

CAMBRIA CSD STUART STREET TANKS REPLACEMENT

TECHNICAL SPECIFICATIONS

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SECTION 011100 COORDINATION OF WORK, PERMITS, AND REGULATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section generally describes the project and includes Contractor's use of premises, and maintenance and operation of existing facilities.

1.02 GENERAL NATURE OF WORK

- A. The work involves demolition and disposal of two bolted steel water storage tanks, and construction of two new welded steel storage tanks. The 212,000 gallon tank has a diameter of 39 feet and a height of 26 feet. The 125,000 gallon tank has a diameter of 30 feet and a height of 26 feet. The work also includes site improvements including grading, site drainage, modification of existing retaining wall, and replacement of fencing.

1.03 LOCATION OF PROJECT SITE

- A. The project site is located at: 1975 Stuart Street, Cambria, CA 93428

1.04 WORK SEQUENCE AND SCHEDULE

- A. Work shall be performed one tank at a time, such that at least one tank is in service at all times.
- B. A minimum of 15 working days prior to start of work activities, submit a detailed Work Sequencing Plan and schedule outlining the sequence of work such that the District may plan for operational impacts accordingly. Plan shall include, at a minimum, the following:
 - 1. Demolition and tank construction sequence and methods. Given the nature of the project site, it is recommended that the existing 210,000-gallon tank be demolished and replaced with the 125,000-gallon tank prior to the demolition and replacement of the existing 125,000 gallon tank with the 210,000-gallon tank. **For the duration of the project the District will require, at a minimum, functional operation of one tank.**
 - 2. Coordination with the District for isolation of tank(s) inlet/outlet piping.
 - 3. Submit within three weeks of award a detailed Critical Path Method Construction Progress Schedule. The Construction Schedule shall indicate the time of starting and completion of each major structure or phase of the project including intermediate phases as will serve for well-defined control points. These phases and control points shall be placed in chronological order on the Construction Schedule. The schedule shall demonstrate the Contractor's plan for fulfilling all Contract

requirements. Indicate the anticipated date of receipt of major items of equipment in which installation is critical to the scheduled progress of the project. Fully identify the critical path for all activities. The schedule shall be broken down into portions of work lasting no more than two weeks (unless that time is a waiting period).

4. Update and resubmit the schedule as indicated herein. With each schedule update, identify all slippages and missed milestones and provide a narrative description of proposed corrective actions

C. Subsequent Schedule Submittals

1. With every progress payment or as required per conditions described below, submit for review the complete construction schedule with updates and narratives as needed.
2. Conditions prompting required schedule revision:
 - a. The schedule does not represent actual progress of work.
 - b. Delays for any reason make re-scheduling necessary.
 - c. Delay in completion of any work item or sequence of work items resulting in an estimated extension of project completion by 7 days or more.
 - d. Approved contract modification necessitates re-scheduling.
3. Provide brief narrative describing the status of work, any existing or anticipated problems and recommended corrective action needed.

D. Delays

1. If the Contractor's progress has fallen behind the approved Construction Schedule, the Contractor shall take such steps as may be required, including but not limited to, increasing the number of personnel, shifts, overtime operations, days of work, and amount of construction equipment until such time as the work is back on schedule. They shall also submit for approval no later than the time of submittal of the next request for partial payment, such supplementary schedule or schedules as may be deemed necessary to demonstrate the manner in which the approved rate of progress will be regained, all without additional cost to the Owner.

1.05 OWNER OCCUPANCY

- A. The storage tanks are part of the District's potable water distribution system. The Contractor's use of the project site shall not interfere with normal operations and maintenance of the in-service Tank; access must be maintained at all times. Coordinate with the District seventy-two (72) hours in advance of any obstructions.

1.06 PERMITS

- A. The following permits for the permanent work have been obtained by the Owner:
 - 1. San Luis Obispo County Building permit for retaining wall.
 - 2. Coastal Development Permit – Minor Use Permit No. C-DRC2024-00038.
 - 3. NPDES discharge permit for discharging water for pressure testing, leakage testing, and disinfection.
- B. The Owner has or will have submitted a Notice of Intent to Discharge, along with appurtenant fee, under the Construction Activities Storm Water General Permit. Under this permit the Contractor must prepare and submit Storm Water Pollution Prevention Plan.
- C. Obtain and pay the fees for the following permits:

Name or Type of Permit	Name, Address, Telephone Number of Permitting Agency
Construction Water permit from District	Cambria Community Services District 2150 Main Street #1-A, Cambria, CA 93428 (805) 927-6223

- 1. Contact the permitting agencies listed above for current fees associated with each permit.
- D. The permits contain requirements that affect the cost of project work and some permanent permits require supplementary work permits and fees to execute construction. Comply with the permit requirements and obtain and pay the fees involved with the supplementary work permits.

1.07 ENVIRONMENTAL MITIGATION

- A. The Contractor is required to comply with the requirements set forth in the Mitigation Monitoring and Reporting Program (MMRP – see Appendix B). The MMRP is based on the mitigation requirements in the project’s Addendum to the Initial Study – Mitigated Negative Declaration (IS-MND). The IS-MND is available for viewing at the District’s office. See Appendix B for requirements.
- B. The Contractor is required to coordinate with the District and to provide 48 hour advance notification to the District when the District’s responsibilities may affect the timing of work.

1.08 PROJECT REPORTS

The following reports which have been prepared for the District are available for review at the District's office:

1. Geotechnical Engineering Report Stuart Street Water Tank Replacement, Earth Systems, July 15, 2024.
2. Addendum to the Initial Study – Mitigated Negative Declaration, Rincon Consultants, July 2024.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 012000 MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 WORK LISTED IN THE SCHEDULE OF WORK ITEMS

- A. Work under this contract will be paid on a unit price or lump-sum basis as outlined on the Bid Form for the quantity of work installed.
- B. The unit prices and lump-sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the contract documents.
- C. The application for payment will be for a specific item based on the percentage completed or quantity installed. The percentage complete will be based on the value of the partially completed work relative to the value of the item when entirely completed and ready for service.

1.02 WORK NOT LISTED IN THE SCHEDULE OF WORK ITEMS

- A. The General Conditions, general requirements, and specifications which are not listed in the schedule of work items of the Bid Form are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the contract documents in the various listed work items of the Bid Form.
- B. The bids for the work are intended to establish a total cost for the work in its entirety. Should the Contractor feel that the cost for the work has not been established by specific items in the Bid Form, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

1.03 BID ITEM 1 – MOBILIZATION

- A. Measurement and payment for mobilization shall be made in accordance with Public Contract Code Section 10264.

BID ITEMS 2A THROUGH 2J – 212,000 GALLON WELDED STEEL TANK

1.04 BID ITEM 2A – DEMOLITION OF EXISTING 212,000 GALLON TANK

- A. Payment for this bid item shall be made on a percent complete basis based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved in the demolition and offsite disposal of the existing tank, as detailed in the contract documents, and shall include, but is not limited to: removal and disposal of the tank plates, dollar plate, rafter beams, girders, foundation, columns, hatches, railings, and work shown in the contract documents.

1.05 BID ITEM 2B – 212,000 GALLON WELDED STEEL TANK AND APPURTENANCES

- A. Measurement for payment will be made as a lump sum amount for construction of the steel tank and appurtenances as shown in the drawings and in accordance with specifications.
- B. Payment for construction of the steel tank will be made on a percentage basis based on the lump sum price bid, and shall include full compensation for furnishing shop drawings, radiographic testing, labor, materials, tools, equipment, and doing all the work involved to provide the structure in place and operational in accordance with the plans and specifications.

1.06 BID ITEM 2C – CATHODIC PROTECTION

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved with furnishing and installing impressed current cathodic protection system as detailed in the specifications.

1.07 BID ITEM 2D – TANK FOUNDATION

- A. Measurement for payment will be made in lump sum amount for construction of the concrete tank foundation including surveying, structural excavation, trenching, backfill, testing, and subgrade preparation in compliance with the drawings and specifications.
- B. Payment will be made in lump sum, which price shall include all costs for furnishing and placing the foundation bedding concrete in accordance with the specifications.

1.08 BID ITEM 2E - VALVES AND FITTINGS

- A. Measurement for payment will be made as a lump sum amount for the furnishing and installing of valves and fittings as shown in the drawings and specified in the contract documents.
- B. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount. This includes full compensation for furnishing all labor, materials, tools, equipment, and performing all work required to install the valves and fittings, including but not limited to: furnishing and installing of all valves and fittings as specified, testing and commission of installed vales and fittings, and connections to the tank and piping system.

1.09 BID ITEM 2F – HYDRODYNAMIC MIXING SYSTEM

- A. Measurement for payment will be made as a lump sum amount for the furnishing and installing of the hydrodynamic mixing system as shown in the drawings and specified in the contract documents.

- B. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount. This includes full compensation for furnishing all labor, materials, tools, equipment, and performing all work required to install the valves and fittings, including but not limited to furnishing and installing of all piping, pipe supports, valves and fittings as specified, testing and commission of the installed system, and connections to the tank piping system.

1.10 BID ITEM 2G – INTERIOR COATING

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for: surface preparation; coating removal and disposal; priming; coating floor and interior shell surfaces of the tank; coating of the tank roof interior; surface prep and coating interior and exterior surface of internal inlet piping, and caulking in accordance with the contract documents

1.11 BID ITEM 2H – EXTERIOR COATING

- A. Payment or this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for priming and coating exterior shell wall and appurtenances of the tank, coating of the roof, and caulking the chime/foundation interface.

1.12 BID ITEM 2I – DISINFECTION, VOC TESTING, AND HYDROSTATIC PRESSURE TESTING

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and performing all the work involved with cleaning, disinfecting, VOC testing, adjustment of residual disinfection, and hydrostatic pressure testing of the tank and piping in accordance with the contract documents

1.13 BID ITEM 2J – FIRST ANNIVERSARY INSPECTION OF TANK

- A. Measurement and payment for this lump sum bid item includes full compensation for the first anniversary inspection of the tank and activation of the impressed current cathodic protection system in accordance with the plans and specifications and furnishing all labor, materials, tools, and equipment necessary to do all the work involved in accordance with the contact documents.

BID ITEMS 3A THROUGH 3J – 125,000 GALLON WELDED STEEL TANK

1.14 BID ITEM 3A – DEMOLITION OF EXISTING 125,000 GALLON TANK

- A. Payment for this bid item shall be made on a percent complete basis based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved in the demolition and offsite disposal of the existing tank as detailed in the contract documents, and shall include, but is not

limited to: removal and disposal of the tank plates, dollar plate, rafter beams, girders, foundation, columns, hatches, railings, and work shown in the contract documents.

1.15 BID ITEM 3B – 125,000 GALLON WELDED STEEL TANK AND APPURTENANCES

- A. Measurement for payment will be made as a lump sum amount for construction of the steel tank and appurtenances as shown in the drawings and in accordance with specifications.
- B. Payment for construction of the steel tank will be made on a percentage basis based on the lump sum price bid, and shall include full compensation for furnishing shop drawings, radiographic testing, labor, materials, tools, equipment, and doing all the work involved to provide the structure in place and operational in accordance with the plans and specifications.

1.16 BID ITEM 3C – CATHODIC PROTECTION

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved with furnishing and installing the impressed current cathodic protection system as detailed in the specifications.

1.17 BID ITEM 3D – TANK FOUNDATION

- A. Measurement for payment will be made in lump sum amount for construction of the concrete tank foundation including surveying, structural excavation, trenching, backfill, testing, and subgrade preparation, in compliance with the drawings and specifications .
- B. Payment will be made in lump sum, which price shall include all costs for furnishing and placing the foundation bedding concrete in accordance with the specifications.

1.18 BID ITEM 3E – VALVES AND FITTINGS

- A. Measurement for payment will be made as a lump sum amount for the furnishing and installing of valves and fittings as shown in the drawings and specified in the contract documents.
- B. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount. This includes full compensation for furnishing all labor, materials, tools, equipment, and performing all work required to install the valves and fittings, including but not limited to furnishing and installing of all valves and fittings as specified, testing and commission of installed vales and fittings, and connections to the tank and piping system.

1.19 BID ITEM 3F – HYDRODYNAMIC MIXING SYSTEM

- A. Measurement for payment will be made as a lump sum amount for the furnishing and installing of the hydrodynamic mixing system as shown in the drawings and specified in the contract documents.
- B. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount. This includes full compensation for furnishing all labor, materials, tools, equipment, and performing all work required to install the valves and fittings, including but not limited to furnishing and installing of all piping, pipe supports, valves and fittings as specified, testing and commission of the installed system, and connections to the tank piping system.

1.20 BID ITEM 3G – INTERIOR COATING

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for: surface preparation; coating removal and disposal; priming; coating floor and interior shell surfaces of the tank; coating of the tank roof interior; surface prep and coating interior and exterior surface of internal inlet piping, and caulking in accordance with the contract documents

1.21 BID ITEM 3H – EXTERIOR COATING

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for priming and coating exterior shell wall and appurtenances of the tank, coating of the roof, and caulking the chime/foundation interface

1.22 BID ITEM 3I – DISINFECTION, VOC TESTING, AND HYDROSTATIC PRESSURE TESTING

- A. Payment for this bid item shall be made on a percent complete basis, based on the lump sum amount and shall include full compensation for furnishing the labor, materials, tools, equipment, and performing all the work involved with cleaning, disinfecting, VOC testing, adjustment of residual disinfection, and hydrostatic pressure testing of the tank and piping in accordance with the contract documents.

1.23 BID ITEM 3J – FIRST ANNIVERSARY INSPECTION OF TANK

- A. Measurement and payment for this lump sum bid item includes full compensation for the first anniversary inspection of the tank and activation of the impressed current cathodic protection system in accordance with the plans and specifications and furnishing all labor, materials, tools, and equipment necessary to do all the work involved in accordance with the contact documents.

BID ITEMS 4 THROUGH 9 – SITE IMPROVEMENTS

1.24 BID ITEM 4 – 8-INCH DUCTILE IRON PIPE

- A. Measurements for payment will be made in linear feet of pipe and pipe fittings and valves placed to lines and grades as shown in the drawings and in accordance with specifications.
- B. Payment will be made at the unit price per linear foot bid, which price shall include all costs for materials, tools, labor, equipment, incidentals, testing, and installation of piping.

1.25 BID ITEM 5 – PVC STORM DRAIN AND CATCH BASINS

- A. Payment for furnishing and installing the PVC storm drain and catch basin system shall be made on a percent complete basis, based on the lump sum amount for this item, and shall include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved in accordance with the contract documents.

1.26 BID ITEM 6 – RETAINING WALL

- A. Payment for furnishing and installing concrete masonry unit retaining wall shall be made on a percent complete basis, based on the lump sum amount for this item, and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved in accordance with the Contract Documents including but not limited to demolition and replacement of existing concrete masonry unit retaining wall, wall drainage, and exterior coatings.

1.27 BID ITEM 7 – CONCRETE STAIRS AND AC REPAIR

- A. Measurement payment will be made as a lump sum amount for the construction of concrete stairs and asphalt concrete repair as shown in the drawings and specified in the contract documents.
- B. Payment for construction of the concrete stairs will be made on a percentage basis based on the lump sum price bid, and shall include full compensation for labor, materials, tools, equipment, and doing all the work involved to provide the structure in place and operational in accordance with the plans and specifications.
- C. Payment for the AC repair shall be on a lump sum basis and shall include full compensation for furnishing the labor, materials, tools, equipment, and doing all the work involved with repairing and replacing any asphalt concrete. This includes but is not limited to placement and compaction of aggregate base, concrete demolition and in-kind replacement, and in-kind replacement of asphalt pavement.

1.28 BID ITEM 8 – 6' CHAIN LINK FENCING AND APPURTENANCES

- A. Measurements for payment will be made in linear feet of chain link fence and appurtenances including concrete post foundations, galvanized steel posts and supports,

hardware, locks, barbed wire, protection posts, and privacy slats installed as shown in the plans and in accordance with the specifications.

- B. Payment shall be made at the unit price per linear feet of chain link fencing and appurtenances which price shall include labor, materials, equipment, and incidentals for demolition of existing and complete installation of the chain link fence.

1.29 BID ITEM 9 – EARTHWORK

- A. Measurement for payment will be made in lump sum amount for earthwork including site grading, welded steel tank over excavation, and miscellaneous earthwork not covered in other bid items to lines, grades, and dimensions as shown in the drawings in accordance with the specifications
- B. Payment will be made at the lump sum price bid, which price shall include all costs for the work including: site grading to match the elevations shown in the grading plan; excavation of materials as described in the contract documents; conditioning the materials at the excavation site prior to excavation or at the stockpile areas prior to transporting to points of final use; transporting excavated materials from the sites of excavation to points of final use, to temporary stockpiles including placing the materials into separate stockpiles designated for each type of materials and from the temporary stockpiles to point final use; Rehandling excavated materials which have been deposited temporarily in stockpiles; removal of oversize materials from otherwise suitable materials and disposal of the oversize materials; Disposal of excavated materials not suitable or required for permanent construction; preparation, compaction, finish grading, and placement of gravel as shown in the plans.

1.30 BID ITEM 10 – ALLOWANCE FOR ENVIRONMENTAL MITIGATION

- A. Measurement and payment for this bid item shall be made on a time and materials basis and shall include full compensation for costs associated with complying with the requirements set forth in the Mitigation Monitoring and Reporting Program (Appendix B) and as directed by the owner.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 013233 PRECONSTRUCTION DIGITAL AUDIO-VIDEO DOCUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials and performance for preconstruction digital audio-video documentation and generally defines Contractor's responsibilities, unless otherwise stated, for the following:
 - 1. Equipment.
 - 2. Submittals.
 - 3. Technique.
 - 4. Quality assurance.

1.02 VIDEO AND AUDIO QUALITY

- A. Documentation shall be performed by a responsible commercial firm skilled and regularly engaged in the preparation of preconstruction color audio-video DVD documentation acceptable to the Owner.
- B. Completed documentation shall reproduce bright, sharp pictures with accurate colors and shall be free from distortion or any other significant picture imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity, and be free of distortion.
- C. The Owner's Representative will accompany the commercial firm in performing the audio-video documentation. The accompanying personnel may direct the commercial firm to record certain features observed. Notify the Owner's Representative five (5) working days in advance so that the accompanying personnel can be scheduled.
- D. Construction shall not proceed until the Owner and Owner's Representative have reviewed the documentation and notified the Contractor of its acceptability. It is anticipated that such review will be completed within 10 working days after submittal.

1.03 MEASUREMENT AND PAYMENT

- A. No separate payment item is provided for this work. The cost of performing this work shall be incorporated into the bid item for mobilization.

PART 2 - MATERIALS

2.01 RECORDING EQUIPMENT

- A. Utilize a high-resolution digital video camera with extended still frame capability.

2.02 RECORDING MEDIA

- A. Utilize new, .mp4 media file on thumb drive having:
 - 1. High resolution.
 - 2. Extended still frame capability.

PART 3 - EXECUTION

3.01 COVERAGE

- A. Record coverage of surface features located in the construction's zone of influence including, but not limited to:
 - 1. Driveways, concrete features, access gates, fences, and access road
 - 2. Electrical facilities including cathodic protection system, pressure transducer, instrumentation, pump, and control panels
 - 3. Both bolted steel tanks, including the tank shell, concrete foundation, exposed conduit and piping, valves, exterior ladder, cage, and handrail, and rooftop power vent.
 - 4. Perimeter fencing and retaining walls.
- B. Record the individual features of each item with particular attention being focused upon the existence of any existing faults, fractures, or defects.
- C. Control pan rate, rate of travel, camera height, and zoom rate to maintain a steady clear view.
- D. Limit recorded coverage to one side of any street at any one time.
- E. Create a single, continuous, unedited recording which begins and ends within each portion of a particular construction area. The recording shall proceed in the direction of ascending baseline stationing.

3.02 AUDIO CONTENT

- A. Simultaneously record audio content during videotaping.

- B. Audio recording shall assist in viewer orientation and in any needed identification, clarification, or description of features being recorded.
- C. Audio recording shall only consist of camera operator commentary.

3.03 INDEXING

- A. Permanently label thumb drive with a sequential number and the project name.
- B. Index thumb drive with a digital record of the time and date of the recording which is continuously displayed as the .mp4 is played.
- C. Prepare a written log which describes the contents of each thumb drive including:
 - 1. Names of streets or easements.
 - 2. Coverage begin/end station and location.
 - 3. Recording date.

3.04 CONDITIONS

- A. Record coverage during dry, clear weather and during daylight hours only.
- B. Record coverage when the area is free of debris or obstructions.
- C. Record coverage no more than 21 days prior to mobilization at the site.

END OF SECTION

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SECTION 013300 SUBMITTALS

PART 1 - GENERAL

1.01 SHOP DRAWINGS

- A. Submit shop drawings in accordance with the General Conditions.
- B. The use of contract drawing reproductions for shop drawings is subject to rejection.
- C. Submit shop drawings electronically in .PDF format compatible adobe Acrobat version 9. Files less than 5MB in size may be submitted to the Owner's Representative via email. Files larger than 5MB shall be submitted by means of a FTP server, USB flash drive, external hard drive, or other method approved by the Owner's Representative. Pages shall be scanned at a resolution necessary for legibility. Hard copies shall be submitted upon request and at no additional cost. Clearly indicate the drawing number to which each shop drawing is referenced.
- D. If the Contractor submits shop drawings of equipment by manufacturers other than those listed in the specifications, provide the following information with the submittal:
 - 1. The name and address of at least three companies or agencies that are currently using the equipment.
 - 2. The name and telephone number of at least one person at each of the above companies or agencies whom the Owner's Representative may contact.
 - 3. A description of the equipment that was installed at the above locations. The description shall be in sufficient detail to allow the Owner's Representative to compare it with the equipment that is proposed to be installed in this project.
- E. For materials originating outside of the United States for which tests are required, provide recertification and retesting by an independent domestic testing laboratory.

1.02 SAMPLES

- A. Furnish samples of the various materials, together with the finish thereon, as specified for and intended to be used on or in the work. Send samples to the office of the Owner's Representative, carriage prepaid.
- B. Submit samples before purchasing, fabricating, applying, or installing such materials and finishes.
- C. Submit samples, other than field samples, in duplicate. A cover letter shall accompany the sample and shall list all items being transmitted, designating their particular usage and location in the project. One sample marked "Resubmittal Not Required" will be returned to the Contractor; rejected samples will not be returned.

