

PART 3

TECHNICAL SPECIFICATIONS FOR CONSTRUCTION OF WATER AND SEWER FACILITIES

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VALLECITOS WATER DISTRICT

PART 3 TABLE OF CONTENTS TECHNICAL SPECIFICATIONS

<u>Section</u>	<u>Description</u>
01010	Summary of Work
01045	Existing Facilities
01300	Submittals
01730	Operation and Maintenance Data
02200	Structure Earthwork
02223	Trenching, Backfilling and Compacting
02303	Bypass Pumping
02315	Jacked Casing
02701	Installation of Gravity Sewer Pipelines
02715	PVC Gravity Sewer Pipe
03300	Concrete
03461	Precast Reinforced Concrete Manholes
03462	Precast Concrete Vaults
09801	Manhole Protective Lining
09900	Painting and Coating
15000	Piping Components
15041	Disinfection of Piping
15042	Hydrostatic Testing of Pressure Pipelines
15043	Leakage and Infiltration in Testing of Non-Pressure Pipelines
15050	Hot Tap Connections
15056	Ductile-Iron Pipe and Fittings
15057	Copper, Brass, and Bronze Pipe, Fittings and Appurtenances
15064	Polyvinyl Chloride (PVC) Pressure Pipe
15072	Asbestos Cement Distribution Pipe (6-inch through 16-inch)
15076	Cement-Mortar Lined and Coated Steel Pipe
15089	Combination Air and Vacuum Release Valve Assembly
15100	Manual Valves
15102	Resilient Seated – Wedge Gated Valves
15103	Butterfly Valves
15112	Backflow Preventers
15139	Fire Hydrants
15150	Meters

STANDARD SPECIFICATIONS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

A. Description

This section includes the summary of work for removal, relocation, replacement or construction of District facilities.

B. Work of this Section

The Contractor shall furnish all labor, materials, supplies, transportation, services, incidentals, equipment, and all other things necessary, including fuel, power, water, and essential communications in order to complete the work in its entirety in accordance with the Drawings and Specifications contained herein. Work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper removal, relocation, replacement, or construction of the Work in good faith shall be provided by the Contractor as though originally so indicated.

PART 2 – MEASUREMENT AND PAYMENT

A. General

Payment for each bid item shall be included in the Contract unit price or lump sum price as stated in the bidder's proposal. Payment for each bid item shall include full compensation for all labor, materials, tools, equipment, supplies, transportation, subcontracts, and incidentals necessary to complete the work in its entirety and no additional compensation will be allowed. This includes the cost of work not specifically listed in the bid schedule or summary of bid items, but is necessary to complete the project as described and shown on the Contract Drawings and as specified in the Contract Documents. Work for which no separate payment has been provided will be considered a subsidiary obligation of the Contractor, and the cost thereof shall be included in the applicable contract price for the item to which it applies. All measurements of work done will be made and/or confirmed by the District or the District's authorized representative.

B. Bid Items

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 01045

EXISTING FACILITIES

PART 1 - GENERAL

A. Description

This section includes requirements for connection to and abandonment of existing District facilities.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or referenced in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Chlorination of Domestic Water Mains and Services for Disinfection:	15041
3.	Hydrostatic Testing of Pressure Pipelines:	15042
4.	Manual Valves:	15100
5.	Hot Tap Connections	15050

C. Condition of Existing Facilities

The District does not warrant the condition, size, material, and location of existing facilities.

D. Location

The contractor shall be responsible for potholing and verifying in advance the location of all existing pipelines as shown on the plans. Discrepancies shall be reported to the project engineer, prior to the fabrication or purchase of material affected by the discrepancy.

E. Protection of Existing Utilities and Facilities

1. The contractor shall be responsible for the care and protection of all existing sewer pipe, water pipe, gas mains, culverts, power or communications lines, sidewalks, curbs, pavement, or other facilities and structures that may be encountered in or near the area of the work.

2. It shall be the duty of the contractor to notify Underground Service Alert (811) and each agency of jurisdiction and make arrangements for locating their facilities prior to beginning construction.
3. In the event of damage to any existing facilities during the progress of the work and of the failure of the contractor to exercise the proper precautions, the contractor will pay for the cost of all repairs and protection to said facilities. The contractor's work may be stopped until repair operations are complete.

F. Protection of Landscaping

1. The contractor shall be responsible for the protection of all the trees, shrubs, irrigation systems, fences, and other landscape items adjacent to or within the work area, unless they are directed to do otherwise on the plans.
2. In the event of damage to landscape items, the contractor shall replace the damaged items in a manner satisfactory to the District representative and the owner, or pay damages to the owner as directed by the District.
3. When the proposed pipeline is to be within planted or other improved areas in public or private easements, the contractor shall restore such areas to the original condition after completion of the work. This restoration shall include grading, a placement of 5 inches of good topsoil, re-sodding, and replacement of all landscape items indicated.
4. If the contractor does not proceed with the restoration after completion of the work or does not complete the restoration in a satisfactory manner, the District reserves the right to have the work done and to charge the contractor for the actual cost of the restoration including all labor, material, and overhead required for restoration.

G. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the County of San Diego, the city having jurisdiction, or other affected agencies involved. The contractor shall keep a copy of all the required permits on the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

All materials used in making the connection or removing the facility from service shall conform to the applicable sections of these specifications.

A. Grout

Grout shall consist of Portland cement and water or of Portland cement, sand, and water; and all grout mixtures shall contain 2% of bentonite by weight of the cement. Grout shall be a pump mix with a minimum of six sacks cement (564 lbs) per cubic yard.

Portland cement, water and sand shall conform to the applicable requirements of the concrete section (Section 03300), except that sand to be used shall be of such fineness that 100% will pass a standard 8-mesh sieve and at least 45%, by weight, will pass a standard 40-mesh sieve.

B. Concrete

Concrete used for the replacement of damaged or removed facilities shall be in accordance with Section 03300 and shall match the mix design of the existing facility and per the requirement of the jurisdictional agency.

PART 3 - EXECUTIONA. Connection to Existing Facilities

1. All connections shall be made by the contractor unless shown otherwise on the plans or specified herein. Cutting of ACP is not allowed. ACP shall be removed and connected to factory joints only.
2. The contractor shall notify the District a minimum of six (6) working days before the time of any proposed shutdown of existing mains or services. The District inspector may postpone or reschedule any shutdown operation if for any reason he feels that the contractor is improperly prepared with competent personnel, equipment, or materials to proceed with the connection work. Due to advance notice requirements, shutdowns will only be scheduled for Tuesdays, Wednesdays, or Thursdays during the work week. Special circumstances may require night or weekend shutdowns.
3. Connections shall be made only in the presence of the District, and no connection work shall proceed until the District has given notice to proceed. If progress is inadequate during the connection operations to complete the connection in the time specified, the District shall order necessary corrective measures. All costs for corrective measures shall be paid by the contractor.
4. The contractor shall furnish all pipe and materials including furnishing all labor and equipment necessary to make the connections, all required excavation, backfill, pavement replacement, lights, and barricades, and may be required to include a water truck, high line hose, and fittings as part of this equipment for making the connections. In addition, the contractor shall assist the District in alleviating any hardship incurred during the shutdown for connections including but not limited to sanitary facilities and water if required. Standby equipment or materials may be required by the District representative.
5. The contractor will de-water existing mains, as required, in the presence of the District representative.
6. Connections shall be made with as little change as possible in the grade of the new main. If the grade of the existing pipe is below that of the new pipeline, a sufficient length of the new line shall be deepened so as to prevent the creation of any high spot or abrupt changes in grade of the new line. Where the grade of the existing pipe is above that of the new pipeline, the new line shall be laid at specified depth, except for the first joint adjacent to the connection, which shall be deflected as necessary up to 3° for DIP or high deflection coupling for PVC to meet the grade of the existing pipe. If sufficient change in direction cannot be obtained by the limited deflection of the first joint, a fitting of the proper angle shall be installed. Where the connection creates a high or low spot in the line, a standard air release or blow off assemble shall be installed as directed by the District representative.
7. Where connections are made to existing valves, the contractor shall furnish and install all temporary blocking, steel clamps, shackles, and anchors as required by the District, and he shall replace the valve riser box and cover and adjust the valve cover to the proper grade in accordance with these specifications. The District will operate all existing valves. All

valves, existing or newly installed, shall be readily accessible at all times to the District for emergency operation.

8. New pipelines shall not be connected to existing facilities until the new pipelines have been successfully tested, disinfected and accepted by the District.
9. Tapping connection can be made to the existing system while it is either in service or shut down depending on the District's prior direction. A tapping valve shall be used when the existing system is maintained in service during connection. Tapping shall be in accordance with the specification requirements for the pipe being tapped. Size on size taps are not allowed.
10. All saddle connections into existing sewer lines shall be made with a wye saddle. Saddles shall conform to the applicable provisions of the section for the existing sewer line material.

B. Removal from Service of Existing Mains and Appurtenances

1. Existing mains and appurtenances shall be removed from service at the locations shown on the plans or as directed by the District representative, [per general notes](#).
2. Abandoned pipe shall be completely removed or filled with grout or a 1-sack slurry.
3. Existing pipe and appurtenances removed from the ground will require backfill and repair of surface in accordance with Section 02223 or the agency having jurisdiction.
4. Removed pipe and appurtenances may be temporarily stockpiled on the job in a location that will not disrupt traffic or constitute a safety hazard, then disposed of in a proper manner (as determined by the District representative). The contractor shall remove and dispose of all removed pipe at his own expense.
5. Before excavating for installing mains that are to replace existing pipes and/or services, the contractor shall make proper provisions for the maintenance and continuation of service as directed by the District representative unless otherwise specified.
6. If the meter box is to be removed from an abandoned water service, the service line is to be [abandoned at the main removing the corporation stop and installing a brass plug in the saddle](#), ~~crimped and the corporation stop closed and capped. If there is no corporation stop on the service, the adapter is to be removed and a brass plug is to be installed in the service saddle.~~
7. Asbestos Cement Pipe (ACP) shall be removed and disposed of in a proper, legal manner. The contractor will be responsible for the proper manifesting of the ACP at an authorized disposal site. See Section 15072 for additional requirements.
8. Sewer lateral connections shall be abandoned at the main. If a factory wye exists, it shall be plugged with an approved mechanical plug. If the lateral connection is a field connection, the section of sewer main containing the connection shall be removed and replaced with approved material and adaptors.

C. Cutting and Restoring Street Surfacing.

1. Where construction is in a State highway, City street or County road, excavation, backfill and resurfacing shall be in accordance with the requirements of the agency having jurisdiction of the street. In general the following shall apply.
2. In cutting or breaking up street surfacing, the contractor shall not use equipment that will damage adjacent pavement.
3. All asphalt and/or Portland cement concrete surfaces shall be scored with sawing equipment of a type meeting the approval of the Agency. Existing paving surfaces shall be saw-cut back beyond the edges of the trenches to form neat square cuts before repaving is commenced.
4. Pavement, sidewalks, curbs, or gutters removed or destroyed in connection with performance of the work shall be saw cut to the nearest score marks, if any, and shall be replaced with pavement sidewalks, curbs, or gutters of the same kind, or better by the contractor in accordance with the latest specifications, rules, and regulations and subject to the inspection of the agency having jurisdiction over the street or highway.
5. Trench backfill above the pipe zone, including the pavement structural section shall be in accordance with the standards of the agency having jurisdiction.

END OF SECTION

SECTION 01300 – SUBMITTALS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section specifies the general methods and requirements for submittals including but not limited to shop drawings, product data, samples, potholing records, and operating and instruction manuals. Individual submittal requirements will be detailed in the technical specification sections specific to that item of Work.
- B. Submittals shall be in accordance with the requirements of this Section and the District's General Conditions.
- C. Incomplete submittals shall be returned without review comments; no time extensions shall be granted due to incomplete submittals.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. General Conditions

1.3 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

A. Shop Drawings

1. Shop drawings, as required by individual Sections, shall include but are not limited to the custom-prepared data such as fabrication and erection/installation (working) drawings, schedule information, design calculations, setting and/or support diagrams, actual workshop manufacturing instructions, custom templates, coordination drawings, test reports, and certifications, as applicable to the Work.
2. All shop drawings submitted by Subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
3. The Contractor shall check all Subcontractors' shop drawings regarding measurements, size of members, materials, and details to satisfy him that they conform to the intent of the plans and specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the Subcontractors for correction before submission thereof.
4. All details on shop drawings submitted for approval shall clearly show the relationship of the various parts of the work. Where correct fabrication depends on field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

B. Product Data

1. Product data, as required by individual Sections, shall include but are not limited to standard prepared data for manufactured products, such as the manufacturer's product specification and installation instructions, dimensional and weight information, color and pattern alternatives, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts,

SECTION 01300 – SUBMITTALS

wiring and control diagrams, product photographs, furnished and recommended spare parts and special tools, handling and storage instructions, safety data sheets (SDS), material, production or quality control inspection and test reports and certifications, mill reports, and printed product warranties, as applicable to the Work.

2. Product data shall include provisions for labeling all lockout points.

C. Samples

1. Samples, as required by individual Sections, shall include but are not necessarily limited to individual units of a specific item of Work, portions of an item of Work which represent the whole, examples of an item of Work which represent the actual item to be installed, and any other sample of an item of Work which allows the District's Representative to determine the suitability of that item.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall review submittals, shop drawings, product data and samples, including those by Subcontractors, prior to submission to determine accuracy and verify the following:
 1. Field measurements
 2. Field construction criteria
 3. Catalog numbers and similar data
 4. Conformance with the Specifications
- B. Each submittal shall be accompanied by a Submittal Transmittal sheet. The Contractor shall sign transmittal and certify the contents of the submittal meet the requirements of the Standard Specifications. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. If deviations from the Standard Specifications are contained in the submittal, the Contractor shall provide a written description of any and all deviations for review by the District's.
- C. The review and approval of submittals, shop drawings, samples, or product data by the District shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the District will have no responsibility therefore.
- D. No portion of the work requiring a submittal, shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site prior to receipt of an approved submittal shall be solely at the Contractor's risk. The District will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity with the Standard Specifications.
- E. Project work, materials, fabrication, and installation shall conform to approved submittals, shop drawings, applicable samples, and product data.

SECTION 01300 – SUBMITTALS

1.5 SUBMISSION REQUIREMENTS

- A. All submittals shall be sufficiently in advance of construction requirements to provide no less than 21 calendar days for review from the time the District receives them. No less than 30 calendar days will be required for review of submittals concerning major equipment, including but not limited to pumps and associated electrical equipment that require review by more than one engineering discipline.
- B. Each submittal shall contain three (3) hard copies and one (1) electronic copy (PDF) of all shop drawings and product data, where one (1) copy of the reviewed submittal will be returned to Contractor.
- C. Each submittal shall be assigned a number starting with “No. 001” and thence numbered consecutively. Resubmittals shall be identified by the original submittal number followed by the suffix “A” for the first resubmittal, the suffix “B” for the second resubmittal, and so forth.
- E. Submittals shall be clearly typed, legible, and complete with the following:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The Project title and number.
 - 3. Contractor identification.
 - 4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 - 5. Identification of the product, with the specification section number, page and paragraph(s).
 - 6. Field dimensions, clearly identified as such.
 - 7. Quantities of items, units and/or components to be supplied.
 - 8. Relation to adjacent or critical features of the Work or materials.
 - 9. Applicable standards, such as ASTM or Federal Specification numbers.
 - 10. Identification of deviations from the Standard Specifications.
 - 11. Identification of revisions on resubmittals.
 - 12. A blank space sized for District and engineer review stamps.
 - 13. Bear the Contractor's Certification Statement with signature on the cover sheet.

SECTION 01300 – SUBMITTALS

- F. Shop drawings and product data sheets 11-inch by 17-inch and smaller shall be bound together in an orderly fashion.

1.5 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. The District's review of submittals is for general conformance with the design concept and the Standard Specifications. Markings or comments shall not be construed as relieving the Contractor from compliance with the plans, specifications, and the Standard Specifications or from correcting Work which is not in compliance. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples shall NOT be construed:
 - 1. As permitting any departure from requirements of the Standard Specifications ;
 - 2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 - 3. As approving departures from details furnished by the District, except as otherwise provided herein.
- C. If a submittal describes variations and shows a departure from requirements of the Standard Specifications which the District finds to be in the interest of the District and to be so minor as not to involve a change in cost or time for performance, the District may return the reviewed drawings without noting an exception.
- D. Submittals will be returned to the Contractor under one of the following codes.
 - 1. Code 1 - "NO EXCEPTIONS TAKEN" is assigned when there are no notations or comments to the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
 - 2. Code 2 - "MAKE CORRECTIONS NOTED/CONFIRM" is assigned when notation and comments to the submittal are minor and only a confirmation of the notations and comments is required by the Contractor. The Contractor's resubmittal need only address the omissions and nonconforming items that were noted. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
 - 3. Code 3 - "AMEND/RESUBMIT" is assigned when notations and comments are extensive enough to require a resubmittal due to noncompliance with the Standard Specifications. The omissions and nonconforming items must be corrected and the entire package resubmitted. This code generally means that the equipment or material cannot be released for manufacture unless the Contractor takes full responsibility for providing the submitted items in accordance with the Standard Specifications and with all comments and notations incorporated into the final product.

SECTION 01300 – SUBMITTALS

4. Code 4 - "REJECTED" is assigned when the submittal does not meet the intent of the Standard Specifications. The Contractor must resubmit the entire package revised to bring the submittal into conformance with the Standard Specifications. It may be necessary for the Contractor to resubmit using a different manufacturer/vendor to meet the Standard Specifications.
 5. Code 5 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.
 6. Code 6 - "FOR YOUR INFORMATION" is assigned when the package provides information of a general nature that may or may not require a response.
 7. Codes 1 through 4 designate the status of the reviewed submittal with Code 5 showing there has been an attachment of additional data. Code 6 is used as necessary.
- E. Resubmittals will be handled in the same manner as first submittals with no less than 21 calendar days required for review. For resubmittals, the Contractor shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to any revisions including those corrections requested by the District on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type of revision that is not in accordance with the Standard Specifications as may be required by the District.
- F. Partial submittals may not be reviewed. The District will be the only judge as to the completeness of a submittal. Incomplete submittals will be returned to the Contractor, and will be considered "Rejected" until resubmitted. The District may at its option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

1.6 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

- A. If specifically required in other Sections of these Specifications, the Contractor shall submit a P.E. Certification for each item required completely filled in and stamped.

1.7 GENERAL PROCEDURES FOR SUBMITTALS

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.8 PAYMENT

- A. Payment for cost of preparation and revisions to submittals shall be at no cost to the District and no additional compensation shall be made therefor.

SECTION 01300 – SUBMITTALS

- B. It is considered reasonable that the Contractor shall make a complete and acceptable submittal to the District's Representative by the second submission (first resubmittal) of a submittal. The District reserves the right to withhold payment due to the Contractor or request payment from the Contractor to cover additional costs of review beyond the second submission (first resubmittal).

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

****END OF SECTION****

SECTION 01730 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall provide operation and maintenance data prior to final acceptance in the form of instructional manuals for use by the District's personnel for all equipment and systems including but not limited to pumps, motors, and drives, all valves, gates and related accessories, and all instruments and control devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 – Submittals

1.3 SUBMITTALS

- A. The following shall be submitted in compliance with the Standard Specifications:
 - 1. The Contractor shall submit six (6) copies of all the operations and maintenance data to the District within 30 days after approval of the final Shop Drawing.
 - 2. Provide a letter of transmittal with each submittal and include the following in the letter:
 - a. Date of submittal.
 - b. Contract title and number.
 - c. Contractor's name and address.
 - d. A list of the attachments and the Specification Sections to which they relate.
 - e. Reference to or explanation of related submittals already made or to be made at a future date.

1.4 OPERATION AND MAINTENANCE DATA

- A. The term "operation and maintenance data" includes all product related information and documents which are required for preparation of the operation and maintenance manual. It also includes all data, which must accompany said manual as directed by current regulations of any participating government agency.
- B. Required operation and maintenance data includes, but is not limited to, the following:
 - 1. Complete, detailed written operating instructions for each product or piece of equipment including: equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal and emergency conditions; regulation and control; and shutdown.
 - 2. Complete, detailed written preventive maintenance instructions. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted and maintained so that the item functions properly throughout its full design life.
 - a. Preventive maintenance instructions include, but are not limited to, the following:

SECTION 01730 – OPERATION AND MAINTENANCE DATA

- i. Written explanation with illustrations for each preventive maintenance task.
 - ii. Recommended schedule for execution of preventive maintenance tasks.
 - iii. Lubrication charts.
 - iv. Table of alternative lubricants.
 - v. Trouble shooting instructions.
 - vi. List of required maintenance tools and equipment.
 3. A functional lockout/tagout standard operating procedure for the equipment/machinery that describes how the equipment/ machinery are to be locked out and where it can be tagged out.
 4. Recommended spare parts lists and local sources of supply for parts.
 5. Written explanations of all safety considerations relating to operation and maintenance procedures.
 6. Name, address and phone number of manufacturer, manufacturer's local service representative, and Subcontractor or installer.
 7. Copy of all approved Shop Drawings, and copy of warranty bond and service contract as applicable.
- C. Format Requirements:
1. The Contractor shall use eight and a half inch (8 ½”) by eleven inch (11”) paper of high quality. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner, which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab or provide fly-leaf for each product.
 2. All text must be legible typewritten or machine printed originals or high quality copies of same.
 3. Each page shall have a binding margin of approximately one and a half inches (1 ½”) and be punched for placement in a three ring loose-leaf or triple post binder. Provide binders not less than one inch or more than two and a half inches (2 ½”) thick. Identify each binder on the spine and outside front cover with the following:
 - a. "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - b. Project name, and number (if applicable).
 - c. Identity of building, structure or area as applicable.
 - d. Identity of general subject matter covered.
 4. The Contractor shall use dividers and typewritten indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

SECTION 01730 – OPERATION AND MAINTENANCE DATA

5. The Contractor shall provide a table of contents for each binder.
6. The Contractor shall identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 02200

STRUCTURE EARTHWORK

PART 1 - GENERAL

A. Description

This section includes excavation, backfilling, materials, testing, and shoring for structures.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or referenced in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- 1. Trenching, Backfilling, and Compacting: 02223
- 2. Concrete: 03300

C. Testing for Compaction

Testing for compaction shall conform to Section 02223.

D. Definition of Zones

- 1. Pavement and street zones shall be as specified in Section 02223.
- 2. Backfill zone is the backfill from the bottom of the structure excavation to the bottom of the street zone in paved areas or to the existing surface in unpaved areas.

E. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, San Diego County, the city having jurisdiction, or any other affected agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

PART 2 - MATERIALS

Native earth backfill, imported backfill material, granular material, imported sand, and crushed rock shall conform to the requirements of Section 02223.

PART 3 - EXECUTION

A. Compaction Requirements

1. Backfill in Street Zone: minimum per jurisdictional agency or 95% relative compaction
2. Structural Backfill: 90% relative compaction
3. Gravel Base: 90% relative compaction
4. Adjacent to existing structures: 95% relative compaction

B. Sidewalk, Pavement, and Curb Removal

1. Saw cut bituminous or concrete pavements regardless of their thickness, and curbs and sidewalks prior to excavation for the structure in accordance with the requirements of the city, or agency having jurisdiction. Curbs and sidewalks that are damaged in the course of construction shall be cut and removed from joint to joint.
2. Haul removed pavement and concrete materials from the site, to a proper disposal facility. These materials are not permitted for use as backfill.

C. De-watering

1. Obtain NPDES discharge permit and provide and maintain means and devices to continuously remove and dispose of all water entering the excavation during construction of the structure and all backfill operations.
2. Dispose of the water in a manner to prevent damage to adjacent property and pipe trenches.
3. Do not allow water to rise in the excavation until backfilling around and above the structure is completed.
4. Removal, disposal and reporting of trench water shall conform to the requirements of the NPDES permit. A copy of the permit shall be provided to the District.
5. The sewer system shall not be used as a drain for de-watering.

D. Structure Excavation

1. Structure excavation shall include the removal of all material of whatever nature necessary for the construction of structures and foundations in accordance with the plans and these specifications.
2. The sides of excavations for structures shall be sufficient to leave at least a 2-foot clearance, as measured from the extreme outside of form work or the structure, as the case may be.
3. Surplus material shall be disposed of by the contractor in accordance with Section 02223.

E. Correction of Over Excavation

1. Where excavation is inadvertently carried below design depths, suitable provision shall be made by the contractor to adjust construction, as recommended by the soils engineer and directed by the District representative, to meet requirements incurred by the deeper excavation.
2. No earth backfill will be permitted to correct over excavation beneath structures.
3. Over excavation shall be corrected by backfilling with crushed rock or concrete, as directed by the District representative.

F. Bracing

1. The contractor's design and installation of bracing and sheeting shall take the necessary precautions to be consistent with the rules, orders, and regulations of the State of California Construction Safety Orders.
2. Excavations shall be so braced, sheeted, and supported that they will be safe, such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.
3. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work.
4. Carefully remove sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

G. Backfill

1. After structures and foundations are in place, backfill shall be placed to the original ground line or to the limits designated on the plans.
2. No material shall be deposited against concrete structures until the concrete has reached a compressive strength of at least 3,000 pounds per square inch as tested per Section 03300.
3. Imported sand or granular material shall be placed in horizontal layers not exceeding 12 inches in depth.
4. Each layer of backfill material shall be moistened and thoroughly tamped, rolled, or otherwise compacted to the specified relative density.
5. Carefully operate compaction equipment near structures to prevent their displacement or damage. Structural fill is to be placed and compacted in uniform layers around all sides of the structure.
6. One-sack cement slurry may be used as structural backfill material or above the pipe zone if applicable. (Per Governing Agency):-

H. Pavement Replacement

Pavement replacement shall be in accordance with the requirements of the city or the agency having jurisdiction.

I. Permits

An Encroachment Permit and/or an Excavation Permit from the city or agency having jurisdiction is required prior to any work within public right-of-way. All traffic control and pavement replacement work shall be in accordance with the requirements of the permit and the agency Inspector.

A permit from OSHA is required of any excavation exceeding 5 feet.

Follow all restrictions of the required permits from other agencies.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 02223

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

A. Description

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

B. Related Work Specified Elsewhere

All related work specified elsewhere, or referenced in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

C. Testing for Compaction

1. Determine the density of soil in place by the use of a sand cone, drive tube, or nuclear tester.
2. Determine laboratory moisture-density relations of existing soils by ASTM D 1557.
3. Determine the relative density of cohesionless soils by ASTM D 2049.
4. Sample backfill materials by ASTM D 75.
5. Express "relative compaction" as the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.
6. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction.
7. The developer will secure the services of a soils tester and pay the costs of all compaction testing. Test results will be furnished by the Developers .

D. Pavement Zone

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

E. Street Zone

The street zone is the top 36 inches of the trench or depth determined by the jurisdictional agency immediately below the pavement zone in paved areas.

F. Trench Zone

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the existing surface in unpaved areas.

G. Pipe Zone

The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level 12 inches above the top of the highest or topmost pipe.

H. Pipe Bedding

The pipe 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 bedding shall be as shown on the drawings or as described in these specifications for the particular type of pipe installed.

I. Excess Excavated Material

1. The contractor shall make the necessary arrangements for and shall remove and legally dispose of all excess excavated material unless indicated differently in the special provisions for any job.
2. It is the intent of these specifications that all surplus material not suitable for backfill or fill shall be properly disposed of by the contractor at his expense at a legal disposal site.
3. No excavated material shall be deposited on private property unless written permission from the owner thereof is secured by the contractor. Before the District will accept the work, the contractor shall file a written release signed by all property owners with whom he has entered into agreements for disposing excess excavated material, absolving the District from any liability connected therewith.
4. The contractor shall obtain a haul route permit from the city or agency having jurisdiction.

J. Safety

1. All excavations shall be performed, protected, and supported as required for safety and in the manner set forth in the operation rules, orders, and regulations prescribed by the Division of Industrial Safety of the State of California.
2. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

3. No trench or excavation shall remain open during non-working hours. The trench or excavation shall be covered with steel plates, spiked in place, or secured with temporary A.C. pavement around the edges, or backfilled per Governing Agency.
4. The contractor shall notify the District of all work-related accidents which occur to persons or property at or near the project site, and shall provide the District with a copy of all accident reports. All accident reports shall be signed by the contractor or its authorized representative and submitted to the District's authorized representative within twenty-four (24) hours of the accident's occurrence.

K. Access

Unobstructed access must be provided to all driveways, water valves, hydrants, or other property or facilities that require routine use.

L. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, San Diego County, the city having jurisdiction, and/or other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

M. Slope Protection (Slope Anchors)

Slope protection shall be installed where shown on the plans in accordance with plan details, wherever the profile of the ground surface above the water or sewer main exceeds 20%, and where no pavement or other permanent surfacing is to be laid over the facility.

PART 2 - MATERIALS

A. Native Earth Backfill

1. The use of native earth as backfill material requires the approval of the District representative in all cases. A soils engineer shall provide testing and recommendations for suitability of excavated material for use as backfill.
2. Generally, native earth backfill, acceptable for use, shall be fine-grained material free from roots, debris, and rocks with a maximum dimension not larger than 3 inches.
3. Native backfill shall not be used in the pipe zone.

B. Imported Backfill Material

1. Whenever the excavated material is not suitable for backfill, the contractor shall arrange for and furnish suitable imported backfill material that is capable of attaining the required relative density. Backfill material shall meet the requirements of the agency having jurisdiction. A soils report or other certification shall be submitted for imported material.
2. The contractor shall dispose of the excess trench excavation as specified in the preceding section. Backfilling with imported material shall be done in accordance with the methods described herein or in accordance with the requirements of the agency having jurisdiction.

C. Granular Material

Granular material shall be defined as soil having a minimum sand equivalent of 30 as determined in accordance with State of California, Division of Highways, Test "California 217", with not more than 20% passing a 200-mesh sieve. Certification shall be provided.

D. Imported Sand

Imported sand shall have a minimum sand equivalent of 30 per State of California, Division of Highways, Test "California 217", with 100% passing a 3/8-inch sieve and not more than 20% passing a 200-mesh sieve. Certification that the sand meets this requirement shall be provided.

E. Crushed Rock and Gravel

1. Crushed rock shall be the product of crushing rock or gravel. Fifty percent of the particles retained on a 3/8-inch sieve shall have their entire surface area composed of faces resulting from fracture due to mechanical crushing. Not over 5% shall be particles that show no faces resulting from crushing. Less than 10% of the particles that pass the 3/8-inch sieve and are retained on the No. 4 sieve shall be weatherworn particles. Gravel shall not be added to crushed rock.
2. Gravel shall be defined as particles that show no evidence of mechanical crushing, are fully weatherworn, and are rounded. For pipe bedding, where gravel is specified, crushed rock may be substituted or added with District approval.
3. Where crushed rock or gravel is specified in the bedding details on the plans, the material shall have the following gradations:

Sieve Size	1-1/2 Inch Max Gravel % Passing	1-inch Max Gravel % Passing	3/4 Inch Max Crushed Rock % Passing
2"	100		
1-1/2"	90 – 100	100	
1"	20 – 55	90 – 100	100
3/4"	0 – 15	60 – 80	90-100
1/2"	-	-	30 – 60
3/8"	0 – 5	0 – 15	0 – 20
No. 4	-	0 – 5	0 – 5
No. 8	-	-	-

4. Mirafi Placed between pipezone and trenchzone per S-12

F. Sand-Cement Slurr

Sand-cement slurry shall consist of one sack (94 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability.

PART 3 - EXECUTION

A. Compaction Requirements

1. The developer will engage the services of a qualified soils engineering firm to determine the relative compaction of the trench backfill.
2. If the backfill fails to meet the specified relative compaction requirements, the contractor shall rework the backfill until the requirements are met.
3. Compaction tests shall be performed at random depths and at 200-foot intervals and as directed by the District representative.
4. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as described below:
 - a. Pipe zone and pipe base: 90% relative compaction
 - b. Trench zone not beneath paving: 90% relative compaction
 - c. Trench zone to street zone in paved areas: 90% relative compaction
 - d. Street zone in paved areas: per agency requirements. The most stringent agency requirements shall prevail
 - e. Rock refill material for foundation stabilization: 90% relative density
 - f. Rock refill for over excavation: 90% relative density or per soils engineer.
 - g. Within one foot around structures.

B. Material Replacement

Removal and replacement of any trench and backfill material which does not meet the specifications shall be the contractor's responsibility.

C. Clearing and Grubbing

1. Areas where work is to be performed shall be cleared of all trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or would form obstructions therein.
2. Organic material from clearing and grubbing operations shall not be incorporated in the trench backfill.
3. Organic material from clearing and grubbing operations will be disposed of at a legal waste disposal facility.

D. Sidewalk, Pavement, and Curb Removal

1. Saw cut bituminous or concrete pavements regardless of their thickness, and curbs and sidewalks prior to excavation for the structure in accordance with the requirements of the city, or agency having jurisdiction. Curbs and sidewalks that are damaged in the course of construction shall be cut and removed from joint to joint.
2. Haul removed pavement and concrete materials from the site, to a legal disposal facility. These materials are not permitted for use as trench backfill.

E. Trenching and Tunneling

1. Excavation for pipe, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the facilities as shown on the plans.
2. Trench banks shall be kept as near to vertical as possible and shall be properly braced, shored and sheeted.
3. Tunneling will not be permitted.
4. The use of a jack and bore or hydraulic ram may be employed with approval of the District.

F. Bracing

1. The contractor's design and installation of bracing and shoring shall be consistent with the rules, orders, and regulations of the State of California Construction Safety Orders.
2. Excavations shall be so braced, sheeted, and supported that they will be safe such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.
3. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.
4. Care shall be exercised in the drawing or removal of sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

G. Trench Widths

1. Excavation and trenching shall be true to line so that a clear space of not more than 9 inches or less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place measured at a point 12 inches above the top of the pipe. For the purpose of this section, the largest outside diameter shall be the outside diameter of the bell on bell and spigot pipe or the pipe collar.
2. Where the sewer trench width, measured at a point 12 inches above the top of the bell of the pipe, is wider than the maximum set forth above, the trench area around the pipe shall be backfilled with crushed rock for PVC and VCP pipe material and sand for DIP material.

H. Length of Open Trench

The maximum allowable length of open trench shall be 500 feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is less. Within developed

areas, the length of open trench may be restricted as determined by the encroachment permit from the city or the agency having jurisdiction.

I. Grade

1. Excavate the trench to the lines and grades shown on the drawings with allowance for pipe thickness and for pipe base or special bedding.
2. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions and shall be at a reasonably uniform grade.

J. Correction of Over Excavation

1. Where excavation is inadvertently carried below the design trench depth, suitable provision shall be made by the contractor to adjust the excavation, as recommended by the soils engineer and directed by the District representative, to meet requirements incurred by the deeper excavation.
2. Over excavations shall be corrected by backfilling with approved graded crushed rock or gravel and shall be compacted to provide a firm and unyielding subgrade or foundation, as directed by the District representative.

K. De-watering

1. The contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. De-watering shall be done by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. De-watering methods may include well points, sump points, suitable rock or gravel placed below the required bedding for drainage and pumping, temporary pipelines, and other means, all subject to the approval of the District representative. Water shall be discharged in accordance with the requirements of the District or contractor NPDES permit.
2. The sewer system shall not be used as a drain for de-watering the construction trenches.
3. De-watering shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise. No concrete shall be poured in water, nor shall water be allowed to rise around the concrete or mortar until it has set at least eight hours.

