable (GWS = 0.2)	Sample Measurement								
PARM Code 01104 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Chloride (as Cl) (GWS = 250)	Sample Measurement								
PARM Code 00940 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Iron, Total Recoverable (GWS = 0.3)	Sample Measurement								
PARM Code 00980 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	mg/L	Annually	24-hr FPC
Copper, Total Recoverable (GWS = 1,000)	Sample Measurement								
PARM Code 01119 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC
Manganese, Total Recoverable (GWS = 50)	Sample Measurement								
PARM Code 11123 P Mon. Site No. RWS-A	Permit Requirement					Report (Max.)	ug/L	Annually	24-hr FPC

**DISCHARGE MONITORING REPORT - PART A (Continued)**

FACILITY: City of Clearwater Northeast WRF      MONITORING GROUP RWS-A      PERMIT NUMBER: FL0128937-016-DW1P/RM  
 NUMBER:      MONITORING PERIOD From: \_\_\_\_\_ To: \_\_\_\_\_

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Silver, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01079 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Sulfate, Total (GWS = 250)	Sample Measurement										
PARM Code 00945 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Zinc, Total Recoverable (GWS = 5,000)	Sample Measurement										
PARM Code 01094 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
pH (GWS = 6.5-8.5)	Sample Measurement										
PARM Code 00400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	s.u.		Annually	Grab
Solids, Total Dissolved (TDS) (GWS = 500)	Sample Measurement										
PARM Code 70295 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Foaming Agents (GWS = 0.5)	Sample Measurement										
PARM Code 01288 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

## DAILY SAMPLE RESULTS - PART B

Permit Number:  
Monitoring Period

FL0128937-016-DW1P/RM  
From: \_\_\_\_\_ To: \_\_\_\_\_

Facility: City of Clearwater Northeast WRF

	BOD, Carbonaceous 5 day, 20C mg/L	Chlorine, Total Residual (For Disinfection) mg/L	Coliform, Fecal #/100mL	Enterococci #/100mL	Nitrogen, Total mg/L	Phosphorus, Total (as P) mg/L	Solids, Total Suspended mg/L	pH (minimum) s.u.	pH (maximum) s.u.	Solids, Total Suspended mg/L	Turbidity NTU
Code	80082	50060	74055	31639	00600	00665	00530	00400	00400	00530	00070
Mon. Site	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFA-01	EFB-01	EFB-01
1											
2											
3											
4											
5											
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26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

**PLANT STAFFING:**

Day Shift Operator	Class: _____	Certificate No: _____	Name: _____
Evening Shift Operator	Class: _____	Certificate No: _____	Name: _____
Night Shift Operator	Class: _____	Certificate No: _____	Name: _____
Lead Operator	Class: _____	Certificate No: _____	Name: _____

## DAILY SAMPLE RESULTS - PART B

Permit Number:  
Monitoring Period

FL0128937-016-DW1P/RM

From: \_\_\_\_\_ To: \_\_\_\_\_

Facility: City of Clearwater Northeast WRF

	Chlorine, Total Residual (For Dechlorinatio n) mg/L	Copper, Total Recoverable mg/L	Dichlorobro momethane ug/L	Oxygen, Dissolved (DO) mg/L	Flow MGD	Flow MGD	Flow MGD	Flow MGD	Flow MGD	BOD, Carbonaceou s 5 day, 20C (Influent) mg/L
Code	50060	01119	32101	00300	50050	50050	50050	50050	50050	80082
Mon. Site	EFD-01	EFD-01	EFD-01	EFD-01	FLW-1	FLW-02	FLW-03	FLW-04	FLW-05	FLW-06
1										
2										
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31										
Total										
Mo. Avg.										

PLANT STAFFING:

Day Shift Operator      Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_

Evening Shift Operator    Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_

Night Shift Operator     Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_

Lead Operator            Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_

## DAILY SAMPLE RESULTS - PART B

Permit Number:  
Monitoring Period

FL0128937-016-DW1P/RM  
From: \_\_\_\_\_ To: \_\_\_\_\_

Facility: City of Clearwater Northeast WRF

	Solids, Total Suspended (Influent) mg/L	Biosolids Temperature Degrees C (Min)	Biosolids Treatment Time Days (Min)								
Code	00530										
Mon. Site	INF-01	RMP-B3	RMP-B2								
1											
2											
3											
4											
5											
6											
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31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator      Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_  
 Evening Shift Operator      Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_  
 Night Shift Operator      Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_  
 Lead Operator      Class: \_\_\_\_\_ Certificate No: \_\_\_\_\_ Name: \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28<sup>th</sup> of the month following the monitoring period. Facilities who submit their DMR(s) electronically through eDMR do not need to submit a hardcopy DMR. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS	CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.	NOD	No discharge from/to site.
DRY	Dry Well	OPS	Operations were shutdown so no sample could be taken.
FLD	Flood disaster.	OTH	Other. Please enter an explanation of why monitoring data were not available.
IFS	Insufficient flow for sampling.	SEF	Sampling equipment failure.
LS	Lost sample.		
MNR	Monitoring not required this period.		

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used, unless indicated otherwise in the permit or on the DMR:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

### PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the permittee or authorized representative:

**Resubmitted DMR:** Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)

**No Discharge From Site:** Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.

**Monitoring Period:** Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.

**Sample Measurement:** Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units. Data qualifier codes are not to be reported on Part A.

**No. Ex.:** Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.

**Frequency of Analysis:** The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.

**Sample Type:** The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.

**Signature:** This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.

**Comment and Explanation of Any Violations:** Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

## PART B - DAILY SAMPLE RESULTS

**Monitoring Period:** Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.

**Daily Monitoring Results:** Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.

**Plant Staffing:** List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

## PART D - GROUND WATER MONITORING REPORT

**Monitoring Period:** Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.

**Date Sample Obtained:** Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.

**Time Sample Obtained:** Enter the time the sample was taken.

**Sample Measurement:** Record the results of the analysis. If the result was below the minimum detection limit, indicate that. Data qualifier codes are not to be reported on Part D.

**Detection Limits:** Record the detection limits of the analytical methods used.

**Analysis Method:** Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.

**Sampling Equipment Used:** Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)

**Samples Filtered:** Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).

**Signature:** This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.

**Comments and Explanation:** Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

## SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

**Flow (Limited Wet Weather Discharge):** Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).

**Flow (Upstream):** Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.

**Actual Stream Dilution Ratio:** To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.

**No. of Days the SDF > Stream Dilution Ratio:** For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (\*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "\*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.

**CBOD<sub>5</sub>:** Enter the average CBOD<sub>5</sub> of the reclaimed water discharged during the period shown in duration of discharge.

**TKN:** Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.

**Actual Rainfall:** Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.

**Rainfall During Average Rainfall Year:** On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.

**No. of Days LWW Activated During Calendar Year:** Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.

**Reason for Discharge:** Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

**AMENDED FACT SHEET  
FOR  
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT**

PA FILE NUMBER: FL0128937-016-DW1P/RM

FACILITY NAME: City of Clearwater- Northeast Water Reclamation Facility (WRF)

FACILITY LOCATION: 3290 S.R. 580, Safety Harbor, FL 34695  
Pinellas County

NAME OF PERMITTEE: City of Clearwater

PERMIT WRITER: Belinda Oliver

**1. SUMMARY OF APPLICATION**

a. Chronology of Application

Application Number: FL00129837-016-DW1P/RM

Application Submittal Date: August 21, 2019

b. Type of Facility

Domestic Wastewater Treatment Plant

Ownership Type: County

SIC Code: 4952

c. Facility Capacity

Existing Permitted Capacity: 13.5 mgd Annual Average Daily Flow

Proposed Increase in Permitted Capacity: 0 mgd Annual Average Daily Flow

Proposed Total Permitted Capacity: 13.5 mgd Annual Average Daily Flow

**2. CHANGES REQUESTED BY PERMITTEE:**

In an application for a substantial revision, received on August 21, 2019, the permittee requested the following permit revisions:

- Temporarily bypassing the pumping and grit removal during construction; demolishing the existing one MGD Plant/irrigation tank; converting the four Pickett thickeners back to grit removal using stacked tray head cell technology and re-locating the grit removal unit process to its original configuration immediately following the screening process; rehabilitate two existing hydro-cyclones and one existing grit classifier; installing one new hydro-cyclone and one new grit classifier; installing four new grit pumps, and the construction and installation of a new equalization basin. This permit revision does not include an authorization to increase effluent discharges to surface waters.

In addition, the applicant requested changes to the draft permit on October 8, 2019. Those changes included the following permit revisions:

- Upgrades to the existing North and South sludge and blend tanks with new tank covers and mixers; installation of two new pump station and canopies (Truck Off-Loading pump station and anaerobic digester feed pump station); replacement of the dewatering feed pump station and canopies, rehabilitation of the existing truck off-loading pump stations and the replacement of the aging yard piping.

**3. CHANGES FROM ISSUED PERMIT TO DRAFT PERMIT MODIFICATION:**

The current wastewater permit for this facility FL00128937-014-DW1P/NR and associated revisions FL00128937-015-DW1P/MR, expire on July 1, 2022. The only item changed from the current permit was an updated wastewater treatment description to include the Second Modification changes requested by the permittee.

**4. CHANGES FROM ISSUED DRAFT PERMIT MODIFICATION TO FINAL PERMIT MODIFICATION:**

- a. Corrected a typographical error in Table B.1. in the permit by changing the units for the Parameter, Fecal Coliform from #/100 mL to percent. No change was necessary for the DMR.
- b. The project code was changed from DW1P/RA to DW1P/RM to more closely match the updated project type.

**5. THE ADMINISTRATIVE RECORD**

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received, and additional information is available for public inspection during normal business hours at the location specified in item 6. Copies will be provided at a minimal charge per page.

**6. PROPOSED SCHEDULE FOR PERMIT ISSUANCE**

Draft Permit and Public Notice to Applicant and EPA      September 25, 2019

Public Comment Period    Beginning: October 11, 2019  
    Ending: November 12, 2019

Notice of Permit Issuance    November 19, 2019

**5. DEP CONTACT**

Additional information concerning the permit issuance may be obtained during normal business hours from:

Belinda Oliver  
Engineer  
Southwest District Office  
13051 N. Telecom Pkwy, Suite 101  
Temple Terrace, FL 33637-0926  
[Belinda.Oliver@floridadep.gov](mailto:Belinda.Oliver@floridadep.gov)  
Telephone No.: 813-470-5871

## **SWFWMD ERP Minor Modification**



# Southwest Florida Water Management District

2379 Broad Street, Brooksville, Florida 34604-6899

(352) 796-7211 or 1-800-423-1476 (FL only)

SUNCOM 628-4150 TDD only 1-800-231-6103 (FL only)

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**Bartow Service Office**  
170 Century Boulevard  
Bartow, Florida 33830-7700  
(863) 534-1448 or  
1-800-492-7862 (FL only)

**Sarasota Service Office**  
6750 Fruitville Road  
Sarasota, Florida 34240-9711  
(941) 377-3722 or  
1-800-320-3503 (FL only)

**Tampa Service Office**  
7601 Highway 301 North  
Tampa, Florida 33637-6759  
(813) 985-7481 or  
1-800-836-0797 (FL only)

August 09, 2019

City of Clearwater  
Attn: David Porter  
1650 N. Arcturas Avenue, Building C  
Clearwater, FL 33765

Subject: **Notice of Intended Agency Action - Approval  
ERP Minor Modification**

Project Name: Northeast Water Reclamation Facility Grit, Salsnes & EQ Basin Modifications  
App ID/Permit No: 788702 / 43005372.007  
County: Pinellas  
Letter Received: July 31, 2019  
Expiration Date: August 09, 2024  
Sec/Twp/Rge: S21/T28S/R16E

Dear Permittee(s):

The Southwest Florida Water Management District (District) has completed its review of the application for Environmental Resource Permit modification. Based upon a review of the information you have submitted, the District hereby gives notice of its intended approval of the application.

The File of Record associated with this application can be viewed at <http://www18.swfwmd.state.fl.us/erp/erp/search/ERPSearch.aspx> and is also available for inspection Monday through Friday, except for District holidays, from 8:00 a.m. through 5:00 p.m. at the District's Tampa Service Office, 7601 U.S. Highway 301 North, Tampa, Florida 33637.

If you have any questions or concerns regarding the application or any other information, please contact the Environmental Resource Permit Bureau in the Tampa Service Office.

Sincerely,

Michelle K. Hopkins, P.E.  
Bureau Chief  
Environmental Resource Permit Bureau  
Regulation Division

cc: Thomas Traina P.E., King Engineering Associates, Inc.



# Southwest Florida Water Management District

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(941) 377-3722 or  
1-800-320-3503 (FL only)

**Tampa Service Office**  
7601 Highway 301 North  
Tampa, Florida 33637-6759  
(813) 985-7481 or  
1-800-836-0797 (FL only)

August 09, 2019

City of Clearwater  
Attn: David Porter  
1650 N. Arcturas Avenue, Building C  
Clearwater, FL 33765

Subject: **Notice of Agency Action - Approval**  
**ERP Minor Modification**

Project Name: Northeast Water Reclamation Facility Grit, Salsnes & EQ Basin Modifications  
App ID/Permit No: 788702 / 43005372.007  
County: Pinellas  
Letter Received: July 31, 2019  
Expiration Date: August 09, 2024  
Sec/Twp/Rge: S21/T28S/R16E

Dear Permittee(s):

The Southwest Florida Water Management District (District) is in receipt of your application for the Environmental Resource Permit modification. Based upon a review of the information you submitted, the application is approved.

This modification to Permit No. 40005372.000 authorizes the following:

1. The removal and replacement of a wastewater treatment tank and associated infrastructure. The Engineer-of-Record has demonstrated that the proposed improvements will have no significant impact on the design rate, volume, quality, or manner of stormwater discharge from the site. No adverse off-site/on-site water quantity or quality impacts are expected.
2. All other terms and conditions of Permit No. 40005372.000, dated August 30, 1989 and entitled "NE Wastewater Treatment Facility," apply.

Please refer to the attached Notice of Rights to determine any legal rights you may have concerning the District's agency action on the permit application described in this letter.

If approved construction plans are part of the permit, construction must be in accordance with these plans. These drawings are available for viewing or downloading through the District's Application and Permit Search Tools located at [www.WaterMatters.org/permits](http://www.WaterMatters.org/permits).

The District's action in this matter only becomes closed to future legal challenges from members of the public if such persons have been properly notified of the District's action and no person objects to the District's action within the prescribed period of time following the notification. The District does not publish notices of agency action. If you wish to limit the time within which a person who does not receive actual written notice from the District may request an administrative hearing regarding this action, you are strongly encouraged to publish, at your own expense, a notice of agency action in the legal advertisement section of a newspaper of general circulation in the county or counties where the activity will occur. Publishing notice of agency action will close the window for filing a petition for hearing. Legal requirements and instructions for publishing notices of agency action, as well as a noticing form that can be used, are available from the District's website at [www.WaterMatters.org/permits/noticing](http://www.WaterMatters.org/permits/noticing). If you publish notice of agency action, a copy of the affidavit of publication provided by the newspaper should be sent to the District's Tampa Service Office for retention in this permit's File of Record.

If you have any questions or concerns regarding your permit or any other information, please contact the Environmental Resource Permit Bureau in the Tampa Service Office.

Sincerely,

Michelle K. Hopkins, P.E.  
Bureau Chief  
Environmental Resource Permit Bureau  
Regulation Division

Enclosures: Notice of Rights  
cc: Thomas Traina P.E., King Engineering Associates, Inc.

## **Notice of Rights**

### **ADMINISTRATIVE HEARING**

1. You or any person whose substantial interests are or may be affected by the District's intended or proposed action may request an administrative hearing on that action by filing a written petition in accordance with Sections 120.569 and 120.57, Florida Statutes (F.S.), Uniform Rules of Procedure Chapter 28-106, Florida Administrative Code (F.A.C.) and District Rule 40D-1.1010, F.A.C. Unless otherwise provided by law, a petition for administrative hearing must be filed with (received by) the District within 21 days of receipt of written notice of agency action. "Written notice" means either actual written notice, or newspaper publication of notice, that the District has taken or intends to take agency action. "Receipt of written notice" is deemed to be the fifth day after the date on which actual notice is deposited in the United States mail, if notice is mailed to you, or the date that actual notice is issued, if sent to you by electronic mail or delivered to you, or the date that notice is published in a newspaper, for those persons to whom the District does not provide actual notice.
2. Pursuant to Subsection 373.427(2)(c), F.S., for notices of intended or proposed agency action on a consolidated application for an environmental resource permit and use of state-owned submerged lands concurrently reviewed by the District, a petition for administrative hearing must be filed with (received by) the District within 14 days of receipt of written notice.
3. Pursuant to Rule 62-532.430, F.A.C., for notices of intent to deny a well construction permit, a petition for administrative hearing must be filed with (received by) the District within 30 days of receipt of written notice of intent to deny.
4. Any person who receives written notice of an agency decision and who fails to file a written request for a hearing within 21 days of receipt or other period as required by law waives the right to request a hearing on such matters.
5. Mediation pursuant to Section 120.573, F.S., to settle an administrative dispute regarding District intended or proposed action is not available prior to the filing of a petition for hearing.
6. A request or petition for administrative hearing must comply with the requirements set forth in Chapter 28-106, F.A.C. A request or petition for a hearing must: (1) explain how the substantial interests of each person requesting the hearing will be affected by the District's intended action or proposed action, (2) state all material facts disputed by the person requesting the hearing or state that there are no material facts in dispute, and (3) otherwise comply with Rules 28-106.201 and 28-106.301, F.A.C. Chapter 28-106, F.A.C. can be viewed at [www.flrules.org](http://www.flrules.org) or at the District's website at [www.WaterMatters.org/permits/rules](http://www.WaterMatters.org/permits/rules).
7. A petition for administrative hearing is deemed filed upon receipt of the complete petition by the District Agency Clerk at the District's Tampa Service Office during normal business hours, which are 8:00 a.m. to 5:00 p.m., Monday through Friday, excluding District holidays. Filings with the District Agency Clerk may be made by mail, hand-delivery or facsimile transfer (fax). The District does not accept petitions for administrative hearing by electronic mail. Mailed filings must be addressed to, and hand-delivered filings must be delivered to, the Agency Clerk, Southwest Florida Water Management District, 7601 Highway 301 North, Tampa, FL 33637-6759. Faxed filings must be transmitted to the District Agency Clerk at (813) 367-9776. Any petition not received during normal business hours shall be filed as of 8:00 a.m. on the next business day. The District's acceptance of faxed petitions for filing is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation, available for viewing at [www.WaterMatters.org/about](http://www.WaterMatters.org/about).

## **JUDICIAL REVIEW**

1. Pursuant to Sections 120.60(3) and 120.68, F.S., a party who is adversely affected by District action may seek judicial review of the District's action. Judicial review shall be sought in the Fifth District Court of Appeal or in the appellate district where a party resides or as otherwise provided by law.
2. All proceedings shall be instituted by filing an original notice of appeal with the District Agency Clerk within 30 days after the rendition of the order being appealed, and a copy of the notice of appeal, accompanied by any filing fees prescribed by law, with the clerk of the court, in accordance with Rules 9.110 and 9.190 of the Florida Rules of Appellate Procedure (Fla. R. App. P.). Pursuant to Fla. R. App. P. 9.020(h), an order is rendered when a signed written order is filed with the clerk of the lower tribunal.

## GEOTECHNICAL SOIL REPORT

**Driggers Engineering Services, Inc. Report of Geotechnical Investigation,  
dated March 23, 2017**

**REPORT OF THE GEOTECHNICAL INVESTIGATION  
PROPOSED EQUALIZATION TANK  
NORTHEAST WWTP  
PINELLAS COUNTY, FLORIDA**



King Engineering Associates, Inc.  
4921 Memorial Highway  
Suite 300  
One Memorial Center  
Tampa FL 33634

March 23, 2017

ATTENTION: Mr. Thomas A. Traina, P.E.

**RE: Report of the Geotechnical Investigation  
Proposed Equalization Tank  
Northeast WWTP  
Pinellas County, Florida  
Our File DES 167824**

Dear Tom:

In accordance with your authorization, **DRIGGERS ENGINEERING SERVICES, INC.** has completed an investigation of subsurface conditions in the area planned for the proposed equalization tank. Presented herein are the results of our geotechnical investigation, together with recommendations for subgrade preparation and foundation support.

#### **FIELD INVESTIGATION PROGRAM**

Plate I of the report attachments identifies the respective positioning of three (3) Standard Penetration Test (SPT) borings that were performed to investigate subsurface conditions in the area of the proposed equalization tank. The Standard Penetration Test boring logs present visual and estimated Unified soil classification corresponding to each sample interval. The test boring logs also present tabulated and graphically plotted penetration resistance values corresponding to each sample interval. Please note that the lines connecting the graphically plotted penetration resistance values are for ease of visual interpretation and do not imply a linear variation in soil properties.

At each SPT boring location, the upper six (6) feet was hand augered as a double-check for utility conflicts. A hand cone penetrometer sounding was performed with penetration

resistance in tons per square foot recorded at one (1) foot intervals. Results are included in the report appendix together with a description of the Hand Cone Penetration test.

The test borings were performed utilizing the Standard Penetration Test method of sampling per ASTM D-1586. Logs of the SPT borings are presented in the report attachments and illustrated in profile on Plate II of the report Appendix. A brief description of this method of testing is also appended for the interested reader.

