SECTION 31 23 36 (Rev.1)

EXCAVATION AND BACKFILL FOR WATER WORK

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Work under this section includes:

1. Trench Excavation and Backfill
    a. Saw cut, excavate, remove and dispose pavement.
    b. Excavate trench to dimensions specified in SFPUC-CDD Standard Plan CDD-LP-002.
    c. Excavate bell holes or joint holes.
    d. Support and protect the adjoining property and structures.
    e. Support and work around existing utilities.
    f. Handle all drainage or ground water.
    g. Furnish, place and compact sand backfill.
    h. Remove surplus material.
2. Shoring trenches and connection pits.
3. Deactivated PG&E Facilities
    a. Contractor shall remove and dispose of deactivated and/or retired underground gas facilities as required for installation of new water mains in accordance with Section 02 41 00 Demolition and PG&E procedures.

B. Additional Excavation and Backfill

1. Perform additional excavation outside of the prescribed trench area as required by the City Representative, and furnish and place backfill material. Work performed without approval of the City Representative shall be at the sole risk and expense of the Contractor.
2. Additional excavation and backfill shall also include:
    a. Excavating test holes.
    b. Change of trench alignment.
    c. Preparation of pipe bedding.
    d. Increase trench depth for preparation of pipe bedding.
    e. Removal of subsurface obstacles.
    f. Removal of concrete pavement, concrete pavement slabs and concrete parking strips.

g. Removal of sidewalk, curbs and gutters.

h. Expose existing mains and services for connections.

i. T-trench and 3-foot rule per DPW Order No. 187,005.

3. Utility Verification. Excavate test holes (potholes) to locate existing pipelines, electrical ducts, concrete encasement and other utilities prior to trenching and general excavation.

4. Classification of Excavation Materials. In the event that the Contractor encounters rock material or subsurface obstacles requiring removal by mechanical means, the Contractor will be compensated under the allowance for unforeseen conditions related to water work. The Contractor shall notify the City Representative at the start and end of each rock zone for verification purposes. The Contractor will not be compensated under the typical bid item for trenching and backfill for water work.

   In the event that the Contractor encounters rock material or other subsurface obstacles outside of the trench limits, the Contractor will be compensated through the bid item associated with additional excavation and backfill within the rock zone.

5. The extra cost of excavation and pavement restoration outside the trench, up to one foot from the edge of the excavated trench due to the T-trench, shall be paid for under the Bid Item for Additional Excavation and Backfill and Pavement Restoration, respectively. At locations where the 3-foot rule Code is triggered, the cost for the extra excavation and restoration shall be paid for under the Bid Items for Additional Excavation and Backfill and Pavement Restoration.

1.02 RELATED SECTIONS

A. SFPW Standard Specifications

B. Section 00 73 20 – Existing Utility Facilities

C. Section 00 73 21 – Utility Crossings Specifications

D. Section 01 55 26 – Traffic Control

E. Section 32 10 00 – Pavement Restoration

F. Section 33 11 00 – Water Utility Distribution Piping

G. SFPUC CDD Standard Plans (http://sfwater.org/waterplans)

1.03 CITED REFERENCES

A. ASTM D-1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

B. ASTM D-6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear

C. California Labor Code Section 6707 - Excavation five (5) feet or more in depth.

D. California Occupational Safety and Health Administration (CAL/OSHA), State of California Code of Regulations, Title 8 – Industrial Relations, Chapter 4 – Division of Industrial Safety.

E. United States Department of Labor, Occupational Safety and Health Administration, Section V, Chapter 2 Excavations: Hazard Recognition in Trenching and Shoring

1.04 SUBMITTALS

A. The Contractor shall submit samples of backfill material specified in Part 2 to the Inspection and Testing Agency hired, employed or approved by the Contractor and approved by the City. The size of samples shall be as required by the Inspection and Testing Agency.

B. The Contractor shall submit pothole plan, log and report showing the results of each test hole. Report and log shall show sizes of exposed utilities as well as horizontal and vertical location of utilities.

C. The Contractor shall submit a shoring plan in accordance with the latest Specifications and signed by a California Registered Civil or Structural Engineer and submitted to the City Representative for approval at least fifteen (15) working days before the Contractor schedules to begin excavating. Regardless of the depth, Contractor shall submit a shoring plan that shows typical shoring for connection holes and trenches where SFWD will perform work. The City Representative's acceptance of the shoring plans does not relieve the Contractor of his/her responsibility of providing a safe shoring system. The Contractor shall be solely liable for any claims or injuries resulting from his/her shoring system. The Contractor shall not start excavation prior to the City acknowledging receipt of the shoring plan by the City Representative.