L. Foundation Stabilization

1. Whenever the trench bottom does not afford a sufficiently solid and stable base to support the pipe or appurtenances, the contractor shall excavate to a depth below the design trench bottom, as recommended by the soils engineer and directed by the District representative, and the trench bottom shall be backfilled with 3/4-inch rock and compacted to provide uniform support and a firm foundation.
2. Where rock is encountered, it shall be removed to a depth at least 6 inches below grade and the trench shall be backfilled with 3/4-inch crushed rock to provide a compacted foundation cushion.

3. If excessively wet, soft, spongy, unstable, or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall be removed to a depth as recommended by the soils engineer and replaced by crushed rock, or as recommended by the soils engineer.

M. Excavated Material

1. All excavated material shall not be stockpiled in a manner that will create an unsafe work area or obstruct sidewalks or driveways. Gutters shall be kept clear or other satisfactory measures shall be taken to maintain street or other drainage.
2. In confined work areas, the contractor may be required to stockpile the excavated material off-site, as determined by the project permits.

N. Placing Pipe Bedding

1. Place the thickness of pipe bedding material over the full width of trench necessary to produce the required bedding thickness when the material is compacted to the specified relative density. Grade the top of the pipe bedding ahead of the pipe to provide firm, uniform support along the full length of pipe.
2. Excavate bell holes at each joint to permit assembly and inspection of the entire joint.

O. Backfilling within Pipe Zone

1. Backfill per the detailed piping specification for the particular type of pipe and per the following.
2. After pipe has been installed in the trench, place pipe zone material simultaneously on both sides of the pipe, 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 that 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.
3. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

P. Backfill within Trench Zone

1. Compact per the detailed piping specification for the particular type of pipe and per the following.
2. 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.
3. The remaining portion of the trench to the street zone or ground surface, as the case may be, shall be backfilled, compacted and/or consolidated by approved methods to obtain the specified relative compaction.

- a. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be done with the type and size of equipment necessary to accomplish the work. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density. The contractor shall repair or replace any pipe, fittings, manholes, or structures as directed by the District representative damaged by the contractor's operations.
- b. Consolidation of backfill performed by flooding, poling, or jetting is not allowed except when recommended by a soils engineer and expressly approved by the District.

Q. Backfill within Street Zone

1. The street zone within roadbed areas shall be compacted using approved hand, pneumatic, or mechanical type tampers to obtain the required relative compaction.
2. All work shall be done in accordance with the requirements and to the satisfaction of the city or the agency having jurisdiction.
3. Flooding and jetting will not be permitted in this Zone.

S. Sidewalk, Pavement, and Curb Replacement

Replace bituminous and concrete pavement, curbs, and sidewalks damaged or removed during construction in accordance with the requirements of the city or the agency having jurisdiction.

T. Slope Protection (Slope Anchors and Cut-off Walls)

1. Where cutoff walls or concrete anchors are required, they shall be in accordance with the approved plans, specifications and details. Generally, they shall be a minimum thickness of 12 inches and shall extend at least 12 inches to undisturbed material on each side of the trench as excavated. Cemented rubble and concrete surface slope protection shall be a minimum of 4-inches thick.
2. Wall or anchors shall be placed with a minimum horizontal spacing of:
 - a. Not over 36 feet center to center on grades 25% to 35%
 - b. Not over 24 feet center to center on grades 35% to 50%
 - c. Not over 16 feet center to center on grades 50% and over
3. Material used for construction of cutoff walls or concrete anchors shall consist of cast-in-place reinforced concrete or reinforced hollow unit masonry. When reinforced hollow unit masonry is used, all cells in the block shall be filled solidly with grout. A No. 4 reinforcing bar shall be placed vertically in each row of cells and No. 9-gage wall mesh shall be placed in each horizontal joint. In addition, a bond beam shall be placed at the top with two No. 4 bars.

Where cutoff walls or concrete anchors are constructed of reinforced concrete, they shall have No. 4 reinforcing bars placed at 6-inches on center each way in the center of the wall. The bars shall extend full length and height of the wall.

END OF SECTION

**VALLECITOS WATER DISTRICT
SECTION 02303 – BYPASS PUMPING**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The Contractor shall provide a complete sewer bypassing system including, but not limited to, the following:
 - 1. Developing a sewer bypassing plan.
 - 2. Demonstration “proof” testing in the field.
 - 3. Developing a spill prevention and emergency response plan.
 - 4. Submitting and obtaining approval from the District for the sewer bypassing plan and the spill prevention and emergency response plan.
 - 5. Implementing the bypassing and spill prevention and emergency response plan.
 - 6. Providing bypassing in accordance with the Approved Plans throughout the duration of the Work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 01300 – Submittals

1.3 SUBMITTALS

- A. Connection and Bypass Pumping Plan (CBPP)
 - 1. Prepare a comprehensive CBPP 60-days prior to the connection or disruption of service to any District sewer system. The CBPP shall detail how each connection to existing sewer will be accomplished.
 - 2. 30-day temporary bypass meter to determine actual flows prior to construction.
 - 3. The design, installation, and operation of any temporary pumping systems shall be the Contractor’s responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the District that they specialize in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five references of projects of a similar size and complexity as this project performed within the last three years. The bypass pumping system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

**VALLECITOS WATER DISTRICT
SECTION 02303 – BYPASS PUMPING**

4. Provide a detailed plan for showing how each bypass pumping system will be performed. Provide the following items:
 - a. Staging areas for pumps.
 - b. Sewer plugging method and the type of plug. How the plug will be secured and emergency removal of the plug.
 - c. Number, size, material, location, and method of installation of the suction and discharge piping.
 - d. Bypass pump sizes, capacity, number of each size to be on site.
 - e. A primary and 100% redundant backup pumping system, each capable of handling the peak flow of the system, which shall be on site and available 24 hours a day.
 - f. Number and size of portable power generators and the details of the noise suppression equipment. At least one standby generator for each size shall be provided in the event of an emergency.
 - g. Hydraulic calculations and a system head curve plotted on the pump curve.
 - h. A flow monitoring plan describing the method of monitoring and showing the location of upstream and downstream monitoring units for all of the construction locations.
 - i. Bypassing of service laterals as necessary to ensure the maximum amount of time a connection is out of service is 8 hours.
 - j. Method of protecting downstream manholes from damage if applicable.
 - k. Method of protecting downstream storm drain inlets from damage if applicable.
 - l. Downstream discharge plan. Plan showing the location of bypass pumping discharge piping. Show any paving drive over required and details.
 - m. The bypassing plan shall be developed in conjunction with the traffic control plans in order to minimize the impact to the community.
 - n. Schedule for installation and maintenance of bypass pumping system. Coordinate with the CBPP.

B. Spill Prevention and Emergency Response Plan

1. The Contractor shall develop and submit to the District, for review and approval, a written Spill Prevention and Emergency Response Plan. The Spill Prevention and Emergency Response Plan shall be developed to prevent and respond to any construction related sewage spills. The plan shall include, but not be limited to:

**VALLECITOS WATER DISTRICT
SECTION 02303 – BYPASS PUMPING**

- a. Identification of all nearby waterways, channels, catch basins and entrances to underground storm drains.
- b. Furnishing of all the necessary materials, supplies, tools equipment, labor and other services to prevent sewage from coming into contact with these areas.
- c. Arrangements for an emergency response unit comprised of emergency response equipment and trained personnel to be immediately dispatched to the Site in the event of sewage spill(s).
- d. An emergency notification procedure, which includes an emergency response roster with telephone numbers and arrangements for backup personnel and equipment and an emergency notification roster of designated District representatives.
- e. Direct phone numbers (no voicemail) for 3 Contractor representatives who shall be accessible and available at all times to respond immediately to any construction related emergency.

C. Confined Space Entry Plan (CSEP)

1. Develop a CSEP to comply with all laws and regulations. Submit for project records. This plan will not be reviewed and approved. It is the Contractor's plan. Be informed that sewers may have methane gas, H₂S gas, and low oxygen gas levels. Include appropriate portable gas safety monitors for worker use in verifying the quality of air inside manholes.

1.4 SYSTEM DESCRIPTION

A. Design Requirements

1. Bypass pumping systems shall have sufficient capacity to pump peak flow. The Contractor shall determine the upstream slope for each pipe to be bypassed by having the Contractor's surveyor dip the upstream and downstream manholes. The Contractor shall determine the full flow pipe capacity of each pipe and add them together to determine the peak pumping capacity to be installed at each bypass pumping site.

1.5 RESPONSIBILITIES OF CONTRACTOR

- A. The Contractor shall observe and comply with all Federal, State, and local laws, ordinances, codes, orders, and regulations which in any manner affect the conduct of the work, specifically as it relates to sewage and prevention of sewage spills. The Contractor shall be fully responsible for preventing sewage spills, containing any sewage spills, recovery and legal disposal of any spilled sewage, paying any and all fines, incurring and handling any penalties, claims, or liability arising from negligently causing or allowing a sewage spill, failure to prevent a sewage spill, or any violation of any law, ordinance, code, order, or regulation as a result of the spillage.

**VALLECITOS WATER DISTRICT
SECTION 02303 – BYPASS PUMPING**

PART 2 – PRODUCTS

2.1 EQUIPMENT

- A. All equipment and tools used for sewer bypassing shall be designed to prevent any and all sewage leaks or spills.
- B. All equipment used as part of the bypassing system shall not cause a significant noise impact to the community in accordance with local noise ordinances. If noise complaints from residents occur due to the Contractor's activities, the Contractor shall immediately replace the noise generating equipment or reduce the noise generated with mitigating devices to the satisfaction of the District.
- C. Pumps
 - 1. Pumps shall be specifically intended for use with raw sewage and shall be capable of passing a 3-inch diameter solid. All pumps shall be fully automatic self-priming units that do not require the use of foot valves or vacuum pumps for priming. The pumps may be electric or diesel powered that comply with noise requirements. Noise levels shall not exceed 85 dBA at 50 feet. All pumps shall be constructed to allow dry running for long periods of time to accommodate the cyclical nature of sewage flows. Provide floats and stop controls for each system. If diesel power is utilized, provide sufficient fuel to run bypass for the entirety of the bypass period.
 - 2. Provide not less than one standby pump of each size. The stand-by pumps shall be on-line but isolated from the discharge pipeline by valves.
- D. Discharge Piping
 - 1. Temporary discharge piping shall be HDPE. Other piping material may be used with approval by the District Engineer or their designee.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The Contractor shall observe and comply with the District policy of "ZERO SPILLS".
- B. Install the bypass pumping system in accordance with the Approved Plan.
- C. Perform hydrostatic pressure test of the system 24-hours prior to actual operation in the presence of the District Engineer or their designee. The Contractor shall demonstrate, to the satisfaction of the District, that both the primary and backup bypass systems are fully functional and adequate before any construction activity is allowed to commence.
- D. Plugging and blocking of sewage flows shall incorporate a primary and secondary plugging device. Remove the blockage when the connection to the new sewer is accomplished.

**VALLECITOS WATER DISTRICT
SECTION 02303 – BYPASS PUMPING**

Coordinate the removal so that the blockage is removed immediately after the pumps have lowered the water level to minimum in the manhole or sump.

- E. Exercise caution when working inside a manhole, sump, or pipeline. Implement the CSEP on all entries.
- F. The Contractor shall continuously monitor the flow levels downstream and upstream of the construction location to detect any possible failure that may cause a sewage backup and spill. The Contractor shall include the means and methods of monitoring the flow in their Sewer Bypassing Plan.
- G. Pipelines shall be located out of streets and shall include digging shallow trenches, burying the pipe, and paving with cold patch. Once completed with bypass pumping the piping shall be removed and the site repaired to the satisfaction of the District and the jurisdictional agency.
- H. Restore the area to the condition prior to installation of the bypass pumping piping and equipment.
- I. Report any spills to the District Engineer or their designee immediately. Contractor is responsible to pay any clean-up costs incurred by the District and any fines levied by any agency associated with a spill from the bypass pumping.
- J. The bypass pumping system shall be manned at all times.
- K. The Contractor shall routinely inspect and maintain the bypass system, including the backup system.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 02315

JACKED CASING

PART 1 - GENERAL

A. Description

This section includes tunneling methods by jacked casing, directional drilling, or a tunnel boring machine, for highway, railroad, creek, and culvert crossings and other shallow depth tunnels, and carrier pipe installation.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or referenced in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- 1. Trenching, Backfilling, and Compacting: 02223
- 2. Concrete: 03300
- 3. Hydrostatic Testing of Pressure Pipeline: 15042

C. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the County of San Diego, the city having jurisdiction, or any other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

D. Alternative Methods/Shop Drawings

The contractor may submit an alternative detailed proposal in lieu of the methods and materials specified herein to jack or bore casing pipe at the locations shown on the plans. Any such proposal shall be presented to the District representative a minimum of 28 calendar days in advance of the work to allow adequate time for review, and must be in accordance with all the conditions set forth in the permits. Shop drawings shall be submitted for approval for casing pipe, carrier pipe, grout, spacers, end seals and cathodic protection.

E. Safety

The contractor shall obtain from the Division of Industrial Safety a classification for each bore exceeding 30-inches in diameter. It shall be the contractor’s responsibility to see that the work is done in conformance with the state requirements. It shall also be the contractor’s responsibility to

call the required safety meeting with representatives from the State Division of Industrial Safety prior to beginning the construction of each bore.

F. Scheduling

If the pipeline is not installed within the casing as a continuous operation following completion of jacking, then bulkhead the portals and backfill the approach trenches and later reopen them for pipe installation.

G. Line and Grade

1. The contractor’s attention is called to the fact that the casing pipe must be installed to the tolerances listed on the plans so as to permit the construction of the carrier pipe to the lines and grades shown on the plans. Casing pipe is to be surveyed to top of casing.
2. It is the contractor’s responsibility to choose a size of casing at or above the minimum specified, to insure that the jacking is done with a high degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans.

H. Design

It is the contractor’s responsibility to retain an engineer to design a casing that meets or exceeds the minimum specified, and to insure that the casing is compatible with the jacking machine, and the boring head used.

PART 2 – MATERIALS

A. Steel Casing

1. New steel casing pipe, unless otherwise approved by the District representative, shall be butt-welded sheets conforming to ASTM A 245, commercial grade or of plate conforming to ASTM A 283, Grade C, or ASTM A-36.
2. The minimum size and thickness of casing pipes for insertion of various sizes of carrier pipes shall be as described below, unless a larger or heavier wall casing pipe is required by the agency having jurisdiction over the road or railroad crossing:

Pipe Size (Inches)	Min. I.D./O.D.. Casing Size (Inches)	Min. Wall Thickness (Inches)
8	18” I.D.	1/4
12	24” O.D.	5/16
16	30” O.D.	3/8

3. It is the contractor's responsibility to retain a design engineer to choose a size of casing at or above the minimum specified, in order that the jacking may be done with a sufficient degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans. The contractor may select a greater thickness and diameter as convenient for method of work and loadings involved, as suitable for the site and as limited by possible interferences, but at no additional cost to District. If specified on the plans, provide 2-inch

grout connections spaced at the top and bottom for casing 30-inches and larger in diameter per plan detail.

Casing sections shall be joined by full-circumference butt welding in the field. Prepare ends of casings for welding by providing ¼-inch X 45 degree chamfer on outside edges.

B. Grout

1. Grout shall consist of Portland cement and water or of Portland cement, sand, and water; and all grout mixtures shall contain 2% of bentonite by weight of the cement.
2. Portland cement, water and sand shall conform to the applicable requirements of the concrete section (Section 03300), except that sand to be used shall be of such fineness that 100% will pass a standard 8-mesh sieve and at least 45%, by weight, will pass a standard 40-mesh sieve.
3. Bentonite shall be a commercially processed powdered bentonite, Wyoming type, such as Imacco-gel, Black Hills or approved equal.

C. Stainless Steel Spacers

Casing spacers shall be bolt on style with a two piece shell made of 304 stainless steel of a minimum 14 gauge thickness. Each shell section shall have bolt flanges formed with fins for added strength. Each connection flange shall have a minimum of three 5/16 inch 304 stainless bolts. The shell shall be lined with a ribbed PVC extrusion with a retaining section that overlaps the edge of the shell and prevents slippage. Bearing surfaces (runners) made from UHMW polymer with a static coefficient of friction of 0.11 - 0.13 shall be attached to support structures (risers). The runners shall be attached mechanically by 304 stainless fasteners that are inserted through the punched riser section and welded for strength. Risers shall be made of 304 stainless of a minimum 14 gauge. All risers over 2 inches in height shall be reinforced. Risers shall be welded to the shell. All metal surfaces shall be fully passivated. Casing spacers shall be as specified on the plans.

D. End Seal

End seals shall be virgin Buna-s or Buna-gis (styrene-butadiene) rubber with 316 stainless steel bands. End seal kits shall include a bottle of bonding cement. End seals shall be "Link Seal" or "PSI Model C" end seals.

E. Sacrificial Anodes for Cathodic Protection

1. Anodes for cathodic protection of steel casing shall be 2-inch by 2-inch by 60-inch high purity zinc anodes, bagged in calcium sulfate and bentonite backfill.
2. The anodes shall be cadwelded to the casing with No. 6 high molecular weight polyethylene (HMWPE) -covered, stranded copper lead wire.
3. Tracer wire or 2-station test stations shall be attached to the ends of the casing and shall extend to the surface in a valve can, marked as "test station".

PART 3 - EXECUTION**A. Sectional Shield or Jacking Head**

1. Fit a sectional shield or steel jacking head to the leading section of the casing. The shield or head shall extend around the outer surface of the upper two-thirds of the casing and project at least 18 inches beyond the driving end of the casing. It shall not protrude more than ½ inch beyond the outer casing surface.
2. Anchor the head to prevent any wobble or alignment variation during the jacking operation.
3. To avoid loss of ground outside the casing, carry out excavation entirely within the jacking head and not in advance of the head. In general, excavated material shall be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.
4. A jacking band to reinforce the end of the pipe receiving the jacking thrust will be required.

B. Jacking Pit

1. The approach trench for jacking or boring operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the casing portal.
2. Place in the approach trench of jacking pit and firmly bed on the required line and grade heavy guide timbers, structural steel, or concrete cradle of sufficient length to provide accurate control of jacking alignment. Provide adequate space to insert the casing lengths to be jacked. Anchor the timbers and structural steel sections to ensure action of the jacks in line with the axis of the casing. Place a timber or structural steel bearing block between the jacks and the end of the casing to provide uniform bearing upon the casing end evenly distribute the jacking pressure.
3. Provide bracing, shoring and ladders necessary to meet trench safety requirements. Confined space testing may be required as conditions dictate.

C. Control of Alignment and Grade

Control the application of jacking pressure and excavation of material ahead of the advancing casing to prevent it from becoming friction bound or deviating from required line and grade, as detailed in the plans. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance necessary to prevent binding in order to avoid settlement or possible damage to overlying structures or utilities.

D. Grouting

Immediately after completion of the jacking or boring operation, lean grout shall be injected through the grout connections of casings 30-inches and larger in a manner that will completely fill all voids outside the casing pipe resulting from the jacking or boring operation. The lean grout shall consist of one part Portland cement, four parts sand, and sufficient water to produce a workable mixture. Grout pressure is to be controlled so as to avoid deformation of the casing and/or avoid movement of the surrounding ground. Sand for grout to be placed outside the casing shall be of

such fineness that 100% will pass a No. 8 sieve and not less than 35% will pass a No. 50 sieve. After completion of grouting, the grout connections shall be closed with cast-iron threaded plugs.

E. Installation of Carrier Pipe

1. The carrier pipe shall be pushed into the casing pipe using stainless steel casing spacers, which shall be sized to restrain the pipe from moving within the casing. If the casing has deviated from the design line and grade; specifically fabricated casing spacers may be used to correct the problem.
2. The casing pipe spacers shall be placed so as to support all of the carrier pipes within two feet or less of the end of the casing pipe. Unless noted otherwise in the plans, casing pipe spacers shall be placed at a minimum of one at the bell end and one at the center of each length of pipe.
3. Before sealing the carrier pipe ends, the carrier pipe shall pass an initial pressure test per Section 15042 or leakage test per Section 15043.

F. Sand Backfill for Annular Space in Jacked Casing

1. Use air-blown sand to fill the annular space between the casing and the carrier pipe unless otherwise required by the agency having jurisdiction over the road or railroad crossing.
2. Furnish the necessary sand, air compressor, hoses, pressure gauges, valves, and fittings for the filling operation.
3. Air blown sand shall conform to the requirements for imported sand in Section 02223. Sand shall be free of lumps when put into the hopper. Sand shall be of a consistency to flow unimpeded and completely fill all voids.
4. Place a bulkhead for retaining the sand in the annular space between the casing and the carrier pipe at each end of the jacked casing. At the start of the sand fill operation, extend the sand discharge pipe from the placing equipment, through the inside of the casing, and to the bulkhead at the remote end of the casing. The method used to place the sand shall be such to ensure complete filling of the annular space. During placement, position the sand discharge pipe so that its discharge end shall be kept well buried in the sand at all times after the sand has been built up over the crown of the pipe at the remote end of the section being filled. Install a riser pipe suitable for a vent in the casing adjacent to the bulkhead at the near end of the casing. Plug the vent pipe with grout upon completion of sand filling.

G. Sealing Ends of the Casing

The ends of the casing pipe shall be sealed with a rubber shroud, held in place with stainless steel straps, as shown on plan details. The diameters and lengths of the end seals shall be sized to fit each casing pipe and carrier pipe to assure a positive barrier to backfill debris and seepage.

H. Installing Sacrificial Anodes for Cathodic Protection

1. One sacrificial anode shall be buried at each end of the casing.
2. Lead wire shall be cadwelded to the casing in accordance with manufacturer's specifications.
3. Cover each weld with Royston "Handy Cap."
4. Each anode shall be saturated with 20 gallons of water, prior to backfill of the trench.

I. Closing the Jacking Pit

After jacking equipment and muck from the tunnel have been removed from the approach trench of jacking pit, prepare the bottom of the jacking pit as a pipe foundation. Remove all loose and disturbed material below pipe grade to undisturbed earth and recompact the material in accordance with Section 02223.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 02701

INSTALLATION OF GRAVITY SEWER PIPELINES

PART 1 - GENERAL

A. Description

This section describes the installation of gravity sewer pipelines fabricated of vitrified clay pipe (VCP), polyvinyl chloride (PVC) and Ductile Iron Pipe (DIP).

B. Related Work Described Elsewhere

1.	Trenching, Backfilling and Compacting:	02223
2.	Jacked Casing:	02315
3.	Vitrified Clay Pipe:	02710
4.	PVC Gravity Sewer Pipe:	02715
5.	Concrete:	03300
6.	Precast Concrete Manholes and Manhole Bases:	03461
7.	Leakage and Infiltration Testing:	15043
8.	Ductile Iron Pipe and Fittings:	15056

C. Submittals

1. Pipe material type, specifications and manufacturer
2. Fittings material, specifications and manufacturer
3. Appurtenances

PART 2 - MATERIALS

A. Installation Material

Refer to Section 02710, Vitrified Clay Pipe and Section 02715, PVC Gravity Sewer Pipe for material requirements.

B. Piping Schedule

Unless noted otherwise on the plans or in the specifications, pipe shall be furnished in accordance with the following materials schedule.

DIAMETER	GRAVITY SEWER
4-inch through 12-inch	PVC SDR-35
14-inch through 36-inch	PVC SDR-35 or C-905 DR-14 DIP with polyethylene lining
Notes: PVC SDR-35 - PVC gravity sewer pipe per Section 02715. PVC C-905 per Section 15064 DR-14 DIP - Ductile iron pipe per Section 15056.	

PART 3 - EXECUTION

A. Delivery and Temporary Storage of Pipe at Site

1. Onsite Storage Limitation: Onsite pipe storage shall be limited to a maximum of one week, unless exception is approved by District. Pipe to be placed on Dunnage.
2. Care of Pipe: At times when the pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hours as well as overnight. In no event shall the sewers be used as drains for removing water which has infiltrated into the construction trenches.
3. All existing facilities shall be potholed to verify the top, bottom and location for potential conflicts. Information to be submitted to the District's Inspector prior to the installation of the new sewer line. No Inspectors will be provided without pothole information.
4. Sewer lines shall be staked at 25 foot intervals. Stakes to include stationing, offset distance and IE cuts. Manholes to be staked at ins and outs including line stakes. Sewer lateral staked with IE cut and line stake at property line.

B. Handling of Pipe

1. Moving Pipe: Pipes shall be lifted with handling beams or wide belt slings as recommended by the pipe manufacturer. Cable slings shall not be used. Pipe shall be handled in a manner to avoid damage to the pipe. Pipe shall not be dropped or dumped from trucks or into trenches under any circumstances.
2. Inspection of Pipe: The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench.

C. Placement of Pipe in Trench

1. General: All pipe shall be laid without a break, upgrade from structure to structure, with the bell ends of the pipe upgrade. Pipe shall be laid to the line and grade given so as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. Manufacturer label to be placed facing up (Top).
2. Trench Excavation: Dewatering, excavation, shoring, sheeting, bracing, backfill material placement, material compaction, compaction testing, and pipe laying requirements and limitations shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting.
3. Pipe Bedding Thickness: Unless shown otherwise on the drawings, pipe bedding material shall be 3/4-inch crushed rock for PVC pipe and Sand for DIP as specified in Section 02223, Trenching, Backfilling, and Compacting.
4. Subgrade at Joints: At each joint in the pipe, the pipe subgrade shall be recessed in firm bedding material so as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel.
5. Cleaning: The interior of the sewer pipe shall be cleaned of all dirt and superfluous materials as the work progresses.
6. Joints: The mating surfaces of the pipe to be joined shall be wiped clean of all dirt and foreign matter and a lubricant applied that is approved by the pipe manufacturer. Then, with the surfaces properly lubricated, the spigot end of the pipe shall be positioned inside the bell and the joint shoved home. No mechanical means will be allowed unless approved by the District Representative.

For larger diameter pipe where a lever attachment is required, the necessary precautions shall be taken to insure an undamaged pipe installation.
7. Pipe Alignment: Unless specified otherwise, pipeline line and grade shall be as shown on the plans. Grade shall be measured along the pipe invert.
8. Pipe Curvature: Construction of curved reaches of sewer is not permitted.
- 9.
10. Laterals: DIP and PVC wyes, and other types of branches shall be furnished and installed along with the DIP or PVC sewer. Wyes sized as specified on the plans shall be installed for all sewer house connections and for future sewer house connections as shown on the plans. The longitudinal barrel of branch fittings, to be placed in line and grade with the sewer mains, shall be of the same diameter, quality, and type as specified herein for sewer installations. Earthwork and bedding for branches shall conform to the applicable provisions set forth for in the specification for each pipe material. Unless otherwise specified, the branch of wye fittings shall be inclined upward at an angle not greater than 45 degrees from a horizontal line. No wye for sewer house connection branch shall be placed closer than 5 feet downstream of the centerline of any structure. The contractor shall place a support of graded crushed rock or imported sand under every wye branch when installed. The support shall be placed in accordance with VWD standard drawings S-4 and S-5, the detail on the plans, or as specified in Section 02223, Trenching, Backfilling, and Compacting.
11. Backfill: Backfill shall be placed and compacted in accordance with the requirements of Section 02223, Trenching, Backfilling and Compacting, and as shown on VWD standard

drawing S-12. Backfill within the pipe zone shall be ¾-inch crushed rock for PVC pipe and VCP.

D. Manholes and Manhole Bases

Precast concrete manholes and manhole bases shall be constructed in accordance with Section 03461, Precast Concrete Manholes and Manhole Bases, per VWD standard drawing S-1. VWD standard drawings S-2 and S-3 detail drop manholes.

E. House Laterals

1. Locations: House laterals and wye branch fittings of the size indicated on the plans shall be installed at the locations shown on the plans. Laterals shall be a minimum of five feet (5') deep from finish grade at the property, easement, or right of way line.
2. Plugged Branches: All branch fittings that are to be left unconnected shall be extended to the right of way or easement limits and plugged and visibly marked at the surface.
3. Fittings: House laterals shall be joined to wye branch fittings at the sanitary sewer main as set forth above by eighth bends. All eighth bends and sixteenth bends are a part of the house lateral sewerline.
4. Alignment: Where possible, all house laterals shall run perpendicular to the sewer main from the main to the property line, and all house laterals shall be bedded the same as the sewer main into which they connect.
5. Plugged House Laterals: All house laterals shall be plugged with an approved stopper in the socket of the last joint of each house lateral so that it will withstand the internal pressure during the test for leakage, but also in such a manner that it may be removed without injury to the socket.
6. Marking: The contractor shall mark the location of each house lateral at its upper end by chiseling a letter "S" 1-1/2-inches high on the face of the curb.
7. Mainline Testing: The mainline sewer shall have passed final testing per Section 15043 before the laterals may be connected to the main.

F. Cleanouts

Cleanouts are not permitted in the main line except for District approved locations where the main will be extended within a subdivision. All sewer mains shall terminate at a manhole. Property line cleanouts, when required, shall conform to VWD standard drawing S-7.

G. Connections to Sewer

1. General: All connections into existing sewerlines shall be made with a wye which is cut in to the main and installed per VWD standard drawing S-4 or S-5.

Alternate Method, as approved by District

1. Scoring and Tapping: The sewerline to be saddled shall be scored to the approximate shape of wye or tee and shall be cut with a hole cutter. The tap holes shall be cleanly machined and may be further worked by hand to provide a true and neat opening for the collar wye or tee saddle. Pipe damaged during this operation shall be repaired or

replaced. The District representative shall be the sole judge as to the method of repair or replacement.

2. Securement: A cut in wye shall be used matching existing pipe material or approved by the District Representative.
3. Encasement: After the connection has set sufficiently long for the epoxy resin to cure, the District will inspect the connection and, if satisfactory, the contractor shall encase the fitting with Class B Portland cement concrete to the limits indicated on VWD standard drawings S-4 or S-5.
4. Cleaning: The saddling operation shall be carried out in a workmanlike manner. Chips, dirt, epoxy mortar, and concrete shall be kept out of the sewer line being saddled. If directed by the District representative, the reach of sewer main saddled shall be flushed and cleaned using a hydrocleaner or vacuum truck.

H. Installation Within Jacked Casing

1. General: Sewer pipe shall be installed within the casing pipe to the lines and grades shown on the plans and in accordance with Section 02315, Jacked Casing.
2. Pipe Support: The carrier pipe shall be supported on cradles such as “PSI” spacers, Model C8G-2, or approved equal before backfilling, in such a manner as to relieve the pipe and bells from any bearing loads.
3. Fill Within the Casing: The annular space between the casing and the carrier pipe shall be backfilled per Section 02315, Jacked Casing.
4. Testing: Before backfilling as specified above, the sewer carrier pipe shall pass an initial test for leakage as provided in Section 15043, Leakage and Infiltration Testing.

I. Pipe Anchorage (For Pipelines Having a Diameter of 10-Inches or Less)

1. General: Concrete slope anchors shall be installed where shown on the plans in accordance with Section 03300 and design details wherever the profile of the ground surface above the sewer main exceeds 20 percent, and where no pavement or other surfacing is to be laid over the facility. The Engineer of Work shall verify adequacy and design of slope anchors. Slope anchors for pipelines over 10-inches shall be designed by a registered engineer.
2. Dimensions: Anchors shall be a minimum of 12-inches thick and shall extend at least 12-inches into undisturbed material on each side of the trench as excavated.
3. Slope Protection: Cemented rubble and concrete surface slope protection shall be a minimum of 4-inches thick.
4. Spacing: Spacing between pipe anchors shall not exceed the distances shown on the plans and details.
5. Reinforcement for Concrete Anchors: Anchors constructed of cast-in-place reinforced concrete shall have No. 4 reinforcing bars placed at 6-inches on center each way in the center of the anchor thickness. The bars shall extend full length and height of the anchor.

6. Reinforcement for Concrete Masonry Unit Anchors: Reinforced hollow masonry units shall have all cells filled solidly with grout. A No. 4 reinforcing bar shall be placed vertically in each row of cells and No. 9 gage wall mesh shall be placed in each horizontal joint. In addition, a bond beam shall be placed at the top with two No. 4 bars.

J. Concrete Encasement

Unless shown otherwise, concrete for encasement shall be unreinforced or unformed or rough formed, and of the class as designated on the plans. Concrete shall be in accordance with Section 03300, Concrete. Concrete used for encasing, cradling, bedding, cover for pipe, or other objects shall be used as shown on the Plans, on VWD standard drawings, or as directed by the District representative.

K. Cleaning

Before testing each pipe shall be thoroughly cleaned from manhole to manhole with a Vac Truck.

L. Mandrel Test for PVC Gravity Sewers 10-inch in Diameter and Smaller

Following placement and compaction of backfill for all utilities, and prior to the placement of permanent pavement, all sewer mains shall be cleaned and mandrelled to verify that the pipeline is free from obstructions (deflections, joint offsets, lateral pipe intrusions, etc.). A rigid mandrel, with a circular cross section having a diameter of at least 95 percent of the specified inside pipe diameter, shall be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe. Obstructions encountered by the mandrel shall be repaired and the pipeline section retested.

M. Leakage and Infiltration Test

The pipe, manholes, and other appurtenances shall be tested for leakage (and infiltration if required by the District) Leakage and Infiltration Testing after all utilities are installed.

N. Closed-Circuit Television Inspection

1. General: In addition to the regular leakage and infiltration test, the entire length of all new sewer lines shall be inspected using closed-circuit television equipment. The inspection shall be conducted after the line has been successfully tested and prior to paving. The inspection shall be conducted in the presence of the District representative.
2. Responsibility: The Contractor shall perform the inspection. The District will perform the 1-year warranty camera inspection.
3. Notification: Sewer line inspection scheduling shall be received by the District representative a minimum of five (5) working days in advance of the inspection date.
4. Flushing: Each sewer section shall be flushed with water being introduced at the upstream manhole of each section prior to video recording.
5. Stationing: The video shall show manhole numbers and footage to wyes corresponding to the plans.
6. Submittal: The videotape shall be in digital format and submitted to the District with two (2) of the computer printouts showing manhole numbers, distances to wyes, and distance

between manholes prior to occupancy release for the dwelling units being served by the sewer. The tape and printout shall be labeled with the project name, tract number, street names, and contractor's name and shall list the location of any defects, dirt, low spots, etc. in the pipe.

7. Repair of Defects: Even though the sewer line may have successfully passed the leakage and infiltration tests, any defects or low spots in the line shall be repaired to the satisfaction of the District. After the 1-year warranty inspection, any defects or low spots in the line shall be repaired to the satisfaction of the District.
8. Acceptance: Sewer sections having standing water or defects shall be repaired by the contractor prior to District acceptance and prior to occupancy release for the dwelling units, industrial site or commercial site being served by the sewer. Standing water in the system will not be allowed. Determination of "standing water" shall be at the sole discretion of the District.

