

SECTION 01 41 28

PROTECTION OF EXISTING WATER AND AWSS FACILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Contractors performing excavation adjacent to or below the San Francisco Public Utilities Commission's (SFPUC) Potable Water (PW), Recycled Water (RW), and Auxiliary Water Supply System (AWSS) facilities to protect those facilities throughout the duration of their respective projects. Contractor will be held responsible for any damage related to or caused by failure to exercise due care. Repair of existing utilities and improvements damaged during construction shall be at the Contractor's expense.
- B. Contractor shall be required to prepare or obtain settlement monitoring plans, approved by SFPUC – City Distribution Division (CDD) Engineering Section, prior to performing work adjacent to or around SFPUC's AWSS System when required as specified hereinafter. If contractor is unable to prepare Settlement Monitoring Plans, contractor may request plans be prepared, at Contractors Expense, by making the request in writing via email to:
cddengineering@sfwater.org
- C. The Contractor shall furnish, install and remove upon completion of the work, Settlement Reference Points (SRP) and Settlement Monitoring Points (SMP) for the SFPUC AWSS piping as shown on the settlement monitoring plan and conduct the survey of SRPs and SMPs as specified hereinafter.
- D. The Contractor shall perform all required work as stated in this specification section and as shown on the Drawing(s) and furnish all materials, other than those specified to be furnished by the City, which are necessary or required to complete the work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Not used.

1.3 RECORD DRAWINGS AND STANDARDS

Records of the existing PW, RW, and AWSS facilities and Standard requirements are available for examination by bidders/awarded Contractor upon request by emailing cddengineering@sfwater.org.

Contractors are warned that changes which do not appear in the records for existing CDD facilities may have been made. The City makes no representation as to the completeness or accuracy of said records and assumes no responsibility thereto.

1.4 DEFINITIONS

- A. Maximum Allowable Settlement: Level at which no further movement will be acceptable and if reached requires work to be halted until submittal and acceptance of a written plan detailing corrective actions and restorative measures.
- B. Response Values: Predetermined values within the instrument range indicating different levels of response as specified herein.
- C. Settlement Monitoring Point: A system of points along the alignment of the AWSS for monitoring vertical deformation (settlement or heave) at or near the ground surface using optical survey techniques.
- E. Settlement Reference Point: A stable, fixed control point established at a surface structure above ground that is referenced during settlement monitoring point measurements to permit calculation of vertical movements.

1.5 REFERENCES

- A. AWSS Standard Plans

<u>Drawing No.</u>	<u>Title</u>
CDD-HP-401	AWSS Settlement Point For Bell & Spigot Pipe
CDD-HP-402	AWSS Settlement Point for Double Spigot Pipe

- B. AWSS Settlement Monitoring Drawings in the Contract showing approximate locations of settlement monitoring and reference points.
- C. State of California Labor Code, Section 6705 and 6707.
- D. State of California Construction Safety Orders, Article 6 - Excavation.

1.6 SUBMITTALS

Submit the following to City Representative for review and acceptance. Work shall not start until acceptance of submittals:

- A. Work plan, support details, and calculations.
- 1) Work Plan for working around existing PW, RW, and AWSS facilities within the influence zone of the excavation. The plan shall show the locations of proposed facilities, existing utilities and pipelines, proposed pipe supports for SFPUC-CDD facilities, pipe storage, spoil bank, excavation and pipe laying equipment, shoring system, and a description of how the work will proceed around the existing SFPUC-CDD facilities. Provide drawings that include dimensions to allow determining the distances of objects relative to the SFPUC-CDD facilities. Sizes of existing and proposed facilities, width and depth of proposed trench, and any other pertinent information must be shown in the drawings. For proposed structural facilities, such as retaining walls and tie back walls, potentially impacting CDD facilities, submit elevation and or section views showing horizontal and vertical locations of CDD facilities relative to the proposed structure.
 - 2) Where supports are required per this specification, submit support details and calculations, signed and stamped by a California licensed Civil or Structural Engineer, for structural support for the protection of exposed and/or undermined sections of SFPUC-CDD pipe or facilities. At the discretion of SFPUC-CDD Engineering, revised support details and calculations may be required to be submitted if conditions vary significantly following excavation.
 - 3) Submit minimum twenty-one (21) calendar days before planned excavation.
- B. Control Density Fill (CDF) mix design where CDF is required per this Specification. Submit certified laboratory test results within the past 1-year that the mix proportions and materials comply with these Specifications.
- C. Survey of Settlement Reference and Monitoring Points data: The Contractor shall submit elevations of all SMPs and SRPs (to be provided in “feet”) by a State of California licensed Land Surveyor in addition to deflection calculations for each pipe joint.