D. The design engineer for the excavation support systems and dewatering work shall perform structural observation and provide a letter stating that the shoring work is in accordance with his/her design.

1.05 QUALITY CONTROL

A. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the City Representative.

C. The design engineer for excavation support systems shall be a licensed Civil or Structural Engineer in the State of California, and shall have experience in providing successful engineering services for excavation support systems and dewatering work similar in extent of that required for this project.

D. Structural Observations: The design engineer for the excavation support systems and dewatering work shall perform structural observation and provide a letter stating that the shoring work is in accordance with his/her design.

PART 2 – PRODUCTS

2.01 BACKFILL MATERIALS

A. Import Backfill

1. All import backfill shall be furnished and placed in accordance with Section 703 of the Standard Specifications Department of Public Works, except as specified herein.

2. All Import backfill material shall consist of dune sand or well-washed beach sand free from rock, concrete, organic material and other objectionable material. Documents shall be submitted to show that the total chloride content is no more than 100 ppm. Imported backfill material shall have 100% passing the 3/8” sieve size, 93% to 100% passing the No. 4 sieve size and 0% to 10% passing the No. 200 sieve size. Samples shall be submitted to, and approved by, the Department of Public Works' Material Testing Laboratory prior to placement. Unacceptable material shall be immediately removed from the site of work.

B. Reuse of excavated soils as backfill

1. The Contractor shall maximize the extent of native soil reuse throughout the project in accordance with this Section 02 81 10.

2. Native soil to be reused must not contain asphalt, un-crushed concrete, bentonite, bay mud, clay, bricks, cobblestones, rocks, rubble, scrap metal, debris, contaminated soils, vegetation, wood, debris, obstructions, and other organic, unsound or deleterious matter. Native soil must meet sieve and chloride requirements for import backfill set forth in the previous section. Unsuitable materials shall be removed from the site properly as the Contractor’s property as specified herein and Section 02 81 10.

3. Contractor shall pay for the services of a laboratory experienced in soil analysis to test for contaminants and submit the report for review and approval by the City Representative.

2.02 BURIED WARNING AND IDENTIFICATION TAPE

A. Manufacturer: THOR Enterprises, Inc.; Line Guard Inc.; or approved equal.

B. General: Warning tape shall be non-detectable underground utility marking tape conforming to ASTM D2103. It shall consist of a minimum 4.0-mil overall thickness, inert 100 percent virgin low-density polyethylene plastic film formulated for extended use underground. The materials shall be acid and alkali resistant. Width of warning tape shall be 6 inches.

C. Color Coding; Blue for potable water and purple for recycled water.

D. Message Inscription: The warning tape shall include an inscription in black letters. The inscription shall be impregnated with color-fast, lead-free, organic pigments suitable for direct burial and prolonged exposure to the elements normally encountered in moderately corrosive type soils. The height of the message letters shall be 1.5 inches minimum, and the message inscription shall be repeated at

approximately 2-foot intervals. The message inscription shall be “CAUTION – WATER LINE BELOW”.

PART 3 – EXECUTION

3.01 SUBSURFACE INVESTIGATION

A. It is the responsibility of the Contractor to investigate and familiarize with the site conditions, including subsurface soil, prior to bidding. Investigation includes but is not limited to the examination of the US Geological Survey (USGS) Map at the project area.

3.02 LAYING OUT OF WORK

A. Contractor shall employ a competent surveyor to properly lay out all grades and stakes preparatory to starting excavation and grading. It shall be the Contractor's sole responsibility to accurately locate all levels, set all stakes and protect stakes against damage by equipment during progress of work.

3.03 BENCH MARK AND MONUMENTS

A. Before any work is started the surveyor shall check all existing monuments, benchmarks, and property corners.

B. Any monument moved or displaced during grading operations shall be put back at Contractor's expense. The establishment of grade stakes and the maintenance of such grade stakes shall be the responsibility of the Contractor.

3.04 WATER MAIN ALIGNMENT

A. It is the responsibility of the Contractor to dig test holes based on contract drawings as well as USA markings on the street as approved by the City Representative to determine a suitable alignment of the water main. The suitable water main alignment based on information from test holes may be different from the proposed alignment as shown on the drawings. Changes in the alignment of any portion may result in different construction methods or different conditions, such as requiring hand digging for portions of the work, will not be subject to claim for any extra payment if the length of trench excavated is not increased. At minimum, three test holes shall be excavated per 500 linear feet of pipe along city blocks and two test holes shall be excavated in each intersection. Contractor shall submit pothole information for approval prior to installation of the water main.