Two (2) shallow classification borings were also requested to a depth of five (5) feet at the approximate locations identified on Plate I. Logs of the classification borings are included in the report attachments reflecting visual together with estimated Unified soil classification.

### **LABORATORY TESTING**

A limited laboratory testing program was also undertaken to aid in establishing the engineering characteristics of the subsurface soils. Our laboratory tests included grainsize analyses, Atterberg Limits and natural moisture content determinations. The results of our laboratory tests are included in the report attachments.

### **GENERALIZED SUBSURFACE CONDITIONS**

The program of test borings identified a somewhat variable near-surface soil profile. Based upon our historic experience conducting geotechnical investigations at this plant site, test boring SB-2 is generally reflective of topical subsurface conditions. SB-2 reflected the presence of predominately fine sands with trace amounts of organic fines extending to a depth of about eight (8) feet, underlain by silty to slightly clayey sands to some 14 feet below existing grade. The intermediate silty to slightly clayey sands below 10 feet exhibited relatively low penetration resistance values, suggesting loose to very loose conditions.

Penetration resistance values increased below 14 feet as medium dense silty to clayey sands overlay hard and variable cemented clays that extended from a depth of about 23 feet to the surface of the underlying limestone formation encountered at a depth of about 50 feet. The limestone formation continued to the termination depth of about 60 feet, and included interbedded seams of variably cemented clays.

Test boring SB-3 encountered similar conditions to SB-2, with the exception of the presence of a very soft clay seam in the depth range of about eight (8) to 10 feet.

SB-1 was performed very close to the perimeter of the existing effluent irrigation storage tank. This test boring suggested the possible presence of sandy fill soils with pockets of clayey sand within the upper 8 to 10 feet. Below 10 feet, penetration resistance values increased as medium dense slightly silty fine sands continued below 10 feet, terminating above medium dense clayey sands with variable cementation below 13 to 14 feet. It should be noted that the base slab for the existing irrigation storage tank is anticipated at approximate El. +47.5 ft. or about 11 feet below the ground surface at test boring SB-1. Considering the added thickness of the existing tank slab and proximity of this test boring to the existing tank, it is likely that the area at SB-1 had been previously over-excavated to at least 12 feet to construct the tank and then subsequently backfilled to existing grade. Notwithstanding, deeper subsurface conditions, typically below 12 to 14 feet, are very similar to conditions encountered at the neighboring borings SB-2 and SB-3 as well as many other borings that have been performed at this site by our firm over the years.

Classification boring HA-1 appeared to encounter upper zones of sands and sandy clays extending to about 3.4 feet below existing grade. Fine sands occurred below that depth to the termination of the classification boring. These upper sands with pockets or seams of sandy clays also probably represent historically placed fill or backfill materials.

Classification boring HA-2 reflected a more typical near-surface soil profile consisting of predominately fine sands throughout the depth of the classification boring with the exception of a surficial seam of sands with limerock gravel.

Groundwater was encountered in the depth range of about 4.0 feet to 7.4 feet, representing the elevation range of El. +51.2 ft. to El. +51.9 ft., with an average of about El. +51.5 ft. It should be noted that these test borings were performed in late February, during a period of minimal rainfall. One should certainly anticipate a nominal one (1) to two (2) foot rise in groundwater levels during the normal wet season. However, it is recognized that well-developed surface drainage, as is commonly established within a treatment plant site, can tend to diminish seasonal fluctuations in groundwater levels. If critical to design or construction, it would be advisable to install some shallow piezometers and maintain observations of groundwater levels during the upcoming wet season.

## **GEOTECHNICAL EVALUATION AND RECOMMENDATIONS**

**PROPOSED EQUALIZATION TANK** – The proposed equalization tank will overlap the majority of the footprint of the existing effluent irrigation storage tank. Of significance is the fact that the existing tank is supported on a mat foundation which probably occurs at approximate El. +46.5 ft. or some 13 feet below the grade at the perimeter of the existing tank. The base slab for the proposed equalization tank will generally slope from a high of near El. +60.0 ft. down to a low of about El. + 57.0 ft. at the interior perimeter sump location. Considering that the top of the tank wall for the proposed equalization tank will occur at approximate El. +82.8 ft., the proposed construction will result in a superimposed dead and live load of about 1.6 ksf.

The proposed construction calls for the complete removal of the existing effluent irrigation tank which would then necessitate appropriate backfilling and compaction of subgrade soils to re-establish the proposed new tank finished grade.

**FOUNDATION CONDITIONS** – Under normal circumstances the construction of the proposed equalization tank would require no inordinate subgrade preparation nor would total and differential settlements be expected to exceed tolerable levels. However, the removal and backfilling of the existing tank under only a portion of the proposed equalization tank would result in a relatively sharp discontinuity in subgrade support conditions and create the potential for undesirable differential settlement over relatively short lateral distance. Accordingly, it is our recommendation that the entire limits of the equalization tank extending beyond the periphery of the existing irrigation tank also be over-excavated to the same depth as the previous elevation for the existing irrigation tank so that all backfill materials can be uniformly placed and compacted so as to minimize the potential for any excessive differential settlement. The over-excavation should extend throughout the extended limits of the proposed equalization tank plus a margin of not less than ten (10) feet measured at the excavation bottom. The over-excavation and replacement should also encompass any appurtenant critical connecting structures.

Backfill materials should consist of clean cohesionless fills soils generally comprising the SP to SP-SM Unified soil classification or as approved by the project geotechnical engineer. Suitable soils excavated can be reused as backfill. The backfill soils should be densified to not less than 95% of the Modified Proctor maximum dry density per ASTM D-1557. Backfill materials should be placed in lift thicknesses not exceeding 12 inches with each lift uniformly compacted to the aforementioned density requirement which must be confirmed by compaction testing during the backfilling operations.

With appropriate subgrade preparation, we would anticipate that maximum total settlements of the tank interior would be in the range of 1.5 to 2.0 inches with the majority of the settlement occurring rapidly upon first filling. Differential settlements from edge to center would be expected to be on the order of an inch or less. When considering the type of construction, we would anticipate that these magnitudes of expected total and differential movement would be considered tolerable although this should be confirmed by the tank manufacturer.

The perimeter ring wall foundations may be designed based upon an allowable soil bearing pressure of up to 2,500 pounds per square foot (psf).

**SETTLEMENT OBSERVATIONS** – We recommend monitoring elevations around the tank perimeter and perhaps tank interior, where accessible, during initial tank filling. Observations should be maintained on a daily basis during filling and at least twice weekly following filling until the time-rate of settlement diminishes to acceptable levels, which we would expect to occur within two (2) to three (3) weeks. Elevations should be obtained by a qualified surveyor utilizing precise instruments so as to obtain accurate and reproducible elevations to the nearest  $0.002 \pm$  feet. The settlement observations are warranted to check predicted versus actual settlements and allow detection of any localized areas that may be experiencing settlements or differential movements that may exceed desired levels and warrant some remediation.

Although we are not familiar with the details of proposed piping connections, there would certainly be merit in allowing for some rotational flexibility in connections until it can be confirmed that tank settlements have diminished to acceptable levels.

**CONTROL AND MANAGEMENT OF GROUNDWATER** – During the over-excavation and re-compaction operations, it will be necessary to effect proper control and management of groundwater. Groundwater should be maintained at least one (1) foot below the excavation bottom. We would anticipate that this can effectively be accomplished by a combination of perimeter well-points perhaps in combination with an interior gravel drainage blanket and interior sumps. We would strongly recommend that the prospective contractor enlist the services of a qualified de-watering consultant in order to appropriately design the drainage system to effect needed groundwater lowering and avoid any pumping of soil fines.

Where a gravel drainage blanket may be utilized, we would recommend that the drainage blanket be placed above an appropriate geotextile fabric in order to prevent any migration of soil fines into the drainage blanket from below due to the upward hydraulic gradient produced by de-watering operations. The drainage blanket may consist of gravel corresponding to an FDOT No.

57 grading or finer compacted to produce a firm and unyielding condition. Furthermore, the gravel drainage blanket should be covered on the top and sides with an appropriate filter fabric in order to prevent any future downward migration of soil fines from the backfilling operations needed to re-establish existing grades. A geotextile fabric such as a Mirafie 140N or equivalent would be considered suitable.

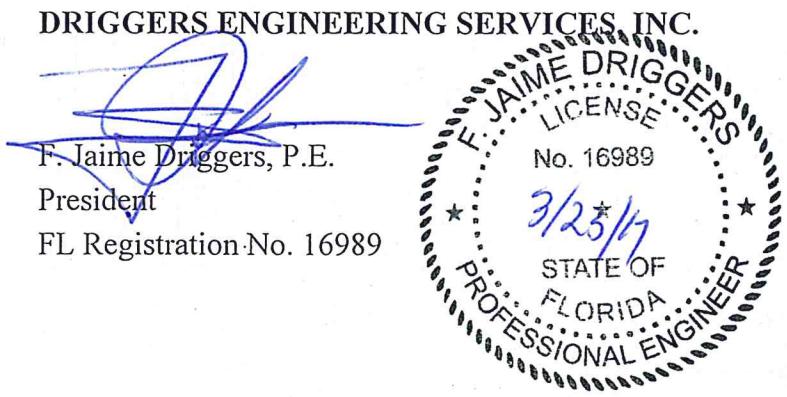
**SPECIAL CONSIDERATIONS** – Although details, to my knowledge, are currently unavailable, the possibility exists that a gravel drainage blanket may have been placed below the existing effluent irrigation tank to facilitate de-watering during construction activities. If present, the gravel blanket may warrant removal and replacement to insure that an appropriate geotextile fabric encapsulates the gravel drainage blanket as discussed above for the ultimate construction of the proposed equalization tank.

**LIGHTLY LOADED GROUND SUPPORTED STRUCTURES** – It is our understanding that there may also be some relatively lightly loaded filters and electrical buildings that we would anticipate would be supported close to existing grade and potentially on shallow mat foundations. We would anticipate that these can be supported with routine subgrade preparation. However, it would certainly be prudent to hand probe these structure areas to check for any historic fill materials that may not be suitable for foundation support and would otherwise warrant removal and replacement with competent structural quality backfill. As details become available with respect to specific structural loading conditions and design grades, we would welcome the opportunity to review this information and offer any additional, more specific recommendations relative to subgrade preparation.

**DRIGGERS ENGINEERING SERVICES** appreciates this opportunity to serve you, and we trust that if you have any questions concerning our report or findings, you will not hesitate to contact the undersigned at your convenience.

Respectfully submitted,

**DRIGGERS ENGINEERING SERVICES, INC.**



F. Jaime Driggers, P.E.

President

FL Registration No. 16989

FJD/ff

FJD-REP\2016\167824

Copies: Email: (1)

**APPENDIX**

**PLATE I – BORING LOCATION PLAN**

**PLATE II - STANDARD PENETRATION TEST BORING PROFILE**

**STANDARD PENETRATION TEST BORING LOGS**

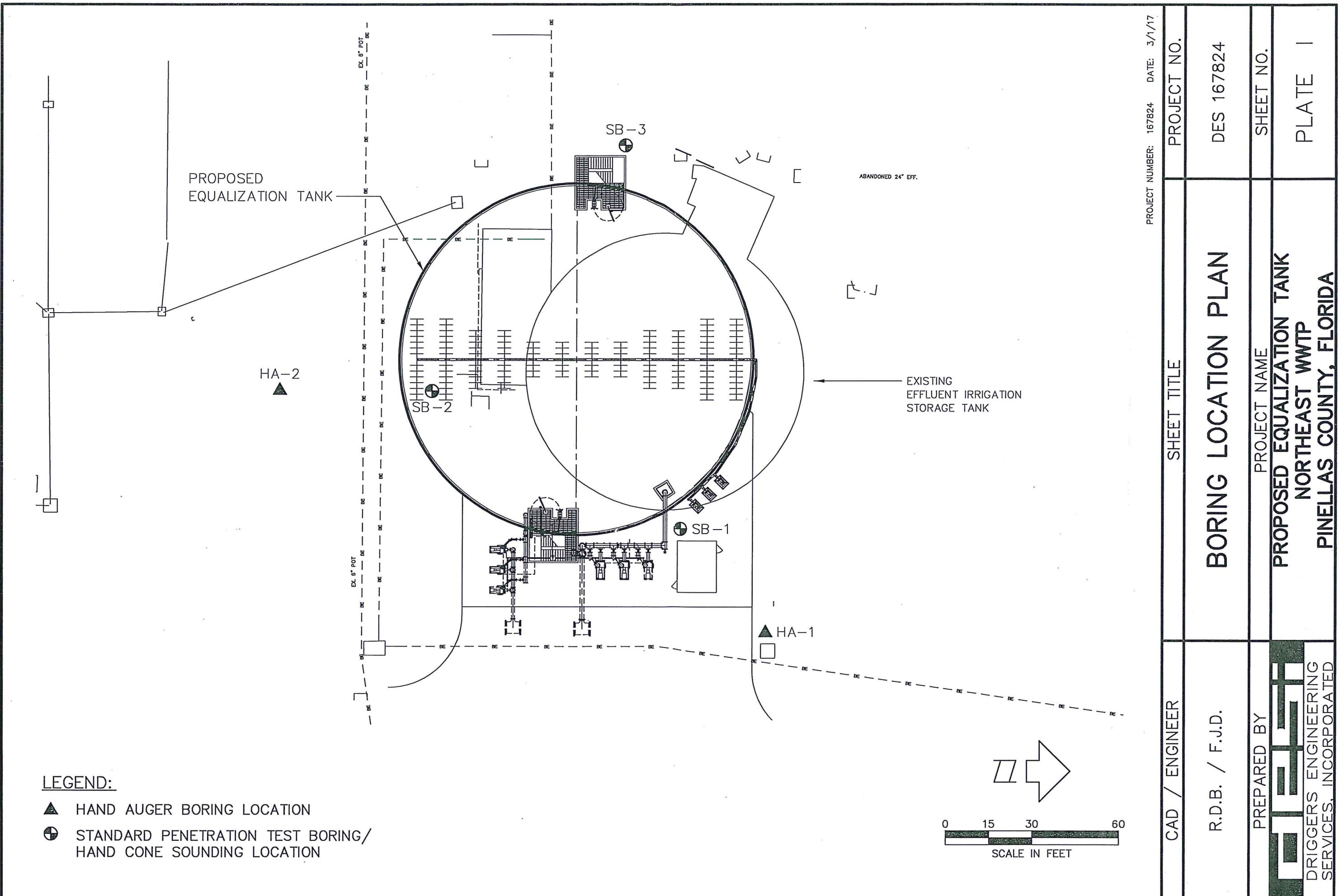
**HAND AUGER AND HAND CONE BORING LOGS**

**SUMMARY OF LABORATORY TESTING**

**GRAINSIZE ANALYSES**

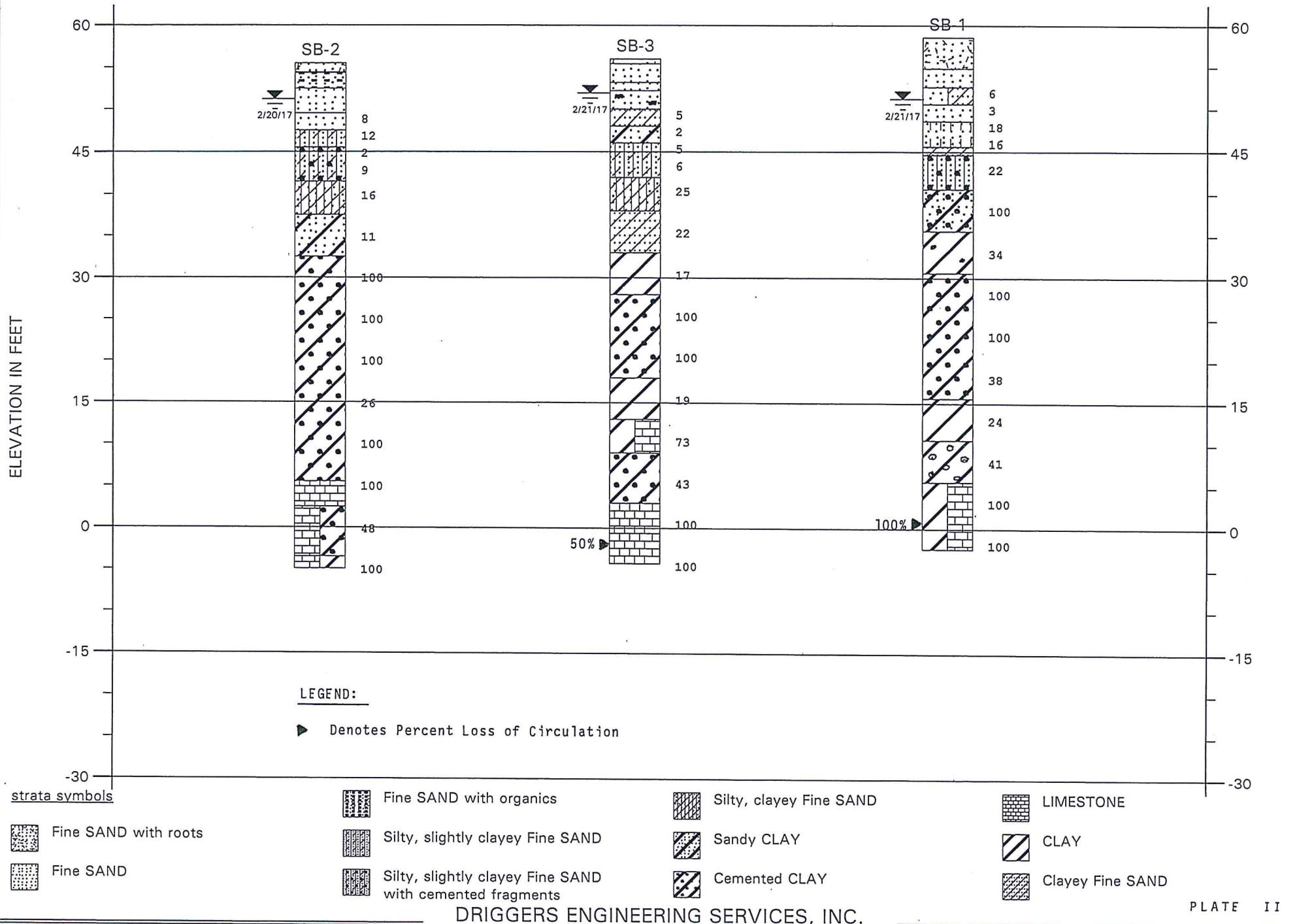
**METHOD OF TESTING**

**PLATE I – BORING LOCATION PLAN**



**PLATE II – STANDARD PENETRATION TEST BORING PROFILE**

**SOIL BORING PROFILE**  
Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida



## **STANDARD PENETRATION TEST BORING LOGS**

**DRIGGERS ENGINEERING SERVICES INCORPORATED**

Project No. DES 167824

**BORING NO. SB-1**

Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I

Foreman J.R.

Completion

Depth 61.0'

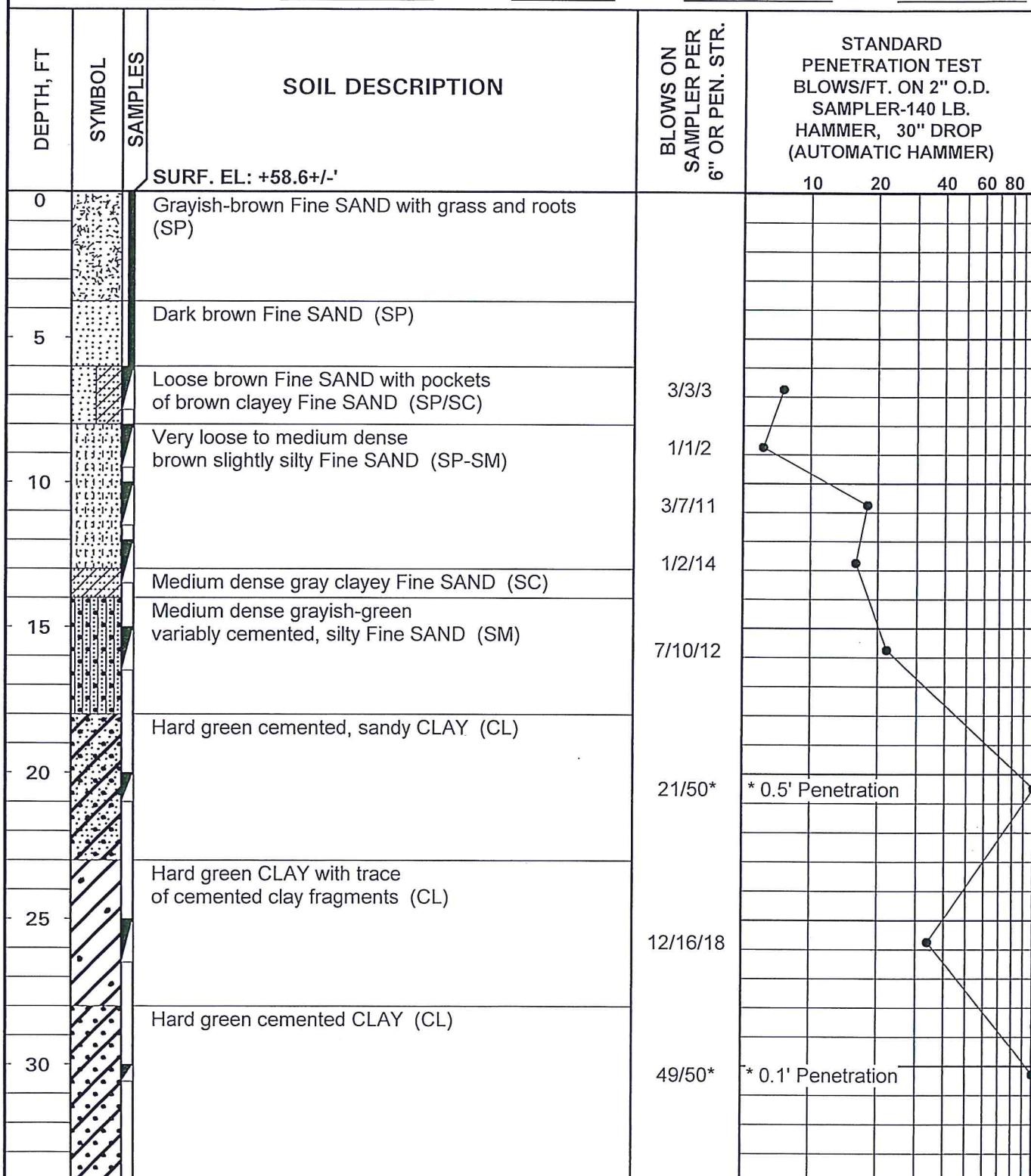
Date 2/21/17

Depth To Water

7.4'

Time

Date 2/21/17



Remarks Borehole Grouted

Casing Length 20.0'

**DRIGGERS ENGINEERING SERVICES INCORPORATED**

Project No. DES 167824

**BORING NO. SB-1**

Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I

Foreman J.R.