- D. Samples shall be submitted and resubmitted until acceptable. Materials, finishes, and workmanship in the completed project shall be equal in every respect to that of the samples so submitted and accepted.
- E. Samples shall conform to materials, fixtures, equipment, surface textures, colors, etc., as required by drawings and specifications or as requested by the Owner's Representative.
- F. Identify sample as to product, color, manufacturer, trade name, lot, style, model, etc., location of use, and contract document reference, as well as the names of the Contractor, supplier, project, and Owner's Representative.
- G. Samples shall be 8 inches by 10 inches in size and shall be limited in thickness to a minimum consistent with sample presentation. In lieu thereof, submit the actual full-size item.
- H. Samples of value may be returned to the Contractor for use in the project after review, analysis, comparison, and/or testing as may be required by the Owner's Representative.
- I. Furnish one 8-inch by 10-inch sample of the finally reviewed materials, colors, or textures to the Owner's Representative for final record. Such material samples shall carry on the back all identification as previously described including, if paint sample, manufacturer, mix, proportion, name of color, building, Contractor, subcontractor, and surfaces to which applied.

1.03 SUBMITTAL REQUIREMENTS

- A. Make submittals promptly in such sequence as to cause no delay in the work. Schedule submission a minimum of 30 calendar days before reviewed submittals will be needed.
- B. Submittals shall contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The project title and number.
 - 3. Contract identification.
 - 4. The names of:
 - a. Contractor.
 - b. Supplier.
 - c. Manufacturer.
 - 5. Identification of the product, with the specification section number.
 - 6. Field dimensions, clearly identified as such.

7. Relationship to adjacent or critical features of the work or materials.
8. Identification of deviations from contract documents.
9. Identification of revisions on resubmittals.
10. A 5-inch by 5-inch blank space for stamps of the Owner's Representative.
11. Contractor's stamp, initialed or signed, shall certify Contractor's review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal that the product meets the requirements of the work and of the contract documents.

1.04 SUBMITTAL FORMAT

- A. Each submittal shall have a transmittal form. Every page in a submittal shall be numbered in sequence. Each copy of a submittal shall be collated and stapled or bound, as appropriate. Copies not collated will be rejected.
- B. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Present a sufficient level of detail for assessment of compliance with the contract documents.
- C. Each submittal shall be assigned a unique number. Submittals shall be numbered sequentially. The submittal numbers shall be clearly noted on the transmittal. Original submittals shall be assigned a numeric submittal number. Resubmittals shall bear an alphanumeric system which consists of the number assigned to the original submittal for that item followed by a number to represent that it is a subsequent submittal of the original. For example, if Submittal 25 requires a resubmittal, the first resubmittal will bear the designation "25-1" and the second resubmittal will bear the designation "25-2" and so on.
- D. Disorganized submittals that do not meet the requirements above will be returned without review.

1.05 RESUBMITTALS

- A. Resubmittal of submittals will be reviewed and returned in the same review period as for the original submittal. It is considered reasonable that the Contractor shall make a complete and acceptable submittal by the second submission of a submittal item. The Owner's Representative reserves the right to withhold monies due to the Contractor to cover additional costs of any review beyond the second submittal.

1.06 CONTRACTOR'S JOBSITE DRAWINGS

- A. Provide and maintain on the jobsite one complete set of prints of all drawings which form a part of the contract. Immediately after each portion of the work is installed,

indicate all deviations from the original design shown in the drawings either by additional sketches or ink thereon. Upon completion of the job, deliver this record set to the Owner's Representative.

END OF SECTION

SECTION 017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING

PART 1 - GENERAL

1.01 GENERAL

- A. This section includes cleaning during construction and final cleaning on completion of the work.
- B. At all times maintain areas covered by the contract and adjacent properties and public access roads free from accumulations of waste, debris, and rubbish caused by construction operations.
- C. Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws. Do not burn or bury rubbish or waste materials on project site. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
- D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.02 CLEANING DURING CONSTRUCTION

- A. During execution of work, clean site, adjacent properties, and public access roads and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- C. Provide containers for collection and disposal of waste materials, debris, and rubbish.
- D. Cover or wet excavated material leaving and arriving at the site to prevent blowing dust. Clean the public access roads to the site of any material falling from the haul trucks.

1.03 FINAL CLEANING

- A. At the completion of work and immediately prior to final inspection, clean the entire project site as follows.
- B. Clean, sweep, wash, and polish all work and equipment including finishes.
- C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces.
- D. Repair, patch, and touch up marred surfaces to match adjacent surfaces.
- E. Broom clean paved surfaces; rake clean landscaped areas.

- F. Remove from the site temporary structures and materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work.

END OF SECTION

SECTION 031000 CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general conditions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.

1.03 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

- a. For Engineerural concrete specified in Section 033300 "Engineerural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).
- B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
 - a. Wind Loads: As indicated on Drawings.
 - 1) Horizontal Deflection Limit: Not more than 1/240 of the wall height.

2.02 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

2.03 RELATED MATERIALS

- A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

- B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.01 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.

- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Engineer prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 3. Place joints perpendicular to main reinforcement.

4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings .
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 3. Clean embedded items immediately prior to concrete placement.

3.03 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

END OF SECTION

SECTION 032000 CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

B. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Engineer.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2.02 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain .

2.03 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.02 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 2. Stagger splices in accordance with ACI 318.

3.03 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.04 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 1. Steel-reinforcement placement.
- C. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and

to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION

SECTION 033000 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 for steel reinforcing bars and welded-wire reinforcement.

1.02 DEFINITIONS

- ##### A. Cementitious Materials:
- Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

- ##### B. Water/Cement Ratio (w/cm):
- The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference:

Conduct conference at Project site .

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Concrete Subcontractor.
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.

- c. Anchor rod and anchorage device installation tolerances.
- d. Cold and hot weather concreting procedures.
- e. Concrete finishes and finishing.
- f. Curing procedures.
- g. Forms and form-removal limitations.
- h. Concrete repair procedures.
- i. Concrete protection.
- j. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
- k. Protection of field cured field test cylinders.

1.04 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Slag cement.
- 4. Aggregates.
- 5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 6. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Durability exposure class.
- 4. Maximum w/cm.

5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Bonding agents.
4. Adhesives.
5. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.

C. Field quality-control reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.07 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
 - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.02 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type V , gray .

2. Fly Ash: ASTM C618, Class C or F.
 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
- D. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.03 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing admixture in concrete, as required, for placement and workability.

2.04 CONCRETE MIXTURES

- A. Class A : Normal-weight concrete used for footings, housekeeping pads, grade beams, and tie beams.
1. Exposure Class: ACI 318 F0 F2 S0 W0 C1 .
 2. Minimum Compressive Strength: 3000 psi at 28 days.

3. Maximum w/cm: 0.50 .
4. Slump Limit: 4 inches , plus or minus 1 inch .
5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B : Normal-weight concrete used for tank ring wall.

1. Exposure Class: ACI 318 F0 S0 W0 C1 .
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50 .
4. Slump Limit: 4 inches , plus or minus 1 inch .
5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

2.05 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
1. Daily access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.03 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.04 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

3.05 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, is complete and that required inspections are completed.
- B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.06 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

- 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view .

B. Related Unformed Surfaces:

- 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.07 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.08 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.

- c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
- 1. Begin curing immediately after finishing concrete.

3.09 TOLERANCES

- A. Conform to ACI 117.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Engineer.
 - 2. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.

- b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
- a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
- a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.11 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength,

aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Engineer.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C39/C39M.

- a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 9. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
 10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.12 PROTECTION

- A. Protect concrete surfaces as follows:
 1. Protect from petroleum stains.

2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit use of pipe-cutting machinery over concrete surfaces.
4. Prohibit placement of steel items on concrete surfaces.
5. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

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SECTION 042200 CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.

1.02 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes. Show exterior color and finish.
 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include data on material properties .

2. Integral water repellent used in CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.02 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.03 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Exterior: Masonry Units shall be smooth finish; color shall match existing wall.
- C. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi .
 - 2. Density Classification: Medium weight unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.04 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.
- B. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- C. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- D. Aggregate for Grout: ASTM C404.
- E. Water: Potable.

2.05 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.06 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.

2.07 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M Type S.
2. For reinforced masonry, use Type S .
3. For mortar parge coats, use Type S .

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond ; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.06 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows :
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

3.07 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches .

3.08 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level C in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 7 days and at 28 days.

3.09 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 065000 STRUCTURAL FRP

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of structural FRP elements and members used for ladders in potable water tanks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. FRP Ladders: 066010.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit layouts of ladder supports and framing which indicate locations and dimensions of structural elements, support points, and support framing.
- C. Submit fabrication drawings of framing. Include plans, elevations, sections, details, and bills of material.
- D. Submit details of connections and supports for tank brackets, ladders, and equipment.
- E. Submit calculations for the design of ladder framing. Calculations shall be sealed and signed by a civil or structural engineer licensed in the state of California.
- F. Submit certificate of compliance with NSF Standard 61 for FRP framing.

PART 2 - MATERIALS

2.01 MANUFACTURERS

Materials shall be manufactured by Strongwell, Creative Pultrusions Incorporated, or equal.

2.02 LADDERS

See Section 066010.

2.03 FRP

- A. Manufacture FRP products using a pultrusion process utilizing a polyester resin conforming with NSF Standard 61, with flame-retardant inhibitor additives. A synthetic

surface veil shall be the outermost layer covering the exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM E84.

- B. After fabrication, seal cut ends, holes, and abrasions of FRP shapes with a compatible NSF 61 certified resin coating to prevent intrusion of moisture.
- C. Exposed surfaces shall be smooth and true to form.
- D. Construct structural shapes from a polyester resin with fire-retardant additives to meet Class 1 flame rating of ASTM E84 and meet the self-extinguishing requirements of ASTM D635.
- E. Structural FRP member composition shall consist of a glass-fiber-reinforced polyester resin matrix, approximately 50% resin-to-glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Continuous glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.
- F. Color of FRP material shall be OSHA Safety Yellow. The color shall be achieved using pigmented resin. Do not paint.
- G. The following minimum mechanical properties shall apply:

Fiberglass Pultruded Material Properties Minimum Ultimate Coupon Properties		
Material Properties for Pultruded Fiberglass Structural Shapes	ASTM Test Method	Value
Ultimate tensile stress in longitudinal direction (psi)	D638	30,000
Ultimate compressive stress in longitudinal direction (psi)	D695	30,000
Ultimate flexural stress in longitudinal direction (psi)	D790	30,000
Ultimate short beam shear in longitudinal direction (psi)	D2344	4,500
Ultimate tensile stress in transverse direction (psi)	D638	7,000
Ultimate compressive stress in transverse direction (psi)	D695	15,000
Ultimate flexural stress in transverse direction (psi)	D790	10,000
Density (lb/cubic inch)	D792	0.060 to 0.070
Water absorption (24-h immersion)	D570	0.60 max, % by weight
Barcol hardness	D2583	45
Coefficient of thermal expansion (in/in/°C)	D696	8×10^{-6}
Expansion (in/in/°F)		4.4×10^{-6}
Thermal conductivity (Btu-in/ft ² /hr/°F)	C177	4

Flame-Retardant Properties	ASTM Test Method	Value
Flammability test	D635	Self-extinguishing
Surface burning characteristics	E84	25 maximum
Flammability class	UL 94	VO
Temperature index	UL 94	130°C

2.04 FASTENERS

Fasteners shall be Type 316 stainless steel. Bolts shall conform to ASTM A193, Grade B8M or ASTM F593, Type 316. Nuts shall conform to ASTM A194, Grade 8M or ASTM F594, Type 316. Use ASTM A194 nuts with ASTM A193 bolts; use ASTM F594 nuts with ASTM F593 bolts. Provide washers (minimum 1/8 inch thick) of the

same materials as the nuts. Provide washer under each nut and bolthead. Provide isolation for dissimilar metals where required.

PART 3 - EXECUTION

3.01 INSPECTION

After delivery to the site, check FRP items for cracks, holes, and other characteristics listed in ASTM D2563, Table I. Remove from the project site any FRP item not complying with ASTM D2563, Table I, Level II.

3.02 FIELD MEASUREMENTS FOR EXISTING FACILITIES

- A. Measure the layout of existing ladder framing, and accessories with respect to hatches, tank wall, and tank floor.
- B. Measure the location of existing piping, conduit, and equipment connected to or supported by existing ladder.

3.03 SEALING FIELD-CUT FRP

Seal field-cut FRP with an NSF 61 certified resin that is compatible with the original resin as recommended by the manufacturer.

END OF SECTION

SECTION 066010 FRP LADDERS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, fabrication, and installation of FRP ladders in potable water tanks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Structural FRP: 065000.

1.03 DESIGN CRITERIA

- A. Ladders: The design of FRP ladder systems including connections shall meet the requirements set forth in OSHA 1910.23 and 1926.1053, UBC, local building codes and industry standards as applicable.
- B. Design live load of 150 psf, maximum deflection of 1/240 of span.
- C. All materials shall be in compliance with ANSI/NSF Standard 61.

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit calculations for fabricated items showing dimensions, materials of construction, and verifying compliance with the specified design criteria. Calculations shall also include the following data on the structural elements: section properties; flexural, tensile, compressive, and shear strengths; weight per foot; and modulus of elasticity.

PART 2 - MATERIALS

2.01 FIBERGLASS LADDERS

Construct fiberglass ladders from pultruded structural fiberglass shapes. Rungs shall be 1.25-inch-diameter pultruded rod with fluted skid resistant surface. Color of ladders shall be OSHA Safety Yellow. Design and construct ladders to meet the requirements as set forth in Part 1, "Design Criteria." The distance between rungs shall not exceed 12 inches and shall be uniform throughout the length of the ladder. The minimum clear length of rungs shall be 16 inches. Ladders shall be attached to the structure wall with Type 316 stainless steel anchor bolts. Provide isolation for dissimilar metals. The ladders shall be pultruded fiberglass ladder system as manufactured by Strongwell or approved equal.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter.

3.02 FABRICATION AND ERECTION

- A. Fabricate FRP items to straight lines. Drilling and punching shall not leave burrs or deformations. Exposed work shall have a smooth finish. Joints shall have a close fit and shall be in true alignment. Unless specifically indicated in the drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp.
- B. For FRP items to be in contact with concrete, clean the surfaces of dirt, grease, and other foreign substances before placing concrete.
- C. Seal cut edges with NSF-61 certified resin.

3.03 LADDERS

- A. Install ladders in accordance with the manufacturer's recommendations.

END OF SECTION

FSECTION 099000 PAINTING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials and application of painting and coating systems for the following surfaces:
 - 1. Submerged metal.
 - 2. Exposed metal.
 - 3. Buried metal.
 - 4. It does not include coating steel water tanks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete: Section 033000.
- B. Coatings for Steel Water Tank: Section 099674.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- 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 and supplier’s data sheets identifying the type and gradation of abrasives used for surface preparation. The certificate or data sheets shall specifically identify that the abrasives comply with federal and state of California regulations for materials to be used for abrasive blasting for surface preparation for paints and coatings. Abrasives used for dry unconfined blast cleaning shall conform to the requirements of the CARB Executive Order G-19-019. Use abrasives that are currently certified by CARB and appear on the Approved Abrasives List.
- E. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.01 PAINTING AND COATING SYSTEMS

- A. 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		
7.	Submerged Metal, Potable or Nonpotable Water	Epoxy
Exposed Metal Coating Systems		
10.	Exposed Metal, Corrosive Environment	High-build epoxy (two-coat system) with polyurethane topcoat
18.	Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up	Organic zinc
Buried Metal Coating Systems		
21.	Buried Metal	Epoxy

- B. 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.
- C. System No. 7--Submerged Metal, Potable or Nonpotable Water:
 - 1. Type: Epoxy.
 - 2. Service Conditions: For use with structures, valves, piping, or equipment immersed in potable or nonpotable water.
 - 3. Surface Preparation: SSPC SP-10.

4. Coating System: Apply the manufacturer's recommended number of coats to attain the specified minimum dry-film coating thickness. Products: Devoe Bar-Rust 233H, Tnemec 100, Scotchkote 323, Tnemec N140, Sherwin-Williams Tank Clad HS B62-80, Scotchkote 306, PPG AQUAPON® LT NSF Low Temperature Epoxy Coatings 95-172, Carboline 891 VOC, PPG Amercoat 395FD, or equal; 16 mils total. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.02 EXPOSED METAL COATING SYSTEMS

A. System No. 10--Exposed Metal, Corrosive Environment:

1. Type: High-build epoxy coat having a minimum volume solids of 60%, with an organic or inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.
2. Service Conditions: For use with metal structures or pipes subjected to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.
3. Surface Preparation: SSPC SP-10 near white blast clean with a 2 mil minimum angular anchor profile.
4. Prime Coat: Self-curing, two-component inorganic zinc-rich coating or organic 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 2.5 to 3.5 mils DFT. Products: Tnemec 94 H2O Hydro Zinc, Devoe Catha-Coat 304 or 304V, International Interzinc 22HS, PPG Dimetcote 9HS, Carboline Carbozinc 11HS, Sherwin-Williams Zinc-Clad II Plus, PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97-672, or equal.
5. Intermediate Coat: Tnemec V69 Epoxoline (2-10 mils DFT), Devoe Devran 224HS or 231 (6-8 mils DFT), International Interseal 670HS (4-10 mils DFT), PPG Amercoat 385 (3-8 mils DFT), Carboline Carboguard 890 (6-8 mils DFT), Sherwin-Williams Macropoxy 646 B58-600 (5-10 mils DFT), PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series (4-7 mils DFT), or equal
6. Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2.0 to 4.0 mils DFT. Products: Tnemec Series 1095 Endura-Shield, Devoe Devthane 379, International Interline 990HS, PPG Amercoat 450HS, Carboline 134HG, Sherwin-Williams Hi-Solids Polyurethane B65-300, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or equal.

B. System No. 18--Organic Zinc Primer for Shop Coating and Field Touch-Up:

1. Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon.
2. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
3. Surface Preparation: SSPC SP-10.
4. Coating: Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97, International Interzinc 308, PPG Amercoat 68HS, Devoe 313, Carboline 859, Sherwin-Williams Zinc-Clad III HS, 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.

2.03 BURIED METAL COATING SYSTEMS

A. System No. 21--Buried Metal:

1. Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).
2. Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.
3. Surface Preparation: SSPC SP-10.
4. Coating System: Apply three or more coats of PPG Amerlock 400 or 400VOC, Tnemec 104HS or 80, Devoe Bar-Rust 233H, Carboline 890LT, Sherwin-Williams Tank Clad HS B62-80 series, or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

PART 3 - EXECUTION

3.01 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, and 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 manufacturer's recommended minimum

temperature or is expected to drop below the manufacturer's recommended minimum temperature within 24 hours.

3.02 SURFACE PREPARATION PROCEDURES

- A. Application of coatings over asphaltic coatings on ductile iron pipe and fittings is not allowed. Unless asphaltic coating is specified in the contract documents as the final coating for ductile iron pipe and fittings, ductile iron pipe and fittings shall arrive at the jobsite from the supplier with a prime coat compatible with the specified coating system. Ductile iron pipe and fittings coated or previously coated with asphaltic coatings will be rejected and shall be removed from the jobsite. Blasting ductile iron pipe to remove asphaltic coatings is not allowed.
- B. 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.
- C. 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.
- D. 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.
- 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 two hours of blasting or before any rust bloom forms.
- F. Surface preparation shall conform with 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 Prior to 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 paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC (Society for Protective Coatings), surface preparation specifications listed above.
- H. 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.
- I. 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 prior to application of coating, 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 the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.

- 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 such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. After application of primer to surfaces, allow coating to cure for a minimum of two 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 ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.05 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 means of 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. Take care that remaining primers are not damaged by the blast cleaning operation. 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. Take care that remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be

prepared per SSPC SP-11. Remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

- E. Use repair procedures on damaged primer that protects 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 per 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.

3.06 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.

3.07 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.

3.08 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 or additives 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 prior to 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 of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
- E. Apply coating systems to the specified minimum dry-film thicknesses as determined per 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. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.
- G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. Apply the brush coat prior to 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.

3.09 SURFACES NOT TO BE COATED

- A. Do not paint the following surfaces unless otherwise noted in the drawings or in other specification sections. Protect during the painting of adjacent areas:

1. Concrete walkways.
2. Mortar-coated pipe and fittings.
3. Stainless steel.
4. Metal letters.
5. Glass.
6. Roofings.
7. Fencing.
8. Electrical fixtures except for factory coatings.
9. Nameplates.
10. Grease fittings.
11. Brass and copper, submerged.
12. Buried pipe, unless specifically required in the piping specifications.
13. Fiberglass items, unless specifically required in the FRP specifications.
14. Aluminum handrail, stairs, and grating.

3.10 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.

3.11 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 aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications.
 2. Coat buried flanges, nuts and bolts, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes per System No. 21.

3.12 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. Provide certification that the gauge has been calibrated by a certified laboratory within the past six 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 six months. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog.
- C. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.
- D. Perform tests in the presence of the Owner's Representative.

3.13 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 coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.14 CLEANING

- A. During the progress of 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

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SECTION 099674 COATINGS FOR STEEL WATER TANK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes the materials, applications, and inspection of the protective coatings to be utilized on the interior and exterior surfaces of the steel water tank. Clean and coat steel water tank in accordance with AWWA D102 and the following.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Aboveground Steel Water Tank: Section 331611.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit Contractor's SSPC-QP1 Certification.
- C. Submit coating manufacturer's catalog data on formulation and recommended use.
- D. Submit coating manufacturer's surface preparation recommendations including maximum height of surface profile on abrasive blast cleaned steel.
- E. Submit coating manufacturer's application instructions, equipment, temperature and humidity limitations, drying time, and recoat cycle time.
- F. Submit coating manufacturer's recommended minimum and maximum time intervals between the application of shop-applied or field-applied primers and the field-applied touch-up or intermediate coats.
- G. Submit two color chip samples illustrating available colors for the finish coats of the exterior coating system.
- H. Submit complete shop and field procedures to be utilized by the tank manufacturer for shop-primed steel surfaces. Include detailed instructions for degreasing steel prior to blast cleaning, cleaning of blast particles before recycling, application of primers, curing period, transporting, handling, storage, and erection of shop-primed steel.
- I. Submit manufacturer's safety data sheets on painting and coating products.
- J. Submit the name of the company and abrasive to be used, the generic type of abrasive, the State of California Air Resources Board (CARB) certification, and product data sheets.

