



DOMESTIC AND NONDOMESTIC WATER AND SEWER DESIGN & CONSTRUCTION MANUAL

TRABUCO CANYON WATER DISTRICT
32003 Dove Canyon Drive
Trabuco Canyon, California 92679
(949) 858-0277

Approved
March 2025

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Trabuco Canyon Water District's
Domestic and Nondomestic Water and Sewer
Design & Construction Manual



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Policies & Procedures, Design Criteria, General Technical Specifications and Standard Drawings

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PREFACE

Trabuco Canyon Water District (TCWD) was established on February 26, 1962, under the provision of the County Water District Law (Section 30000. Et. Seq. of the California Water Code). The District presently supplies domestic and nondomestic water and sewer services within the District boundaries.

The District has established an Assessment District and numerous Community Facilities District within the majority of its boundaries in accordance with the needs of specific portions of the District based on characteristics of water supply, water distribution, nondomestic water supply and distribution, and wastewater collection and treatment needs.

It is the District's desire to provide domestic and nondomestic water and sewer services and to standardize wherever possible the design and construction of the facilities to be operated and maintained by the District in a uniform manner District-wide. Therefore, this manual has been prepared to formulate the general procedures and requirements to serve these purposes.

TCWD serves nondomestic water throughout the District via its Reclaimed Water Distribution System. The District is a contract agency of and under the jurisdiction of the South Orange County Wastewater Authority (SOCWA), which was formed in 2001. SOCWA was formed, with the support of the San Diego Regional Water Quality Control Board (RWQCB), in order to promote the beneficial use of treated wastewater through reclamation in South Orange County, and to pursue comprehensive basin plan amendments to accommodate reclamation as stated in San Diego RWQCB Resolution No.97-52.

These procedures also include TCWD's nondomestic water system and covers the administrative, design, construction, and operational requirements for obtaining nondomestic water service and the use of nondomestic water in onsite facilities as well as the aspects of the relationship between users and the District.

Reference for additional coverage (1) South Orange County Wastewater Authority's (SOCWA) "Rules and Regulations for the Producers and Distributors of Nondomestic Water", and (2) TCWD's "Rules and Regulations for users of Nondomestic Water".

RESOLUTION NO. 2025-1340

**RESOLUTION OF THE BOARD OF DIRECTORS OF THE
TRABUCO CANYON WATER DISTRICT ADOPTING UPDATED
DOMESTIC AND NON DOMESTIC WATER AND SEWER
DESIGN & CONSTRUCTION MANUAL**

WHEREAS, the Trabuco Canyon Water District ("District") adopted Procedures and Design Criteria for Water and Sewer Facilities ("Standard Specifications") in July 2002; and

WHEREAS, the District has revised its Standard Specifications to include updated policies and procedures, design criteria, general technical specifications and standard drawings for domestic and non-domestic water and sewer facilities; and

WHEREAS, it would be in the best interest of the District to have said revised Standard Specifications approved and adopted by the Board of Directors.

NOW, THEREFORE, THE BOARD OF DIRECTORS OF THE TRABUCO CANYON WATER DISTRICT DOES HEREBY RESOLVE, DETERMINE, AND ORDER AS FOLLOWS:

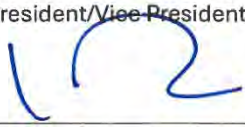
Section 1. The Board of Directors of the Trabuco Canyon Water District hereby adopt the 2025 edition of the Domestic and Non Domestic Water and Sewer Design and Construction Manual.

Section 2. Said revisions shall apply to all design and construction of domestic and non-domestic water and sewer facilities effective the date of the adoption.

ADOPTED, SIGNED, AND APPROVED this 19th day of March 2025

TRABUCO CANYON WATER DISTRICT

By: 
President/Vice President

By: 
Secretary/Assistant Secretary

STATE OF CALIFORNIA)

) ss.

COUNTY OF ORANGE)

I, Michael Perea, District Secretary of the Trabuco Canyon Water District, do hereby certify that the foregoing resolution was duly adopted by the Board of Directors at a meeting of said Board held on the 19th day of March 2025, and that it was so adopted by the following vote.

AYES: Mandich, Acosta, Anderson, Horst, & Safranski

NOES: None

ABSTAIN: None

ABSENT: None



District Secretary,
Trabuco Canyon Water District

STATE OF CALIFORNIA)

) ss.

COUNTY OF ORANGE)

I, Michael Perea, District Secretary of the Trabuco Canyon Water District, do hereby certify that the foregoing is a full, true, and correct copy of Resolution No. 2025-1340 of such Board and that the same has not been amended or repealed.

Dated this 19th day of March 2025.



District Secretary,
Trabuco Canyon Water District

DEFINITIONS

Whenever the following terms, or pronouns used in their place, occur in these policies, procedures, and design criteria, or in any documents herein, the intent and meaning shall be interpreted as follows:

Acceptance: The formal action by the Board accepting the dedication of completed facilities.

Air Gap Separation: A physical break where a pipe or hose is connected to or discharge into a vessel or conduit, provided that the break is at least double the diameter of the pipe, measured vertically above the rim of receiving vessel or conduit and in no case less than one inch.

Applicant: Shall refer to an owner, developer, builder, engineer, or other authorized representative who applies as the owner's official agent to the District for domestic and nondomestic water and sewer service.

Application Rate: The rate at which water is applied to an irrigation or construction area, expressed in inches per day or gallons per minute per acre.

Approved Backflow Prevention Assembly: A device installed to protect the potable water supply from contamination by reclaimed water, such as treated wastewater. This device shall be approved by the SWRCB and the District in conformance with SWRCB - Cross-Connection Control Policy Handbook approved July 1, 2024.

Approved Use: An application of reclaimed water in a manner, and for a purpose, designated in a Use permit issued by the District and in compliance with any and all applicable regulatory agency requirements.

Approved Use Area: A site with well-defined boundaries, designated in a Use Permit to receive nondomestic water for approved use and acknowledged by the District and any and all applicable regulatory agencies.

ASTM: American Society for Testing and Materials. All references to the specifications of the ASTM are understood to refer to the current specifications as revised or amended at the date of construction.

Attorney: the District's General Counsel

AWWA: The American Water Works Association. All references to the specifications of the AWWA are understood to refer to the current specifications as revised or amended at the date of construction.

AWWA Guidelines: American Water Works Association Guidelines for Distribution of Potable and Nonpotable Water, latest edition.

AWWA Standards: American Water Works Association Standards for Construction Materials, latest edition.

Board: Board of Directors of the Trabuco Canyon Water District.

California Water Code: Describes California Waters of the State. This act regulates the discharge of waste or fill into these waters. The defined waters of California include: Any surface or groundwater (including saline waters) within the boundaries of the state.

City: Incorporated areas within the County of Orange having local governing powers (i.e., City of Rancho Santa Margarita or City of Lake Forest).

Community Facilities District (CFD), Improvement Area (IA) and Assessment Districts (AD): Subarea of the District formed to set up assessments to pay for bonds sold to construct water and sewer facilities benefiting landowners in that subarea.

Commercial Use: Water used for toilets, urinals, decorative fountains, cooling towers, and other related uses.

Construction Use: An approved use of reclaimed water to support construction activities such as soil compaction and dust control during grading.

Contractor: the person, firm or corporation entering into contract with the owner or developer for the performance of work required under said contract and the District's ordinances, rules & regulations, and TCWD's Domestic and Nondomestic Water and Sewer Design & Construction Manual.

County: County of Orange, State of California

Cross Connection: Any unprotected actual or potential connection between a potable water system and any source or system containing unapproved water or a substance that is not or cannot be approved safe, wholesome, and potable. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices and other devices through which backflow could occur, shall be considered to be cross-connections.

Cross-Connection Control Policy Handbook: Cross-Connection Control Policy Handbook (CCCPH) is the protection of public health through the establishment of standards intended to ensure a public water system (PWS) drinking water distribution system will not be subject to the backflow of liquids, gases, or other substances.

Design Area: A site, with well-defined boundaries, proposed to receive water, sewer, and reclaimed water for approved use as delineated in an application for a Use Permit.

Design Consultant: Any person or firm registered with the State of California providing site layout, engineering, landscaping, or irrigation system design services.

Direct Beneficial Use: The use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to the waters of the State.

Direct Overspray: Any discharge of water directly onto areas other than that for which the application of reclaimed water is approved.

Director of Engineering or District Engineer: The person holding the position or acting in the capacity of the Director of Engineering or District Engineer for the District.

Discharge: Any release or distribution of reclaimed water to a use area or disposal site/mechanism (outfall, live stream discharge, municipal sewage system). All discharges of reclaimed water must be approved by TCWD and any regulatory agencies.

Discharge Permit: A permit issued by the San Diego RWQCB for the discharge of reclaimed water.

District: Trabuco Canyon Water District, its authorized employees, and agents.

Domestic Water (Potable Water): Water which is pure and wholesome, does not endanger the lives or health of human beings, and conforms to the latest edition of the United States Safe Drinking Water Act (SDWA), United States Environmental Protection Agency (US EPA) Drinking Water Regulations, the State Water Resources Control Board, Division of Drinking Water (DDW) Regulations, or other applicable standards.

Effluent: Treated wastewater discharged from a water reclamation plant.

General Manager: an individual designated by the Trabuco Canyon Water District as the chief executive officer and agent for the District.

General Public: Any person(s) at large who may come in contact with facilities and/or areas where reclaimed water is approved for use.

Industrial Use: Water used for industrial processes such as cooling, flushing, or construction and other related uses.

Infiltration Rate: The rate at which soil will accept water without overland flow, expressed in inches per hour.

Individual Sewage Disposal System: A single system of sewage treatment tanks and disposal facilities serving only a single lot.

Inspector: Person authorized by the District to perform inspection of either onsite or offsite facilities prior to construction, during construction, after construction and during operation.

Installer: A person(s) or firm performing work necessary to construct or install equipment or facilities subject to these regulations.

Landscape Impoundment: A body of reclaimed water which is used for aesthetic enjoyment, or which otherwise serves a function not intended to include public content.

Landscape Irrigation: Reclaimed water used for the propagation and maintenance of trees, shrubs, groundcover, and turf.

Nondomestic Water: Water served from the District's offsite nondomestic water facilities, including but not limited to, a combination of treated wastewater, recycled water, intercepted surface, and subsurface stream flow, supplemented by other waters, including domestic (potable) water for irrigation purposes only and in accordance with the California Water Code (Water Code) Section 13050(n). Also, referred to as "Recycled Water," "Reclaimed Water" or "Non-potable Reuse." Water is not intended for human consumption.

National Pollutant Discharge Elimination System Permit (NPDES Permit): As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches.

Offsite Facilities: Designates or relates to domestic water, sewer and, nondomestic water facilities up to and including the water meters, and sewer facilities within a public street, right-of-way, District property or easement. All offsite domestic water, sewer, and nondomestic water facilities will be owned, operated, and maintained by the District, upon acceptance by the District of the dedicated facilities by the Owner.