Completion

Depth 61.0'

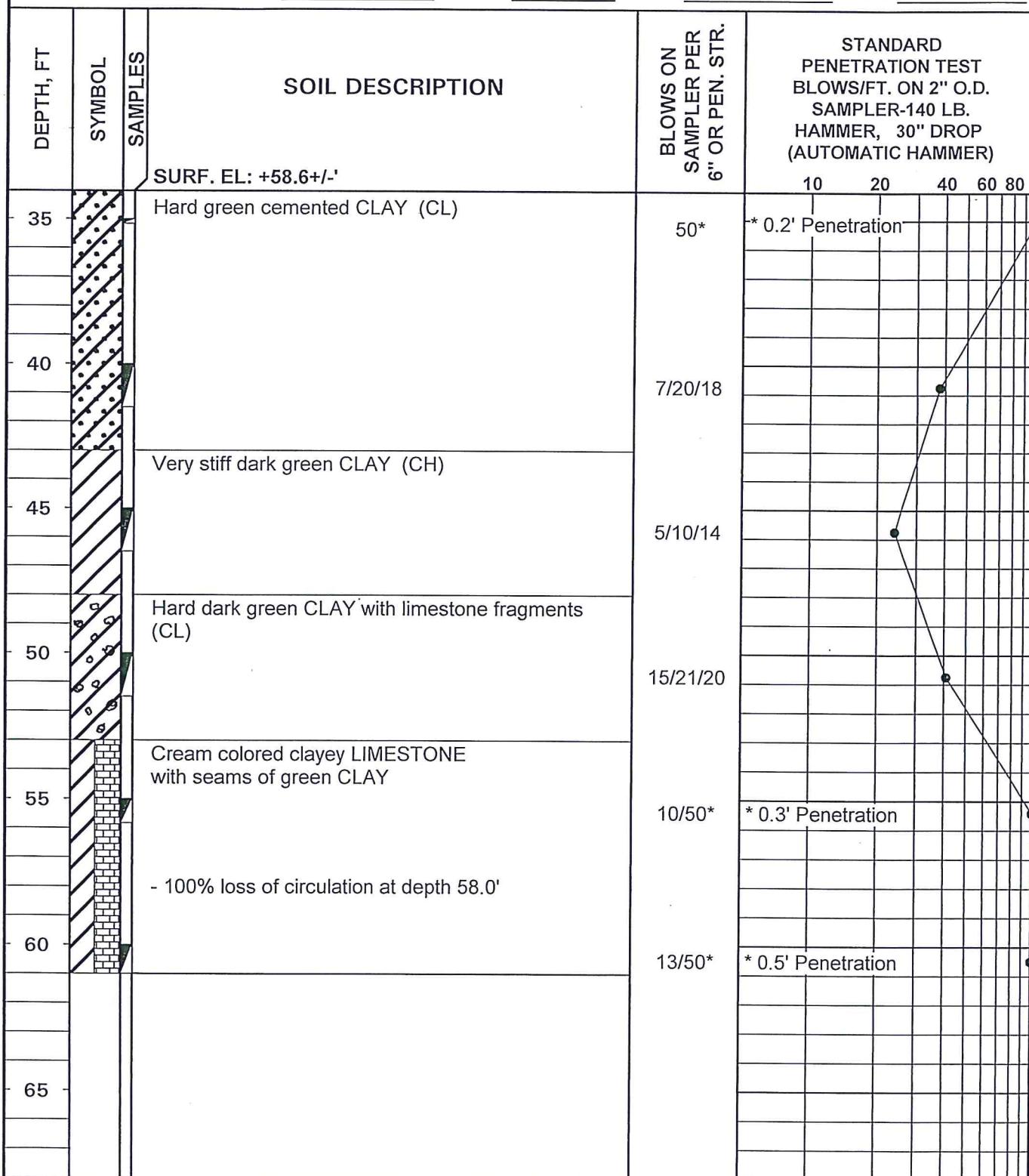
Date 2/21/17

Depth To Water

7.4'

Time

Date 2/21/17



Remarks Borehole Grouted

Casing Length 20.0'

**DRIGGERS ENGINEERING SERVICES INCORPORATED**

Project No. DES 167824

**BORING NO. SB-2**

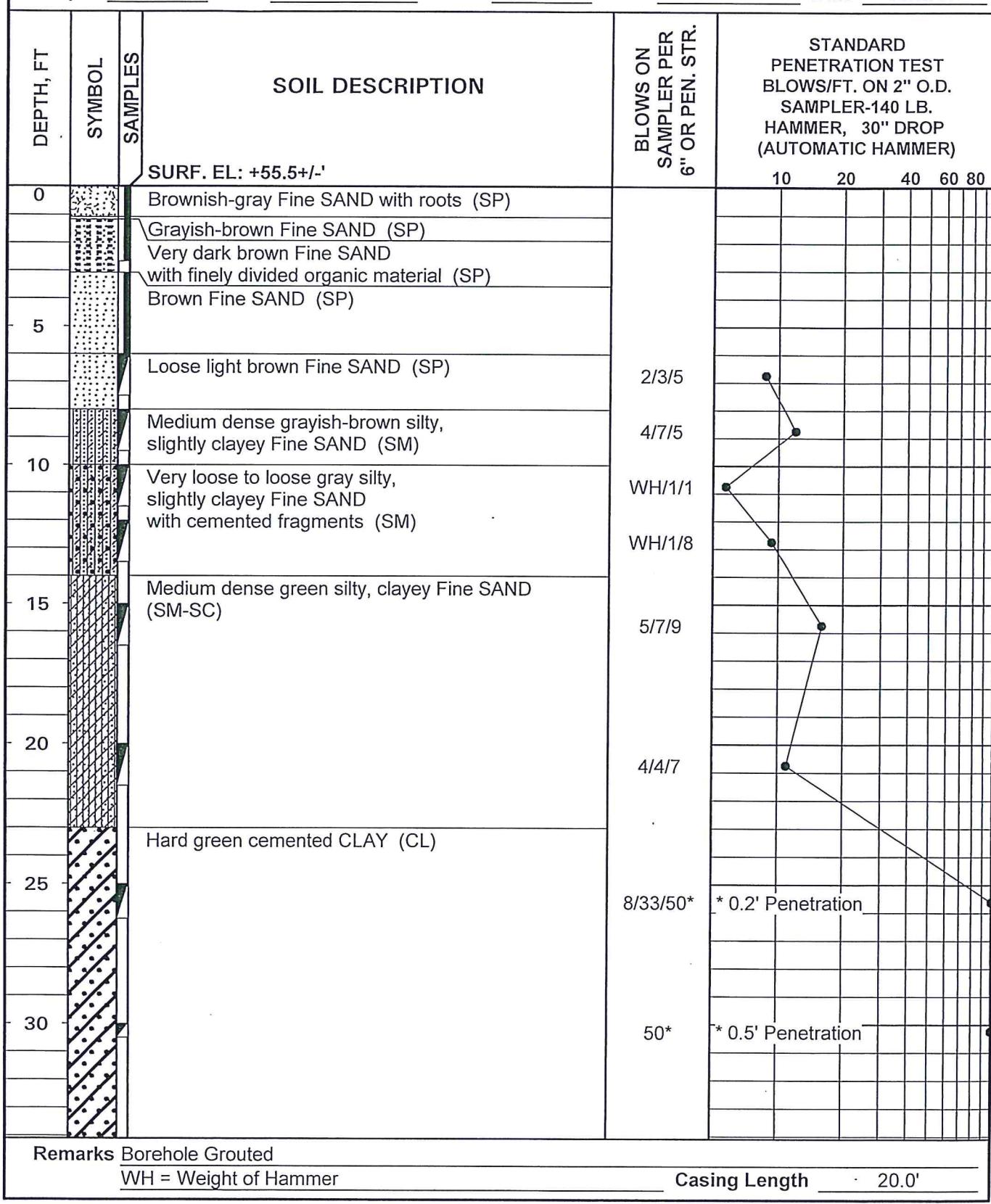
Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I

Foreman J.R.

Completion

Depth 60.4' Date 2/20/17 Depth To Water 4.3' Time \_\_\_\_\_ Date 2/20/17



**DRIGGERS ENGINEERING SERVICES INCORPORATED**

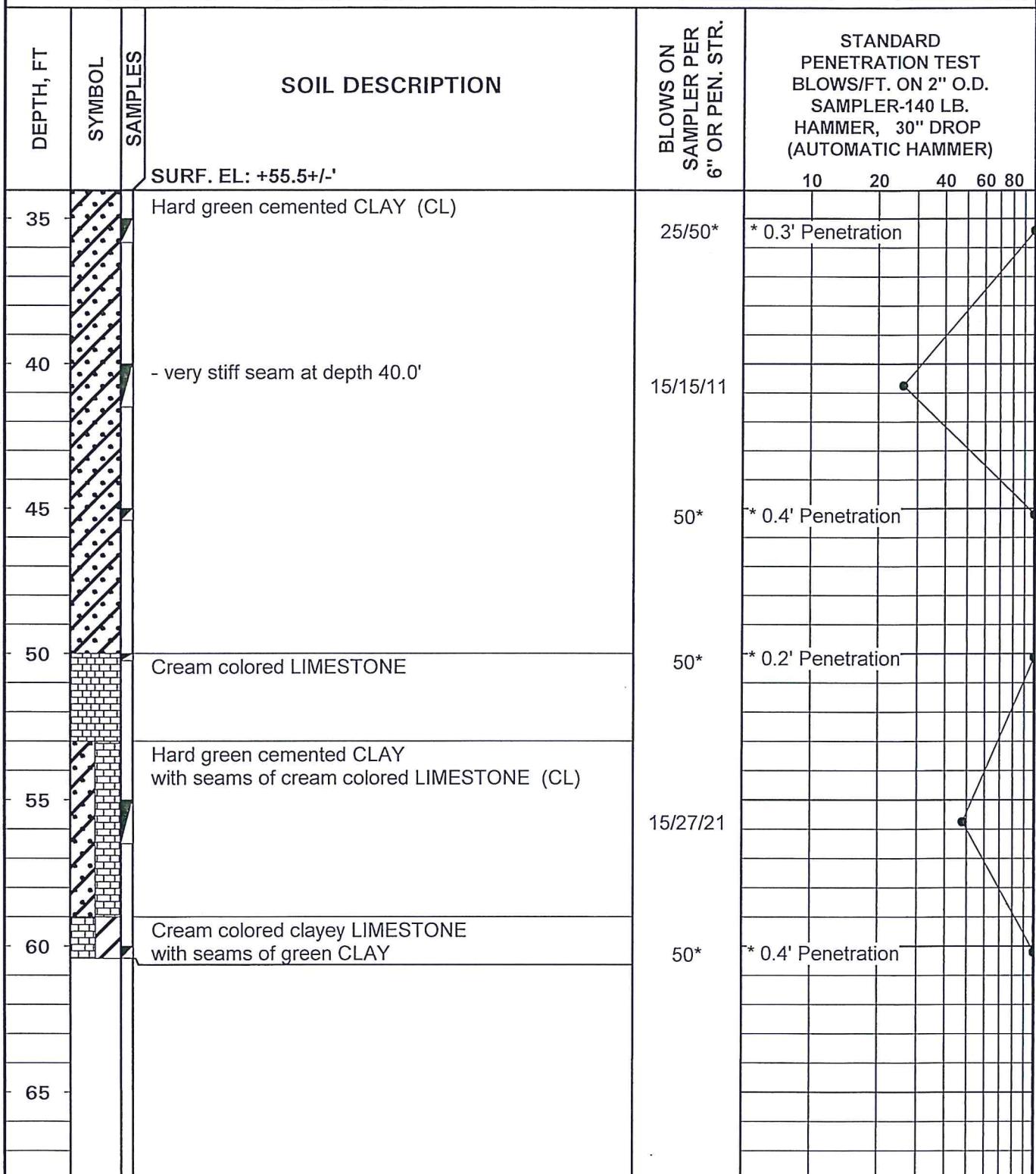
Project No. DES 167824

**BORING NO. SB-2**

Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I Foreman J.R.

Completion Depth 60.4' Date 2/20/17 Depth To Water 4.3' Time \_\_\_\_\_ Date 2/20/17



Remarks Borehole Grouted

WH = Weight of Hammer

Casing Length 20.0'

**DRIGGERS ENGINEERING SERVICES INCORPORATED**

Project No. DES 167824

**BORING NO. SB-3**

Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I

Foreman J.R.

Completion

Depth 60.2'

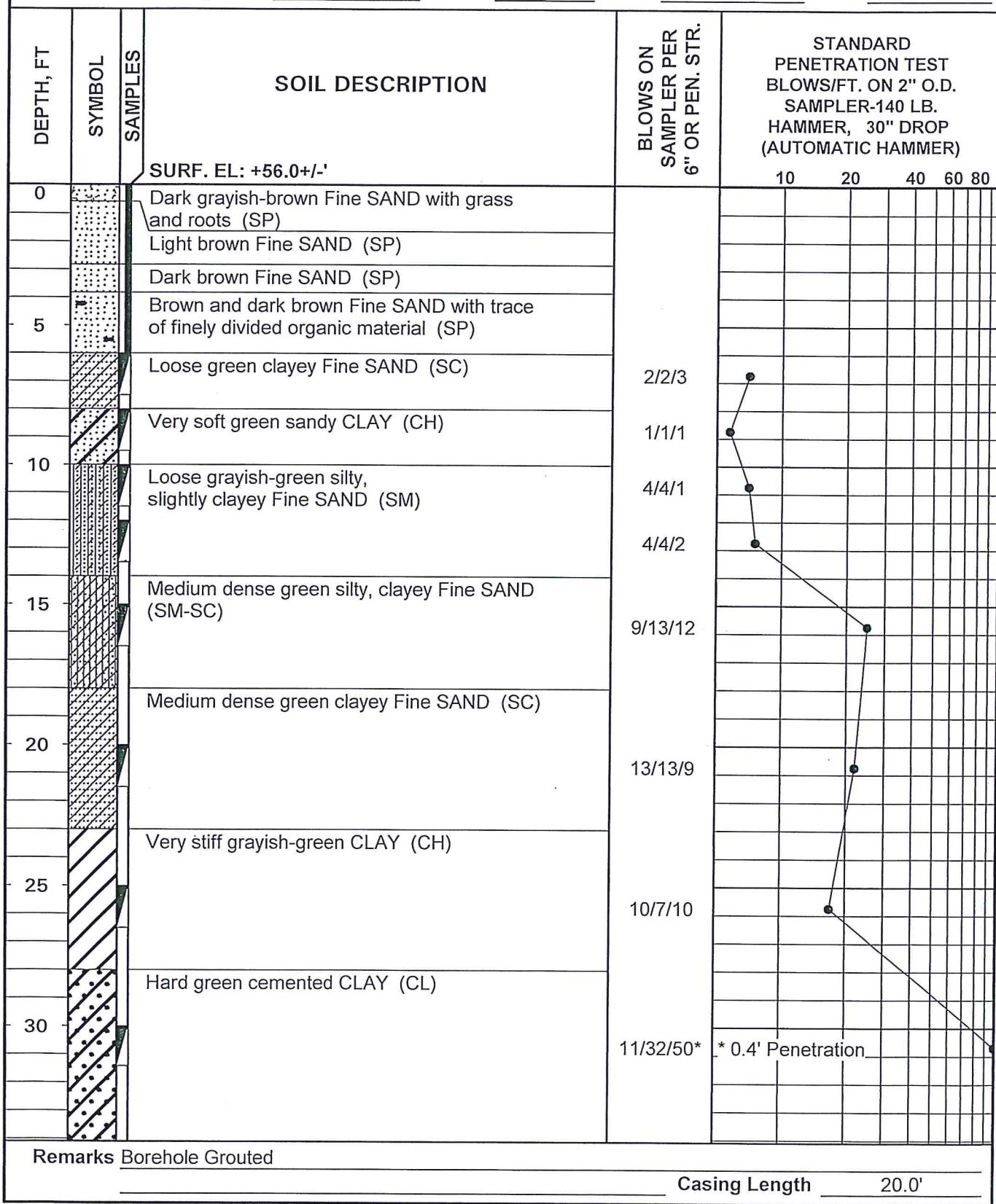
Date 2/21/17

Depth To Water

4.1'

Time

Date 2/21/17



**DRIGGERS ENGINEERING SERVICES INCORPORATED**

Project No. DES 167824

**BORING NO. SB-3**

Project Proposed Equalization Tank, Northeast WWTP, Pinellas County, Florida

Location See Plate I

Foreman J.R.