- K. Submit product data and procedures for the dehumidification and temperature control system.
- L. Submit welding procedure specifications (PS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR). For each welder and welding operator.

1.04 PRECONSTRUCTION CONFERENCE

- A. At least 14 days prior to the shop or field application of the coating systems to the steel tank, schedule and arrange a conference with the Owner's Representative, tank manufacturer, coating applicator, and the coating manufacturer to coordinate the following:
 - 1. Tank manufacturer's work schedule for inspection coordination.
 - 2. Surface preparation methods.
 - 3. Specification compliance of blast abrasives and surface profile.
 - 4. Schedule of blast cleaning and coating application.
 - 5. List of equipment for cleaning and coating applications.
 - 6. Weather limitations for acceptable work.
 - 7. Inspection facilities.

1.05 WORKER PROTECTION

- A. Conform to federal, State, County, District, and Owner safety and environmental protection codes and regulations. Do not create conditions for which the Owner is subject to citations by any regulatory agency. Should the Owner be cited for a condition under the control of the Contractor, the Contractor will be responsible for payment and settlement of said citation. Provide safety equipment, including that for confined space entry and safety equipment necessary for use by the Owner's Representative.
- B. Comply with applicable regulations for properly storing, handling, transporting, and disposing of any hazardous waste.
- C. Provide at least one working telephone on the jobsite at all times.
- D. Maintain a full-time standby hole watch in case of an emergency. This employee shall be certified in CPR, have confined space certification, and be able to comply with GISO 5157 (Operating Procedures and Employee Training) and GISO 5158 (Pre-Entry). This employee shall also be fully equipped to operate within the directives of GISO 5159 (Confined Space Operations). This person shall have his own personal safety equipment and operating telephone (not the jobsite telephone).

- E. During the interior abrasive blasting operations, blast operators shall wear National Institute of Occupational Safety and Health (NIOSH) approved air supplied helmets. The air compressor used to supply breathing air shall conform to OSHA regulations on carbon monoxide and high-temperature protection and meet Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1 (ANSI S86.1). Breathing air shall also be free of dust, fumes, vapors, or gases that may result in harmful exposure. Other persons who are exposed to blasting dust shall wear approved filter-type respirators and safety goggles. When coatings are applied in confined areas, persons exposed to toxic vapors and dust shall wear NIOSH-approved air-supplied masks.
- F. Prepare a written respirator program per CAL/OSHA regulations. The elements of a respirator protection program are summarized, but not limited to, the following:
 - 1. Written standard operating procedures for selection and use;
 - 2. Employee instructions and training in the use and limitations of respirators;
 - 3. Regular cleaning and disinfection;
 - 4. Sanitary storage of respirators; and
 - 5. Regular inspection of respirators to assure that they are in good repair.
- G. Blasting and spraying hoses shall be grounded to prevent accumulation of charges of static electricity.
- H. Provide explosion proof artificial lighting for all work-confined spaces. Light bulbs shall be guarded to prevent breakage. Lighting fixtures and flexible cords shall comply with requirements of NFPA 70 NEC for the atmosphere in which they will be used.
- I. Coating materials may be irritating to the skin and eyes. When handling and mixing coatings, workers shall wear gloves and eye shields.

1.06 QUALIFICATIONS

- A. The Contractor shall require the coating applicator to hold a valid State of California Contractor's Class C-33 license for performing abrasive blast cleaning and coating/painting work.
- B. The Contractor's coating applicator shall have a minimum of five years' experience and successful history in the application of the specified products to surfaces of steel tanks.
- C. The Coating Contractor shall be SSPC QP1 certified at the time of bidding and throughout the project. In lieu of SSPC QP1 certification, the Coating Contractor may submit evidence of a minimum of ten (10) years' experience and completion of a minimum of twenty (20) welded steel potable water tanks of similar complexity.

1.07 INSPECTION

- A. The Owner will provide a coating inspector. The Owner's Representative will provide test equipment, except for the low-voltage holiday detector. The Contractor shall conduct the low-voltage holiday test in the presence of the Owner's Representative.
- B. The Owner's Representative will perform inspection on all phases of the surface preparation, abrasive blast cleaning, and application of the coating systems.

1.08 EXTERIOR COLORS

- A. Color of finish coat shall be tan, Tnemec 67BR or approved equal. Submit color chip for owner approval.

PART 2 - MATERIALS

2.01 COATING SYSTEMS

- A. All materials of a specified system including primer, touch-up, intermediate, and finish coats shall be provided by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the coating manufacturer for the specified system.
- B. Coating materials, including additives to be used on interior tank surfaces, shall not contain trichloroethylene (TCE) or tetrachloroethylene (PCE) volatile organic constituents.
- C. No request for product substitution will be considered which decreases the dry-film thickness designated, the number of coats to be applied, or which changes the generic type of coating specified.
- D. Requests for substitution shall contain the full name of each product, descriptive literature, complete data on past performance, manufacturer's instruction for use, generic type, its nonvolatile content by volume, and complete product information as outlined in AWWA D102. This information shall demonstrate equivalence of product and performance to the specified materials. No coating materials shall be procured or delivered to the project site prior to the review of the proposed material by the Owner's Representative.

2.02 INTERIOR COATING SYSTEM (ZINC/EPOXY)

- A. Primer: Single-component zinc-rich primer in compliance with the requirements of San Luis Obispo County APCD VOC limitations associated with Industrial Maintenance Coatings. Products: Tnemec Series 94-H20 Hydro-Zinc, or approved equal. Apply 2.5 to 3.5 mils dry-film thickness.
- B. Stripe Coat: Minimum 65% solids epoxy. Product: Tnemec L140 Pota-Pox, or approved equal. Apply 2.0 to 4.0 mils dry-film thickness.

- C. Finish: 100% solids epoxy. Products: Tnemec Series FC22 or 22 Epoxoline, or approved equal. Apply 20.0 to 25.0 mils dry-film thickness.
- 2.03 EXTERIOR COATING SYSTEM (ZINC/EPOXY/POLYURETHANE)
- A. Primer: Single-component zinc-rich primer. Products: Tnemec Series 94-H20 Hydro-Zinc, or approved equal. Apply 2.5 to 3.5 mils dry-film thickness.
 - B. Intermediate: field-applied epoxy with minimum volume solids of 66%. Products: Tnemec L69F Hi Build Epoxoline II, or approved equal. Apply 6.0 to 8.0 mils dry-film thickness.
 - C. Finish: Field-applied polyurethane having a minimum volume solids of 66%. Product: Tnemec 1095 Endura-Shield, or approved equal. Apply 2.5 to 4.0 mils dry-film thickness.
- 2.04 ABRASIVES FOR BLAST CLEANING
- A. Abrasives used for dry unconfined blast cleaning shall conform to the requirements of the CARB Executive Order, latest edition. Use abrasives that are currently certified by CARB and appear on the Approved Abrasives List.
- 2.05 ORGANIC ZINC PRIMER FOR FIELD TOUCH-UP AND SHOP COATING
- A. Where shop-applied inorganic zinc primers cannot be used because of volatile organic compound (VOC) regulations, the organic zinc primer described below may be substituted for the specified inorganic zinc primers.
 - B. Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon.
 - C. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
 - D. Surface Preparation: SSPC SP-10.
 - E. Coating: Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97, PPG Amercoat 68 HS, Devco Cathacoat 313, Carboline 859, Sherwin-Williams Zinc-Clad III HS, or equal; applied to a minimum dry-film thickness of 3 mils.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE OF COATING MATERIALS

- A. Deliver coating materials to the job in original sealed containers identified with labels indicating manufacturer; product name and number; color, batch, or lot number; and date of manufacture. Note the date of manufacture and apply coatings prior to the expiration of the guaranteed storage life. Coating materials exceeding storage life will be rejected.

- B. Store coating materials in enclosed structures to protect from weather and excessive heat or cold. Conform to state and local requirements for flammable materials.

3.02 PROTECTION OF THE WORK

- A. Protect adjacent work and surfaces not to be coated from blast cleaning, overspray, spattering, and spillage. Use protective coverings or drop cloths. Where protection is required or provided for coated surface, maintain until the coating has properly cured. Do not handle, work on, or disturb these areas until the coating is completely dry and hard.

3.03 CONDITION OF EQUIPMENT

- A. Use coating equipment designed for the application of the specified materials. Use compressors with traps and filters to remove water and oils from the air.

3.04 VENTILATION OF TANK INTERIOR

- A. Use forced-air ventilation at all times and after the application of the interior coating systems. It is essential that the solvent vapors released during the application and from the deposited film be removed from the tank interior. During the coating application, provide a ventilating system with a capacity of at least 300 cfm per gallon of coating applied per hour. After the application of the finish coat, force ventilate the tank continuously at a rate of one air change per hour for a period of five days. If the Owner's Representative has any doubt about the adequacy of the curing conditions, provide additional curing time with continued forced-air ventilation.

3.05 HUMIDITY AND TEMPERATURE CONTROL

- A. Use dehumidification equipment, by Munters Moisture Control Services or equal, to control the environment within the tank 24 hours per day during blast cleaning, coating, and coating curing. Dehumidification equipment shall:
 1. Continuously deliver air with a maximum relative humidity of 11% sufficient to supply the space with two complete air changes per hour.
 2. Supply sufficient dry air so that the air adjacent to the work surfaces shall not exceed 35% relative humidity at any time during the blasting, coating, or curing cycle.
 3. Be capable of depressing the dew point in the tank 10°F below ambient air temperature within 20 minutes.
 4. Maintain a minimum temperature inside the tank of 60°F.
- B. Auxiliary heaters or chillers may be required to maintain the surface temperature at a level acceptable to the coating manufacturer's application parameters. This auxiliary

equipment shall be approved for use by the manufacturer of the dehumidification equipment and shall:

1. Be installed in the process air supply duct between the dehumidifier and the space, as close to the space as possible.
 2. Use electric or indirect gas-fired heaters. Do not use direct-fired space heaters.
 3. Include heater controls that automatically turn the heater off if the airflow is interrupted or the internal temperature of the heater exceeds design temperature.
- C. Air heaters or refrigeration equipment are not acceptable substitutes for dehumidification.
- D. Seal the space to be controlled as well as possible, allowing air to escape at the bottom of the space away from the point where the dehumidified air is introduced. Maintain a slight positive pressure within the space, unless dust from the blasting operation is hazardous.
- E. If it is necessary to filter the air escaping the tank, design the filtration system to match the air volume of the dehumidification equipment to avoid interference with the ability to control the space as described herein. Do not recirculate air from the space or from filtration equipment back through the dehumidifier when coating or solvent vapors are present.

3.06 SURFACE PREPARATION PRIOR TO ABRASIVE BLAST CLEANING

- A. Remove oil, grease, dust, dirt, rust, moisture, mill scale, and all other foreign or interference substances that would adversely affect the adhesion or durability of the coating system.
- B. Remove oil and grease 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.
- C. Remove weld spatter and weld slag, and grind smooth rough welds, beads, peaked corners, and sharp edges, including erection lugs, in accordance with SSPC SP-2 and SSPC SP-3.

3.07 LIMITATIONS ON ABRASIVE BLAST CLEANING

- A. The specified limitations on the application of coatings also applies to blast cleaning. Do not blast clean when conditions would not permit the subsequent application of coating. Blast clean only the area that can be coated with primer or touch-up coating during the same day. In the event that a cleaned surface colors, oxidizes, or becomes moist, blast clean it again before applying the coating.

3.08 STANDARD BLAST-CLEANED PANELS

- A. On the first day of abrasive blast cleaning, both on-site and off-site, prepare sample panels with a minimum size of 8 1/2 inches by 11 inches of the same steel plate as the tank for use in maintaining a standard during the work on the project. Achieve the specified surface profile and select with the Owner's Representative a panel illustrating the degree of cleaning specified. Both parties then initial the selected panel and coat it with a clear finish that will not fade or yellow. Submit panel to the Owner's Representative.

3.09 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Use a maximum particle size to produce a 1.5- to 2.0-mil surface profile or as recommended by the manufacturer of the specified coating system. Measurement of surface profile will be in accordance with NACE RP0287-02. Sand used for cleaning shall be washed, uniformly graded, dry, and free of contaminants. Do not use sand containing salt or unwashed beach sand. When shop blast cleaning with stationary automatic equipment that recycles the blast particles, use new abrasives in the equipment at the beginning of blast cleaning operations for this project. Do not use abrasives that have become contaminated in automatic equipment. When shop or field blast cleaning with hand-held nozzles, do not recycle or reuse blast particles.
- B. After blast cleaning and prior to application of coating, 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 the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast-cleaned surface not coated within said eight-hour period.
- 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. Cover the reservoir inlet, outlet, drain, hydrants, and overflow piping, and prevent blasting particles from being blown into the piping.
- D. During blast cleaning, exercise caution to prevent damage to adjacent preapplied coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces. Restore any damaged coatings to their specified condition.

3.10 LIMITATIONS ON THE APPLICATION OF COATINGS

- A. Do not apply coatings under the following conditions:
 - 1. When the surrounding ambient air temperature or the temperature of the surface to be coated is below 50°F or as recommended by the manufacturer of the specified coating system.

2. When the temperature of the surface to be coated is more than 5°F below the air temperature or when the surface temperature is over 120°F.
 3. When the surface to be coated is wet, moist, or contaminated with any foreign matter.
 4. During rain, snow, fog, or mist or when the relative humidity exceeds 85%.
 5. When the surface temperature is less than 5°F above the dew point within eight hours after application of coating.
 6. During high wind conditions, Owner's representative shall have discretion to start and stop work based on weather conditions.
- B. If above conditions are prevalent, the application of coating shall be delayed or postponed until conditions are favorable. Dew or moisture condensation should be anticipated, and if such conditions are prevalent, coating work shall be delayed until midmorning to be certain that the surfaces are dry. The day's coating shall be completed in time to permit the film sufficient drying time prior to damage by climatic conditions.
- C. Climatic conditions will be monitored by the Owner's Representative utilizing psychrometers and other measuring gauges at the worksite to aid in inspection.
- D. If a change in climatic conditions damages a coating application, repair the damaged coatings to their specified condition.

3.11 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. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Finished surfaces shall be free from holidays, defects, or blemishes.
- C. Use a different shade or tint on succeeding coating applications to indicate coverage.
- D. Prior to each coating application, brush coat with the coating material all welds, sharp edges, nuts, bolts, and irregular surfaces difficult to coat to provide complete coverage of all surfaces.
- E. 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 prior to 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.

- F. 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 of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
- G. Observe a minimum time interval of 90 days between the application of shop-applied inorganic zinc and the field-applied touch-up or intermediate coat of the exterior coating system on roof and knuckle plates. This time interval may be increased or decreased as recommended by the coating manufacturer.
- H. Observe minimum and maximum recoat times between primer and succeeding coating applications to achieve maximum crosslinking of coatings. If the recommended minimum or maximum recoat time is exceeded, prepare the surface as directed by the coating manufacturer. Apply a second application of the primer or coating if the maximum recoat time has been exceeded.
- I. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile. Measurement shall be in accordance with SSPC PA-2 and shall be corrected for the magnetic effect of the surface profile.
- J. Apply primer or touch-up coating immediately after blast cleaning and before any surface rusting occurs or any dust, dirt, or any foreign matter has accumulated. Reclean steel surfaces by blast cleaning that have surface colored or become moist prior to coating application.

3.12 PROCEDURES FOR SHOP-APPLIED PRIMERS

- A. Blast cleaned steel surfaces will be tested by the Owner's Representative utilizing chemical and/or ultraviolet (black light) tests to detect oil and other contaminants deposited on the surface from abrasive recycling. Tests will be conducted prior to the application of primers. Reclean contaminated surfaces, use new abrasives in the equipment, and prepare the surfaces as specified.
- B. After application of primer to steel surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.
- C. When loading for shipment to the project site, use spacers and other protective devices to separate the plates and steel members 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 steel and minimize damage to the shop-primed surfaces.
- D. Cover shop-primed steel surfaces 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

- E. Handle shop-primed steel plates and members with care during unloading and erection operations to minimize damage. Do not slide steel across another plate or member, except for fitting plates into final position during roof construction. Do not place or store shop-primed steel on the ground or on top of other steelwork unless ground or steelwork is covered with a protective covering or tarpaulin. Place steel above the ground upon platforms, skids, or other supports.

3.13 TOUCH-UP OF SHOP-APPLIED PRIMERS AFTER ERECTION

- A. After erection, the Owner's Representative will inspect all surfaces of the tank that have shop-applied primers to determine surface deficiencies. Remove contaminants that have accumulated on the surfaces of the shop-applied primers during shipment, storage, and erection. Perform corrective action as noted.
- B. Remove oil and grease surface contaminants in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- C. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.
- D. Brush blast clean all shop-primed surfaces to remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system in accordance with SSPC SP-7.
- E. After abrasive blast cleaning, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming and apply the specified touch-up coating to all shop-primed surfaces. Touch-up coating shall be applied separately and shall not be included as part of the intermediate coating.

3.14 APPLICATION OF INTERIOR COATING SYSTEM

- A. Surface Preparation: Abrasive blast clean interior surfaces per SSPC SP-10/NACE 2 Near White Blast Cleaning. The surface profile shall be a minimum 2.0 mil angular profile.
- B. Primer: Apply one primer coat of zinc on the interior surfaces to a dry-film thickness of 2.5 to 3.5 mils.
- C. After application of zinc prime coat, stripe coat welds, sharp edges, nuts, bolts, and irregular surfaces with finish epoxy prior to applying finish coats.
- D. Finish: After observing specified recoat time and surface condition, field apply one intermediate coat of epoxy on the exposed interior surfaces to a dry-film thickness of 20 to 25 mils.

- E. Total System: The total interior coating system shall have a minimum dry-film thickness of 22.5 to 28.5 mils.
- F. Place a fillet of caulk at the roof to shell seam and along unsealed roof plate joints. Caulk shall be Sika-Flex 1A or approved equal.

3.15 APPLICATION OF EXTERIOR COATING SYSTEM

- A. Surface Preparation: Clean exterior surfaces, including ferrous metal accessories and piping, prior to primer application in accordance with SSPC SP-10.
- B. Primer: After surface preparation, apply one primer coat of zinc on the exterior surfaces to a dry-film thickness of 2.5 to 3.5 mils.
- C. After application of zinc prime coat, stripe coat welds, sharp edges, nuts, bolts, and irregular surfaces with finish epoxy prior to applying finish coats.
- D. Intermediate: After observing specified recoat time and surface condition, field apply one intermediate coat of epoxy paint on the exterior surfaces to a dry-film thickness of 6.0 to 8.0 mils.
- E. Finish: After observing specified recoat time and surface condition, field apply one finish coat of polyurethane enamel on the exterior surfaces to a dry-film thickness of 2.5 to 4.0 mils. Use the color selected by the Owner.
- F. Total System: The total exterior coating system shall have a minimum dry-film thickness of 11.0 to 15.5 mils.

3.16 EXTERIOR CAULKING

- A. Place a fillet of caulk at the bottom chime to the concrete footing interface. Place around the entire tank after final coat of exterior paint has fully cured. Protect adjacent surfaces by masking or other acceptable means.
- B. Caulk shall be a high-performance, non-sag elastomeric type caulk, such as Sika Flex-1a by Sika Corporation or approved equal.

3.17 FIELD INSPECTION FACILITIES

- A. Provide the Owner's Representative with facilities for inspection including:
 - 1. Illumination and labor to move the lights, whenever required by the Owner's Representative. Provide additional lights and supports sufficient to illuminate areas to be inspected. The Owner's Representative will determine the level of illumination required for inspection purposes.
 - 2. Temporary ladders and scaffolding. Erect and move to the locations requested by the Owner's Representative.

3.18 INSPECTION AND TESTING

- A. The Owner's Representative will perform such tests as are required to demonstrate substantial compliance with all phases of the surface preparation, abrasive blast cleaning, and application of the coating systems. Test equipment shall include but not be limited to the following: SSPC surface preparation standards, surface profile comparator, test tape, micrometer, abrasive sieve test, ultraviolet lamp, mirror, certified thickness calibration plates, magnetic-type dry-film thickness gauge, and nonsudsing-type wetting agent. Equipment will be calibrated by the Owner's Representative in the presence of the Contractor to verify its accuracy prior to use.
- B. The Contractor shall provide the low-voltage holiday detector and shall conduct the low-voltage holiday test in the presence of the Owner's Representative.
- C. Notify the Owner's Representative three working days in advance of field operations involving abrasive blast cleaning and coating applications.
- D. The Owner's Representative will verify the degree of surface cleanliness profile of the field blast cleaned surface. Perform additional blast cleaning over areas not conforming to the specified surface preparation.
- E. The Owner's Representative will inspect each coat of primer, touch-up, intermediate, and finish coating to determine thickness and integrity. Each coating application will be checked and deficiencies marked. After observing specified recoat time, apply additional coating materials over areas not having the specified minimum dry-film thickness and areas having any holidays or pinholes. After correction of deficiencies, the Owner's Representative will reinspect those areas to determine the acceptability of the additional coating. Each coating application must be 100% to the satisfaction of the Owner's Representative prior to succeeding coating applications.
- F. After completion of the epoxy coating curing cycle, conduct an MEK wipe test with a clean rag, using 25 rubs per each immersion test area on the floor and shell. Test areas will be selected at random by the Owner's Representative. The coating shall be considered cured if it retains its gloss and hardness after the MEK wipe test.

3.19 DISINFECTION

- A. Provide the District with a written request to fill the tank no less than seven (7) calendar days prior to the desired date to begin filling.
- B. Disinfect the interior surfaces of the tank and inlet and outlet piping after the finish coat of the interior coating system has dried and cured. Observe the manufacturer's recommendations of the specified coating system for ventilation requirements and time interval for complete drying.
- C. Prior to disinfection, remove all scaffolding, planks, tools, rags, and other material not a permanent part of the tank. Thoroughly flush the inlet and outlet piping with potable water. Use a high-pressure water blaster and wash interior surfaces of the tank with

potable water. Drain and squeegee water, dirt, and foreign material accumulated in this cleaning operation from the tank.