3.05 DEWATERING

A. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the structures and/or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water to accumulate in the excavation or levels to return to natural groundwater elevations.

B. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems he proposes for handling groundwater and surface water encountered during construction of structures and water main pipelines.

C. All permits for disposal of dewatering drainage shall be acquired and all fees paid by the Contractor. The Contractor shall submit his/her water disposal plans for approval by the City Representative.

3.06 SHORING

A. The term "shoring" as used in connection with the excavation items of this contract, shall include all structures used to support temporarily the earth adjacent to any excavation.

1. The Contractor shall furnish, put in place and maintain, all shoring necessary to support the sides of any excavation and to prevent any movement, which might, in any way, injure the proposed structures or endanger any person.

2. Provision of protection from caving ground does not relieve the Contractor from the requirement of maintaining safety in all operations performed by him/her or his/her subcontractor.

3. The manner of shoring or bracing excavations shall be in accordance with the approved shoring plans and with the rules, orders and regulations of the State of California Code of Regulations, Title 8, Chapter 4 and United States Department of Labor, Occupational Safety and Health Administration, Section V, Chapter 2.

4. Wherever, in the opinion of the City Representative, sufficient or proper shoring has not been provided, the Contractor shall, on demand, furnish additional shoring but neither compliance with such demand nor failure of the City Representative to make such demand shall relieve or release the Contractor from his responsibility for the sufficiency of the shoring.

5. The Contractor shall be responsible for any injury occurring to persons or property or to the work due directly or indirectly to improper or insufficient shoring or to the replacement or removal of shoring.

6. Unless otherwise permitted or directed, shoring may be removed from the excavation before backfilling, to the greatest extent practicable and consistent with safety.

7. For main connections to be done by SFWD crews, complete and solid shoring is required for the excavation hole regardless of the depth.

3.07 PAVEMENT EXCAVATION

A. The removal of pavement, sidewalk, parking strip and other roadway structures shall be performed in accordance with Section 701 ‘Pavement Excavation’ of the "Standard Specifications D.P.W.", and in accordance with DPW Order No. 187,005 ‘Regulations for Excavating and Restoring Streets in San Francisco’, approved on February 6, 2018 and all modifications, unless otherwise specified herein. Saw cuts in concrete pavement and parking strip shall be of sufficient size to provide neat,

regular and vertical edges, but shall not be less than 3/4-inch in depth. The use of a saw may be omitted on approval of the City Representative in streets where the existing pavement is due to be reconstructed or is in visibly poor condition.

3.08 TRENCH EXCAVATION

A. All trench excavation shall be performed in accordance with Section 702 'Trench Excavation' of the "Standard Specifications D.P.W." and DPW Order No. 187,005, 'Regulations for Excavating and Restoring Streets in San Francisco', Approved on February 6, 2018 and all modifications, unless otherwise specified herein.

B. In accordance with rules and regulations adopted by the D.P.W., the trench length of all street openings shall not exceed the length of one block in any three-block section without special permission from SFMTA. The amount of excavated trench in excess of pipe laid therein shall not exceed 200 linear feet at the end of each working day.

C. The depth of a trench as specified in the proposal is below the gutter grade. The gutter grade shall be defined as the existing gutter grade or six inches below the official grade (grade at top of curb as established by the San Francisco Board of Supervisors) whichever is lower. The section of trench above the gutter grade shall be included in the cost of the excavation per linear foot of trench and no additional payment will be allowed for that section of trench cut from the present ground surface to the gutter grade. Where the existing pavement elevation is below the gutter grade, the depth of the trench shall be measured from the existing pavement grade.

D. The trench shall be excavated so that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operations in connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

3.09 INSTALLATION OF WARNING TAPE

A. The pipe, fittings, and pipe encasement shall be installed with a continuous strip of warning tape located 12 inches directly above the pipe but not less than 12 inches below the finished grade. The Contractor shall ensure that the warning tape is not removed or damaged during the backfilling of the trench.

B. Warning tape ends shall overlap each other a minimum of 12 inches and be fastened together with an approved water resistant adhesive tape.

3.10 REMOVAL AND INSTALLATION OF METER BOX

A. Saw cuts in sidewalk pavement shall be made along existing rectangular flag lines. Saw cuts shall be of sufficient size to provide a neat, regular and vertical edge after removal of the pavement flags but shall not be less than 1-1/2 inches in depth. If the Contractor damages the sidewalk pavement outside of the flag being removed, the Contractor at his expense shall replace the entire damaged flag in accordance with Section 204 'Concrete Sidewalk' of the Standard Specifications, D.P.W.