Completion

Depth 60.2'

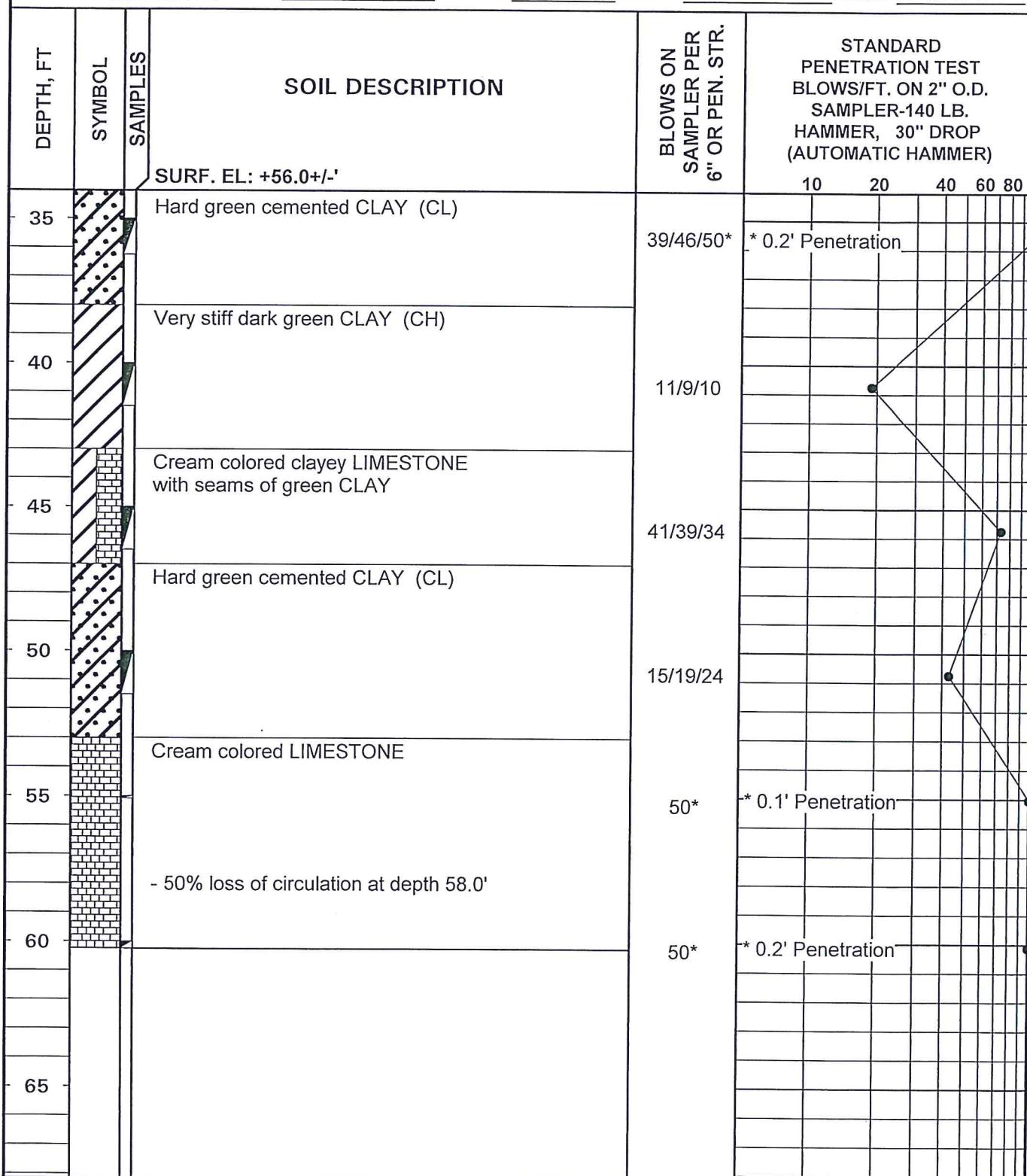
Date 2/21/17

Depth To Water

4.1'

Time

Date 2/21/17



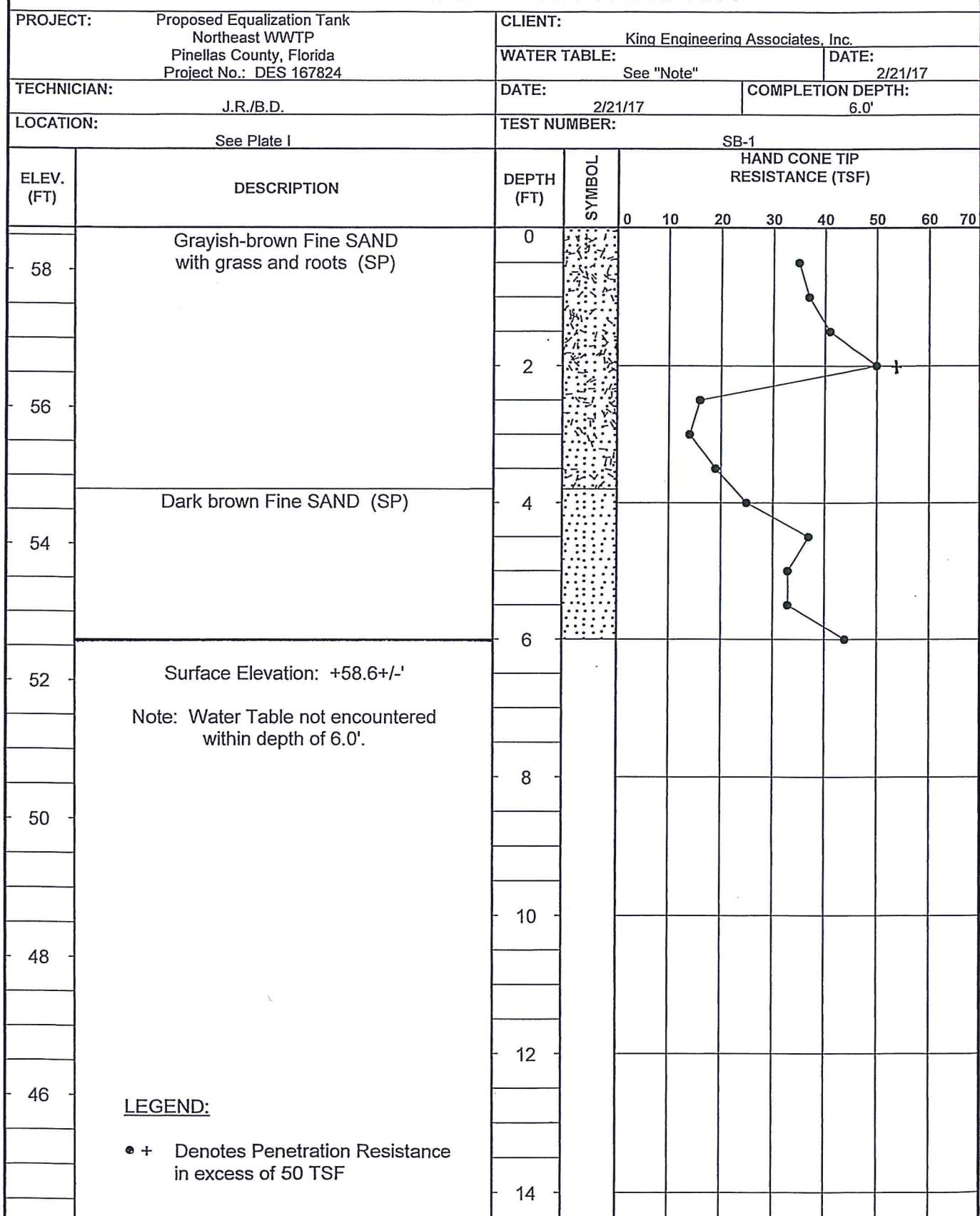
Remarks Borehole Grouted

Casing Length 20.0'

## **HAND AUGER AND HAND CONE BORING LOGS**

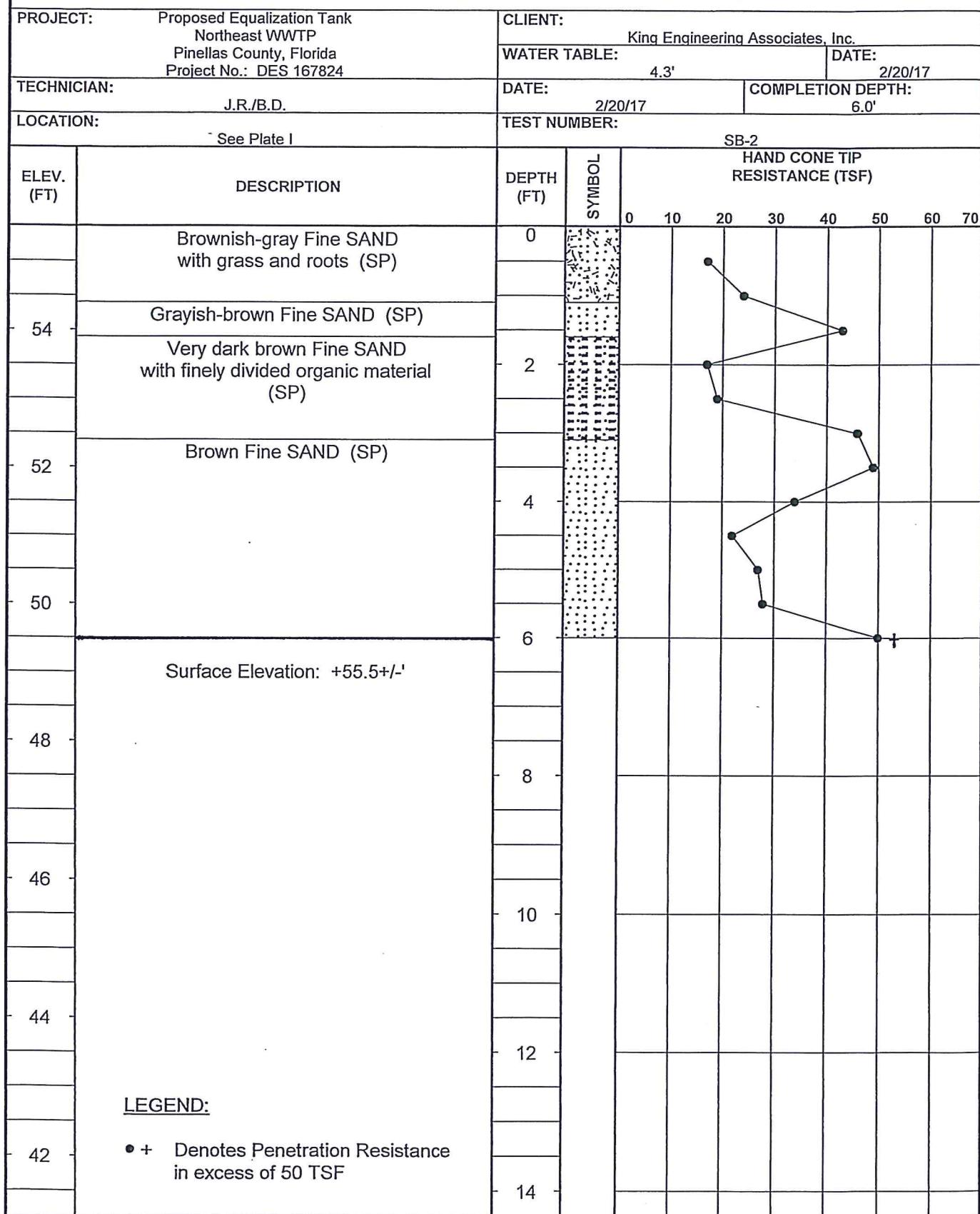
DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING/HAND CONE SOUNDING LOG



**DRIGGERS ENGINEERING SERVICES INCORPORATED**

**HAND AUGER BORING/HAND CONE SOUNDING LOG**



**DRIGGERS ENGINEERING SERVICES INCORPORATED**

**HAND AUGER BORING/HAND CONE SOUNDING LOG**

PROJECT: Proposed Equalization Tank Northeast WWTP Pinellas County, Florida Project No.: DES 167824		CLIENT: King Engineering Associates, Inc.			
		WATER TABLE: 4.1' DATE: 2/21/17			
TECHNICIAN:	J.R./B.D.	DATE: 2/21/17 COMPLETION DEPTH: 6.0'			
LOCATION:	See Plate I	TEST NUMBER: SB-3			
ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	HAND CONE TIP RESISTANCE (TSF)	
56	Dark grayish-brown Fine SAND with grass and roots (SP)	0		0	10 20 30 40 50 60 70
	Light brown Fine SAND (SP)				
54		2			
	Dark brown Fine SAND (SP)				
52	Brown and dark brown Fine SAND with trace of finely divided organic material (SP)	4			
50	Surface Elevation: +56.0+/-'	6			
48		8			
46		10			
44		12			
42		14			

The figure is a hand cone tip resistance (TSF) log. It consists of a vertical column of data points on the left and a grid on the right. The data points are connected by lines to show the variation of resistance with depth. The grid has major ticks at 0, 10, 20, 30, 40, 50, 60, and 70 TSF. The depth axis is labeled from 0 to 14 feet in increments of 2. The data points are as follows:

Depth (ft)	TSF (0)	TSF (2)	TSF (4)	TSF (6)	TSF (8)	TSF (10)	TSF (12)	TSF (14)
0	25	28	30	32	35	38	40	42
2	28	30	32	35	38	40	42	45
4	30	32	35	38	40	42	45	48
6	32	35	38	40	42	45	48	50
8	35	38	40	42	45	48	50	52
10	38	40	42	45	48	50	52	55
12	40	42	45	48	50	52	55	58
14	42	45	48	50	52	55	58	60

**DRIGGERS ENGINEERING SERVICES INCORPORATED**

**HAND AUGER BORING LOG**

PROJECT:		CLIENT:		
Proposed Equalization Tank Northeast WWTP Pinellas County, Florida Project No.: DES 167824		King Engineering Associates, Inc.		
TECHNICIAN:		WATER TABLE:	DATE:	
J.R./C.D./B.D.		4.0'	2/20/17	
LOCATION:		DATE:	COMPLETION DEPTH:	
See Plate I		2/20/17	5.3'	
TEST NUMBER:		HA-1		
ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
55	Grayish-brown Fine SAND with roots (SP)	0		Surface Elevation: +55.8+/-'
54		1		
53	Brown Fine SAND with pockets of green sandy CLAY (SP/CH)	2		
52	Green sandy CLAY (CH)	3		
51	Brown Fine SAND (SP)	4		
50	Gray and dark gray Fine SAND (SP)	5		
49		6		
48		7		



DRIGGERS ENGINEERING SERVICES INCORPORATED

## HAND AUGER BORING LOG

HAND AUGER BORING LOG					
PROJECT:		Proposed Equalization Tank Northeast WWTP Pinellas County, Florida Project No.: DES 167824		CLIENT: King Engineering Associates, Inc.	
TECHNICIAN:		J.R./C.D./B.D.		WATER TABLE:	DATE: 3.8' 2/20/17
LOCATION:		See Plate I		TEST NUMBER:	COMPLETION DEPTH: 5.2'
ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS	
55	Brown Fine SAND with Limerock Gravel and roots (SP)	0		Surface Elevation: +55.3+/-'	
54	Brown Fine SAND with trace of roots (SP)	1			
53	Grayish-brown to dark brown Fine SAND (SP)	2			
52	Brown Fine SAND (SP)	3			
51	Light brown Fine SAND with trace of roots (SP)	4			
50	Brown Fine SAND (SP)	5			
49		6			
		7			

## **SUMMARY OF LABORATORY TESTS**

## SUMMARY OF LABORATORY TEST RESULTS

W % = Water Content

**Y d (pcf) = Dry Density**

$G_s$  = Specific Gravity

LL = Liquid Limit

PL = Plastic Limit

PI = Plasticity Index

P.P. (tsf) = Pocket Penetro

U.C. = Unconfined Compressive Strength

Con. = Consolidation Test

G.S. (+1) = Grainsize Analysis (Hydrometer)

Cl. (ppm) = Total Chloride

$\text{SO}_4$  (ppm) = Total Sulfate

RES. (ohm-cm) = Lab Resistivity

\* See Test Curves

\*\* = Percent Passing No. 200 Sieve

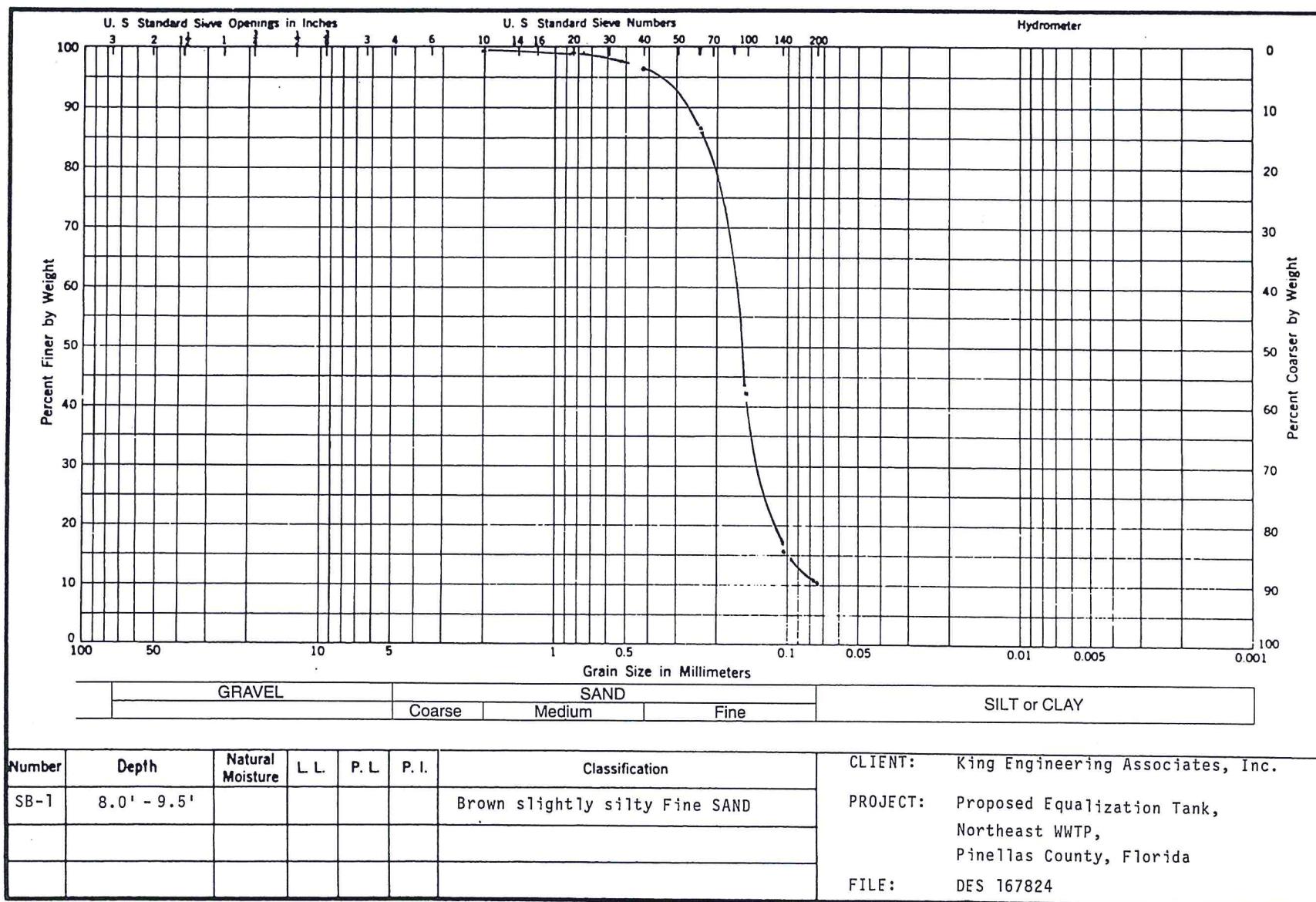
**CLIENT:** King Engineering Associates, Inc.

**PROJECT:** Proposed Equalization Tank,  
Northeast WWTP, Pinellas County, Florida

**FILE:** DES 167824

## **GRAINSIZE ANALYSES**

**DRIGGERS ENGINEERING SERVICES, INC.**



## **METHOD OF TESTING**

# **STANDARD PENETRATION TEST WITH AUTOMATIC HAMMER AND SOIL CLASSIFICATION**

## **STANDARD PENETRATION TEST (ASTM D-1586)**

In the Standard Penetration Test borings, a rotary drilling rig is used to advance the borehole to the desired test depth. A viscous drilling fluid is circulated through the drill rods and bit to stabilize the borehole and to assist in removal of soil and rock cuttings up and out of the borehole.

Upon reaching the desired test depth, the 2 inch O.D. split-barrel sampler or "split-spoon", as it is sometimes called, is attached to an N-size drill rod and lowered to the bottom of the borehole. A 140 pound automatic hammer, attached to the drill string at the ground surface, is then used to drive the sampler into the formation. The hammer is successively raised and dropped for a distance of 30 inches using an automated lifting mechanism. The number of blows is recorded for each 6 inch interval of penetration or until virtual refusal is achieved. In the above manner, the samples are ideally advanced a total of 18 inches. The sum of the blows required to effect the final 12 inches of penetration is called the blowcount, penetration resistance or "N" value of the particular material at the sample depth.

After penetration, the rods and sampler are retracted to the ground surface where the core sample is removed, sealed in a glass jar and transported to the laboratory for verification of field classification and storage.

## **SOIL SYMBOLS AND CLASSIFICATION**

Soil and rock samples secured in the field sampling operation were visually classified as to texture, color and consistency. The Unified Soil Classification was assigned to each soil stratum per ASTM D-2487. Soil classifications are presented descriptively and symbolically for ease of interpretation. The stratum identification lines represent the approximate boundary between soil types. In many cases, this transition may be gradual.

Consistency of the soil as to relative density or undrained shear strength, unless otherwise noted, is based upon Standard Penetration resistance values of "N" values and industry-accepted standards. "N" values, or blowcounts, are presented in both tabular and graphical form on each respective boring log at each sample interval. The graphical plot of blowcount versus depth is for illustration purposes only and does not warrant continuity in soil consistency or linear variation between sample intervals.

The borings represent subsurface conditions at respective boring locations and sample intervals only. Variations in subsurface conditions may occur between boring locations. Groundwater depths shown represent water depths at the dates and time shown only. The absence of water table information does not necessarily imply that groundwater was not encountered.

## HAND CONE PENETRATION TEST

The cone penetration test was performed using a DGSI Model S-215 double rod Static Cone Penetrometer.

Dual rods enable the cone stress to be measured directly. Soil friction on the outer rod does not influence the reading. Depending upon the application, either the maximum bearing for an increment of push or the least bearing for an increment can be reported. If you were investigating for soft spots, you would take the least reading. In typical use, you would force the cone into the soil 6 inches, retract the cone slightly until the gauge reads zero, then advance an additional 6 inch increment. If you meet with refusal, the cone can be removed and the hole opened with a hand auger to permit a continuation of measurements against depth.

The tool has been designed to allow a maximum force of 250 lbf to be applied, somewhat more than the average weight of an operator. The unit can be operated in a vertical or horizontal position. The cone tip has an included angle of  $60^\circ$ . The cone has a section area of  $1.5 \text{ cm}^2$ . The maximum total bearing ( $Q_u$ ) is  $70 \text{ kg/cm}^2$ .

The reading ( $Q_c$ ) is in  $\text{kg/cm}^2$  which is essentially equal to  $\text{ton}/\text{ft}^2$ .

The cone index ( $Q_c$ ) is read directly. The correlation between the cone index and soil constants is not absolute. Generally, the following results have been determined through extensive field use of the unit. Further verification of correlation in your local soil types is essential.