- D. Disinfect the interior of the tank in accordance with AWWA C652, Chlorination Method 2. Use either liquid chlorine or sodium hypochlorite solution as the available form of chlorine.
- E. Disinfect interior surfaces of inlet piping by filling with water containing a minimum of 10 mg/l free chlorine solution and retaining for at least 30 minutes. Purge chlorine solution prior to filling tank.
- F. After purging inlet piping, fill the tank to the overflow level. Potable water necessary for one round of disinfection/VOC testing will be provided by the Owner. If the first round of disinfection/VOC testing fails to pass bacteriological testing, water must be procured from other means, or purchased at the District's normal rate of charge.
- G. After the tank has been filled to the overflow level, the Owner will take water samples from the tank for bacteriological testing within six hours and obtain a bacteriological quality test to demonstrate the absence of coliform organisms.
- H. If the testing procedure shows the presence of coliform bacteria, Contractor shall drain the tank, disinfect, and refill for test at the Contractor's expense. Owner will deduct the cost of water used to refill the tank from progress payments due the Contractor.
- I. For any discharge, dechlorinate per AWWA C655, perform testing of residual chlorine before discharge of water, and furnish and install erosion control measures.
- J. The disposal of water shall, in all cases, be carried out in strict observance of the water pollution control requirements of the California State Regional Water Quality Control Board. The Contractor shall be responsible for dechlorinating the water solution and monitoring the quality of all water being discharged. Contractor shall maintain and submit all records of discharge water testing and monitoring to the Owner.
- K. Discharge shall be controlled to prevent erosion of surrounding soil, damage to vegetation, and altering of ecological conditions in the area. The Contractor is responsible for providing and maintaining all best management practices.
- L. Continue disinfecting and retesting until satisfactory results are achieved. If the initial chlorination fails to produce required bacteriologic test results, repeat the chlorination and retesting until satisfactory results are obtained. Contractor will be charged the cost of additional water at the Owner's current rates.

3.20 TESTING FOR VOLATILE ORGANIC COMPOUNDS

- A. After the tank has been disinfected and filled to the overflow level, allow a five-day soaking period for the interior coating systems to leach organic compounds into the water.

- B. At the completion of the soaking period, the Owner's Representative will take water samples from the tank and deliver the samples to the state-approved laboratory for analysis.
- C. If levels of the volatile organic compounds exceed the action levels recommended by the California State Water Resources Control Board, Division of Drinking Water, take the following action:
 - 1. Drain the tank, cure and force ventilate the tank for a minimum of 10 days
 - 2. Repeat the VOC test at the Contractor's expense. This process shall continue until the sample passes. The Owner will deduct the cost of water used to refill the tank and the cost of additional laboratory testing of from progress payments due the Contractor. Contractor shall be assessed the cost of water at the City's current rate.

3.21 ELEVEN-MONTH INSPECTION OF COATING SYSTEMS

- A. Conduct a first-anniversary warranty inspection of the interior and exterior surfaces of the tank during the eleventh month following final acceptance of the work by the Owner to determine whether any repair work is necessary. The Owner will establish the inspection date and notify the Contractor. Provide underwater inspection by means of videotape with photos. Videotape and photograph the entire interior surface, including roof underside. If the underwater examination reveals failed areas of coating or joints, then the Owner will drain and wash down the tank. The Contractor shall provide lighting, scaffolding, and any ventilation for the tank inspection. Where coatings have peeled off, bubbled, or cracked, and any location where rusting is evident shall be considered to be a failure of the coating system. Perform repairs at failures by removing the deteriorated coating. Prepare the surface by abrasive blast cleaning and apply the same coating systems as specified in this section. Perform remedial work and provide inspection reports. Inspection, repairs, disinfection, and other activities associated with the failure of the workmanship shall be performed at no cost to the Owner.
- B. Activate impressed-current cathodic protection system upon completion of the 11-month inspection.

END OF SECTION

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SECTION 099754 POLYETHYLENE SHEET ENCASUREMENT (AWWA C105)

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials and installation of a polyethylene sheet encasement for buried iron pipe, fittings, and valves.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Trenching, Backfilling, and Compacting: Section 312316.
- B. General Piping Requirements: Section 400500.
- C. Ductile-Iron Pipe: Section 402040.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with General Conditions and Section 013000.
- B. Submit manufacturer's catalog literature and product data sheets describing the physical, chemical, and electrical properties of the encasement material.

PART 2 - MATERIALS

2.01 POLYETHYLENE WRAP

- A. The encasement shall consist of low-density polyethylene wrap of at least 8-mil thickness conforming to AWWA C105. Color: blue or black.
- B. Polyethylene encasement for ductile-iron pipe shall be supplied as a flat tube meeting the dimensions of Table 1 in AWWA C105 and shall be supplied by the ductile-iron pipe manufacturer.

2.02 PLASTIC ADHESIVE TAPE

- A. Tape shall consist of polyolefin backing and adhesive which bonds to common pipeline coatings including polyethylene.
- B. Minimum Width: 2 inches.
- C. Products: Canusa Wrapid Tape; Tapecoat 35; Polyken 934; AA Thread Seal Tape, Inc.; or equal.

PART 3 - EXECUTION

3.01 APPLICATION OF MOLDABLE MASTIC FILLER TO IRREGULAR ADJACENT SURFACES

- A. When the adjacent joints are bell-and-spigot or mechanical joints and any associated welding specifications do not require an external full fillet weld, apply a moldable mastic filler (per Section 400500) at the step-down area prior to the application of the sheet encasement and tape.

3.02 APPLYING SHEET COATING TO BURIED PIPING AND FITTINGS

- A. Apply wrapping per AWWA C105 as modified herein.
- B. Apply a double wrapping.
- C. Install the polyethylene to completely encase the pipe and fittings to provide a watertight corrosion barrier. Continuously secure overlaps and ends of sheet and tube with polyethylene tape. Make circumferential seams with two complete wraps, with no exposed edges. Tape longitudinal seams and longitudinal overlaps, extending tape beyond and beneath circumferential seams.
- D. Minimize voids beneath polyethylene. Place circumferential or spiral wraps of polyethylene tape at 2-foot intervals along the barrel of the pipe to minimize the space between the pipe and the polyethylene.
- E. Overlap adjoining polyethylene tube coatings a minimum of 1 foot and wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Hand wrap the polyethylene sheet, apply two complete wraps with no exposed edges to provide a watertight corrosion barrier, and secure in place with 2-inch-wide plastic adhesive tape.

3.03 APPLYING SHEET COATING TO BURIED VALVES

- A. Wrap with a flat sheet of polyethylene. Place the sheet under the valve and the flanges or joints with the connecting pipe and fold in half. Extend the sheet to the valve stem and secure the sheet in place with 2-inch-wide plastic adhesive tape. Apply a second layer and secure with tape. Make two complete wraps, with no exposed edges, to provide a watertight corrosion barrier. Secure the sheets with tape around the valve stem below the operating nut and around the barrel of the connecting pipe to prevent the entrance of water and soil. Place concrete anchor and support blocks after the wrap has been installed.

3.04 APPLYING SHEET COATING TO BURIED FLEXIBLE PIPE COUPLINGS

- A. Apply two layers or wraps around the coupling. Overlap the adjoining pipe or fitting a minimum of 1 foot and secure in place with tape. Provide sufficient slack in polyethylene to allow backfill to be placed around fitting without tearing polyethylene. Apply tape around the entire circumference of the overlapped section on the adjoining

pipe or fitting in two complete wraps, with no exposed edges, to provide a watertight corrosion barrier.

3.05 REPAIR OF POLYETHYLENE MATERIAL

- A. Repair polyethylene material that is damaged during installation. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch-wide plastic adhesive tape.

3.06 APPLYING SHEET COATING TO EXISTING BURIED PIPING

- A. When connecting polyethylene-encased pipe or fittings to existing pipe, expose existing pipe, thoroughly clean the surface, and securely tape the end of the polyethylene to the existing as specified above. When the existing pipe is polyethylene encased, wrap new polyethylene encasement over the existing, with overlap of at least 2 feet. Tape securely as specified above.

3.07 BACKFILL FOR POLYETHYLENE-WRAPPED PIPE, VALVES, AND FITTINGS

- A. Place sand backfill within 1 foot of the pipe, valves, and fittings wrapped with polyethylene encasement per Section 312316.

END OF SECTION

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SECTION 264226 IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM FOR
STEEL WATER TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, installation, and testing of an automatic impressed current cathodic protection system conforming to AWWA D104 except as modified herein, including rectifier, anodes, wiring, and reference electrode, to control corrosion on the interior surfaces of steel water tanks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: Section 099000.
- B. Coatings for Steel Water Tank: Section 099674.
- C. Aboveground Steel Water Tank: Section 331611.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit shop drawings of the following items: CP system layout, rectifier, handhole details, automatic controller, ammeters and voltmeter, anode reference electrode weatherproof enclosure, anode mounting details, rectifier cabinet mounting details, installation test procedure, and operation manual.
- C. Submit manufacturer's catalog data and descriptive literature on rectifier, controller, anodes, wire and cables, test stations, and reference electrodes.
- D. Submit operation and maintenance instructions. The instructions shall cover wiring diagrams, description, and function of the respective parts of the system, as-built drawings, and any other details necessary for a thorough understanding of the proper care and operation of the system. Attach outline operating instructions to the door of the power unit.

1.04 SYSTEM DESIGNER/SUPPLIER

- A. The system designer shall have a minimum of five recent continuous years' experience in the design and installation of cathodic protection systems for steel tanks. System designer shall also have permanent service organizations within 300 miles of the project location.

1.05 DESIGN INFORMATION

- A. The cathodic protection systems shall be the impressed current type per NACE International RP0388 latest revision. Vertical anodes suspended from the tank roof shall be used. The system shall have sufficient capacity to maintain tank-to-water potentials of 0.85 to 1.10 volts negative to a copper-copper sulfate reference electrode (CSE) if the submerged portions of the tank are not recoated for a period of twenty years.
- B. The protection area shall include shell and floor.

1.06 WATER QUALITY

- A. Assume that the water quality is within the ranges listed below.
 - 1. Design cathodic protection system for service in water having a maximum temperature of 85°F and having the following approximate chemical characteristics:

Constituent	Concentration (mg/L)	Constituent	Concentration (mg/L)
Ca	57 to 95	TDS	340 to 700
Mg	39 to 75	pH	7.9 to 8
Na	19 to 46	SO ₄	52 to 133
K	2 to 4	Cl	19 to 56
NO ₃ ^{-N}	0 to 0.6	Hardness	303 to 546
Alkalinity	270 to 500	--	--

- 2. Electrical Conductivity (EC): 622 to 1120 micromhos/c.

- B. The Contractor and the Contractor's manufacturer shall verify water quality parameters prior to installation. Water quality parameters may vary, and no additional compensation will be allowed therefor.

1.07 SYSTEM OPERATION

- A. The cathodic protection system shall automatically adjust the current output to maintain a preselected potential with respect to a permanent reference electrode.

1.08 WARRANTY

- A. The Manufacturer shall warrant that the system will maintain a tank to copper-copper sulfate reference electrode (CSE) potential of -0.85 to -1.05 volts on submerged surfaces of the tank for 20 years. In the event the potential is not so maintained and the system has been maintained in accordance with the Contractor's instructions, the Contractor shall modify the system to provide the required degree of protection without cost to the Owner.

1.09 MANUFACTURER'S SERVICES

- A. Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:
 - 1. One labor day to check the installation, calibrate equipment, and advise during start-up and testing of the cathodic protection system.
 - 2. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

PART 2 - MATERIALS

2.01 EQUIPMENT

- A. Equipment shall have a minimum 20-year life and allow for adjustment of the system voltage from 0% to 100% of rated capacity.

2.02 ANODES

- A. Anodes shall be silicon iron conforming to ASTM A518, Grade 3 or platinum-clad niobium over copper/mixed metal oxide coated titanium rods made for use in fresh water. Platinum anodes shall be at least 0.062 inch thick, and thickness of platinum over niobium shall be not less than 100 microinches.
- B. Provide sufficient anodes for a life of at least 20 years, with a circuit resistance not exceeding 1.05 ohms, located to distribute current to all submerged surfaces.
- C. Provide anodes in the form of strings in which individual anodes are connected in series by a continuous cable. Run submerged anode cables without splicing. Cables shall be not smaller than No. 8 AWG stranded copper with high molecular weight or cross-linked polyethylene insulation for silicon iron anodes or No. 10 AWG for other type anodes.

2.03 RECTIFIER UNIT AND CONTROLLER

- A. The rectifier shall automatically maintain the steel tank at a specific potential by adjusting the current output. Provide the following features:
 - 1. Air-cooled.
 - 2. Lightning protection.
 - 3. Silicon or selenium stacks with surge and overload protection, suitable for continuous operation over an ambient temperature range of 0°C to 45°C.
 - 4. Center tap, single phase.
 - 5. 120-volt a-c, 60-hertz, single-phase input.

6. Separate continuous reading meters for output current and voltage.
 7. Direct readout of potential level.
 8. Automatic control of output from 0% to 100% of rated capacity.
- B. The units shall conform to NEMA 7-27, Part 7, covering cathodic protection units. Provide a transformer of the two-winding type conforming to NEMA TR 1. Power unit efficiency shall exceed 70% at rated output. Provide a-c and d-c circuit protection using magnetic circuit breakers. Minimum current capacity of the power unit shall be 28 amperes, but this shall not relieve the Contractor from providing sufficient capacity to satisfy the specified requirements herein.
- C. Provide an ammeter and voltmeter that are zero adjustable, both within 2% accuracy of full scale and having a minimum scale length of 1.7 inches. Meter scales shall be commensurate with rectifier current and voltage rating. If low current requirements prevent accurate readings, install lower range instruments and leave the original meters with the Owner for future use. Digital meters may be used.
- D. The automatic controller shall have the ability to regulate the current output over the unit's full rated capacity. Current output shall be controlled to maintain a preselected metal-to-water potential using a permanent reference electrode within 1 inch of the protected metal or, if remote from submerged metal, without IR drop error. The preset potential shall be maintained within 15 millivolts. The power unit shall also be manually operable from 0% to 100% of rated capacity in case of controller failure. Provide a digital or analog meter for monitoring structure-to-reference cell potential. The meter shall have a sensitivity not less than 10 megohms and conform to the following, where applicable: accuracy within 2% of full scale, zero adjustable, with a scale length of at least 2 1/2 inches.
- E. The enclosure thickness shall be not less than 14-gauge epoxy-coated steel or 12-gauge anodized aluminum with locking hasp. Anodizing shall be Type 1 architectural grade. The cabinet shall be weatherproof (NEMA 3R), ventilated, and have stainless steel, brass, or aluminum hinges. The cabinet door shall have a rack or other means for holding operating and maintenance instructions. Cover air-cooling openings with aluminum insect screening.
- F. A completely sealed cabinet of 16-gauge epoxy-coated steel or 12-gauge anodized or fusion-bonded epoxy-coated aluminum may be used to house the aforementioned power unit. Provide heat sinks so that the internal temperature does not exceed the specified ambient temperature by more than 10°C. A single digital meter may be used for all meter functions and shall include circuitry for printer readout of operating characteristics and modem connections for remote monitoring.

2.04 REFERENCE ELECTRODE

- A. CSEs shall be of the permanent type, suitable for continuous immersion and remain stable for a period of at least 10 years while drawing 2 microamperes. They shall have a potential of -0.316 volt, ± 15 millivolts, to a standard hydrogen electrode.
- B. The lead wire shall be not smaller than No. 14 AWG copper with Type RHW or XHHW insulation and shall be silver soldered to the copper core of the reference cell and sealed watertight by the manufacturer. The lead wire shall have no underwater splices.
- C. Manufacturers: Harco "Perma-Cell," Wallace and Tiernan, or equal.

2.05 CONDUIT

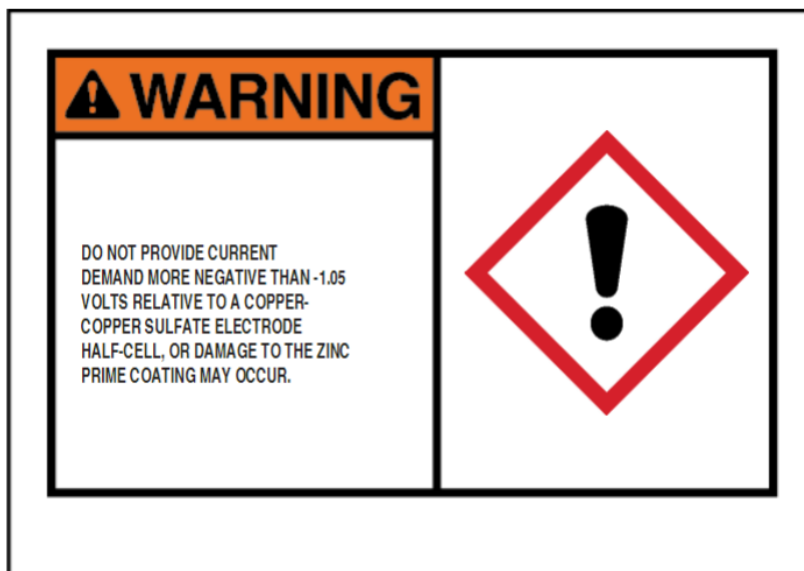
- A. Conduit shall be rigid, thick wall, hot-dipped galvanized inside and out with galvanized threads.

2.06 WIRING

- A. Wiring shall be Type THWN. Anode and reference electrode lead wires shall be as specified above.

2.07 VOLTAGE WARNING SIGN

- A. Furnish and install adhesive voltage warning sign. Warning sign shall be vinyl self-sticking with minimum dimensions of 3 inches by 5 inches. Warning sign shall read "DO NOT PROVIDE CURRENT DEMAND MORE NEGATIVE THAN -1.05 VOLTS RELATIVE TO A COPPER-COPPER SULFATE ELECTRODE HALF-CELL, OR DAMAGE TO THE ZINC PRIME COATING MAY OCCUR". Product shall be Brady B-946, or equal.



- B. Install voltage warning sign inside the cathodic protection control panel in an easily identifiable location.

2.08 OTHER MATERIALS

- A. Provide all other items necessary to complete the installation. Materials shall be expressly manufactured for the end use of cathodic protection.

PART 3 - EXECUTION

3.01 ELECTRICAL WORK

- A. Aboveground wiring shall be in rigid galvanized steel conduit unless shown otherwise.

3.02 HANDHOLES

- A. Cut or grind smooth handholes and other penetrations of tank metal. Remove weld spatter prior to application of protective coatings. Grind smooth sharp edges, burrs, and weld spatter.
- B. Provide 316 stainless steel cover, clamping bar and hardware. Grommet shall be FarWest Corrosion handhole grommet style, model HH-3, or equal.

3.03 PAINTING

- A. Coat exposed ferrous surfaces and hardware attached to the exterior of the tank the same as the tank exterior.

3.04 PLACING CATHODIC PROTECTION SYSTEM IN SERVICE

- A. Prior to energizing the system and after filling the tank with water, measure structure-to-reference cell potentials at a minimum of five locations on the tank floor and 5-foot intervals up the tank wall. Then energize and adjust the cathodic protection system so as to obtain a minimum IR (voltage drop) free or compensated for structure-to-reference cell potential equivalent to CSE potential of -0.85 volt at all locations tested. Current-on potentials shall not exceed -1.05 volts to a CSE placed within one centimeter of the metal surface. If the specified potentials cannot be obtained, modify the system as directed under "Warranty" above. Neatly tabulate native, current-on, and IR compensated polarized potential measurements. Provide two copies to the Owner.
- B. Upon completion of 3.04A, de-energize the system. Cathodic protection system shall remain off until completion of the 11-month inspection per specification section 099674.**
- C. After completion of 11-month inspection per specification section 099674, energize cathodic protection system. **Do not provide current demand more negative than -1.05**

Volts relative to a copper-copper sulfate electrode half-cell, or damage to the zinc prime coating may occur.

3.05 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Furnish six complete sets of detailed instructions covering operation and maintenance of the impressed current system to the Owner. The instructions shall cover wiring diagrams, description and function of the respective parts of the system, as-built drawings, and any other details necessary for a thorough understanding of the proper care of the system. Attach outline operating instructions to the door of the power unit.

END OF SECTION

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SECTION 312300 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, testing, and installation of earthwork for excavations, fills, and embankments for structures and sites.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Existing Conditions: General Conditions.
- B. Cast-in-Place Concrete: Section 033000.
- C. Trenching, Backfilling, and Compacting: Section 312316.

1.03 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with the General Conditions.
- B. Submit copy of a report from a testing laboratory verifying that the material contains less than 0.25% asbestos by weight or volume.
- C. Submit testing reports that indicate material qualities for imported materials.

1.04 TESTING FOR COMPACTION

- A. Test for compaction and relative compaction as described below.
- B. Determine the density of soil in place by nuclear methods, ASTM D6938. Compaction tests will be performed for each lift or layer.
- C. Determine laboratory moisture-density relations of soils per ASTM D1557. Compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.
- D. Determine the relative density of cohesionless soils per ASTM D4253 and D4254.
- E. Sample materials per ASTM D75.
- F. "Relative compaction" is the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density.

- G. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction. The Contractor shall test a minimum of three samples. The Contractor shall pay the costs of any retesting of work not conforming to the specifications.

1.05 DISPOSAL OF EXCESS MATERIALS

- A. Excess site excavated or wasted material shall be disposed of offsite by the Contractor at their expense. No prearranged disposal site or related permits have been determined or secured by the Owner.

1.06 MATERIAL AVAILABILITY

- A. Sufficient earthwork material to complete the work is available at the site.

PART 2 - MATERIALS

2.01 STRUCTURAL FILL

- A. Structural fill is material that is to be placed beneath the tanks to the limits indicated in the drawings. Material shall be excavated material that is free from organic matter, roots, debris, and rocks larger than 3 inches in the greatest dimension.