B. Meter boxes removed in salvable condition shall be re-installed in the work whenever feasible.

3.11 PROTECTION OF EXISTING STRUCTURES

A. The trench shall be excavated in a manner to avoid existing structures, property, and other obstructions encountered during the progress of the work. The Contractor shall support, protect, maintain, and provide for the safe operation and use of all such structures and property so encountered. Should the Contractor damage any structure or property during the progress of the work, he shall immediately notify the proper owners or authorities and shall arrange for the immediate repair of the same at his expense.

B. The Contractor shall maintain access to adjacent areas/property at all time. This shall be considered as incidental work.

C. When side sewers are encountered that interfere with the laying of the pipelines, the City Representative shall direct the Contractor to remove and replace or relocate such side sewers as required during the progress of the work. Removed side sewers shall be reconstructed in accordance with the "Standard Specifications, D.P.W." Where the City Representative determines that the removal and replacement or relocation of side sewers is infeasible, the Contractor may be directed to adjust the grade of the pipeline to avoid such side sewers. Additional excavation required to avoid such side sewers shall be paid for under the Bid Item for Additional Excavation and Backfill.

D. Where proposed water main crosses under streetcar, cable car or railroad tracks, the tracks must be properly supported in a manner required by the owner and approved by the City Representative. The Contractor shall submit detailed drawings and specifications delineating the method of support approved by the owners.

E. Supporting, working around and protecting of all utility facilities owned and operated by the City and County of San Francisco are considered as incidental work per provisions of the Section 00 73 20 - Existing Utility Facilities and Section 00 73 21 - Utility Crossings Specifications.

3.12 ADDITIONAL EXCAVATION

Test Holes (Potholes)

1. The contractor shall excavate test holes to locate existing utilities for potential horizontal and vertical conflicts (Refer to Section 01 71 33 Protection of Adjacent Construction) as directed by the City Representative. Excavation methods shall meet California Government Code 4216.

B. Change of Trench Alignment

1. Where change of alignment of the main becomes necessary after the pavement has been broken or removed and no trench excavated, the volume of pavement required to be removed in order to repave shall be paid for under –the Bid Item for Additional Excavation and Backfill.

C. Increase Trench Depth for Preparation of Pipe Bedding

1. Where ordered by the City Representative, the Contractor shall excavate the trench to a depth of at least 4 inches below the prescribed trench depths. Refer to Section 3.16 for backfilling of the trench.

D. Removal of Subsurface Obstacles

1. While excavating for contract work, the Contractor may encounter subsurface obstacles such as: man-made structures not apparent prior to the bid date and/or field conditions differing substantially from those normally encountered and recognized as inherent to the work; or existing pavement in excess of 14-inches in depth; or abandoned pavement sections below the existing pavement; concrete piers; concrete conduits; wooden ties etc., beneath the pavement. The Contractor shall remove such subsurface obstacles to the extent necessary to complete the work, when such excavation is directed and approved by the City Representative. This work will be paid for as additional excavation under the appropriate bid item in the quantity equal to the volume of subsurface obstacles removed.

E. Removal of Concrete Pavement and Concrete Parking Strips

1. When work involves water main replacement in streets having concrete pavement or concrete parking strips, the entire slab or parking strip affected shall be saw cut, excavated entirely to construction joints and concrete removed to dump site, and furnish backfill material required to prepare bedding for new concrete pavement slab or new concrete parking strip, to comply with DPW Order No. 187,005, 'Regulations for Excavating and Restoring Streets in San Francisco' Approved on February 6, 2018 and all modifications.

F. Sidewalk

1. When removing and installing meter boxes in accordance with the Bid for Removal and Installation of Meter Box, Contractor shall saw cut, excavate and remove the concrete sidewalk within prescribed flag lines and/or as directed by the City Representative, and furnish backfill material required to prepare sub-base for new concrete sidewalk and meter boxes.

G. Expose Existing Mains and Service for Connections

1. The Contractor shall excavate and expose existing mains and services as directed by the City Representative for measurements, water main and service connections and disconnection work by the Water Department.

2. At the minimum, the connection hole shall have 24 inches of clearance from the edge of the pipe to the edge of the shoring and 12 inches of clearance from the bottom of the pipe to the bottom of the connection hole. If the water main or service connection involves offsetting pipe, the hole shall be a minimum of 7 feet in addition to the length of the offset. Depending upon the condition of the existing pipes, SFWD may request to expand the hole at the time of measurement.