Standard Penetration	Strength and Cohesion
Test "N" Value $Q_c = 4 \text{ "N"}$	$Q_u$ - Unconfined compression ( $\text{kg/cm}^2$ ) $c$ - Cohesion ( $\text{kg/cm}^2$ )  Uniform clay and silty clays: $Q_c = 5 Q_u$ Clayey Silts: $Q_c = 10 c$ $Q_c = (10 \text{ to } 20) Q_u$ $Q_c = (20 \text{ to } 40) c$

## ASBESTOS REPORT

Terracon, Pre-Demolition NESHPAs Asbestos Survey, Lead-Based Paint and Hazardous Materials Survey Report, dated January 19, 2017

# **Pre-Demolition NESHPAs Asbestos Survey, Lead-Based Paint and Hazardous Materials Survey Report**

**Northeast Wastewater Treatment Facility – Designated Structures  
S.R. 580 + McMullen Booth Road  
Clearwater, Pinellas County, Florida**

January 19, 2017

Terracon Project No. H4167137



**Prepared for:**  
King Engineering & Associates, Inc.  
Tampa, Florida

**Prepared by:**  
Terracon Consultants, Inc.  
Tampa, Florida

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**Terracon**

January 19, 2017

King Engineering & Associates, Inc.  
4921 Memorial Highway One Memorial Center, Suite 300  
Tampa, FL 33634

Attn: Mr. Thomas Traina, P.E.  
Senior Project Manager

P: 813-880-8881

E: [ttraina@kingengineering.com](mailto:ttraina@kingengineering.com)

Re: Pre-Demolition NESHPAs Asbestos Survey, Lead-Based Paint and Hazardous Materials Survey Report  
Northeast Wastewater Treatment Facility – Designated Structures  
State Road 580 and McMullen Booth Road  
Clearwater, Pinellas County, Florida 33761  
Terracon Project No. H4167137

Dear Mr. Traina:

The purpose of this report is to present the results of the pre-demolition NESHPAs asbestos survey, lead-based paint and hazardous materials survey report, performed on January 05, 2017 at the above referenced facility in Clearwater, Florida. This survey was conducted in general accordance with our revised proposal dated December 06, 2016. We understand that this survey was requested to identify and locate asbestos-containing materials (ACMs), lead-based paint (LBP) and potentially hazardous materials prior to future demolition & renovation activities.

**Asbestos was identified** in samples of non-friable materials collected at the subject site. Please refer to the attached report for details.

**Lead was detected** in painted coatings at the project site. Please refer to the attached report for details.

**Potentially Hazardous Materials** were identified at the project site. Please refer to the attached report for details.



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Geotechnical



Environmental



Construction Materials



Facilities



Terracon appreciates the opportunity to provide this service to King Engineering Associated, Inc. If you have any questions regarding this pre-demolition NESHPA asbestos survey, lead-based paint and hazardous materials survey, please contact the undersigned at (813) 221-0500.

Sincerely,

**Terracon**

Florida Asbestos Business License Number ZA-337

*Prepared by:*

Peter MacKay, CIEC  
Staff Industrial Hygienist

*Reviewed by:*

Russell E. Stauffer, P.E.  
Florida Licensed Asbestos Consultant EA-16  
Authorized Project Reviewer



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## TABLE OF CONTENTS

	Page
<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 Project Objective .....	1
<b>2.0 FIELD ACTIVITIES - ASBESTOS.....</b>	<b>2</b>
2.1 Visual Assessment .....	2
2.2 Physical Assessment.....	2
2.3 Sample Collection.....	2
2.4 Sample Analysis .....	2
<b>3.0 REGULATORY OVERVIEW - ASBESTOS .....</b>	<b>3</b>
<b>4.0 FINDINGS AND RECOMMENDATIONS – ASBESTOS .....</b>	<b>4</b>
<b>5.0 HAZARDOUS MATERIALS INVENTORY .....</b>	<b>5</b>
5.1 Visual Observation .....	5
5.2 Regulatory Overview.....	6
5.3 Findings & Recommendations .....	6
<b>6.0 FIELD ACTIVITIES LEAD – BASED PAINT .....</b>	<b>6</b>
6.1 Visual Observation .....	7
6.2 Visual Assessment.....	7
6.3 Sample Analysis .....	7
<b>7.0 REGULATORY OVERVIEW – LEAD-BASED PAINT.....</b>	<b>7</b>
<b>8.0 FINDINGS AND RECOMMENDATIONS – LEAD-BASED PAINT.....</b>	<b>8</b>
<b>9.0 GENERAL COMMENTS .....</b>	<b>10</b>

**APPENDIX A SUMMARY OF ASBESTOS-CONTAINING MATERIAL SAMPLE LOCATIONS**

**APPENDIX B SUMMARY OF LEAD-BASED PAINT SAMPLE LOCATIONS**

**APPENDIX C ASBESTOS ANALYTICAL LABORATORY DATA**

**APPENDIX D LEAD ANALYTICAL LABORATORY DATA**

**APPENDIX E SITE PLAN AND PHOTOGRAPHS**

**APPENDIX F CERTIFICATIONS AND LICENSES**

# **PRE-DEMOLITION NESHAP ASBESTOS SURVEY, LEAD-BASED PAINT SURVEY AND HAZARDOUS MATERIALS SURVEY REPORT**

**Northeast Wastewater Treatment Facility  
State Road 580 and McMullen Booth Road  
Clearwater, Florida 33761  
Terracon Project No. H4167137**

**January 19, 2017**

## **1.0 INTRODUCTION**

Terracon conducted a pre-demolition NESHAP asbestos survey, lead-based paint and hazardous materials survey of client designated items at the Northeast Wastewater Treatment Facility located at State Road 580 and McMullen Booth Road in Clearwater, Florida:

The survey was conducted on January 05, 2017 by Terracon's State of Florida accredited asbestos building inspector and EPA certified lead inspector Mr. Peter MacKay (certificate Nos. 170538-5886 & FL-I-118220-2, respectively) in accordance with Terracon's revised proposal number PH4150101 dated December 06, 2016.

Building components were surveyed and homogeneous areas of suspect asbestos-containing materials (ACM) and lead-based paint (LBP) components were visually identified and documented. Additionally, potentially hazardous materials were inventoried that may be recycled and / or require modified disposal procedures related to the planned renovations/demolition of the designated structures. Although reasonable effort was made to survey accessible suspect materials, additional suspect but un-sampled materials could be located in walls, in voids, below the ground or in other concealed areas. The designated suspect ACM samples were collected in general accordance with the sampling protocols outlined in EPA regulation 40 CFR 763 (Asbestos Hazard Emergency Response Act, AHERA). Asbestos samples were delivered to an accredited laboratory for analysis. Suspect ACM samples were analyzed by Polarized Light Microscopy. Lead-based paint chip samples were obtained only from the designated representative surfaces potentially containing lead-based coatings. Potentially Hazardous Materials were visually observed but with no samples obtained.

### **1.1 Project Objective**

We understand this survey was requested to identify and locate ACM, LBP and Hazardous Materials prior to the proposed future renovation or demolition activities of the respective designated structures. The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. The NESHAP regulation also requires the identification and classification of existing ACM according to friability prior to the disturbance activities. In addition, asbestos and/or lead-based components are subjected to other regulations including the

Occupational Safety and Health Administration (OSHA) and State of Florida. Terracon also performed a visual survey and documented observed potential PCB light ballasts and electrical transformers, and potential mercury containing thermostat switches and fluorescent light bulbs, batteries and high intensity lights, etc., or other items that might be considered as hazardous or regulated.

## **2.0 FIELD ACTIVITIES - ASBESTOS**

The survey was conducted by Mr. Peter MacKay, a State of Florida accredited asbestos inspector. The survey was conducted in general accordance with the sample collection protocols established in EPA regulation 40 CFR 763, the Asbestos Hazard Emergency Response Act (AHERA). A summary of survey activities is provided below.

### **2.1 Visual Assessment**

Our survey activities began with visual observations of the designated areas to identify homogeneous areas of suspect ACM. A homogeneous area consists of building materials that appear similar throughout in terms of color, texture and date of application. The interior assessment was conducted throughout visually accessible areas of the designated areas.

Building materials identified as glass, wood, masonry, metal or rubber were not considered suspect ACM.

### **2.2 Physical Assessment**

A physical assessment of each homogeneous area of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the EPA as a material which can be crumbled, pulverized or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

### **2.3 Sample Collection**

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with AHERA sampling protocols. Random samples of suspect materials were collected in each homogeneous area. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

Forty-eight (48) bulk samples were collected from twenty-four (24) homogeneous areas of suspect ACM. A summary of suspect ACM samples collected during the survey is included as Appendix A.

## 2.4 Sample Analysis

Bulk samples were submitted under chain of custody to Cates Laboratories, Inc. (Cates) for analysis by Polarized Light Microscopy per EPA methodology EPA/600/R-93/116. The percentage of asbestos, where applicable, was determined by microscopic visual estimation or point counting. Cates is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP Accreditation No. 200569-0).

## 3.0 REGULATORY OVERVIEW - ASBESTOS

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. The NESHAP regulation also requires the identification and classification of existing ACM according to friability prior to demolition or renovation activity.

Under NESHAP, asbestos-containing building materials are classified as:

1. Friable ACM, or
2. Category I Non-Friable ACM, or
3. Category II Non-Friable ACM.

Friable materials are those that, when dry, may be crumbled, pulverized or reduced to powder by hand pressure. Category I Non-Friable ACM includes packings, gaskets, resilient floor coverings and asphalt roofing products containing more than 1% asbestos. Category II Non-Friable ACM are any materials other than Category I Non-Friable ACM that contain more than 1% asbestos.

Under NESHAP, Regulated Asbestos-Containing Materials (RACM) are classified as:

1. Friable ACM,
2. Category I Non-Friable ACM that is in poor condition and/or has become friable,
3. Category I Non-Friable ACM that will or has been subjected to sanding, grinding, cutting or abrading
4. Category II Non-Friable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act upon the material in the course of renovation or demolition operations.

In the State of Florida, asbestos activities are regulated by the Florida Department of Environmental Protection (FDEP). Some counties have developed an enforcement division to carry out the responsibilities of the FDEP and have developed environmental and asbestos ordinances in which additional compliance is required. Since the facility is located in Pinellas County Florida, the NESHAP regulations are under the jurisdiction of the Pinellas County, Air Quality Division, who have enacted the Code of Ordinances, Part II, Chapter 58-145, et al., to additionally delineate their asbestos program requirements.

Per the NESHAP, RACM must be removed prior to activities that will disturb the materials. Removal of the ACM or RACM must be conducted by a State of Florida-licensed asbestos abatement contractor, in compliance with Florida Statute (F.S) 469.001-014. In addition, third party air monitoring should be performed during and following the abatement.

The Occupational Safety and Health Administration (OSHA) Asbestos standard for construction (29 CFR 1926.1101) regulates employee workplace exposure to asbestos. The OSHA standard has (2) Permissible Exposure Limits (PEL) that require employee exposure to airborne asbestos fibers be maintained below 0.1 asbestos fibers per cubic centimeter of air (0.1 f/cc) for an 8-hour Time-Weighted Average (8-Hr. TWA) and 1.0 f/cc for a 30-minute TWA (Excursion Limit. The OSHA standard classifies construction and maintenance activities which could disturb ACM, and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

## **4.0 FINDINGS AND RECOMMENDATIONS - ASBESTOS**

Below is a list of materials that were found to contain asbestos.

**TABLE 1**

HA	Material Description	Material Location	Percent	NESHAP CATEGORY	Estimated Quantities <sup>(1)</sup>
MS2	Pipe Gasket on 6" Pipe – Flange (Dark Green)	Primary Pump House	35% - Chrysotile	Category I - Non-Friable	15 SF
MS4	Pipe Gasket on 10" Pipe – Valve Flange (Yellow)	Primary Pump House	35% - Chrysotile	Category I - Non-Friable	30 SF
MS6	Caulking (Off-White)	Primary Pump House – North & South Tank	3% - Chrysotile	Category II - Non-Friable	10 SF
R2	Pitch Pan Tar (Black)	Irrigation System – Roof	5% - Chrysotile	Category I - Non-Friable	20 SF

<sup>(1)</sup> Estimated Quantities are approximate and not intended or developed for bidding or notification, etc., purposes and are to be confirmed prior to any such usage.

**Pipe Gaskets (Green & Yellow):** These materials, in their current state, are considered to be a Category I non-friable material. The asbestos containing materials identified during this survey should be removed from the structure prior to demolition activities in accordance with applicable provisions for Class II asbestos work, by a Florida Licensed Asbestos Abatement Contractor

**Caulking (Off-White):** This material, in its current state, can be considered to be a Category II non-friable material. The asbestos containing materials identified during this survey should be removed from the structure prior to renovation activities in accordance with applicable provisions for OSHA Class II asbestos work, by a Florida Licensed Asbestos Abatement Contractor.

**Roofing Materials – Pitch Pans:** Asbestos-containing roofing materials (Pitch Pans) were identified as ACM. In its current state this material is categorized as Category I Non-Friable ACM by the EPA/NESHAP that appeared to be in good condition. If subjected to aggressive removal activities they could become RACM and should be removed as such by a Florida Licensed Asbestos Abatement Contractor prior to disturbance activities. Additionally, as a minimum, their removal would be considered an OSHA Work Class II activity, subject to specialized work practices, controls, etc.

**Overview Recommendations:** Terracon recommends that the materials identified as containing asbestos be removed by a Florida-Licensed Asbestos Abatement Contractor prior to the demolition of the structure.

Generally stated, the NESHAP requires notification to the local regulatory agency ten (10) working days prior to abatement activities if any of the following threshold quantities of RACM are impacted: (1) 260 linear feet of piping, or (2) 160 square feet of other RACM, or (3) 35 cubic feet of debris. For demolition projects, the notification is required prior to all disturbance of ACM even in buildings with no asbestos present. Notification is typically sent electronically.

The remediation contractor may need to wait ten (10) working days (Monday – Friday) from the date of notification before starting any disturbance activities. Any change to the start date of the disturbance requires notification to the agency by phone, followed by a written revision to the Notification Form. We also recommend direct contact with the Pinellas Air Quality Division (727.464.4422) for confirmation and clarifications of their asbestos program requirements.

A summary of the classification and approximate quantity of identified ACM is presented in Table 1. The summary of sample locations is presented in Appendix A. Laboratory analytical reports are included in Appendix C.

Terracon can provide the Client with a proposal for developing asbestos abatement specifications (project design) and for performing abatement oversight and air monitoring upon request.

## 5.0 HAZARDOUS MATERIALS INVENTORY

Potentially hazardous materials observed within the designated structures at the facility were inventoried by Terracon representative Mr. Pete MacKay.

### 5.1 Visual Observations

Our survey activities included a visual observation of each designated structure and an inventory of their respective suspect hazardous / regulated materials, if identified. Hazardous / regulated materials may include items that may be recycled or disposed of prior to demolition such as used

tires, computer monitors, treated power transmission poles, suspect polychlorinated biphenyl (PCB) and mercury-containing materials, used oils, batteries, and other materials such as electronics and certain fire suppression systems. This assessment was conducted throughout visually accessible interior and exterior areas of the designated structures.

Our services did not include the collection of samples of suspect hazardous / regulated materials. Exhibits (Site Plans) presenting building locations are presented in Appendix E. Selected photographs are presented in Appendix E.

## **5.2 Regulatory Overview**

The United States Environmental Protection Agency (USEPA) regulates bulk PCB product waste under 40 Code of Federal Regulations (CFR) 761.62 of the Toxic Substances Control Act (TSCA). Certain mercury-containing equipment is covered under the Universal Waste regulation (40 CFR 273.9); other mercury wastes are regulated under the Resource Conservation and Recovery Act (RCRA) and are considered hazardous if the waste exceeds the toxicity characteristic leachate procedure (TCLP) level of 0.2 milligrams per liter (mg/L) for mercury.

State of Florida hazardous materials regulations are addressed in Florida Administrative Code (FAC) rule 63.730- Hazardous Waste.

Equipment such as transformers may contain mineral oil with minor amounts of PCBs and could be considered “PCB contaminated” (PCB content 50-500 ppm).

Under Florida law, it is illegal to discard nickel / cadmium or lead / acid batteries as trash; the batteries must be recycled or sent to a facility permitted to dispose of those batteries.

The generator is responsible for compliance with applicable regulations regarding hazardous waste disposal.

## **5.3 Findings and Recommendations**

<b>Structure</b>	<b>Hazardous Materials Identified</b>
Primary Pump House	None
North Tank and South Tank	None
Head Works – Sludge Thickener	None
Grit Pumps – Lower Level	None
Electrical Motor Control Center	None
Irrigation System Tank – Chlorine Feed System	One (1) Transformer Two (2) Generator Batteries

Terracon identified one pad-mounted electric transformer at the southeast corner of the Irrigation System building. The transformers appeared in fair condition and no evidence of leakage of fluids was observed

in association with the transformers. If this equipment will not be reused, Terracon recommends that the transformer be removed and properly disposed of prior to demolition activities in accordance with Federal, state, and local regulations.

Additionally, two (2) acid batteries associated with the generator were observed in the vicinity of the chlorine feed system room. The acid batteries must be recycled or sent to an EPA certified waste disposal facility.

## 6.0 FIELD ACTIVITIES – LEAD-BASED PAINT SURVEY

The lead-based paint survey was conducted by EPA accredited Lead Based Paint Inspector Mr. Peter MacKay (Accreditation No. FL-I-118220-2). A summary of survey activities is provided below.

### 6.1 Visual Observation

This limited LBP screening was limited to readily observable and accessible surfaces. Terracon cannot guarantee a building or property to be LBP free as the possibility exists that LBP coated surfaces may be hidden from sight or in inaccessible locations, or the homogeneous construction areas identified may not be truly homogeneous. This LBP survey was not performed to the HUD *Guidelines for the Evaluation and Control of Lead Containing Paint Hazards in Housing* standards. It should be understood that this LBP survey is not considered to be comprehensive in nature, and the results are not intended to be used to determine lead hazards, develop abatement plans, or prepare detailed cost estimates for abatement.

### 6.2 Visual Assessment

A visual assessment of each unique combination of suspect LBP was additionally conducted to assess the condition of the paint. A suspect LBP testing combination was defined as a component/substrate and color. The condition of the paint was documented to be intact, fair, and poor.

### 6.3 Sample Analysis

Terracon performed a lead based paint (LBP) survey that consisted of collecting forty-two (42) paint chip samples from various painted components. Paint chip samples were submitted under chain of custody to EMSL Analytical Inc. for analysis by flame atomic absorption spectrometry per EPA SW-846/3050B/7000B. EMSL is accredited under the Environmental Lead Laboratory Accreditation Program (ELLAP) (ELLAP Accreditation No. 163563).

## 7.0 REGULATORY OVERVIEW – LEAD BASED PAINT

Lead is regulated by the EPA, HUD, FDEP and OSHA. The EPA and FDEP regulate lead use, removal, and disposal, and OSHA regulates lead exposure to workers. The EPA defines LBP as paint, varnish, stain, or other applied coating that contains lead equal to or greater than 1.0 mg/cm<sup>2</sup>, 5,000 mg/kg, or 0.5% by dry weight as determined by laboratory analysis. **For the purpose of the OSHA lead standard, lead includes any detectable concentrations of metallic lead**, all inorganic lead compounds, and organic lead soaps. A synopsis of the OSHA regulations (29 CFR 1926.62) and the applicability are as follows:

The OSHA *Lead Standard for Construction* (29 CFR 1926.62) applies to all construction work where an employee may be occupationally exposed to lead. All work related to construction, alteration, or repair (including painting and decorating) is included. The lead-in-construction standard applies to any **detectable concentration of lead in paint**, as even small concentrations of lead can result in unacceptable employee exposures depending upon on the method of removal and other workplace conditions.

Under this standard, construction includes, but is not limited to, the following:

- Disturbance or salvage of structures where lead or materials containing lead are present
- Removal or encapsulation of materials containing lead
- New construction, alteration, repair, or renovation of structures, substrates, or portions containing lead, or materials containing lead
- Installation of products containing lead
- Lead contamination/emergency clean-up
- Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed
- Maintenance operations associated with construction activities described above

## 8.0 FINDINGS AND RECOMMENDATIONS – LEAD BASED PAINT

Based on a review of the analytical results, lead concentrations were detected in twenty-two (22) of the forty-two (42) paint chip samples collected during the survey. The results of components with documented lead levels are presented in Table 2.0.

Whole architectural component removal is the recommended removal method to reduce the potential creation of hazardous waste. However, disturbance of coatings containing detectable levels of lead would be subjected to the requirements of the OSHA 29 CFR 1926.62 controls, training, etc.

A summary of the samples and their results is presented in the following tables. Laboratory analytical reports are included as Appendix D.