2.02 STRUCTURAL BACKFILL

- A. Structural backfill is material that is to be placed adjacent to and around piping and structures.
- B. Excavated onsite material may be used for structural backfill.

2.03 FILL

- A. Fill material is material that is to be placed in locations that are not to be constructed as structural fill or structural backfill. Fill material shall be native material.

2.04 SAND, INCLUDING IMPORTED SAND FOR PIPE ZONE AND PIPE BASE IN PIPE TRENCHES

- A. Granular, noncorrosive material free from clay balls, organic matter, and other deleterious substances and conforming to the following gradations:

Sieve Size	Percent Passing By Weight
3/8 inch	100
No. 4	75 to 100
No. 30	12 to 50
No. 100	5 to 20
No. 200	0 to 10

- B. Sand shall have a minimum sand equivalent of 30 per ASTM D2419.

2.05 WATER FOR COMPACTION

- A. Water shall be provided by the District per Specification Section 011100, 1.06C. Provide temporary piping and valves to convey water from the source to the point of use.

2.06 AGGREGATE BASE

- A. Aggregate base shall be imported material conforming to Section 26-1.02B of the California Department of Transportation Standard Specifications for Class 2 Aggregate Base.

2.07 DRAIN MATERIAL

- A. Use Class 2 permeable material per Caltrans Standard Specifications, Section 68.

2.08 FILTER FABRIC

- A. Filter fabric shall conform to Standard Specifications Section 96-1.02B – Class C per Caltrans Standard Specifications, latest edition.

2.09 DRAINPIPE

- A. Underdrain or back of wall drainpipe shall be 6-inch-diameter perforated and solid pipe, Schedule 80 polyvinyl chloride (PVC) conforming to the requirements of ASTM D1785. Perforated sections of pipe shall have two rows of 3/8-inch-diameter holes 60 degrees apart spaced at 4 inches on center. Fittings for drainpipe shall be Schedule 80 Type II PVC solvent weld type conforming to ASTM D2467.

PART 3 - EXECUTION

3.01 DEWATERING

- A. Provide and operate equipment adequate to keep excavations and trenches free of water. Remove water during period when concrete is being deposited, when pipe is being laid, and during the placing of backfill. Avoid settlement or damage to adjacent property.

Dispose of water in a manner that will not damage adjacent property. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation.

3.02 EXCAVATION

- A. Excavations shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926 Subpart P-Excavations, CAL/OSHA requirements, and the General Conditions.
- B. Excavation is unclassified. Perform excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.
- C. After the required excavation has been completed, the Owner will observe the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation is to be conducted in all areas within the influence of the structure where unacceptable subgrade materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the structure or within a zone outside and below the structure defined by a line sloping at 1-horizontal to 1-vertical from 1 foot outside the edge of the footing. Refill the overexcavated areas with structural backfill material.
- D. The Contractor will not receive any additional payment for refill material used for his convenience.

3.03 LIMITS OF FOUNDATION EXCAVATION

- A. Excavate to the depths and widths needed to accomplish the construction. Allow for forms, working space, structural backfill, and site grading. Do not excavate for footings, slabs, or conduits below elevations indicated. Unless unacceptable material is encountered and overexcavation is authorized by the Owner, backfill overexcavations with compacted structural backfill material. Correct cuts below grade by benching adjoining areas and creating a smooth transition. The Contractor shall bear all costs for correcting unauthorized overexcavated areas.

3.04 PREPARATION OF FOUNDATION SUBGRADE

- A. The finished subgrade shall be within a tolerance of ± 0.08 of a foot of the grade and cross section indicated, shall be smooth and free from irregularities, and shall be at the specified relative compaction. The subgrade shall extend over the full width and extend 1 foot beyond the edge of the foundations.
- B. Compact the top 12 inches of the subgrade to 90% relative compaction. Recompanction will not be required if rock is exposed at final subgrade.

- C. Remove soft material encountered and replace with structural backfill. Fill holes and depressions to the required line, grade, and cross sections with structural backfill.

3.05 PREPARATION FOR PLACING FILL OR BACKFILL

- A. After excavation of existing material or removal of unacceptable material at the exposed subgrade, scarify the final subgrade surface to a depth of 12 inches and compact to 90% relative compaction.
- B. Remove foreign materials and trash from the excavation before placing any fill material. Obtain the specified compressive strength and finish of concrete work per Section 033000 before backfilling.

3.06 PLACING AND COMPACTING FILL AND STRUCTURAL FILL

- A. Place in minimum 8-inch lifts and compact each lift to 90% relative compaction.
- B. Where fill is to be constructed on slopes steeper than 5:1, bench the fill into competent undisturbed materials as the fill progresses up the slope. Benches shall be sloped at least 2% into the slope and shall be of a width at least equal to the height of fill lift.

3.07 PLACING AND COMPACTING STRUCTURAL BACKFILL

- A. Place structural backfill material around piping, structures, channels, and other areas, including authorized overexcavation areas, to the lines and grades shown or specified. Do not exceed loose lifts of 8 inches.
- B. Limits of Structural Backfill: Limits of structural backfill shall be 3.0 feet from edge of footing.
- C. Compact each lift to 90% relative compaction, unless otherwise shown in the drawings. Stop structural backfill at least 6 inches below finished grade in all areas where topsoil is to be placed.
- D. Backfill around concrete structures as specified in Section 033000.
- E. Do not operate earthmoving equipment within 5 feet of walls of concrete structures. Place and compact backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

3.08 MOISTURE CONTROL

- A. During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the material. Maintain uniform moisture content throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points

above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.09 SITE GRADING

- A. Perform earthwork to the lines and grades shown in the drawings. Shape, trim, and finish slopes of channels to conform to the lines, grades, and cross sections as shown. Remove exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves of not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces. Do not overexcavate and backfill to achieve the proper grade.

3.10 PLACING AND COMPACTING AGGREGATE BASE

- A. Place the aggregate base in 6- to 8 inch lifts and compact to 90% relative compaction.

END OF SECTION

SECTION 312316 TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, testing, and installation for pipeline trench excavation, backfilling, and compacting.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-in-place concrete: Section 033000.
- B. Earthwork: Section 312300.
- C. Pressure Testing of Piping: Section 400515.
- D. Equipment, Piping Duct, and Valve Identification: Section 400775.

1.03 SUBMITTALS

- A. Submit report from a testing laboratory verifying that material contains less than 0.25% asbestos by weight or volume and conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, rock refill for foundation stabilization, and water. Submit asbestos test results with the submittals for materials gradation. Material gradation reports without the accompanying asbestos test results will be rejected as incomplete.
- B. Submit method(s) of compaction including removal sequence of shoring where used.

1.04 TESTING FOR COMPACTION

- A. Test for compaction as described in Section 312300.

1.05 TRENCH ZONE

- A. The trench zone includes the portion of the trench from 12 inches above the pipe zone to the bottom of the restored pavement in paved areas or to the crushed gravel surface in unpaved areas.

1.06 PIPE ZONE

- A. The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a 12 inches above the top of the pipe.

1.07 PIPE BASE OR BEDDING

- A. The pipe base or bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be a minimum of 6 inches.

PART 2 - MATERIALS

2.01 NATIVE EARTH BACKFILL -- TRENCH ZONES

- A. Native earth backfill used above the pipe zone shall be excavated fine-grained materials free from roots, debris, rocks larger than 3 inches, asbestos, organic matter, clods, clay balls, broken pavement, and other deleterious materials.
- B. Native earth backfill shall be moisture conditioned and compacted to a minimum of 90 percent of maximum dry density. Trenches located within areas subject to vehicle loading shall be compacted to a minimum of 95 percent of maximum dry density within the upper foot of subgrade and all aggregate base.
- C. Moisture condition prior to applying compactive effort. Trench backfill shall be placed in level lifts not to exceed 6 inches.

2.02 IMPORTED SAND--PIPE ZONE AND PIPE BASE

- A. See Section 312300. Imported sand used in the pipe zone or for the pipe base shall be noncorrosive and have the following gradation:

Sieve Size	Percent Passing By Weight
3/8 inch	100
No. 4	75 to 100
No. 30	12 to 50
No. 100	5 to 20
No. 200	0 to 10

- B. Imported sand shall have a coefficient of permeability greater than 0.014 measured in accordance with ASTM D2434 or a minimum sand equivalent of 30 per ASTM D2419. Imported sand shall have a saturated resistivity greater than 1,000 ohm-cm per ASTM G187, a neutral pH, and chlorides less than 100 ppm.

2.03 WATER FOR COMPACTION

- A. See Section 312300. Water shall be free of organic materials injurious to the pipe coatings.

- B. Compaction of trench backfill by jetting or flooding is not allowed unless approved by project geotechnical engineer.

PART 3 - EXECUTION

3.01 SLOPING, SHEETING, SHORING, AND BRACING OF TRENCHES

- A. Trenches shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P--Excavations, CAL/OSHA requirements, and the General Conditions.

3.02 PAVEMENT REMOVAL

- A. Cut bituminous and concrete pavements regardless of the thickness and curbs and sidewalks prior to excavation of the trenches with a pavement saw or pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface. Haul pavement and concrete materials from the site. Do not use for trench backfill.

3.03 TRENCH EXCAVATION

- A. Excavate the trench to the lines and grades shown in the drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base or special bedding.
- B. Trench widths in the pipe zone shall be as shown in the drawings. Comply with 29CFR Part 1926 Subpart P--Excavations. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 2 feet between the top edge of the trench and the structure or footing.

3.04 LOCATION OF EXCAVATED MATERIAL

- A. During trench excavation, place the excavated material only within the working area or within the areas shown in the drawings. Do not obstruct any roadways or streets. Do not place trench spoil over pipe, buried utilities, manholes, or vaults. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.
- B. Locate trench spoil piles at least 15 feet from the tops of the slopes of trenches. Do not operate cranes and other equipment on the same side of the trench as the spoil piles.

3.05 DEWATERING

- A. Provide and maintain means and devices to remove and dispose of water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during both working and nonworking hours, including lunchtime, evenings, weekends, and holidays. Dispose of the water in a manner to prevent damage

to adjacent property and in accordance with regulatory agency requirements. Do not drain trench water through the pipeline under construction.

3.06 FOUNDATION STABILIZATION

- A. After the required excavation has been completed, the Owner will inspect the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exist directly beneath the pipeline to a width 24 inches greater than the pipe outside diameter and to the depth required.
- B. Place filter fabric on the bottom of the trench and up the sides a sufficient height to retain rock refill material. Backfill the trench to subgrade of pipe base with rock refill material for foundation stabilization. Place the foundation stabilization material over the full width of the trench and compact in layers not exceeding 6 inches deep to the required grade. Place additional layer of filter fabric on top the foundation stabilization material for the full width of the trench after reaching the required grade. Foundation stabilization work shall be executed in accordance with a change order.

3.07 INSTALLING BURIED PIPING

- A. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Place the specified thickness of pipe base material over the full width of trench. Grade the top of the pipe base ahead of the pipe laying to provide firm, continuous, uniform support along the full length of pipe, and compact to the relative compaction specified herein. Before laying each section of the pipe, check the grade and correct any irregularities.
- B. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill the area excavated for the joints with the bedding material specified or indicated in the drawings for use in the pipe zone
- C. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
- D. Handle pipe in such a manner as to avoid damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.
- E. When installing pipe, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure elevation at the pipe invert.
- F. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, in maximum 6-inch lifts, keeping the level of backfill the same on each side.

Carefully place the material around the pipe so that the pipe barrel is completely supported and no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

- G. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free-fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Do not operate heavy equipment or a sheepsfoot wheel mounted on a backhoe over the pipe until at least 3 feet or one-half of the internal diameter, whichever is greater, of backfill has been placed and compacted over the pipe.
- H. When the pipe laying is not in progress, including the noon hours, close the open ends of pipe. Do not allow trench water, animals, or foreign material to enter the pipe.
- I. Keep the trench dry until the pipe laying and jointing are completed.

3.08 BACKFILL COMPACTION

- A. Unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:
 - 1. Pipe Zone: 90% relative compaction.
 - 2. Backfill in Trench Zone Not Beneath Paving: 90% relative compaction. Compact backfill within embankment above the pipe zone to the same relative compaction as the adjacent embankment as specified in Section 312300.
 - 3. Backfill in Trench Zone in Paved Areas: 95% relative compaction.
- B. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction or hand tamping. Do not use high-impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
- C. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.
- D. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of building walls, foundations, and other structures.

3.09 MATERIAL REPLACEMENT

- A. Remove and replace any trenching and backfilling material that does not meet the specifications, at the Contractor's expense.

END OF SECTION

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SECTION 331300 DISINFECTION OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials and procedures for disinfection of water mains by the continuous feed method. Disinfect piping in accordance with AWWA C651, except as modified below.

1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Pressure Testing of Piping: Section 400515.

1.03 JOB CONDITIONS

- A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Dechlorinate the disinfection water such that the chlorine residual complies with California Regional Water Quality Control Board and NPDES requirements.
- B. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and cognizant regulatory authorities.
- C. Use potable water for chlorination.
- D. Submit request for use of water from waterlines of Owner 72 hours in advance.

PART 2 - MATERIALS

2.01 LIQUID CHLORINE

- A. Inject with a solution feed chlorinator and a water booster pump. Follow the instructions of the chlorinator manufacturer.

2.02 CALCIUM HYPOCHLORITE (DRY)

- A. Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

2.03 SODIUM HYPOCHLORITE (SOLUTION)

- A. Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

2.04 CHLORINE RESIDUAL TEST KIT

- A. For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWWA C651, Appendix A.1. Maintain kits in good working order available for immediate test of residuals at point of sampling.

2.05 DECHLORINATION MATERIALS

- A. If dechlorination is required and the Contractor elects to use a means of chemical dechlorination, use one of the chemicals described in AWWA C655.

PART 3 - EXECUTION

3.01 CONTINUOUS FEED METHOD FOR PIPELINES

- A. Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 25 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

3.02 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

- A. During the period that the chlorine solution is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

3.03 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

- A. Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

3.04 CONFIRMATION OF RESIDUAL IN PIPING

- A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 10 mg/L minimum exists along the pipeline by sampling at air valves and other points of access.

3.05 PIPELINE FLUSHING

- A. After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is no higher than that generally prevailing in the distribution system.

3.06 SAMPLING AND BACTERIOLOGIC TESTING

- A. There shall be no water in trenches up to the connection for sampling. The sampling piping shall be clean, disinfected, and flushed prior to sampling.
- B. Collect two sets of samples per AWWA C651, Section 5.1, deliver to a certified laboratory within six hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline after chlorination and refilling. Collect at least one set of samples from every line stopping insertion point, plus one set from the end of the pipeline. At each connection to an existing pipeline, take two additional samples. Use pipeline dedicated sampling ports for obtaining samples.

3.07 PIPING TEST FACILITY REMOVAL

- A. After satisfactory disinfection, disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

3.08 PIPING TO BE DISINFECTED

- A. Disinfect all piping except:
 - 1. Storm drain piping.

3.09 DISINFECTION OF STRUCTURES

- A. Disinfect tanks per Specification Section 099674.

3.10 REPETITION OF PROCEDURE

- A. If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

3.11 DECHLORINATION

- A. Dechlorinate per AWWA C655. Perform testing of residual chlorine before discharge of water into the environment.

END OF SECTION

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SECTION 331611 ABOVEGROUND STEEL WATER TANK (AWWA D100)

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes design, fabrication, and erection of a ground-supported flat-bottom welded steel water tank in accordance with AWWA D100-21 .
- B. Provide connected valves, impressed current cathodic protection, and level gauges.
- C. Required ringwall foundation shall be constructed by the Contractor as indicated in the drawings.

1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Cast-in-Place Concrete: Section 033000.
- B. Painting and Coating: Section 099000.
- C. Coatings for Steel Water Tank: Section 099674.
- D. Impressed Current Cathodic Protection of Steel Water Tank: Section 264226.
- E. Earthwork: Section 312300.
- F. Trenching, Backfilling, and Compacting: Section 312316.
- G. Manual, Check, and Process Valves: Section 400520.
- H. Hydrodynamic Mixing System: Section 400765.

1.03 STANDARD SPECIFICATIONS

- A. Wherever reference is made to the State Specifications, such reference shall mean the State of California, Business, Transportation, and Housing Agency, Department of Transportation Standard Specifications, latest edition.

1.04 DESIGN INFORMATION

- A. The tank capacity in millions of U.S. gallons (MG) and dimensions are as follows:

Tank No.	Nominal Capacity (MG)	Tank Bottom Elevation at Ringwall (feet)	Overflow Height Elevation/TCL (feet)	Freeboard Above Overflow (feet)
1	0.212	441.3	464.3	3.0
2	0.125	441.3	464.3	3.0

- B. Provide a supported cone roof with a slope of 3/4 inch in 12 inches.
- C. Design Roof Live Load: 15 psf.
- D. Design Wind Velocity: 103 mph.
- E. Lowest One-Day Mean Ambient Temperature: +5°F.
- F. Allowable Bearing Pressure of Interior Columns on Soil: 4,000 psf including all direct roof loads, wind or earthquake, and overturning, not including water. Design for maximum load combination.

1.05 EARTHQUAKE DESIGN

- A. Mapped maximum considered earthquake spectral response accelerations, 5% damped, at 0.2-second period S_s is less than 0.15 and 1.0-second period S_1 is less than 0.04 and seismic design is not required. Apply the pseudodynamic approach of Section 13 with the following data used to determine the minimum strength requirements of the tank for seismic design.
 - 1. Seismic Use Group: IV.
 - 2. Mapped Spectral Response Accelerations
 - a. S_s : 1.179g
 - b. S_1 : 0.427g
 - 3. Spectral Response Coefficients
 - a. S_{ds} : 0.943g
 - b. S_{d1} : 0.427g
 - 4. Long Period Site Coefficient, F_v : 1.5.
 - 5. Response Modification Factors:
 - a. R_i : 3.
 - b. R_c : 1.5.

6. Design Spectral Response Acceleration: Conform to Section 13.2.7 of AWWA D100-21.
 7. Freeboard: 3.0 feet from the top of contained liquid (TCL) to the lowest level of roof framing.
 8. Combine hoop stresses shall be the larger of root mean square or direct sum.
 9. Shell Compression: Use AWWA D100, Section 13.5.4.2.4 for allowable stress for all levels of earthquakes. Do not consider pressure stability for allowable compression stress.
 10. Roof Seismic Design: Vertical acceleration A_v , $0.14 \times S_{DS}$. Column lateral dynamic water load, 10 psf. Column horizontal acceleration, 0.35 g.
- B. Tank Sliding: Provide positive anchorage to ringwall footing where frictional resistance alone is inadequate. Use a coefficient of friction of 0.577. Check sliding per AWWA D100, Section 13.5.4.6.
- C. Anchor Bolts: Design anchor bolts, when required, in accordance with AWWA D100 for all earthquake levels. Design attachment of anchor bolts to the tank per AISI publication "Steel Plate Engineering Data, Volume 2, Part VII."
- D. Hydrodynamic Seismic Hoop Tension:
1. Calculate the impulsive hoop force (N_i) in pounds per inch from:

- a. For $D/H > 1.333$

$$N_i = 4.50 \times A_i \times G \times D \times H \times \left[\frac{Y}{H} - 1/2 \left(\frac{Y}{H} \right)^2 \right] \times (\tanh [0.866 \times (D/H)])$$

where

D = tank diameter, feet

G = specific gravity of fluid

H = height of water, feet

Y = distance below water surface, feet

- b. For $D/H < 1.333$ and $Y < 0.75 D$

$$N_i = 2.77 \times A_i \times G \times D^2 \times \left[\frac{Y}{0.75D} - 1/2 \left(\frac{Y}{0.75D} \right)^2 \right]$$

c. For $D/H < 1.333$ and $Y > 0.75D$

$$N_i = 1.39 \times A_i \times G \times D^2$$

2. Calculate the convective hoop force (N_c) in pounds per inch from:

$$N_c = 0.975 \times A_c \times G \times D^2 \times \left[\frac{\cosh(3.68 \times [H - Y] / D)}{\cosh(3.68 \times [H / D])} \right]$$

3. Calculate the added hydrodynamic force (N_h) in pounds per inch from: $N_h \times A_v$

where:

$$N_h = 2.6 \times Y \times D \times G$$

$$A_v = 0.14 \times S_{DS}$$

4. Calculate the hydrodynamic seismic hoop tensile stresses at the bottom of each shell ring per AWWA D100-05, Section 13.5.4.2.3.

5. Verify that combined stresses are less than allowable shell stresses including the one-third increase in the allowable stress. Increase shell thickness as required to limit stresses to allowable level in each shell ring. No shell ring shall be thicker than the ring below it.

E. Column Lateral Loads: Design roof columns for lateral forces in addition to vertical loads. Compute equivalent static lateral loads by multiplying column weight by acceleration. Also include lateral force from sloshing water which may be assumed to be 10 psf over the projected area of the column. Combine lateral loads with vertical weight of roof structure and live load (as required) increased by vertical component of acceleration A_v . Design connections for 1.5 times the calculated forces to provide ductile behavior.

F. Thermal Movement: Design connections of roof rafters to provide for thermal expansion and contraction for a temperature range of 5°F to 120°F.

1.06 SUBMITTALS

A. The drawing and accessory list of AWWA D100 is not required with the bid. Submit with detail drawings.

B. Submit the design calculations in sufficient detail to indicate the procedures used, signed by a civil or structural engineer licensed to practice in the project state. Foundation plans are provided by the Owner.

C. Detail Drawings: Submit in accordance with 013300 and General Conditions. Include:

1. Dimensional drawing.

2. Welding data tabulation.
 3. Accessory list with fabrication detail.
 4. Erection drawings.
 5. Catalog cuts, descriptions of standard manufactured items.
 6. Anchor bolt size and layout.
- D. Mill test reports of all steel materials with a certification of which ASTM or other AWWA D100-required specification each material complies with.
- E. Report of initial test radiographs and evaluation for each welder within a week after his employment for erection/fabrication of the tank on the site.
- F. Report per AWWA D100, Section 11.2 at the conclusion of the work certifying the inspection.
- G. Certificate of compliance with AWWA D100 with addenda.