O. Final Inspection

After paving has been completed and all manholes raised to grade, a final visual inspection shall be made. The necessary labor shall be furnished to assist the District representative in making the final inspection. Additional balling may be required if the lines are dirty, even though lines were previously balled. The contractor shall furnish a responsible person or supervisor for the final inspection to remove manhole covers and to note any corrections required by the District representative in order to obtain final approval. Final District inspection shall be requested through the District representative by giving at least two day's notice.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 02715

PVC GRAVITY SEWER PIPE

PART 1 - GENERAL

A. Description

This section includes materials, testing, and installation of polyvinyl chloride (PVC) gravity sewer pipe and fittings.

B. Related Work Specified Elsewhere

- | | | |
|----|--|-------|
| 1. | Trenching, Backfilling and Compacting | 02223 |
| 2. | Jacked Casing: | 02315 |
| 3. | Installation of Gravity Sewer Pipelines: | 02701 |
| 4. | Concrete: | 03300 |
| 5. | Precast Concrete Manholes and Manhole Bases: | 03461 |
| 6. | PVC Distribution Pipe: | 15064 |

C. Submittals

1. Provide materials list showing material of pipe and fittings with ASTM references and grade.
2. Provide certificates of compliance with all standards referenced in this section.

D. Application

PVC SDR 35 shall be used for gravity sewer mains up to and including 12-inch in diameter, except as specifically called out on the District approved project plans. PVC gravity sewer pipe larger than 12-inch diameter, when approved for use by the District, shall conform to AWWA C905.

E. Sewer Force Mains

PVC sewer force mains shall be constructed in accordance with the requirements for PVC Distribution Pipe, Section 15064.

F. Inverted Siphons

Inverted siphons will be permitted only at those locations approved by the District.

PART 2 - MATERIALS**A. Pipe and Fittings**

1. ASTM Requirements: Pipe, fittings, couplings, and joints shall be in conformance with the size, material and performance requirements of ASTM D 3034, SDR 26, SDR 35, and shall have gasketed joints. Pipe shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13364-B as defined in ASTM D 1784. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C. All pipe shall be of solid wall construction with smooth interior and exterior surfaces.
2. Manufacturer's Testing Certification: During production of the pipe, the manufacturer shall perform the specified tests for each pipe marking. A certification by the manufacturer indicating compliance with specification requirements shall be delivered with the pipe. The certification shall include the test result data.
3. Pipe Marking: All pipe, fittings, and couplings shall be clearly marked at an interval not to exceed 5-feet as follows:
 - a. Nominal pipe diameter
 - b. PVC cell classification
 - c. Company, plant, shift, ASTM, SDR, and date designation
 - d. Service designation or legend

For fittings and couplings, the SDR designation is not required. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.
4. Additional Pipe Tests Following Delivery: When pipe is delivered to the jobsite, the District representative may require additional testing to determine conformance with the requirements of pipe flattening, impact resistance, pipe stiffness, and extrusion quality. When testing is required, one test pipe shall be selected at random by the Director of Engineering from each 1,200 feet or fraction thereof of each size of pipe delivered to the jobsite but not less than one test pipe per lot. A lot shall be defined as pipe having the same identification marking. The length of specimen for each selected pipe shall be a minimum of 8-feet.
5. Pipe Retest: Pipe which is not installed within 120 days of the latest test shall not be used without prior approval of the District representative.
6. Fitting and Coupling End Configurations: The socket and spigot configurations for fittings and couplings shall be compatible with those used for the pipe.
7. Manufacturers: Pipe shall be as manufactured by J-M Manufacturing Ring-Tite, Vinyltech, P W Pipe, or approved equal. Fittings shall be as manufactured by J-M Manufacturing, GPK Products, or approved equal.

B. Gaskets for PVC Pipe

1. General: Unless otherwise specified, gaskets shall be manufactured from a synthetic elastomer, and shall be extruded or molded and cured in such a manner as to be dense, homogeneous and of smooth surface, free of pitting, blisters, porosity, and other

imperfections. The compound shall contain not less than 50 percent by volume of first-grade synthetic rubber. The remainder of the compound shall consist of pulverized fillers free of rubber substitutes, reclaimed rubber, and deleterious substances. The tolerance for any diameter measured at any cross section shall be $\pm 1/32$ -inch (.8mm).

2. Gasket Material Requirements: When required by the District representative, the contractor shall furnish test samples of gaskets from each batch used in the work. Gasket material shall meet the following requirements:

Property	Value	ASTM Test Method
Tensile Strength (min. psi)	2,000	D 412
Elongation at break (% min.)	350	D 412
Shore durometer, Type A (Pipe manufacturer shall select value suitable for type of joint)	40 to 65*	D 2240
Compression set (constant deflection) max % of original deflection	16	D 395
Compression strength after oven aging (96 hours, 158°F {70°C}) % of tensile strength before aging	80	D 573
Increase in Shore durometer hardness after oven aging. Maximum increase over original Shore durometer	10	D 2240
Physical requirements after exposure to ozone concentration (150 pphm, 70 hours, 140°F {40°C}), 20% strain)	No Cracks	D 1149

*This applies only to the sealing component of the gasket.

3. Splices: No more than one splice will be permitted in a gasket. A splice shall be made by applying a suitable cement to the ends and vulcanizing the splice in a full mold. The splice shall show no separation when subjected to the following tests:
4. Elongation Test: The part of the gasket which includes the splice shall withstand 100% elongation with no visible separation of the splice. While in the stretched position, the gasket shall be rotated in the spliced area minimum of 180 degrees in each direction in order to inspect for separation.
5. Bend Test: The portion of the unstretched gasket containing the splice shall be wrapped a minimum of 180 degrees and a maximum of 270 degrees around a rod of a diameter equal to the cross section diameter of the gasket.

PART 3 - EXECUTION

A. Related Installation Specification

PVC gravity sewer pipe shall be installed in accordance with the requirements of Section 02701, Installation of Gravity Sewer Pipelines.

END OF SECTION

**VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section describes concrete materials, mixing, placement, form work, reinforcement and curing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 02223 – Trenching, Backfilling, and Compacting

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
 - 1. ASTM C33 Concrete Aggregates
 - 2. ASTM C94 Ready-Mixed Concrete
 - 3. ASTM C150 Portland Cement
 - 4. ASTM C494 Chemical Admixtures for Concrete
 - 5. ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 6. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
 - 7. ASTM A1064 Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 8. Concrete Reinforcing Steel Institute – “Recommended Practice for Placing Reinforcing Bars”
 - 9. Concrete Reinforcing Steel Institute – “Manual of Standard Practice”
 - 10. COE CRD C621 Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)

1.4 SUBMITTALS

- A. Delivery Tickets: Where ready-mix concrete is used, the Contractor shall furnish delivery tickets at the time of delivery for each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, or cement,

**VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE**

sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.

PART 2 – PRODUCTS

2.1 CONCRETE

- A. All Portland cement concrete shall conform to the provisions of Section 201 of the SSPWC (Green Book), except as herein modified.
- B. Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water proportioned and mixed to produce a smooth dense workable mixture. It can of the ready-mix variety as produced by any reliable ready-mix concrete firm.
- C. Portland cement, including Portland cement used in precast products, shall be Type II & V conforming to ASTM C150.
- D. In certain circumstances, rapid-setting concrete may be required. Accelerating admixtures shall conform to ASTM C494 and may be used in the concrete mix as permitted by the District Engineer or their designee. Calcium chloride shall not be used in concrete.
- E. Ready-mixed concrete shall be delivered to the site of the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the District Engineer or their designee.
- F. Concrete mix design shall conform to ASTM C94. Use classes of concrete as described in the following table:

Class	Type of Work	28-Day Compressive Strength (in psi)	Minimum Cement Content (in lbs. Per C.Y.)
A (560-C-3250) *	Concrete for encasements, plugs, slope protection	3,000	564 (6 sack)
B (450-C-2000) *	Concrete for anchors, manhole cover ring, cutoff walls, cradles and miscellaneous unreinforced concrete	2,000	470 (5 sack)
C (650-CW-4000) *	Concrete for thrust blocks, manhole bases, all reinforced structures, piers, and vaults, and precast manhole and vault sections	4,000	677 (7 sack)

*concrete class per SS PWC

**VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE**

2.2 REINFORCING STEEL

- A. Reinforcement shall conform to ASTM A615, Grade 40.
- B. Fabricate reinforcing steel in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.
- C. Deliver reinforcing steel to the site bundled and tagged with identifying tags.
- D. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

2.3 WELDED WIRE FABRIC

- A. Welded wire fabric shall conform to ASTM A1064.

2.4 TIE WIRE

- A. Tie wire shall be 16-gage minimum, black soft annealed.

2.5 BAR SUPPORTS

- A. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.6 FORMS

- A. Forms shall be accurately constructed of clean lumber and shall be of sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure and tamping without deflection from the prescribed lines.
- B. The surface of forms against which concrete is placed shall be smooth and free from irregularities, dents, sags, or holes. The surface shall leave uniform marks conforming to the general lines of the structure.

2.7 CURING MATERIALS

- A. All curing compounds shall be white pigmented and resin based. Sodium silicate compounds shall not be allowed. Water based curing compounds shall be Hunt Process Corporation or equal.

2.8 BONDING AGENT

- A. The epoxy bonding agent shall be an epoxy-resin-based product intended for bonding new concrete to hardened concrete and shall conform to ASTM C881. The bonding agent shall be Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Concrete Liquid (LPL), as manufactured by Master Builders; BurkEpoxy MV as manufactured by The Burke Company; or equal.

**VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE**

2.9 GROUT

- A. Cement Grout: Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28-days shall be 4000 psi.
- B. Non-Shrink Grout:
 - 1. Non-shrink grout shall be prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.
 - 2. Class A non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C621.
 - 3. Application: Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at locations where grout is specified on the Approved Plans.

2.10 MORTAR

- A. Cement mortar shall consist of a mixture of Portland cement, sand and water. One part cement and two parts sand shall first be combined, and then thoroughly mixed with the required amount of water.

2.11 EPOXY MORTAR

- A. Epoxy mortar shall be a two-component, cement-based product specifically designed for structurally repairing damaged concrete surfaces. The repair mortar shall exhibit the properties of high compressive and bond strengths and low shrinkage. A medium-slump repair mortar shall be used on horizontal surfaces, and a non-sag, low-slump repair mortar shall be used on vertical or overhead surfaces. The prepared mortar shall wet the contact surface and provide adhesion, or a bonding agent shall be applied prior to placement. SikaTop 122 or approved equal.

PART 3 – EXECUTION

3.1 FORM WORK

VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE

- A. The Contractor shall notify the District Engineer of their designee a minimum of one working day before the placement of concrete to enable the District to check the form lines, grades, and other required items for approval before placement of concrete.
- B. Unless otherwise indicated on the plans, all exposed sharp edges shall be chamfered with at least 3/4- by 3/4-inch triangular fillets.
- C. Before placing concrete, the form surface shall be clean and coated with form oil of high penetrating qualities.
- D. The forms shall be braced to provide sufficient strength and rigidity to hold the concrete and to withstand the necessary fluid pressure and consolidation pressures without deflection from the prescribed lines.

3.2 REINFORCEMENT

- A. Place reinforcing steel in accordance with the current edition of “Recommended Practice for Placing Reinforcing Bars”, published by the Concrete Reinforcing Steel Institute.
- B. All reinforcing steel shall be of the required sizes and shapes and placed where shown on the drawings or prescribed by the District Engineer of their designee.
- C. Do not straighten or bend reinforcing steel in a manner that will injure the material. All steel shall be cold bent - do not use heat. Do not use bars with bends not shown on the drawings.
- D. All bars shall be free from rust, scale, oil, or any other coating which would reduce or destroy the bond between concrete and steel.
- E. Position reinforcement steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specific concrete coverage. Bars, additional to those shown on the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided and paid for by the Contractor.
- F. Place reinforcement a minimum of 2-inches clear of any metal pipe or fittings.
- G. The reinforcement shall be so secured in position that it will not be displaced during the placement of concrete.
- H. All reinforcing steel and wire mesh shall be completely encased in concrete.
- I. Reinforcing steel shall not be welded unless specifically required by the Approved Plans or otherwise directed by the District Engineer or their designee.
- J. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE

- K. Minimum lap for all reinforcement shall be 40 bar diameters.
- L. Place additional reinforcement around the pipe or opening as indicated in the drawings.
- M. Wire mesh reinforcement is to be rolled flat before being placed in the form. Support and tie wire mesh to prevent movement during concrete placement.
- N. Extend welded wire fabric to within 2-inches of edges of the slab. Lap splices at least 1-1/2 courses of fabric and a minimum of 6-inches. Tie laps and splices securely at ends and at least every 24-inches with 16-gage black annealed steel wire. Pull the fabric into position as the concrete is placed by means of hooks, and work concrete under the steel to ensure that it is at the proper distance above the bottom of the slab.

3.3 EMBEDDED ITEMS

- A. All embedded bolts, dowels, anchors, and other embedded items shall be held correctly in place in the forms before concrete is placed.

3.4 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS TO EXISTING STRUCTURES

A. Hole Preparation:

1. The hole diameter shall be as recommended by the epoxy manufacturer, but shall be no larger than 1/4-inch greater than the diameter of the outer surface of the reinforcing bar deformations.
2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.
6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.

- B. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

- C. Adhesive for concrete shall be Hilti RE 500-SD or approved equal.

VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE

- D. Drilled reinforcing dowels shall only be used where specifically detailed on the Approved Plans or when permitted by the District Engineer or their designee.

3.5 MIXING AND PLACING CONCRETE

- A. No concrete shall be placed except in the presence of duly authorized representative of the District. The Contractor shall notify the District in writing at least 24 hours in advance of placement of any concrete. Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the Contractor.
- B. All concrete shall be placed in the forms by mechanical means before taking its initial set.
- C. No concrete shall be placed in water except with permission of the District Engineer of their designee.
- D. As the concrete is placed in the forms, or in excavations to be filled with concrete, it shall be thoroughly settled and compacted throughout the entire layer, which is being consolidated, into a dense, homogenous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, by internal vibration and tamping bars.
- E. Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 8 feet below the ends of ducts, chutes, or buggies.
- F. All concrete surfaces upon which or against which the concrete is to be placed, and to which new concrete is to adhere, shall be roughened, thoroughly cleaned, wet, and grouted before the concrete is deposited.
- G. The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees F for all other sections. The Contractor shall employ effective means as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F at no additional cost to the District.
- H. Where the District allows casting new concrete against old concrete, an epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations.

3.6 CONCRETE FINISHING

**VALLECITOS WATER DISTRICT
SECTION 03300 – CONCRETE**

- A. Immediately upon the removal forms, all voids shall be reamed with suitable toothed reamers, so as to leave the surfaces of the holes clean and rough, and neatly filled with dry-packed cement grout.
- B. The surfaces of concrete to be permanently exposed to view must be smooth, free from projections, and thoroughly filled.
- C. Exposed surfaces of concrete not finished against forms, such as horizontal or sloping surfaces, shall be screened to a uniform surface and worked with suitable tools to a smooth finish.

3.7 PROTECTION AND CURING OF CONCRETE

- A. All concrete shall be cured for not less than 7 days. No material shall be deposited against concrete structures until the concrete has reached its designated compressive strength in accordance with this Standard Specification.
- B. The Contractor shall protect all concrete against damage, including damage due to rain. Exposed surfaces of new concrete shall be protected from the direct rays of the sun and from frost by being kept damp for at least two weeks after the concrete has been placed, or by using Hunt Process White Pigmented Concrete Curing Compound or approved equal.

3.8 GROUTING PROCEDURES

- A. Prepackaged Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Base concrete must have attained its design strength before grout is placed, unless authorized by the District Engineer or their designee.
- C. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

****END OF SECTION****

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes materials, testing, and installation of precast concrete manholes, manhole bases, manhole frames, and covers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 02223 - Trenching, Backfilling, and Compacting
 - 2. Section 03300 – Concrete
 - 3. Section 09801 - Manhole Protective Lining
 - 4. Section 15042 - Leakage and Infiltration Testing

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
 - 1. ASTM A48 Gray Iron Castings
 - 2. ASTM A536 Ductile Iron Casting
 - 3. ASTM C478 Precast Reinforced Concrete Manhole Sections

1.3 SUBMITTALS

- A. Submit manufacturer’s catalog and test data on precast concrete manholes, frames, and covers along with installation recommendations for inlet and outlet seals and watertight caulking. Show dimensions and materials of construction by ASTM reference and grade. Show manhole cover lettering and pattern.

1.4 PROJECT CONDITIONS

- A. Any proposed work inside an existing manhole that is part of a sewage system in service, shall not be undertaken until all the tests and safety provisions of Article 4, Section 1532 “Confined Spaces” State of California Construction Safety Orders have been made.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

- A. Precast reinforced concrete manholes shall comply with ASTM C478.
- B. Manhole components shall be designed for H-20 highway loads and site soil conditions.
- C. Precast reinforced concrete manhole risers and tops shall be constructed of Class C concrete with Type II and Type V cement per the Standard Specifications.
- D. Manholes shall be fabricated only from eccentric taper sections and standard cylinder units of the proper internal diameter.
- E. Unless noted otherwise, minimum diameter and minimum wall thickness of manholes and manhole sections shall be as follows:

Sewer Main Diameter, inches	<u>Min.</u> Manhole Diameter, inches	Manhole Section Wall Thickness, inches
8 – 12	48	5
15 – 24	60	6
Greater than 24	96	9

At the District’s discretion, manhole diameter may be increased due to excessive depth of cover, which shall be measured from surface elevation to the lowest pipe invert.

- F. Manhole sections shall be cast without steps.
- G. Precast reinforced concrete manholes shall be manufactured by Mar-Con Products, or approved equal.

2.2 MANHOLE FRAMES AND COVERS

- A. Manhole frames and covers shall be three-piece and shall be made of ductile iron conforming to ASTM A536, Class 400, or cast iron conforming to ASTM A48, Class 30. Casting shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Frames and covers shall be of the traffic type, designed for H-20 loading.
- B. Each manhole cover shall be ground or otherwise finished so that it will fit in its frame without rocking. Frames and covers shall be matchmarked in sets before shipping to the site.
- C. Covers shall have the words: “VALLECITOS WATER DISTRICT” and “SEWER” cast thereon as shown on VWD Standard Drawings S-1, S-2, and S-3. No other lettering on the top side shall be permitted.
- D. Before leaving the foundry, castings shall be cleaned and subjected to a hammer inspection. Castings shall then be dipped twice in a preparation of asphalt or coal tar and oil applied at a temperature of not less than 290° F, not more than 310°F, and in such a manner as to form a firm and tenacious coating.

2.3 BACKFILL MATERIAL

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

- A. Crushed rock for manhole bedding, imported sand for backfill, and 2-sack slurry for backfill shall be in accordance with the Standard Specifications.

2.4 MANHOLE BASES

- A. Concrete used in pouring the manhole base shall be Class C concrete, Type V cement per the Standard Specifications.
- B. Sand collar water stop fitting shall be a watertight ring-type seal matching the material of the connecting pipe per the manufacturer's recommendations.

2.5 EPOXY MORTAR

- A. Epoxy grout shall be used in repairing existing manhole and manhole base surfaces per the Standard Specifications.

2.6 JOINT SEALING COMPOUND

- A. Joint sealing compound for manhole joints shall be a pre-formed, cold-applied, ready-to-use butyl sealant. Ez-Stik Premium, Pro-Stik, or approved equal.
- B. Where groundwater is present or possible under wet weather conditions, or as directed by the District Engineer or their designee, a hydrophilic waterstop shall be used for the joint sealing compound. Sika Swellstop Waterstop, or approved equal.

2.7 GROUT AND MORTAR

- A. Cement grout, non-shrink grout, and cement mortar for grade joints, patching the manhole interior, and setting manhole frames per the Standard Specifications.

2.8 PROTECTIVE LINING

- A. Protective lining shall be a 100% solid, non-solvented hydrid polyurethane coating per the Standard Specifications.

2.9 WATERPROOFING

- A. Waterproofing applied to the exterior of precast manhole sections prior to delivery to the jobsite shall be 16-24 mils of coal tar epoxy Tnemec 46H-413, Carboline Bitumastic No. 300M, or approved equal.
- B. Waterproofing applied to the exterior joints of precast manhole sections in the field shall be a two-layer joint shrink wrap sleeve. The first layer shall be an elastic adhesive liquid sealant covered by a heat shrink sleeve. The heat shrink is a thick-walled high density polyethylene membrane. Riser-Wrap by Pipeline Seal and Insulator or equal.

PART 3 – EXECUTION

3.1 MANHOLE BASE

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

- A. Excavation for the manhole base shall be in accordance with the Standard Specifications.
- B. 3/4-inch crushed rock shall be used for the manhole bedding. Crushed rock shall extend a minimum 1-foot beyond the outside edge of the concrete manhole base. A 4 to 6-inch thick base of 3/4-inch crushed rock shall be placed prior to the placement of concrete for all installations.
- C. Manhole bases shall be poured in place against undisturbed soil with Class C concrete having 3/4-inch maximum size aggregate and a slump of not greater than 2-inches. The manhole base shall be poured as one monolithic pour. Limitations for site-mixed and ready mixed concrete set forth in the Standard Specifications. Manhole base shall be poured under observation of the District Engineer or their designee.
- D. Invert elevations of connecting sewers may vary depending upon sizes. The crown elevation of all pipes shall be the same.
- E. The invert of the manhole base shall be formed so as to provide smooth channels conforming in size and shape to the lower portions of the inlet and outlet pipes. The channel shall vary uniformly in size and shape from inlet to outlet, and a shelf shall be constructed higher than the pipe as indicated on the drawings. The manhole base shall extend a minimum of 8-inches below the bottom of the lowest pipe.
- F. All transitions shall be smooth and of the proper radius to give an uninterrupted transition of flow.
- G. The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets.
- H. A sand collar water stop fitting shall be cast into the concrete base where pipe connections are shown on the Approved Plans.
- I. Unless approved otherwise by the District Engineer or their designee in advance, the bases shall be set, with a minimum of 24-hours cure time, before the manhole construction is continued.
- J. Manhole bases that exhibit defects in the concrete surface shall be rejected.

3.2 INSTALLING MANHOLES

- A. Excavation for the precast concrete manhole shall be in accordance with the Standard Specifications.
- B. Manholes shall be constructed as shown on VWD Standard Drawings S-1, S-2, and S-3. Manholes for special cases shall be constructed as shown on the Approved Plans.
- C. Two passes of joint sealing compound will be required at each manhole joint to make a watertight seal between manhole units, including at the manhole base, but excluding grade rings. Excess joint sealant shall be trimmed flush with the interior of the manhole. Precast

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

grade rings shall be set in a bed of mortar or grout at least 1/2-inch thick. Manhole sections shall be set perfectly plumb.

- D. Minor defects, precast manhole step holes, and joint gaps shall be patched with grout or mortar for a smooth finish.
- E. It is the intent of these specifications that manholes and appurtenances be watertight and free from infiltration. The adequacy of manholes and appurtenances as to watertightness shall be determined by the District Engineer or their designee and, if required, shall be tested in accordance with the Standard Specifications.
- F. Manhole sections that exhibit defects in the concrete surface shall be rejected.
- G. Finish Elevation of Manhole Covers
 - 1. Precast sections shall be assembled so that the cover conforms to the elevation determined by the manhole location as follows, but limited to a maximum of 18-inches from the top of the manhole cone to the bottom of the ring and cover, unless otherwise instructed by the District Engineer or their designee.
 - a. In Paved Areas: Top of cover shall be flush with the paving surface.
 - b. In Shoulder Areas: Top of cover shall be flush with existing surface where it is in traveled way or shoulder and 0.1-foot above existing surface where outside limits of traveled way but not in the existing roadside ditch.
 - c. In Roadside Ditch or Unpaved Open Areas: Top of cover shall be a minimum of 6-inches above the ground surface and surrounded with a concrete collar, per VWD Standard Drawings. In special instances, as designated by the District Engineer or their designee or as shown on the Approved Plans, the top of the cover shall be flush with the surrounding ground surface and within square concrete pad 2-feet larger than the manhole in open areas.
- H. Sealing Before Completion: In order to prevent accidental use of the new sewer before completion and acceptance, the inlet to existing tie-in manholes shall be sealed with block and mortar or plugs approved by the District Engineer or their designee. Plugs shall be removed at the time of final inspection or as directed by District Engineer or their designee.
- I. Block and mortar bulkheads shall be installed at the downstream end of all unused stub channels over 5-feet long to prevent the creation of a septic condition resulting from ponding of sewage and debris in the unused channels, and until such time as the manhole stub is connected and normal sewage flow can occur. A plug shall be required for all downstream stubs.
- J. New connections to existing manholes wherein stubs have not been provided shall be made by core drilling through the base, as directed by the District Engineer or their designee.

VALLECITOS WATER DISTRICT
SECTION 03461 – PRECAST REINFORCED CONCRETE MANHOLES

- K. Backfill around the precast concrete manhole shall be imported sand, and shall be placed and compacted in accordance with the Standard Specifications. A 2-sack sand-cement slurry is required around the manhole in existing street sections per governing agency.
- L. Grade Rings: Class B concrete rings shall be cast around manhole frames that are flush with the surface. The ring shall be placed after final grading or paving together with final cleanup.
- M. Pavement Replacement shall be in accordance with the requirements of the governmental agency having jurisdiction.

3.3 MANHOLE FRAME AND COVER

- A. The manhole frame shall be secured to grade ring with grout or mortar and a cement mortar fillet. Where the frame sets directly on the grade ring, a butyl sealant shall be applied. After the frames are securely set, the frames and the covers shall be cleaned and scraped free of foreign materials, and shall be ground or otherwise finished as needed so the cover fits in its frame without rocking.

3.4 PROTECTIVE LINING

- A. Unless otherwise directed by the District Engineer or their designee, the interior of all manholes 60-inches in diameter or larger shall be lined per the Standard Specifications. Manholes that are to be given a protective lining shall be free of any seeping or surface moisture.

3.5 WATERPROOFING

- A. Where groundwater is present or possible under wet weather conditions, or as directed by the District Engineer or their designee, all manhole precast sections shall be waterproofed. Exterior joints shall be patched with grout and made smooth and waterproofing shall be applied to the exterior walls and joints of buried precast manhole sections in accordance with the manufacturer's instructions. Protection shall be placed over the waterproofing to prevent damage. Repairs in the field shall be at the direction of the District Engineer or their designee.

3.6 EXISTING MANHOLE AND MANHOLE BASE REPAIRS

- A. Defective concrete surfaces in existing manhole sections and bases determined to be minor by the District Engineer or their designee, shall be repaired by chipping away unsound or imperfect concrete. Edges shall be left sharp and square with the surface. Loose material and dust remaining after chipping shall be removed by means of an air jet. Epoxy mortar shall be applied to the surface to be repaired in accordance with the manufacturer's instructions. The prepared mortar shall wet the contact surface and provide adhesion, or a bonding agent shall be applied prior to placement.

****END OF SECTION****

**VALLECITOS WATER DISTRICT
SECTION 03462– PRECAST CONCRETE VAULTS**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes the materials, manufacture, and installation of precast concrete vaults.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 02223 - Trenching, Backfilling, and Compacting
 - 2. Section 03300 - Concrete
 - 3. Section 09801 - Manhole Protective Lining

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
 - 1. VWD Approved Material List

1.4 SUBMITTALS

- A. Submit manufacturer’s catalog and test data on precast concrete vaults, frames, and lids along with installation recommendations for inlet and outlet seals and watertight sealing. Show dimensions and materials of construction by ASTM reference and grade.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE VAULT

- A. Precast concrete vaults and covers shall be manufactured in a plant specifically designed for that purpose and shall conform to the shapes and dimensions indicated on the Approved Plans.
- B. Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table and any other loads which may be imposed upon the structure. Live loads shall be for H-20 per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be that which produces the maximum shears and bending moments in the structure.
- C. Concrete shall be Class C per the Standard Specifications.
- D. Vault floor shall drain to a concrete sump hole with a minimum size of 12” x 12” x 18”.

**VALLECITOS WATER DISTRICT
SECTION 03462– PRECAST CONCRETE VAULTS**

- E. All vaults greater than 3-feet deep shall have a ladder. Ladder shall be hot dipped galvanized, have pipe rail guides, locking mechanism for extended handrail, and 48” handrail extension above the top of the ladder. All mounting hardware shall be Type 316 stainless steel. Ladder shall be #VL-100 manufactured by Pipeline Products.

2.2 VAULT LIDS

- A. Vault frames and lids shall be fabricated aluminum with stainless steel hardware per VWD Approved Material List, latest edition.
- B. Lids shall be fabricated with supports to resist deflection.
- C. All lids shall be hinged. Lids shall have hydraulic assists. All lids shall be equipped a hold-open mechanism. All lids shall be equipped with recessed locking hasp and hinged reading lid (if applicable).
- D. All vaults that may be subject to equipment or vehicle loading shall have traffic rated lids. Vaults in all other locations shall have parkway lids unless specified otherwise by the District Engineer or their designee.

2.3 JOINT SEALING COMPOUND

- A. Joint sealing compound for manhole joints shall be a pre-formed, cold-applied, ready-to-use butyl sealant. Ez-Stik Premium, Pro-Stik, or approved equal.
- B. Where groundwater is present or possible under wet weather conditions, or as directed by the District Engineer or their designee, a hydrophilic waterstop shall be used for the joint sealing compound. Sika Swellstop Waterstop, or approved equal.

2.4 GROUT AND MORTAR

- A. Cement grout, non-shrink grout, and cement mortar for patching the vault interior per the Standard Specifications.

2.5 PROTECTIVE LINING

- A. Protective lining shall be a 100% solid, non-solvented hydrid polyurethane coating per the Standard Specifications.

2.6 WATERPROOFING

- A. Waterproofing applied to the exterior of precast vault sections prior to delivery to the jobsite shall be 16-24 mils of coal tar epoxy Tnemec 46H-413, Carboline Bitumastic No. 300M, or approved equal,
- B. Waterproofing applied to the exterior joints of precast vault sections in the field shall be a two-layer joint shrink wrap sleeve. The first layer shall be an elastic adhesive liquid sealant covered by a heat shrink sleeve. The heat shrink is a thick-walled high density polyethylene membrane. Riser-Wrap by Pipeline Seal and Insulator or equal.

**VALLECITOS WATER DISTRICT
SECTION 03462– PRECAST CONCRETE VAULTS**

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Structure excavation for precast concrete vaults shall be in accordance with the Standard Specifications, and the requirements herein. The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations.
- B. The bottom of the structure shall be placed on 12-inches of compacted, 3/4-inch crushed rock, graded level and to the proper elevation as shown on the Approved Plans.
- C. After the structure and all appurtenances are in place approved, backfill shall be placed to the original ground line or to the limits designated on the Approved Plans and in accordance with the Standard Specifications.
- D. Two passes of joint sealing compound will be required at each joint to make a watertight seal between precast vault units. Excess joint sealant shall be trimmed flush with the interior of the vault. Vault sections shall be set perfectly plumb. Minor defects, precast holes, and joint gaps shall be patched with grout or mortar for a smooth finish.
- E. Vault top with incorporated lids shall be built up so that it is flush with the surrounding surface unless otherwise specified on the Approved Plans or by the District Engineer or their designee in the field. The Contractor is responsible for placing the vault top and lid at the proper elevation where paving is to be installed and shall make all necessary adjustments so that it meets these requirements. In unimproved areas, top of the vault to be surveyed for proper elevation.
- F. Vault ladder shall be installed as shown on the Approved Plans or as directed by the District Engineer or their designee. Ladder shall provide access for entry into the vault with sufficient clearance from piping and other obstructions.
- G. When indicated on the Approved Plans or at the direction of the District Engineer or their designee, the interior of the vault shall be lined per the Standard Specifications. Vault surfaces shall be free of any seeping or surface moisture.
- H. Where groundwater is present or possible under wet weather conditions, or as directed by the District Engineer or their designee, all vault precast sections shall be waterproofed. Exterior joints shall be patched with grout and made smooth and waterproofing shall be applied to the exterior walls and joints of buried precast vault sections in accordance with the manufacturer's instructions. Protection shall be placed over the waterproofing to prevent damage. Repairs in the field shall be at the direction of the District Engineer or their designee.
- I. All field penetrations require core drilling. All opening for pipe penetrations shall be watertight with link seal assemblies in accordance with the Standard Specifications.

****END OF SECTION****

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

PART 1 – GENERAL.

1.1 DESCRIPTION

- A. The Contractor shall coordinate District provided manhole protective linings complete in place, in accordance with this Section. This protective lining shall be used for all interior surfaces of the manhole or vaults that require the application of a protective lining. The protective lining shall be Zebron lining system. Substitutions will not be allowed.
- B. Definitions
 - 1. The term “paint”, “coatings”, “linings”, or “finishes” as used herein, shall include all surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective linings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
 - 2. The term “DFT” means minimum dry film thickness.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 01300 – Submittals
 - 2. Section 03461 – Precast Reinforced Concrete Manholes
 - 3. Section 03462 – Precast Concrete Vaults

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:
 - 1. References herein to “SSPC Specifications” or “SSPC” shall mean the published standards of SSPC, the Society for Protective Coatings.
 - 2. References herein to “NACE” shall mean the published standards of the National Association of Corrosion Engineers.
 - 3. NACE
 - a. Publication 6D-173, “A Manual for Painter Safety”
 - b. Publication TPC2, Coatings and Linings for Immersion Service; Chapter 1 Safety, Chapter 2 Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection

VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING

- c. RP0892 Standard Recommended Practice, Lining over Concrete in Immersion Service.
 - d. RP0188 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
 - e. RP0288 Standard Recommended Practice, Inspection of Lining on Steel and Concrete.
4. ASTM
- a. B499 Standard Test Method for Measurement of Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
 - b. C109 Compressive Strength Hydraulic Cement Mortars
 - c. C579 Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars
 - d. C794 L.R. Standard Test Method for Adhesion-in-Peel of Elastometric Joint Sealants (Modified for field conditions)
 - e. D543 Resistance of Plastics to Chemical Reagents
 - f. D638 Tensile Properties of Plastics
 - g. D695 Compressive Properties of Rigid Plastic
 - h. D790 Flexural Properties of Unreinforced and Reinforced Plastics
 - i. D2240 Durometer Hardness Type D
 - j. D2369 Standard Test Method for Volatile Content of Coatings
 - k. D2584 Volatile Matter Content
 - l. D4138 Standard Test Methods for Measurement Dry Film Thickness of Protective Coating Systems by Destructive Means
 - m. D4262 Standard Test Method of pH of Chemically cleaned or Acid Etched Concrete Surfaces
 - n. D4414 Standard Practice for Measurement – Wet Film Thickness by Notched Gages

VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING

- o. D4541 Standard Method for Pull-Off Strength of Coatings using Portable Adhesion Testers
 - p. D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
 - q. D5162 Standard Practice for Discontinuity Testing of Nonconductive Protective Coating on Metallic Substrates
 - r. E337 Standard Practice Test Method for Measuring Humidity with a Psychrometer
5. International Concrete Repair Institute (ICRI)
- a. No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
 - b. No. 03733 Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces
6. Federal Specifications
- a. OSHA 1910.144 – Safety Color Code for Marking Physical Hazards
7. American Concrete Institute (ACI)
- a. ACI506.2.77 – Specifications for Materials, Proportioning, and Application Concrete Institute (ACI)
8. SSPWC 210-2.3.3 – Chemical resistance testing published in the Standard Specifications for Public Works Construction (“Greenbook”), most recent edition.