Data and calculations shall be submitted once prior to the start of construction, once a week during construction, once at the end of construction and final survey is completed, and when threshold values are exceeded as specified below. Pipe deflection angles and elevation readings calculated from SMPs and SRPs are to be tabulated in chronological order with all previous results for review and approval within 24 hours of the survey being performed.

PART 2 – PRODUCTS

2.1 CONTROLLED DENSITY FILL

A. Materials shall conform to the following.

- 1) Cement: ASTM C150, Type II or V.
- 2) Aggregate: ASTM C33. Aggregate shall consist of fine aggregate with a maximum size of 1/4", free of clay, organics, and other deleterious materials. Less than 10 percent by weight shall pass the No. 200 sieve, and material passing the No. 40 sieve shall be non-plastic as determined in accordance with ASTM D4318.
- 3) Water: Potable.
- 4) Pozzolans: ASTM C618, Class C fly ash. Class F fly ash and slag is not permitted.
- 5) Air entraining: ASTM C260. Air content shall not exceed 25 percent.
- 6) Admixtures: Shall not contain chloride ions and shall not cause delayed strength gain.

B. Mixes:

- 1) Performance requirement: proportioned to be free-flowing, self-consolidating, hand tool excavatable, low-shrink slurry.
- 2) Mix design requirement: The Contractor and its supplier shall determine the materials and proportions used to meet the requirements of the Specifications.
- 3) Strength: Unconfined compressive strength at 28 days shall be less than 100 psi tested per ASTM D 4832.
- 4) Flowability: 6 to 9 inches when tested per ASTM C-143 or ASTM D 6103.
- 5) Cementitious Material: Portland Cement. Where pozzolans are used, pozzolans shall be limited to maximum 60% of the weight of cement.

2.2 AWSS SETTLEMENT REFERENCE AND MONITORING POINTS

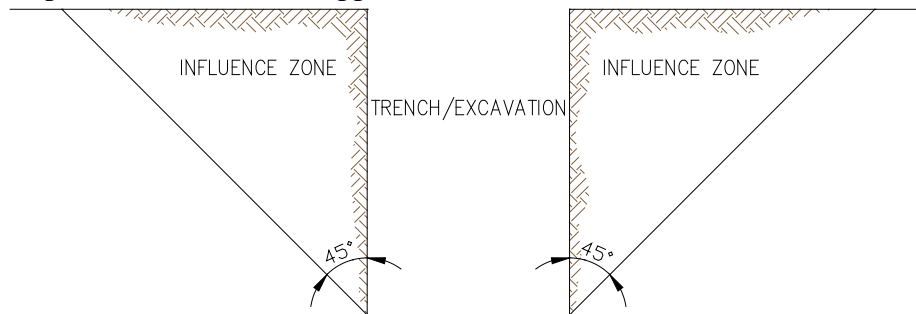
- A. AWSS Settlement Reference and Monitoring Well Covers:

6-inch valve cover, H-20 load rated, cover similar to the San Francisco Water Department's 6-inch gate valve cover.
- B. Required survey monitoring of AWSS facilities outside of trenches and/or excavations:
 - 1) Refer to the AWSS Settlement Monitoring Drawing(s) for the location of SMPs to be installed as part of the contract work; and
 - 2) For trench/excavation crossing AWSS, the SMPs shall be located starting on the closest pipe bell near the edge of the trench and/or excavation and installed outward away from the trench and/or excavation; and
 - 3) Rod, guide pipe, and monitoring well shall be per Drawings CDD-HP-401 and CDD-HP-402, which are available for download at sfwater.org/waterplans.
- C. Required monitoring of AWSS facilities inside of trenches and/or excavations:
 - 1) Exposed AWSS pipe joints in trenches and/or excavations shall be identified as a SMP regardless of whether the joint is called out on the AWSS Settlement Monitoring Drawing(s) to be surveyed and monitored. Field verification of the exact location shall be required and approved by SFPUC-CDD Engineering.
 - 2) Additional SMPs within trenches and/or excavations may be necessary on either or both sides of the AWSS joint to distinguish the difference between vertical displacement and joint deflection.
- D. Placement of SRP(s) for survey monitoring of SMPs:
 - 1) A settlement reference point shall be designated by a marking on a hydrant or other stable, permanent fixture located within the public right-of-way. The same location shall be surveyed for reference over the course of the project. Refer to the AWSS Settlement Monitoring Drawing(s) for the location of SRP(s) to be installed as part of the survey monitoring work.

PART 3 – EXECUTION

3.1 SUPPORT AND REPLACEMENT OF EXISTING PW, RW, AND AWSS FACILITIES WITHIN THE INFLUENCE ZONE

A. Inspection, Review and Approval of Methods



- 1) The influence zone is defined as the trench/excavation and the 45 degree soil wedge on the sides of the excavation as shown in the figure above. The Contractor shall contact CDD Engineering prior to doing any work inside the influence zone.
- 2) If existing SFPUC-CDD facility, not shown on the drawing or is shown on the drawing outside of the influence zone, is found to be within the influence zone, the Contractor is required to contact CDD Engineering and request an inspection to review and approve the field methods being used and/or proposed for the protection of CDD facility.
- 3) If two or more consecutive SFPUC-CDD lead filled, cast-iron pipe joints are located within the trench/excavation, CDD requires replacement of the existing pipe with new ductile iron pipe with elastomeric EPDM joint gaskets within the influence zone.
- 4) Existing valves exposed in trench/excavation:
 - a) If existing valve with lead filled joints is exposed within the trench/excavation, CDD requires replacement of the existing valve and cast-iron pipe with new ductile iron pipe with elastomeric EPDM joint gaskets within the influence zone.
 - b) If existing valve with restrained elastomeric gasketed joints connecting to ductile-iron pipe is exposed within trench/excavation, pipe support requirement shall be the same as that for ductile-iron pipe as specified in the following requirement. If valve is not restrained, restraints shall be added by CDD at the project owner's cost.
- 5) Pipe supports are required where CDD pipe is exposed more than:
 - a) 6 ft. for cast-iron pipe with no exposed joint.
 - b) 3.5 ft. for cast-iron pipe with exposed joint.

- c) 10 ft. for ductile-iron pipe with no exposed joint.
 - d) 6 ft. for ductile iron pipe with exposed joint(s).
- 6) Sheet pile driving adjacent to existing CDD pipe shall maintain a minimum clear spacing between back of sheet pile and edge of pipe of:
- a) 1.5 ft. for ductile iron pipes.
 - b) 4 ft. for cast-iron pipes. If within 4 ft., settlement monitoring is required for both LPW and AWSS lines. Settlement monitoring of LPW lines shall be the same as for AWSS lines unless approved otherwise by CDD Engineering.
- 7) Main disconnection/reconnection for PW and RW shall be performed by SFPUC-CDD. Pipe, valve, fittings, hydrants, and all necessary work not stated to be performed by SFPUC-CDD shall be performed by the Contractor. Excavation, backfilling, paving, traffic control, permitting, and any other support work necessary for the PW and RW replacement work including work to be performed by SFPUC-CDD shall be the Contractor's responsibility. All AWSS replacement work shall be performed by Contractor or subcontractor qualified by CDD to perform AWSS main installation. All replacement valves and piping for CDD replacement is supplied by CDD.
- 8) Submit details and calculations for structural support for the protection of exposed and/or undermined sections of SFPUC-CDD facilities if required per this specification. Details and calculations shall be signed and stamped by a California licensed Civil or Structural Engineer. Structural supports shall be designed to protect (1) AWSS pipes constructed with Class H cast iron lead jointed pipe operating at 350 psi static pressure, (2) AWSS pipes constructed with Class 56 ductile iron pipe, (3) PW pipes constructed with Class B cast iron lead jointed pipe operating at 150 psi static pressure, and (4) PW or RW pipes constructed with Class 53 ductile iron pipe operating at 150 psi static pressure. Maximum deflection in pipe support members shall not exceed $L/500$, where L is the unsupported length of the member.