PART 2 - MATERIALS

2.01 ACCESSORIES

- A. Roof Columns, Rafters, Girders, and Accessories: Provide roof support system members whose slope and layout facilitates cleaning and preparation for application of protective coatings. Columns shall be circular with section properties not less than those of a 6-inch-diameter standard pipe section. The column baseplate shall not be welded to the floor plates but held in position by angles or other stops welded only to the floor plates at diagonal corners of the column base. Provide full filler plate seal welded under baseplate to provide uniform bearing where column baseplate overlaps a lap seam in the floor plates.
- B. Shell Manholes: Two each, circular, 30 inches in diameter, with swing type cover as shown in the drawings.
- C. Pipe Connections:
1. Inlet and outlet nozzles, sized for clear inside diameters.
 2. Locate piping connections per AWWA D100 Section 13.5. Penetrations of shell shall be not less than 12 inches clear above bottom.
- D. Overflow: Circular weir inlet and overflow pipe to ground with elbow and of no smaller dimensions than shown.
- E. Ladders, Inside and Outside Vertical:

1. Width of interior and exterior ladder shall conform to CAL/OSHA requirements and as specified on the plans.
 2. Provide exterior ladder with anti-climb door as shown on the plans.
 3. Provide safety climb system as shown in the drawings.
 4. Equip the exterior ladder with pivot dismount section located in the center of the ladder. Atop the exterior ladder, provide OSHA gate as shown in the drawings.
 5. Interior ladder shall be pultruded fiberglass ladder system as manufactured by Strongwell or approved equal and shall comply with Specification Sections 065000 and 066010.
 6. Requirements set forth in OSHA 1910.23 and 1926.1053, UBC, local building codes and industry standards as applicable.
 - a. Design live load of 150 psf and maximum deflection of 1/240 of span.
 - b. All materials shall be in compliance with ANSI/NSF Standard 61.
 - c. Ladders shall be attached to the ladder supports with Type 316 stainless steel anchor bolts.
 - d. The distance between rungs shall be uniform throughout the length of the ladder.
 - e. Seal cut edges with NSF-61 certified resin.
 - f. Install ladders in accordance with the manufacturer's recommendations.
 7. Ladder landing, checkered plate with handrails conforming to CAL/OSHA extending from the outside ladder to the roof.
- F. Roof hatches, one over interior ladder, open with hinges of minimum 3/8-inch steel to lie flat on roof, hasp for padlock.
1. Roof hatch over interior ladder shall be Bilco Company Type S or equal. Hatch shall be aluminum construction with heavy pentle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and exterior padlock hasps, and neoprene seal. Equip each cover with an automatic hold-open and release device and a safety chain mounted at the end opposite the ladder. Hardware shall be Type 316 stainless steel. Provide an insulating seal between ferrous and aluminum surfaces.
- G. Center roof vent containing removable panels with Type 316 stainless steel screen and fiberglass insect mesh. Size vent system to accommodate a maximum tank flow rate of 725 gpm.

2.02 LEVEL GAUGE

- A. Water level indicator shall be a float-actuated level gauging system consisting of a target sliding vertically over an aluminum gauge board graduated in feet and inches with numerals at each foot. Use Type 316 stainless steel for the float, cable, and guide wires. Provide brackets, pipe, and pulleys. Equip indicator with a Type 316 stainless steel pull chain. Products: Shand & Jurs Model 92302, Varec Figure No. 6700, or equal.

2.03 SERVICE AND CONTROL OUTLETS

- A. Flanges, Drilling, and Bolt Size for Nominal 4 Inches to 36 Inches in Diameter: AWWA C207, Class D. For 3 inches: ASME B16.5.

2.04 EXPANSION JOINT FILLER

- A. Preformed expansion joint filler, ASTM D1751, nonextruding, resilient bituminous type, except do not use strips utilizing cork. Use cane or other cellular fibers uniformly saturated with asphalts.

2.05 BITUMINOUS MASTIC

- A. Bituminous Sealant: Henry's 204 as manufactured by Henry Company, APCO 100, Marvin, or equal.

2.06 SAND CUSHION

- A. Fine aggregate for concrete sand per Section 90 of State Specifications (California).
- B. The resistivity of the material before adding oil shall be greater than 3,000 ohm-cm when saturated with distilled or deionized water. The chloride content of the material before adding oil shall be less than 100 ppm, and the sulfate content shall be less than 200 ppm.
- C. Fine aggregate may be separated into two or more sizes and stored separately, provided that when the materials are combined, they will conform to the grading requirements specified.

2.07 LIQUID ASPHALT FOR SAND CUSHION

- A. Grade SC-250 or SC-800 per Section 93 of the State Specifications (California).

2.08 CONCRETE FOR RINGWALL

- A. See Section 033000.

PART 3 - EXECUTION

3.01 FIELD WELD INSPECTION AND TESTING

- A. The Contractor shall obtain and provide the services of a qualified testing laboratory to perform the quality control specified in AWWA D100, Section 11.2.

3.02 CONCRETE RINGWALL

- A. Place concrete so top surface is smooth and lies within 1/8 inch of a straight line in any 16-foot segment and all points are within 1/4 inch of true elevation. Install anchor bolts per design requirements provided in the structural plans.

3.03 ASPHALT-IMPREGNATED SAND CUSHION

- A. Mix sand thoroughly with liquid asphalt prior to placement within the concrete ringwall. Asphalt content of the mix shall be 5% to 7% by weight. Place sand and compact by rolling with pneumatic tired rollers so finished surface is true to grade and the edge is approximately 1/4 inch above concrete ringwall.

3.04 WELDING

- A. Review Contractor-certified qualification records of the welders employed for erection with the Owner's Representative at the start of erection and each time a new welder is employed. Provide a record for each welder indicating:
 - 1. Date and result of qualification tests.
 - 2. Contractor conducting tests.
 - 3. Identifying mark of welder.
- B. All butt joints require complete joint penetration welds.
- C. Do not weld when the temperature is less than 32°F; during rain, snow, or high winds; or when ice is on the metal. For plate thicknesses in excess of 1 1/2 inches, preheating is required when the metal temperature is less than 70°F.

3.05 SPOT RADIOGRAPHS

- A. During erection of the tank shell, obtain and evaluate spot radiographs in the first 10 feet of joint welded by each welder. In addition to the procedure in AWWA D100, Section 11.2, transmit the radiographs and the evaluation to Owner's Representative within one week after the employment of each welder on the site.
- B. Obtain and evaluate a spot radiograph in each 100 feet of shell weld subject to primary stress and in each 200 feet of shell weld subject to secondary stress. Maintain for review by the Owner's Representative on the site and include in the report at job conclusion a

record of the extent of repair of defective welds and the spot radiographs of the repaired joint.

3.06 VACUUM TEST

- A. Test for porosity in the welded seams of the tank bottom by observation for bubbles in a soap solution coating with a glass top metal testing box connected to equipment that produces a vacuum of at least 2 psi. Correct deficient welds.

3.07 JOINT FILLER, TANK RESERVOIR BOTTOM TO RINGWALL

- A. Place preformed expansion joint filler on top of the ringwall and pipe encasements under the tank bottom sketch plate. Cut the exposed edge of the strips to a radius 1 inch greater than the sketch plate and butt together adjacent strips. After the tank shell has been constructed and painted, seal exposed expansion joint filler between the sketch plate and the top of the ringwall with bituminous mastic.

3.08 TEMPORARY CLOSURE OF TANK OPENINGS

- A. Provide and emplace with three or more bolts temporary covers of metal, 10 gauge minimum, or plywood, concrete form quality, cut to fit the tank openings that are not fitted with valves, hatches, or manhole covers at the completion of erection. The covers are intended to exclude dust, animals, and intruders before and after painting and after disinfection.

3.09 DISINFECTING

- A. Disinfect per Section 099674.

3.10 WATER TEST OF STEEL TANK

- A. Initial filling, testing, and draining shall be coordinated with the Owner.
- B. Repair any leaks disclosed as provided in AWWA D100, Section 11.

3.11 FIRST ANNIVERSARY INSPECTION OF TANK

- A. Per specification sections 099674 and 264226.

END OF SECTION

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SECTION 400500 GENERAL PIPING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes the general requirements for selecting piping materials; selecting the associated bolts, nuts, and gaskets for flanges for the various piping services in the project; and miscellaneous piping items.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).
- C. 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.
- D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

1.03 DEFINITIONS OF BURIED AND EXPOSED PIPING

- A. Buried piping is piping buried in the soil, commencing at the wall or beneath the slab of a structure. Where a coating is specified, provide the coating up to the structure wall. Unless detailed otherwise, coating shall penetrate wall no less than 1 inch. Piping encased in concrete is considered to be buried. Do not coat encased pipe.
- B. Exposed piping is piping in any of the following conditions or locations:
 - 1. Above ground.
 - 2. Inside buildings, vaults, or other structures.
 - 3. In underground concrete trenches or galleries.

1.04 PIPING SERVICE

- A. Piping service is determined by the fluid conveyed, regardless of the pipe designation. For example, pipes designated "Air Low Pressure," "Air High Pressure," and "Air" are all considered to be in air service.

PART 2 - MATERIALS

2.01 THREAD FORMING FOR STAINLESS STEEL BOLTS

- A. Form threads by means of rolling, not cutting or grinding.

2.02 BOLTS AND NUTS FOR FLANGES FOR STEEL AND DUCTILE-IRON PIPING

- A. Bolts and nuts for buried or submerged Class 125 or 150 flanges and Class 125 or 150 flanges located outdoors above ground or in vaults and structures shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.
- B. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.03 BOLTS AND NUTS FOR FLANGES

- A. Bolts and nuts for buried and submerged flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts

2.04 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.
- B. Gaskets for flat face and raised face flanges shall be 1/8-inch thick and shall be one of the following nonasbestos materials:
 - 1. NSF-61 certified synthetic fiber gasket with rubber binder. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 180°F. Products: Garlock Style 3760-U or equal.
 - 2. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 400°F.

2.05 GASKETS FOR FLANGES FOR DUCTILE-IRON PIPING AND FITTINGS IN WATER SERVICE

- A. NSF-61 certified synthetic fiber gasket with rubber binder. Gaskets shall be suitable for a pressure of 500 psi at a temperature of 180°F. Products: Garlock Style 3760-U or equal

2.06 THREADED CAPS FOR PROTECTION OF NUTS AND BOLT THREADS

- A. Caps shall be high-density polyethylene, color black. The caps shall be filled with an anticorrosive lubricant to prevent nuts and bolts from rusting and corroding. Lubricant shall be suitable for use in potable water. Caps shall withstand temperatures from -40°F to 200°F. Caps shall be suitable to use in exposed, buried, and submerged service conditions.

Products: Sap-Seal Products, Inc.; Advance Products and Systems, Inc., "Radolid"; or equal.

2.07 MOLDABLE FILLER TAPE FOR PIPE SURFACE TRANSITION AREAS

- A. Filler tape shall be a 100% solids mastic-like butyl-rubber filler designed to fill and smooth the transition areas between adjacent coating surfaces such as step-down weld areas, surface irregularities beneath heat-shrink sleeves, pipefittings, and exothermic welds for cathodic protection bonding wire connections. Characteristics:
 - 1. Thickness per ASTM D1000: 1/8 inch minimum.
 - 2. Peel adhesion to primed pipe: 300 ounces per inch minimum.
 - 3. Elongation: 600% minimum.
- B. Products: Tapecoat "Moldable Sealant," Polyken No. 939 Filler Tape, or equal.

PART 3 - EXECUTION

3.01 RAISED FACE AND FLAT FACE FLANGES

- A. Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.02 INSTALLING ABOVEGROUND OR EXPOSED PIPING

- A. Provide pipe supports as detailed in the drawings.
- B. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.03 INSTALLING FLANGED PIPING

- A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16 inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.
- B. Inspect each gasket to verify that it is the correct size, material, and type for the specified service and that it is clean and undamaged. Examine bolts or studs, nuts, and washers for defects such as burrs or cracks and rust and replace as needed.
- C. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.

- D. Bolt lengths shall extend completely through their nuts. Any that fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.
- E. Do not use more than one gasket between contact faces in assembling a flanged joint.
- F. Tighten the bolts to the manufacturer's specifications, using the recommended cross bolt pattern in multiple steps of increasing torque, until the final torque requirements are achieved. Do not over torque.
- G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
- H. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation. Install on exposed and buried piping.

3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

- A. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

SECTION 400515 PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section specifies the cleaning and hydrostatic and leakage testing of pressure piping for buildings, water distribution and transmission mains.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Manual, Check, and Process Valves: Section 400520.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.
- C. Submit copy of the test records to the Owner's Representative upon completion of the testing.

1.04 TESTING RECORDS

- A. Provide records of each piping installation during the testing. These records shall include:
 - 1. Date and times of test.
 - 2. Identification of pipeline, or pipeline section tested or retested.
 - 3. Identification of pipeline material.
 - 4. Identification of pipe specification.
 - 5. Test fluid.
 - 6. Test pressure at low point in pipeline or pipeline section.
 - 7. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
 - 8. Certification by Contractor that the leakage rate measured conformed to the specifications.

PART 2 - MATERIALS

2.01 TESTING FLUID

- A. Testing fluid shall be potable water.
- B. Submit request for use of water from waterlines of Owner 48 hours in advance.
- C. The Contractor may obtain the water from the Owner at the Owner's rate of charges.

2.02 TESTING EQUIPMENT

- A. Provide calibrated pressure gauges, pipes, bulkheads, pumps, chart recorder, and meters to perform the hydrostatic testing.

PART 3 - EXECUTION

3.01 TESTING PREPARATION

- A. Pipes shall be in place, backfilled, and anchored before commencing pressure testing.
- B. 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. Perform the final pressure test, however, 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. Drain the pipes after they have been tested.
- F. Prior to starting the test, the Contractor shall notify the Owner's Representative.

3.02 CLEANING

- A. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 fps for water testing. Flush pipes for time period as given by the formula

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)

L = pipe length (feet)

3.03 TESTING AND DISINFECTION SEQUENCE FOR POTABLE WATER PIPING

- A. Locate and install test bulkheads, valves, connections to existing pipelines, and other appurtenances in a manner to provide an air gap separation between existing potable water pipelines and the pipeline being tested. Disinfect water and pipeline being tested before hydrostatic testing when connected to a potable waterline.
- B. Disinfect tank, piping on interior of tank, and piping per Specification Sections 099674 and 331300.

3.04 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

- A. Maximum rate of filling shall not cause water velocity in pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

3.05 HYDROSTATIC TESTING OF BURIED PIPING

- A. Where any section of the piping contains concrete thrust blocks or encasement, do not perform the pressure test until at least 10 days after placing the concrete. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.
- B. Apply and maintain the test pressure by means of a positive displacement hydraulic force pump.
- C. Maintain the test pressure for the following duration by restoring it whenever it falls an amount of 5 psi:

Pipe Diameter (inches)	Hours
18 and less	4

- 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 formula

$$L = \frac{HND(P)^{1/2}}{C}$$

in which:

- L = allowable leakage (gallons)
- H = specified test period (hours)
- N = number of rubber-gasketed joints in the pipe tested
- D = diameter of the pipe (inches)
- P = specified test pressure (psig)
- C = 7,400

- E. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.
- F. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

3.06 REPETITION OF TEST

- A. If the actual leakage exceeds the allowable, 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.

3.07 BULKHEAD AND TEST FACILITY REMOVAL

- A. After a satisfactory test, remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings.

3.08 TEST PRESSURE AND TEST FLUIDS

Testing pressure (psig) shall be as listed below:

Pipe Service	Pipe Material	Testing Fluid	Test Pressure
Potable Water	Ductile Iron	Potable Water	150 psi

END OF SECTION

SECTION 400520 MANUAL, CHECK, AND PROCESS VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, testing, and installation of manually operated valves..

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: Section 099000.
- B. Polyethylene Sheet Encasement (AWWA C105): Section 099754.
- C. General Piping Requirements: Section 400500.
- D. Pressure Testing of Piping: Section 400515.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions Section 013300.
- B. Submit manufacturer's catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.
- C. Show valve dimensions including laying lengths. Show port sizes. Show 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.
- D. Show valve linings and coatings. Submit manufacturer's catalog data and descriptive literature.

PART 2 - MATERIALS

2.01 GENERAL

- A. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.
- B. For buried locations, valves with mechanical joint ends may be substituted for the flanged ends specified provided the mechanical joint ends are mechanically restrained and are compatible with the pipe ends.

2.02 VALVE ACTUATORS

- A. Provide lever or wrench actuators for exposed valves 8 inches and smaller. For larger valves, provide handwheels.
- B. Provide 2-inch AWWA operating nuts for buried and submerged valves.
- C. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets.
- D. Valve actuators, handwheels, or levers shall open by turning counterclockwise.

2.03 CAST-IRON VALVE BOXES FOR BURIED VALVES

- A. Valve boxes shall be two-piece sliding type, cast iron. Units shall be as manufactured by Tyler Pipe, Geneco, Star Pipe Products, or equal. Extension pipes shall be cast iron.

2.04 BOLTS AND NUTS FOR FLANGED VALVES

- A. Bolts and nuts for flanged valves shall be as described in Section 400500.

2.05 GASKETS FOR FLANGES

- A. Gaskets for flanged end valves shall be as described in Section 400500.

2.06 PAINTING AND COATING

- A. Coat metal valves located above ground or in vaults and structures in accordance with Section 099000, System No. 10. Apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in field. Finish coat shall match the color of the tank and adjacent piping. Coat handwheels the same as the valves.
- B. Coat buried metal valves at the place of manufacture per Section 099000, System No. 21.
- C. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless steel pieces, per Section 099000, System No. 7. Apply lining at the place of manufacture.
- D. Alternatively, line and coat valves at the factory with fusion-bonded epoxy.
- E. Measure the thickness of the valve interior linings per Section 099000. Repair areas having insufficient film thickness per Section 099000.

2.07 PACKING, O-RINGS, AND GASKETS

- A. Unless otherwise stated in the detailed valve specifications, packing, O-rings, and gaskets shall be one of the following nonasbestos materials:

1. Teflon.
2. Kevlar aramid fiber.
3. Acrylic or aramid fiber bound by nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal.
4. Buna-N (nitrile).

2.08 RUBBER SEATS

- A. Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/L in the fluid conveyed.

2.09 VALVES

A. Gate Valves:

1. Cast-Iron Resilient Wedge Gate Valves 3 Through 20 Inches (AWWA C509):
 - a. Valves shall comply with AWWA C509 and the following. Valves shall be of the bolted-bonnet type with nonrising stems. Valve stems shall be Type 304 or 316 stainless steel or cast, forged, or rolled bronze. Provide operating nut for buried valves. Provide handwheel for exposed valves. Stem nuts shall be made of solid bronze. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum or more than 7% zinc. Bronze shall conform to ASTM B62 or ASTM B584 (Alloy C83600), except the stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584 or B763, Alloy C87600 or C99500). Body bolts shall be Type 316 stainless steel. End connections for exposed valves shall be flanged. End connections for buried valves shall be flanged or restrained mechanical joint type.
 - b. Provide reduction thrust bearings above the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in stem above thrust collar. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
 - c. Manufacturers: Mueller, Clow R/W, AVK, American Flow Control CRS-80, Waterous Series 500, Kennedy Ken-Seal, or equal.

B. Butterfly Valves:

1. Flanged, Rubber-Seated Butterfly Valves 4 Through 72 Inches, Class 150B:
 - a. Butterfly valves shall be short body, flanged type for exposed valves and valves in vaults or structures, and either flanged or mechanical joint for

buried valves. Valve shall conform to AWWA C504, Class 150B. Minimum working differential pressure across the valve disc shall be 150 psi. Flanged ends shall be Class 125, ASME B16.1. Valve shafts shall be stub shaft or one-piece units extending completely through the valve disc. Materials of construction shall be as follows:

Component	Material	Specification
Body	ductile iron	AWWA C504
Exposed body cap screws and bolts and nuts	Stainless steel	ASTM A276, Type 316
Discs	Cast iron, ductile iron, or Ni-Resist	AWWA C504
Shafts, disc fasteners, seat retention segments, and seat fastening devices	Stainless steel	ASTM A276, Type 316
Seat material	Buna-N	—

b. Valves shall be Pratt, DeZurik Series BAW, M&H, Val-Matic, or equal.

C. Ball Valves:

1. Type 300—Full Port Threaded Bronze Ball Valves 2 Inches and Smaller:

a. Ball valves, 2 inches and smaller, for air or water service shall have a pressure rating of at least 600 psi WOG at a temperature of 100°F. Provide full port ball and body design. Valves shall comply with MSS SP-110. Provide bronze (ASTM B62 or ASTM B584, Alloy C83600 or C84400) body and plug ball retainer. Ball and stem shall be Type 316 stainless steel. Valves shall have threaded ends (ASME B1.20.1), nonblowout stems, reinforced Teflon seats, and have plastic-coated lever actuators. Provide locking lever handle. Valves shall be Stockham T-285 Series, Apollo 77C-140 Series, or equal.

PART 3 - EXECUTION

3.01 VALVE SHIPMENT AND STORAGE

A. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Install closures at the place of valve manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures. Alternatively, ship flanged valves 3 inches and smaller in separate sealed cartons or boxes.

- B. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Install caps or plugs at the place of valve manufacture prior to shipping. Alternatively, ship valves having threaded openings or end connections in separate sealed cartons or boxes.
- C. Store resilient seated valves in sealed polyethylene plastic enclosures with a minimum of one package of desiccant inside. Store resilient seated valves in the open or unseated position. Valves with adjustable packing glands shall have the packing gland loosened prior to storage. Inspect valves at least once per week, replace desiccant if required and repair damaged storage enclosures. Do not store valves with resilient seats near electric motors or other electrical equipment.
- D. Inspect valves on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload valves carefully to the ground without dropping. Use forklifts or slings under skids. Do not lift valves with slings or chain around operating shaft, actuator, or through waterway. Lift valves with eyebolts or rods through flange holes or chain hooks at ends of valve parts.
- E. Protect the valve and actuators from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.
- F. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean. Check the bolting attaching the actuator to the valve for loosening in transit and handling. If loose, tighten firmly. Open and close valves having manual or power actuators to make sure the valve operates properly and that stops or limit switches are correctly set so that the valve seats fully. Close valve before installing.