1.4 SUBMITTALS

- A. Submittals shall be furnished in accordance with the Standard Specifications unless indicated otherwise below.
- B. Submittals shall include the following information:
 - 1. Protective Lining Materials List: Three copies and an electronic copy of the protective lining materials list showing the manufacturer and the protective lining number. The list shall be submitted before or at the time of submittal of samples
 - 2. Manufacturer’s Information: The Contractor shall provide the following data:
 - a. Technical data sheet for each product proposed, including ASTM test results indicating the product conforms to and is suitable for its intended use per the Contract Documents. Data shall include curing requirements and duration.

VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING

- b. Detailed sequence of work for protective lining work.
 - c. Shop Drawings: Show locations and extent of coating. Including details for substrate joints and cracks, penetrations, inside and outside corners, tie-ins with adjoining coatings, if any, and other termination conditions.
 - d. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 - e. Protective lining manufacturer’s instructions and recommendations on surface preparation and application.
 - f. Certification of compatibility from all product manufacturers of protective linings, concrete rehabilitation products, grouts, sealants, or other materials used in the manhole rehabilitation process.
 - g. Safety Data Sheet for each product used.
 - h. Material and Installation Warranty as specified below.
 - i. Statement from manufacturer that they have reviewed the Standard Specifications and that they certify that their product, as specified herein, is recommended and appropriate for this application.
 - j. Applicator Qualifications:
 - i. Manufacturer certification that Applicator has been trained and approved in the handling, mixing, and application of the products to be used.
 - ii. Certification by the protective lining manufacturer that the equipment to be used for applying the products has been approved and Applicator personnel have been trained and certified for proper use of the equipment.
 - iii. Experience and references of projects for Contractor and Lining Applicator.
 - iv. Proof of any necessary federal, state, or local permits or licensed applicator.
3. Inspection records of shop or field-applied protective linings and linings for buried or submerged items shall be submitted within 15 days after the Work has been accepted.

1.5 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

- A. Warranty Inspection

VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING

1. The warranty period for the coating material specified herein shall be for a one (1)-year period and shall include a 1-year product warranty from protective lining manufacturer and 1-year installation guarantee by the Contractor and Lining Applicator. The Contractor shall be responsible for the repair of any defects in the protective lining which may develop during the warranty period. Defects shall be repaired to the satisfaction of the District at the Contractor's expense and without cost to the District. The defects must be corrected within a two-month period.

1.6 SERVICES OF MANUFACTURER

- A. The Contractor shall require the Protective Lining Manufacturer to furnish the following services:
 1. Manufacturer shall provide certification that the Contractor's Lining Applicator is either a licensed applicator for the specified product or has been trained and qualified by the manufacturer to apply their product.
 2. The manufacturer shall have directly employed, full-time, on-staff chemists that interface directly with the in-house manufacturing personnel. The Chemist(s) interfacing with the production personnel shall be available to the District and the Contractor for technical support during the construction phase and warranty period. The manufacturer shall, if directed by the District, provide on-site technical support on a reasonable fee basis.
 3. All coating product(s) manufactured and marketed by the same company Certification (no toll blending).

1.7 QUALITY ASSURANCE

- A. The Protective Lining Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the manufacturer's recommendations.
- B. The Protective Lining Applicator shall conform to all local, State, and Federal regulations including those set forth by OSHA, RCRA, and the EPA and any other applicable authorities.
- C. The District Engineer or their designee shall observe daily operations, procedures, and final product to evaluate conformance with the specifications and recommendations of the Protective Lining Manufacturer.
- D. For further inspection and testing details, see Section 3.4.
- E. The Contractor shall furnish inspection devices in good working condition through final acceptance of linings to demonstrate that protective linings are installed in accordance with these specifications and the manufacturer's written instructions. The following inspection equipment (or District approved equal) shall be used, as necessary and as directed by the District, for performing quality control testing in accordance with the Standard Specifications:

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

1. High range wet and dry film thickness.
2. High voltage holiday detector (capability to 16,000 Volts)
3. Portable Adhesion tester.
4. Additional inspection equipment may be required at the request of the District Engineer or their designee.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be stored, handled, and transported according to their safety data sheets and the manufacturer's written recommendations.

1.9 SAFETY AND HEALTH REGULATIONS

A. General

1. The Contractor shall perform all work in accordance with the requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions and appropriate technical bulletins and manuals. In accordance with these standards, the Contractor shall provide and require use of personal protective lifesaving equipment for persons working in or about the project site. Safety and health recommendations provided herein are guidelines only. The Contractor shall be fully responsible for performing all Work in accordance with all local, State, and Federal regulations including those set forth by OSHA, RCRA, and the EPA and any other applicable authorities. Protective coating materials are to be handled according to their safety data sheets.

B. Head and Face Protection and Respiratory Devices

1. Equipment provided by the Contractor shall include protective helmets which shall be worn by all persons while in the vicinity of the Work. Workers engaged in or near the Work during any blasting or application operations shall wear OSHA approved eye and face protection devices and air purifying, half-mask or mouthpiece respirators. Barrier creams shall be used on any exposed areas of skin.

C. Ventilation

1. Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Forced air ventilation shall be provided by the Contractor and shall reduce the concentration of air contaminant to a safe limit. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. Sound Levels

1. Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall implement, furnish and require the use of approved ear protective devices.

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

E. Temporary Ladders and Scaffolding

1. All temporary ladders and scaffolding shall be provided by the Contractor and shall conform to applicable safety requirements. They shall be erected where requested by the District to facilitate inspection and shall be moved by the Contractor to locations as requested by the District.

PART 2 – PRODUCTS

2.1 PROTECTIVE LINING

- A. Prior to application of the polyurethane topcoat, all surfaces shall receive a 1 – 3 mil thickness of a 100% solids non-solvented, moisture-tolerant, low temperature cure, epoxy primer as is manufactured by Zebron Corporation, California.

Zebron Corporation
P. O. Box 2874
Newport Beach, CA 92659

Tel: 1-800-824-4214; Fax: 1-714-632-6647

The primer materials shall be 100% solids, moisture tolerant epoxy capable of spray application to 1-3 mils thickness in one continuous coat.

The lining material shall be a plural-component, 3 - 1 mix ratio, 100% solid, non-solvented hybrid polyurethane coating with a shore “D” hardness of 57 at 77 degrees Fahrenheit such as Zebron #386 as manufactured by Zebron Corporation, California. The material shall be the high-build type capable of application thickness, as specified, without runs or sags and shall be capable of passing ASTM D-1737 for flexibility using cylinder mandrel of 0.5 inch (12.7 millimeter). The flash point of the fluid mixture shall be 450 degrees Fahrenheit.

The coating material shall meet the following resistive specifications:

Solution - Concentration

Acetic Acid - 5%
Sulfuric Acid - 20%
Sodium Hydroxide - 5%
Ammonium Hydroxide - 5%
Nitric Acid - 1%
Ferric Acid - 1%
Soap - 0.1%
Detergent (Linear Alkyl Benzyl Sulfonate or LAS) - 0.1%
Bacteriological - BOD not less than 700 PPM
Petroleum Oils and Greases - N/A
Vegetable and Animal Oils - N/A
Volumetric percentages of concentrated C.P. grade reagents

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

The material shall have evidence of passing the “Pickle Jar Test” as is noted in section 207-15.3 Chemical Resistance, in the “Greenbook” Standard Specifications for Public Works Construction, 2006 Edition. The material shall also meet the requirements specified in 500-2.4, and the table 500-2.4.10(A), in the “Greenbook” Standard Specifications for Public Works Construction, 2006 edition. The color shall be white or cream. The complete coating shall be impermeable to sewer gases and liquids and nonconductive to bacterial or fungus growth. The lining shall be capable of repair at any time during its life.

PART 3 – EXECUTION

3.1 GENERAL

- A. The sewer system shall remain operable during rehabilitation and protective lining work in accordance with the responsibilities and requirements of the Standard Specifications.

3.2 SURFACE PREPARATION

- A. All surfaces receiving the protective lining shall be made free of oils, grease, water, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts and other contaminants that may inhibit bonding to the substrate or lining performance. High pressure water blasting (minimum 5,000 psi) shall be used for surface preparation. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC SP-12), abrasive blasting, detergent water cleaning, hot water blasting, shot blasting, grinding, or scarifying may also be used, but only if the protective lining manufacturer certifies in writing that the surface preparation procedure is acceptable and recommended for use with their product. All sand, generated waste, and/or debris resulting from surface preparation must be immediately removed and legally disposed of by the Contractor. After surface preparation operations, the concrete surfaces shall be tested to verify that the pH is between 6 and 9 prior to applying the coating, or additional cleaning or conditioning shall be performed to achieve the specified pH.
- B. The Contractor shall capture and remove debris and extraneous materials during the manhole rehabilitation and coating work and to prevent any debris or materials from entering the sewage system.
- C. If abrasive blasting is selected as the surface preparation technique, the Contractor shall contain abrasives to prevent intrusion into the atmosphere, traveled way, or into the existing sewer system.
- D. All concrete or mortar that is damaged by chemical exposure or is otherwise considered unsuitable, in the opinion of the District Engineer or their designee, to receive bonding agents, patching material, or new lining material shall be removed to expose durable, intact concrete.
- E. The Contractor shall remove any existing coatings prior to application of the new protective coating. Applicator is to maintain strict adherence to applicable NACE and SSPC recommendations with regard to proper surface preparation.

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

- F. The manufacturers of all materials used for manhole rehabilitation, including the protective lining manufacturer, shall provide written certification stating that their products are mutually compatible.
- G. The Contractor shall stop infiltration and/or leaks prior to applying protective linings.

3.3 APPLICATION OF PROTECTIVE COATING

- A. Application procedures shall conform to the recommendations of the protective lining manufacturer including material handling; mixing; curing requirements; environmental controls during application and curing; safety and application equipment.
- B. The polyurethane lining application shall take place after the gunite/mortar has cured for a minimum of 1 hour at 55 degrees Fahrenheit.
- C. The polyurethane application, the vault surfaces shall be primed with the epoxy primer to a thickness of 1 – 3 mils. The polyurethane lining is installed immediately after the epoxy primer application or up to 24 hours after the epoxy primer application. The polyurethane lining shall be applied to a minimum 125 mil thickness.
- D. Protective coating must be applied by a Certified Applicator of the protective primer and coating manufacturer and according to manufacturer specifications.
- E. Installation of the protective coating shall not commence until the concrete substrate has been properly cleaned, prepared, and cured.
- F. The temperature of the surface to be coated should be maintained between 40 degrees F and 120 degrees F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, apply the coating when the temperature is falling versus rising (i.e. late afternoon into evening vs. morning into afternoon).
- G. Application of the lining shall not take place when exposed to rain, fog or high winds. It is the Contractor's responsibility to ensure protection of the work for the above-mentioned conditions.
- H. The minimum DFT shall be 125 mil thickness. If the Contractor chooses to install the coating thicker than this minimum DFT, it will be done at the Contractor's sole expense, with no additional compensation provided by the District, and only within recommendations and instructions from the coating manufacturer.
- I. During the application, the Contractor shall take wet gauge film thickness readings as required to ensure correct lining thickness. The polyurethane lining shall be uniform in color, fully cured, and free of pinholes, surface imperfections, and blisters. All areas in question shall be removed and reworked and patched.
- J. The Contractor shall notch the concrete directly below the manhole frame to a depth and width of 1/4-inch with a grinding wheel. The coating shall be applied to the manhole wall and into the notch in one continuous sheet in order to provide a continuous coating from manhole frame to manhole wall. The coating shall extend down to cover the manhole shelf

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

in its entirety and to overlap joints in the inlet/outlet sewer pipe penetrations. The coating shall not extend into the channel and flowline.

- K. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be maintained in proper working order. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.
- L. Subsequent top coating or additional coats of the protective lining shall be within the allowable time frame as required by manufacturer.

3.4 INSPECTION

- A. The District Engineer or their designee shall observe daily operations, procedures, and final product to ensure adherence to the specifications and recommendations of the Protective Lining Manufacturer. The District Engineer or their designee will observe completed surface preparation before coating. The District Engineer or their designee will observe spark testing and pull testing. A visual inspection will be performed upon completion. Any deficiencies in the finished coating shall be marked and repaired in strict accordance with the manufacturer's recommendations. Inspection and repair shall continue until final acceptance of linings at no additional cost to the District.
- B. During application, a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.
- C. After the protective coating has set too hard to the touch, it shall be inspected with high-voltage holiday detection equipment. Surfaces shall first be dried. An induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). The cured polyurethane lining shall be spark tested for pinholes with a spark tester set at 15,000 volts minimum. All pinholes shall be repaired as specified. All detected holidays shall be marked and repaired in strict accordance with manufacturer's recommendations.
- D. Bond strength of the protective coating to the substrate shall be measured in accordance with ATSM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the District. Further bond tests may be required by the District Engineer or their designee on structures that have inadequate bond strength to determine the extent of potentially deficient bonded area. A minimum of three (3) 3/4-inch dollies shall be affixed to the lined surface at the cone area, mid-section and at the bottom of the structure selected for testing by the District Engineer or their designee. A minimum of 10% of the lined manholes shall be tested as determined by the District Engineer or their designee. The adhesive used to attach the dollies to the liner shall be rapid setting with tensile strengths in excess of the liner material and permitted to cure in accordance with the manufacturer recommendations. The lining material and dollies shall be adequately prepared to receive the adhesive. The coating shall be scored around the dolly through to the substrate. Failure

**VALLECITOS WATER DISTRICT
SECTION 09801 – MANHOLE PROTECTIVE LINING**

of the dolly adhesive shall require re-testing. Two of the three adhesion pulls shall exceed 200 psi or concrete failure with more than 50% of the subsurface adhered to the coating. If one of the three dollies fails, an additional location shall be tested in the same structure. If two of the four dollies tested fail, the un-adhered coating shall be removed and replaced at the Contractor's expense. If a structure fails the adhesion test, one additional structure or 10% of the initial number of structures selected for testing, whichever is greater, shall be tested at the discretion of the District. Additional tests and repairs shall be made by the Applicator and in strict accordance with the manufacturer's recommendations at no additional cost to the District. Applicator shall repair any coating damaged during bond strength testing at no additional cost to the District.

3.5 REPAIR METHODS

- A. All defects in the gunite/mortar shall be repaired as specified in 303-2 in the "Greenbook" Standard Specifications for Public Works Construction 2006 Edition. All pinholes in the protective lining shall be highlighted with black indelible ink for the purpose of identifying them for the repair process. Using the pinholes as a center point, the area 6 inches around the pinhole must be abraded with a 60-grit paper or "equivalent". Abraded surfaces are then cleaned, primed and top coated Zebron #385 hand mix. Blisters, uncured lining, and surface imperfections shall be completely removed and the areas recoated with epoxy primer and polyurethane lining to a point 6-inches beyond the repair areas at minimum thickness of 100 mils. Where imperfections exceed an area of one square-foot, the Contractor shall repair as stated above using the Zebron #386 spray applied polyurethane.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 09900

PAINING AND COATING

PART 1 - GENERAL

A. Description

This section pertains to District distribution piping and appurtenances and includes the materials and application of painting and coating systems for buried and exposed surfaces. This section does not apply to piping and appurtenances within structures, or to vaults, tanks or structures, or any District facilities which are constructed with their own set of plans and specifications.

B. Related Work Described Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- 1. Ductile-Iron Pipe and Fittings: 15056
- 2. Manual Valves: 15100
- 3. Fire Hydrants: 15139

C. Approved Manufacturers: See Approved Materials List

1. Organic Zinc Primer

- Koppers
- Tnemec 90-93
- Rust-Oleum

2. Alkyd Enamel

- Koppers Glamortex 501
- Dunn-Edwards Syn-Lustro
- Rust-Oleum Industrial Enamel
- Tnemec Endura Shield IV

3. Epoxy Paint
 - a. Field Applied
Koppers 200
Tnemec Series 66 Epoxoline
Rust-Olem 9100 High Performance Epoxy
 - b. Factory Applied
Keysite 750
Tnemec Series 140 NSF 61
 - c. Factory Applied
Fusion Bonded Epoxy
3M Scotchkote 134 NSF 61
4. Bituminous Mastic
Minnesota Mining and Manufacturing EC 244
Koppers (Supertank) 505

D. Paint Schedule

It is desired that above ground or exposed facilities be color coded for domestic water or fire facilities.

1. Domestic Water System
 - a. Above Ground Piping, Valves and Enclosures: National Blue
FSC Coatings – Silicone PolyPlus
 - b. Public Fire Hydrants: Safety Yellow
FSC Coatings – Silicone PolyPlus
 - c. Private Fire System: ANSI Safety Red

PART 2 - MATERIALS

A. Primer

1. All primer shall be synthetic-alkyd based.
2. All primer shall contain not less than 73% solids by volume and not less than 54% pigment by weight.
3. All primer shall contain not less than 43% zinc chromate pigment and 14% red iron oxide pigment by weight.

B. Alkyd Enamel

- 1. All enamels shall be synthetic-alkyd based.
- 2. All enamels shall be lead-free.
- 3. All enamels shall be high gloss industrial type intended for use on exterior metal surfaces.
- 4. All enamels shall contain not less than 60% solids by volume and not less than 30% pigment by weight.

C. Non-Oxide Grease and Wax Tape

- 1. Bituminous mastic shall be coal-tar pitch based.
- 2. Bituminous mastic shall have a minimum of 68% solids by volume.

D. Epoxy Paint

- 1. Epoxy shall be a colored polyamide cured epoxy with not less than 49% solids by volume.
- 2. All coatings and pigments to be used on domestic water services shall have FDA approval for use with domestic water.

PART 3 - EXECUTION

A. Surface Preparation

- 1. Do not sandblast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not sandblast epoxy-coated pipe that has already been factory coated.
- 2. Surface preparation shall conform to the SSPC specifications as described below:

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

- 3. 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 (Steel Structure Painting Council, Surface Preparation Specifications, ANSI A159.1) specifications listed above.

B. Painting Systems

1. 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.
2. Deliver all paints to the job site in the original, unopened containers.

C. Surfaces Not To Be Coated

The following surfaces shall not be painted and shall be protected during painting of adjacent areas:

1. Stainless steel
2. Metal letters
3. Nameplates
4. Grease fittings
5. Brass and copper
6. Buried pipe, unless specifically required in the piping specifications
7. Bronze meters and strainers

D. Protection of Surfaces Not To Be Painted

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.

E. Field Touch Up of Manufacturer-Applied Prime Coats

Surfaces that are primed at the place of manufacture shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.

F. Alkyd Enamel

1. The following items shall be painted using an alkyd enamel system:
 - a. All aboveground or exposed piping and all piping in vaults
 - b. Fire hydrants
 - c. Valve box lids
 - d. Air release valves
 - e. All exposed metalwork as directed by the District representative

2. Surface Preparation:
 - a. All rust, mill scale, or weld splatter shall be removed by sandblasting or power tool cleaning.
 - b. All unpainted surfaces shall be solvent cleaned in accordance with SP-1.
 - c. All abraded or scratched enamel coatings shall be sanded smooth or receive power tool cleaning per SP-3.
 - d. All failures in the existing coating shall be sandblasted in accordance with SP-6.
 - e. All existing surfaces to be repainted shall be washed with TSP, or other cleanser suitable for removing grease, dust or other residue, and a stiff bristle brush.
3. All unpainted or damaged surfaces shall be coated with primer to a dry-film thickness of not less than 2 mils.
4. The finish coats shall be two or more coats of alkyd enamel applied to a dry-film thickness of 3 mils, providing a total painted dry film thickness of not less than 5 mils.

G. Non-Oxide Grease and Wax Tape

1. Buried metal (flanges, non-stainless steel nuts and bolts, flexible couplings, exposed reinforcing steel, etc.) shall be coated with a non-oxide grease and wax tape.
2. All surfaces coated with bituminous mastic shall be covered with 8 mil polyethylene wrap

H. Epoxy Coating

1. Only those metal surfaces specifically called out shall be epoxy coated.
2. Epoxy lining and coating of valves shall be per AWWA C550 and Section 15100 Manual Valves. All valves shall be lined and coated by manufacturer.
3. Surfaces to be epoxy coated shall be sandblasted to SP-6 requirements.
4. Sandblasted surfaces shall be coated with organic zinc primer to a dry film thickness of 3 mils.
5. Apply two coats of epoxy paint (4 mils each) to the primed surface. The manufacturer's recommended drying time between coats shall be followed.
6. 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.

H. Dry-Film Thickness Testing

1. Measure coating thickness specified for metal surfaces with a majestic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Measuring equipment shall be provided by the contractor. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.
2. If the item has an improper finish color or insufficient film thickness, the surface shall be cleaned and topcoated with the specified paint material to obtain the specified color and coverage. Visible areas of chipped, peeled, or abraded paint shall then be primed and finish coated in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

END OF SECTION

SECTION 15000 – PIPING COMPONENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.
- B. The piping shown in the plans is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The plans are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and other appurtenances for a complete and functional system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 – Submittals
- B. Section 01730 – Operation and Maintenance Data
- E. Section 09900 – Painting and Coating
- F. Section 15042 – Hydrostatic Testing of Pressure Pipelines

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Uniform Mechanical Code
- B. Uniform Plumbing Code
- C. Uniform Fire Code
- D. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. American Water Works Association (AWWA)
 - 5. American Welding Society (AWS)
 - 6. American Iron and Steel Institute (AISI)
 - 7. National Fire Protection Association (NFPA)

SECTION 15000 – PIPING COMPONENTS

E. The following standards have been referenced in this Section:

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings, NPS ½ through NPS 24
ANSI/ASME B31.1	Power Piping
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
ANSI/AWS D1.1	Structural Welding Code – Steel
ANSI/MSS SP 58	Pipe Hangers and Supports – Materials, Design, and Manufacture
ANSI/MSS SP 69	Pipe Hangers and Supports – Selection and Application
ASTM A 36	Specification for Carbon Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 285	Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate- Tensile Strength
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM A 563	Specification for Carbon and Alloy Steel Nuts
ASTM D 2000	Classification System for Rubber Products in Automotive Applications
ASTM/AWWA C219	Bolted, Sleeve-Type Couplings for Plain- End Pipe
AWWA Manual M11	Steel Pipe - A Guide for Design and Installation

1.4 CONTRACTOR SUBMITTALS

A. The Contractor shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems for review by the Engineer in accordance with the requirements in the Standard Specifications, and as indicated in the individual piping sections. The shop drawings shall include dimensions and details on pipe joints,

SECTION 15000 – PIPING COMPONENTS

fittings, fitting specials, harnessed joints, valves, pipe supports, restraints, hangers, anchors, guides, and appurtenances, and shall include design calculations and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

- B. The Contractor shall submit operation and maintenance data in accordance with the Standard Specifications

1.5 QUALITY ASSURANCE

- A. Inspection: All pipe shall be subject to inspection at the place of manufacture. The Contractor shall notify the District in writing of the date for the start of each phase of pipe production and the dates for the proof of design tests. The notification shall be given at least 14 days prior to the start of the pipe manufacture. During the manufacture of the pipe, the District's Representative shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Standard Specifications.
- B. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The Contractor shall perform all tests at no additional cost to the District. Copies of all test reports shall be furnished to the District.
- C. Welding Requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- D. Welder Qualifications: Certified under Section IX, Part A of the ASME Boiler and Pressure Vessel Code or in accordance with AWWA C206, Section 3. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders at no increased cost to the District.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

- A. Where the assistance of a manufacturer's service representative is advisable in order to obtain perfect pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the District.

1.7 MATERIAL DELIVERY, STORAGE, AND PROTECTION

- A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and shall be stored off the ground to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.8 CLEANUP

SECTION 15000 – PIPING COMPONENTS

- A. After completion of the Work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site by the Contractor. The entire piping system shall be handed over to the District in a clean and functional condition.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 and 15 of the Standard Specifications and this Section.
- B. Pipe Supports: All pipes shall be adequately supported in accordance with the requirements of this Section.
 1. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1 - Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.
 2. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided at no additional cost to the District. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the Engineer.
 3. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.
 4. Hangers Subject to Horizontal Movements: At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than a half-inch (1/2"), or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.
 5. Spring-Type Hangers: Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. All spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions encountered. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the

SECTION 15000 – PIPING COMPONENTS

compression of the spring. Supports shall be capable of accommodating at least four times the maximum travel due to thermal expansion.

6. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.
 7. Riser Supports: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.
 8. Freestanding Piping: Free-standing pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps securing the pipes.
 9. Materials of Construction: All piping, as well as piping, conduits, and equipment in hydraulic structures, shall be supported with support, assemblies, including framing, hardware, and anchors, constructed of fiberglass reinforced plastic and Type 316 stainless steel, unless otherwise indicated.
 10. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.
 11. Noise Reduction: To reduce transmission of noise in piping systems, all copper tubes in buildings and structures shall be wrapped with a two-inch (2") wide strip of rubber fabric or similar, suitable material at each pipe support, bracket, clip, or hanger.
- C. Lining: The thickness, application, and curing of pipe lining shall be in accordance with the requirements of the applicable Sections of Division 2 of the Standard Specifications, unless otherwise indicated.
- D. Coating: The thickness, application, and curing of pipe coating shall be in accordance with the requirements of the applicable Sections of Division 2 of the Standard Specifications, unless otherwise indicated. Pipes installed above ground or in structures shall be field-painted in accordance with the Standard Specifications .
- E. Pressure Rating: All piping systems shall be designed for the maximum expected pressure as defined in Section 15042, or as indicated on the piping schedule.

2.2 PIPE FLANGES

- A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-pound class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to

SECTION 15000 – PIPING COMPONENTS

either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-pound class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-pound class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207.

- B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207. All blind flanges for pipe diameters twelve-inches (12") and over shall be provided with lifting eyes in form of welded or screwed eye bolts.
- C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- D. Flange Bolts: All bolts and nuts shall conform to this Section. Studs and bolts shall extend through the nuts a minimum of a fourth-inch (1/4"). All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.
- E. Insulating Flanges: Insulated flanges shall have bolt holes a fourth-inch (1/4") diameter greater than the bolt diameter.
- F. Insulating Flange Sets: Insulating flange sets shall be provided where shown on the plans. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is one and a half-inches (1 1/2") or smaller and shall be made of acetal resin. For bolt diameters larger than one and a half-inches (1 1/2"), insulating sleeves and washers shall be two-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.
- G. Insulating Flange Manufacturers, or Equal:
 - 1. Tripac
 - 2. Calpico, Inc.
 - 3. Farwest
 - 4. PSI Products, Inc., Gardena, California.
- H. Flange Gaskets: Gaskets for flanged joints shall be ring-faced, one eighth-inch (1/8") thick compressed sheets of asbestos-free aramid fiber base, with nitrile binder and nonstick coating, suitable for temperatures to 700 degrees F, a pH of 1 to 11, pressures to 1,000 psig, and NSF-61. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.
- I. Flange Gasket Manufacturers, or Equal:
 - 1. Tripac
 - 2. John Crane, Style 2160.

SECTION 15000 – PIPING COMPONENTS

3. Garlock, Style 3000.

- J. Nuts and Bolts: Bolts, nuts, and washers shall conform to ASTM A307, zinc plated, in accordance with this Section. All buried nuts and bolts shall be completely coated with no-oxide grease, as manufactured by KOP-COAT, Inc., or approved equal, which must be applied in two coats to a minimum thickness of 15 mils per coat.

Bolts, nuts and washers for aboveground, below ground structures, and sanitary sewer installations shall be Type 316 stainless steel. All aboveground or below ground structure bolt threads shall be lubricated with graphite and oil.

The fit shall be ANSI B1.1, "Unified Screw Threads," Class 2, except that Class 3 fit shall be used in holes tapped for studs. Threads may be made by either cutting or cold forming. Between fourth-inch (1/4") and three eighth-inch (3/8") shall project through the nut when drawn tight.

2.3 THREADED INSULATING CONNECTIONS

- A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.
- B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.
- C. Manufacturers: Isojoint or approved equal.

2.4 VICTAULIC COUPLINGS

- A. Couplings for Grooved and Shouldered Joints: Couplings shall be cast of ductile iron conforming to ASTM A536 Grade 65-45-12. Gaskets shall be EPDM (ethylene propylene diene monomer) conforming to ASTM D 2000. Nuts and bolts shall be in accordance with ASTM A183, 110,000 psi tensile strength.
- B. Couplings for pipe smaller than twenty four-inches (24") shall be flexible type, square cut groove, such as Victaulic Style 77, Gustin-Bacon Figure 100, or equal. Use Victaulic Style 44, or equal, couplings with Type "D" collars for pipe twenty four-inches (24") and larger.
- C. The grooves and shoulders for pipe shall conform to AWWA C606, latest revision.
- D. All rings for shouldered joints shall be provided by the coupling manufacturer.

2.5 SLEEVE-TYPE COUPLINGS

- A. Construction: Sleeve-type couplings shall be provided where indicated on the plans, in accordance with ANSI/AWWA C219 unless otherwise indicated on the plans, and shall be of steel with Type 316 stainless steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings. The middle ring shall be not less than 1/4-inch in thickness and shall be either five-inches (5") or seven-inches (7") long for sizes up to and including

SECTION 15000 – PIPING COMPONENTS

thirty-inches (30") and ten-inches (10") long for sizes greater than thirty-inches (30"), for stainless steel couplings, and sixteen-inches (16") long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts for buried couplings shall be Type 316 stainless steel. Bolts and nuts for exposed couplings shall conform to the requirements of this Section and shall be coated in accordance with the Standard Specifications. Buried sleeve-type couplings shall be fusion bonded epoxy lined and coated at the factory in accordance with AWWA C213.

- B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of twelve-inches (12") from the ends of the pipe, with outside diameter not more than one sixth four-inch (1/64") smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.
- C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. Gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid conveyed. The rubber in the gasket shall meet the following specifications:
1. Color - Jet Black.
 2. Surface - Nonblooming.
 3. Durometer Hardness - 74 ± 5 .
 4. Tensile Strength - 1,000 psi minimum.
 5. Elongation - 175 percent minimum.
- D. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.
- E. Restrained Joints: Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall conform to the requirements of the appropriate reference standard, to the requirements specified herein, or to the plans.
1. Joint Harnesses for Sleeve-Type Couplings on Steel Water Pipelines: Bolts and stud materials shall conform to ASTM A307, Grade B. Nuts shall conform to ASTM A563, Grade A, heavy hex. Lug material shall conform to one of the following: ASTM A36; ASTM A283 Grade B, Grade C, or D; or ASTM A285, Grade C. Lug dimensions shall be as shown in AWWA Manual M11. Lugs

SECTION 15000 – PIPING COMPONENTS

shall be Type P for pipe from six-inch (6”) through ten-inch (10”) diameter, and Type RR for pipe twelve-inch (12”) diameter and larger.

2. End Thrust: Joint harnesses shall be designed to accommodate the design working pressure of 200 psi plus a surge allowance of 66 psi.
3. Coating of Joint Harnesses: Coatings for joint harnesses shall conform to the Standard Specifications.

F. Manufacturers, or Equal:

1. Dresser, Style 38.
2. Ford Meter Box Co., Inc., Style FC1 or FC3.
3. Smith-Blair, Style 411.

2.6 FLEXIBLE CONNECTORS

- A. Flexible connectors shall be installed in all piping connections to engines, compressors, and other vibrating equipment, and where shown on the plans. Flexible connectors for service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application, unless otherwise shown. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise shown on the plans. The connectors shall be nine-inch (9”) long, face-to-face flanges, unless otherwise shown on the plans. The final material selection shall be approved by the manufacturer. The Contractor shall submit to the District, the manufacturer's shop drawings and calculations.

2.7 EXPANSION JOINTS

- A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement, without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be of stainless steel, monel, rubber, or other materials, best suited for each individual service. The Contractor shall submit to the District detailed calculations and manufacturer's shop drawings, guaranteeing satisfactory performance of all proposed expansion joints, piping layouts showing all anchors and guides, and information on materials, temperature and pressure ratings.

2.8 QUICK DISCONNECT COUPLER

- A. All quick disconnect couplers shall be of “dry disconnect” type and be constructed of type 316 stainless steel. The size and location shall be as shown on the plans. The gaskets shall be made of Buna-N.
- B. Quick disconnect couplers shall be Model 600-F-SS Kamlock adapter as manufactured by Dover Corporation/ OPW Division or approved equal. Coupler shall be equipped with a lockable cap and have MIP x Male ends.

SECTION 15000 – PIPING COMPONENTS

2.9 PIPE THREADS

- A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1

2.10 AIR AND GAS TRAPS

- A. Air and gas pipes shall be sloping to low points, provided with drip legs, shutoff valves, strainers and traps. The traps shall be piped to the nearest drain. Air and gas traps shall be not less than 150-pound iron body float type with copper or stainless steel float. Bracket, lever, and pins shall be of stainless steel. Drain traps shall have threaded connections.
- B. Manufacturers, or Equal:
 - 1. Armstrong Machine Works.
 - 2. Spirax Sarco, Inc.

2.11 LINK SEALS

- A. Contractor shall furnish and install complete link seal assemblies of size and location as shown on the plans. Link Seal Assemblies shall be as follows:
 - 1. Wall opening sizes (i.e. cored hole) shall be selected according to manufactured recommendations based on most recent Link Seal catalog or approved equal.
 - 2. Calculations shall be provided to determine sufficient quantity and type of Link Seal are provided to effectively provide a hydrostatic seal.
 - 3. Each individual link shall be clearly and permanently shown with the name of the manufacturer and model number.
- B. Link Seals shall be modular, mechanical type, consisting of inter locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM: EPDM = ASTM D2000 M3 BA510
- C. References to installation guideline's shall be latest published edition of Link Seal Selection Guide for the service intended.
- D. Approved Manufacturer's:
 - 1. Thunderline/Link Seal
 - 2. Or approved equal

2.12 Y-STRAINERS

- A. Unless otherwise indicated, y-type strainers shall be sized and installed as indicated in the plans and shall conform to the following requirements:

SECTION 15000 – PIPING COMPONENTS

1. Cast iron bodies
2. NPT screwed ends
3. Type 304 stainless steel screen with 1/32 inch perforations
4. Steel screen drain plug
5. Unit shall be suitable for minimum pressure of 250 psi

B. Approved Manufacturers:

1. Fisher Controls Company, Type 260C
2. Approved equal

2.13 PIPE UNIONS

- A. Screw unions may be employed on pipelines two and a half-inches (2 1/2") in diameter and smaller. Pipes and fittings made of non-ferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings, unions or couplings manufactured by Smith-Blair, Pipe Seal and Insulator Co. or approved equal.

2.14 RED BRASS PIPE

- A. Brass pipe shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" (ASTM B43).

2.15 PIPE SUPPORTS

- A. Supports for piping shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. Pipe support spacing shall not exceed the maximum spans in the tables below. For temperatures other than ambient temperatures and for other piping materials or wall thicknesses, the pipe support spacings shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects.