## Components with Detectable Levels of Lead

TABLE 2.0

Sample ID	Sample location	Component	Color	Substrate	Lab Results (% by weight)	Condition (Intact, Fair, or Poor)
LBP-1	Primary Pump House – 1FL – Pipe, 10"	Pipe	Yellow	Metal	3.4	Poor
LBP-3	Primary Pump House – 1FL – Pipe, 6"	Pipe	Green	Metal	0.034	Poor
LBP-4	Primary Pump House – 1FL – Valve, 6"	Valve	Green	Metal	0.053	Poor
LBP-6	Primary Pump House – 1FL – Pump #2 – Valve	Valve	Red	Metal	1.5	Poor
LBP-7	Primary Pump House – 1FL – Sludge Pump #1	Pump	Light Blue	Metal	0.11	Poor
LBP-11	Primary Pump House – 1FL – Stairs	Step	Yellow	Concrete	4.5	Poor
LBP-13	Primary Pump House – North Tank – Drive Motor	Motor	Red	Metal	0.015	Poor
LBP-21	Headworks – Lower Level – Grit Pumps – Pipe, 6"	Pipe	Green	Metal	0.013	Poor
LBP-22	Headworks – Lower Level – Grit Pumps – Pipe, 6"	Pipe	Black	Metal	0.018	Poor
LBP-24	Headworks – Lower Level – Grit Pump – Pipe, 36"	Pipe	Gray	Metal	0.038	Poor
LBP-26	Irrigation System – Reclaimed Water Pump #2	Pump	Gray	Metal	0.72	Fair
LBP-29	Irrigation System – Reclaimed Water – Electric Panel Cabinet	Doors	Gray	Metal	0.47	Poor
LBP-30	Irrigation System – Reclaimed Water – Storage Box	Lid/Cover	Gray	Metal	0.060	Poor
LBP-31	Irrigation System – Reclaimed Water – Natural Gas Pipeline, 3"	Pipe	Orange	Metal	2.5	Poor
LBP-33	Irrigation System – Reclaimed Water – Pump #2	Motor	Dark Gray	Metal	0.27	Poor
LBP-34	Irrigation System – Reclaimed Water – Wall	Wall	Light Yellow	Concrete	0.010	Poor
LBP-35	Irrigation System – Reclaimed Water – Roof Support Beam	Beam	Yellow	Wood	0.062	Poor
LBP-36	Irrigation System – Reclaimed Water – Overhead PVC Drain Pipe, 2"	Pipe	Yellow	PVC	6.3	Poor
LBP-37	Irrigation System – Chlorine Feed System Room	Wall	White	CMU	0.031	Fair
LBP-38	Irrigation System – Chlorine Feed System Room	Wall	Gray	CMU	0.021	Fair
LBP-39	Irrigation System – Chlorine Feed System Room	Door Frame	Yellow	Metal	0.030	Poor
LBP-41	Irrigation System - Chlorine Feed System Room – Conduit Pipe	Pipe	Yellow	Metal	0.030	Poor

Disturbance of any of the materials and/or components found to contain detectable levels of lead would require such activities be conducted in compliance with the requirements of the OSHA standard. As such, personnel disturbing materials/components would need to have the OSHA level required training, comply with the work practices, levels of potential exposure documented and compared to the Action and Permissible Levels of 30 ug/m<sup>3</sup> and 50 ug/m<sup>3</sup> respectively. In addition, disposal of the waste materials would be tested utilizing the Toxicity characteristic leaching procedure (TCLP) to document lead content and compared to the EPA and FDEP threshold of 5.0 mg/Liter and disposed of accordingly.

## 9.0 GENERAL COMMENTS

This pre-demolition NESHAP asbestos, lead-based paint and hazardous materials survey was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings, conclusions and recommendations expressed in this report are based on conditions observed during our survey of the building. The information contained in this report is relevant to the date on which this survey was performed, and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by King Engineering Associates, Inc. This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding further investigation or remediation deemed necessary. Terracon does not warrant the work of regulatory agencies, laboratories or other third parties supplying information which may have been used in the preparation of this report. No warranty, express or implied is made.

## **APPENDIX A**

### **SUMMARY OF ASBESTOS CONTAINING MATERIALS SAMPLE LOCATIONS**

**APPENDIX A**  
**SUMMARY OF ASBESTOS CONTAINING MATERIAL SAMPLE LOCATIONS**  
**Northeast Wastewater Treatment Facility, Clearwater, FL**

HA No.	Sample Number	Location	Material Description	Size/Color	Lab Results <sup>(1)</sup>
MS1	1	Primary Pump House, Flange	Gasket Material	10" Pipe (Black/Painted Yellow)	None Detected
	2	Primary Pump House, Flange	Gasket Material		None Detected
MS2	3	<b>Primary Pump House, Flange</b>	<b>Gasket Material</b>	6" Pipe (Dark Green)	<b>35% - Chrysotile</b>
	4	<b>Primary Pump House, Flange</b>	<b>Gasket Material</b>		<b>35% - Chrysotile</b>
MS3	5	Primary Pump House, Flange	Gasket Material	10" Pipe (Red)	None Detected
	6	Primary Pump House, Flange	Gasket Material		None Detected
MS4	7	<b>Primary Pump House, Valve Flange</b>	<b>Gasket Material</b>	10" Pipe (Yellow)	<b>35% - Chrysotile</b>
	8	<b>Primary Pump House, Valve Flange</b>	<b>Gasket Material</b>		<b>35% - Chrysotile</b>
MS5	9	Primary Pump House, North tank (tank wall)	Concrete	Yellow	None Detected
	10	Primary Pump House, South tank (tank wall)	Concrete		None Detected
MS6	11	<b>Primary Pump House, North Tank</b>	<b>Caulking</b>	Off-White	<b>3% Chrysotile</b>
	12	<b>Primary Pump House, South Tank</b>	<b>Caulking</b>		<b>3% Chrysotile</b>
MS7	13	North Tank, outer Ring	Black Coating	Black	None Detected
	14	North Tank, outer Ring	Black Coating		None Detected
MS8	15	Sludge Thickener, Flange Valve	Gasket Material	10" Flange Valve (Black)	None Detected
	16	Sludge Thickener, Valve	Gasket Material		None Detected
MS9	17	Sludge Thickener, Flange	Gasket Material	6"-10" (Brown)	None Detected
	18	Sludge Thickener, Cyclone Plug Valve Flange	Gasket Material		None Detected
MS10	19	Pickett Thickener, Tank 1 Wall	Concrete	Yellow	None Detected
	20	Pickett Thickener, Tank 4 Wall	Concrete		None Detected
MS11	21	Headworks (LL) Grit Pump Room, Flange Pipe 3	Gasket Material	Black (Painted Yellow)	None Detected
	22	Headworks (LL) Grit Pump Room, Pump 1 – Pipe Flange	Gasket Material		None Detected
MS12	23	Headworks (LL) Grit Pump Room, Pump 4 Flange	Gasket Material	10" Pipe (Red)	None Detected
	24	Headworks (LL) Grit Pump Room, Pump 2 Flange	Gasket Material		None Detected
C1	25	Electrical Motor Control Room	Ceiling Tile	2'x2' (Fissure, small & Medium Pinhole)	None Detected
	26	Electrical Motor Control Room	Ceiling Tile		None Detected
MS13	27	Pipe Flange Headworks (LL) Room	Gasket Material	36" Pipe (Gray)	None Detected
	28	Pipe Flange Headworks (LL) Room	Gasket Material		None Detected
MS14	29	Irrigation System, Pump 3	Vibration Dampener	18" Pipe (Gray)	None Detected
	30	Irrigation System, Pump 2	Vibration Dampener		None Detected
MS15	31	Irrigation System, Pump 4	Gasket Material	18" Pipe (Red/Painted Purple)	None Detected
	32	Irrigation System, Pump 4	Gasket Material		None Detected
MS16	33	Irrigation System, Pump 2	Concrete Slab	N/A	None Detected
	34	Irrigation System, Generator 1	Concrete Slab		None Detected

**APPENDIX A**  
**SUMMARY OF ASBESTOS CONTAINING MATERIAL SAMPLE LOCATIONS**  
**NORTHEAST WASTEWATER TREATMENT FACILITY, CLEARWATER, FL**

HA No.	Sample Number	Location	Material Description	Component Layer	Lab Results <sup>(1)</sup>
MS17	35	Irrigation System, Slab South Side	Concrete Slab	N/A	None Detected
	36	Irrigation System, Chlorine Feed System Room	Concrete Slab		None Detected
R1	37	Irrigation System Roof	Rolled Roofing	Gray	None Detected
	38	Irrigation System Roof	Rolled Roofing		None Detected
R2	39	<b>Irrigation System Roof</b>	<b>Roofing Mastic</b>	<b>Pitch Pan (Black)</b>	<b>5% Chrysotile</b>
	40	<b>Irrigation System Roof</b>	<b>Roofing Mastic</b>		<b>5% Chrysotile</b>
MS18	41	Tank Wall	Concrete	N/A	None Detected
	42	Tank Wall	Concrete		None Detected
R3	43	Irrigation System, Chlorine Feeder Room Roof	Rolled Roofing	w/Gravel	None Detected
	44	Irrigation System, Chlorine Feeder Room Roof	Rolled Roofing		None Detected
MS19	45	Chlorine Feeder Room – Block Wall	Concrete Block	Filler/Texture	None Detected
	45	Chlorine Feeder Room – Block Wall	Concrete Block	CMU Block	None Detected
	45	Chlorine Feeder Room – Block Wall	Concrete Block	Mortar	None Detected
	46	Chlorine Feeder Room – Block Wall	Concrete Block	Filler/Texture	None Detected
	46	Chlorine Feeder Room – Block Wall	Concrete Block	CMU Block	None Detected
	46	Chlorine Feeder Room – Block Wall	Concrete Block	Mortar	None Detected
MS20	47	Effluent Pump House	Caulking	N/A	None Detected
	48	Effluent Pump House	Caulking		None Detected

**APPENDIX B**  
**SUMMARY OF LEAD-BASED PAINT SAMPLE LOCATIONS**  
**Northeast Wastewater Treatment Facility, Clearwater, FL**

Sample ID	Sample location	Component	Color	Substrate	Lab Results (% by weight)	Condition (Intact, Fair, or Poor)
LBP-1	<b>Primary Pump House – 1FL – Pipe, 10”</b>	Pipe	Yellow	Metal	<b>3.4</b>	<b>Poor</b>
LBP-2	Primary Pump House – 1FL – Valve, 10”	Valve	Yellow	Metal	<0.010	Poor
LBP-3	<b>Primary Pump House – 1FL – Pipe, 6”</b>	Pipe	Green	Metal	<b>0.034</b>	<b>Poor</b>
LBP-4	<b>Primary Pump House – 1FL – Valve, 6”</b>	Valve	Green	Metal	<b>0.053</b>	<b>Poor</b>
LBP-5	Primary Pump House – 1FL – Pump #1	Pump	Red	Metal	<0.016	Poor
LBP-6	<b>Primary Pump House – 1FL – Pump #2 – Valve</b>	Valve	Red	Metal	<b>1.5</b>	<b>Poor</b>
LBP-7	<b>Primary Pump House – 1FL – Sludge Pump #1</b>	Pump	Light Blue	Metal	<b>0.11</b>	<b>Poor</b>
LBP-8	Primary Pump House – 1FL – Sludge Pump #2	Valve	Dark Blue	Metal	<0.014	Poor
LBP-9	Primary Pump House – 1FL – Sludge Pump #1	Motor Slab	Silver	Metal	<0.010	Poor
LBP-10	Primary Pump House – 1FL – Wall	Wall	Yellow	Concrete	<0.010	Poor
LBP-11	<b>Primary Pump House – 1FL – Stairs</b>	Tread	Yellow	Concrete	<b>4.5</b>	<b>Poor</b>
LBP-12	Primary Pump House – South Tank (North Side)	Wall	Yellow	Concrete	<0.010	Poor
LBP-13	<b>Primary Pump House – North Tank – Drive Motor</b>	Motor	Red	Metal	<b>0.015</b>	<b>Poor</b>
LBP-14	Primary Pump House – North Tank – Sump Pump	Outer Ring	Black	Metal	<0.010	Poor
LBP-15	Primary Pump House – Pickett Thickener Tank #3	Wall	Yellow	Concrete	<0.010	Fair
LBP-16	Primary Pump House – Pickett Thickener Tank #1	Drive Motor	Green	Metal	<0.010	Poor
LBP-17	Primary Pump House – Pickett Thickener Tank #3	Drive Motor	Blue	Metal	<0.010	Poor
LBP-18	Primary Pump House – Pickett Thickener - Feeder Pipe, 10”	Pipe	Black	Metal	<0.010	Fair
LBP-19	Primary Pump House – Pickett Thickener - Feeder Pipe, 6”	Pipe	Brown	Metal	<0.010	Fair
LBP-20	Headworks – Lower Level – Grit Pumps – Pipe, 10”	Pipe	Tan	Metal	<0.010	Poor
LBP-21	<b>Headworks – Lower Level – Grit Pumps – Pipe, 6”</b>	Pipe	Green	Metal	<b>0.013</b>	<b>Poor</b>
LBP-22	<b>Headworks – Lower Level – Grit Pumps – Pipe, 6”</b>	Pipe	Black	Metal	<b>0.018</b>	<b>Poor</b>
LBP-23	Headworks – Lower Level – Grit Pumps – Pump	Pump	Blue	Metal	<0.010	Poor
LBP-24	<b>Headworks – Lower Level – Grit Pump – Pipe, 36”</b>	Pipe	Gray	Metal	<b>0.038</b>	<b>Poor</b>
LBP-25	Headworks – Lower Level – Grit Pump Room – Wall	Wall	Yellow	Concrete	<0.010	Poor
LBP-26	<b>Irrigation System – Reclaimed Water Pump #2</b>	Pump	Gray	Metal	<b>0.72</b>	Fair
LBP-27	Irrigation System – Reclaimed Water – Pump #4	Pump	Purple	Metal	<0.010	Fair
LBP-28	Irrigation System – Reclaimed Water – Generator	Pump	Green	Metal	<0.010	Poor
LBP-29	<b>Irrigation System – Reclaimed Water – Electric Panel Cabinet</b>	Doors	Gray	Metal	<b>0.47</b>	<b>Poor</b>
LBP-30	Irrigation System – Reclaimed Water – Storage Box	Lid/Cover	Gray	Metal	<b>0.060</b>	<b>Poor</b>
LBP-31	Irrigation System – Reclaimed Water – Natural Gas Pipeline, 3”	Pipe	Orange	Metal	<b>2.5</b>	<b>Poor</b>

**APPENDIX B**  
**SUMMARY OF LEAD-BASED PAINT SAMPLE LOCATIONS**  
**Northeast Wastewater Treatment Facility, Clearwater, FL**

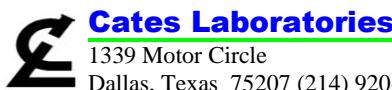
Sample ID	Sample location	Component	Color	Substrate	Lab Results (% by weight)	Condition (Intact, Fair, or Poor)
LBP-32	Irrigation System – Reclaimed Water – Roof Support Post	Post	Yellow	Metal	<0.010	Poor
<b>LBP-33</b>	<b>Irrigation System – Reclaimed Water – Pump #2</b>	<b>Motor</b>	<b>Dark Gray</b>	<b>Metal</b>	<b>0.27</b>	<b>Poor</b>
<b>LBP-34</b>	<b>Irrigation System – Reclaimed Water – Wall</b>	<b>Wall</b>	<b>Light Yellow</b>	<b>Concrete</b>	<b>0.010</b>	<b>Poor</b>
<b>LBP-35</b>	<b>Irrigation System – Reclaimed Water – Roof Support Beam</b>	<b>Beam</b>	<b>Yellow</b>	<b>Wood</b>	<b>0.062</b>	<b>Poor</b>
LBP-36	Irrigation System – Reclaimed Water – Overhead PVC Drain Pipe, 2"	Pipe	Yellow	PVC	6.3	Poor
LBP-37	Irrigation System – Chlorine Feed System Room	Wall	White	CMU	0.031	Fair
LBP-38	Irrigation System – Chlorine Feed System Room	Wall	Gray	CMU	0.021	Fair
<b>LBP-39</b>	<b>Irrigation System – Chlorine Feed System Room</b>	<b>Door Frame</b>	<b>Yellow</b>	<b>Metal</b>	<b>0.030</b>	<b>Poor</b>
LBP-40	Irrigation System – Chlorine Feed System Room	Door	Yellow	Metal	<0.024	Poor
<b>LBP-41</b>	<b>Irrigation System – Effluent Pump – Electrical Conduit</b>	<b>Pipe</b>	<b>Yellow</b>	<b>Metal</b>	<b>0.030</b>	<b>Poor</b>
LBP-42	Irrigation System – Effluent Feed System – Lift	Pipe	White	Metal	<0.010	Poor

Note: Bolded entries indicate detectable levels of lead & regulated by OSHA

**APPENDIX C**

**ASBESTOS ANALYTICAL LABORATORY DATA**

# PLM REPORT SUMMARY



NVLAP Lab No. 200569-0  
TDSHS License No. 30-0287

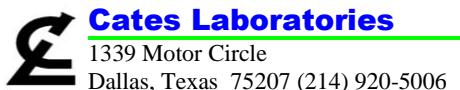
Client:	Terracon	Lab Job No.:	PLM-13606
Project:	Northeast Wastewater Treatment Facility, S.R. 580 & McMullen Booth Rd.	Set No.:	20437
Project No:	H4167137	Report Date:	1/11/2017
Identification:	Asbestos, Bulk Sample Analysis	Sample Date:	1/5/2017
Test Method:	Polarized Light Microscopy/Dispersion Staining (PLM/DS) EPA Method 600/R-93/116		Page 1 of 4

On 1/9/2017, forty-eight (48) bulk samples were submitted by Mr. Pete MacKay of Terracon for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

Lab Sample No.	Client Field I.D.	Sample Description/Location	Asbestos Content
CL503437	1	Pipe Gasket on 10" Pipe (black, painted yellow) - Primary Pump House, Flange	None Detected
CL503438	2	Pipe Gasket on 10" Pipe (black, painted yellow) - Primary Pump House, Flange	None Detected
CL503439	3	Pipe Gasket on 6" Pipe (dark green) - Primary Pump House, Flange	35% Chrysotile
CL503440	4	Pipe Gasket on 6" Pipe (dark green) - Primary Pump House, Flange	35% Chrysotile
CL503441	5	Pipe Gasket on 10" Pipe (red, black gasket) - Primary Pump House, Flange	None Detected
CL503442	6	Pipe Gasket on 10" Pipe (red, red gasket) - Primary Pump House, Flange	None Detected
CL503443	7	Pipe Gasket on 10" Pipe (yellow) - Primary Pump House, Valve Flange	35% Chrysotile
CL503444	8	Pipe Gasket on 10" Pipe (yellow) - Primary Pump House, Valve Flange	35% Chrysotile
CL503445	9	North Tank Concrete Wall (yellow) - Primary Pump House, North tank (tank wall)	None Detected
CL503446	10	South Tank Concrete Wall (yellow) - Primary Pump House, South tank (tank wall)	None Detected
CL503447	11	Off-white Caulking - Primary Pump House, North Tank	3% Chrysotile
CL503448	12	Off-white Caulking - Primary Pump House, South Tank	3% Chrysotile
CL503449	13	North Tank (black coating) - North Tank, outer Ring	None Detected
CL503450	14	North Tank (black coating) - North Tank, outer Ring	None Detected
CL503451	15	Pipe Gasket 10" (black) - Sludge Thickener, Flange Valve	None Detected
CL503452	16	Pipe Gasket 10" (black) - Sludge Thickener, Valve	None Detected
CL503453	17	Pipe Gasket 6"-10" (brown) - Sludge Thickener, Flange	None Detected
CL503454	18	Pipe Gasket 6"-10" (brown) - Sludge Thickener, Cyclone Plug Valve Flange	None Detected

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.

# PLM REPORT SUMMARY



NVLAP Lab No. 200569-0  
TDSHS License No. 30-0287

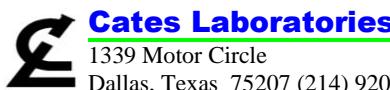
Client:	Terracon	Lab Job No.:	PLM-13606
Project:	Northeast Wastewater Treatment Facility, S.R. 580 & McMullen Booth Rd.	Set No.:	20437
Project No:	H4167137	Report Date:	1/11/2017
Identification:	Asbestos, Bulk Sample Analysis	Sample Date:	1/5/2017
Test Method:	Polarized Light Microscopy/Dispersion Staining (PLM/DS) EPA Method 600/R-93/116		Page 2 of 4

On 1/9/2017, forty-eight (48) bulk samples were submitted by Mr. Pete MacKay of Terracon for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

Lab Sample No.	Client Field I.D.	Sample Description/Location	Asbestos Content
CL503455	19	Tank Wall Concrete (yellow) - Pickett Thickener, Tank 1 Wall	None Detected
CL503456	20	Tank Wall Concrete (yellow) - Pickett Thickener, Tank 4 Wall	None Detected
CL503457	21	10" Pipe Gasket (black, painted yellow) - Headworks (LL) Grit Pump Room, Flange Pipe 3	None Detected
CL503458	22	10" Pipe Gasket (black, painted yellow) - Headworks (LL) Grit Pump Room, Pump 1 Pipe Flange	None Detected
CL503459	23	10" Pipe Gasket (red) - Headworks (LL) Grit Pump Room, Pump 4 Flange	None Detected
CL503460	24	10" Pipe Gasket (red) - Headworks (LL) Grit Pump Room, Pump 2 Flange	None Detected
CL503461	25	2' X 2' Ceiling Tile (fissure & small/medium pinhole) - Electrical Motor Control Room	None Detected
CL503462	26	2' X 2' Ceiling Tile (fissure & small/medium pinhole) - Electrical Motor Control Room	None Detected
CL503463	27	Pipe Gasket 36" (grey) - Pipe Flange Headworks (LL) Room	None Detected
CL503464	28	Pipe Gasket 36" (grey) - Pipe Flange Headworks (LL) Room	None Detected
CL503465	29	18" Pipe Damper (grey) - Irrigation System, Pump 3	None Detected
CL503466	30	18" Pipe Damper (grey) - Irrigation System, Pump 2	None Detected
CL503467	31	18" Pipe Gasket flange (red, painted purple) - Irrigation System, Pump 4	None Detected
CL503468	32	18" Pipe Gasket flange (red, painted purple) - Irrigation System, Pump 4	None Detected
CL503469	33	Concrete Foundation (equipment foundation) - Irrigation System, Pump 2	None Detected
CL503470	34	Concrete Foundation (equipment foundation) - Irrigation System, Generator 1	None Detected
CL503471	35	Concrete Foundation Slab - Irrigation System, Slab South Side	None Detected

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.