3. The Contractor shall cover the excavations with steel plates. The Contractor shall remove and replace steel plates and provide traffic control to accommodate the work by the Water Department. This shall be considered as incidental work.

H. T-Trench

1. The pavement excavation for a T-Trench involves additional excavation on both sides of the normal trench. The volume of pavement removed in order to form the T-Trench shall be paid for under Additional Excavation and Backfill. Refer to DPW Order No. 187,005 for Pavement Base Restoration Requirements.

3.13 MAINTENANCE AND PROTECTION OF SUBSURFACE UTILITIES, OTHER STRUCTURES AND AREAS

A. Known locations of underground utilities and structures are indicated on the Drawings. Contractor shall determine exact locations of underground utilities and structures sufficiently in advance of excavation to allow adjustment of alignment and elevation.

B. Excavation and other work under or adjacent to underground pipes, and conduits or other structures thereto, shall be conducted and maintained in such a manner so as not to disrupt or interfere with the safe operations and use of such structures. The Contractor shall prosecute the work in such a manner as not to damage any private or public property.

C. Should any such structures or property be damaged in the course of the Contractor's operations, the Contractor shall immediately notify the City Representative as well as proper authorities or owners, and shall arrange for the immediate repair of same in accordance with the applicable provisions of these Specifications, at Contractor's expense.

3.14 UNDERGROUND OBSTRUCTIONS

A. Any data shown on the Drawings, or imparted to the Contractor by the City Representative, relative to location, dimensions, type or character of pipes, conduits, and/or other structures along or across the line of the pipe, are based on information obtained from field surveys and the owners of such structures. The City assumes no responsibility for the accuracy or completeness of such data, which are offered solely for the convenience of the Contractor and should be checked by him/her to his/her satisfaction. The Contractor shall assume full responsibility and shall make no claim against the City on account of any damage to any pipes, conduits and/or other structures or for any inconvenience or added cost of performing the work which may be attributed in any degree to inaccuracy of information furnished relative to the location of such structures, or for failure thereto.

3.15 DISPOSAL OF MATERIALS

A. The Contractor shall be compensated for transportation and disposal of all unsuitable excavated material per the associated bid items.

3.16 BACKFILL AND COMPACTION OF TRENCHES / PITS

A. All trench backfill shall be performed in accordance with Section 703 ‘Trench Backfill’ of the "Standard Specifications D.P.W." and DPW Order No. 187,005, ‘Regulations for Excavating and Restoring Streets in San Francisco’, Approved on February 6, 2018 and all modifications, unless otherwise specified herein. All compaction shall be performed in accordance with Section 707 “Compaction” of the “Standard Specifications D.P.W.” unless otherwise specified herein.

B. Prior to backfilling, the trench and pits shall be cleared of all wood, debris and loose soil.

C. Backfill material shall not be dropped directly on the pipe.

D. Shoring Removal:

1. Carefully remove shoring and bracing system using methods that will minimize caving.

2. Metal sheet piling, sheeting, and bracing shall not be left in place.

E. Low points along the pipe trench shall not be backfilled until all backfill at adjacent higher elevation has been completed. Water collecting at the low points shall be removed by pumping or other approved means.

F. Backfill of Pipe Bedding

1. Whenever directed by the City Representative, the Contractor shall place a four (4) inch uniform layer of import sand over the bottom of the trench to provide continuous support for the pipe prior to installing the pipe. The pipe bedding import sand shall be compacted with approved plate-type vibrating equipment before pipe installation. Bell holes shall be excavated for each pipe bell or joint.

G. The level of the backfill on either side of the pipe barrel shall be brought up to the same approximate elevation simultaneously.

H. Backfill at 1 foot above the top of the pipe shall be made in lifts no more than 12 inches between and compacted using only hand-operated motor driven plate type vibrating equipment. Compaction by jetting or saturating with water is not permitted.

I. Each lift of backfill material shall be satisfactorily compacted before placing the next lift thereon.

J. The last lift shall be tested for a relative compaction of not less than 95%.

K. Tests of relative compaction, including determination of optimum moisture content and maximum density of backfill shall be made in accordance with ASTM D 1557 and ASTM D 2922. Laboratory maximum dry density will be determined in accordance with ASTM D 1557. Field in-place density will be determined in accordance with ASTM D 2922 and Field in-place moisture will be determined in accordance with ASTM D 3017. As stated herein, the term “relative compaction” means the percentage ratio of the field-compacted dry density to the maximum dry density obtainable by compaction at optimum moisture content.

L. At the time of compaction, the moisture content of backfill material shall be such that the required relative compaction will be obtained.

END OF SECTION