1. Support Spacing for Schedule 40 and Schedule 80 Steel Pipe:

<u>Nominal Pipe Diameter (inches)</u>	<u>Maximum Span (feet)</u>
1/2	6
3/4 and 1	8
1-1/4 to 2	10
3	12
4	14
6	17
8 and 10	19
12 and 14	23
16 and 18	25

SECTION 15000 – PIPING COMPONENTS

20 and 22

30

2. Support Spacing for Welded Fabricated Steel Pipe:

Maximum Spans (feet) for Pipe Supported in Minimum 120 Degree Contact Saddles

Nominal Pipe Diameter (inches)	Wall Thickness – inches									
	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
24	33	37	41	43	45	47				
26	34	38	41	44	46	48				
28	34	38	41	44	47	49				
30	34	38	42	45	48	49				
32	34	39	42	45	48	50				
34	35	39	42	46	48	50				
36	35	39	43	46	49	51	55			

For steel pipe sizes not presented in the previous table, the support spacing shall be designed so that the stress on the pipe does not exceed 5,000 psi. Maximum deflection of pipe shall be limited to 1/360th of the span and shall be calculated by using the formula:

$$L = [(7500tD) / (32t + D)]^{0.5}$$

Where: T = Thickness (inches)
 D = Diameter (inches)
 L = Maximum span (feet)

3. Support Spacing for Copper Tubing:

<u>Nominal Pipe Diameter (inches)</u>	<u>Maximum Span (feet)</u>
1/2 to 1-1/2	6
2 to 4	10
6 and greater	12

4. Support Spacing for Schedule 80 PVC Pipe:

<u>Nominal Pipe Diameter (inches)</u> <u>(at 100 degrees F)</u>	<u>Maximum Span (feet)</u>
1/2	4
3/4	4.5
1	5
1-1/4	5.5
1-1/2	5.75
2	6.25
3	7.5
4	8.25
6	10
8	11
10	12.25
12	13.25

SECTION 15000 – PIPING COMPONENTS

B. MANUFACTURED SUPPORTS

1. Stock Parts: Designs shall exemplify good engineering practice and use stock or production parts. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose.
2. Manufacturers or equal:
 - a. Unistrut
 - b. Bergen - Paterson Pipesupport Corp., Woburn, MA
 - c. Grinnell Corp., Exeter, PA
 - d. B – Line Systems Inc.

C. COATING

1. Galvanizing: Unless otherwise indicated, all fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. Other Coatings: Other than stainless steel or non-ferrous supports, all supports shall receive protective coatings in accordance with the requirements of the Standard Specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of Divisions 2 and 15 of the Standard Specifications. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.
- B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

3.2 PIPE SUPPORTS

- A. General: All pipe supports, seismic restraints, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ANSI/ASME B31.1 - Power Piping. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.
- B. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be

SECTION 15000 – PIPING COMPONENTS

adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, and without interference with other work.

- C. Quality Control: Pipe hangers, supports, and seismic restraints shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available. Fabricated supports shall be neat in appearance without sharp corners, burrs, and edges.

****END OF SECTION****

**VALLECITOS WATER DISTRICT
SECTION 15041 – DISINFECTION OF PIPING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes requirements for disinfection of domestic water mains, services, appurtenances and connections by chlorination and all requirements for bacterial testing of the facilities, and obtaining subsequent clearances for operation issued by the District and all state and local health agencies having jurisdiction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 15042 – Hydrostatic Testing of Pressure Pipelines

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
 - 1. AWWA C651 Disinfecting Water Mains

1.4 PROJECT CONDITIONS

- A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Apply to cognizant environmental regulation authority and obtain permit for permission to discharge. Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility.
- B. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with the District and cognizant regulatory authorities: San Diego County Health Department. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. See AWWA C651, Appendix B for neutralizing chemicals.

PART 2 - PRODUCTS

2.1 SODIUM HYPOCHLORITE

- A. Sodium Hypochlorite solution shall be 10-16% available chlorine by weight.

PART 3 - EXECUTION

3.1 PROCEDURE

**VALLECITOS WATER DISTRICT
SECTION 15041 – DISINFECTION OF PIPING**

- A. Before being placed in service or connected to existing facilities, all facilities shall be disinfected using a method approved by the District Engineer of their designee.
- B. Contractor shall notify the District two (2) working days prior to chlorination of facilities.
- C. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed by and at the expense of the Contractor.
- D. All mains shall be thoroughly flushed prior to disinfection.
- E. Every service connection served by a main being disinfected shall be tightly shutoff at the curb stop before water is turned into the main. Care shall be taken to expel all air from the main and services during the filling operation.
- F. The Sodium Hypochlorite solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply. Pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.
- G. Water shall be fed slowly into the pipeline with chlorine applied in amounts to produce a dosage of not less than 50 ppm or more than 100 ppm in all sections of the pipeline and appurtenances.
- H. Treated water shall be retained in the system for a minimum of 24 hours and shall contain a chlorine residual of not less than 25 ppm at the end of the retention period in all sections being disinfected. Treated water shall be retained in the system for a maximum of 48 hours.

3.2 CONCURRENT TESTING

- A. Disinfecting the mains and appurtenances, hydrostatic pressure testing, and preliminary retention may run concurrently for the required 24-hour period, but in the event there is leakage and repairs are necessary, additional disinfection shall be made by injection of Sodium Hypochlorite solution into the line as provided hereinafter.

3.3 FLUSHING

- A. After chlorination, the water shall be flushed from the line, in accordance with AWWA C651, at its extremities until the chlorine concentration in the water leaving the pipe is within 0.5 mg/l of the replacement water. The chlorinated water may be used later for testing other lines, or if not so used, shall be disposed of by the Contractor, as designated in AWWA C651, Section 6.2. The Contractor shall be responsible for all costs to dechlorinate the water before it enters any storm drain or watercourse. The District will not be responsible for loss or damage resulting from such disposal.

3.4 BACTERIOLOGICAL TESTING

- A. The Contractor shall provide the services of an acceptable state certified laboratory to take all samples, deliver to laboratory, and provide written test results to the District Engineer or their designee.

**VALLECITOS WATER DISTRICT
SECTION 15041 – DISINFECTION OF PIPING**

- B. Perform bacteriologic quality testing after disinfection, final flushing, and refilling of the pipeline in accordance with AWWA C651. Samples shall be taken throughout the length of the new pipeline(s) at locations not more than 1,000 feet apart and at all branches and dead ends. Sample point locations and spacing shall be determined by the District Engineer or their designee and may be adjusted in the field to insure complete representation is achieved.
- C. Deliver samples to a certified laboratory within three hours after collecting and have a bacteriologic quality test performed. Test for coliform organisms and perform a heterotrophic plate count for each sample taken. Coordinate the collection of the samples with the laboratory's hours of operation and allow adequate time for the test results.
- D. All samples must show the absence of coliform organisms and all heterotrophic plate counts must be less than 500 colonies forming unit/ml.

3.5 ADDITIONAL DISINFECTION

- A. If any samples fail the Coliform Bacteria or HPC Tests, the entire pipeline(s) shall be re-flushed by the Contractor and re-sampled as required by the District Engineer or their designee. Additional disinfection may be required. Disinfection procedures as described herein shall continue until satisfactory results are obtained. All re-disinfection, re-flushing and re-sampling required shall be at the Contractor's expense.
- B. Retesting of the system may be required if 90 days have passed between the date of testing and acceptance by the District.

3.6 FINAL CONNECTIONS TO EXISTING MAINS

- A. Final connections are allowed following satisfactory bacteriological sample results and proper notification and scheduling with the District. Following the opening of an existing domestic water main, the interior of all accessible pipes and fittings shall be sprayed disinfected or swabbed with a Sodium Hypochlorite solution per AWWA C651, Section 4.10 and 4.11. The drained portion of the existing line and any new section shall be flushed from two directions toward the cut-in, if possible.
- B. Within 24 hours of making a connection to an existing waterline, a bacteriologic quality test shall be performed by a state certified laboratory. Collect a sample from the existing waterline at the nearest access point to the connection. If the sample fails the test, the District Engineer or their designee will direct the Contractor to perform corrective action and retest.
- C. Any repairs to an existing pipe shall follow disinfection procedures in accordance with AWWA C651, Section 4.11.

****END OF SECTION****

VALLECITOS WATER DISTRICT
SECTION 15042 – HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes hydrostatic pressure and leakage testing of pressure pipelines and appurtenances.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.
 - 1. Section 01300 –Submittals
 - 2. Section 15041 – Disinfection of Piping

1.3 SUBMITTALS

- A. Submit shop drawings, test bulkhead locations, pipe attachment details, methods to prevent excessive pipe wall stresses, blocking to overcome thrust conditions and design calculations.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide calibrated pressure gauges, calibrated recorder, pipes, pumps, water meters, and other equipment necessary to perform the hydrostatic pressure test.

PART 3 – EXECUTION

3.1 TESTING PREPARATION

- A. All labor, materials, tools, and equipment for testing shall be furnished by the Contractor.
- B. Prior to hydrostatic pressure testing new pipelines which are to be connected to existing pipelines, isolate the new pipeline from the existing pipeline by means of test bulkheads, test plates, or blind flanges. Continue with connection work after the new pipeline has been successfully tested and approved by the District.
- C. The Contractor shall provide the District Engineer of their designee with a minimum of 2 days' notice prior to the requested date and time for any preliminary hydrostatic test and 5 days' notice prior to the requested date and time for hydrostatic pressure tests.
- D. Subject the pipeline and appurtenances to a hydrostatic pressure test after the pipe has been laid and backfilled with a 24" minimum of cover for required restraint. Allow concrete pipe anchors, collars, encasements and thrust blocks to cure for at least 5 days prior to testing. The Contractor shall be responsible for determining thrust blocks have

VALLECITOS WATER DISTRICT
SECTION 15042 – HYDROSTATIC TESTING OF PRESSURE PIPELINES

reached their optimal strength for testing of the pipeline. Existing facilities will be operated under direction of the District Engineer or their designee only.

- E. Contractor shall provide source of water, shall make all connections with the water source, transporting the water, and all other arrangements concerning the water to be used for the pipeline hydrostatic pressure test. Use only metered potable water for the hydrostatic pressure test. Provide a reduced pressure backflow prevention assembly if source of potable water is from District waterlines. Provide temporary piping to convey and dispose of the water used in the pipeline. Disconnect and remove temporary piping after successful completion of the hydrostatic pressure test.
- F. No testing will be allowed against District valves. All testing shall be performed in the presence of the District Engineer or their designee.
- G. All pipelines shall be satisfactorily tested prior to the placement of final pavement.

3.2 CLEANING

- A. Before conducting hydrostatic pressure 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).

3.3 LENGTH OF TEST SECTION

- A. Due to excessive length or elevation difference, it may be necessary to test the pipeline in sections. In any one test, do not exceed more than 2,500 feet, the distance between closed valves, or as directed by the District Engineer or their designee. In any one section, conduct the test in so that no pipe section is tested at less than the required test pressure, nor more than 1-1/2 times the pipe pressure class.

3.4 INITIAL PIPELINE FILLING

- A. Maximum rate of filling with test fluid shall not cause water velocity in pipeline to exceed 1 foot per second. Expel air from the pipeline while filling and prior to testing. Provide necessary outlets to fill and test pipeline. The following table has been provided to relate the velocity filling rate to an equivalent volume flow rate.

Filling Rate in gpm equivalent to filling velocities of 1fps.

Nominal Size (inches)	Flow Rate Q (gpm)
4	38
6	88
8	158
12	353
16	624

VALLECITOS WATER DISTRICT
SECTION 15042 – HYDROSTATIC TESTING OF PRESSURE PIPELINES

- B. Allow 24 hours for the water filled pipeline to soak and release entrapped air prior to testing. Pipelines with cement-mortar lining shall be filled with water and placed under a minimum pressure of 25 psi for at least 72 hours prior to the hydrostatic pressure test.
- C. Cement-mortar lined pipe shall not be filled with water until a minimum period of 24 hours has elapsed after the last joint in any section has been made. Steel pipelines shall not be tested before the mortar lining and coating on all of the pipe lengths in the line have attained an age of 14 days.
- D. The same water used for chlorination of the pipeline may be used to fill the line for hydrostatic pressure testing.

3.5 PRELIMINARY TEST

- A. Prior to scheduling a hydrostatic pressure test, the Contractor shall demonstrate to the District Engineer or their designee that the pipeline can maintain the required test pressure with zero leakage for a duration of 4-hours.
- B. The preliminary test should be discontinued if a large quantity of water is required to increase the pressure during testing. The source of the problem, such as entrapped air, leakage at joints, or broken pipe, should be identified and corrected.

3.6 PRESSURE AND DURATION OF TEST

- A. After a Preliminary Test has been performed and approved by the District Engineer or their designee, the pipeline shall be subjected to a field hydrostatic pressure of 225 psi or 50 psi in excess of the maximum operating pressure of the pipe being tested, whichever is greater, for a period of 1-hour. Maximum operating pressure to be determined by the District.
- B. Maintain the pipeline test pressure for 1-hour with zero leakage.

3.7 ALLOWABLE LEAKAGE

- A. The allowable leakage for aboveground and buried piping having threaded, soldered, welded, flanged, push-on joint, mechanical joint, and elastomeric gasket joint shall be zero.

3.8 BULKHEAD AND TEMPORARY EQUIPMENT REMOVAL

- A. After a satisfactory hydrostatic pressure and leakage test and disinfection: drain the water; remove test bulkheads, temporary valves and piping, and other test facilities; connect to existing facilities; and restore the pipe coatings.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 15043

LEAKAGE AND INFILTRATION TESTING OF NON-PRESSURE PIPELINES

PART - 1 GENERAL

A. Description

This section describes the requirements and procedures for leakage and infiltration testing of gravity sewer systems, in accordance with ANSI/ASTM C828, Low Pressure Air Test of Vitrified Clay Pipelines.

B. Related Work Specified Elsewhere

- | | | |
|----|--|-------|
| 1. | PVC Sewer Pipe: | 02715 |
| 2. | Hydrostatic Testing of Pressure Pipelines: | 15042 |

C. Testing

1. General: All tests shall be made in the presence of the District representative.
2. Leakage: Each section of sewer between two successive manholes shall be tested for leakage and the leakage test shall be made on all sections of sewer.
3. Infiltration: The infiltration test shall be made where excessive groundwater is encountered.
4. Retesting: Even though a section may have previously passed the leakage or infiltration test, each section of sewer shall be tested subsequent to the last backfill compacting operation if, in the opinion of the District representative, heavy compaction equipment or any of the operations of the contractor or others may have damaged or affected the structural integrity or watertightness of the pipe, structure, and appurtenances.
5. Other Utilities: Official District tests will not be made until after all the other utilities have been installed and their trench compaction verified.
6. Excessive Leakage or Infiltration: If the leakage or infiltration rate is greater than the amount specified, the pipe joints shall be repaired or, if necessary, the pipe shall be removed and relaid by the contractor.
7. Acceptance: The sewer will not be accepted until the leakage or infiltration rate, as determined by test, is less than the maximum allowable.
8. House Laterals: House laterals are not to be connected until after the sewer main has been successfully tested.
9. Force Mains: Force mains shall be pressure tested per section 15042.

PART 2 - MATERIALS

The contractor shall furnish all equipment and materials required for testing.

B. Air Test for PVC Gravity Sewers

1. Test Section: Each section of sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs.
2. Addition of Air: Air shall be slowly added until the internal pressure is raised to 4.0 pounds per square inch gage (psig). The compressor used to add air to the pipe shall have a blowoff valve set at 5 psig to ensure that at no time the internal pressure in the pipe exceeds 5 psig.
3. Internal Pressure: The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize, after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psig.
4. Minimum Duration for Allowable Pressure Drop: 3 PSI?
5. Retest: If the pressure drop from 3.5 psig to 3.0 psig occurs in less time than the above-tabulated or calculated values, the pipe shall be overhauled and, if necessary, replaced and relaid until the joints and pipe shall hold satisfactorily under this test.

C. Infiltration Test

1. Preparation of Test Section: The end of the sewer at the upper structure shall be closed to prevent the entrance of water, and pumping of groundwater shall be discontinued for at least three days, after which the section shall be tested for infiltration.
2. Allowable Infiltration Rate: The infiltration shall not exceed 0.025 gpm per inch of diameter per 1,000 feet of main line sewer being tested, not including the length of laterals entering that section.
3. Excessive Infiltration: Where infiltration in excess of the allowable amount is discovered before completion and acceptance of the sewer, the sewer shall be immediately uncovered and the amount of the infiltration reduced to a quality within the specified amount of infiltration, before the sewer is accepted.
4. Individual Leaks: Even if the infiltration is less than the allowable amount, any individual leaks that may be observed shall be stopped as ordered by the District representative.
5. Completion of Tests: All tests must be completed before the street or trench is resurfaced, unless otherwise directed by the District representative.

D. Deflection Test

1. General: All PVC main line pipe shall be tested for deflection, joint displacement, or other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to permanent resurfacing. The mandrel shall be a full circle, solid cylinder, or a cylinder, approved by the District as to design and manufacture. The circular cross section of the mandrel shall have a diameter of at least 95 percent of the specified average inside pipe diameter of the pipe, as follows:

Pipe Material	Nominal Size Inches	Minimum Mandrel Diameter Inches
PVC-ASTM D 3033 (SDR 35)	6	5.169
	8	7.309
	10	9.137
	12	10.963

E. Manhole Test

1. General: Water tightness of manholes shall be tested in connection with tests of sanitary sewers, or at the time the manhole is completed and backfilled. Testing of the manholes is at the sole discretion of the District representative.
2. Vacuum test in accordance with ASTM C1244 and as follows:
 - a: Plug pipe openings; securely brace plugs and pipe.
 - b: Inflate compression band to affect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
 - c: Determine test duration for manhole from the following table:

Manhole Diameter	Test Period
4 feet	60 seconds
5 feet	75 second
6 feet	90 seconds

3. Record of vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
4. When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15050

HOT TAP CONNECTIONS

PART 1 - GENERAL

A. Description

This section describes materials, requirements and procedures for hot tap (system under pressure) connections to existing distribution systems.

B. Related Work Specified Elsewhere

1.	Existing Facilities	01045
2.	Chlorination of Domestic Water Mains for Disinfection	15041
3.	Hydrostatic Testing of Pressure Pipelines	15042
4.	Copper, Brass and Bronze Pipe, Fittings and Appurtenances	15057
5.	Cement-Mortar Lined and Coated Steel Pipe	15076
6.	Manual Valves	15100

C. Approved Manufacturers

1. Service Saddles and Corporation Stops
Per VWD Approved Material List, latest edition.
2. Tapping Sleeves
Per VWD Approved Material List, latest edition.
3. Tapping Valves
Per VWD Approved Material List, latest edition.

D. Direct Tap

All taps into existing pipes will be made through a service saddle, tapping sleeve, welded nozzle or welded coupling. Direct taps are not permitted.

PART 2 – MATERIALS

A. Service Saddles and Corporation Stops

Service saddles and corporation stops shall comply with Section 15057.

B. Tapping Sleeves

1. Tapping sleeves onto pipelines 12-inch and smaller shall be per VWD Approved Material List, latest edition.
2. Tapping sleeves onto 14-inch and larger DIP and ACP shall be fabricated steel with mechanical joint ends. All fabricated parts shall be epoxy coated per Section 09900. Tapping sleeves for pipe sizes 14-inch and larger shall be submitted for approval by the District.

C. Tapping Valves

Tapping valves shall be flanged resilient seat wedge gate valves

D. Weld Nozzles

Weld nozzles and reinforcing plates shall be fabricated steel per Section 15076.

PART 3 – EXECUTION

A. Notification

The contractor shall provide proper notification to the District inspector prior to making a hot tap connection per Section 01045.

B. Verification

The contractor shall pothole the proposed connection to verify the outside diameter, location and type of pipe to be tapped.

C. Surface Preparation

The pipe barrel to be tapped shall be thoroughly cleaned with a wire brush to provide a smooth, hard surface for the saddle, sleeve or nozzle.

D. Service Saddle and Corporation Stop

Service saddles and corporation stops will be installed onto ACP, DIP or PVC mains in accordance with the manufacturer's recommendations and Section 15057. The outlet shall be oriented to comply with the intended use of the service connection.

E. Weld Nozzles

Nozzles and reinforcing plates are to be welded onto steel pipe shells in accordance with Section 15076. The connection is to be hydrostatic in the presence of the District inspector prior to making the tap.

F. Tapping Sleeves

Tapping sleeves shall be installed as outlined below.

1. The tapping sleeve shall be installed in accordance with the manufacturer's instructions and to the satisfaction of the District representative.
2. The pipe barrel shall be thoroughly cleaned with a wire brush to provide a smooth, hard surface for the sleeve.
3. The sleeve shall be supported independent of the pipe during the tapping operation.
4. The sleeve shall be hydrostatic tested in the presence of the District representative prior to tapping.
5. Thrust blocks shall be provided at the tapping sleeve after tap completed.

G. Tapping Valve

The tapping valve shall be installed on the tapping sleeve or weld nozzle per Section 15100.

H. Hot Tap

1. The hot tap into the existing pipe shall be made using the appropriate type of cutting machine and shell cutting bit for the material being tapped. Tapping method to be submitted to District for approval.
2. Size on size taps are not allowed.
3. The tapping machine shall be operated per the manufacturer's operating instructions.
4. Proper care shall be taken to prevent cutting material from entering the pipeline. The tapping coupon must be extracted and provided to the District representative.

I. Mortar Coating Repair

The exterior mortar coating on welded steel pipe shall be repaired in accordance with Section 15076.

J. Disinfection

The interior of the tapping valve and connecting piping shall be sprayed with a sodium hypochlorite solution prior to connection.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15056

DUCTILE-IRON PIPE AND FITTINGS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of ductile-iron pipe and fittings.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | | |
|----|--|-------|
| 1. | Trenching, Backfilling, and Compacting: | 02223 |
| 2. | Concrete: | 03300 |
| 3. | Chlorination of Domestic water Mains for Disinfection: | 15041 |
| 4. | Hydrostatic Testing of Pressure Pipelines: | 15042 |

C. Approved Manufacturers

1. Fittings

Per VWD Approved Material List, latest edition.

2. Pipe

Per VWD Approved Material List, latest edition.

3. Gaskets

Per VWD Approved Material List, latest edition.

D. Use of Gray-Iron Fittings

Gray-iron fittings may not be substituted for ductile-iron.

PART 2 - MATERIALS

A. Ductile-Iron Pipe

1. Pressure class or thickness class of DIP shall be determined by the design method detailed in AWWA C150 the "Thickness Design Method."
2. Ductile-iron pipe shall be manufactured in accordance with AWWA C151.
3. All ductile-iron pipe shall be pressure class shown on the plans for bell and spigot pipe, pressure class 350 for plain end pipe and thickness Class 53 for flanged spools unless indicated otherwise.
4. All domestic water ductile-iron pipe shall be cement-mortar lined in accordance with AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.8.
5. Unless otherwise called out on the plans, a "push-on" type joint shall be used. The joint dimensions and gasket shall be as specified in AWWA C111.
6. Where restrained joints are called for on 8-inches in diameter and smaller pipe, push-on joints shall be restrained with locking gasket rated for 250 psi operating pressure. Joint restraint shall be push-on joint with "Field-Lok" gaskets as manufactured by U.S. Pipe, Perma-Lock Joint as manufactured by Pacific States Cast Iron Pipe Company or approved equal. "TR-Flex" restrained joint pipe as manufactured by U.S. Pipe or approved equal is also an acceptable option for restraint of push-on joints.

Where restrained joints are called for on 10-inches in diameter and larger pipe, use a "TR-Flex" restrained joint pipe as manufactured by U.S. Pipe or approved equal. The restrained joint shall be a boltless restrained push-on joint design and shall contain a positive axial locking restrained system and be capable of deflection after assembly. Restraint of field cut pipe by using U.S. Pipe's "TR Flex Gripper Ring" or approved equal will be permitted as long as the "TR Flex" pipe field weldments are not required. Any restrained joint fitting which will require a pipe field weldment will **not** be permitted under any circumstances. Restraint of field cut pipe shall be kept to a minimum.

7. Flanges for ductile-iron pipe shall be the "screwed-on" type in accordance with AWWA C115.
8. Outlets for DIP shall be as follows:

2" or smaller:	bronze service saddle installed on the outside of poly wrap
2-1/2":	tapped tee or service saddle
4" and larger:	D.I. tee fitting

9. All field cutburied ductile iron pipe for domestic water use shall have a factory applied bituminous coating of not less than 1 mil. Thickness per approved material list
10. All ductile iron pipe and fittings approved for use in sewer applications shall be polyurethane or polyethylene lined.

B. Ductile-Iron Fittings

1. Ductile-iron fittings shall be manufactured in accordance with AWWA C110, or AWWA C153. Compact body fittings, as described in AWWA C153, will not be permitted in vault structures.
2. All domestic water fittings shall be cement-mortar lined in accordance with AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.8.
3. All fittings shall be made with "push-on" or MJ joints designed for use with the type of pipe to be joined unless noted otherwise.
4. Restrained push-on joint fittings shall be used only as shown on the plans. For pipe sizes 8-inches in diameter and smaller, push-on joint fittings shall be restrained with locking gasket rated for 250 psi operating pressure. Joint restraint shall be push-on joint with "Field-Lok" gaskets as manufactured by U.S. Pipe, Perma-Lock Joint as manufactured by Pacific States Cast Iron Pipe Company or approved equal. "TR-Flex" restrained joint fitting as manufactured by U.S. Pipe or approved equal is also an acceptable option for restraint of push-on joint fittings in this size.

For pipe sizes 10-inches in diameter and larger, restrained joint fittings shall either be "TR-Flex" restrained joint fitting as manufactured by U.S. Pipe or approved equal, or mechanical joint ductile iron fittings fitted with joint restraints. Mechanical joint restraint shall be incorporated with the design of the follower gland and shall include a restraining mechanism which, when activated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. The joint shall maintain flexibility after burial. Follower glands shall be manufactured of ductile iron conforming to ASTM A536-80. The mechanical joint restraint shall be EBBA IRON, Inc., MEGALUG, UNIFLANGE Series 1400, The Ford Meter Box Co., Inc. or approved equal. Any restrained joint fitting which will require a pipe field weldment will not be permitted.

5. Unless otherwise indicated on the drawings, all fittings with flanged ends shall be ductile iron class 150. The gasket surface shall have a serrated finish of approximately 16 serrations per inch, approximately 1/32-inch deep, with serrations in either a concentric or spiral pattern. All flanges shall be flat faced. In addition, all flanges shall meet the following tolerances:

Bolt circle drilling	$\pm 1/16$ inch
Bolt hole spacing	$\pm 1/32$ inch
Eccentricity of bolt circle and	$\pm 1/32$ inch
Maximum facing with respect to bore	

C. Gaskets

Ring gaskets for flanged joints shall be 1/8-inch thick, non-asbestos.

Rubber gaskets for push-on joints shall be synthetic or natural rubber manufactured in accordance with AWWA C111.

D. Bolts and Nuts

1. All bolts and nuts shall conform to ASTM A 307, zinc plated.
2. The length of each bolt or stud shall be such that between 1/4 inch and 3/8 inch will project through the nut when drawn tight.

E. Polyethylene Lining

1. Lining material for ductile iron pipe and fittings (sewer applications) shall be polyethylene complying with ASTM D1248 and bonded to the interior of the pipe fittings by heat process. The lining material shall be compounded with inert filler and a compound which resists ultraviolet light.
2. The lining shall cover the interior surface of the pipe/fitting from the lain or beveled end to the rear of the gasket socket. The lining thickness shall be not less than 20 mils. The lining may taper at the ends, starting at 4 inches from the edge of the pipe. The minimum thickness at the end of the taper shall be 10 mils.
3. Each pipe shall be guaranteed against separation of the lining from the pipe. Random checks for operation will be made during construction and any indication of separation shall be cause for rejection. The test method shall be mutually agreed upon by the contractor and the District.

F. Polyurethane Lining System

1. The lining material shall be manufactured by Madison Chemical Industries, Inc., or approved equal. The material shall consist of a liquid-applied polyurethane coating especially formulated for use as a protective lining of pipelines carrying sewage. The material shall be Corropipe II Wasteliner, or approved equal. The dry film thickness (DFT) of the lining shall be 40 mils (0.040 inch) nominal.
2. In order to minimize potential dimensional and assembly problems, the coating thickness on sealing areas in the bell socket interior and on the spigot end of the pipe exterior shall be 8 mils (0.008 inch) nominal with a maximum of 10 mils (0.010 inch). Thicker coatings in these areas are acceptable if it is demonstrated that joint dimensions are within allowable tolerances after coatings.
3. The lining material shall be applied to the pipe and fittings by a certified applicator only. The coating shall be holiday tested with a high voltage tester at 50 volts/mil of material thickness. The material shall be applied and repaired to the pipes and fittings in strict accordance with the manufacturer's requirements with no exceptions. District shall be notified five (5) days in advance of the coating installation for factory inspection during the application of the material.

4. All field cut ends shall be repaired and sealed prior to installation per the manufacturer's recommendations.

G. Lubricants

Lubricant for pipe insertion shall be food grade, and biodegradable.

PART 3 - EXECUTION

A. General

Ductile-iron pipe and ductile iron fittings shall be installed in accordance with the applicable Sections of AWWA C600 and as specified herein.

B. Trenching, Backfilling, and Compacting

1. Trenching, backfilling, and compacting shall be in accordance with Section 02223 and as specified herein.
2. Backfill within the pipe zone, including the pipe base, shall be imported sand placed and compacted in accordance with Section 02223.
3. Backfill within the trench zone within VWD easement shall be native earth backfill placed and compacted in accordance with Section 02223 or governing agency requirements.

C. Placement of Pipe in Trench

1. Lay pipes uphill if the grade exceeds 10%.
2. The radius of curvature of the trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection at a joint. Combined deflections at rubber gasket, restrained joint, deflection coupling or flexible coupling joints shall not exceed 2 degrees.

3. The pipe shall be laid true to the line and grade shown on the plans.

4. Plastic Film Wrap

All ductile-iron pipe and fittings buried underground shall be double wrapped based. with plastic film wrap in accordance with AWWA C105, unless noted otherwise below. Wrap shall be a loose 8-mil-thick clear polyethylene tube. All joints between plastic tubes shall be wrapped with 2-inch-wide polyethylene adhesive tape, Polyken 900, Scotch wrap 50, or approved equal.

5. Fittings shall be supported independently of the pipe.

6. Until thrust blocks and supports are poured, fittings shall be temporarily supported by placing wooden skids under the bells so that the pipe is not subjected to the weight of the fitting. Temporary supports to be removed just prior to pouring of thrust blocks.
7. All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly with a mastic, Minnesota Mining and Manufacturing EC 244, Koppers (Super-Tank) 505, or an approved equal.
8. All flanges to be waxed taped.

D. Anchors and Thrust Blocks

Concrete anchors and thrust blocks shall be poured against wetted undisturbed soil in accordance with Section 03300 and VWD standard drawing W-15.

E. Flanged Connections

1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe run.
2. Clean flanges by wire brushing before installing gasket.
3. Clean flange bolts and nuts by wire brushing, lubricate threads with anti-seize compound, and tighten nuts uniformly and progressively. Between 1/4 inch and 3/8 inch shall project through the nut when drawn tight.
4. 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.

F. Pipe Support

All exposed pipe shall be supported as detailed in the plans.

G. Disinfection

All domestic water piping shall be disinfected by chlorination in accordance with Section 15041.

H. Testing

All domestic water piping shall be hydrostatically pressure tested in accordance with Section 15042.

I. Bonding

Bonding of joints to provide continuity for cathodic protection shall be as specifically shown on the project plans, or directed by the District representative.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15057

COPPER, BRASS, AND BRONZE PIPE
FITTINGS AND APPURTENANCES**PART 1 - GENERAL**A. Description

This section includes materials and installation of copper, brass, and bronze pipe, fittings and appurtenances.

B. Approved Manufacturers

1. All materials shall be the appropriate manufacturer and model number specified in the VWD Approved Material List, latest edition.
2. Copper Tubing
Per VWD Approved Material List, latest edition.
3. Service Saddle
Per VWD Approved Material List, latest edition.
4. Corporation Stop
Per VWD Approved Material List, latest edition.
5. Angle Meter Stop
Per VWD Approved Material List, latest edition.
6. Customer Valve
Per VWD Approved Material List, latest edition.
7. Insulating Pipe Bushings, Unions, or Couplings
Per VWD Approved Material List, latest edition.

PART 2 - MATERIALSA. Copper

1. Copper tubing shall conform to the requirements of ASTM B 88 for seamless copper water tube. Piping located above ground or suspended within vaults shall be Type L. Buried piping shall be Type K, soft. Copper pipe shall be of domestic manufacture.
2. Fittings shall be copper conforming to ASTM B 75 and ANSI B16.22, with solder end joints. Fittings 3/8 inch and smaller may have flared end connections or compression joint connections.
3. Solder shall be silver solder conforming to ASTM B 32, Grade 95TA. Do not use cored solder.

B. Brass Pipe, Nipples, and Fittings

Short threaded nipples, brass pipe and fittings shall conform to ASTM B 43, regular wall thickness, except that nipples and pipe of sizes 1-inch and smaller shall be extra strong. Threads shall conform to ANSI B2.1.

C. Bronze Appurtenances

1. All items specified herein shall be manufactured of bronze conforming to ASTM B 62, "Composition Brass or Ounce Metal Castings."
2. Service saddles shall be of the double-strap type for ACP and DIP. The straps (or bails) shall be flat and shall be manufactured of silnic bronze for ACP and DIP. For C900 PVC, the service saddles shall be of the single-strap type and shall be manufactured of stainless steel. The body shall be manufactured of bronze and shall be tapped for an iron pipe thread. The seal with the pipe shall be made with either a rubber gasket or an O-ring. [Saddles to be installed on the outside of the poly wrap.](#)
3. Corporation stops shall be ball valve type and shall be manufactured of bronze. The inlet fitting shall be a male iron pipe thread when used with saddle and the outlet connection shall be a compression type up to 150 psi. Female iron pipe (FIP) thread shall be used above 150 psi.
4. Angle meter stops shall be ball valve type for 1-inch services and ground inverted key type for 1-1/2-inch and 2-inch services and shall be manufactured of bronze. The inlet connection shall be a compression type up to 150 psi, or female iron-pipe thread above 150 psi and the outlet fitting shall be a meter flange or meter coupling. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the side of the fitting to operate the shutoff mechanism.
5. Customer service valves shall be manufactured of bronze, ball valve type, with lever-type turn handle. The inlet connection shall be a meter flange or a meter coupling and the outlet female iron pipe.

D. Flanges, Gaskets, Bolts, and Nuts

1. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange. Use solder end companion flanges.
2. Gaskets for flanged-end fittings shall be 1/16-inch-thick ring gaskets.
3. When both adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F 468, Grade C65100 or C63000. Nuts shall conform to ASTM F 467, Grade C65100 or C63000.
4. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B 193, Grade B7. Nuts shall comply with ASTM A 194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.

PART 3 - EXECUTION**A. Copper Tubing and Fittings**

1. Cut tubing square and remove burrs. Clean both the inside and outside of fitting and pipe ends with steel wool and muriatic acid before soldering. Prevent annealing of fittings and tubing when making connections. Do not miter joints for elbows or notch straight runs of pipe for tees.
2. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.
3. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Silver solder shall be used. Solder shall penetrate to the full depth of the cup in joints and fittings. Solderers shall comply with ANSI B31.3, paragraph 328.
4. Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A MINIMUM COVER OF 30 INCHES BELOW THE FINISHED STREET GRADE SHALL BE MAINTAINED. The tubing is to be bedded and covered with sand or select material as determined by the District representative.
5. All domestic service laterals shall be 1-inch minimum size continuous copper tubing. End connections shall be compression or FIP type.
6. All 2-inch size services shall be installed with straight lengths of soft copper water tube Type K. All couplings and adapters shall be silver soldered.
7. The service line shall extend perpendicular to the centerline of the street from the water main to the meter stop or structure, except in a cul-de-sac, where the service shall run in a straight line from the water main to the meter stop.