Offsite Supervisor: A qualified person designated by the District to be responsible for the safe and efficient operation of the District's reclaimed water distribution system. This person shall be knowledgeable in the construction and operation of reclaimed water distribution systems and in the application of Federal, State, and local guidelines, criteria, standards, and regulations governing the use of reclaimed water.

Onsite Facilities: designates or relates to water and sewer facilities located within the Owner's property, and domestic water and nondomestic water facilities downstream of the water meter. All onsite domestic water, sewer, and nondomestic water facilities will be owned, operated, and maintained by the District, unless otherwise specified.

Onsite Supervisor: A qualified person designated by a reclaimed water user and approved by the District to be responsible for the safe and efficient operation of the user's reclaimed water system. This person shall be knowledgeable in the construction and operation of reclaimed water and irrigation systems and in the application of Federal, State, and local guidelines, criteria, standards, and regulations governing the use of reclaimed water. This person shall be trained in cross connection control to the satisfaction of the District.

Operations Personnel: Any employee of a user, whether permanent or temporary, or any contracted worker who is regular or assigned work involves supervision, operation, or maintenance of equipment on any portion of onsite facilities using reclaimed water.

Operator: Any person(s) or firm who, by entering into an agreement with a User is responsible for operating onsite facilities.

Orange County Health Care Agency (OCHCA): is a regional interdisciplinary health jurisdiction and an accredited health department, charged with protecting and promoting individual, family and community health through partnership and coordination of public and private sector resources.

Orange County Fire Authority (OCFA): The Orange County Fire Authority is a regional fire service agency that serves 23 cities in Orange County and all unincorporated areas. OCFA provides fire service within TCWD's service area.

Owner: Any holder of legal title, contract purchaser, or lessee of property for which service is requested from the District.

Pantone: Color standard system.

Peak Moisture Demand: The demand during the highest period of combined reference evapotranspiration (ET) and crop coefficients (K) for a specific site and plant material being irrigated on that site.

Permittee: The permittee or customer operating under a Use Permit for nondomestic water or the installation or construction of nondomestic water facilities.

Person: Any public or private individual, partnership, corporation, agency, or association including homeowner's association.

Plans: The plans, working drawings, detail drawings, profiles, typical cross sections, general cross sections, and supplemental drawings, or reproductions thereof, approved by the District, which show locations, character, dimensions, or details of the work to be installed.

POC: Point of connection.

Ponding: Retention of nondomestic water on the surface of the ground or other natural or manmade surface that exceeds the surface infiltration rate and that is unable to runoff due to gravity such that a hazard or potential hazard to the public health results.

Potable Water: Water, which is pure and wholesome, that will not endanger the health, safety, and welfare of human beings, and conforms to the latest edition of the United States Safe Drinking Water Act (SDWA), United States Environmental Protection Agency (US EPA) Drinking Water Regulations, the State Water Resources Control Board, Division of Drinking Water (DDW) Regulations, or other applicable standards.

Producer: An agency which produces nondomestic water.

Reclaimed Water System: District facilities that produce, convey, supply, store and intercept reclaimed or nondomestic water.

Reclaimed Water: Means urban runoff water which can be collected, treated, transported, and distribute by District's facilities so as to be usable for some beneficial purpose. Recycled Water, for purpose of these Rules and Regulations, is different from Reclaimable Sewage and Reclaimed Water as defined herein.

Recreational Impoundment: A body of reclaimed water used for recreational activities including, but not limited to, fishing, boating, and/or swimming. Allowable uses will depend on treatment level of the reclaimed water.

Record Drawings: Drawings which show the facilities including all revisions to the original plans that occurred during construction. Also called "As-Built."

Regional Water Quality Control Board (RWQCB): Refers to the State of California, San Diego Regional of the Regional Water Quality Control Board which preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations.

Regulatory Agencies: Those public agencies are legally constituted to protect the public health and water quality and have regulatory authority over the District, such as the State Water Resources Control Board, Division of Drinking Water, the California Regional Water Quality Control Boards, the Orange County Health Care Agency, Environmental Health Division, Orange County Fire Authority, and others as may be appropriate.

Regulations: the District's "Rules and Regulations for Domestic and Nondomestic Water and Sewer Service," including all rules and regulations any other local or State agency or other regulations referred to and incorporated herein.

Runoff: Flow of water along the surface of the ground or other natural or man-made surface, including but not limited to, pedestrian walkways, streets, playground surfaces and grassy slopes.

San Diego RWQCB: California Regional Water Quality Control Board, San Diego Region (9).

Secondary Effluent: Wastewater which has been treated to a minimum level of effluent quality based on rules and regulations of the Environmental Protection Agency and defined with respect to biochemical oxygen demand, suspended solids, fecal coliform bacteria, and pH.

Service: Furnishing of domestic and nondomestic water and sewer to an Owner's property through a metered connection to the onsite facilities, and the reception, transfer, treatment, and disposal of sewage from an Owner's property through a connection to the offsite facilities, or the disposal of sewage from an Approved (by the District) onsite individual's sewage disposal system.

Service Connection: The facilities between the water and nondomestic water distribution system and the customer's water meter.

Sewage Flows: Estimated quantities of wastewater generated on a per capita basis, which shall be determined to be in conformance with the District's Sewer Master Plan or as otherwise specified by the District.

Sewer: a pipe or conduit used to convey liquid waste.

South Orange County Wastewater Authority (SOCWA): Joint Powers Authority with ten member agencies, consisting of local retail water agencies and cities that provide water to their residents. It operates three treatment plants and two ocean outfalls, in addition to multiple programs to meet the needs of its member agencies and the requirements of the Clean Water Act and applicable National Pollutant Discharge Elimination System (NPDES) permit.

Standard Technical Specifications and Standard Drawings: District's "Standard Technical Specifications and Standard Drawings for Domestic and Nondomestic Water and Sewer Construction" latest edition.

Standard Specifications for Public Works Construction (SSPWC or the "Greenbook"): Specifications accepted and used by the those involved in public works construction.

State of California, Department of Industrial Relations (DIR): The California Department of Industrial Relations (DIR) protects and improves health, safety, and economics and helps their employers comply with state labor laws. DIR administers and enforce laws governing wages, hours and breaks, overtime, retaliation, workplace safety and health, apprenticeship training programs, and medical care and other benefits for injured workers.

State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW): The Division of Drinking Water under the direction of the State Water Resources Control Board, regulates public water systems; oversees water recycling projects; permits water treatment devices; supports and promotes water system security.

TCWD: Trabuco Canyon Water District

Tenant: Any person, group, firm, partnership, corporation, association, or agency who pays rent to occupy and use land or a building.

Tertiary Effluent: Secondary effluent which has been disinfected and filtered consistently with provisions in California Code of Regulations - Title 22.

Terms: All terms relating to matter of opinion or judgement, such as in regard to approvals, requirements, directions, or acceptances, denote the option or judgement of Trabuco Canyon Water District.

Transfer: The conveyance or movement of nondomestic water from one agency to another agency. Transfer includes the conveyance of control or responsibility of a volume of Nondomestic water stored in a storage facility commonly owned or controlled by more than one agency.

Treated Wastewater: Wastewater treated in accordance with the requirements of "Wastewater Reclamation Criteria," of the California Code of Regulations - Title 22.

Underwriter's Laboratory (UL): Underwriters Laboratories product safety testing, consulting and certification organization for safety-related testing, inspection, auditing, advising, validation, and certification.

Uniform Plumbing Code (UPC), latest edition: The Uniform Plumbing Code governs the installation and inspection of on-site plumbing systems as a means of promoting the public's health, safety, and welfare.

Use Area: The specific area designated to be served with nondomestic water through onsite facilities.

Use Permit: A Permit issued by the District to a nondomestic water service applicant after the satisfactory completion of the service application procedures set forth in these regulations. This permit constitutes a service agreement that legally binds the user to all conditions in these regulations and to any and all applicable regulatory agency requirements.

User: Any person, group, firm, partnership, corporation, association, or agency accepting nondomestic water from the District's reclaimed water facilities for use in accordance with these regulations.

Violation: Noncompliance with any condition or conditions of these regulations and/or a User Permit by any person, action, or occurrence, whether willfully or by accident.

Water Reclamation: The planned renovation of wastewater to produce an effluent that is approved for specific beneficial uses by the appropriate regulatory agency.

Windblown Spray: Dispersed, airborne irrigation water or Nondomestic water capable of being transmitted through the air by natural or manmade wind to locations other than that for which the direct application of irrigation water or Nondomestic water is approved.

Work: The entire improvement proposed is to be constructed pursuant to a legal agreement and consistent with these regulations.

Part 1
Requirements for Procuring
Domestic and Nondomestic Water and Sewer Service

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SECTION A - PROCEDURE FOR DOMESTIC AND NONDOMESTIC WATER AND SEWER SERVICE

A. General

This section describes the required procedure for an Applicant to obtain service from Trabuco Canyon Water District ("the District" or TCWD") for the proposed service area and approval for construction of domestic and nondomestic water and sewer facilities to be dedicated to the District for operation and maintenance.

Unless otherwise approved by the Board, all water service and sewage disposal service by the District shall be in accordance with the District's "Domestic and Nondomestic Water and Sewer Design & Construction Manual" that includes Policies and Procedures, Design Criteria, Standard Technical Specifications and Standard Drawings for Domestic and Nondomestic Water and Sewer Service.

The design and construction of all domestic and nondomestic water and sewer facilities to be operated and maintained by the District shall conform to the requirements of the latest edition of the following:

1. Domestic and Nondomestic Water and Sewer Design & Construction Manual, (This Manual).
2. Standard Specifications for Public Works Construction ("Green Book"), Latest Edition.
3. American Water Works Association (AWWA) Standards, Latest Edition
4. State Water Resources Control Board, Division of Drinking Water (DDW) Regulations
5. Orange County Fire Authority (OCFA) Permit Requirements.
6. Permit requirements from County of Orange, Cities of Rancho Santa Margarita, Mission Viejo, and Lake Forest.

A-1 AVAILABILITY OF SERVICE

The Applicant shall check with the District to determine the availability of domestic and nondomestic water and sewer service within the proposed project area.

The District will not provide sewer service to areas within its service area unless it is also the water purveyors for that area and a part of the District's nondomestic water program.

Nondomestic water may only be used for approved use in areas approved by the District. Approval may be obtained only through the service application procedure contained in these procedures. In all cases, approval of a use and use area by the District will be contingent upon satisfaction of the requirements of the District and other applicable regulatory agencies. The applicant shall also obtain approval from the District for any proposed change in the character of the use of nondomestic water.

A-2 SUB AREA MASTER PLAN (SAMP)

The District may require a SAMP or Hydraulic Analysis to establish whether and how the District can most efficiently serve the proposed area pursuant to this section and, as applicable to Section 5.3 of the Rules and Regulations.