# PLM REPORT SUMMARY



NVLAP Lab No. 200569-0  
TDSHS License No. 30-0287

Client:	Terracon	Lab Job No.:	PLM-13606
Project:	Northeast Wastewater Treatment Facility, S.R. 580 & McMullen Booth Rd.	Set No.:	20437
Project No:	H4167137	Report Date:	1/11/2017
Identification:	Asbestos, Bulk Sample Analysis	Sample Date:	1/5/2017
Test Method:	Polarized Light Microscopy/Dispersion Staining (PLM/DS) EPA Method 600/R-93/116		Page 3 of 4

On 1/9/2017, forty-eight (48) bulk samples were submitted by Mr. Pete MacKay of Terracon for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

Lab Sample No.	Client Field I.D.	Sample Description/Location	Asbestos Content
CL503472	36	Concrete Foundation Slab - Irrigation System, Chlorine Feed System Room	None Detected
CL503473	37	Rolled Roofing (grey) - Irrigation System Roof	None Detected
CL503474	38	Rolled Roofing (grey) - Irrigation System Roof	None Detected
CL503475	39	Pitch Pan Tar (black) - Irrigation System Roof	5% Chrysotile
CL503476	40	Pitch Pan Tar (black) - Irrigation System Roof	5% Chrysotile
CL503477	41	Poured Concrete - Tank Wall	None Detected
CL503478	42	Poured Concrete - Tank Wall	None Detected
CL503479	43	Rolled Roofing w/Gravel - Irrigation System, Chlorine Feeder Room Roof	None Detected
CL503480	44	Rolled Roofing w/Gravel - Irrigation System, Chlorine Feeder Room Roof	None Detected
CL503481	45	Block Wall - Chlorine Feeder Room	None Detected - Filler/Texture None Detected - CMU Block None Detected - Mortar
CL503482	46	Block Wall - Chlorine Feeder Room	None Detected - Filler/Texture None Detected - CMU Block None Detected - Mortar
CL503483	47	Caulking Material - Effluent Pump House	None Detected
CL503484	48	Caulking Material - Effluent Pump House	None Detected

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.



**Cates Laboratories**

1339 Motor Circle  
Dallas, Texas 75207 (214) 920-5006

## PLM REPORT SUMMARY

NVLAP Lab No. 200569-0  
TDSHS License No. 30-0287

Client:	Terracon	Lab Job No.:	PLM-13606
Project:	Northeast Wastewater Treatment Facility, S.R. 580 & McMullen Booth Rd.	Set No.:	20437
Project No:	H4167137	Report Date:	1/11/2017
Identification:	Asbestos, Bulk Sample Analysis	Sample Date:	1/5/2017
Test Method:	Polarized Light Microscopy/Dispersion Staining (PLM/DS) EPA Method 600/R-93/116	Page 4 of 4	

On 1/9/2017, forty-eight (48) bulk samples were submitted by Mr. Pete MacKay of Terracon for asbestos analysis by PLM/DS.  
Copies of the lab data sheets are attached; additional information may be found therein.

## STATEMENT OF LABORATORY ACCREDITATION

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116 or the U.S. Environmental Protection Agency method, under AHERA (EPA 600/M4-82-020), for the analysis of asbestos in building materials by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Specific questions concerning bulk sample results shall be directed to the Laboratory Director.

Analyst: Kathy Schosek

Laboratory Director: John R. Cates, P.G.

Approved Signatory:

  
**NVLAP<sup>®</sup>**

NVLAP LAB CODE 200569-0

**APPENDIX D**

**LEAD – ANALYTICAL LABORATORY DATA**



# EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 786-5974

<http://www.EMSL.com>

EMSL Order:	201700157
CustomerID:	TERA72
CustomerPO:	H4167137
ProjectID:	

Attn: **Pete MacKay**  
**Terracon Consultants, Inc.**  
**5463 West Waters Avenue**  
**Suite 830**  
**Tampa, FL 33634**

Project: H4167137

Phone: (813) 626-1730  
Fax: (813) 626-1452  
Received: 01/09/17 10:30 AM  
Collected:

## Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

Client Sample Description	Lab ID	Collected	Analyzed	Lead Concentration
LBP-1	201700157-0001	1/11/2017	Site: Primary Pump House 10" Pipe	3.4 % wt
LBP-2	201700157-0002	1/11/2017	Site: Primary Pump House 10" Valve	<0.010 % wt
LBP-3	201700157-0003	1/11/2017	Site: Primary Pump House 6" Pipe	0.034 % wt
LBP-4	201700157-0004	1/11/2017	Site: Primary Pump House 6" Valve	0.053 % wt
LBP-5	201700157-0005	1/11/2017	Site: Primary Pump House Pump 1	<0.016 % wt
LBP-6	201700157-0006	1/11/2017	Site: Primary Pump House Pump 2 Valve	1.5 % wt
LBP-7	201700157-0007	1/11/2017	Site: Primary Pump House Sludge Pump 1 Valve	0.11 % wt
LBP-8	201700157-0008	1/11/2017	Site: Primary Pump House Sludge Pump 2 Valve	<0.014 % wt
LBP-9	201700157-0009	1/11/2017	Site: Primary Pump House Sludge Pump 1 Motor Slab	<0.010 % wt
LBP-10	201700157-0010	1/11/2017	Site: Primary Pump House Wall	<0.010 % wt
LBP-11	201700157-0011	1/11/2017	Site: Primary Pump House Stairs	4.5 % wt
LBP-12	201700157-0012	1/11/2017	Site: South Tank Wall	<0.010 % wt
LBP-13	201700157-0013	1/11/2017	Site: North Tank Drive Motor	0.015 % wt
LBP-14	201700157-0014	1/11/2017	Site: North Tank Outer Ring	<0.010 % wt
LBP-15	201700157-0015	1/11/2017	Site: Sludge Thickener Room, Tank 3 Wall	<0.010 % wt

Phillip Worby, Lead Laboratory Manager  
or other approved signatory

\*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 01/12/2017 11:18:45



# EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 786-5974

<http://www.EMSL.com>

EMSL Order:	201700157
CustomerID:	TERA72
CustomerPO:	H4167137
ProjectID:	

Attn: **Pete MacKay**  
**Terracon Consultants, Inc.**  
**5463 West Waters Avenue**  
**Suite 830**  
**Tampa, FL 33634**

Project: H4167137

Phone: (813) 626-1730  
Fax: (813) 626-1452  
Received: 01/09/17 10:30 AM  
Collected:

## Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

Client Sample Description	Lab ID	Collected	Analyzed	Lead Concentration
LBP-16	201700157-0016	1/11/2017		<0.010 % wt
		Site: Sludge Thickener Room, Tank 1 Drive Body		
LBP-17	201700157-0017	1/11/2017		<0.010 % wt
		Site: Sludge Thickener Room, Tank 3 Drive Body		
LBP-18	201700157-0018	1/11/2017		<0.010 % wt
		Site: Sludge Thickener Room- Feeder Pipe		
LBP-19	201700157-0019	1/11/2017		<0.010 % wt
		Site: Sludge Thickener Room Pipe Raw Sewage		
LBP-20	201700157-0020	1/11/2017		<0.010 % wt
		Site: Headworks Lower Level Grit Pipes		
LBP-21	201700157-0021	1/11/2017		0.013 % wt
		Site: Headworks Lower Level Grit Pipes		
LBP-22	201700157-0022	1/11/2017		0.018 % wt
		Site: Headworks Lower Level Grit Pumps Pipes		
LBP-23	201700157-0023	1/11/2017		<0.010 % wt
		Site: Headworks Lower Level Grit Pumps Pipes		
LBP-24	201700157-0024	1/11/2017		0.038 % wt
		Site: Headworks Lower Level Grit Pumps Room		
LBP-25	201700157-0025	1/11/2017		<0.010 % wt
		Site: Headworks Lower Level Grit Pumps Room		
LBP-26	201700157-0026	1/11/2017		0.72 % wt
		Site: Irrigation System Reclaimed Water Pump 2		
LBP-27	201700157-0027	1/11/2017		<0.010 % wt
		Site: Irrigation System Reclaimed Water Pump 4		
LBP-28	201700157-0028	1/11/2017		<0.010 % wt
		Site: Irrigation System Reclaimed System Generator		
LBP-29	201700157-0029	1/11/2017		0.47 % wt
		Site: Irrigation System Reclaimed System- Electrical Panel Cabinet		
LBP-30	201700157-0030	1/11/2017		0.060 % wt
		Site: Irrigation System Reclaimed System- Storage Box		

Phillip Worby, Lead Laboratory Manager  
or other approved signatory

\*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 01/12/2017 11:18:45



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## Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

Client Sample Description	Lab ID	Collected	Analyzed	Lead Concentration
LBP-31	201700157-0031	1/11/2017	Site: Irrigation System Reclaimed System- Natural Gas Line	2.5 % wt
LBP-32	201700157-0032	1/11/2017	Site: Irrigation System Reclaimed System- Roof Support Post	<0.010 % wt
LBP-33	201700157-0033	1/11/2017	Site: Irrigation System Reclaimed System Pump 2 Motor	0.27 % wt
LBP-34	201700157-0034	1/11/2017	Site: Irrigation System Reclaimed System Wall	0.010 % wt
LBP-35	201700157-0035	1/11/2017	Site: Irrigation System Reclaimed System Roof Support Beam	0.062 % wt
LBP-36	201700157-0036	1/11/2017	Site: Irrigation System Reclaimed System PVC Pipe Drain 2"	6.3 % wt
LBP-37	201700157-0037	1/11/2017	Site: Chlorine Feed System Room	0.031 % wt
LBP-38	201700157-0038	1/11/2017	Site: Chlorine Feed System Room	0.021 % wt
LBP-39	201700157-0039	1/10/2017	Site: Chlorine Feed System Room	0.030 % wt
LBP-40	201700157-0040	1/10/2017	Site: Chlorine Feed System Room	<0.024 % wt
LBP-41	201700157-0041	1/10/2017	Site: Effluent Chlorine Feed System	0.030 % wt
LBP-42	201700157-0042	1/10/2017	Site: Effluent Chlorine Feed System	<0.010 % wt

Phillip Worby, Lead Laboratory Manager  
or other approved signatory

\*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 01/12/2017 11:18:45

**APPENDIX E**  
**SITE PLANS & PHOTOGRAPHS**



Project Manager:  
RES  
Drawn by:  
PM  
Checked by:  
RES  
Approved by:  
RES

Project: H4167137  
Scale: NTS  
File Name: C:\...\  
Date: 1/13/2017

**Terracon**

5436 W. Waters Ave., Suite 830  
Tampa, Florida 33634

#### SAMPLE LOCATION DIAGRAM

Primary Pump House & Headworks Sludge Thickener  
Northeast Wastewater Treatment Facility  
S.R. 580 + McMullen Booth Road  
Safety Harbor, Florida 34695

Exhibit

1



Project Manager:

RES

Drawn by:

PM

Checked by:

RES

Approved by:

RES

Project: H4167137

Scale: NTS

File Name: C:\...\

Date: 1/13/2017

**Terracon**

5436 W. Waters Ave., Suite 830

Tampa, Florida 33634

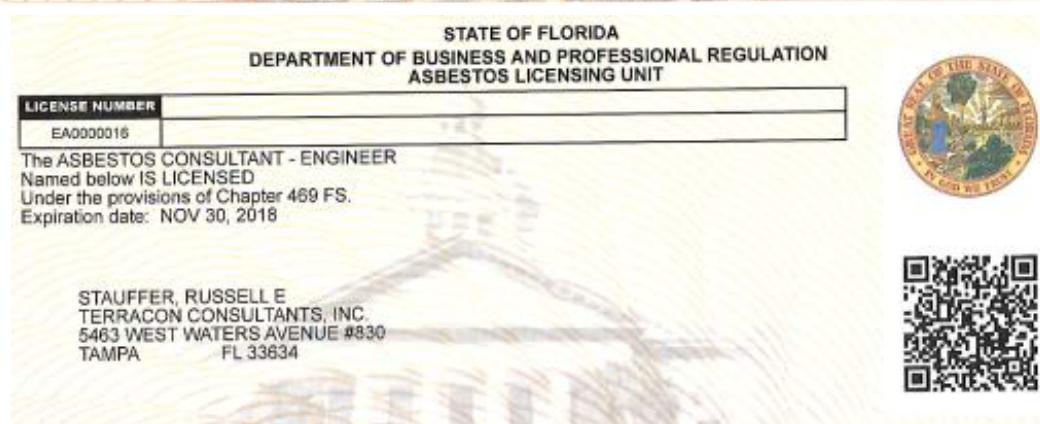
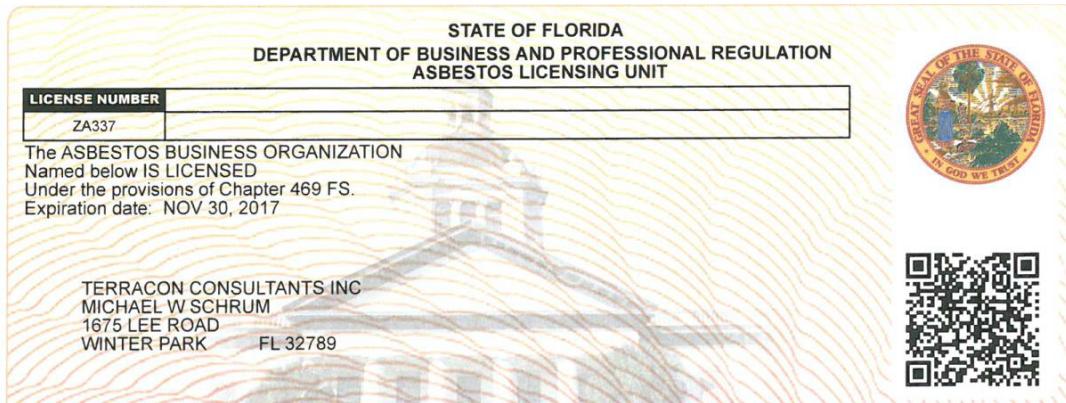
#### SAMPLE LOCATION DIAGRAM

Irrigation System - Reclaimed Water  
Northeast Wastewater Treatment Facility  
S.R. 580 + McMullen Booth Road  
Safety Harbor, Florida 34695

Exhibit

2

**APPENDIX F**  
**CERTIFICATIONS AND LICENSES**



Center for Training, Research and Education for Environmental Occupations

certifies

**Peter C. MacKay**

Terracor Consultants, Inc., 504 E Tyler St, Tampa, FL 33602  
Having passed a 25-question exam with a score of 70% or higher has successfully met training requirements for

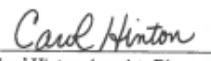
**Asbestos Refresher: Inspector**

FDBPR Asbestos Licensing Unit: Provider #000095; Course #FL49-0004731 (½ Day; 3.40 Contact Hours)  
(Reaccreditation for Inspector under TSCA Title II/AHERA)

Conducted

**08/24/2016**

Certificate #: 170538-5896  
Exam Date: 08/24/2016  
EPA accreditation expires: 08/24/2017  
Principal Instructor: Brian Duchene, PE, LAC  
CEUs: .4  
FBPR LAC: #0000995; Course #0004731  
FBPE PDHs: #0004021; Course #0009083/Educational Institutions: 4 PDHs

  
Carol Hinton, Associate Director

University of Florida TREEO Center • 3900 SW 63 Boulevard • Gainesville, FL 32608-3800 • 352-392-9570 • [www.treeo.ufl.edu](http://www.treeo.ufl.edu)

**United States Environmental Protection Agency**  
**This is to certify that**

Terracon Consultants Inc.

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226

**In the Jurisdiction of:**

Florida

This certification is valid from the date of issuance and expires May 24, 2017

FL-2606-4

Certification #

July 30, 2014

Issued On



*Michelle Price*

Michelle Price, Chief

Lead, Heavy Metals, and Inorganics Branch

**United States Environmental Protection Agency**  
**This is to certify that**

Peter Christian MacKay

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:



**In the Jurisdiction of:**

Florida

This certification is valid from the date of issuance and expires January 11, 2018

FL-I-118220-2

Certification #

April 24, 2014

Issued On



*Adrienne Priselac*

Adrienne Priselac, Manager, Toxics Office

Land Division

# **SECTION V**

## **CONTRACT DOCUMENTS**

### **Table of Contents**

<b>PUBLIC CONSTRUCTION BOND .....</b>	<b>1</b>
<b>CONTRACT.....</b>	<b>3</b>
<b>CONSENT OF SURETY TO FINAL PAYMENT .....</b>	<b>7</b>
<b>PROPOSAL/BID BOND .....</b>	<b>8</b>
<b>AFFIDAVIT .....</b>	<b>9</b>
<b>NON-COLLUSION AFFIDAVIT .....</b>	<b>10</b>
<b>PROPOSAL.....</b>	<b>11</b>
<b>CITY OF CLEARWATER ADDENDUM SHEET .....</b>	<b>13</b>
<b>BIDDER'S PROPOSAL.....</b>	<b>14</b>
<b>SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM.....</b>	<b>16</b>
<b>SCRUTINIZED COMPANIES THAT BOYCOTT ISRAEL LIST CERTIFICATION FORM.....</b>	<b>17</b>

**PUBLIC CONSTRUCTION BOND**

(1)

This bond is given to comply with § 255.05, Florida Statutes, and any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in subsections (2) and (10).

Pursuant to § 255.05(1)(b), Florida Statutes, “**Before commencing the work or before recommencing the work after a default or abandonment, the contractor shall provide to the public entity a certified copy of the recorded bond.** Notwithstanding the terms of the contract or any other law governing prompt payment for construction services, the public entity may not make a payment to the contractor until the contractor has complied with this paragraph.”

<b><u>CONTRACTOR</u></b>	<b><u>SURETY</u></b>	<b><u>OWNER</u></b>
[name]	[name]	City of Clearwater Engineering 100 S. Myrtle Avenue Clearwater, FL 33756 (727) 562-4750
[principal business address]	[principal business address]	
[phone number]	[phone number]	

**PROJECT NAME:** North East WRF Improvements

**PROJECT NO.:** 19-0029-UT

**PROJECT DESCRIPTION:** modifications to existing grit and primary treatment and sludge blend and storage systems, and new flow equalization system at the City’s Northeast Water Reclamation Facility (WRF).

BY THIS BOND, We, \_\_\_\_\_, as Contractor, and \_\_\_\_\_, a corporation, as Surety, are bound to the City of Clearwater, Florida, herein called Owner, in the sum of \$[x,xxx,xxx.xx], for payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

THE CONDITION OF THIS BOND is that if Contractor:

1. Performs the contract dated \_\_\_\_\_, between Contractor and Owner for construction of North East WRF Improvements, the contract documents being made a part of this bond by reference (which include the Advertisement for Bids, Proposal, Contract, Surety Bond, Instructions to Bidders, General Conditions, Plans, Technical Specifications and Appendix, and such alterations as may be made in said Plans and Specifications as therein provided for), at the times and in the manner prescribed in the contract; and
2. Promptly makes payments to all claimants, as defined in Section 255.05(1), Florida Statutes, supplying Contractor with labor, materials, or supplies, used directly or indirectly by Contractor in the prosecution of the work provided for in the contract; and

**PUBLIC CONSTRUCTION BOND**  
**(2)**

3. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of a default by Contractor under the contract; and
4. To the limits of § 725.06(2), Florida Statutes, shall indemnify and hold harmless Owner, their officers and employees, from liabilities, damages, losses and costs, including, but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of Contractor and persons employed or utilized by Contractor in the performance of the construction contract; and
5. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this bond is void; otherwise it remains in full force.
6. Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.
7. Any changes in or under the contract documents and compliance or noncompliance with any formalities connected with the contract or the changes does not affect Surety's obligation under this bond, and Surety does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

**IN TESTIMONY WHEREOF**, witness the hands and seals of the parties hereto this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

*(If sole Ownership or Partnership, two (2) Witnesses required).*

*(If Corporation, Secretary only will attest and affix seal).*

**[TYPE LEGAL NAME OF CONTRACTOR]**

By: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Print Name: \_\_\_\_\_

**WITNESS:**

Corporate Secretary or Witness  
 Print Name: \_\_\_\_\_

*(affix corporate seal)*

Print Name: \_\_\_\_\_

*(Corporate Surety)*

By: \_\_\_\_\_  
 ATTORNEY-IN-FACT  
 Print Name: \_\_\_\_\_

*(affix corporate seal)*

*(Power of Attorney must be attached)*

**CONTRACT**

(1)

This **CONTRACT** made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and \_\_\_\_\_, of the City of \_\_\_\_\_ County of \_\_\_\_\_ and State of Florida, hereinafter designated as the "Contractor".

[Or, if out of state:]

This **CONTRACT** made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and \_\_\_\_\_, a/an \_\_\_\_\_(State) Corporation authorized to do business in the State of Florida, of the City of \_\_\_\_\_ County of \_\_\_\_\_ and State of \_\_\_\_\_, hereinafter designated as the "Contractor".