B. Restoration of Facilities

If project work exposes CDD facilities, the Contractor is required to

- 1) backfill and compact in compliance with San Francisco Department of Public Works (SFPDW) Street Excavation; and
- 2) perform soil compaction testing for backfill material placed within three (3) feet, horizontally or vertically, from the outside edge of a water facility, with all test results furnished to CDD Engineering.

For excavations that expose more than four (4) feet of CDD facilities or pipe joint (4-inch and smaller pipes are excluded), backfill is required to be constructed with control density fill (CDF) material.

CDF material shall begin at (3) feet below the CDD facility and continue up to the bottom of the CDD facility. CDF material shall not extend beyond the spring-line of any CDD facility. Width of CDF backfill shall be OD of CDD pipe + 1ft on each side. Compaction test must be performed on the backfill material below the CDD facility immediately before CDF placement.

3.2 INSTALLATION OF AWSS SETTLEMENT REFERENCE AND MONITORING POINTS AND SUPPORT OF PIPE

A. Installation

The SRPs and SMPs shall be installed prior to the start of construction work requiring excavation around AWSS pipe.

For SRPs at fire hydrants, the contractor shall select the top center of fire hydrant. The contractor must ensure that the exact same point is used to establish survey control prior to monitoring of SMPs and additional SRPs.

For installation of SMPs outside of trench/excavations, the Contractor shall expose the bell of the pipe so that the position of the guide pipe on the bell can be visually verified before backfilling. The installation method used shall not cause the guide pipe to move from its intended position.

For installation of SMPs inside of trench/excavations, the Contractor shall verify the leveling rod is positioned on top of the pipe by verifying the pipe crown with a level vial and marking the exact location on the pipe to ensure consistent monitoring of the same point.

The correct positioning of each SRP and SMP on the top of the pipe bell shall be verified and approved by a CDD Representative by visual inspection. To request an inspection by a CDD Representative, please contact CDD Engineering a minimum of five (5) business days in advance to schedule the inspection.

It is the responsibility of the Contractor to maintain all SRP and SMP installations in working order at all times.

B. Removal

The SMPs and SRPs shall be removed by the Contractor, including pipe guides, monitoring well frames and covers and the roadway restored to its original condition(s).

C. Survey of Settlement Reference and Monitoring Points

- 1) The Contractor shall obtain elevations of all SMPs and SRPs, by a State of California licensed Land Surveyor.
- 2) Initial Survey: Record the elevations within an accuracy of 0.005 feet (1/16-inch) for each settlement monitoring point on all surveys. After completion of each instrument installation, take 3 sets of verification data readings for each instrument to demonstrate the adequacy of the installation, to demonstrate the proper operation and precision of the instrument, and to establish an initial value. Differential Leveling and Total station accuracy shall comply with the accuracy standard specified in Caltrans Second Order Differential Leveling Specifications and Second Order (Vertical) TSSS Survey Specifications respectively. If differential leveling survey method is used, a collimation (Two-Peg) test shall be performed to ensure accuracy within 0.003 feet prior to each survey run. Submit the initial readings to the City Representative.
- 3) Monitoring Schedule: Take readings of all SMPs and SRPs prior to the start of construction, once after the construction work is completed on the city block and adjacent intersections, and a final time two weeks after all construction work is completed on the city block and adjacent intersections. Intermediate monitoring frequency during construction shall as a minimum comply with the following:

Monitoring Frequency During Sheet Pile Driving	Monitoring Frequency During Excavation or Backfill	Monitoring Frequency in or Around Open Trench	Monitoring Frequency Away from Open Trench
Daily ¹	Daily ²	3 Days ³	Once ⁴

Notes:

¹ For SMP's within 25 ft. of pile driving, monitor daily if pile installation using vibratory hammer and every four hours if pile installation using impact hammer.