SAMP's are required for those residential developments of two (2) Equivalent Dwelling Units (EDU) or greater, commercial/industrial developments and any large scale development. For those developments that are up to one (1) EDU, TCWD will require a hydraulic analysis.

An agreement shall be executed, and fees deposited, if deemed necessary by the District, whereby the Applicant shall pay the estimated cost to the District for performing the SAMP or Hydraulic Analysis.

A-3 IF SERVICE AREA IS OUTSIDE DISTRICT'S BOUNDARIES

If all or any part of the area proposed to be served by the District is located outside of the District's boundaries, the Applicant shall officially request, by letter to the General Manager, for annexation of the area to the District. A minimum of 180 calendar days should be allowed for Action by the Board on the annexation request. A complete legal description of the property to be annexed, three (3) copies of a Tract

or Parcel Map showing the property area, and the appropriate fees shall be paid and accompany the annexation request letter.

A-4 CONTROL OF DESIGN AND PLAN REVIEW

The Owner/Developer (Applicant) shall provide a written request to TCWD to prepare a SAMP by TCWD and its consultant for the proposed on-site and off-site domestic and nondomestic water and sewer facilities. The purpose of a SAMP is to determine the necessary infrastructure for water, wastewater, reclaimed, and recycled water systems needed for the project.

The District shall, at its sole discretion, determine the engineering consultant to prepare the plan and the cost of the SAMP and all related District staff time shall be borne by the Owner/Developer. The SAMP shall become the property of the District. The length of time necessary to prepare a completed SAMP may vary on a case by case basis and is dependent on the information available from the Applicant.

The District shall determine the extent of the analysis required. In addition, the conditions of a SAMP requirement may be a condition for the issuance of a Will-Serve Letter.

The Water and Sewer Improvement Plans for the proposed domestic and nondomestic water and sewer facilities to the District shall be reviewed and approved, as specified in Section C-1 herein and Section 5.3 of the TCWD's Rules and Regulations. The improvement plans for all facilities shall be prepared by a Registered Civil Engineer in the State of California and shall conform to the requirements contained within this manual.

A-5 WILL SERVE LETTER, SERVICE AGREEMENT AND DEPOSIT OF FEES

Domestic and Nondomestic Water and Sewer Service: The applicant shall request in writing a "Will-Serve Letter" from TCWD. TCWD shall prepare a Will-Serve Letter based on the SAMP or Hydraulic Analysis and will include an invoice for payment of capacity charges other required fees as outlined herein.

Upon acceptance of the Will-Serve Letter, payment of all associated fees and after the approval of the Board of Directors, the District shall prepare a service agreement for Domestic Water and Nondomestic Water and Sewer Service for the Applicant. The Applicant shall return a service agreement per Section 5.8 of the TCWD's Rules and Regulations.

Industrial or Non-Domestic Sewage Service: An application for Industrial or Non-Domestic Sewage service which would involve discharge of industrial or other non-domestic sewage is required and, in addition to the information required above, shall state the estimated gallons of wastes proposed to be discharged and also state information as to peak loads, character of wastes, and such other details as the General Manager may direct or request.

The Applicant shall comply with all Federal, State, and local requirements including, but not by way of limitation, all requirements of the EPA including, but not limited to, any commitments for reimbursements required by the EPA in excess of the charges of District. These requirements are set forth in the Federal Water Pollution Control Act and the Code of Federal Regulations.

The applicant shall, at the same time, deposit in an account with the District the required sum of money necessary to meet all fees and other charges, as specified in Section B Plan Review, Inspection and Connection Fees, TCWD's Rules and Regulations, or as otherwise agreed upon by District and Applicant before the District will approve any domestic and nondomestic water and sewer improvement plans.

Cost of Construction Statement forms are available in Appendix A-5, A-6, and A-7. These forms shall be used to establish the Improvement Bonds required by the Applicant prior to the installed facilities that will be dedicated to the District.

A-6 GRANTING OF EASEMENT TO THE DISTRICT

The Applicant shall prepare, process, grant, record and convey to the District all easements, which are not to be dedicated on a Tract or Parcel Map that are required by the District for operating, maintaining, modifying, or replacing their facilities.

The Applicant shall complete these documents prior to the District signing the improvement plans for the domestic and nondomestic water and sewer facilities required to serve the area for which Applicant has requested service from the District.

All easements shall be provided in a form with all content, and purpose satisfactory to the District, and shall be recorded with the Office of the Recorder, County of Orange, California. All easements shall conform to the requirements contained in Section C-2.

A-7 RESPONSIBILITY FOR CONSTRUCTION OF FACILITIES

The Applicant will be responsible for the construction of all domestic and nondomestic water and sewer facilities outside the area proposed to be served at its expense, except for the District's Master plan facilities.

The Applicant shall cause all installation work to meet the requirements of this Manual, including Policies and Procedures, Design Criteria, Standard Technical Specifications and Standard Drawings.

Upon the District's acceptance of the facilities, the Applicant shall convey the facilities to the District. The Applicant and the District shall execute an agreement in the form of "Bill of Sale" as set forth in Appendix A-2, A-3, and A-4 prior to the District's final acceptance of the facilities.

A-8 DEDICATION OF FACILITIES TO DISTRICT

Upon completion and final inspection of all work, the Applicant shall file a request to the District, at least 30 calendar days prior to a regular Board meeting, for dedication to and formal acceptance of the facilities by the District.

The Applicant shall also furnish the District with a report of actual costs (Appendix A-5, A-6, & A-7) of said facilities, a proper bill of sale (Appendix A-3, A-4, & A-5), and record drawings of the facilities (See Subsection C-13).

Upon Acceptance, the District will approve the release of bonds posted to the District for the construction of domestic and nondomestic water and sewer facilities.

A-9 GUARANTEES

As set forth in the Application and Agreement for Domestic Water and Nondomestic Water and Sewer Service (Appendix A-1), the Applicant shall be responsible for any and all repairs and/or replacement to District facilities for a period of one (1) year after the **Date of Acceptance** by the District without any additional expense to the District. Any ordinary wear and tear and unusual abuse or neglect of such facilities may be accepted as determined by the District.

In the event of failure to comply with aforementioned conditions, the District is hereby authorized to proceed to have any and all defects repaired and made good at the expense of the Applicant, who shall pay any costs and charges, including attorney fees and other incidental costs involved thereof, and immediately upon demand.

SECTION B - PLAN REVIEW, INSPECTION AND CONNECTION FEES

B-1 GENERAL

The Applicant shall complete all required financial arrangements and provide any associated documentation to the District before any improvement plans will be signed by the District and before the start of any construction activities.

All payments must be made to Trabuco Canyon Water District. The amounts of the required fees and other charges will be determined as provided in this Manual and are based on the latest schedule of rates and charges adopted by the Board.

B-2 PLAN REVIEW FEE DEPOSIT

After the SAMP and Will Serve letter have been approved by the Board and the Applicant has paid all associated fees, the Applicant shall pay the required plan review fee deposit for the proposed domestic and nondomestic water and sewer facilities to the District to compensate the District for its review of these documents. The required plan review fee deposit will be based on **3.3%** of the Cost of Construction Statement for water and sewer facilities. The Applicant must deposit a minimum of \$1,000 for each project. Upon receipt of the plan review fee deposit by the District, the District will review the Tentative Tract Map and water and sewer improvement plans.

B-3 FINAL PLAN REVIEW AND INSPECTION FEE

The Applicant shall deposit with the District the final plan review and inspection fees, which shall be based on a percentage of the water and sewer bond amounts as established by the District in Section 5 of the TCWD's Rules and Regulations prior to approval of the improvement plans by the District.

The District may also establish a minimum fixed lump-sum fee (at the District's discretion) to cover the costs of plan review, inspection, and administration for projects valued at less than the amount specified by the Board in the current fee schedule. The District will advise the Applicant of the amount of the fee after completion of the initial plan review.

For both the percentage and lump-sum fee calculation basis described above, the Applicant will be given credit for any plan review fee deposited as outlined in Section B-1 above.

B-4 OTHER FEES AND CHARGES

In addition to the plan review and inspection fees described above, the Applicant shall deposit with the District any and all other required fees and charges, as outlined below:

1. Capacity Charges include capital improvement charges, supplemental water capacity charges, and in-lieu water storage charges, sewer charges, where applicable, per Section 5.11 of the Rules and Regulations.
2. Any other applicable fees or charges established by the Board.

SECTION C - DOMESTIC AND NONDOMESTIC WATER, AND SEWER DESIGN FOR DEVELOPMENTS

C-1 WATER AND SEWER DESIGNS FOR TRACT DEVELOPMENT

C-1.1 Sub Area Master Development Plan (SAMP): The Applicant shall request the District to prepare a SAMP based on the proposed location of the domestic and nondomestic water and sewer systems to determine the project parameters before the District will issue a will serve letter per Section 5.3 the Rules and Regulations for proposed development.

The information required to be included in the SAMP and the criteria upon which the District will prepare, review, and approve are outlined below.

C-1.2 Domestic Water System SAMP: The SAMP shall show the sizes and relative locations of water lines, valves, fire hydrants, fire services, and if applicable, reservoirs, pump stations and pressure reducing stations. The location and width of all required District easements for the domestic water facilities shall be included in the SAMP. The District will provide preliminary criteria for the design of the domestic water system for the planned development by the Applicant taking into consideration the following:

1. Existing transmission main locations, sizes, pressures, and available capacities.
2. Orange County Fire Authority's fire flow requirements.
3. District's Domestic Water System Master Plan.
4. District's Design Criteria as set forth in this Manual.

The Applicant shall pay any costs associated with the District's preparation of the SAMP and any hydraulic modeling necessary to determine the final pipe size and looping of the project's water system. The final sizing and required looping of the water system will be determined by the SAMP and specified by the District.

The Applicant shall submit to the District written tentative approval from the OCFA for verification of fire flow requirements, hydrant location and spacing as part of the Improvement Plan submittal process.

C-1.3 Nondomestic Water System SAMP: Before the District begins preparation of a Nondomestic Water SAMP for the proposed development, the Applicant shall submit a preliminary Nondomestic Water layout for approval by the District in accordance with the requirements of the Rules and Regulations for nondomestic water service.

A SAMP for a proposed nondomestic water system shall show the sizes and relative locations of all water lines, valves, and if applicable, reservoirs, pump stations and pressure reducing stations. The location and width of all required District easements for the nondomestic water facilities shall be shown on the SAMP.

Each Nondomestic Water SAMP shall also include the following information provided by the Applicant:

1. Areas proposed to be irrigated with nondomestic water.
2. Location of all irrigation water meters.
3. The maximum flow rates required.
4. The design pressure required for the irrigation system to operate.
5. District nondomestic water main pressure for each water meter service.

The District will provide preliminary criteria for the design of the nondomestic water system for the proposed development, taking into consideration the following information:

1. Existing transmission main locations, sizes, pressures, and available capacities.
2. The District's Nondomestic Water System Master Plan.
3. The District's Design Criteria set forth in this Manual.