B. Service Saddle

1. The service saddle shall be no closer than 18 inches to a valve, coupling, joint, or fitting.
2. The surface of the pipe shall be filed to remove all loose material and to provide a hard, clean surface before placing the service saddle.
3. The service saddle shall be tightened per manufacturer's recommendation. Care shall be used to prevent damage or distortion of either the corporation stop or service saddle by over tightening.
4. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

C. Installing Flange Bolts and Nuts

1. Lubricate bolt threads with anti-seize compound prior to installation.

2. Set flanged pipe with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

D. Insulating Bushings and Unions

Pipe or fittings made of nonferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings, union, or couplings, [to be submitted for approval by District Engineer.s](#).

E. Backfill Material

The pipe zone material for all service laterals shall be compacted sand per Section 02223.

END OF SECTION

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section designates the requirements for the manufacture and installation of polyvinyl chloride, abbreviated PVC, pressure pipe.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01300 – Submittals
2. Section 02223 – Trenching, Backfilling, and Compacting
3. Section 03300 – Concrete
4. Section 15000 – Piping Components
5. Section 15041 – Disinfection of Piping
6. Section 15042 – Hydrostatic Testing of Pressure Pipelines
7. Section 15056 – Ductile Iron Pipe and Fittings
8. Section 15057 – Copper, Brass, and Bronze Pipe Fittings and Appurtenances

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
1. VWD Approved Material List
 2. AWWA C900-16 PVC Pressure Pipe, 4 In. Through 60 In.
 3. AWWA Manual M23 Pipe Design and Installation

1.4 SUBMITTALS

- A. The Contractor shall submit the following information:
1. Manufacturer's product data and installation instructions.

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

2. Manufacturer's certification of compliance, including, but not limited, to the standards referenced herein and of the National Sanitation Foundation (NSF). NSF compliance is required for pipe and elastomeric gaskets for all potable water systems.
3. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.
4. Outline of Quality Control Program.

PART 2 - PRODUCTS

2.1 PIPE

- A. PVC pressure pipe, 4-inch through 60-inch, shall be manufactured in accordance with AWWA C900-16, and shall be of the sizes and dimension ratio (DR) shown on the Approved Plans. The pipe shall have integral bell and spigot joints with elastomeric gaskets in accordance with AWWA C900-16 Section 4.3 (Pipe Requirements). The pipe shall conform with the outside diameter of cast-iron pipe unless otherwise specified and shall conform with the wall thickness of DR series 14 through 18.
- B. DR14 (pressure class 305 psi) PVC pipe shall be used unless specifically shown otherwise on the Approved Plans.
- C. Each pipe length shall be marked showing the nominal pipe size and O.D. base, the AWWA pressure class, the maximum allowable axial deflection (in degrees), and the AWWA specification designation. For domestic water application, the seal of the testing agency that verified the suitability of the material for such service shall be included. Pipe shall be within 1 year of the manufactured date.
- D. Pipe for recycled lines shall be purple in color and marked with "RECYCLED WATER" designation in addition to the standard factory labeling required by AWWA and as approved by the District Engineer or their designee.
- E. Lubricant and elastomeric gasket shall be supplied by the pipe manufacturer. Lubricant for pipe insertion shall be food grade and biodegradable.

2.2 FITTINGS

- A. Ductile-iron fittings shall conform to the Standard Specifications. Fittings shall have push-on type joints manufactured specifically for PVC pipe.

2.3 DEFLECTION COUPLINGS

- A. Deflection couplings shall have a maximum allowable deflection of 2.5° at each bell for a maximum of 5° total deflection with each deflection coupling.

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

2.4 JOINT RESTRAINT SYSTEMS

- A. Joint Restraint Systems may be used for PVC where shown on the Approved Plans with prior approval of the District and shall conform to the Standard Specifications.

2.5 CONCRETE

- A. Concrete used for thrust, anchor, and support blocks shall conform to the Standard Specifications. Concrete for thrust blocks shall be Class "C".

2.6 TRACER WIRE

- A. Tracer wire materials shall conform to the Standard Specifications.

2.7 WARNING/IDENTIFICATION TAPE

- A. Warning/Identification tape materials shall conform to the Standard Specifications.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATIONS PROCEDURES AND WORKMANSHIP

- A. PVC pipe shall be stored in suppliers' yards and on the job site in accordance with AWWA M23 and the manufacturer's recommendations. Store PVC pipe in the field by supporting the pipe uniformly in accordance with AWWA M23. PVC shall be supported by racks or dunnage to prevent damage to pipe. Pipe shall not be stacked higher than 4 feet or with weight on the bell ends. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the District Engineer or their designee.
- B. PVC pressure pipe and fittings shall be installed per AWWA Manual M23, and as herein specified
- C. Laying lengths shall be 20 feet. When deep trenches or shoring restrictions hinder the use of the standard length sections, the use of 10-foot and 15-foot lengths shall be allowed with approval from the District Engineer or their designee. Random lengths are not allowed.
- D. The pipe shall not be laid along curves. No deflections at bells, fittings, or of the pipe will be allowed. Use of high deflection couplings or ductile-iron fittings at bends or angle points to be approved by the District Engineer or their designee.
- E. The pipe sections shall be accurately placed in the trench to the true alignment and grades as shown on the Approved Plans. Where the grade is not shown, pipe shall have a cover of 42 inches, for pipe 12 inch and smaller, or 48 inches, for pipe larger than 12 inch, to finished grade or as approved by the District Engineer. The pipe grade shall be approved by

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

the District. The pipe sections shall be placed such that the manufacturers labelling shall be visible, at the top of the pipe.

- F. Tracer wire and warning/identification tape shall be installed on all PVC pressure mains.
- G. At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the lunch break as well as overnight. In no event shall the pipeline be used as a drain for removing water which has infiltrated into the trench. The Contractor shall maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the District.
- H. All existing facilities shall be potholed to verify the top, bottom and location for potential conflicts. Information to be submitted to the District Engineer or their designee prior to the installation of the new pipeline. No Inspections will be provided without pothole information.
- I. Pipelines shall be staked at 25 foot maximum intervals including all angle points, appurtenances and grade changes. Stakes to include stationing, offset and top of pipe. Appurtenances shall be staked at mainline and property line. Any appurtenances not perpendicular to the main will require an additional line stake with the property line stake. Additional staking at each high deflection coupling may be required for radii.

3.2 INSTALLATION

- A. The Contractor shall furnish and install all the pipe, closure sections, fittings, valves, and appurtenances shown including pipe supports, bolts, nuts, gaskets, and jointing materials as shown on the Approved Plans and as required to provide a complete and workable installation. All material connected to the pipe and the pipe shall be cleaned before assembly.
- B. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Hoist pipe with fork lift or other handling equipment to prevent major damage or shorten its service life. A cloth belt sling or a continuous fiber rope shall be used to prevent scratching the pipe. The pipe shall be lowered and not dropped from the truck. Dropped pipe will be rejected.
- C. Trenching, backfilling, and compacting, including the pipe bedding, shall conform to the Standard Specifications. Place and compact a minimum of 4 inches of imported sand for the pipe bedding. Imported sand shall be used for backfill within the pipe zone.
- D. The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source; shall assume full responsibility for any damage due to this cause; and shall pay for and perform the work to restore and replace the pipe to its specified condition and grade if any displacement occurs due to floating.
- E. Prior to laying the pipe, the bottom of the trench shall be graded and prepared to provide uniform bearing throughout the entire length of each joint of pipe. Bell holes of ample

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

dimension shall be dug at each joint to permit proper assembly and inspection of the entire joint. The trench shall have a flat bottom conforming to the grade to which the pipe is to be laid.

- F. Pipe shall be cut by a method recommended in the pipe manufacturer's installation guide, as approved by the District Engineer or their designee. When pipe is cut, and is to be joined to a ductile-iron fitting or another piece of pipe, the end shall be beveled in the field equal in quality to the machined ends of the pipe as furnished by the manufacturer. Such machining shall not result in undercutting the wall thickness and must be approved by the District Engineer or their designee before installation.
- G. All fittings and valves shall be independently supported so that the pipe is not subjected to the weight of these appurtenances. All fittings and valves shall have joints that match the type of adjoining pipe.
- H. Concrete thrust blocks shall be placed as follows:
 - 1. As shown on the Approved Plans or where directed by the District Engineer or their designee and shall conform to the requirements of the Standard Specifications and Standard Drawing W-15 and as specified herein.
 - 2. Shall be provided at the location of all angles greater than 5 degrees, at changes in pipe size, ductile-iron fittings, valves, fire hydrants ells, and end of line plugs.
 - 3. The bearing surface shall be against the stable undisturbed ground and the fittings to be anchored. In unstable conditions, the bearing surface shall be as recommended by the Engineer and as directed by the District Engineer or their designee.
 - 4. The concrete shall be placed, unless specifically shown otherwise on the Approved Plans, so that the pipe joints and fittings will be accessible to repairs.

3.3 PIPE JOINT ASSEMBLY

- A. The spigot and bell shall slide together without displacement of the elastomeric gasket. The joint shall be dirt free. The best laying practice is with the bell facing in the direction of laying.
- B. Insert the elastomeric gasket into the groove making sure the gasket is completely seated. Lubrication of the spigot and instruction of use shall be supplied by the pipe manufacturer. The use of excessive lubricant will not be permitted.
- C. The spigot shall be inserted into the bell and forced slowly into position by use of a large bar lever and a wood block across the pipe end. Machine insertion will not be allowed. For large pipe, a come-along with padding that will not scratch the pipe) may be used. Care shall be taken to not "over-stab" the pipe.
- D. All fittings and valves shall have joints that match the type of adjoining pipe.

VALLECITOS WATER DISTRICT
SECTION 15064 – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

E. There shall be no tap within 30 inches of a pipe joint.

3.4 JOINT RESTRAINT SYSTEMS

A. Joint Restraint Systems shall be installed as shown on the Approved Drawings and in accordance with the manufacturer's recommendations.

3.5 HYDROSTATIC TESTING

A. All pipelines shall pass a hydrostatic pressure test in accordance with the Standard Specifications.

3.6 DISINFECTION

A. All domestic water pipelines shall successfully be chlorinated in accordance with the Standard Specifications prior to connection to the existing distribution system.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 15072

ASBESTOS CEMENT DISTRIBUTION PIPE
(6 Inch through 16 Inch)

PART 1 - GENERAL

A. Description

The installation of asbestos cement pipe (ACP) is not permitted within the District. This section includes connecting to existing ACP and handling and disposal of existing asbestos cement distribution pipe.

B. Related Work Described Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Chlorination of Domestic Water Mains for Disinfection:	15041
4.	Hydrostatic Testing of Pressure Pipe:	15042
5.	Hot Tap Connections:	15050
6.	Ductile Iron Pipe and Fittings:	15056
7.	PVC Pressure Distribution Pipe:	15064
8.	Combination Air and Vacuum Release Valve Assembly:	15089
9.	Manual Valves:	15100
10.	Copper, Brass, and Bronze Pipe Fittings & Appurtenances	15057

C. Referenced Standards

AWWA C400, "Asbestos-Cement Transmission Pipe 6 in. through 16 in for Water and Other Liquids."

D. Certification

Removal of ACP pipe shall be performed by a contractor registered by Cal/OSHA and certified by the State Contractors Licensing Board for asbestos removal.

PART 2 - MATERIALS

A. Fittings

1. Ductile-iron fittings shall conform to Section 15056.
2. All ring-gasketed fittings shall have ring grooves that conform to the same dimensions and tolerances that the manufacturer of the pipe specifies for asbestos-cement couplings. Each groove shall be gauged for tolerance before arriving at the construction site.

B. Rubber Rings

Rubber rings for use in the ACP couplings and fittings shall conform to the requirements of ASTM D 1869.

C. ACP Closure systems

1. ACP Closure Couplings and Lengths
 - a. ACP closure couplings and lengths shall conform to all requirements of this specification.

D. Lubricants

Lubricant for pipe insertion shall be food grade, and biodegradable.

E. Health Hazard

The contractor is warned that asbestos is a known human carcinogen when inhaled and poses serious health risks. Asbestos fibers are easily inhaled and can result in chronic respiratory illness, cancer and other server health effects.

PART 3 - EXECUTION

A. General

1. The contractor shall install all the pipe, closure sections, fittings, valves, and appurtenances shown including pipe supports, bolts, nuts, gaskets, and jointing materials.
2. Where closure sections are required by the contractor's installation operations, the sections shall be installed in accordance with the applicable sections of these specifications. Field cutting of AC pipe using abrasive wheel equipment will not be permitted.

B. Cutting and Handling

1. Pipe cutting will not be permitted. New connections for repair shall be made at machined ends only with approved coupling adaptors.
2. All connecting parts of pipe, rings, couplings, and castings shall be clean before assembly. After bearing has been obtained, couplings shall be assembled in a proper manner (as determined by the District representative). The use of excessive lubricant will not be permitted, and the assembly of the couplings and rings shall be in accordance with the manufacturer's recommendations. Lubricant and rubber rings shall be supplied by the pipe manufacturer. All fittings and valves shall have joints that match the type of adjoining pipe.

C. Removal of Existing Pipe

Removal of existing asbestos material shall be performed by a contractor registered by Cal/OSHA and certified by the State Contractors Licensing Board for asbestos removal. Copies of the certification shall be submitted to the District prior to the commencement of any asbestos removal activities. The contractor or subcontractor shall comply with all State and Federal laws regarding handling and removal of asbestos materials. The contractor shall be responsible for the proper identification, removal and disposal of all asbestos materials.

D. Combination Air and Vacuum Release Valves

1. Air release valve assemblies and combination air and vacuum valves shall be installed at each point in the pipeline as shown on the drawings or as specified by the District representative.
2. The tap for the air valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting. No tap shall be permitted in any machined section of ACP.
3. Valves shall be installed in accordance with VWD standard drawing W-16 and Section 15089.

E. Blow Off Assemblies

1. Blow off assemblies shall be installed in accordance with the standard drawings at locations noted on the plans and at such additional locations as required by the District representative for removing water or sediment from the pipeline.
2. The assembly shall be installed in a level section of pipe.
3. The tap for blow off in the line shall be no closer than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main. No tap will be permitted in any machined section of ACP.
4. Blow offs shall be installed in accordance with VWD standard drawing W-1 and the applicable sections of these specifications.
5. Blow offs shall not be connected to any sewer, submerged in any stream, or installed in any manner that will permit back siphoning into the distribution system.

END OF SECTION

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes materials, design, fabrication, testing, and installation of cement-mortar lined and/or cement-mortar coated welded steel pipe with special pieces in accordance with AWWA C200, C205, C208 and the following options and restrictions to be used in water transmission pipelines 16-inches and larger.
- B. A special is defined by any piece of pipe other than a normal full length straight section pipe. This includes, but is not limited to elbows, manhole sections, short pieces, reducers, tees, crosses, ellipsoidal dished heads, and adapter sections with special ends, sections with outlets, beveled sections, and etcetera.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).
- B. Other sections of the Standard Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 01300 - Submittals
 - 2. Section 02223 - Trenching, Backfilling, and Compacting
 - 3. Section 09900 - Painting and Coating
 - 4. Section 15000 - Piping Components
 - 5. Section 15041 - Disinfection of Piping
 - 6. Section 15042 - Hydrostatic Testing of Pressure Pipelines
 - 7. Section 15045 – Closed-Circuit Television (CCTV) Inspection
 - 8. Section 15050 - General Piping Requirements

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards have been referenced in this Section:
 - 1. American National Standards Institute (ANSI)
 - a. B16.1 Cast Iron Pipe Flanges and Flanged Fittings
 - b. B16.5 Flanges and Flanges Hinges
 - c. B16.11 Forged Steel Fittings, Socket-Welding and Threaded

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- d. B16.47 Large Diameter Steel Flanges
- e. B36.10 Welded and Seamless Wrought Steel Pipe
- 2. American Society for Testing and Materials (ASTM)
 - a. A36 Structural Steel
 - b. A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - c. A82 Steel Wire, Plain, for Concrete Reinforcement
 - d. A105 Forgings, Carbon Steel, for Piping Components
 - e. A106 Seamless Carbon Steel Pipe for High-Temperature Service
 - f. A181 Forgings, Carbon Steel, for General-Purpose Piping
 - g. A185 Steel Welded Wire Reinforcement, Plain, for Concrete
 - h. A216 Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service.
 - i. A234 Piping Fittings of Wrought Carbon Steel And Alloy Steel for Moderate and Elevated Temperatures
 - j. A283 Low and Intermediate Tensile Strength Carbon Steel Plates
 - k. A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - l. A516 Pressure Vessel Plates, Heat-Treated Carbon-Manganese-Silicon Steel
 - m. A572 High Strength Low-Alloy Columbium-Vanadium Structural Steel
 - n. A1011 Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - o. A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot-Rolled Carbon, Structural, High-Strength Low-Alloy Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.
 - p. C33 Concrete Aggregates

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- q. C40 Test method for Organic Impurities in Fine Aggregate for Concrete
 - r. C87 Test method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
 - s. C136 Method for Sieve Analysis of Fine and Coarse Aggregates
 - t. C150 Portland Cement
 - u. E94 Standard Guide for Radiographic Examination
 - v. E165 Practice for Liquid Penetrant Inspection Method
 - w. E709 Practice for Magnetic Particle Examination
 - x. E1032 Standard Test Method for Radiographic Examination of Weldments
3. American Society of Mechanical Engineers (ASME)
- a. AMSE Boiler and Pressure Vessel Code, Section VIII
 - b. ASME Boiler and Pressure Vessel Code, Section IX
4. American Water Works Association (AWWA)
- a. C200 Steel Water Pipe 6-Inch or Larger
 - b. C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4-inches and Larger, Shop Applied
 - c. C207 Steel Pipe Flanges for Waterworks Services-Sizes 4 inches through 144-inches
 - d. C208 Dimensions for Fabricated Steel Water Pipe Fittings
 - e. M11 Steel Pipe Guide for Design and Installation
5. American Welding Society (AWS)
- a. D1.1 Structural Welding Code, Steel
6. American Society for Nondestructive Testing (ASNT)
- a. SMT-TC-1A, Recommended Practice

1.4 SUBMITTALS

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- A. The following shall be submitted in accordance with the Standard Specifications:
1. Submit an affidavit of compliance with AWWA C200, C205, C208.
 2. Submit detailed shop drawings for the pipe and specials showing:
 - a. Materials of construction, including references to industry standards being met (i.e. ASTM, ANSI, AWWA, etc.).
 - b. Order of installation and closures with designation by piece number for each steel pipe and fabricated special to be furnished and installed.
 - c. Pipe station and invert elevation at each change of grade and horizontal alignment.
 - d. Elements of curves and bends, both in horizontal and vertical alignment including elements of the resultant true angular deflections in case of combined curvature.
 - e. Pipe outside diameter, wall thickness, lining and coating thickness, location of welded seams, and working pressure rating.
 - f. Locations of bulkheads for field hydrostatic testing of pipeline. Testing against valves shall not be permitted.
 - g. Locations of closures, including cut-to-fit allowances, for length adjustment and for construction convenience.
 - h. Locations and laying lengths of valves, meters, manholes, and other mechanical equipment which determine piping dimensions.
 - i. Limits of each reach of field-welded joints, rubber gasket joints, and of concrete encasement.
 - j. Call out weld sizes and dimensions of thrust ring collars, grooved end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.
 - k. Paint primer type and thickness where joints and other cement-mortar holdbacks occur.
 3. Submit joint details. Include insulting joints.
 4. Submit details of lining and coating.
 5. Submit drawings of butt straps, couplings, and flanges.
 6. Submit details of bulkheads and of their method of attachment to the pipeline.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

7. Submit calculations supporting the sizing of reinforcing collar plates, wrapper plates or crotch plates, supporting selected wall thickness of pipe and specials, and supporting welded joint design and joint welding details.
8. Submit certificate that cement complies with ASTM C150, designating type.
9. Submit certified copies of mill test reports on each heat from which steel is rolled.
10. Submit test reports on physical properties of rubber used in gaskets.
11. Certification of dye penetrant shop-weld testing.
12. Document and certify by pipe mark number that cement mortar lining thickness measurements meet the requirements as specified herein for each pipe, fitting, and pipe special.
13. Submit welding procedure specifications (WPS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR) for each welder and welding operator.
14. Shop drawings of all pipes and specials shall be submitted to the District Engineer or their designee for review. The Contractor and Engineer shall both review and mark the review action taken, before submitting to the District. Shop drawings shall be complete in all respects. If the shop drawings show any deviations from the requirements of the Approved Plans and specifications because of standard shop practices or other reasons, the deviations and the reasons therefore shall be set forth in the District approves Submittal Form.
15. Submit fabricator's quality control program results in one complete binder including all inspection reports, conducted tests, certified mill test reports, weld test coupon reports, welder qualification records, hydrostatic testing reports, shop testing reports, final fabrication checklist for each special, and affidavit of compliance. The quality control program results shall document all phases of the fabrication process.
16. Installation Schedule
17. Shop and field welder qualification certificates and records for each welder, including a reference list of three completed buried pipeline welding projects.
18. Inspection reports and field tests results for all field welding.
19. Certificates of welding rods used for field welding.

1.5 QUALIFICATIONS OF MANUFACTURERS

- A. Only manufacturers who manufacture a complete lined and coated pipe can be qualified for this work. All pipe manufacturing operations shall be performed at the same location for all pieces of pipe. Supervisors of cement-mortar coating operations shall have at least two

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

years' continuous recent experience in the application of cement-mortar coating systems for steel pipe.

- B. Welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by independent local, approved testing agency not more than six months before commencing work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests.

1.6 INSPECTION AND FIELD VERIFICATION

- A. The District Engineer or his authorized representative will inspect materials, fabrication, and testing of pipes and specials at the manufacturer's plant.
- B. Where new pipelines are to be connected to existing waterlines, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the pipe fabrication or installation. The field verification shall be performed in the presence of the District Engineer or their designee. Adjust and align the new pipeline as necessary to meet the field conditions and provide all required material, labor, and equipment to make the connection.
- C. When required by the District, the Contractor shall provide a certified and qualified welding inspector at no cost to the District. Contractor is responsible for performing Quality Control in accordance with AWS D1.1 requirements during installation and welding operations.

1.7 CERTIFICATIONS

- A. Certifications: Furnish a certified affidavit of compliance for all pipe and other products, materials, or related work upon delivery to the jobsite, provided under this Section, as specified in ANSI/AWWA C200, C205, C206, and C602, respectively, and the following supplemental requirements:
 - 1. Compliance with the additional requirements included in the Standard Specifications.
 - 2. Physical and chemical properties of all steel.
 - 3. Hydrostatic test reports.
 - 4. Results of production weld tests.
 - 5. Sand, Cement, and mortar tests.
 - 6. Rubber gasket tests.
 - 7. All materials are NSF approved for use with potable water.
 - 8. All welds were performed in conformance with these Standard Specifications.

**VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE**

- B. All expenses incurred in making samples or collecting data for certification of tests shall be borne by the Contractor at no increased cost to the District.

PART 2 – PRODUCTS

2.1 DESIGN CRITERIA

- A. Obtain the following information from the Approved Plans:
1. Elevation of pipe invert and completed ground.
 2. Alignment of the pipeline.
 3. Working pressure rating (psi) or pipe wall thickness. Working pressure is the maximum high water level (HWL) or maximum static head (HGL) of the pressure zone minus the pipe centerline elevation in feet divided by 2.31 feet per psi.
 4. Normal pipe size. The nominal diameter or inside diameter of the pipe and other fabricated steel sections as shown on the Approved Plans is the clear diameter of the lined pipe after the application of the interior mortar lining.
 5. Location of single or double lap welded and butt-welded joints.
- B. Field hydrostatic test pressure shall be as indicated in the Standard Specifications, unless noted otherwise on the Approved Plans.
- C. Steel Cylinder.
1. The following formula shall be used to determine the stress in the steel cylinder:

$$S = \frac{PD}{2T}$$

Where

- S = Stress
- P= Working pressure rating, PSI
- D= Actual outside diameter of steel cylinder, inches (not bell)
- T= Wall thickness of steel cylinder, inches

2. Stress in steel cylinders shall not exceed 15,000 psi at the working pressure rating with no allowance for tensile strength of cement mortar, except that the following minimum cylinder thickness shall prevail:

Nominal Pipe Size (inches)	Minimum Thickness (inches)
6 to 12	0.1875
14 to 36	0.2500
> 36	TBD (0.3125 min)

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

3. Steel cylinder outside diameters for pipe twelve inches (12”) and smaller in nominal pipe size shall conform to the following:

Nominal Pipe Size (inches)	Steel Cylinder Outside Diameter (inches)
6	6.625
8	8.625
10	10.750
12	12.750

4. For pipe larger than twelve inches (12”) in nominal diameter, the steel cylinder outside diameter shall meet the following minimum dimensions:

Nominal Pipe Size (inches)	Steel Cylinder Outside Diameter (inches)
14	15.375
16	17.375
18	19.375
20	21.875
24	25.875
27	28.875
30	31.875
33	34.875
36	37.875

2.2 SPECIALS

- A. Fabricated steel fittings shall comply with AWWA C208. For elbows, unless otherwise noted, fabricate to a minimum centerline radius of 2.5 pipe diameters and provide the number of pieces as tabulated below:

Deflection Angle	Number of Pieces
0 to 22.5 degrees	2
22.6 to 45.0 degrees	3
45.1 to 67.5 degrees	4
67.6 to 90.0 degrees	5

- B. Maximum circumferential stress at the working pressure rating shall not exceed 40 percent of the minimum yield stress.
- C. Material for fabricated specials shall be the same as the pipe and may be from previously tested pipe manufactured in accordance with these specifications. Minimum wall thickness shall be equal to the thickest adjacent straight pipe, except that the following minimum wall thickness shall prevail for a special.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

Nominal Pipe Size (inches)	Minimum Thickness (inches)
6 to 27	0.1875
30 to 36	0.2500

D. Select the type of reinforcement for specials with outlets from the following:

$$R = \frac{\text{ID outlet}}{\text{ID main run} \times \sin B}$$

Where B = Angle between the longitudinal axis of the main run and the outlet.

R	Type of Reinforcement
Maximum of 0.5	Collar Plate
Maximum of 0.7	Wrapper Plate
No limit	Crotch Plate

Where outlets are located opposite each other in a special (i.e., the cross), the limiting values of “R” shall be 0.25 and 0.35, respectively. Use wrapper plate when the pipe main run is twenty one-inches (21”) smaller, and “R” is larger than 0.7. Use crotch plate when the pipe main run is twenty-four-inches (24”) and larger, and “R” is larger than 0.7.

E. Collar Plate Reinforcement

1. For collar plate reinforcement, select an effective shoulder width “W” of a collar from the inside surface of the steel outlet to the outside edge of the collar, measured on the surface of the cylinder of the main run, such that:

$$W = (1/3 \text{ to } 1/2) \times \frac{\text{ID outlet}}{\sin B}$$

2. For collar plate reinforcement of tangential outlets, use:

$$\sin B = \sqrt{\frac{\text{OD outlet}}{\text{OD main run}}}$$

3. The minimum thickness “T” of the collar is determined by:

$$T = \frac{P \times \text{ID main run} \times \text{ID outlet} \times (2 - \sin B)}{4 \times F \times W \times \sin B}$$

Where P = Working Pressure, PSI

F = Allowable stress at working pressure (40% of minimum yield)

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

B = As in paragraph 2.02, D.

4. Collars may be oval in shape or rectangular with rounded corners.
- F. For wrapper plate reinforcement, use the above collar formula except that the wrapper is of thickness “T”, its total width is $(2W + ID \text{ outlet} / \sin B)$, and it extends around the main pipe diameter portion of the steel special.
- G. Base crotch plate design on Swanson, H.S. et. al., DESIGN OF WYE BRANCHES FOR STEEL PIPES, summarized in AWWA Manual M11 (Current Edition), Chapter 13.
- H. Steel pipe used for outlets, twelve-inches (12”) and smaller, shall be standard weight conforming to ASTM A53 (Type E or S), Grade B. For flanged outlets, use a slip-on flange, double welded, and match the flange of the connecting component.
- I. At flanged outlets not indicated to be connected to valves or to other pipes, provide blind flanges with bolts, nuts, washers, and gaskets in accordance with the Standard Specifications.

2.3 STEEL FOR PIPE AND SPECIALS

- A. Use steel conforming to ASTM A36, ASTM A283 Grade D, ASTM A1011 SS Grade 36, ASTM A1018 SS Grade 36 with carbon content of 0.25% maximum. Use steel plate and sheet having a thickness with a maximum allowable variation of not more than 0.01-inch less than the minimum thickness specified.

2.4 CEMENT FOR INTERIOR MORTAR LINING

- A. Use cement conforming to ASTM C150, Type II.

2.5 CEMENT FOR EXTERIOR MORTAR COATING

- A. Use cement conforming to ASTM C150, Type II.

2.6 FLANGES

- A. Use flanges conforming to AWWA C207, Class E or Class F; or ANSI B16.5, Class 150 or Class 300.

2.7 BOLTS, NUTS, WASHERS, AND GASKETS FOR FLANGES

- A. Bolts, nuts, washers, and gaskets for flanges shall be per the Standard Specifications.

2.8 INSULATING FLANGE SETS

- A. Install insulating flange sets as shown in the Approved Plans, and per the Standard Specifications.

2.9 OUTLETS

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- A. For threaded outlets three inches (3”) and smaller, use a Thredolet type per AWWA Manual M11 (Current Edition), Chapter 13. Outlets shall be 3000 pound WOG forged steel per ASTM A105 or ASTM A216, Grade WCB. Threads shall comply with ANSI B1.20.1, NPT. Do not use pipe couplings for outlets.
- B. Threaded insulating bushings as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved in accordance with the Standard Specifications.

2.10 MECHANICAL CLAMP-TYPE COUPLINGS

- A. Mechanical clamp-type couplings for grooved or shouldered end pipe shall be per the Standard Specifications.
- B. Couplings for pipe, twelve three fourths-inches (12-3/4”) outside diameter and smaller, shall conform to AWWA C606 for flexible, square cut grooved joints in IPS steel pipe with weld-on grooved adapters. Couplings shall be Victaulic Style 77 or District approved equal.
- C. Couplings for pipe, fifteen three eighths-inches (15-3/8”) outside diameter and larger, shall conform to AWWA C606 for shouldered end flexible joints with Type D special ends. Couplings shall be Victaulic style 44 or District approved equal.

2.11 TYPE OF PIPE JOINTS

- A. Joint ends of pipe sections shall be as indicated on the Approved Plans.
- B. Welded joints: Use expanded bell with matching spigot to penetrate a minimum of two and a half inches (2-1/2”) into the bell. The manufacturing tolerances stated in AWWA C200 do not apply and are hereby exceeded by the following: Joint tolerances shall not exceed a total of an eighth inch (1/8”) on diameter with the joint gap equalized around the perimeter. Lap joints prepared for field welding shall be in accordance with ANSI/AWWA C200 and 206. The method used to form, shape and size bell ends shall be such that the physical properties of the steel are not substantially altered. Unless otherwise approved by the District Engineer, bell ends shall be formed by an expanding press or by the pipe being moved axially over a die in such a manner as to stretch the steel plate beyond its elastic limit to form a truly round bell of suitable diameter and shape. The ends shall not be rolled. Faying surfaces of the bell and spigot shall be essentially parallel, but in no case shall the bell slope vary more than 2 degrees from the longitudinal axis of the pipe.
- C. Flanges: Use slip-on or ring-type welded to the interior and exterior circumference of the pipe section. Weld-neck flanges (conforming to ANSI B16.5) shall be provided for piping 4-inches in diameter and smaller to connect to flanged valves, fittings and equipment. Slip-on or weld-neck flanges shall be provided for piping 4-inches in diameter. Flanges shall match the connecting flanges on adjacent fitting, valve or piece of equipment.
- D. Butt Strap Closures: Butt straps shall be the same thickness and material as the pipe wall, at least ten inches (10”) wide, rolled to fit the outside cylinder diameter in two half-sections, and shall be centered over the plain ends of the pipe sections they are to joint. Weld a six inch (6”) threaded, steel, standard half-coupling or couplings to the interior and exterior of the tip butt strap half-section to provide access for mortar lining the inside of the joint.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

Provide two couplings for pipes eighteen-inches (18”) to thirty inches (30”) at the 2 and 10-o’clock position. Provide a threaded steel plug for each half-coupling.

- E. Mechanical Clamp-Type Couplings: Use grooved or shouldered ends as determined by the outside diameter of the pipe and per AWWA C606. Prepare the pipe ends to properly engage with the specified dimensions of the coupling manufacturer for a correct fit.
- F. Flexible Couplings: Use plain end pipe and provide joint harness where shown. Flexible couplings and harness shall conform to Approved Material List, latest edition.

2.12 PAINTING AND COATING

- A. Cement and mortar coat all buried pipe where shown on the Approved Plans. Apply coating in shop.
- B. Coat the exposed bare steel surfaces of the spigot and bell ends of each pipe section per the Standard Specifications, System No. 15 (prime coat only). Apply primer in shop to the interior and exterior surfaces to a 2-mil dry film thickness.
- C. Coat inside surfaces of threaded outlets and blind flanges per the Standard Specifications, System No. 5. Apply coating in shop.
- D. Coat the grooved and shouldered ends of pipe to be in contact with mechanical clamp-type couplings per the Standard Specifications, System No. 5. Apply coating in shop to the described surfaces to a maximum of 10-mils dry film thickness.
- E. Coat the ends of plain end pipe where flexible pipe couplings are to be installed per the Standard Specifications, System No. 5. Apply coating in shop.

PART 3 – EXECUTION

3.1 LENGTH OF PIPE SECTIONS

- A. Provide pipe with a maximum length of thirty feet (30’) unless spreader beams are used in lifting the pipe sections at the third points, in which case lengths up to forty feet (40’) can be used.

3.2 PIPE CYLINDER FABRICATION

- A. Longitudinal and Girth Welds: Fabricate the pipe cylinder by full penetration butt welding with spiral seam or straight seam. Limit girth welds to two per pipe section with full penetration butt welds. Limit longitudinal welds to one seam for pipe diameters up to thirty inches (30”) and two seams for thirty inches (30”) to thirty six inch (36”) diameters. Stagger longitudinal seams of adjacent shell courses. When using spiral seam, coil splices shall be a minimum of two feet (2’) away from the ends of the pipe cylinder.
- B. Preparation of Edges: Machines or face the ends and edges of pipe sections for butt welds. Inspect sheared edges of plates or sheets over a fourth inch (1/4”) in thickness for cracks. Do not use plates or sheets with edges containing cracks.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

1. If the ends are faced with a cutting torch, removed irregularities and scale due to burning by grinding or chipping.
2. The dimensions and shape of the edges of the plates to be joined by welding and the gap between the plates shall be such as to allow thorough fusion and complete penetration, and the edges of plates shall be properly formed to accommodate the various welding conditions. Remove projecting burrs. Do not use hammering to shape the edges preparatory to welding.
3. Cut plates true to line so that the edges, when in position for welding, shall be straight, parallel, and in contact on longitudinal seams.
4. The maximum gap between the edges of plates prior to welding shall not be more than one sixteenth inch (1/16").