**WITNESSETH:**

That the parties to this contract each in consideration of the undertakings, promises and agreements on the part of the other herein contained, do hereby undertake, promise and agree as follows:

The Contractor, and his or its successors, assigns, executors or administrators, in consideration of the sums of money as herein after set forth to be paid by the City and to the Contractor, shall and will at **their** own cost and expense perform all labor, furnish all materials, tools and equipment for the following:

**PROJECT NAME:** North East WRF Improvements

**PROJECT NO.:** 19-0029-UT

**in the amount of \$ \_\_\_\_\_**

In accordance with such proposal and technical supplemental specifications and such other special provisions and drawings, if any, which will be submitted by the City, together with any advertisement, instructions to bidders, general conditions, technical specifications, proposal and bond, which may be hereto attached, and any drawings if any, which may be herein referred to, are hereby made a part of this contract, and all of said work to be performed and completed by the contractor and its successors and assigns shall be fully completed in a good and workmanlike manner to the satisfaction of the City.

If the Contractor should fail to comply with any of the terms, conditions, provisions or stipulations as contained herein within the time specified for completion of the work to be performed by the Contractor, then the City, may at its option, avail itself of any or all remedies provided on its behalf and shall have the right to proceed to complete such work as Contractor is obligated to perform in accordance with the provisions as contained herein.

**CONTRACT**

(2)

**THE CONTRACTOR AND HIS OR ITS SUCCESSORS AND ASSIGNS DOES HEREBY AGREE TO ASSUME THE DEFENSE OF ANY LEGAL ACTION WHICH MAY BE BROUGHT AGAINST THE CITY AS A RESULT OF THE CONTRACTOR'S ACTIVITIES ARISING OUT OF THIS CONTRACT AND FURTHERMORE, IN CONSIDERATION OF THE TERMS, STIPULATIONS AND CONDITIONS AS CONTAINED HEREIN, AGREES TO HOLD THE CITY FREE AND HARMLESS FROM ANY AND ALL CLAIMS FOR DAMAGES, COSTS OF SUITS, JUDGMENTS OR DECREES RESULTING FROM ANY CLAIMS MADE UNDER THIS CONTRACT AGAINST THE CITY OR THE CONTRACTOR OR THE CONTRACTOR'S SUB CONTRACTORS, AGENTS, SERVANTS OR EMPLOYEES RESULTING FROM ACTIVITIES BY THE AFOREMENTIONED CONTRACTOR, SUB CONTRACTOR, AGENT SERVANTS OR EMPLOYEES, TO THE LIMITS OF § 725.06(2).**

In addition to the foregoing provisions, the Contractor agrees to conform to the following requirements:

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, sex, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; lay off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post hereafter in conspicuous places, available for employees or applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the non-discrimination clause.

The Contractor further agrees to insert the foregoing provisions in all contracts hereunder, including contracts or agreements with labor unions and/or worker's representatives, except sub-contractors for standard commercial supplies or raw materials.

It is mutually agreed between the parties hereto that time is of the essence of this contract, and in the event that the work to be performed by the Contractor is not completed within the time stipulated herein, it is then further agreed that the City may deduct from such sums or compensation as may be due to the Contractor the sum of **\$1,000.00 per day** for each day that the work to be performed by the Contractor remains incomplete beyond the time limit specified herein, which sum of **\$1,000.00 per day** shall only and solely represent damages which the City has sustained by reason of the failure of the Contractor to complete the work within the time stipulated, it being further agreed that this sum is not to be construed as a penalty but is only to be construed as liquidated damages for failure of the Contractor to complete and perform all work within the time period as specified in this contract.

It is further mutually agreed between the City and the Contractor that if, any time after the execution of this contract and the public construction bond which is attached hereto for the faithful performance of the terms and conditions as contained herein by the Contractor, that the City shall at any time deem the surety or sureties upon such public construction bond to be unsatisfactory or if, for any reason, the said bond ceases to be adequate in amount to cover the performance of the work the Contractor shall, at his or its own expense, within ten (10) days after receipt of written notice from the City to do so, furnish an additional bond or bonds in such term and amounts and with such surety or sureties as shall be satisfactory to the City. If such an event occurs, no further payment shall be made to the Contractor under the terms and provisions of this contract until such new or additional security bond guaranteeing the faithful performance of the work under the terms hereof shall be completed and furnished to the City in a form satisfactory to it.

**CONTRACT**

(3)

In addition to all other contract requirements as provided by law, the contractor executing this agreement agrees to comply with public records law.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, THE CONTRACTORS DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT. CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 727-562-4092, [Rosemarie.Call@mclearwater.com](mailto:Rosemarie.Call@mclearwater.com),  
600 Cleveland St. Clearwater, FL 33756

The contractor's agreement to comply with public records law applies specifically to:

- a) Keep and maintain public records required by the City of Clearwater (hereinafter “public agency”) to perform the service being provided by the contractor hereunder.
- b) Upon request from the public agency’s custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.
- c) Ensure that the public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the public agency.
- d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the contractor or keep and maintain public records required by the public agency to perform the service. If the contractor transfers all public records to the public agency upon completion of the contract, the contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency’s custodian of public records, in a format that is compatible with the information technology systems of the public agency.
- e) A request to inspect or copy public records relating to a public agency’s contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the contractor of the request and the contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.
- f) The contractor hereby acknowledges and agrees that if the contractor does not comply with the public agency’s request for records, the public agency shall enforce the contract provisions in accordance with the contract.
- g) A contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.
- h) If a civil action is filed against a contractor to compel production of public records relating to a public agency’s contract for services, the court shall assess and award against the contractor the reasonable costs of enforcement, including reasonable attorney fees, if:
  1. The court determines that the contractor unlawfully refused to comply with the public records request within a reasonable time; and

**CONTRACT**

(4)

- 2. At least 8 business days before filing the action, the plaintiff provided written notice of the public records request, including a statement that the contractor has not complied with the request, to the public agency and to the contractor.
- i) A notice complies with subparagraph (h)2. if it is sent to the public agency’s custodian of public records and to the contractor at the contractor’s address listed on its contract with the public agency or to the contractor’s

SECTION V – Contract Documents

**registered agent. Such notices must be sent by common carrier delivery service or by registered, Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.**

- j) **A contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.**

IN WITNESS WHEREOF, the parties to the agreement have hereunto set their hands and seals and have executed this Agreement, the day and year first above written.

**CITY OF CLEARWATER  
IN PINELLAS COUNTY, FLORIDA**

By: \_\_\_\_\_

William B. Horne, II  
City Manager

(SEAL)

Attest:

Countersigned:

Rosemarie Call  
City Clerk

By: \_\_\_\_\_

Frank Hibbard  
Mayor

Approved as to form:

Owen Kohler  
Assistant City Attorney

Contractor must indicate whether:

Corporation,  Partnership,  Company, or  Individual

\_\_\_\_\_  
(Contractor)

By: \_\_\_\_\_ (SEAL)

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title; where the person is signing for a Corporation, he must, by Affidavit, show his authority to bind the Corporation – **provide Affidavit**.

**CONSENT OF SURETY TO FINAL PAYMENT**

TO OWNER: City of Clearwater PROJECT NAME: North East WRF Improvements

Engineering PROJECT NO.: 19-0029-UT

100 S. Myrtle Ave. CONTRACT DATE: [REDACTED]

Clearwater, FL 33756 BOND NO.: [REDACTED], recorded in O.R. Book [REDACTED], Page [REDACTED], of the Public Records of Pinellas County, Florida.

CONTRACTOR: [REDACTED]

Pursuant to § 255.05(11), Florida Statutes, and in accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the:

[Insert name of Surety]

[address]

[address]

, SURETY,

on bond of

[Insert name of Contractor]

[address]

[address]

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve Surety of any of its obligations to

City of Clearwater  
Engineering  
100 S. Myrtle Ave.  
Clearwater, FL 33756

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_  
(Surety)

\_\_\_\_\_  
(Signature of authorized representative)

\_\_\_\_\_  
(Printed name and title)

Attest:  
(Seal):

**PROPOSAL/BID BOND**

(Not to be filled out if a certified check is submitted)

**KNOWN ALL MEN BY THESE PRESENTS:** That we, the undersigned, \_\_\_\_\_  
 \_\_\_\_\_ as Contractor, and \_\_\_\_\_  
 \_\_\_\_\_ as Surety, whose address is \_\_\_\_\_,  
 \_\_\_\_\_, are held and firmly bound unto the City of Clearwater,  
 Florida, in the sum of \_\_\_\_\_ Dollars (\$\_\_\_\_\_) (being a  
 minimum of 10% of Contractor's total bid amount) for the payment of which, well and truly to be made, we hereby jointly  
 and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the attached Proposal of \_\_\_\_\_  
 \_\_\_\_\_ as Contractor, and \_\_\_\_\_ as Surety, for work specified  
 as: \_\_\_\_\_ all as stipulated

in said Proposal, by doing all work incidental thereto, in accordance with the plans and specifications provided herefor, all  
 within Pinellas County, is accepted and the contract awarded to the above named bidder, and the said bidder shall within  
 ten days after notice of said award enter into a contract, in writing, and furnish the required Public Construction Bond with  
 surety or sureties to be approved by the City Manager, this obligation shall be void, otherwise the same shall be in full force  
 and virtue by law and the full amount of this Proposal/Bid Bond will be paid to the City as stipulated or liquidated damages.

Principal must indicate whether:

Corporation,  Partnership,  Company, or  Individual

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
 Contractor

\_\_\_\_\_  
 Principal

By: \_\_\_\_\_  
 Title \_\_\_\_\_

\_\_\_\_\_  
 Surety

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title; where the person  
 is signing for a Corporation, he must, by Affidavit, show his authority to bind the Corporation – **provide Affidavit**.

## **SECTION V – Contract Documents**

## AFFIDAVIT

(To be filled in and executed if the bidder is a corporation)

**STATE OF FLORIDA**

**COUNTY OF** \_\_\_\_\_)

\_\_\_\_\_, being duly sworn, deposes and says that he/she is Secretary of \_\_\_\_\_ a corporation organized and existing under and by virtue of the laws of the State of Florida, and having its principal office at:

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(City)

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(County)

(State)

Affiant further says that he is familiar with the records, minute books and by-laws of

(Name of Corporation)

Affiant further says that \_\_\_\_\_ is \_\_\_\_\_  
(Officer's Name) (Title)

of the corporation, is duly authorized to sign the Proposal for \_\_\_\_\_

or said corporation by virtue of \_\_\_\_\_  
(state whether a provision of by laws or a Resolution of  
Board of Directors. If by Resolution give date of adoption).

---

Affiant

Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Notary Public

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Type/print/stamp name of Notary

Title or rank, and Serial No., if any

**NON-COLLUSION AFFIDAVIT**

**STATE OF FLORIDA** )

**COUNTY OF \_\_\_\_\_)**

\_\_\_\_\_ being, first duly sworn, deposes and says that he is

of \_\_\_\_\_,

the party making the foregoing Proposal or Bid; that such Bid is genuine and not collusive or sham; that said bidder is not financially interested in or otherwise affiliated in a business way with any other bidder on the same contract; that said bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidders or person, to put in a sham bid or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price or affiant or any other bidder, or to fix any overhead, profit or cost element of said bid price, or that of any other bidder, or to secure any advantage against the City of Clearwater, Florida, or any person or persons interested in the proposed contract; and that all statements contained in said proposal or bid are true; and further, that such bidder has not directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

\_\_\_\_\_  
Affiant

Sworn to and subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Notary Public

**PROPOSAL**

(1)

**TO THE CITY OF CLEARWATER, FLORIDA, for**

**North East WRF Improvement (19-0029-UT #)**

and doing such other work incidental thereto, all in accordance with the contract documents, marked

**North East WRF Improvement (19-0029-UT #)**

Every bidder must take notice of the fact that even though his proposal be accepted and the documents signed by the bidder to whom an award is made and by those officials authorized to do so on behalf of the City of Clearwater, Florida, that no such award or signing shall be considered a binding contract without a certificate from the Finance Director that funds are available to cover the cost of the work to be done, or without the approval of the City Attorney as to the form and legality of the contract and all the pertinent documents relating thereto having been approved by said City Attorney; and such bidder is hereby charged with this notice.

The signer of the Proposal, as bidder, also declares that the only person, persons, company or parties interested in this Proposal, are named in this Proposal, that he has carefully examined the Advertisement, Instructions to Bidders, Contract Specifications, Plans, Supplemental Specifications, General Conditions, Special Provisions, and Public Construction Bond, that he or his representative has made such investigation as is necessary to determine the character and extent of the work and he proposes and agrees that if the Proposal be accepted, he will contract with the City of Clearwater, Florida, in the form of contract; hereto annexed, to provide the necessary labor, materials, machinery, equipment, tools or apparatus, do all the work required to complete the contract within the time mentioned in the General Conditions and according to the requirements of the City of Clearwater, Florida, as herein and hereinafter set forth, and furnish the required surety bonds for the following prices to wit:

If the foregoing Proposal shall be accepted by the City of Clearwater, Florida, and the undersigned shall fail to execute a satisfactory contract as stated in the Advertisement herein attached, then the City may, at its option determine that the undersigned has abandoned the contract, and thereupon this Proposal shall be null and void, and the certified check or bond accompanying this Proposal, shall be forfeited to become the property of the City of Clearwater, Florida, and the full amount of said check shall be retained by the City, or if the Proposal Bond be given, the full amount of such bond shall be paid to the City as stipulated or liquidated damages; otherwise, the bond or certified check accompanying this Proposal, or the amount of said check, shall be returned to the undersigned as specified herein.

## SECTION V – Contract Documents

**PROPOSAL**

(2)

Attached hereto is a bond or certified check on \_\_\_\_\_  
\_\_\_\_\_, Bank, for the sum of \_\_\_\_\_  
\_\_\_\_\_ (\$\_\_\_\_\_) (being a minimum  
of 10% of Contractor's total bid amount).

The full names and residences of all persons and parties interested in the foregoing bid are as follows:

(If corporation, give the names and addresses of the President and Secretary. If firm or partnership, the names and addresses of the members or partners. The Bidder shall list not only his name but also the name of any person with whom bidder has any type of agreement whereby such person's improvements, enrichment, employment or possible benefit, whether subcontractor, materialman, agent, supplier, or employer is contingent upon the award of the contract to the bidder).

NAMES:

ADDRESSES:

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Signature of Bidder: \_\_\_\_\_

The person signing shall, in his own handwriting, sign the Principal's name, his own name and his title. Where the person signing for a corporation is other than the President or Vice President, he must, by affidavit, show his authority, to bind the corporation.

Principal: \_\_\_\_\_

By: \_\_\_\_\_ Title: \_\_\_\_\_

Company Legal Name: \_\_\_\_\_

Doing Business As (if different than above): \_\_\_\_\_

Business Address of Bidder: \_\_\_\_\_

City and State: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Phone: \_\_\_\_\_ Email Address: \_\_\_\_\_

Dated at \_\_\_\_\_, this \_\_\_\_\_ day of \_\_\_\_\_, A.D., 20\_\_\_.

**CITY OF CLEARWATER**  
**ADDENDUM SHEET**

**PROJECT: North East WRF Improvements (19-0029-UT #)**

Acknowledgment is hereby made of the following addenda received since issuance of Plans and Specifications.

Addendum No. \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_  
(Name of Bidder)

\_\_\_\_\_  
(Signature of Officer)

\_\_\_\_\_  
(Title of Officer)

\_\_\_\_\_  
(Date)

**BIDDER'S PROPOSAL****PROJECT: North East WRF Improvements (19-0029-UT #)****CONTRACTOR:** \_\_\_\_\_**BIDDER'S GRAND TOTAL:** \$\_\_\_\_\_ (Numbers)**BIDDER'S GRAND TOTAL:** \_\_\_\_\_

(Words) \_\_\_\_\_

ITEM NO.	BASE BID ITEMS	UNIT	EST. QTY.	UNIT PRICE	TOTAL
<b>NORTHEAST WRF SLUDGE BLEND TANKS IMPROVEMENTS</b>					
1	Remove contents of existing sludge storage and blend tanks in accordance with Section 01150, 3.01A.	CY	400		
2	Existing sludge storage and blend tank concrete crack repair in accordance with Section 01150, 3.01B.	LF	100		
3	Existing sludge storage and blend tank spalled concrete repair in accordance with Section 01150, 3.01C.	SF	54		
4	Demolition of existing aeration equipment, mixing equipment, and associated appurtenances in accordance with Section 01150, 3.01D.	LS	1		
5	Existing odor control piping, stair treads, and tank walkway repair and refurbishment in accordance with Section 01150, 3.01E.	LS	1		
6	Clean and coat the interior and exterior of the existing sludge storage and blend tanks in accordance with Section 01150, 3.01F.	LS	1		
7	Sludge storage and blend tanks, pump stations, and yard piping equipment and rehabilitation in accordance with Section 01150, 3.01G.	LS	1		
8	New truck off-loading and anaerobic digester feed pump station canopy in accordance with Section 01150, 3.01H.	LS	1		
9	Dewatering feed pump station canopy removal and replacement in accordance with Section 01150, 3.01I.	LS	1		
10	Thickened primary sludge and thickened WAS yard piping modification in accordance with Section 01150, 3.01J.	LS	1		
11	Mobilization in accordance with Section 01150, 3.01K.	LS	1		
12	Indemnification in accordance with Section 01150, 3.01L.	LS	1	\$ 100.00	
<b>Sub-total NE WRF Sludge Blend Tanks Imp</b>					
13	10% Owner's Contingency	LS	1	\$ -	
	<b>Total NE WRF Sludge Blend Tanks Imp</b>				

## SECTION V – Contract Documents

<b>NE WRF GRIT REMOVAL, MOVING BELT FILTER AND EQUALIZATION SYSTEM IMPROVEMENTS</b>					
14	NE WRF Pretreatment and primary treatment improvements in accordance with Section 01150, 3.01N.	LS	1		
15	Removal and replacement of the top portion of the existing primary clarifier effluent box channel in accordance with Section 01150, 3.01O.	LS	1		
16	Rehabilitation of the walls and floors of the flow channel in the headworks building, the flow channel to the primary clarifier splitter box, the primary clarifier splitter box, the scum box, and the primary clarifier effluent box channel in accordance with Section 01150, 3.01P.	SF	7300		
17	Mobilization in accordance with Section 01150, 3.01Q.	LS	1		
18	Indemnification in accordance with Section 01150, 3.01R.	LS	1	\$ 100.00	
	<b>Sub-total NE WRF Grit Removal, Moving Belt Filter and Equalization System Imp</b>				
19	10% Owner's Contingency	LS	1	\$ -	
	<b>Total NE WRF Grit Removal, Moving Belt Filter, and Equalization Sys Imp</b>				
	<b>Sub-total</b>				
	<b>Total Contingency</b>				
	<b>Total Contract</b>				
	<b>BIDDER'S GRAND TOTAL</b>				

THE BIDDER'S GRAND TOTAL ABOVE IS HIS TOTAL BID BASED ON HIS UNIT PRICES AND LUMP SUM PRICES AND THE ESTIMATED QUANTITIES REQUIRED FOR EACH SECTION. THIS FIGURE IS FOR INFORMATION ONLY AT THE TIME OF OPENING BIDS. THE CITY WILL MAKE THE TABULATION FROM THE UNIT PRICES AND LUMP SUM PRICE BID. IF THERE IS AN ERROR IN THE TOTAL BY THE BIDDER, IT SHALL BE CHANGED AS ONLY THE UNIT PRICES AND LUMP SUM PRICE SHALL GOVERN.

**THE CONTRACTOR SHALL PROVIDE COPIES OF A CURRENT CONTRACTOR LICENSE/REGISTRATION WITH THE STATE OF FLORIDA AND PINELLAS COUNTY IN THE BID RESPONSE.**

**SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM**

***PER SECTION III, ITEM 25, IF YOUR BID IS \$1,000,000 OR MORE, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.***

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or engaging in business operations in Cuba and Syria; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on either the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engaged in business operations in Cuba and Syria; and
3. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engages in business operations in Cuba and Syria.

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Entity/Corporation

**STATE OF** \_\_\_\_\_

**COUNTY OF** \_\_\_\_\_

The foregoing instrument was acknowledged before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_ (name of person whose signature is being notarized) as the \_\_\_\_\_ (title) of \_\_\_\_\_ (name of corporation/entity), personally known to me as described herein \_\_\_\_\_, or produced a \_\_\_\_\_ (type of identification) as identification, and who did/did not take an oath.

\_\_\_\_\_  
Notary Public

\_\_\_\_\_  
Printed Name

My Commission Expires: \_\_\_\_\_  
NOTARY SEAL ABOVE

**SCRUTINIZED COMPANIES THAT BOYCOTT ISRAEL LIST CERTIFICATION  
FORM**

***PER SECTION III, ITEM 25, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.***

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
3. “Boycott Israel” or “boycott of Israel” means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel.

---

Authorized Signature

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Printed Name

---

Title

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Name of Entity/Corporation

**STATE OF** \_\_\_\_\_

**COUNTY OF** \_\_\_\_\_

The foregoing instrument was acknowledged before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_ (name of person whose signature is being notarized) as the \_\_\_\_\_ (title) of \_\_\_\_\_ (name of corporation/entity), personally known to me as described herein \_\_\_\_\_, or produced a \_\_\_\_\_ (type of identification) as identification, and who did/did not take an oath.

---

Notary Public

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Printed Name

My Commission Expires: \_\_\_\_\_  
NOTARY SEAL ABOVE