C-1.4 Sewer System SAMP: The Sewer SAMP shall show the sizes, directions of flow, and relative locations of all sanitary sewer mains, manholes, lift stations, and if applicable, treatment and disposal facilities. The location and width of all required District easements for the sewer facilities shall be shown on the SAMP. The District will provide preliminary criteria for the design of the sewer system for the planned development by the Applicant that will consider the following information:

1. Existing trunk sewer locations, sizes, and available capacities.
2. Slopes, sizes, and design capacities of sewer collection mains in relation to the projected population for the lots to be served.
3. The District's Sewer System Master Plan
4. The District's Design Criteria set forth in this Manual.

C-1.5 Approval of SAMP: After the District has completed the SAMP and the Applicant has agreed with the SAMP, the District will present the SAMP to the District's Engineering and Operations Committee for review and recommendations. Upon the completion of any revisions to the SAMP, the District will present the SAMP to its Board of Directors for final approval.

The SAMP is a preliminary layout only and shall not be used for construction. The final design and construction work shall be based on the approved water and sewer improvement plans.

C-1.6 Improvement Plans for Individual Tracts: The Applicant shall submit to the District two sets of individual Tract domestic and nondomestic water and sewer improvement plans, along with a County or City approved precise grading plans and landscaping and irrigation plans for plan review.

Also, the Applicant shall submit a preliminary or final tract or parcel map that shows the overall gross acreage included in the proposed development, and also submittal of separate easements, legal descriptions, and exhibits, if required, together with the required plan review fee (See Section B-1).

Engineering calculations, as specified in Section F - Design Criteria for Domestic Water Facilities, Section G - Design Criteria for Nondomestic Water Facilities and Section H - Design Criteria For Sewer Facilities shall accompany the first submittal of the domestic and nondomestic water and sewer improvement plans for the District's review.

The District will review the improvement plans for conformance with the approved Tentative Tract Map, the approved SAMP and the District's design criteria. The District will also review the tract maps and parcel maps to determine whether they correctly depict the required District easements and signatures.

The District will return one "red lined" set of the reviewed improvement plans, tract maps and easement documents to the Applicant showing any corrections and/or comments. The Applicant shall make the corrections noted and shall respond to the District's comments in a manner appropriate to the comments.

The Applicant may deliver the original drawings to the District for signature upon completion of these requirements to the satisfaction of the District and after all fees have been paid. Applicant shall provide copies of all signed and notarized easement documents for approval by the District's Board of Directors.

C-2 PROVIDING REQUIRED EASEMENTS

If any easement is required for construction and/or maintenance of domestic and nondomestic water and sewer facilities, the minimum width of the easement shall be **20 feet**, unless otherwise specified or approved by the District.

In areas where domestic and nondomestic water and sewer facilities are to be located in private streets, the District shall be granted an easement for its facilities as well as for ingress and egress purposes over the entire right-of-way width of the private street.

Where fire hydrants and/or water meter services are to be located outside the public or private street right-of-way, the easement shall be extended to a **minimum of 3 feet** beyond the hydrants or meter box, unless otherwise specified or approved by the District.

Each domestic and nondomestic water and sewer easement shall be located on one lot unless otherwise specified or approved by the District. All easements shall incorporate adequate provisions within the document for a means of ingress and egress into the facilities at all times by the District.

The Applicant shall comply with the following procedure for the processing of easements for the District that are not conveyed on a Tract or Parcel Map:

1. The Applicant shall submit two copies of the easement description to the District for review.
 - a. The Applicant shall furnish a current title report (less than six months old) with copies of all existing easements for the benefit of the District that reflects all deeds of trust and encumbrances on the property.
 - b. Exhibit shall be presented in a finished size of 8½" x 11" or 8½" x 14".
 - c. The District will return the easement document including legal description and exhibits with the required corrections noted.
 - d. The Applicant shall make any required corrections and resubmit two copies of the revised original easement with legal description and exhibits to the District.
 - e. All blanks in the documents, such as project identifications, title report numbers, map and book numbers and pages, dates, etc., shall be filled in prior to the initial submittal.
 - f. Exhibits to the easement exhibit must contain a vicinity map showing the location of the easement in relation to major streets and highways, as well as a drawing depicting the easement boundaries with bearings, distances, points of beginning, north arrow, scale, and any other information required by the District.
2. The District will prepare the required documents for recordation, determine required subordinations, and prepare agreements for same, and distribute the documents for the required signatures.
 - a. After approval by the District's Board of Directors, the documents will be forwarded by the District to the County of Orange for recordation.
 - b. The applicant shall pay any fees charged by the County or Title Company involving the recordation of the easements.
3. Upon recordation, three (3) copies of each easement document shall be retained by the District for its use, and one (1) copy shall be forwarded to the party executing the easement.

C-3 DEDICATION OF WATER RIGHTS TO THE DISTRICT

The District requires all landowners dedicate any and all water and water rights within the boundaries of record maps filed within the District.

The following dedication shall appear on all new Tract or Parcel Maps and any existing map that has not yet been recorded:

"We also dedicate to the Trabuco Canyon Water District all water and water rights, if any, included within and underlying the distinctive border of this Tract."

C-4 FURNISHING APPROVED PLANS

C-4.1 Signed Improvement Plans: Five sets of completely signed and approved domestic and nondomestic water and sewer systems improvement plans shall be furnished by the applicant to the District, no later than two working days before the required pre-construction conference and prior to commencing any work.

C-4.2 Time Period Signed Plans Valid: Plans approved by the District will be valid for only one year from the date shown on the District-approved plans. If construction has not started within one year after date of approval, the Applicant must re-submit plans to the District for review and must pay any additional plan review or inspection fees charged by the District.

C-4.3 Plans for Mapping: At the time that it submits improvement plans to the District for final approval, the Applicant shall also submit the following:

1. An accurate 1" = 80' scale composite of the tract. The plot of the tract improvement plans shall not exceed 30 x 36 inches.
2. In the event that more than one sheet is required, the Applicant shall furnish the required number of separate sheets, with each sheet not exceeding the size indicated above.
3. These composite 80 scale maps will be used to prepare and update the District's GIS mapping system.
4. If the Applicant fails to provide these composites timely, the final approval of the Applicant's project may be delayed.
5. The District may require the Applicant to furnish information relative to the District's boundary, if applicable, Project plan and land base information in a GIS format.

C-5 NOTICE TO START CONSTRUCTION

The Applicant shall provide written notice to the District no later than **48 hours** before requesting a pre-construction conference.

C-5.1 Curbs Installed Before Starting Facilities Construction: Proposed curbs must be installed, and/or the new facilities must be staked for line and grade in in the project before the start of the installation of any domestic and nondomestic water and sewer facilities in accordance with District's standards.

C-6 PRECONSTRUCTION CONFERENCE

A preconstruction conference shall be held no later than **48 hours** before the start of construction. The meeting will be attended by, at a minimum, the Contractor's working foremen and /or job superintendent, representative of the Applicant, all utility companies and the District's Engineer and/or Inspector. The purpose of this meeting will be to resolve any questions about the District specification requirements, to obtain the Contractor's construction schedule, and to disclose and discuss any known circumstances that might affect the construction work.

C-7 INSPECTION OF WORK

All work shall be subject to inspection by the District and shall be left open and uncovered until approved by the District or its authorized representative. Applicant or Contractor shall provide no less than **48-hour notice** before the time for which it requests inspection.

The Contractor shall not proceed with any sequent phase of work until the previous phase has been inspected and approved by the District.

The Applicant or Contractor must obtain inspection and approval of the work by the District during and/or at the completion of the following portions of work and as otherwise determined by the District.

C-7.1 Domestic and Nondomestic Water System Inspections:

1. Trench excavation and pipe bedding installation.
2. Placing pipe, fittings, and structures, including identification tape on domestic and nondomestic water main and service lines.
3. Placing of all concrete anchors and thrust blocks.
4. Placing and compacting the pipe zone backfill.
5. Backfilling the balance of trench to grade.
6. Compaction Testing:

- (1) To be performed by the District in public rights-of-way or District Property.
- (2) To be performed by a private soils engineering consultant retained by the Applicant and approved by the District in private streets and easements.
- (3) Copies of test results shall be given to the District and/or County by the Applicant for approval before final acceptance of the work.

7. Pressure testing of all mains and services per AWWA Standards.
8. Disinfecting and flushing of pipelines per AWWA Standards.
9. Repaving trench cuts.
10. Raising valve box covers to finish grade.
11. Installation of services lines, meter boxes and water meters.

C-7.2 Sewer System Inspections:

1. Trench excavation and pipe bedding installation.
2. Placement of pipe, fittings, and manhole structures.
3. Placement and compaction of the pipe zone backfill.
4. Backfill of the balance of trench to grade.
5. Compaction Testing:
 - (1) To be performed by the District in public rights-of-way
 - (2) To be performed by private soils engineering consultant retained by the Applicant and approved by the District in private streets and easements.
 - (3) The Applicant must provide the District with copies of test results for approval before final acceptance of the work.
6. Testing of all sewers and laterals after backfill compaction.
7. Manholes and main line cleanouts are raised to finish grade, and the system balled and flushed, and a mandrel test performed for PVC sewers.
8. Video inspection of mainline and laterals by TCWD prior to acceptance.

C-7.3 Costs of Overtime Inspections and Other Services:

1. Inspection of the work as well as other required services will be provided by District between hours of 7:00 a.m. and 3:30 p.m. Monday through Friday only.
2. Any inspections or other services by the District requested by Contractor and/or Developer made necessary as a result of actions of the Contractor or Developer beyond the hours stated above, shall be paid for by the Contractor or Developer at the prevailing rate for overtime and/or holiday work.
3. Inspections or other services by the District that have been requested by or made necessary because of the actions of the Contractor or Developer on Saturdays, Sundays, or Holidays, must be scheduled no later than 48 hours before the time request, Request must be approved by the District and shall paid for by the Contractor or Developer in advance at the prevailing rate for overtime and/or holiday work.

C-8 DISTRICT AUTHORITY

The Developer and/or Contractor shall provide the District at all times with access to the work area during construction and shall provide the District with reasonable assistance to obtain significant knowledge about the progress, workmanship, and character or materials used and employed in the Work.

No pipe, fittings, or other materials may be installed and/or backfilled until inspected and approved by the District. The Contractor shall notify the District's Inspector no later than **48 hours** before backfilling these items and before completing work in all other inspection phases to permit the District to properly inspect the work.

The District's inspection of the work does not relieve the Contractor of its obligations to complete the work as prescribed by the District's standards. Contractor shall, at its own expense, repair and upgrade any defective work so that it meets all applicable District standards. The District may reject any defective work or unsuitable materials whether the District previously inspected such work or materials.

The District may suspend the work wholly or in part for such time as it may be necessary in its sole discretion if the Contractor fails to comply with any written orders given by the District's Inspector or any other District representative to perform any work as required by the provisions of the District's standards and/or approved plans and specifications.