3.02 FACTORY PRESSURE TESTING

- A. Hydrostatically test the valve pressure-containing parts at the factory per the valve specification or per the referenced standard. If no testing requirement is otherwise specified or described in the referenced standards, then test with water for 30 minutes minimum at a pressure of 1.5 times the rated pressure but not less than 20 psig. Test shall show zero leakage. If leaks are observed, repair the valve and retest. If dismantling is necessary to correct valve deficiencies, then provide an additional operational test and verify that the valve components function.
- B. The chloride content of liquids used to test austenitic stainless steel materials shall not exceed 50 ppm. To prevent deposition of chlorides as a result of evaporative drying, remove residual liquid from tested parts at the conclusion of the test.

3.03 INSTALLING VALVES—GENERAL

- A. Remove covers over flanged openings and plugs from threaded openings, after valves have been placed at the point to which the valves will be connected to the adjacent piping. Do not remove valves from storage cartons or boxes until they are ready to be installed.

- B. Handle valves carefully when positioning, avoiding contact or impact with other equipment, vault or building walls, or trench walls.
- C. Clean valve interiors and adjacent piping of foreign material prior to making up valve to pipe joint connection. Prepare pipe ends and install valves in accordance with the pipe manufacturer's instructions for the joint used. Do not deflect pipe-valve joint. Do not use a valve as a jack to pull pipe into alignment. The installation procedure shall not result in bending of the valve/pipe connection with pipe loading.
- D. Make sure valve ends and seats are clean. Check exposed bolting for loosening in transit and handling and tighten to manufacturer's recommendations. Open and close the valve to make sure it operates properly and that stops or limit switches are correctly set so that the vane, ball, gate, needle, diaphragm, disc, plug, or other seating element seats fully. Close the valve before installing. Check coatings for damage and repair. Handle valves carefully when positioning, avoiding contact or impact with other equipment or structures.
- E. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

3.04 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.

3.05 INSTALLING BURIED VALVES

- A. Connect the valve, coat the flanges, 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.

3.06 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, per Section 099000, System No. 21.
- B. Wrap buried metal valves 6 inches and larger in two layers of polyethylene conforming to AWWA C105, 8 mils in thickness each. Pass the two sheets of polyethylene under the valve and the coated flanges or joints with the connecting pipe and draw the sheets

around the valve body, the valve bonnet, and the connecting pipe. Secure the sheets with plastic adhesive tape about the valve stem below the operating nut and about the barrel of the connecting pipe to prevent the entrance of soil. Fold overlaps twice and tape. Backfill the valve with care to avoid damaging the polyethylene.

3.07 ASSEMBLING 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, reseal 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.

3.08 VALVE FIELD TESTING

- A. Test valves for leakage at the same time that the connecting pipelines are hydrostatically tested. See Section 400515 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.

END OF SECTION

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SECTION 400765 HYDRODYNAMIC MIXING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, testing, and installation of hydrodynamic mixing system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: Section 099000.
- B. Aboveground Steel Water Tank (AWWA D100-05): Section 331611
- C. Disinfection of Piping and Structures: Section 331300.
- D. General Piping Requirements: Section 400500.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions and Section 013300.
- B. Submit at least one project where an independent company conducted CFD modeling on the mixing system design and the modeling results verified the design achieved complete mixing.
- C. Submit dimensional drawings for manifold piping, and each inlet and outlet nozzles.
- D. Submit engineering installation drawings of the complete mixing system as supplied by the manufacturer. These drawings shall include plan view piping arrangement, sections and elevations as required, support bracket installation details, duckbill nozzle orientation details, and all dimensions required for locating the system within the specified dimensions of the reservoirs.
- E. Submit test report from an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."
- F. Submit design calculation by duckbill valve manufacturer showing the fill time and water level drawdown required to achieve complete mix of the reservoir volume at minimum, average and peak fill rates.
- G. Submit manufacturer's recommended maximum operating pressure and maximum recommended flow.
- H. Submit Installation, Operation and Maintenance Manuals.

PART 2 - MATERIALS

2.01 GENERAL

- A. All components of hydrodynamic mixing system shall be NSF Certified.
- B. Valves shall be able to accomplish complete reservoir mixing with a maximum turnover of 13% of reservoir volume. Jet Velocity shall be minimum 8.5 fps at 300 gpm. Total headloss from mixing system shall be 1.2 feet at 300 gpm, maximum.
- C. Inlet valves shall consist of a contoured rubber body with a duckbill sleeve-type exit. The body entrance shall be round, with a connecting Class 125 ASME B16.5 rubber flange to match the connecting pipe. Provide synthetic fabric reinforcement. Provide Type 316 stainless steel backing rings on the rubber body flanges.
- D. The outlet flow valves shall be perforated disc type with elastomeric membrane. The perforated disc shall be fabricated of stainless steel 304 plate with or without welded support gussets depending on maximum backpressure. The disc shall be flanged and drilled to mate with ANSI B16.1, Class 125/ANSI B16.5 Class 150 flanges. The disc shall have three (3) tapped holes used for fastening the membrane and support rod to the disc with stainless steel 304 bolts, nuts, and lock washers. The top of the disc shall be tapped and supplied with lifting eyebolt for installation. The membrane shall be circular, one-piece rubber construction with fabric reinforcement. The support rod shall be stainless steel 304 and drilled with three (3) longitudinal holes to allow fastening of rod to membrane and perforated disc. When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the membrane to open, allowing flow to pass through the perforations in the disc. When backpressure exceeds the line pressure, the membrane seats on the perforated disc preventing backflow.
- E. Valves shall be manufactured by Red Valve Company/Tideflex Technologies, Onyx Valve or approved equal.

2.02 BOLTS AND NUTS

- A. Bolts and nuts for flanged valves shall be Type 316 stainless steel and as described in Section 400500.

2.03 GASKETS FOR FLANGES

- A. Gaskets for flanges shall be as described in Section 400500.

2.04 RUBBER SEATS

- A. Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/L in the fluid conveyed.

2.05 PIPE AND FITTINGS

- A. All steel piping and fittings shall be lined and coated with NSF-600 compliant FBE.

2.06 PIPE SUPPORTS

- A. Pipe supports are required to be provided by mixing system manufacturer.

PART 3 - EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Individual nozzles and outlet valves shall be packaged separately from the piping equipment.
- B. All flanges shall be protected by using plastic inserts or plank wood, pipe sections are to be fully supported to prevent pipe deflection or damage to fittings or connections.
- C. Duckbill nozzles should be protected from contact with rigid objects during handling and storage. The contractor shall be responsible for replacing any duckbill nozzles or elastomeric components that are damaged after arrival on the site through installation and start-up of the system.
- D. Protect the valves from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.

3.02 FACTORY PRESSURE TESTING

- A. Hydrostatically test the valve pressure-containing parts at the factory per the valve specification or per the referenced standard.

3.03 INSTALLING GENERAL

- A. Remove covers over flanged openings and plugs from threaded openings, after valves have been placed at the point to which the valves will be connected to the adjacent piping. Do not remove valves from storage cartons or boxes until they are ready to be installed.
- B. Handle valves carefully when positioning, avoiding contact or impact with other equipment, vault or building walls, or trench walls.
- C. Clean valve interiors and adjacent piping of foreign material prior to making up valve to pipe joint connection. Prepare pipe ends and install valves in accordance with the pipe manufacturer's instructions for the joint used. Do not deflect pipe-valve joint. Do not use a valve as a jack to pull pipe into alignment. The installation procedure shall not result in bending of the valve/pipe connection with pipe loading.

- D. Make sure valve ends and seats are clean. Check exposed bolting for loosening in transit and handling and tighten to manufacturer's recommendations. Open and close the valve to make sure it operates properly and that stops or limit switches are correctly set so that the vane, ball, gate, needle, diaphragm, disc, plug, or other seating element seats fully. Close the valve before installing. Check coatings for damage and repair. Handle valves carefully when positioning, avoiding contact or impact with other equipment or structures.
- E. Prior to assembly, coat threaded portions of stainless-steel bolts and nuts with lubricant.

3.04 START UP FLOW TESTING

- A. Following installation of the complete manifold piping system, the contractor shall open the upstream isolation valve to allow flow into the tank through the manifold system. The isolation valve must be opened slowly to prevent surge or over-pressurization of the manifold system. The isolation valve must be fully opened to inspect the flow characteristics of the manifold system.
- B. The contractor shall take videos and photos during the filling operation and submit them to the owner to confirm there is no leakage in the piping system and that all of the duckbill inlet nozzles are discharging flow into the tank.

END OF SECTION

SECTION 402040 DUCTILE-IRON PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section describes materials, testing, and installation of ductile-iron pipe and fittings 54 inches and smaller.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: Section 099000.
- B. Polyethylene Sheet Encasement (AWWA C105): Section 099754.
- C. Trenching, Backfilling, and Compacting: Section 312316.
- D. Disinfection of Piping and Structures: Section 331300.
- E. General Piping Requirements: Section 400500.
- F. Pressure Testing of Piping: Section 400515.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions and Section 013300.
- B. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5 is met.
- C. Provide the following information:
 - 1. Mortar lining thickness.
 - 2. Wall thickness.
 - 3. Show deflections at push-on and mechanical joints.
 - 4. Submit joint and fitting details and manufacturer's data sheets.
- D. Submit calculations and test data proving that the proposed restrained joint arrangement can transmit the required forces with a minimum safety factor of 1.5.

- E. Submit certificate that cement for mortar lining complies with ASTM C150, designating type.
- F. Submit test report on physical properties of rubber compound used in the gaskets.
- G. Submit drawing or manufacturer's data sheet showing flange facing, including design of facing serrations.
- H. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile-iron pipe.

PART 2 - MATERIALS

2.01 PIPE

- A. Pipe shall be cast ductile (nodular) iron, conforming to AWWA C151.

2.02 PIPE WALL THICKNESS

Minimum wall thickness for pipe having push-on or mechanical joints, restrained joints, plain ends, or cast flange ends shall be Class 150, unless otherwise shown in the drawings.

2.03 FITTINGS

- A. Fittings 48 inches and smaller shall conform to AWWA C110 with a minimum pressure rating of 250 psi. Material shall be ductile iron. Flanges shall be flat faced.
- B. Mechanical joint fittings conforming to AWWA C153 may be used in lieu of AWWA C110 fittings.

2.04 FLANGES

- A. Flanges shall be solid back, Class 125 per AWWA C115. Flanges on pipe shall be either cast or threaded. Material shall be ductile iron.
- B. Flanged pipe and fittings shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115. Flanges shall be individually fitted and machine tightened in the shop, then machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket.

2.05 PIPE LINING--CEMENT MORTAR

- A. Line pipe interior and fittings with cement-mortar per AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.7. Cement for lining material shall conform to ASTM C150, Type II.
- B. Line blind flanges per Section 099000, System No. 7.
- C. Maintain a moist environment inside the lined pipe and fittings by sealing the ends with polyethylene sheet.
- D. Loose areas of cement-mortar lining are not acceptable. Remove and reconstruct lining in areas where quality is defective, such as sand pockets, voids over sanded areas, blisters, drummy areas, cracked areas, and thin spots. Repair longitudinal cracks in excess of 1/32 inch in width or where crack extends to metal with epoxy. Repair all cracks larger than 1/16 inch with epoxy.

2.06 GASKETS FOR FLANGES

- A. See Section 400500.

2.07 GASKETS FOR MECHANICAL, PUSH-ON, AND RESTRAINED JOINTS

- A. Synthetic rubber in accordance with AWWA C111.

2.08 BOLTS AND NUTS FOR FLANGES

- A. See Section 400500.

2.09 JOINTS

- A. Joints in aboveground or submerged piping or piping located in vaults and structures shall be flanged.
- B. Joints in buried piping shall be of the restrained or mechanical joint type per AWWA C111 except where flanged joints are required to connect to valves, meters, and other equipment.
- C. Restrained joints for piping 6 inches and larger shall be American Cast Iron Pipe "Lok-Ring" or "Flex-Ring," U.S. Pipe "TR-Flex," or equal. Weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E165. Restrained joints for field closures shall be "Megalug" by EBAA Iron.
- D. Where thrust restraint is called for in the drawings, provide pipe with restrained joints capable of transmitting 1.5 times the thrust, as calculated by the following equation:

$$T = 1.5 * (0.785 * P * D^2)$$

where:

- P = Pressure class of pipe in psi.
D = Outside diameter of pipe in inches.
T = Thrust in pounds.

2.10 DUCTILE-IRON PIPE WELDMENTS

- A. All welding to ductile-iron pipe, such as for bosses, joint restraint, and joint bond cables, shall be done at the place of manufacture of the pipe. Perform welding by skilled welders experienced in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.
- B. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.
- C. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

PART 3 - EXECUTION

3.01 DELIVERY, UNLOADING, AND TEMPORARY STORAGE OF PIPE AT SITE

- A. Use unloading and installation procedures that avoid cracking of the lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep cement-mortar lining moist.
- B. Deliver the pipe alongside the pipelaying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling.
- C. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures.

3.02 SANITATION OF PIPE INTERIOR

- A. During laying operations, do not place tools, clothing, or other materials in the pipe.
- B. When pipelaying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug.

3.03 INSTALLING FLANGED PIPE AND FITTINGS

- A. Install in accordance with Section 400500. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

3.04 INSTALLING BURIED PIPING

- A. Install in accordance with AWWA C600, Section 312316, and as follows.
- B. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
- C. Assemble restrained joints per manufacturer's instructions.
- D. For all field cut-to-fit joints, do not stress or deflect the pipe when mating pipe ends.

3.05 JOINT DEFLECTIONS FOR BURIED PIPE

- A. Do not exceed the following deflection angles for unrestrained buried pipe joints:

Pipe Size (inches)	Maximum Deflection (degrees)	
	Push-On Joint	Mechanical Joint
4	4	6 1/2
6	4	5 1/2
8	4	4
10	4	4
12	4	4

- B. For restrained joints, do not exceed 80% of the manufacturer's recommended maximum deflections.
- C. Assemble joints in accordance with AWWA C600 and the manufacturer's recommendations.

3.06 INSTALLING ABOVEGROUND OR EXPOSED PIPING

- A. See Section 400500.

3.07 PAINTING AND COATING

- A. Furnish exposed pipe located above ground and in vaults and structures without standard asphaltic coating. Exposed pipe shall be shipped to site with factory primer compatible with finish coating system. Applying coatings over asphaltic coatings is not allowed.
- B. Coat pipe located above ground and in vaults and structures per Section 099000, System No. 10. Apply prime coat in the shop before transporting pipe to the jobsite. Apply intermediate and finish coats in the field before installing the pipe, then touch up after installation.
- C. Coat buried flanges and buried mechanical and restrained joint bolts, nuts, and glands per Section 099000, System No. 21.

3.08 POLYETHYLENE ENCASEMENT OF BURIED PIPE AND FITTINGS

- A. Wrap buried pipe, fittings, and joints with polyethylene per Section 099754.

3.09 CLEANING PIPE

- A. After interior joints have been pointed and mortar has hardened, sweep pipe clean of all dirt and debris. If hardened mud exists in the pipe, remove with the use of pressurized water hoses.

3.10 FIELD HYDROSTATIC TESTING

- A. Test pressures are shown in Section 400515. Test in accordance with Section 400515.

END OF SECTION

APPENDIX A: GEOTECHNICAL BORING LOGS AND TEST RESULTS

APPENDIX A

Figure 1 – Site Vicinity Map

Figure 2 – Exploration Location Map

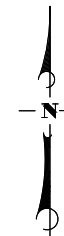
Boring Log Legend

Boring Logs (ESC 1991)



306519-001-STUARTSTREETWATERTANKREPLACEMENT.mxd

BASE MAP PROVIDED BY: Google Earth (2024)



NOT TO SCALE



Earth Systems Pacific

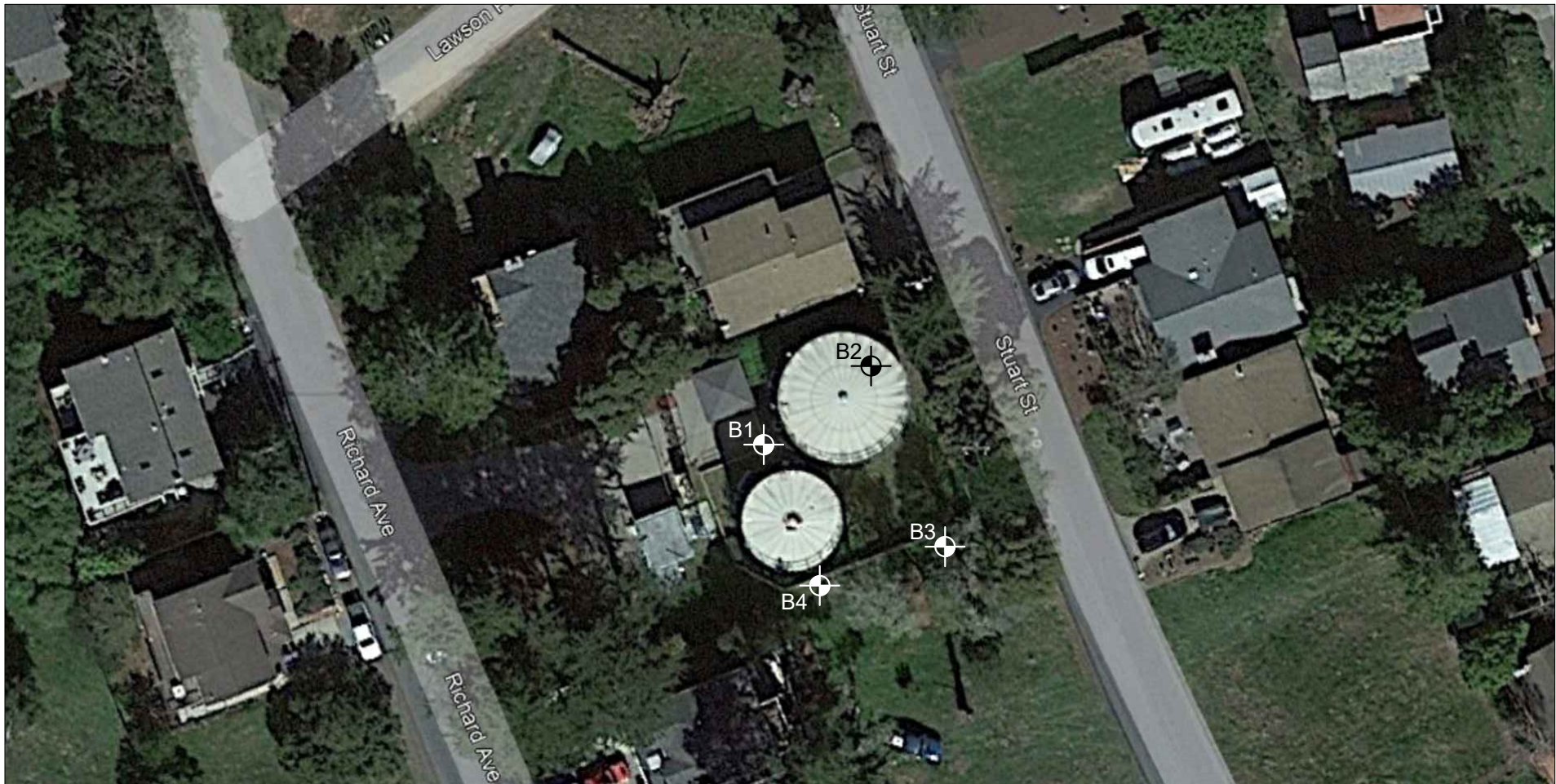
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
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(805) 544-3276 • Fax (805) 544-1786

SITE VICINITY MAP
Stuart Street Water Tank Replacement
1975 Stuart Street
Cambria, California



Date
July 2024

Project No.
306519-001

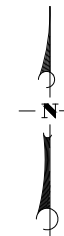
Figure 1



LEGEND

- B1, B2  Boring Location (Approx.) (ESC, 1991)
- B3, B4  Boring Location (Approx.) (ESP, 2024)

BASE MAP PROVIDED BY: Google Earth (2024)



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EXPLORATION LOCATION MAP

Stuart Street Water Tank Replacement
 1975 Stuart Street
 Cambria, California

Date
 July 2024

Project No.
 306519-001

Figure 2



Earth Systems Pacific

BORING LOG LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

SAMPLE / SUBSURFACE WATER SYMBOLS		GRAPH. SYMBOL	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)			
			MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
CALIFORNIA MODIFIED STANDARD PENETRATION TEST (SPT) SHELBY TUBE BULK SUBSURFACE WATER DURING DRILLING SUBSURFACE WATER AFTER DRILLING			COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
				GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
				GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
				SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
				SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
				SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
			FINE GRAINED SOILS HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
PT	PEAT AND OTHER HIGHLY ORGANIC SOILS					

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)
-----	----------------	-------	------------	-----------------

CONSISTENCY

COARSE GRAINED SOILS			FINE GRAINED SOILS		
BLOWS/FOOT		DESCRIPTIVE TERM	BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER		SPT	CA SAMPLER	
0-10	0-16	LOOSE	0-2	0-3	VERY SOFT
11-30	17-50	MEDIUM DENSE	3-4	4-7	SOFT
31-50	51-83	DENSE	5-8	8-13	MEDIUM STIFF
OVER 50	OVER 83	VERY DENSE	9-15	14-25	STIFF
			16-30	26-50	VERY STIFF
			OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING			
# 200	# 40	# 10	# 4	3/4"	3"	12"	
SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
UNWEATHERED	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES; SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
HIGHLY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY



EARTH SYSTEMS CONSULTANTS
Northern California, Pacific Geoscience Division

Boring No. 1

LOGGED BY: DB
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

PAGE 1 of 1
JOB NO.: PG-7861-W01
DATE: 10/29/91

DEPTH (in feet)	USCS CLASS	SYMBOL	SAMPLE DATA					
			INTERVAL	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	
Stuart Street Tank Replacement Cambria, California								
SOIL DESCRIPTION								
0	SC		Moist, dense, brown Clayey SAND	0.0-2.0	○			
1								
2			Dry, dense, light brown SANDSTONE	2.0-2.5	■			50-5"
3								
4								
5				5.0-6.0	●			38/50-4"
6								
7								
8			Moist					
9								
10				10.0-10.5	●	No return		50-3"
11								
12								
13								
14								
15				15.0-15.5	●			50-5.5"
16			END OF BORING @ 15.5'. No subsurface water encountered.					
17								
18								
19								
20								
21								
22								
23								
24								
25								

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT
Note: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.