² Daily for SMPs within 25 ft. of a trench section being actively excavated or backfilled.

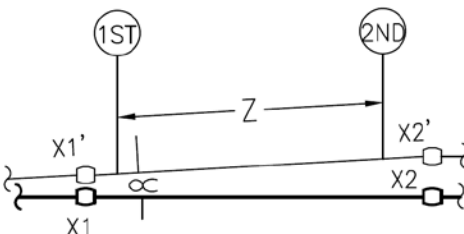
³ Once every three days for SMPs within 25 ft. of an open trench after excavation is completed and utilities are being installed.

⁴ Once after trench within 25 ft of SMP is completely backfilled unless directed otherwise by the City Representative.

- 4) Elevation readings from SMPs and SRPs are to be tabulated in chronological order with all previous results and sent to CDD Engineering within 24 hours of the survey being performed. Measurements shall be provided in “feet”. Provide a plot of measured values versus time, including a time history of construction activity likely to influence such readings.

D. Response Values and Required Actions

- 1) The Maximum Allowable Settlement shall not result in any joint deflecting more than 1/4 degrees, where the deflection angle is calculated using this equation:

$$\alpha = \tan^{-1} \frac{(X1 - X1') - (X2 - X2')}{Z}$$


α = DEFLECTION ANGLE IN DEGREES
 $x1$ = INITIAL READING OF 1ST SMP
 $x1'$ = CURRENT READING OF 1ST SMP
 $x2$ = INITIAL READING OF 2ND SMP
 $x2'$ = CURRENT READING OF 2ND SMP
 z = DISTANCE BETWEEN SMPs

- 2) The response values are measured as a percentage of the Maximum Allowable Settlement. The Contractor shall abide by the following Response Values.

Threshold Value	Contractor Response Value	Shutdown Value
50%	80%	100%

- 3) When a given response value is reached, the Contractor shall provide written notice within the specified time and respond in accordance with the following:
 - a) Threshold Value: The Contractor shall provide written notice within 24 hours of occurrence and meet with the City Representative within 24 hours of providing notice to discuss his means and method to determine what corrective actions, if any, shall be made to better control ground movement. Instrument readings shall be required on a daily basis, unless instructed otherwise, until five consecutive working days of readings do not worsen the settlement by more than 5% of the Maximum Allowable.
 - b) Contractor Response Value: The Contractor shall provide written notice and meet with the City Representative within 24 hours to discuss his means and method to determine what corrective actions

shall be made to better control ground movement. The Contractor shall actively control ground movement in accordance with the corrective actions to prevent reaching the Shutdown Value:

- c) Shutdown Value: Contractor shall stop all work immediately in the vicinity of the AWSS facilities and provide written notice within one hour upon occurrence. The Contractor shall meet with the City Representative to develop a plan of action before the work can be resumed. A drop-test will be performed by CDD prior to continuation of work. If shutdown value is reached from surveys after completion of construction, a drop-test will be performed by CDD to determine if any repairs are required. Excavation, shoring, and restoration, if required, to expose affected AWSS facilities for visual inspection or repairs will be at the Contractor's expense.

E. Arrangement with Utility Companies

The Contractor shall make all necessary arrangements with the public service utility companies and obtain all necessary permits for any work or alteration of facilities as may be required due to the above described work.

F. Street and Sidewalk Restoration

Street and Sidewalk restoration shall include the replacement of traffic lane(s) and crosswalk stripes, parking stall markings, and curb painting that might be damaged during the installation/removal of the SRPs and SMPs construction. The Contractor shall perform preconstruction survey by photo and video to document the existing condition of Street and Sidewalk prior to doing any work in the area.