The Contractor shall immediately comply with any written order of the District to suspend the work wholly or in part. The work shall be resumed when methods or defective work are corrected as ordered and approved in writing by the District.

C-9 FINAL DOMESTIC AND NONDOMESTIC WATER FACILITIES INSPECTION

Prior to final acceptance, the District's Inspector and/or other District personnel as required and the Contractor's superintendent or foreman shall meet for a final inspection of all work to assure that the work has been completed including, without limitation, the following:

1. All phases of the work are completed in accordance with approved plans and specifications and the District's standards.
2. All valve boxes are raised to finish grade, and all pavement has been replaced.
3. All valves are referenced according to the District's standards and the District's Inspector has been given all reference measurements to locate the valve in the field.
4. All angle meter stops, and meters are properly positioned, and all meter boxes are positioned and raised to proper grade.
5. All AMI metering equipment has been installed and is operating properly.
6. All fire hydrants are raised to proper grade, in a vertical position, and painted, and concrete pads are installed and properly placed.
7. All trenching backfill has passed all compaction requirements and compaction reports have been provided to the District.
8. All waterlines have been chlorinated and disinfected per District and AWWA Standards.
9. All waterlines have been pressure tested and flushed per District and AWWA Standards.
10. The jobsite has been cleaned up and all of the Contractor's equipment and materials have been properly removed from the site. All excess materials have been properly disposed of by the contractor.
11. All water service lateral locations have been clearly marked on curbs pursuant to the District's standards.

C-10 FINAL SEWER SYSTEM FACILITIES INSPECTION

Before final acceptance, the District's Inspector and/or other District personnel as required and the Contractor's superintendent or foreman shall meet for a final inspection to assure that the following work has been completed including, without limitation, the following:

1. All bulkheads and plugs have been removed, and all debris has been cleaned from all sewer mains.
2. Contractor has flushed, balled, and mandreled all PVC sewer mains with the District's Inspector present. This must be completed even if the mains had previously been balled and video inspected.
3. Concrete base and channels in manholes are smooth and flow properly.
4. Manhole interiors are clean of all debris and any excess concrete mortar has been removed.
5. All manhole concrete grade rings have been adequately grouted and properly set to grade.
6. Pavement around manhole covers has been properly asphalted to correct grade.

7. Proper field tests have been completed on all sewer main sections and manholes, particularly where sections of manholes were repaired.
8. Trenching backfill has passed all compaction requirements and the District has received all compaction reports.
9. Lateral locations have been clearly marked on curb per District's standards.

C-11 INTERPRETATION OF SPECIFICATIONS AND DETAIL DRAWINGS

The figured dimensions shown on the drawings will take precedence, but any work not dimensioned shall be performed as directed. The Contractor shall perform work not particularly shown or specified in the same manner as similar parts that are shown or specified or as directed.

Full size or large-scale details shall take precedence over smaller scale drawings as to shape and details of construction. Specifications shall govern as to material.

Scale drawings, full-size details, and specifications are intended to be fully consistent; but if any discrepancy or apparent difference occurs between plans and specifications or if errors occur in work being constructed by other contractors that affect the work of the Contractor, the Contractor shall immediately inform the District **in writing**. If the Contractor proceeds with the work in the affected area without instruction from the District, the Contractor shall be fully responsible for any resultant damage or defect at no cost to the District.

C-12 ACCEPTANCE OF FACILITIES AND RELEASE OF BONDS

1. As-Built Drawings: After completion of the construction of all domestic and nondomestic water and sewer facilities, and upon the satisfaction of all final inspection requirements, the Developer's Engineer shall prepare record as-built drawings accurately reflecting the facilities and showing all revisions in the work which constituted modifications from the original improvement plans approved by the District. The Developer's Engineer shall submit one set of record as-built drawings to the District. The Developer shall assure us that the record as-built drawings are forwarded to the District's Inspection Office for review. If any corrections to the as-built drawings are needed, the plans will be returned to the Developer's Engineer for updating. Once the corrections are made, the Developer's Engineer shall submit one complete set of the record as-built drawings and the DWG files to the District. The DWG files must be compatible with the District's GIS platform.
2. Bill of Sale: The applicant shall submit a "Bill of Sale" to the District which acknowledges that the Applicant has transferred and conveyed to the District, all right, title, and interest in to the Domestic and Nondomestic Water and Sewer facilities installed including pipelines, valves, service connections, fire hydrants, meters, sewer laterals, manholes, sewer clean outs, lift stations, and any other appurtenances related to the installation, construction, and installation of Domestic and Nondomestic Water and Sewer facilities located on the relevant property, and further warrants that the same is free and clear of any encumbrance. See Appendices A-2, A-3, and A-4.

C-13 DISTRICT POLICY ON REGENERATIVE WATER SOFTENERS AND DISCHARGE TO THE SEWER SYSTEM

The District has built and maintains a modern water reclamation plant to treat and conserve as much water as possible. Wastewater from the sewer system is treated to the standards established by the DDW for nondomestic water and will be used for irrigation water.

Salts and minerals that are harmful to vegetation and agricultural crops must be kept out of the District's sewer system as required by DDW, since minerals are not removed from the wastewater during the water reclamation process. The Rules and Regulations strongly discourage the use of any home regenerative or automatic water softener that can discharge saltwater or brine into the District's sewer collection system.

Water softeners that are self-contained units and are recharged at central plants may be used. Commercial services will rent recharged water softeners and exchanging periodically are readily available. Commercial installations of regenerative water softeners will be specifically permitted by the District only and California Health & Safety Code Sections 116775 through 116795 after approval of holding facilities that allow brine to be pumped and transported outside the District area of sewage collection.

C-14 USE OF DISTRICT SEWER FACILITIES

The District regulates the types of wastewater that may be discharged into its sewer system in order to protect its facilities and operations to meet its discharge water requirements.

Rules and Regulations, Chapter 7: Wastewater Facilities and Services sets forth these requirements. These provisions identify the conditions under which certain users may obtain permits to use of District's sewer facilities.

Applicants whose sewage discharges qualify for a permit may not connect to a District lateral sewer or sewer main until the District has provided written approval for such a connection. All users must comply with the discharge prohibitions established in Rules and Regulations Chapter 7.

C-15 DISTRICT BACKFLOW PROTECTION AND CROSS-CONNECTION CONTROL PROGRAM

All domestic water services shall be subject to TCWD's Rules and Regulations, Chapter 3: Operational Matters, Section 3.5 - Cross-Connection Prevention on water backflow prevention and the SWRCB's Cross-Connection Control Policy Handbook dated July 2024. The following summarizes these provisions:

1. Cross connections of any type that permit a backflow condition from any source or system other than that of the District's potable water system are **prohibited**.
2. A connection constituting a potential or actual backflow hazard is **not** permissible unless a backflow prevention device or air gap, which is approved by the DDW Regulations, OCHCA and complies with SWRCB's Cross-Connection Control Policy Handbook (CCCPH) is installed.
3. Such an installation shall at all times be subject to inspection, annual testing, and regulation by the District for the purpose of avoiding possibility of backflow condition.
4. The District has a Cross-Connection Control Inspector who is available for consulting on any questions regarding cross-connections.
5. The District **will not** provide any water services to any premises unless the public water supply is protected as required by DDW, OCHCA, CCCPH, and District regulations.
6. Only those backflow prevention devices approved by the USC Foundation for Cross Connection Control and Hydraulic Research (latest edition) shall be acceptable for use in the District.
7. The District shall regularly test (at least once a year) and service such devices owned by the District, maintain them in satisfactory operating condition, and shall overhaul or replace such devices if they are found defective.
8. Records of such annual tests, repairs and overhauling shall be kept by the District and copies forwarded to the OCHCA.
9. Service of water to any premises may be discontinued by the District, if a backflow prevention device as required by DDW, OCHCA, and District Rules and Regulations is not installed.
10. If any defect is found in an installed backflow prevention device, or if it is found that a backflow prevention device has been removed or bypasses, or if unprotected cross-connections exist on the premises and services will not be restored until such conditions or defects are corrected.

A copy of the District's Ordinance instituting a Cross-Connection Control Program in Appendix A-8.

Additional reference for guidelines as to when, why and what types of backflow and cross-connection control devices are approved may be found in:

1. Cross Connection Control Policy Handbook dated July 2024, State Water Resources Control Board
2. Manual of Cross-Connection Control, University of Southern California (USC)-Foundation for Cross Connection Control and Hydraulic Research - Latest Edition.
3. Manual M-4 - Backflow Protection and Cross-Connection Control - Recommend Practices, AWWA, - Latest Edition.

C-16 RAISING OF VALVE BOXES AND MANHOLE RIMS

Where domestic and nondomestic water and sewer facilities are constructed by the District or Applicant and prior to paving of the street by the Applicant and in conjunction with scheduling of the proposed developments, the Applicant shall raise to grade all valve boxes and manholes that are within paved portions of the development after each lift of pavement at no cost to the District.

The Applicant's shall also maintain access to all valves and manholes at all times before, during and after construction.

C-17 ENCROACHMENT PERMITS

Encroachment permits or a set of approved improvement plans are required for any work on the District's system, or within a District easement, except for District Employees and Contractors employed by the District for emergency repairs of District facilities.

If the District has not issued a permit or approved improvement plans, no construction work on the District's system may be carried out until a permit has been issued or such plans have been approved. Any costs associated with work completed that is not performed in compliance with the District's standards shall be paid by Applicant.

SECTION D - CONSTRUCTION AND/OR CONVERSION TO NONDOMESTIC WATER SYSTEMS

D-1 District Procedures and Requirements

The use, procedures, regulations, requirements, design, construction, and operation of onsite facilities for nondomestic water service shall be in accordance with the Rules and Regulations, and the requirements for Nondomestic Water System Tract Maps as specified in Subsection C-1.3 of this Manual.

PART 2
Design Criteria
for
Domestic and Nondomestic Water and Sewer Facilities

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SECTION E - GENERAL DESIGN CRITERIA

E-1 IMPROVEMENTS PLANS

Improvement plans shall be prepared and submitted to the District for approval and signature for all domestic and nondomestic water and sewer facilities to be constructed by the District or by the Applicant and dedicated to the District.

All improvements shall be designed and constructed in accordance with the District's "Domestic and Nondomestic Water and Sewer Design & Construction Manual" that includes Policies and Procedures, Design Criteria, Standard Technical Specifications and Standard Drawings for Domestic and Nondomestic Water and Sewer Service.

The general requirements for the preparation of the improvement plans are outlined below.