C. Forming

1. General:
 - a. Before rolling or forming longitudinal edges, plates shall be lap broken by a continuous rolling operation or be formed in a press having dies that are machined to the proper radius. The pressure exerted during the lap breaking operation shall be sufficient to secure a true and uniform curve at the edges of the plate. Roll or press form plates to the specified diameter.
 - b. Continually remove scale and other foreign matter accumulating on the plate during the rolling and forming operation by an air blast so that it will not be rolled or pressed into the surface of the plate. Keep the surfaces of breaker dies and rolls clear of bits of metal or other accumulated materials during forming operations.
 - c. Form each section of pipe to a true circle of the specified diameter throughout its entire length so as to produce a finished pipe truly round and free from dents, kinks, and abrupt changes in curvature. The outside circumference of the finished pipe shall not be less than its design value and shall not exceed its design value by more than 0.4%.
 - d. Complete rolling and forming prior to making butt welds.
 - e. Do not heat or hammer for the necessary forming of angles.
2. Minimum Radius: Do not use any forming process in which the plates are bent or otherwise formed during any stage of the process to a curvature of appreciably smaller radius than the radius of curvature corresponding to the specified diameter of the pipe
3. Forming Bells:
 - a. Shape the bells to accommodate the spigot penetration. Form the bell on an expanding press or by being thrust axially over a die in such a manner

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

as to stretch the steel plate beyond its elastic limit to a round bell of required diameter and shape, avoiding injurious reduction in plate properties of any part of the plate.

- b. Do not use any process in which the bell is formed by rolling.
- c. Bells for mitered pipe shall be normal to the axis of adjacent course of the adjoining pipe, and the axis of any such bell shall be parallel to the axis of such adjacent course.

D. Preparation for Welding:

1. Fit Up:

- a. Take special care in the layout of joints in which fillet welds are to be used in order to ensure the fusion of the weld material at the bottom of the fillet. Prior to welding, fit the plates closely; and during welding, hold them firmly together.
- b. Tack weld or clamp in place the edges of butt joints in proper alignment and hold throughout the welding process. Do not use dogs, clips, lugs, or equivalent devices welded to the steel plate for the purpose of forcing it into position.

2. Cleaning:

- a. Prior to welding, clean the surface of plates and members to be welded by an automatic process of all scale and rust for a distance of not less than one inch (1") and of all oil or grease for a distance of not less than three inches (3") from the welding edge and on both sides of the plates in the case of butt joints.
- b. Remove grease or oil with lye or other solvent. Do not use kerosene or any heavier petroleum solvent.
- c. Blasting and other cleaning shall preferably be done prior to any tack welding of the plates. Should inspection indicate a greater amount of porosity at the tack welds than in the remainder of the welds, sandblast the tack welds prior to automatic welding.
- d. When it is necessary to deposit metal over a previously welded surface, remove any scale, slag, or welding flux thereon by a roughing tool, chisel, air chipping hammer, or other means to prevent inclusion of impurities in the weld metal.

3. Aligning:

- a. Where butt-welded joints are used, take particular care in aligning the edges to be joined so that complete penetration and fusion at the bottom of the joint is accomplished. The offset in abutting edges shall not exceed one

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

sixteenth inch (1/16") at the circumferential and spiral seams and shall not exceed one thirty second inch (1/32") at longitudinal seams.

- E. Fabrication of Specials: Fabricate specials from previously hydrostatically tested straight pipe sections.

3.3 SHOP WELDING

- A. Material and Objective:

1. Perform welding by skilled welders who have had experience in the method and materials to be used. Welding operators shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications. Any welder or welding operator performing work shall have been qualified for the process involved within the past three years.
2. Perform welding by an unvarying arc-welding process, which excludes the atmosphere during the process of deposition and while the metal is in a molten state. The size and type of electrode used, the current and voltage required, and the type of wire and flux to be used for automatic processes shall be subject to review by the District Engineer of their designee.
3. Do not use rusted or damaged electrodes. Sift used flux from automatic welders free of fines and coarse pieces and remove mill scale before reusing.
4. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Make welds with a technique which will ensure uniform distribution of load throughout the welded section with a minimum tendency to produce
5. Make all welds in such manner and on such time schedule as to avoid residual internal stresses in the welded joints and stresses due to temperature changes in the completed pipe sections. Weld longitudinal seams before girth seams.

- B. Quality of Welds:

1. There shall be no greater evidence of oxidation in the metal of the weld than in the metal of the unwelded plate. Welded joints shall be of a type that will produce complete fusion of the plates and shall be free from unsound metal, pinholes, and cracks.
2. The finish of welded joints shall be reasonably smooth and free from grooves, depressions, burrs, and other irregularities. There shall be no valley or undercut in the center or edges of any weld.
3. Any pipe section which shows irregularities in shape after welding may be rerolled to make it cylindrical, but in no case shall it be reformed by hammering, and in no event shall reforming be permitted of pipe sections which after welding are found to have abrupt changes in curvature at longitudinal seams, unless such welds are subsequently removed and re-welded following the reforming operation.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

4. Back chipping on both automatic and hand welding, whether for repairs or preparation of the groove for the original weld, are subject to inspection by the District Engineer or their designee before being filled with weld metal. Do not make butt welds prior to the completion of the rolling and forming. Grind butt welds for both hand and automatic welding to sound metal before welding the reverse side.

C. Longitudinal Joints:

1. Longitudinal joints shall be double butt welded by a fully automatic welding process, using welding heads which permit visual investigation of the deepest point of penetration of the first pass and which permit backfilling of extensive repair cuts by the automatic process. Use starter and runoff plates for longitudinal weld. The first pass on longitudinal welds shall be on the inside of the pipe and shall accomplish at least 75 percent of the complete penetration.
2. Joint welds shall be continuous for the full length of the seam, and shall be built up uniformly at the center of the weld to form a reinforcement on both sides of the plate. The bead on the outside of the pipe shall have a height of at least one sixteenth inch (1/16") and no more than three thirty second inch (3/32") and a minimum width of at least one and one-half times the thickness of the plate; provided that in any case the weld and penetration shall be of sufficient width so that both edges to be joined shall be entirely involved in the weld, regardless of a possible inaccuracy in the line of travel of the automatic electrode. Where the welding method permits a considerable deviation in the line of travel of the welding head, place a scribed line parallel to and at a fixed distance from the edges of the plates prior to welding so that the location of the welding bead with regard to the plate joints may be readily checked.
3. Where welding on small pipe is done from one side only, remove the bead on the inside of the pipe by chipping so that the finished weld on the inside of the pipe will be practically flush with the plates. The inside bead will in no case be required to be larger than the outside bead but shall be of sufficient size so that, upon its removal, the inside fusion lines and any defects near the under surface of the weld metal will be exposed.
4. If complete penetration and reinforcement on both sides of butt-welded joints are not satisfactorily accomplished, when the welding is done from one side, then chip out the reverse side to the extent necessary to secure a clean surface of the originally deposited weld metal and make an automatic welding pass on the reverse side. The bead on the inside of the pipe shall be not more than one sixteenth inch (1/16") in height and the width of the bead shall be not less than three eighth inch (3/8") with smoothly tapered edges. Before making the second weld, chip out the underside of the first weld with a round-nosed tool until entirely solid and clean metal is reached.
5. Welding shall be subject to the requirement that there shall be no valley, groove, or undercut along the edge of or in the center of the weld, and that the deposited metal shall be fused smoothly and uniformly into the plate surface at the edges of the joint.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

6. If the normal welding process is interrupted for any reason, take special care when welding is resumed to get full penetration and thorough fusion between the weld metal and the plates and the weld metal previously deposited. Where welding is interrupted by faulty machine operation, chip back the weld to where the presence of solid, clean metal indicates correct machine operation before resuming welding operations.
- D. Shop Circumferential Joints and Spiral Seam Joints: Shop circumferential and spiral seam joints shall be double butt welded. The details of shop circumferential and spiral seam joints shall conform to the requirements for longitudinal joints as given above. Circumferential joints in bends and welded fabricated fittings need not be made by automatic welding methods.
- E. Defects: Completely chip out porosity and cracks, trapped welding flux, or other defects in the welds in a manner which will permit proper and complete repair by welding. Repair defective welds by hand welding. Where the defect is so extensive as to make a hand repair impractical, use automatic welds.
- F. Equipment: In welding by an automatic process, both the rate of deposition of the weld metal and the rate of travel of the electrode shall be automatically controlled. Use the submerged arc welding process for automatic welding.

3.4 SHOP TESTING

- A. General: After completion of fabrication and welding in the shop, and prior to the application of any lining or coating, test each component according to the following requirements.
- B. Shop Test Requirements:
 1. Perform tests of production welds in accordance with the AWWA C200 for each heat of steel used. A guided-bend test specimen shall be considered as having passed only if no crack or other open defect exceeding one eighth inch (1/8") measured in any direction is present in the weld metal or heat affected zone of the base material after the bending. A tension test specimen shall be considered as having passed only if failure occurs in the base metal at a stress in excess of the minimum specified tensile strength. There shall be at least one set of welding tests as described in AWWA C200, Section 3.3.5 for each 1,000 linear feet of spiral seam weld in addition to tests specified in Section 3.3.6 of the same standard.
 2. Test each straight pipe section in the shop by the hydrostatic test method.
 3. Inspect all welds in the expanded portion of the pipe bell in accordance with the magnetic particle test.
 4. Test back-gouge and completed weld of all manual process groove welds by the liquid penetrant method. Test completed fillet welds by the liquid penetrant method.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

5. Any production weld or manual process weld that appears to be of poor quality as determined by the District Engineer or their designee shall be subjected to 100 percent radiographic testing. One hundred percent ultrasonic testing may be used in lieu of 100 percent radiographic testing.
6. After shop fabrication testing, retest each pipe section with a mitered bend or reducer. Test the mitered or butt joints by 100 percent radiographic testing.
7. After shop fabrication, retest each pipe section with an attached outlet. Test the collar or wrapper with soap and compressed air method. Test the outlet by the liquid penetrant method.
8. Test each slip-on or ring type flange welded to the pipe by the liquid penetrant method and with the soap and compressed air method.

C. Test Methods:

1. Shop Hydrostatic Test: Vent air from the pipe section before the test pressure is applied. Hold the test pressure on each section for a sufficient length of time to permit inspection of all joints.
2. Use the following hydrostatic test pressure for testing straight pipe sections:

$$P = \frac{2ST}{D}$$

Where P = Hydrostatic test pressure, PSI
S = Stress, PSI, use 75% of the minimum yield point of the Steel
T = Wall thickness of the steel pipe section to be tested in inches
D = Actual outside diameter of the steel pipe section to be tested in inches.

3. When subjected to the above hydrostatic test pressure, the pipe shall show no leaks, distortion, or other defects. Repair any leaks or other defects which develop during the hydrostatic test by chipping out and re-welding, after which the repaired section shall again be tested until it shows no leaks or other defects.
4. Test Bulkheads: Furnish and attach suitable dished heads and blind flanges for making the hydrostatic tests, and after completion of the tests, remove the heads and properly restore the ends of the sections.
5. Radiographic Test: Make the radiographs in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair and defects in the welds disclosed by the radiographs. Submit all radiographs and the notation of areas for repair to the District Engineer or their designee for review.
6. Ultrasonic Test: Make the ultrasonic tests in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by ultrasonic testing. Prepare a report of the ultrasonic testing and submit to the District Engineer or their designee for review.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

7. Soap and Compressed Air Test: Use compressed air at maximum 40-psi pressure into the joint, and while the joint is under pressure, swab every portion of every welded seam forming a part of the joint with a heavy soap solution or a commercial bubble-producing leak test fluid. Examine for leakage. Repair any defects disclosed by the test by chipping out, re-welding the chipped section, and retesting. Drill and tap the necessary test holes, and plug weld holes after testing.
8. Liquid Penetrant Test: Conform to the requirements specified in ASTM E165, Method B. The materials used shall be either water washable or nonflammable. Products: “Spotcheck” by the Magnaflux Corporation or “Met-L-Check Flaw-Findr” by the Met-L-Check Company. Chip out all defects, re-weld, and retest the section affected until it shows no leaks or other defects.
9. Magnetic Particle Test: Magnetic particle test shall conform to the requirements specified in ASTM E709, using the wet particle technique. Chip out all defects, re-weld, and retest the section affected until it shows no leaks or other defects.

3.5 ALIGNMENT CRITERIA

- A. For horizontal and vertical curve alignment, use straight or beveled pipe of normal or one-half normal lengths pulled partially open on one side of the joint or use pipes with a welded mitered bend of up to 10 degrees next to the bell end. Design pipes with a bend in excess of 10 degrees as a special. Do not use angular deflections at the butt strap joints.
- B. Deflection by Pulled Joints:
 1. For rubber gasket joints, do not pull joint more than one-half of the watertight extensibility provided by the bell and spigot design or more than three fourth inch (3/4”) on the outside of the curve. Minimum interior joint space shall be half inch (1/2”).
 2. For welded joints, do not pull joint to exceed the minimum overlap of the assembled bell and spigot lap joint or more than one half inch (1/2”) on the outside of the curve. Minimum overlap of the assembled joint shall be one inch (1”) or 3 times the pipe wall thickness, whichever is greater per AWWA C206. Minimum interior joint space shall be one fourth-inch (1/4”). Maximum interior joint space shall be two inches (2”).
- C. Deflection By Beveled Joints: For welded joints only, use pipe sections having beveled bell ends for curves and angles in the alignment which cannot be accomplished using the maximum allowable deflection by pulled joints. Beveled pipe sections used in curved alignment shall be of standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length. Do not bevel spigot ends. The beveled end of a pipe shall not have a deflection from a plane perpendicular to the pipe axis exceeding 5 degrees. From the bell end perpendicular to the plane of the beveled end, so there is no loss of lap joint tolerance. Do not pull beveled joints.
- D. Deflection By Mitered Bends: For rubber gasket joints and welded joints, use pipe sections with welded mitered bends of up to 10 degrees next to the bell end for curves and angles which cannot be accomplished using the maximum allowable deflections by pulled or

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

beveled joints. Pipe sections with mitered bends used in curved alignment shall be of standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length.

3.6 THICKNESS OF INTERIOR MORTAR LINING

- A. Conform to AWWA C205 except provide minimum thickness of mortar lining over steel cylinder and steel specials as follows:

Nominal Pipe Size (inches)	Lining Thickness (inches)
6 through 10	3/8
12 through 18	1/2
20 through 36	3/4

3.7 THICKNESS OF EXTERIOR MORTAR COATING

- A. Conform to AWWA C205 except provide three-quarter inch (3/4") minimum thickness of mortar coating over all metal surfaces, except at flanges. Coating within one bolt length of a flange shall be held to 50 percent of the above thickness.

3.8 PRODUCT MARKING

- A. Plainly mark each length of straight pipe and each special at the bell end to identify the date of manufacture and the proper location of the pipe item by reference to the layout schedule. For beveled joints and mitered bends at the bell end, show the degree of bevel or miter and the point on the circumference to be laid uppermost.

3.9 INSTALLATION

- A. Delivery and Temporary Storage of Pipe
1. When loading pipes and specials for shipment to the project site, use wooden stringers between pipe layers and secure the load with padded chains or ribbon binders. Place internal braces for pipes twenty four inches (24") in diameter and larger prior to loading.
 2. Limit onsite pipe storage to a maximum of one week. Place the pipe in the numerical order in which it is to be installed and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Place the supports at about the one quarter point from the pipe ends. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.
 3. Place plastic caps over the ends of the pipes and specials. Replace caps damaged during shipment to the project site. Do not remove the plastic caps placed over the ends until the pipe is ready to be placed in the trench. Plastic caps may be opened temporarily to spray water inside the pipe for moisture control. Replace plastic caps damaged during shipment.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

B. Handling of Pipe

1. Lift pipes and specials with mechanical equipment using spreader beams or wide nylon straps, wide canvas or padded slings, wide padded forks, and skids designed to prevent damage to the pipes and specials. Do not use cable slings or chains directly bearing on the pipe. Lift pipes at two points, at approximately a third (1/3) to a fourth (1/4) of the pipe length from the pipe ends.
2. For pipes twenty four inches (24") in diameter and larger, maintain internal braces placed in pipes until backfilling is complete. Where the pipe is to be concrete encased, do not remove internal braces until the concrete has set hard and the subsequent backfill has been completed.
3. Measure each pipe and special to check the laying length against the tabulated layout schedule for fabrication accuracy. Mark the required stab depth of the spigot end around the circumference of each pipe and special prior to joint assembly.
4. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective damage or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench.

C. Sanitation of Pipe Interior

1. During laying operations, do not place tools, clothing, or other materials in the pipe. Keep the interior of the pipe clean as the pipeline construction progresses. The purpose of maintaining a clean interior is to aid in the passage of the bacteriologic quality testing after disinfection.
2. When pipe laying is not in progress, including the noon, hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, and storm water.

D. Installing Pipe in Trench

1. Trenching, Backfilling, and Compacting, Shoring, and Dewatering shall be in accordance with the Standard Specifications.
2. Lay pipes uphill if the grade exceeds 10 percent.
3. Place and compact the pipe base material (imported sand).
4. Cut a depressing to accommodate the pipe bell, external joint filler form, and polyethylene encasement at valves and flanges; and spaces to permit removal of the pipe handling slings.
5. Handle pipe and specials in a manner to avoid any damage to the pipe or coatings. Do not drop pipe or specials into trenches under any circumstances.
6. Lay each pipe and special in the order and position shown on the tabulated layout schedule. Lower the pipe onto the pipe base and install it to line and grade along its

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

full length on firm bedding except at the bell and at the sling depressions. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the tabulated layout schedule.

7. When installing pipe with beveled joints or mitered bends at the bell end, do not deviate the pipe top mark by more than two inches (2") from the vertical line passing through the pipe center.
8. Do not cut or modify a fabricated steel special in the field. Notify the District Engineer or their designee immediately in the event of interferences with the installation of adjoining components.
9. For all pipes, regardless of diameter, the District will require that the Contractor provide closed-circuit television (CCTV) inspection in accordance with the Standard Specifications of the completed interior mortar joints in the installed pipe at an interval of approximately nine hundred and sixty feet (960') or less. This inspection will be reviewed by the District Engineer or their designee. No additional pipe will be allowed to be installed in the trench until the interior joints have been inspected and repaired. An interior joint will be considered a failed joint when cement mortar does not fill the gap 100 percent between the adjacent mortar linings of the two joined pipes. All failed joints will be repaired by cutting out the joint and installing a butt strap closure. The inspection equipment shall be capable of providing distance readings; high quality visual transmission to the monitor; tape recordings; brightness, contrast, and focus adjustments; 360-degree camera head rotation within a 90-degree plane from the longitudinal centerline of the pipe; and remote operation.
10. For pipes twenty four inches (24") in diameter and larger, the amount of pipe to be laid and assembled in a trench shall be limited to a distance of approximately three hundred and twenty feet (320'). No additional pipe will be allowed to be installed in the trench until the other related operations of pipeline construction are completed. Other operations include, but are not limited to, joint welding or bond wires, grouting of exterior pipe joints, backfilling and compacting, removal of internal braces, completion of interior joints, and inspection by the District Engineer or their designee. The intent of this limitation is to provide a safe environment for the construction and inspection of the pipeline. The interior of the pipeline is considered a confined or enclosed space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.
11. All ferrous metal pipes and all pipes specified or shown on the Approved Plans to be cathodically protected shall be completed in accordance with the Approved Plans and specifications.
12. Warning and locator tape shall be installed on all pipelines per the Standard Specifications.

E. Installing Polyethylene Encasement

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

1. Wrap buried valve and flanges with polyethylene material per the Standard Specifications. Repair polyethylene material damaged during construction.

F. Assembling Pipe Joints

1. Clean the ends of the pipe to be joined of foreign material.
2. For rubber gasket joints, apply a food grade and biodegradable lubricant to the inside of the bell of the pipe in the trench and to the rubber gasket and spigot groove of the pipe to be installed. Stretch the rubber gasket into the groove of the spigot end of the pipe to be inserted and distribute it uniformly around the circumference. Immediately lower the pipe to be installed into the trench and, without tilting the pipe, entire its spigot into the bell of the pipe in the trench. Use come-a-longs or pipe jacks to drive spigot end home horizontally. Maintain joint recess recommended by pipe manufacturer for made-up joint.
3. For field-welded joints and pipes smaller than twenty four inches (24") in diameter, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its spigot into the top portion of the bell of the pipe in the trench. Continue to lower the pipe to be installed and push the spigot end into the bell horizontally to the marked stab depth on the spigot. Maintain a minimum fourth inch (1/4") to maximum two inch (2") joint space.
4. For field-welded joints and pipes twenty four inches (24") in diameter and larger, lower the pipe to be installed into the trench. Slightly tilt up the pipe to be installed and enter its bell onto the top portion of the spigot of the pipe in the trench. Continue to lower the pipe to be installed and push the bell onto the spigot horizontally to the marked stab depth on the spigot. Maintain a minimum fourth inch (1/4") to maximum two inch (2") joint space for welded joints.

G. Installing Pipe in Vaults

1. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.
2. Provide pipe supports per the Standard Specifications or as shown on the Approved Plans.
3. Link seal assemblies shall be installed at all pipe penetrations in accordance with the Standard Specifications.

H. Installing Flanged Joints

1. Flanged joints shall be installed per the Standard Specifications.

I. Installing Insulating Flange Sets

1. Insulating flange sets as shown in the Approved Plans shall be installed per the Standard Specifications.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

J. Installing Mechanical Clamp-Type Couplings

1. Install mechanical Clamp-Type couplings in accordance with the manufacturer's recommendations and the Standard Specifications.

K. Installing Flexible Pipe Couplings

1. Install flexible pipe couplings and joint harnesses where shown per the manufacturer's recommendations.

L. Field Welded Joints

1. Field welding shall be completed and inspected by the District Engineer's designee or an approved welding inspector prior to the application of cement mortar to the interior joint and cement grout to the exterior joint.
2. Provide single or double welded lap joints and butt strap closures where indicated on the Approved Plans. The minimum overlap of the assembled lap joint shall be one inch (1") or 3 times the pipe wall thickness, whichever is greater per AWWA C206.
3. Field welding shall be in accordance with AWWA C206. Welder's qualifications shall be in accordance with AWWA C206 Section 4.4. Any welder performing work shall have been qualified for the process involved within the past three years. Welders shall present a copy of their certification and references to the District Engineer or their designee prior to performing any field welding.
4. If joint faying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or abrasive blast cleaning.
5. Provide a two inch (2") minimum overlap for the butt strap on each of the adjoining pipe ends. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds. The longitudinal seams of the butt strap shall be offset from the pipe seams by a minimum of three inches (3"). Do not install butt straps with angular deflections.
6. To apply a fillet weld to the exterior joint of lap welded pipe or butt strap closures, deposit weld material in successive layers. Minimum size of fillet weld shall be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before commencing the next pass. Use electrodes recommended by the pipe fabricator. Do not deposit more than an eighth inch (1/8") of throat thickness per pass. The minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness (inches)	Fillet Weld Minimum Number of Passes
0.2500 and Less	2

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

Greater than 0.2500

3

7. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.
8. In lieu of exterior welded joints, the interior may be welded where the pipe diameter is greater than twenty four inches (24"). Backfill to one foot over the top of pipe except at the joints. Complete the interior weld prior to filling the outside joint recess with cement mortar.
9. Welding Procedures, Welding Qualifications, and Testing:
 - a. Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1 and as defined in Section 3 of ANSI/AWWA C206 or ANSI/AWWA C200, as applicable. All qualifications shall be in accordance with all-position pipe tests as defined in Section 5 of AWS D1.1. Field welders shall be proficient in the welding processes required for pipe 6G in accordance with AWS standards. Field welders shall have a reference list of completing three buried pipeline welding projects in the last five years. If work is to be performed on rod wrapped concrete cylinder pipe, field welder shall provide references for performing such work in the past to the satisfaction of the District Engineer or their designee.
 - b. For field welding, if required by the District Engineer or their designee, the welder qualification testing shall be performed at the site. Previous qualifications will not be accepted. The Contractor shall obtain the services of an independent testing laboratory to perform the welder qualification onsite. Copies of all test data and certifications shall be provided to the District Engineer or their designee. All costs for welder qualification testing shall be at no increased cost to the District.
 - c. Upon completion of each field-welded joint, the welding operator shall mark his regularly assigned identification number and the last two numbers of the year in which the work was completed to a specific joint. Steel stamping directly on piping will not be permitted unless "low stress" die stamps, such as interrupted dot or round nose types, are used.
 - d. All field lap welds will be inspected by magnetic particle or dye penetration methods. Field butt welds will be inspected in accordance with the requirements of API 1104 by the radiographic method and the acceptance criteria of API 1104. Magnetic particle testing is not required for seal welds.
 - e. The Contractor shall inform the District Engineer or their designee before completed weld joints are to be backfilled so that the joint may be inspected. The Contractor shall assume all costs of exposing backfilled joints for inspection when backfilling preceded the inspection.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- f. Personal performing visual inspection of welds shall be qualified and currently certified as Certified Welding Inspectors in accordance with AWS QCI, Standard for Qualification and Certification of Welding Inspectors. Personnel performing nondestructive tests shall be qualified and certified to the requirements of SNT-TC-1A.
- g. The District Engineer or their designee, at their discretion, may also order nondestructive testing by an independent testing laboratory in addition to any testing specified herein. Except as otherwise specified herein, all costs for the independent testing laboratory to inspect and field test welds will be paid for by the Contractor. If the weld is defective, the inspection costs shall be paid for by the Contractor. Defective welds shall be repaired and retested at the Contractor's expense.
- h. Test reports of all laboratory tests shall be submitted as provided in the inspection and field verification section.
- i. All weld testing and inspection described herein shall be performed by the Contractor at no additional cost to the District.

M. Pipeline Closure Assemblies

- 1. Use pipeline closure assemblies (butt straps) to unite sections of pipeline laid from opposite directions and to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations.
- 2. Center the shaped steel butt straps over the ends of the pipe sections they are to join and provide a minimum of two inches (2") of overlap on the pipe ends. Weld the butt straps to the outside of the pipes with complete circumferential fillet welds equal in size to the thinnest part being joined and on the inside where indicated. Butt weld the longitudinal seams of the butt strap before completing the circumferential fillet welds.
 - a. Where butt straps are to be installed with no interior access available, perform welding from the outside of the pipe only. Butt strap shall include six inch (6") threaded, steel, standard half coupling or couplings, i.e. hand holes. One hand hole shall be installed for pipe 16" diameter pipe and smaller. Two hand holes shall be installed for pipe 18" to 24" diameter. Prepare the longitudinal seams of the butt strap for a single-groove, full penetration butt weld. Use an interior backing plate in the gap for the full width of the joint. Provide carbon steel plates equal to the thickness of the pipe wall by one inch (1") wide by the width of the joint. Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project a half inch (1/2") above the longitudinal seams are complete, then the circumferential fillet welds at each end of the butt strap can be completed.
 - b. Where butt straps are to be installed with interior access available, perform welding from both the inside and outside of the pipe. Prepare the outside longitudinal seams of the butt strap for a single-groove, full penetration

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

butt weld. Use an interior backing plate in the gap for the full width of the joint minus one inch (1"). Provide carbon steel plates equal to the thickness of the pipe wall by one inch (1") wide by the width of the joint minus one inch (1"). Fillet weld the backing plates to each interior side of the bottom half of the butt strap. Each backing plate shall project a half inch (1/2") above the longitudinal seam of the bottom half of the butt strap and be centered in the longitudinal length of the butt strap. Once the butt welds of the outside longitudinal seams are complete, then the outside circumferential fillet welds at each end of the butt strap can be completed. When the outside welds are complete, fillet weld around the inside backing plate and then complete the inside circumferential fillet welds at each end of the butt strap.

3. Cement mortar line closure assemblies to a mortar thickness equal to the adjoining pipe sections. Clean the inside steel surfaces by wire brushing or power brushing. Apply a cement and water wash coat prior to applying the cement mortar. Where the joint width exceeds four inches (4"), place welded wire fabric reinforcement in two inch (2") by four inch (4") pattern of No. 13 gage over the exposed steel. Install the fabric so that the wire on the two inch (2") spacing run circumferentially around the pipe. Crimp the wires on the steel surface. Pack the cement mortar into the recess of the joint and steel trowel finish to match the adjoining pipes.
4. Apply welded wire fabric reinforcement and cement mortar to the inside face of the closure plug. Thread plug into coupling once cement mortar is dry and seal weld.
5. Cement mortar coat the exterior of closure assemblies. Clean the outside steel surfaces of the butt strap and adjoining pipes by wire brushing or power brushing. Apply cement and water wash coat to the steel surfaces and allow to dry. Wrap welded wire fabric reinforcement or expanded metal lath around the exposed steel and secure in place. Crimp the metal wires of the fabric or the metal lath at four inch (4") spacing around the pipe to support the fabric or lath three eighths inch (3/8") from the exposed steel surface. Trowel cement mortar over the exposed steel surfaces in a two-coat application. Apply the scratch coat and four (4) hours later the finish coat. The finish coat may be applied sooner if the scratch coat is hard and self-supporting. The cement mortar coating shall be equal in thickness to the adjacent coatings and have no voids, cracks, or blisters. Keep the coating moist by sprinkling or spraying with water to retard drying while curing.

N. Connection to Existing Waterlines

1. Where new pipelines are to be connected to existing steel waterlines, the Contractor shall verify in the field location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the installation. Where rod wrapped concrete cylinder pipe exists, weld the reinforcing rod wrap to the cylinder wall of the pipe for a sufficient distance to anchor the rod wrap from the movement at the point of connection. Do not cut or damage the rod wrap under any circumstances and do not cut the concrete cylinder pipe until the rod wrap has been anchored. This field verification shall be performed in the presence of the District Engineer or their designee.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

- O. Installing Corrosion Control Components
 - 1. Install bond wires, anodes, and test stations in accordance with the Approved Plans and specifications.

- P. Completing Interior Mortar Joints for Pipes Smaller than 24-Inches in Diameter
 - 1. Butt Strap Assembly Method:
 - a. The interior of joints shall be completed as described elsewhere in this specification for pipeline closures using a butt strap with hand holes.
 - b. Upon approval by the District, hand holes can be fabricated onto the spigot end of the pipe for the purposes of completing the interior joint. The centerline of the hand hole shall be a minimum of sixteen inches (16") from the spigot end of the pipe. The hand hole shall not be welded directly onto the joint, on the bell end of the pipe, or within the bell deformation zone as determined by the pipe manufacturer.
 - c. After backfill operations are complete, joints shall be inspected and repaired per the procedures outlined in Section 3.10, D, 9.

- Q. Completing Interior Mortar Joints for Pipes 24-Inches in Diameter and Greater.
 - 1. Backfill the trench before applying the interior lining at joints. Joints shall be lined immediately after backfilling and at no time shall the completion of the lining be further than three hundred and twenty feet (320') behind pipe laying.
 - 2. Do not remove the internal braces until backfilling has been completed or until the concrete encasement and subsequent backfill are completed.
 - 3. Working inside the pipe, remove foreign substances which adhere to the steel joint rings, clean them, and pack cement mortar into each joint. Finish the surface with a steel trowel to match the adjoining pipes.
 - 4. Remove by sweeping excess mortar and other construction debris from the pipe interior as the pipeline construction progresses.

- R. Completing Exterior Pipe Joints Where Cement-Mortar Coated
 - 1. Fill exterior joint recess with cement grout using a fabric form placed around the joint and secured with steel straps. At the option of the Contractor, a rapid set cement grout may be used to shorten the set up time before backfilling.
 - 2. Pour and rod the grout from one side only until it is visible on the opposite side.

- S. Trench Backfill
 - 1. Provide sufficient space along each side of the pipe and trench wall to observe that the pipe zone material (imported sand) fills all the spaces below pipe spring line.

VALLECITOS WATER DISTRICT
SECTION 15076 – CEMENT-MORTAR LINED AND COATED STEEL PIPE

2. Start the backfilling operations specified in the Standard Specifications after completing the exterior pipe joints and the cement grout has cured for 24-hours or is hard enough to be self-supporting as determined by the District Engineer or their designee.
3. No exterior pipe joint shall be backfilled until it has been inspected by the District Engineer or their designee.
4. Until the pipeline is filled with water, install bulkheads and apply moisture inside the bullheaded portions in a manner that will effectively prevent the drying out of the mortar lining.
5. After the pipe zone has been backfilled and compacted, place the warning/identification tape on the compacted zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap tape around the valve box extension pipes and continue along pipe.

T. Painting and Coating

1. Coat exterior surfaces of bare steel pipe in vaults per the Standard Specifications, System No. 10. Apply finish coat in the field.
2. Coat exterior surfaces of mechanical clamp-type couplings and flexible pipe couplings the same as the adjacent pipes.
3. Do not paint or coat exposed insulating flange sets in vaults. Sets shall be electrically non-conductive and any paint on the washers and nuts will prevent the proper function of the set.

U. Pressure Testing and Disinfection

1. Hydrostatic pressure testing and disinfection requirements shall be in accordance with the Standard Specifications.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 15089

COMBINATION AIR VACUUM / AIR-RELEASE VALVE ASSEMBLY

PART 1 - GENERAL

A. Description

This section includes materials and installation of combination air vacuum/air-release valves.

Valves are to be provided and installed per AWWA C 512, unless noted otherwise in this section.

B. Application

1. Combination valves shall be installed at high points on the line or as shown on the plans.
2. If the profile changes during construction from that shown on the drawings, valve assemblies shall be installed at the high points in lines as constructed.
3. The installation shall be complete as shown on VWD standard drawings W-2, or W-3, or W-24 and W-25.
4. Combination valve assemblies shall function to slowly release pockets of air which accumulate at high points, or changes in line gradient, exhaust large quantities of air from pipeline while being filled and admit large quantities of air into pipeline when being drained to prevent air lock or vacuum collapse of the pipe.

C. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- | | |
|---|-------|
| 1. Concrete: | 03300 |
| 2. Painting and Coating: (item C-3.C.) | 09900 |
| 3. Hydrostatic Testing of Pressure Pipelines: | 15042 |
| 4. Copper, Brass and Bronze Pipe, Fittings and Appurtenances: | 15057 |
| 5. Manual Valves: | 15100 |

D. Approved Manufacturers

Per VWD Approved Material List, latest edition.

E. Air-Release Valve Criteria

Air release shall be sized to accommodate the release of the maximum amount of entrained air that could be released in the system, as a function of the maximum differential in temperature and pressure which could result in air entrainment, or 2% of the volume of water passing through the system; whichever is greater.

F. Vacuum Release Criteria

The vacuum release shall be sized to accommodate 100% of the CFM of air of the pipeline.

PART 2 - MATERIALS

A. Combination Air Release Valves

1. Materials of construction for combination air and vacuum release valves shall be as

B. Steel Vented Pipe Vertical Cover

The steel vented pipe vertical cover shall be Pipeline Products, or approved equal, per VWD standard drawing W-25.