3.3 EXPOSE, TEST, AND REPAIR OF AWSS PIPES

A. Requirement of Repair Work

The Contractor is hereby notified that change in deflection of an AWSS pipe joint in exceedance of the shut-down value may require individual joint repairs or replacement of all the pipes adjacent to the SRPs (on each side of the surveyed joints) showing deflection at CDD's discretion.

If the CDD Representative determines that repairs are required, the Contractor will be responsible for preparing and restoring the site(s) for repairing the damaged joint(s). Repair of damaged joint(s) shall be done by CDD at Contractor's expense.

Site preparation and restoration for AWSS joint repair will include

- 1) Contractor shall submit for review and approval by CDD Engineering, structural plans and details for the support and protection of AWSS facilities in the vicinity during repair of the damaged joint;
- 2) Contractor shall support and protect AWSS facilities per approved submittal(s);
- 3) Contractor shall excavate a trench as required by CDD Engineering to expose the damaged AWSS pipe joint for repair purposes;
- 4) Upon direction and approval from a CDD Representative, Contractor shall remove support and protection devices, and restore facilities as described in this Section; and
- 5) CDD Representative shall inspect and approve all site preparation and restoration for AWSS joint repair work.

B. Contractor Responsible for all Costs

Exposure and restoration, testing, replacement, and repair of existing AWSS facilities as described in this Section including furnishing of materials, labor, equipment including pump and tools necessary, or required, to do such work shall be at the expense of the Contractor.

The Contractor shall be responsible for all CDD labor and material costs associated with repairing the damaged AWSS facilities.

C. Testing

The pipe repairs/replacement shall require CDD to isolate the pipe by closing gate valve(s), testing the repaired/replaced pipe section at a pressure of 300 psi (or other pressure designated by CDD engineering depending on site-specific constraints), repair any joints showing leakage or lead extrusions during pressure testing, and reactivating the pipe.

A CDD Representative will witness all pressure tests. The Contractor shall inform CDD Engineering a minimum of five (5) business days before all tests.

3.3 PROTECTION OF AWSS CISTERNS

A. Notify the City Representative

When excavation is to occur within 4 feet of an AWSS cistern, the Contractor is required to contact CDD Engineering a minimum of 5 business days in

advance to review the field methods being used and/or proposed for the protection of the cistern and to schedule a baseline visual inspection by a CDD representative.

B. Required Inspections

The Contractor must schedule with the CDD representative to perform the following inspections:

- 1) Baseline visual inspection prior to excavation: CDD representative will take two measurements of the water surface within the cistern from grade separated by a minimum of 72 hours apart and document the water level measurements with the dates and times when these measurements were taken with signed acknowledgement by the CDD representative and the Contractor's representative. This information will be used to establish a baseline leakage rate.
- 2) Prior to backfilling: CDD representative will verify that the minimum clearances to the cistern roof and wall are met and inspect for any visible damages to the cistern that may be a result from construction activities.
- 3) Before and after pavement surface modifications: Where any excavation occurs within the outside edge of the brick ring, the CDD representative shall inspect ground surface before excavation and after pavement restoration. Prior to excavation, the CDD representative will inspect existing conditions of the brick ring, frame and cover. If the frame and cover is within the limits of paving work, the CDD representative will inspect if the frame and cover is outdated, worn or cracked and the City will provide a newer version at no cost to the Contractor for replacement prior to paving unless damage was caused by the Contractor. After paving is completed, the CDD representative will inspect the installation of the brick rings, frame, and cover. It is the Contractor's sole responsibility to ensure that the frame and cover is properly re-installed with the brick rings outlining the perimeter of the cistern.
- 4) After construction around cistern is completed: the Contractor must notify the CDD representative within a week after pavement restoration is completed to schedule an inspection to re-measure the water level. If the water level has lowered, the cause of the leakage will be investigated. If the cause of leakage is determined a result of Contractor's construction activities, all cost associated with the investigation and repair will be the Contractor's responsibility.

C. Minimum Clearance

Underground facilities must be installed with 12" horizontal clearance from the outside face of cistern wall and 12" vertical clearance from the top of the cistern roof.

END OF SECTION