E-1.1 Drawings:

- a. Drawings shall be on standard (24" x 36") sheets with sheet number, title, revisions, and signature blocks. See Appendix A-11 for sample standard sheet.
- b. Improvement plans shall be prepared on bond paper.
- c. Title sheet(s) shall have
 - (1) Location map showing the location of the project.
 - (2) An index or key map clearly indicating the sheet numbers issued.
- d. The following shall be clearly shown on the drawings, preferably on the Title Sheet:
 - (1) Project benchmark(s) and, basis of bearings.
 - (2) Detailed quantity estimates and standard notes, categorized by domestic and nondomestic water and sewer facilities (See Sections F, G, & H).
- e. Improvement plans for large tracts shall have a separate small-scale map showing the overall layout of domestic water, sewer, and nondomestic water facilities.
- f. The following scales shall be used on all drawings, unless otherwise approved.
 - (1) Plan and Profile Sheets:
Horizontal: 1" = 40'
Vertical: 1" = 4' (1" = 8', or as appropriate for steep grades)
 - (2) Details: As appropriate to clearly indicate the work.
- g. Profiles shall be shown on the top of the sheets for water & sewer main that are 6-inch diameter and larger.
- h. All facilities to be operated and maintained by the District shall be located within public rights-of-way or recorded easements, which shall be clearly shown on the improvement plans (see Section C-2 for easement requirements).
- i. The drawings shall show on plan and profile, the position of all known or proposed underground facilities.
- j. Record drawings shall be prepared upon completing the construction of the improvements.

E-1.2 Signatures:

- a. Each sheet of plans submitted for approval shall be signed and sealed by Civil Engineer responsible for design, unless otherwise specified or approved by District.
- b. Improvement plans for complex grading, structural, mechanical, or electrical plans shall be signed by the Professional Engineer responsible for that design. The registration seal shall clearly indicate the expiration date.

- c. Civil and other professional engineers' signing plans to be submitted for the District's approval shall be registered with the State of California.
- d. Plan revisions subsequent to the District's approval shall be clouded and highlighted and resigned per the requirements above prior to resubmittal for District's approval.

E-1.3 Submittals:

- a. Domestic and nondomestic water and sewer structural design calculations shall accompany plans submitted for plan review by the District.
- b. Plans submitted for approval shall be accompanied by a letter of transmittal addressed to the District.
- c. Plans shall be reviewed for consistency, accuracy, drafting and conformance to the District's "Domestic and Nondomestic Water and Sewer Design and Construction Manual."
- d. If plans provided to TCWD show incomplete information, they will be returned unapproved by the District.
- e. All Plan Review prints shall accompany revised plans when resubmitted for approval and shall be accompanied by a letter of transmittal addressed to the District.

E-2 SEPERATION BETWEEN DOMESTIC AND NONDOMESTIC WATER MAINS AND SEWER MAIN

E-2.1 Horizontal Separation: DDW regulations require a 10-foot minimum separation between domestic water and nondomestic water mains and sewer mains.

In special situations where there is less than the required separation, special construction will be required as shown on TCWD Std Dwg W-21. Applicant also shall be required to obtain approval from DDW. In no case, nondomestic water mains shall be located within a street at a distance of 6 feet from the curb face.

E-2.2 Vertical Separation: domestic water and nondomestic water mains and sewer mains shall be located vertically from the street surface in order of higher quality, i.e., domestic water shall be above nondomestic water, and nondomestic water shall be above sewer in accordance with District's Standard Drawings and DDW requirements.

Whenever a nondomestic water main or sewer main crosses a domestic water main, special construction will be required as shown on the District's Standard Drawings. Applicant also shall be required to obtain approval from DDW. If a sewer or nondomestic water main is above a domestic water main or if a sewer main is above a nondomestic water main, the special construction shall extend a sufficient distance on both sides of the crossing to provide a minimum of 10 feet of horizontal clearance.

If a sewer or a nondomestic water main is located below a domestic water main and there is less than the required 1-foot vertical clearance between the mains, special construction will be required as shown on TCWD Std Dwg W-21. Applicant also shall be required to obtain approval from DDW.

These construction requirements shall not apply to those sewers lateral that cross less than 3 feet below domestic water or nondomestic water main.

SECTION F - DESIGN CRITERIA FOR DOMESTIC WATER FACILITIES

F-1 GENERAL WATER SYSTEM CRITERIA

- F-1.1 Standard Requirements: The design and construction of all domestic water system facilities to be operated and maintained by the District shall be in accordance with these Design Criteria, the District's Standard Specifications, the District's Standard Technical Provisions, the District's Standard Drawings, DDW Waterworks Standards, AWWA Standards, SSPWC, and the requirements of the OCFA.
- F-1.2 Calculations Required: Substantiating engineering calculations for water demands, pressures, and structural designs shall accompany plan submittals to the District.
- F-1.3 Looped Systems: Each project or development shall have at least two (2) connections to existing waterlines in different streets to form a looped water system. If connection to different streets is impractical or impossible in the opinion of the District, connections to a waterline in the same street will be permitted, provided that adequate valving for isolation of the segments of waterlines within the proposed development.
- Non-looped systems **will be permitted only** with the express written permission of the District.
- F-1.4 Design System Demands: In general, the design of the domestic water system facilities shall be based on water demands, pressure zones and system elements as outlined in District's Domestic Water System Master Plan (latest edition).
- Demand factors for specific types of localized development not addressed in the Master plan (e.g., industrial, heavy commercial, high, and heavy density residential areas, etc.) shall be based on normally accepted standard of the water industry and is subject to written approval of the District.
- Average day, maximum day, and peak hour water demands shall be established by the District prior to the start of design and as outlined in the District's Master Plan.
- Fire flow demands shall be established by the OCFA. The Applicant shall obtain the fire flow requirements from OCFA prior to submitting for the District's review. A hydraulic analysis may be required to show that the proposed water system is adequate to meet the required fire flows.
- F-1.5 Design System Pressures: The following criteria shall be met for **all** domestic water systems unless otherwise approved or specified by the District:
- The minimum residual pressure at any point in system shall be a minimum of 20 psi at maximum day plus design fire flow demands and the minimum residual pressure near the location of a fire flow shall conform to the requirements of OCFA.
 - The minimum residual pressure at any point in the system shall be 40 psi at peak hour demand conditions.
 - The minimum static pressure at any service location (meter) shall be 50 psi, unless waived by the District.
 - Pressure regulations are required to be installed on the customer's side of the meter if the static pressure exceeds 80 psi at the water meter.
 - Each dwelling unit must be supplied with its own water service and meter.

- F-1.6 Improvement Plans: Improvement plans for domestic water system facilities shall be prepared in accordance with the requirements of Subsection E-1 and shall include the following:
- a. Profiles of water mains that are 8 inches in diameter and larger.
 - b. Detailed quantity estimated indicating linear footage of pipe by size, class, and type; number of valves by size, class, and type; number of fire hydrants; number of water services by size; number of blowoffs and air and vacuum valves assemblies; linear footage of concrete encasements (if applicable); and any other appurtenances which should be identified for quantity purposes.
 - c. Standard domestic water system notes, including but not limited to the following:
 1. The water system as shown on these plans shall be constructed by the Developer in accordance with the District's "Domestic and Nondomestic Water and Sewer Design and Construction Manual."
 2. The Contractor shall have a copy of each of these standards, as well as a copy of the project plans and specifications, on the job **at all times**.
 3. The Developer shall furnish the District with recorded easements for all portions of the water system outside the public right-of-way.
 4. The District shall be furnished with six (6) copies of approved construction plans prior to the start of construction.
 5. The District Inspector shall be notified at **least 48 hours** prior to the start of construction and any subsequent required inspection. Phone (949) 858-0277 to arrange for an inspection.
 6. A preconstruction conference with representatives from all affected agencies, utilities, and the Contractor shall be held on the job site at **least 48 hours** prior to the start of construction.
 7. The Contractor shall obtain all required City and/or County permits prior to the start of construction. The contractor shall provide copies of all permits to the District prior to construction.
 8. Water mains shall be either staked for line and grade or shall be installed subsequent to the installation of the curbs but prior to final paving of the streets.
 9. The minimum cover over domestic water mains shall be 42 inches below pavement finished grade.
 10. **No** valve or valve boxes shall be located within a gutter or other concrete drainage device.
 11. All fire hydrants shall be installed per the District's Standard Drawings.
 12. All exposed buried metal appurtenances in contact with the soil or water, including pipes, flanges, nuts, bolts, valves, couplings, etc., shall be given two (2) coats of Devwrap 142S protective coating, or equal.
 13. No facility shall be backfilled until it is inspected by the District.
 14. Shut down of existing waterlines to facilitate connection to existing facilities shall be coordinated with the District Inspector.
 15. Developer or Contractor shall provide a minimum of **48-hour notice** before any connection to existing facilities.
 16. No connections to the District's existing water system shall be made **until** the new facilities have been successfully tested and disinfected.

17. The contractor shall be required to notify any customers that will be out of water in writing for a minimum of **48 hours** before water is shut off. All connections to the District's water system shall be made in the presences of the District Inspector.
18. All water services shall be installed behind the curb prior to paving the street. The services shall be extended to their final location by the Developer at a time prior to pressure testing of the water system.
19. All water services shall be installed with a 5-foot horizontal separation from any sewer lateral and in accord with District's Standard Drawings.
20. All water services supplied with pressure higher than 80 psig shall be provided with approved pressure regulators set at 80 psig on the customer's side of the meter.
21. Meter boxes shall be installed directly behind the curb or behind the sidewalk per TCWD Std. Dwgs. W-1 through W-4. Meter boxes installed behind rolled curbs or within driveways shall have traffic-rated lids.
22. All buried bolts, anchor bolts and nuts shall be Type 316 stainless steel and shall be coated with Devwrap 142S or approved equal.
23. The Developer shall raise all valve boxes to the finished pavements grade upon completion of the pavement.
24. If the surface course of pavement is not completed within a reasonable amount of time after the base course of pavement is completed, the Developer shall raise the valve boxes to the finished grade of the base course so that the District may operate the valves.
25. The Developer shall then raise all valve boxes to the final finished grade of the pavement upon completion of the surface course of pavement. The required raising of valve boxes to the finished grade of the base course of pavement will be determined and specified by the District.

F-2 WATER MAINS

F-2.1 Sizes of Mains:

- a. The normal minimum size transmission main shall be 12 inches in diameter.
- b. The normal minimum size distribution main shall be 8 inches in diameter.
- c. **No** 10-inch or 14-inch diameter mains will be allowed without approval of the District.
- d. All water mains shall be designed in a looped system, unless otherwise specified herein and approved by the District,
- e. Transmission mains shall be sized based on a head loss of 3 feet or less per 1000 linear feet of pipe, and **in no case** shall the design head loss exceed 5 feet per 1000 linear feet of pipe unless specifically approved by the District.
- f. For Distribution mains, the maximum allowable design velocity shall be 8 feet per second.
- g. On dead-end streets, the minimum size main shall be 8 inches to at least the last fire hydrant on the water main.
- h. On dead-end streets serving the equivalent of 25 or less normal-size residential lots, or no more than two (2) fire hydrants looping of the water main will be required.

However, the water main shall be extended beyond the last fire hydrant with a minimum 6-inch diameter line, which shall terminate with a blowoff or a dead-end service connection conforming to the District's Standard Drawings.