EARTH SYSTEMS CONSULTANTS

Northern California, Pacific Geoscience Division

Boring No. 2

LOGGED BY: DB

DRILL RIG: Mobile B-53

AUGER TYPE: 8" Hollow Stem

PAGE 1 of 1

JOB NO.: PG-7861-W01

DATE: 10/29/91

DEPTH (in feet)	USCS CLASS	SYMBOL	SAMPLE DATA				
			INTERVAL	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
Stuart Street Tank Replacement Cambria, California							
SOIL DESCRIPTION							
0	SC						
1			1.0-1.5				50-4"
2							
3							
4							
5			5.0-5.5				50-3"
6			END OF BORING @ 5.5'. No subsurface water encountered.				
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

LEGEND: Ring Sample Grab Sample Shelby Tube Sample SPT

Note: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.



DEPTH (feet)	USCS CLASS	SYMBOL	SAMPLE DATA				
			INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
Stuart Street Water Tank Replacement 1975 Stuart Street Cambria, California							
SOIL DESCRIPTION							
0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18 - 19 - 20 - 21 - 22 - 23 - 24 - 25 - 26 -	SM		0.0 - 1.5	○			
End of Boring @ 1.5' due to refusal on bedrock No subsurface water encountered							

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT
NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.



DEPTH (feet)	USCS CLASS	SYMBOL	SAMPLE DATA				
			INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
Stuart Street Water Tank Replacement 1975 Stuart Street Cambria, California							
SOIL DESCRIPTION							
0	SM		0.0 - 1.5	○			
1		SILTY SAND WITH GRAVEL: brown, loose, slightly moist (Top Soil)					
2		End of Boring @ 1.5' due to refusal on bedrock No subsurface water encountered					
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							

LEGEND: ■ Ring Sample ○ Grab Sample □ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Geotechnical Laboratory Test Results (ESC 1991)



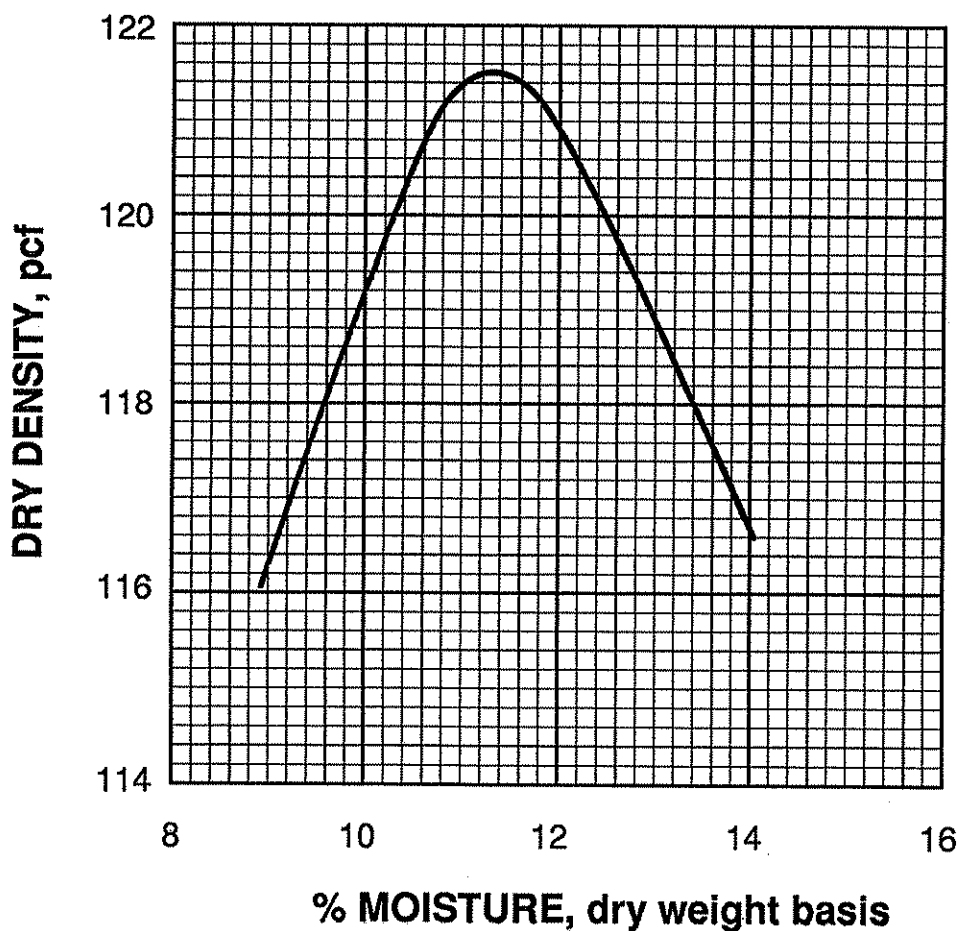
MAXIMUM DENSITY/OPTIMUM MOISTURE CURVE

ASTM D-1557 METHOD: A

PROJECT: STUART STREET TANK REPLACEMENT

DATE: 11/11/91

JOB NUMBER: PG-7861-W01



SAMPLE I. D.: Boring #1 @ 0-2'

SOIL DESCRIPTION: BROWN CLAYEY SAND (SC)

MAXIMUM DENSITY, pcf: 121.5

OPTIMUM MOISTURE, percent: 11.3



PROJECT: STUART STREET TANK REPLACEMENT
JOB NO.: PG-7861-W01
DATE: 11-Nov-91

BULK DENSITY TEST RESULTS

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	2.0-2.5	6.2	140.3	132.1
2	1.0-1.5	3.9	133.7	128.6

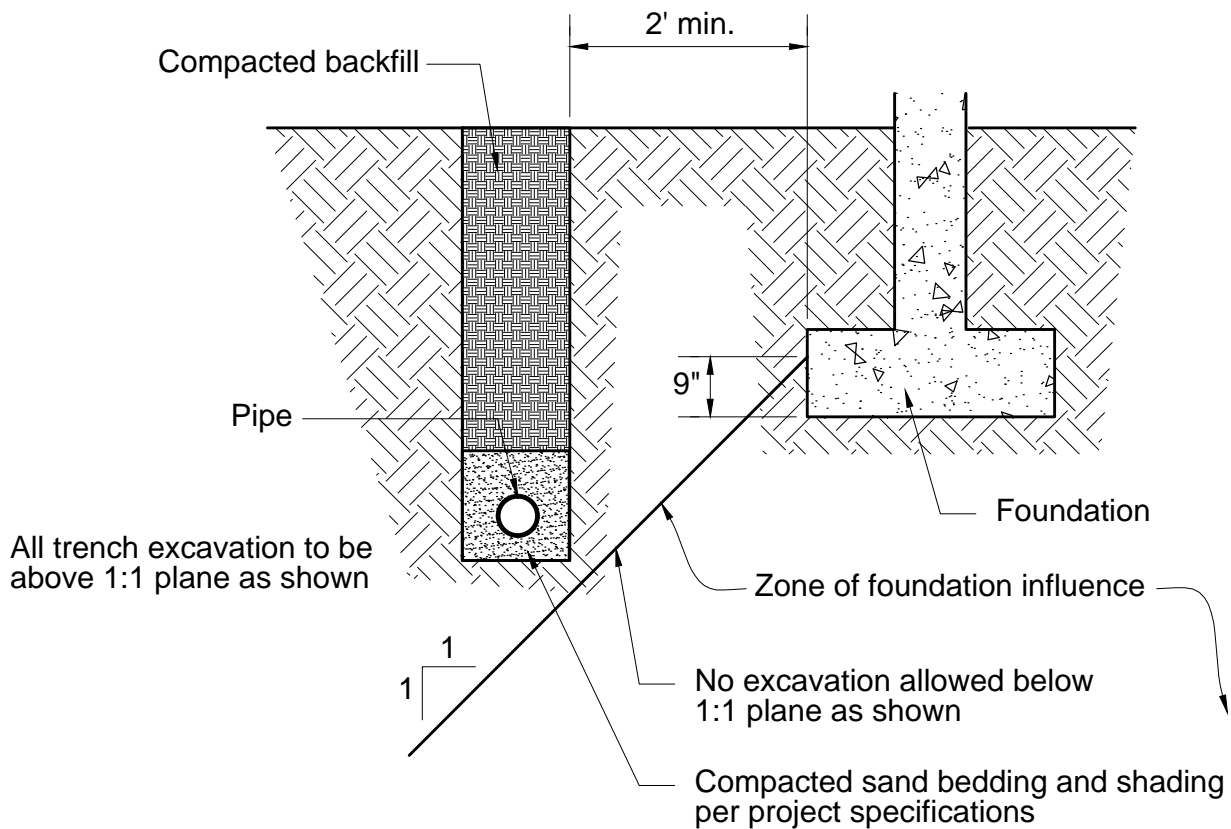
EXPANSION INDEX TEST RESULTS

BORING NO.	DEPTH feet	EXPANSION INDEX
1	0-2	18

APPENDIX C

Typical Detail A: Pipe Placed Parallel to Foundations

TYPICAL DETAIL A PIPE PLACED PARALLEL TO FOUNDATION



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E-mail: esp@earthsystems.com

APPENDIX B: MITIGATION MONITORING AND REPORTING PROGRAM

Stuart Street Water Tanks Replacement Project Mitigation Monitoring and Reporting Program

The Cambria Community Services District (CCSD) has prepared this Mitigation Monitoring and Reporting Program (MMRP) for the Stuart Street Water Tanks Replacement Project. The California Environmental Quality Act (CEQA) requires that a reporting or monitoring program be adopted for the conditions of project approval that are necessary to mitigate or avoid significant effects on the environment (Public Resources Code 21081.6). This MMRP is intended to track and ensure compliance with adopted mitigation measures during the project implementation phase. For each mitigation measure recommended in the July 2024 Addendum to the Initial Study – Mitigated Negative Declaration, specifications are made herein that identify the action required, the monitoring that must occur, and the agency or department responsible for oversight.

Cambria Community Services District
Stuart Street Water Tanks Replacement Project

Mitigation Measure	Implementing Action	Implementing Monitoring/Reporting Responsibility	Implementing Timing Requirements
Aesthetics			
AES-1			
<p>Prior to Grading Permit issuance, the CCSD shall confirm that the plans and specifications stipulate that, Project construction shall implement standard practices to minimize potential adverse aesthetic impacts, including the following:</p> <ul style="list-style-type: none"> ▪ Construction staging areas shall be located as far as practicable from sensitive receptors; ▪ Construction areas shall receive appropriate routine maintenance to minimize unnecessary debris piles; ▪ Construction areas shall have appropriate erosion and dust control programs in place; and ▪ Construction lighting shall be limited to that sufficient for safety and security, and shall be directed to minimize light and glare impacts to any adjacent sensitive receptors. 	<ul style="list-style-type: none"> ▪ Include standard practices listed in AES-1 on the plans and specifications. ▪ Perform site inspections, once at the start of construction and once half-way through construction, to verify contractor compliance with standard practices. ▪ Retain copies of inspection records in project file. 	<p>CCSD is responsible for verifying the standard practices listed in the measure are included on the plans and specifications and are implemented.</p> <p>The construction contractor is responsible for implementing the standard practices listed the measure.</p>	<p>Prior to the issuance of the Grading Permit and throughout the construction phase.</p>
Air Quality			
AQ-1			
<p>During clearing, grading, earth moving or excavation operations, excessive fugitive dust emissions shall be controlled by regular watering or other dust preventive measures using the following procedures, as specified in the San Luis Obispo Air Pollution Control District (SLOAPCD) CEQA Air Quality Handbook:</p> <ul style="list-style-type: none"> ▪ All material excavated or graded shall be sufficiently watered to prevent excessive amounts of dust. Watering shall occur at least twice daily with complete coverage, preferably in the late morning and after work is done for the day. Increased watering frequency shall be required whenever wind speeds exceed 15 miles per hour. Reclaimed (nonpotable) water shall be used whenever possible. All dirt stock-pile areas shall be sprayed daily as needed. ▪ Permanent dust control measures identified in the approved Project revegetation and landscape plans shall be implemented as soon as possible following completion of any soil disturbing activities. ▪ Exposed ground areas that are planned to be reworked at dates greater than one month after initial grading shall be sown with a fast-germinating native grass seed and watered until vegetation is established. All disturbed soil areas not subject to revegetation shall be stabilized using approved chemical soil binders, jute netting, or other methods approved in advance by the SLOAPCD. ▪ Vehicle speed for all construction vehicles shall not exceed 15 miles per hour on any unpaved surface at the construction site. 	<ul style="list-style-type: none"> ▪ Include standard practices listed in AQ-1 on the plans and specifications. ▪ Prior to initiating ground disturbance, identify dust control inspection monitor. ▪ Perform site inspections to verify contractor compliance with dust control techniques. ▪ Retain copies of inspection records in project file. 	<p>CCSD staff are responsible for verifying the dust control techniques listed in the measure are included on the plans and specification and are implemented.</p> <p>The construction contractor is responsible for implementing the dust control measures.</p>	<p>During clearing, grading, earth moving, or excavation operations. Permanent dust control measures to be implemented as soon as possible following soil disturbing activities. Monitoring duties to include holidays and weekends.</p>

Mitigation Measure	Implementing Action	Implementing Monitoring/Reporting Responsibility	Implementing Timing Requirements
<ul style="list-style-type: none"> All material transported on site or off site shall be either sufficiently watered or securely covered or maintain at least two feet of freeboard (minimum vertical distance between top of the load and top of the trailer) to prevent excessive amounts of dust. The area disturbed by clearing, grading, earth moving or excavation operations shall be minimized so as to prevent excessive amounts of dust. Installation of wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the Project site. Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water shall be used where feasible. These control techniques shall be indicated in Project specifications and included in the grading and building plans. Compliance with this measure shall be subject to periodic site inspections by the CCSD. Visible dust beyond the property line emanating from the Project site shall be prevented to the maximum extent feasible. The construction contractor or builder shall designate a person or persons to monitor the dust control program to prevent transport of dust off site. Duties shall include holidays and weekend periods when work may not be in progress. The name and telephone number of the monitor shall be provided to the SLOAPCD prior to land use clearance for map recordation and land use clearance for finish grading of the structure. 			

AQ-2			
<p>Project grading plans shall show the duration of construction. Ozone precursor emissions from construction equipment vehicles shall be controlled by maintaining equipment engines in good condition and in proper tune per manufacturer's specifications, to the satisfaction of the CCSD Engineer. Compliance with this measure shall be subject to periodic inspections of construction equipment vehicles by the CCSD.</p>	<ul style="list-style-type: none"> Include the duration of construction on project grading plans. Perform site inspections to verify contractor compliance with AQ-2. Retain copies of inspection records in project file. 	<p>The CCSD Engineer is responsible compliance verification. CCSD staff are responsible for including the construction duration on the grading plans and for periodic inspections of construction equipment vehicles. The construction contractor is responsible for maintaining equipment engines.</p>	<p>Throughout the construction phase, with periodic inspections.</p>

Cambria Community Services District
Stuart Street Water Tanks Replacement Project

Mitigation Measure	Implementing Action	Implementing Monitoring/Reporting Responsibility	Implementing Timing Requirements
AQ-3			
<p>All trucks that are to haul excavated or graded material to/from the Tank Sites shall comply with State Vehicle Code Section 23114, with special attention to Sections 23114(b)(F), (e)(2) and (e)(4) as amended, regarding the prevention of such material spilling onto public streets and roads.</p>	<ul style="list-style-type: none"> ▪ Perform site inspections to verify contractor compliance with AQ-3. ▪ Retain copies of inspection records in project file. 	<p>CCSD staff are responsible for compliance verification. The construction contractor is responsible for ensuring all haul trucks comply with State Vehicle Code requirements.</p>	<p>Throughout hauling operations.</p>
Biological Resources			
BIO-1			
<p>The CCSD shall comply with the following measure, in order to mitigate any effects of clearing or construction activities on biological resources and to protect special status resources, including impacts to birds subject to the Migratory Bird Treaty Act (MBTA):</p> <ul style="list-style-type: none"> ▪ To avoid impacts on nesting birds, the onsite vegetation should be cleared between August 16 and March 14. If vegetation clearing occurs inside the peak nesting season (between March 15 and August 15), the CCSD shall have a pre-construction survey (or possibly multiple surveys) conducted by a qualified Biologist to identify any active nesting locations. If the Biologist does not find any active nests within the impact area, the vegetation clearing/construction work shall proceed. If the Biologist finds an active nest within the construction area and determines that the nest may be impacted, the Biologist shall delineate an appropriate buffer zone around the nest; the size of the buffer zone shall depend upon the species and the type of construction activity. Any active nests observed during the survey shall be mapped on an aerial photograph. Only construction activities (if any) that have been approved by a Biological Monitor shall take place within the buffer zone until the nest is vacated. The Biologist shall serve as a construction monitor during those periods when construction activities occur near active nest areas, in order to ensure that no inadvertent impacts on these nests occur. Results of the pre-construction survey and any subsequent monitoring shall be provided to the California Department of Fish and Game and any other appropriate CEQA Lead Agency. 	<ul style="list-style-type: none"> ▪ Include BIO-1 in the construction plans and specifications. ▪ If construction must commence within the bird breeding season, retain a qualified Biologist to conduct pre-construction nesting bird surveys. ▪ If nests are identified, perform site inspections, at least once at the start of construction and once half-way through construction, to verify contractor compliance with avoidance buffer. ▪ Retain copies of survey results, monitoring results, and inspection records in project file. 	<p>CCSD staff are responsible for compliance verification and for submitting the monitoring report (if needed) to the California Department of Fish and Wildlife. The Qualified Biologist is responsible for conducting surveys and monitoring and for preparing a monitoring report (if needed). The construction contractor is responsible for scheduling initial clearing and grading between August 16 and March 14 or for ensuring a pre-construction survey is conducted.</p>	<p>Schedule vegetation clearing and grading between August 16 and March 14. Pre-construction surveys and monitoring during the nesting season (March 15 to August 15) if initial construction activities occur between March 15 and August 15. Ongoing monitoring during construction activities near active nests.</p>
Noise			
NOI-1			
<p>Prior to Grading Permit issuance at the Stuart Street Site, the CCSD shall demonstrate that a "Construction Noise Mitigation Plan" has been developed to address construction-related noise impacts. The Plan shall incorporate the following, at minimum:</p>	<ul style="list-style-type: none"> ▪ Confirm that the Construction Noise Mitigation Plan includes measures within NOI-1. 	<p>CCSD staff are responsible for including the noise reduction measures in the plans and specification,</p>	<p>Prior to the issuance of the Grading Permit and throughout the construction phase.</p>

Mitigation Measure	Implementing Action	Implementing Monitoring/Reporting Responsibility	Implementing Timing Requirements
<ul style="list-style-type: none"> ▪ Provisions necessary to minimize or eliminate adverse construction noise impacts shall be incorporated into the Project plans and specifications. ▪ Provisions for truck routing, location of staging areas, worker parking, noise attenuating barriers, engine enclosure devises, muffling blankets, and other appropriate measures for achieving an overall attenuation of construction noise of at least 6 dBA, or to County standards, whichever is less. ▪ Construction contracts shall specify that all construction equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers that exceed state requirements for muffler attenuation devices. ▪ All construction equipment shall use available noise suppression devices and properly maintained mufflers. All internal combustion engines used in the Project area shall be equipped with the type of muffler recommended by the vehicle manufacturer. In addition, all equipment shall be maintained in good mechanical condition to minimize noise created by faulty or poorly maintained engine, drive-train and other components. ▪ All residential units, or other sensitive receptors as defined by the Coastal Zone Land Use Ordinance, located within 500 feet of the construction site shall be sent a notice at least 14 and not more than 30 days prior to commencement of construction activity, and shall include a brief description of the Project, the overall duration of the various construction stages, noise abatement measures that shall be taken, and the name and phone number of the “Noise Disturbance Coordinator” or his designee to report any violation of a noise or mitigation standard. ▪ A Noise Disturbance Coordinator who shall be responsible for responding to any local complaints about construction noise shall be established. The Coordinator shall determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and implement reasonable measures such that the complaint is resolved. The Coordinator shall be required to maintain a log of complaints for CCSD’s inspection. The log shall include the source of complaint, the complaint, time received, and the action taken in response. The Coordinator shall make good faith efforts to respond, within 24 hours of receipt, to noise inquiries and complaints. ▪ A sign, legible at a distance of 50 feet, shall also be prominently posted at the construction site. All notices and signs shall indicate the dates and duration of construction activities, and provide the telephone number of the Noise Disturbance Coordinator. ▪ During construction, material stockpiling, and equipment and vehicle staging areas, shall be located as far as practical from the noise sensitive receptors. During construction, stationary construction equipment shall be placed such that emitted noise is directed away from sensitive noise receivers where feasible. ▪ Construction noise reduction methods (i.e., shutting off idling equipment, installing temporary acoustic barriers around stationary construction noise 	<ul style="list-style-type: none"> ▪ Retain a copy of the Construction Noise Mitigation Plan in the project file. ▪ Retain copies of notices and monitoring logs in the project file. 	<p>compliance verification, and periodic inspections.</p> <p>A Qualified Noise Specialist is responsible for preparing the Construction Noise Mitigation Plan.</p> <p>The Noise Disturbance Coordinator for handling complaints and maintaining a log.</p> <p>The construction contractor is responsible for implementing the measures specified in the Construction Noise Mitigation Plan.</p>	

Cambria Community Services District
Stuart Street Water Tanks Replacement Project

Mitigation Measure	Implementing Action	Implementing Monitoring/Reporting Responsibility	Implementing Timing Requirements
<p>sources, maximizing the distance between construction equipment staging areas and occupied residential areas, and use of electric air compressors and similar power tools, rather than diesel equipment) shall be employed where feasible. Unnecessary idling of construction equipment shall be avoided whenever feasible. "Feasible," as used here, means that the implementation of this measure would not have a notable effect on construction operations or schedule.</p>			