C. Service Piping

Per approved material list.

Water service piping utilized in the installation of the combination air and vacuum relief valve shall be Type K, soft copper with bronze accessories.

D. Meter Box

Meter box and lids shall be per VWD Approved Material List, latest edition.

E. Stainless Steel Pipe

The pipe nipple between the isolation valve and the combination air release assembly shall be brass.

PART 3 - EXECUTION

A. Location

1. Combination air-vacuum/air-release valves shall be installed at each point in the pipeline as shown on the drawings or as specified by the District representative.

2. The tap for the air valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting. No tap shall be permitted in any machined section of ACP.

B. Installation

1. Combination valves shall be installed in accordance with VWD standard drawings W-2, or W-3, or W-24 and W-25.
2. The tap and piping shall be installed per Section 15057.
3. The concrete pad and support shall be constructed per Section 03300. Riser piping shall extend through concrete slab and wrapped in 10 mil. tape.
4. 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.
5. The combination valve and the steel vented pipe cover shall be painted in accordance with Section 09900. The final coat of paint shall be applied immediately prior to the final inspection.

C. Valve Pressure Testing

1. Test valves at the same time that the connecting pipelines are pressure tested. See Section 15042 for pressure testing requirements.
2. Protect or isolate any parts whose pressure rating is less than the test pressure.

END OF SECTION

SECTION 15100 – VALVES

PART 1 – GENERAL

1.1 DESCRIPTION

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

Manual valves to be supplied and installed per ANSI/AWWA C504, C507, and C509, unless noted otherwise below.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- A. Section 01300 – Submittals
- B. Section 02223 – Trenching, Backfilling, and Compacting
- C. Section 03300 - Concrete
- D. Section 09900 – Painting and Coating
- E. Section 15000 – Piping Components
- F. Section 15042 – Hydrostatic Testing of Pressure Pipelines
- G. Section 15102 – Resilient-Wedge Gate Valves
- H. Section 15103 – Butterfly Valves

1.3 APPROVED MANUFACTURERS AND MODELS

- A. Ball Valves – Above ground Smaller Than 3 Inch
Per plans and specifications.
- B. Gate Valves - 3 Inch and Smaller
Per plans and specifications.
- C. Butterfly Valves
Per VWD Approved Material List, latest edition.
- D. Resilient - Seated Wedge Gate Valves: 4 Inch through 24 Inch
Per VWD Approved Material List, latest edition.
- E. Valve Boxes
Per VWD Approved Standard Drawing W-14.

1.5 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

SECTION 15100 – VALVES

Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:

ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings
ANSI/ASME B16.47	Large Diameter Steel Flanges: NPS 26 through NPS 60
ANSI/ASME B1.20.1	Pipe Threads (Inch), General Purpose
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.34	Valves, Flanged Threaded and Welding End
ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216	Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High Temperature Service
ASTM A351	Standard Specification for Steel Castings, Austenitic, Austenitic-Ferritic (Duplex), and Pressure-Containing Parts
ASTM A395	Standard Specification for Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures
ASTM A515	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A743	Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Purposes
ASTM B61	Standard Specification for Steam or Valve Bronze Castings
ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B148	Standard Specification for Aluminum-Bronze Sand Castings
ASTM B584	Specification for Copper Alloy Sand Castings for General Applications
ASTM D429	Standard Test Methods for Rubber Property – Adhesion to Rigid Substrates
ANSI/AWWA C110	Ductile-Iron and Gray-Iron Fittings
ANSI/AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
ANSI/AWWA C207	Steel Pipe Flanges for Waterworks Service – Sizes 4 inch Through 144 Inch
ANSI/AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
ANSI/AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
ANSI/AWWA C504	Rubber-Seated Butterfly Valves
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water Supply Service
ANSI/AWWA C512	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
ANSI/AWWA C515	Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
ANSI/AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
SSPC SP 2	Hand Tool Cleaning
SSPC SP 5	Joint Surface Preparation White Metal Blast Cleaning

SECTION 15100 – VALVES

MSS SP6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
MSS SP25	Standard Marking Systems for Valves, Fittings, Flanges, and Unions

1.6 SUBMITTALS

Contractor shall furnish submittals in accordance with the requirements of Standard Specifications. The following submittals are required:

- A. Product data from manufacturer, calculations, manufacturer's catalog data and detail construction sheets showing all valve parts and describing material of construction by material and specification (such as AISI, ASTM, SAE, or CDA). Submittal shall include valve dimensions including laying lengths and dimensions, orientation of valve operators, port sizes, number of turns, and required torque input of the actuator to be used. Information shall be submitted on valve handles, hand wheels, actuators, position indicators, limit switches, integral control systems, needle valves, and control systems. Submittal shall show location of internal stops for gear actuators. Submittals shall also indicate valve linings and coatings with manufacturer's and paint numbers listed. Contractor shall indicate the size, quantity and pressure rating of valves, including the class and drilling pattern of the flanges where applicable.
- B. Manufacturer's certification that products comply with the requirements set forth in the Standard Specifications.
- C. Manufacturer's certification that all linings and coatings have been factory tested for holidays and lining/coating thickness and comply with the indicated requirements. Include factory test data.
- D. For valves requiring certified tests, submit certified test results.
- E. A schedule of valves to be labeled, indicating in each case the valve location, station, valve structure, type, manufacturer, size, pressure rating, drilling pattern, model number of each valve and type, manufacturer, model number of each valve operator, and the proposed wording for the label.
- F. Operation and maintenance data shall be submitted and shall include, but not be limited to, the following information:
 1. Manufacturer's installation and operating instructions.
 2. Manufacturer's maintenance procedures.
 3. List of special tools.
 4. Schedule of valves indicating valve identification and location.
 5. Spare Parts List: A spare parts list shall be provided with information for each valve assembly.

SECTION 15100 – VALVES

1.7 APPLICATION

A. Flanged End

All valves connecting to mains shall be flanged on at least one side and bolted to the fitting on the main.

B. Single Type of Valve

The contractor shall choose an approved valve and then use only that valve throughout the project.

C. Detector Check and Backflow Prevention Assembly

Isolation valves on a detector check or backflow prevention assembly are to be part of an integral unit, furnished and assembled by the manufacturer of the device.

D. Butterfly Valves

Butterfly valves shall only be considered for approval on lines 14 inches and larger or as specifically shown on the plans.

E. Resilient-Seated Wedge Gate Valves

Resilient-seated wedge gate valves shall be used on all pressure class 150 lines 6 inch through 24 inch or as specifically shown on the plans.

1.8 DELIVERY, STORAGE, AND HANDLING

Valves shall be delivered and stored in accordance with ANSI/AWWA C550. The port openings shall be covered with plastic, cardboard or wood while in transit and during storage in the field. These covers shall remain in place until valves are ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Valves shall be installed complete with operating handwheels or levers, extension stems, worm gear operators, operating nuts, chainwheels, chains, and wrenches required for operation.
- B. Valves shall have the name of the manufacturer, the size of the valve, and the date of manufacture cast or molded onto the valve body or bonnet or shown on a permanently attached plate. Do not attach ID plates to the valve body or bonnet for gate valves.
- C. Valve body and trim casting shall be of domestic origin.
- D. Coordinate the drilling pattern and orientation of bolt holes between valves and adjacent flanges. Use only flat-faced flanges for all valves.
- E. Bolts, nuts, and washers for flanged valves shall conform to the Standard Specifications .

SECTION 15100 – VALVES

- F. Gaskets for flanged end valves shall be NSF-61 only as described in the Standard Specifications.
- G. All valves shall be new and of current manufacture. Valves shall be furnished and installed by the Contractor at the location and in accordance with the type of ends as shown on the Plans and as specified herein. Where not indicated, the valves shall have the same type of connection as the pipeline in which valves are to be installed and conform to the Specifications.
- H. The Contractor shall furnish and install each specific type of valve from a single manufacturer and use it throughout the Work.

2.2 VALVES

A. ABOVE GROUND BALL VALVES 3 INCHES AND SMALLER

- 1. Aboveground threaded end ball valves, 1/4 inch through 3 inches, for water service shall be full bore port ball type having a minimum working pressure of 200 psi WOG. Valves shall have plastic coated lever operators.
- 2. Materials of construction shall be as described below:

Component	Material	Specification
Body	Bronze	ASTM B 62
Ball	Bronze	ASTM B 62
Seat, Seals	Teflon	
Stem	Bronze or Copper silicon	ASTM B 62, B 99 (Alloy 651), B 584 B 371 (Alloy 694)

- 3. Stem material shall have a minimum tensile strength of 60,000 psi and a minimum yield strength of 30,000 psi.

B. GATE VALVES 3 INCHES AND SMALLER

- 1. Valves shall conform to AWWA C500 and the following:
- 2. Gate valves shall be designed for a working pressure of 200 psi or 250 psi as required.
- 3. Gate valves shall be furnished with ends as specified on plans or by the District.

C. TAPPING VALVES

- 1. Tapping valves shall conform to all requirements for gate valves 6 inches and larger and the additional requirements listed herein.
- 2. All valve ends shall be flanged. The flange on one end shall have slotted bolt holes to fit all standard tapping machines.
- 3. Seat rings shall be oversized to permit the use of full-size cutters.

SECTION 15100 – VALVES

4. Resilient-seated wedge gate valves may be used as tapping valves, provided that the disk fully retracts to produce a full port opening.

D. BUTTERFLY VALVES

Butterfly valves shall be in accordance to the Standard Specifications.

E. RESILIENT-SEATED WEDGE GATE VALVES

Resilient-seated wedge gate valves shall be in accordance to the Standard Specifications.

F. MISCELLANEOUS VALVES

1. Hose Bibbs and Valves: Hose bibbs shall be furnished and installed in the locations shown on the Plans and shall be of the sizes required. They shall be brass hose valves, Crane 58 or approved equal. Hose valves shall be Crane 117 or approved equal, with National Standard threads, cap, and chain.
2. Globe valves smaller than two-inches (2") in diameter shall have threaded ends, bronze bodies per ASTM B62 with union bonnets for class 150 rating. Globe valves shall contain a Teflon disc, brass or bronze disc holder and nut per ASTM B62, malleable iron hand wheel, bronze packing nut per ASTM B584, copper-silicon bronze stem per ASTM B371, and shall have non-asbestos fiber with Teflon packing.

G. CORPORATION STOPS – BRONZE, 2 INCHES AND SMALLER

1. Stops per Approved Material List, latest edition. Use either flared tube fittings for working pressures from zero to 150 psi, or solder joint fittings for working pressures from zero to 300 psi.

H. BALL VALVES – BRONZE, 2 INCHES AND SMALLER

1. Ball valves per Approved Materials List, latest edition. Use a lever handle for non-buried installations and a tee handle for buried installations.

2.3 VALVE OPERATORS

- A. Provide lever or wrench operators having adjustable, "position indicator" for exposed valves smaller than 6 inches.
- B. Provide 2-inch ANSI/AWWA operating nuts for buried and submerged valves.
- C. Gear operators shall be enclosed, suitable for running in oil with seals provided on shafts to prevent entry of dirt and water into the operator. Gear operators for valves located above ground or in vaults and structures shall have handwheels. Minimum handwheel diameter shall be 12 inches. The operator shall contain a dial indicating the position of the valve disc or plug. Gear operators for buried or submerged valves shall have 2-inch square AWWA operating nuts.
- D. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets.

Provide totally enclosed operators designed for buried or submerged service.

SECTION 15100 – VALVES

- E. Traveling nut and worm and gear operators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full operating head with a maximum pull of 80 pounds on the handwheel or crank and shall be fully grease packed. Provide stop limiting devices in the operators in the open and closed positions. Operators shall be of the self-locking type to prevent the disc or plug from creeping. Design operator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel operators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.
- F. Operators on buried valves shall produce the required torque on the operating nut with a maximum input of 150 foot-pounds.
- G. Valve operators, handwheels, or levers shall open by turning counterclockwise.

2.4 PAINTING AND COATING

- A. Coat metal valves (except bronze and stainless-steel valves) located above ground or in vaults and structures in accordance with the Standard Specifications. Apply the specified prime coat at the place of manufacture. Apply finish coat in field. Finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.
- B. Coat buried metal valves at the place of manufacture per the Standard Specifications. Valves shall be holiday-free tested at the factory.
- C. Valves 4 inches and larger shall be coated on their interior metal surfaces excluding seating areas and bronze and stainless-steel pieces in accordance with AWWA C550 and these specifications. Surfaces shall be sandblasted in accordance with SSPC SP-5. Remove all protuberances which may produce pinholes in the lining. Round all sharp edges to be coated. Remove any contaminants which may prevent bonding of the lining. Coat the interior ferrous surfaces using one of the following methods:
 - 2. Apply powdered thermosetting epoxy (Scotchkote 134 or equal) per the manufacturer's application recommendations to a thickness of 8 to 10 mils.
 - 3. Apply two coats of catalytically setting epoxy (Keysite 750, Gilpon, or equal) to a dry-film thickness of 8 to 10 mils total. Follow the paint manufacturer's application recommendations including minimum and maximum drying time between the required coats.

All valve coatings shall be factory applied per the Approved Materials List, latest edition. Coating applied by the valve distributor will not be permitted. Touch up and repair of valve coatings shall be only done by authorized factory distributors.

2.5 VALVE BOXES FOR BURIED VALVES

- A. Valve extension pipe material shall be 8-inch SDR-41 PVC, white.
- B. Valve boxes and caps shall be per VWD standard drawings W-14 and W-16.

2.6 EXTENSION STEMS FOR BURIED VALVE OPERATORS

SECTION 15100 – VALVES

- A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 24 to 30-inches below the surface of the ground and/or box cover.
- B. Extension stems shall be galvanized steel and shall be complete with 2-inch-square operating nut.
- C. Valve stem extensions shall be of a solid design (no pinned couplings permitted) with guides.

PART 3 – EXECUTION

3.1 LOCATION

Valve assembly shall be installed in a level section of pipe. No tap shall be installed within 18 inches to a valve.

3.2 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.
- C. Rubber ring grooves of valves shall be inspected before installation by the contractor for ridges or holes that would interfere with the rubber ring. Interferences with the rubber ring shall be corrected to a satisfactory condition or the valves replaced, as determined by the District. (All valves shall have the same rubber-ring groove profile as the groove of the pipe couplings furnished with the pipe.)

3.3 EXTERIOR PROTECTION

- A. All exposed flanges and other metal surfaces and all damaged coatings shall be per the Standard Specifications.
- B. Wrap buried valves with 8-mil clear polyethylene wrap per ANSI/AWWA C105 such that only the stem and operating nut are exposed. Polyethylene wrap shall be clear for use with potable water and purple for use with recycled water. Secure with 2” wide polyethylene or vinyl adhesive tape.

3.4 CONCRETE SUPPORTS

- A. Concrete shall be placed in accordance to the Standard Specifications.
- B. Valves shall be anchored in concrete as shown in VWD standard drawing W-15.
- C. Concrete supports are required under valves bolted to flanged fittings.
- D. Until supports are poured, valves may be temporarily supported by means approved by the

SECTION 15100 – VALVES

District representative so that the pipe is not subjected to the weight of the valve. Temporary supports to be removed after permanent supports are poured.

- E. All concrete anchors and thrust blocks specified or required by the District representative are considered as part of the pipeline installation.
- F. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement.

3.5 VALVE BOXES

- A. Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve.
- B. Beveled sections of pipe will not be allowed at the top of the valve extension pipe. The top cut shall be square and machine made.
- C. During the construction of new tracts, the valve extension pipes for "key valves" shall extend well above the ground level to permit ease of location in case of emergency shutoffs.
- D. The box cover shall be flush with the surface of the finished pavement or at any other level designated by the District representative as per VWD standard drawing W-14.

3.6 BACKFILL

- A. All backfill within 24 inches of a valve shall be clean, washed sand, placed, and compacted in accordance with the Standard Specifications.

3.7 PRESSURE TESTING

- A. Valves requiring a factory hydrostatic test and holiday detection that are delivered to the site prior to approval will be subject to rejection. Valves shall be hydrostatically tested in the field in conjunction with the pipeline in which it is connected in accordance with the Standard Specifications.

3.8 VALVE FIELD TESTING

- A. Operate manual valves through ten full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. If valves stick or bind, repair or replace valve and repeat the tests.
- B. Manual gear actuators for butterfly, ball and plug valves shall operate valves from full open to full close through ten cycles without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having two inch AWWA nuts shall not exceed 150 foot pounds. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Fully lubricate operators in accordance with the manufacturer's recommendations prior to operating.

SECTION 15100 – VALVES

3.9 FIELD PAINTING AND COATING

- A. The exterior of valves installed above ground or exposed in vaults or enclosures shall be field painted in accordance with the Standard Specifications.

****END OF SECTION****

SECTION 15102 – RESILIENT-SEATED WEDGE GATE VALVES

PART 1 – GENERAL

1.1 DESCRIPTION

This section includes materials, testing, and installation of resilient-seated wedge gate valves.

Butterfly valves to be supplied and installed per ANSI/AWWA C509 and C515, unless noted otherwise below.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

A. Section 01300 – Submittals

B. Section 09900 – Painting and Coating

C. Section 15100 – Valves

1.3 APPROVED MANUFACTURERS AND MODELS

A. Resilient-seated wedge gate valves shall be manufactured by AFC, AVK, Clow, or Mueller per VWD Approved Material List, latest edition.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:

ANSI/AWWA C509	Resilient-Seated Gate Valves for Water Supply Service
ANSI/AWWA C515	Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

1.5 SUBMITTALS

Submittals shall conform to the Standard Specifications.

1.6 FACTORY TESTING

A. Valves shall be facility tested in compliance with ANSI/AWWA C509.

B. Proof-of-design tests reports shall be submitted in compliance with ANSI/AWWA C509.

PART 2 – PRODUCTS

2.1 RESILIENT-SEATED WEDGE GATE VALVES (ANSI/AWWA)

A. General

SECTION 15102 – RESILIENT-SEATED WEDGE GATE VALVES

1. All valves shall be leak tight at their rated working pressure.
2. Valves shall have non-rising stems, opening by turning left and provided with 2-inch-square operating nut. Outside stem and yolk valves shall be used on backflow device shutoff valves.
3. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
4. Stem seals (Stuffing boxes) shall be O-ring seal type with two rings located in stem per ANSI/AWWA C509.
5. Low friction torque reduction thrust bearings shall be located both above and below the stem collar.
6. Materials shall be as described below:

Component	Material	Specification
Body, Operating Nut Bonnet, Seal Plate	Ductile Iron	ASTM A 126 Class B
Gate	Ductile Iron	ASTM A 126 Class B
Bonnet and Seal Bolts	Stainless Steel	Type 316
O-Rings	Synthetic Rubber	ASTM D2000

7. All internal working parts (excluding gate) shall be all bronze containing not more than 2 percent aluminum or more than 7 percent zinc. Valve stems shall be of low zinc content (2%) or stainless steel, having a minimum tensile strength of 70,000 psi, a yield strength of 40,000 psi, and 12% elongation in 2 inches. The stem is to be visibly marked so that it meets this requirement. For sewer applications, the stem shall be Type 316 stainless steel.
 8. All gates shall be encapsulated in Buna-S rubber or nitrile elastomer.
 9. All drain cocks and plugs to be stainless steel.
- B. Coatings: Ferrous surfaces of valves, four-inch (4”) and larger, which will be in contact with water (exclusive of flange faces) shall be coated complying with the Standard Specifications and external surfaces fusion bonded and epoxy coated.
- C. Valve Testing
1. Resilient-seated wedge gate valves shall be hydrostatically tested and coatings shall be holiday detected prior to shipment to the field.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The installation shall be in accordance with the Standard Specifications.
- B. Install valves with the bolt holes straddling the vertical centerline of pipe and the operating nut in the vertical position unless otherwise noted on the Plans.

****END OF SECTION****

SECTION 15103 – BUTTERFLY VALVES

PART 1 – GENERAL

1.1 DESCRIPTION

This section includes materials, testing, and installation of butterfly valves, actuators, and appurtenances.

Butterfly valves to be supplied and installed per ANSI/AWWA C504, unless noted otherwise below.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

A. Section 01300 – Submittals

B. Section 09900 – Painting and Coating

C. Section 15100 – Valves

1.3 APPROVED MANUFACTURERS AND MODELS

A. Butterfly valves shall be manufactured by Pratt Valve, per VWD Approved Material List, latest edition.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:

ANSI/AWWA C504	Rubber-Seated Butterfly Valves
ANSI/AWWA C540	Power Actuating Devices for Valves and Slide Gates
ANSI/AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
API 598	Valve Inspection and Testing
API 6D	Specification for Pipeline Valves
API 607	Fire Test for Soft-Seated Quarter Turn Valves
API 609	Butterfly Valves: Double-Flanged, Lug and Wafer Type

1.5 SUBMITTALS

Prior to ordering or delivery of butterfly valves, submittals shall be submitted for review and approval by the District Engineer in accordance with the Standard Specifications.

1.6 FACTORY TESTING

A. Valves shall be facility tested in compliance with ANSI/AWWA C504.

B. Proof-of-design tests reports shall be submitted in compliance with ANSI/AWWA C504.

SECTION 15103 – BUTTERFLY VALVES

PART 2 – PRODUCTS

2.1 BUTTERFLY VALVES (ANSI/AWWA)

A. General

1. Butterfly valves shall conform to ANSI/AWWA C504 - Rubber-Seated Butterfly Valves, subject to the following requirements. Valves shall be of the size and class indicated. Flanged valves shall have Class 250 flanges, complying with ASME/ANSI B16.1, and shall be short-bodied and leak-tight closing except as otherwise noted.
2. Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal.
3. Valve shafts shall be Type 316 stainless steel or carbon steel with Type 316 stainless-steel journals and static seals. Valve shafts shall be dual stub shafts or a one-piece shaft extending completely through the valve disc.
4. Materials of construction shall be as described below:

Component	Material	Specification
Body	Ductile Iron	ASTM A 126 Class B
Exposed Body Capscrews, and Bolts and Nuts	Stainless Steel	Type 316
Discs	Ductile Iron with a Stainless Steel edge	ASTM A 126 Class B/Type 316

5. The rubber seat shall be an integral part of the valve body. Rubber seats fastened to the disc by any means shall not be permitted.
 6. Discs shall be retained by stainless steel pins which extend through the full diameter of the shaft to withstand the specified line pressure up to valve rating and the torque required to operate the valve. Disc stops located in the flow stream are not allowed.
 7. The interior passage of butterfly valves shall not have any obstructions or stops. The seats shall be positively mounted in the body of the valve; cartridge-type seats which rely on a high coefficient of friction for retention shall not be acceptable. Valve disc shall rotate ninety degrees (90°) from the full open position to the tight shut position.
- B. Coatings: Ferrous surfaces of valves, four-inch (4") and larger, which will be in contact with water (exclusive of flange faces) shall be coated complying with the Standard Specifications and external surfaces fusion bonded and epoxy coated.
- C. Manual Operators:
1. Operators shall conform to ANSI/AWWA C540, subject to the following requirements. Unless otherwise indicated, all manually-operated butterfly valves shall be equipped with a hand wheel (exposed) or two-inch (2") square operating nut, 316 stainless steel with couplings extension stem wall and guide brackets and position indicator (buried or

SECTION 15103 – BUTTERFLY VALVES

submerged). Valve key extensions shall be installed on all buried butterfly valves unless indicated otherwise in accordance with Owner Standards.

2. Valves, twelve-inches (12”) and larger, as well as all submerged and buried valves, shall be equipped with worm-gear operators, lubricated and sealed to prevent entry of dirt or water into the housing. Screw-type (traveling nut) operators will not be permitted for valves twelve-inches (12”) in diameter and larger. Operators shall require a minimum of 40 turns to rotate the disc from fully open to fully closed position.

D. Valve Testing

1. Butterfly valves shall be hydrostatically tested and coatings shall be holiday detected prior to shipment to the field. Testing shall be inspected at the supplier’s distribution site by the District’s representative. Contractor shall be responsible for District representative’s expenses, including travel, time, meals and overnight accommodations.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator.
- B. Butterfly valve installation shall be in accordance with the Standard Specifications.
- C. Butterfly valves shall be installed with the operators on the street centerline side of the pipeline.

****END OF SECTION****

STANDARD SPECIFICATIONS

SECTION 15112

BACKFLOW PREVENTERS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of backflow prevention assemblies.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Concrete:	03300
2.	Ductile-Iron Pipe and Fittings:	15056
3.	Copper, Brass, and Bronze pipe, Fittings, and Appurtenances:	15057
4.	Manual Valves:	15100
5.	Meters:	15150

C. Approved Assemblies

The backflow prevention assembly shall be included in the latest edition of the "List of Approved Backflow Prevention Assemblies," Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, School of Engineering.

D. Application

1. A backflow prevention device shall be installed at all locations where the potential for a backflow condition into the District's domestic water mains exists. The device shall be located immediately behind the meter assembly, or as close as reasonably possible.
2. The type of device required will depend on the level of potential hazard which exists and will be a Reduced Pressure Principle Device (RPP). The fire system protection, RPDA or DCDA, will be as determined by the District.
3. Any service providing domestic water to anything other than a private residential dwelling shall have backflow protection.

E. Responsibility

The District will maintain only the by-pass meter and the service from the main to the Public Right of Way or Easement. The owner is responsible for the testing, maintenance and repair or replacement of the device.

PART 2 - MATERIALSA. Shut-Off Valves

The shut-off valves for assemblies 3-inch and larger shall be resilient seat gate valves conforming to Section 15100. Ball valves shall be used on assemblies smaller than 3-inch.

B. Ductile Iron Piping and Fittings

Ductile iron piping and fittings shall be furnished and installed in accordance with Section 15056.

C. Concrete

Concrete thrust blocks and supports shall be in conformance with Section 03300.

D. By-Pass Piping

By-pass piping shall be copper or brass conforming to Section 15057.

E. Backflow Prevention Assembly

All backflow prevention assemblies shall conform to the latest edition of AWWA C506 and the "Manual of Cross-Connection Control," Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, School of Engineering.

F. By-Pass Meter

The by-pass meter shall conform to the requirements of Section 15150 and shall be sized and compatible with the backflow device on which it is installed. The backflow prevention assembly and the by-pass meter shall be furnished as one complete unit. All by-pass meters shall be per the VWD Approved Material List, latest edition, with registers reading in cubic feet.

PART 3 - EXECUTIONA. Installation

Installation of the double detector check assembly or the reduced pressure principle assembly will be per VWD standard drawings W-12, W-13 or W-19, and as noted below.

1. Installation shall comply with the latest plumbing codes and applicable local agency requirements.
2. Installation shall comply with the requirements of the latest District standard drawings.

B. Testing

Upon completion of the installation of the device, a test shall be performed and a certificate of the adequacy and operational compliance shall be furnished to the District. The tests shall be performed by a testing agency or tester approved by the District.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15139

FIRE HYDRANTS

PART 1 - GENERAL

A. Description

This section includes the materials, installation and testing of fire hydrants.

Hydrants shall be supplied and installed per VWD standard drawings W-4 and W5, AWWA C 503 and as described herein.

B. Related Work Described Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Trenching, Backfilling, and Compacting:	02223
2.	Concrete:	03300
3.	Painting and Coating:	09900
4.	Hydrostatic Testing of Pressure Pipelines:	15042
5.	Ductile Iron Pipe and Fittings:	15056
6.	Manual Valves:	15100

C. Approved Wet Barrel Hydrants

1. Residential Use
Per VWD Approved Material List, latest edition
2. Commercial and Industrial Use
Per VWD Approved Material List, latest edition

PART 2 - MATERIALS

A. Wet Barrel Hydrant

1. Hydrant Top Section

Per governing fire agency and District Approved Material List.

2. Bury Section

- a. The bury section shall be 6-inch Ductile Iron shortradius bury elbow and shall be cement lined in conformance with Section 15056. Bury inlet shall be 6-inch non-asbestos hub bell connection for ductile iron pipe or C900 PVC pressure pipe.
- b. A ground ductile iron cast iron spool shall be installed to position the hydrant flange 4-6 inches above the concrete pad (finish grade).
- c. All wet-barrel fire hydrant cast-iron buries are to be cement lined.
- d. When using a riser spool, bolts shall conform to ASTM A307, zinc plated.
- e. Bury section outlet and riser spool flanges shall be six-hole "San Diego" drilling.

C. Break-Away Bolts

1. Break-away bolts shall be used to join the spool section to the hydrant top section.
2. All bolts and nuts, shall conform to ASTM A307, zinc plated.

D. Valve

The shut-off valve shall be a resilient-seated gate valve per Section 15100, including the valve box. Butterfly valves will not be permitted on fire hydrant service.

E. Ductile Iron Pipe

Ductile iron pipe shall be per Section 15056.

F. Ductile Iron Pipe and Fittings

Ductile-iron Pipe and fittings shall be in accordance with Section 15056.

G. Concrete

Concrete pads and supports shall be Class B concrete conforming to Section 03300.

H. Gaskets

Gaskets shall be of rubber composition per Section 15056.

PART 3 - EXECUTION

A. General

1. Fire hydrant assemblies shall be installed in accordance with the standard drawing and as specified herein, and shall include the connection to the main, the fire hydrant, hydrant bury, shutoff valve, valve well and valve box, connection piping, concrete thrust blocks, concrete pad and appurtenances.
2. Refer to VWD standard drawings W-4 and W-5.

B. Location

Fire hydrant assemblies shall be located as shown on the plans or as approved by the District representative. The center of the fire hydrant shall be, except as otherwise approved by the District representative, located per VWD standard drawing W-5.

The flange elevation at the base of the hydrant shall be set 4-inches to 6-inches above the sidewalk or the concrete pad, or as approved by the District representative. Additional spools will not be permitted when correcting the flange elevation.

C. Trenching, Backfilling, and Compacting

1. All trenching, backfilling, compaction and other excavation shall be in accordance with Section 02223.
2. All backfill within 24 inches of a valve shall be imported sand.

D. Valve and Valve Box

The valve and valve box shall be installed in accordance with Section 15100.

E. Ductile Iron Pipe

Ductile iron pipe shall be installed in conformance with Section 15056.

F. Break-Away Bolts

Break-away bolts shall be installed with the threads away from the top of the hydrant.

G. Concrete

The concrete pad shall be Class B concrete and thrust blocker shall be Class A concrete and shall be placed per Section 03300.

H. Painting

All public fire hydrants shall be painted with one prime coat and two finish coats of yellow paint at the place of manufacture. Final painting shall be in accordance with Section 09900. The color shall be per VWD Approved Material List, latest edition.

I. Testing

Test hydrants at the same time that the connecting pipeline is pressure tested. See Section 15042 for pressure testing requirements.

END OF SECTION

STANDARD SPECIFICATIONS

SECTION 15150

METERS

PART 1 - GENERAL

A. Description

This section describes the materials and installation of meter assemblies.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1.	Structure Excavation:	02200
2.	Concrete:	03300
3.	Precast Concrete Vaults:	03462
4.	Painting and Coating:	09900
5.	Ductile-Iron Pipe and Fittings:	15056
6.	Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances:	15057
7.	Manual Valves:	15100

C. Approved Manufacturers

1. Per VWD Approved Materials List, latest edition.

D. Residential and Irrigation Meters 2” and Smaller

1. The developer/contractor is responsible for furnishing and installing meters and meter boxes.
2. The developer shall expose and set to grade all angle meter stops prior to installing meters.
3. The developer is responsible for the purchase and installation of the meter box, angle meter stop, meter, and customer service valve. If a pressure regulator is required on the District side of the meter, the angle meter stop, regulator, meter and customer service valve shall be placed in a single meter box, per Standard Drawing W-8, or as approved by the District representative.

4. For all 3/4" through 1" water meter installations with pressures greater than 150 psi, a pressure regulating valve shall be installed to protect the District meter. 1" high pressure water services will require a #6B meter box. For 1½" and larger water meter installations with pressures less than 200 psi, use Invensys Omni T² meters. For 1½" and larger water meter installations with pressures greater than 200 psi, a pressure regulating valve shall be installed to protect the District meter.
5. Prior to occupancy, the District will, upon finding the installation to be acceptable, record all meter account information provided by the developer and padlock the curb stop in the off position until all District conditions of approval for the project are met.

PART 2 - MATERIALS

A. General

1. All meters shall be new and of current manufacture design.
2. All parts of the meters of the same size and model shall be interchangeable.
3. The serial number of each meter shall be imprinted on the register box cover, and the main case.

B. Registers

1. The registers on all meters shall have straight reading dials with full sweep test circles.
2. All registers are to be calibrated to read in cubic feet x 100.

C. Remote Reading Device

1. All meters in boxes or vaults shall be equipped with touch-read registers per the VWD Approved Material List, latest edition. Meters placed outside, above ground are not required to be equipped with touch-read registers unless specified.

D. Meters

1. Displacement meters shall conform to the requirements of AWWA C700, latest revision.
2. Turbine meters shall conform to the requirements of AWWA C701 Class II, latest revision.
3. Compound meters shall conform to the requirements of AWWA C702, latest revision.
4. Propeller meters shall conform to the requirements of AWWA C704, latest revision.

E. Precast Vaults and Boxes

Precast meter vaults and boxes shall conform to Section 03462 and the VWD Approved Material List, latest edition.

F. Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances

All service connection and by-pass piping shall conform to Section 15057 and the VWD Approved Material List, latest edition.

G. Ductile-Iron Pipe and Fittings

All piping for meter assemblies 3-inch and larger shall conform to Section 15056 and the VWD Approved Material List, latest edition.

H. Manual Valves

1. All valves shall conform to Section 15100 and the VWD Approved Material List, latest edition.
2. All valves on by-pass lines shall be lockable in the closed position. On 3-inch and larger by-pass lines, resilient seat gate valves with hand wheels and a chain and lock are permitted.

PART 3 - EXECUTION

A. Meter Installations

1. All residential and irrigation meters shall be installed by the contractor per VWD standard drawings W-6, W-7, or W-8, as applicable.
2. All 3-inch and larger meter installations shall conform with VWD standard drawings W-9 or W-11.

B. Excavation and Backfill

Excavation and backfill for the meter installation shall be in accordance with Section 02200.

C. Service Piping

1. All piping for service lines and by-pass lines up to 2-inch shall be installed in conformance with Section 15057 and the applicable standard drawing.
2. The piping for all service installations 3-inch and larger shall be in accordance with Section 15056 and the applicable standard drawing.

D. Test Tap

On services 6 inches and larger, a 2-inch service saddle or welded coupling and corporation stop shall be installed on the spool downstream of the meter, per VWD standard drawing W-11. The tap shall be located a minimum of three (3) pipe diameters downstream of the meter. On propeller meter installations, the location of the test tap will be determined by the District representative.

E. Meter Vaults and Boxes

All precast concrete meter vaults and boxes shall be installed in accordance with Section 03462 and the VWD standard drawings W-6, W-7, W-8, W-9, or W-12, as applicable.

F. Concrete Work

All thrust blocks, foundations, and supports shall be of the sizes shown in the applicable standard drawings and conform to Section 03300.

G. Valves

All valves installed shall conform to Section 15100 and the VWD Approved Material List, latest edition.

H. Painting and Coating

1. All exposed and buried piping shall be painted or coated in accordance with Section 09900. Manufacturer and color per the VWD Approved Material List, latest edition
2. The meter reading lids on all recycled water services shall be painted in accordance with Section 09900.

END OF SECTION