- i. If the water main is looped to an adjacent street, the water main shall be a minimum of 8 inches in diameter.
- j. If the water main is extending through an easement within a casing as shown on standard drawings, a valve at each end of the easement within the street pavement is required.
- k. Any water main located within an easement area shall have access and drivable.

F-2.2 Type and Class of Pipe: All transmission mains shall be of the type and class as specified by the District.

- a. All 4-inch, 6-inch and 8-inch domestic water distribution mains shall be polyvinyl chloride pipe (PVC), Class 200 minimum, conforming to AWWA C-900 with ductile-iron, push-on type fittings, Class 200 minimum, Unless otherwise approved by the District.
- b. All water mains located within an easement area through a property shall be Ductile Iron Pipe, Class 50 minimum. Ductile Iron Pipe shall have mechanically and bonded restrained joints, and sacrificial anodes, unless otherwise approved by the District.

F-2.3 Minimum Depth to Top of Water Main: The minimum depth to the top of domestic water main shall be a minimum 42 inches, below the street pavement finished grade. Unless otherwise approved by the District.

F-2.4 Standard Location: Domestic water mains shall be located within the street pavement area at a distance of 6 feet from the curb face as shown in the District's Standard Drawings. Special approval by the District is required for any water main which is not located within a street or at a distance of 6 feet from the curb face.

F-3 WATER VALVES

F-3.1 Types of Valves:

- a. All main line water valves less than 12" diameter shall be resilient wedge gate valves, unless otherwise specified or approved by the District.
- b. All mainlines water valves 12" diameter and larger shall be butterfly valves with actuator.
- c. Other valves shall be as specified in the District's Special Provisions and Standard Drawings.

F-3.2 Location of Valves:

- a. There shall be at least two (2) control valves at any 3-way intersection of any water mains.
- b. There shall be at least three (3) control valves at any 4-way intersection of any water mains.
- c. There shall be at least four (4) control valves at any 4-way intersection of major distribution mains.
- d. All fire hydrant laterals shall have a gate valve and a break-away check valve.
- e. The control valves at all intersections or fire hydrants shall be flanged to the main line tees or cross, unless otherwise approved by the District.

- f. Valves shall be spaced so that no more than two (2) fire hydrants would be taken out of service at any one time.
- g. The maximum allowable spacing for intermediate valves on transmission mains is 1,200 feet, unless specifically approved by the District or OCFA.
- h. All intermediate main line valves should be located on the prolongation of a property line wherever possible.
- i. Where water mains are located within an easement outside of paved streets, a valve shall be located at each end of the easement within the street section or public right-of-way.
- j. **No** valve or valve box shall be installed within a gutter or other concrete drainage device.
- k. Valve stem tops having over 48 inches of cover shall be provided with an approved extension.
- l. The final determination of the location of all valves shall be subject to the approval of the District.

F-3.3 Blowoff Valves and Air and Vacuum Release Assemblies:

- a. Blowoffs: shall be installed at the end of all mains where the flow velocity of the slope of the main could cause sediment to settle at the end of the main.
 - 1. If a dead-end service connection is installed at the end of a distribution main and in accordance with the District's Standard Drawings, a blowoff is not required.
 - 2. Blowoffs shall normally be installed at all low points in water mains larger than 8" in diameter and any other location specified by the District to assure the capability of complete flushing of a water main.
- b. Air and Vacuum Release Assemblies: shall be installed at all high points in all transmission and distribution mains in accordance with the District's Standard Drawings.

F-4 WATER SERVICES

All water services shall be installed in accordance with the District's Technical Provisions and Standard Drawings, and the following requirements:

- a. The minimum services line sizes to the meter shall be 1-inch in diameter.
- b. Special designs are required to be submitted for approval of the District for commercial, irrigation, or industrial services to which the District's Special Provisions and Standard drawings are not applicable.
- c. Water meter shall not be located in an area or location **which is not** easily accessible to the District at all times.
- d. Any water service that is connected to an on-site residential fire sprinkler system shall also install a backflow prevention device directly behind the water meter.
- e. For any lot which is also supplied with a nondomestic water service, an air gap device, or an approved reduced pressure principle (PRP) backflow prevention device, if approved by the District and DDW, it shall be installed on the customer side of the domestic water meter as shown on the District's Standard Drawings and in accordance with DDW requirements.
- f. Each dwelling unit shall be supplied with its own separate water service meter.

F-5 COMMERCIAL/INDUSTRIAL PRIVATE WATER SYSTEMS

- F-5.1- Private Water Systems: All plans submitted for review and acceptance for commercial/industrial developments shall have private onsite water systems.
- a. The District may at its sole discretion require the onsite system to be “public,” if it would be of a significant benefit to the District. Each site will be reviewed on an individual basis at the time plans are submitted.
 - b. As a condition of water service, District will require the applicant and/or party responsible for payment of the water charges to enter into an agreement with the District acknowledging that the onsite facilities are private, will be properly maintained according to industry standards and further agree to hold the District harmless from any claims on the design, existence, maintenance and operation of the private onsite system.
 - c. Any unauthorized use of water through onsite detector check assembly will be billed to the customer at the current water rate and will also be responsible for the service charge for the fire service.
 - d. Standards and standard drawings used for the private onsite system shall be in conformance with the requirements of the County or City or any other responsible regulatory agency.
- F-5.2 Commercial/Industrial Water Systems: All onsite domestic water systems for commercial/industrial developments shall be private and shall be owned, operated, and maintained by the property owner.
- a. Each commercial unit shall have an individual water meter located directly behind the curb within a public street right-of-way as indicated on the District’s Standard Drawings.
 - b. An approved backflow device and security cage shall be installed and located to the satisfaction of the District’s Cross Control Specialist. The backflow device and the remainder of the service from the meter to the building shall be private and operated and maintained by the property owner.
 - c. If the water meter cannot be located within the public right-of-way, it shall be located in an easement dedicated to the District adjacent to the street right-of-way.
- F-5.3 Commercial/Industrial Irrigation Systems: All onsite domestic irrigation water systems for commercial/industrial developments shall be private and shall be owned, operated, and maintained by the property owner.
- a. Each commercial irrigation area shall have an individual water meter located directly behind the curb within a public street right-of-way as indicated on the District’s Standard Drawings and an approved backflow device located to the satisfaction of the District’s Cross Control Specialist.
 - b. The backflow device and security cage and the remainder of the service from the meter shall be private. If the meter cannot be located within the public right-of-way, it shall be located in an easement dedicated to the District adjacent to the street right-of-way.
- F-5.4 Commercial/Industrial Fire Protection Systems: All onsite fire hydrants and fire protection supply mains for commercial/industrial developments shall be private system and shall be owned, operated, and maintained by the property owner.

- a. Each private fire protection system shall be connected to the District's domestic water system through an approved detector check assembly per the District's standards and an approved backflow device located to the satisfaction of the District's Cross Control Connection Specialist.
- b. The responsibility for maintenance of the service up to the property line or detector check assembly shall be owned and maintained by the District. The remainder of the system, including the detector check, shall be private and maintained by the property owner.

F-6 RESERVOIRS, PUMP STATIONS AND PRESSURE REDUCING STATIONS

All reservoirs, pump stations and pressure reducing stations required for the project shall be of special design and are subject to the review and approval of the District. Applicant required to submit plan review fees prior to any review by the District.

SECTION G - DESIGN CRITERIA FOR NONDOMESTIC WATER FACILITIES

G-1 GENERAL NONDOMESTIC WATER SYSTEM CRITERIA

- G-1.1 Standard Requirements: The design and construction of all nondomestic water system facilities to be operated and maintained by the District shall be in accordance with these Design Criteria, the District's Standard Specifications, the District's "Standard Special Provisions and Standard Drawings," the District's "Regulations for Nondomestic Water Facilities," as well as the guidelines and requirements of the DDW, the California Clean Water Act, and the San Diego RWQCB.
- No fire hydrants or water service connections** other than irrigation services shall be connected to the Nondomestic Water System.
- G-1.2 Calculations Required: Substantiating engineering calculations for nondomestic water demands, pressures, and structural designs shall accompany plan submittals to the District.
- G-1.3 Design System Demands: In general, the design of the nondomestic water system facilities shall be based on the water demands, pressure zones and system elements as outlined in the District's nondomestic water system master plan. Unless otherwise approved by the District
- a. All nondomestic irrigation systems shall be designed with an application rate not to exceed 25 gallons per minute per acre for turf areas and 20 gallons per minute per acre for slope areas.
 - b. All nondomestic irrigation systems also include moisture sensors that override the time clocks.
- G-1.4 Design System Pressures: The following criteria shall be met for nondomestic water systems unless otherwise approved or specified by the District:
- a. The minimum residual pressure at any point in system shall be a minimum of 20 psi at maximum day demands.
 - b. The minimum residual pressure at any point in the system shall be 40 psi at peak hour demand conditions.
 - c. The minimum static pressure at any service location (meter) shall be 50 psi, unless waived by the District.
 - d. Pressure regulations are required to be installed on the customer's side of the meter if the static pressure exceeds 80 psi at the water meter.
 - e. Each dwelling unit with a separate irrigation meter must be supplied with its own water service and meter.
- G-1.5 Improvement Plans: Improvement plans for nondomestic water system facilities shall be prepared in accord with requirements of Subsection E-1 and shall include the following:
- a. Profiles of water mains that are 6 inches in diameter and larger.
 - b. All nondomestic water mains shall have a minimum cover of 42" below the street pavement finished grade or be encased in concrete.
 - c. Detailed quantity estimated indicating linear footage of pipe by size, class, and type; number of valves by size, class, and type; number of irrigation water services by size; number of blowoffs and air and vacuum valves assemblies; linear footage of concrete encasements (if applicable); and any other appurtenances which should be identified for quantity purposes.
 - d. Standard nondomestic water system notes shall include the standard domestic water system notes (Subsection F-1.6) and include but are not limited to the following:

1. The nondomestic water system shall be chlorinated, disinfected and pressure tested in accordance with the District's Standards and AWWA requirements.
2. All nondomestic water facilities included work shall be installed accordance with the District's "Rules and Regulations for Nondomestic Water Services." in Appendix B.

G-2 NONDOMESTIC WATER MAINS

G-2.1 Sizes of Mains:

- a. The minimum size transmission nondomestic main shall be 8 inches in diameter.
- b. The minimum size distribution nondomestic main shall be 6 inches in diameter.
- c. No **10-inch or 14-inch** diameter mains will be allowed without approval of District.
- d. For distribution nondomestic mains, the maximum allowable design velocity shall be 8 feet per second.

G-2.2 Type and Class of Pipe:

- a. All nondomestic water mains shall be AWWA C900 PVC pipe, Class 200, except for mains located within an easement through a property or lot shall be Ductile Iron Pipe, Class 50 minimum, unless otherwise specified or approved by District.
- b. Ductile Iron Pipe shall have restrained joints, sacrificial anodes and shall be encased in a loose polyethylene encasement in accordance with AWWA C 105 standards.

G-2.3 Minimum Depth to Top of Water Main: The top of nondomestic water mains shall be a minimum of 42 inches below street pavement finished grade or the main shall be encased in concrete.

G-2.4 Standard Location: Nondomestic water mains shall normally be located between domestic water mains and sewer mains as shown on the District's Standard Drawings and shall conform to the separation requirements of Subsection E-2.

G-3 VALVES

The type and location of nondomestic water system valves shall conform to the requirements of Subsection F-3, except that intermediate main line valves shall be located as specified by the District.

G-4 NONDOMESTIC WATER SERVICES

Nondomestic water services shall conform to the requirements of Subsection F-4.

G-5 RESERVOIRS, PUMP STATIONS AND PRESURE REDUCING STATIONS

All reservoirs, pump stations and pressure reducing stations required for a Nondomestic Water project shall be a special design and are subject to the review and approval of the District. Applicant required to submit plan review fees prior to any review by the District.

SECTION H - DESIGN CRITERIA FOR SEWER FACILITIES

H-1 GENERAL SEWER SYSTEM CRITERIA

H-1.1 Standard Requirements: The design and construction of all sanitary sewer system facilities to be operated and maintained by the District shall be in accordance with these Design Criteria, the District's Standard Specifications, the District's Standard Special Provisions and Standard Drawings, as well as the water quality guidelines and requirements of the San Diego RWQCB.

H-1.2 Calculations Required: Substantiating engineering calculations for projected sewage flow rates, size pipe and structural designs shall accompany plan submittals to the District.

H-1.3 Design Sewage Flows: In general, the design of sanitary sewer system facilities shall be based on the latest version of TCWD's Wastewater Master Plan which provides projected ultimate sewage flow rates and system elements.

Sewer generation rates for specific types of localized development not addressed in the Master Plan (e.g., heavy commercial, high, and heavy density residential areas, etc.) shall be require the Developer to prepare and submit a Sub-Area Master Plan shall be subjected to the approval of the District.

All sewer mains shall be designed for peak sewage generation rates based on the ultimate development plan for the area proposed to be served and in accordance with the criteria specified below.

H-1.4 Improvement Plans: Improvement plans for sanitary sewer system facilities shall be prepared in accordance with the requirements of Subsection E-1 and shall include the following:

- a. Sewer centerline stationing shall be shown (example: [0+00.00]) independently of street stationing. Also, all manholes shall be numbered (example MH No.1).
- b. Stations shown as [0+00.00] are sewer stations and are independent of all other stations. Sewer lengths are calculated horizontal distances along the centerline of the sewer.
- c. Profiles of all sewer mains, with invert elevations at the centerline of manholes. The profile shall also show invert elevations and directions in and out of manholes if there is a drop in elevation through a manhole or a change in flow line slope.
- d. Location and size of all sewer laterals (Also called "house connection sewers").
- e. Detailed quantity estimates indicating linear footage of pipe by size, class, and type; number of manholes; linear footage of concrete encasements (if applicable); and any other appurtenances which should be identified for quantity purposes on the Title Sheet.
- f. Standard sewer system notes to be shown on the improvement plans, including but not limited to the following:
 1. The sewer system as shown on these plans shall be constructed by the Developer in accordance with the SSPWC, Technical Provisions and Standard Drawings.
 2. The District shall be furnished with six (6) copies of the approved construction plans prior to the start of construction.
 3. The District Inspector shall be notified at **least 48 hours** prior to the start of construction and any subsequent required inspection. Phone (949) 858-0277 to arrange for an inspection.

4. A preconstruction conference with representatives from all affected agencies, utilities and the Contractor shall be held on the job site at **least 48 hours** prior to the start of construction.
5. The Contractor shall obtain all required City and/or County permits prior to the start of construction. The Contractor shall provide copies of all permits to the District prior to construction.
6. Sewer mains, manholes, and laterals shall be installed prior to paving of streets.
7. The Contractor shall verify the horizontal and vertical locations of all utility crossings and points of connection to the District's existing sewer system prior to construction of the sewers.
8. All sewer mains, manholes, and laterals shall be supplied to the District Inspector prior to installation.
9. A separate sewer lateral shall be constructed from the sewer main to the property line for each individually owned dwelling unit, unless otherwise specified or approved by the District.
10. Construction and location of all sewer laterals shall be in accordance with the District's Standard Special Provisions and Standards Drawings.
11. No facility is to be backfilled until inspected by the District.
12. In order to prevent accidental use of the new sewer prior to completion and acceptance of the work, the outlet or inlet to existing tie-in manholes(s) shall be sealed with broken brick and mortar. Installation of these plugs shall be approved by the District. Plugs shall be removed at the time of final inspection.
13. The Developer shall raise all manhole frames and covers to the finished pavement grade upon completion of the pavement.
14. If the surface course of pavement is not completed within a reasonable amount of time after the base course of pavement is completed, the Developer shall raise the manhole frames and cover to the finished grade of the base course so that the District will have access to the sewer system.
15. The Developer shall then raise all manhole frames and covers to final finished grade of the pavement upon completion of the surface course of pavement. The required raising of manhole frames and covers to the finished grade of the base course of pavement will be determined and specified by the District.
16. All sewer laterals from apartment buildings, condominiums buildings, industrial and commercial projects shall not be connected to the District's sewer system until all fine grading and landscaping is completed adjacent to the private sewer lateral. In addition, all manholes and/or cleanouts shall be adjusted to final grade and the private sewer lateral shall be cleaned to the satisfaction of the District before it is connected to the District's system.
17. All sewer laterals from single family houses shall not be connected to the District's sewer system until the house is ready for occupancy or a certificate of occupancy is provided from the County/City Building Departments. The lateral shall be cleaned to the satisfaction of the District before it is connected to the District's system.

18. A gap (section of line not installed) shall be provided between a sewer line from a development and an “active” sewer line until all units above the gap are ready for occupancy.
19. The units shall be considered ready for occupancy when the plumbing fixtures are set, and final grading completed for all units above the gap and the sewer line and all laterals above the gap have been cleaned to the satisfaction of the District.
20. If it is proposed to use the gap alternative to Note 15 and/or 16 herein, the gap shall be shown on the plans. If occupancy is desired for a number of units just upstream of the gap, a new gap shall be shown on the plans. If occupancy is desired for a number of units just upstream of the gap, a new gap shall be shown on the plans by addendum and provided onsite prior to the release on units below the new gap. Under the “gap” alternative, it shall be the Developer’s responsibility to pump the sewer above the gap and prevent any sewer spills above the gap. If a sewer spill occurs above the gap, the District may require that each sewer lateral above the gap be disconnected and left disconnected until the unit is ready for occupancy.
21. In order to verify acceptable constructions, all sewer lines that will be owned, operated, and maintained by the District shall be video inspected after cleaning and man drilling. District personnel will perform this video inspection. The Developer shall contract with an independent video inspection company to perform this inspection. Any sewer line found to be defective shall be repaired and reinspected, including video, prior to being placed in service and at no cost to the District.

H-2 SEWER MAINS

H-2.1 Minimum Size: The minimum size sewer main shall be 8 inches in diameter.

H-2.2 Minimum Slope Design:

- a. All sewers shall be so designed and constructed as to give mean velocities, when flowing half full, of not less than 2.0 feet per second, based on Manning’s formula using an “n” value of 0.013.
- b. Sewer mains 12 inches in diameter and smaller shall be designed to flow no greater than half full at design peak flows.
- c. Sewer mains larger than 12 inches in diameter shall be designed to flow no greater than three-quarter full at design peak flows.
- d. The following are minimum slopes that should be provided; however, slopes greater than these are desirable and should be provided whenever possible.

Pipe Size (inches)	Minimum Slope (feet per 100 ft)
8	0.40
10	0.28
12	0.22
15	0.16
18	0.12
21	0.10
24	0.08

H-2.3 Types of Pipes: Except as otherwise specified in Section E-2 and as shown on the District's Standard Drawings for sewers in the vicinity of water mains, the acceptable types of sewer pipe and uses are as follows:

- a. All gravity sewers shall be extra strength VCP or PVC pipe conforming to the requirements of ASTM Specifications D 3034 for SDR 35, or Uni-bell Uni-B-7 conforming to the requirements of ASTM Specifications F679.
- b. Sewer forces mains shall be Class 200 PVC pipe meeting AWWA C 900 standards, or poly-lined ductile iron pipe, Class 50 minimum, with mechanically restrained joints and sacrificial anodes.
- c. All sewer service laterals shall be extra strength VCP, or PVC pipe conforming to the requirements of ASTM Specifications D 3034 for SDR 35.
- d. Same pipe material shall be used between manholes.

H-2.4 Depth to Top of Sewer Mains: The top of the sewer main shall be a minimum of 7 feet below the finished surface, unless otherwise approved by the District. Sewer mains exceeding 13 feet in depth require special approval by the District.

H-2.5 Standard Location and Alignment: In local residential and industrial streets, sewer mains shall be located 6 feet from the centerline of the street, as shown on the District's Standard Drawings.

- a. In major, primary, and secondary highways, sewer mains shall be located in the center of the driving lane nearest to the center of the street.
- b. No sewer main is to be located within a median strip or a parking lane.
- c. Special approval by the District is required for any sewer main which is not located with a paved street.
 - (1) All-weather access roads shall be provided for all sewers not located within a paved street.
- d. A maximum separation between sewer and water mains in new subdivisions shall be achieved by the following construction procedures:
 - (1) On curvilinear streets, the sewers shall parallel as possible the street centerline by means of horizontal curves.
 - (2) Sewer mains should normally be installed on the opposite side of the centerline from the water mains, unless otherwise specified or approved by the District.
 - (3) Any other limiting design and construction considerations need special approved by the District.

The minimum horizontal radius of curvature for the various sizes of each of the acceptable types of sewer pipe materials is as follows:

VCP					PVC	
Normal Pipe Size (inches)	Minimum radius of Curvature (feet)				Normal Pipe Size (inches)	Minimum radius of Curvature (feet) For Standard 20 Ft. Lengths
	6 Ft. Lengths	5 Ft. Lengths	4 Ft. Lengths		8	240
8 -12	175	150	125		10	350
15-24	230	190	150		12	420
27-36	340	235	230		15	490

H-2.6 Siphons: Special approval of the District must be obtained prior to the design of any sewer siphon.

H-3 SEWER MANHOLES

H-3.1 Manhole Location and Spacing: Manholes shall be located and installed as follows:

- a. At all changes in size, slope, or alignment of sewer mains, including the beginning and end of
- b. be provided with all-weather vehicular access horizontal curves.
- c. At the end of each sewer main.
- d. At the junction of sewer mains, as well as the junction of sewer main and a lateral of the same size as the sewer main.
- e. With vehicular access.
- f. At other locations as specified by the District.
- g. The maximum spacing of manholes shall be 400 feet for 8-inch through 15-inch diameter sewers, and 500 feet for sewers greater than 15 inches in diameter.
- h. All manholes shall.

H-3.2 Manhole Type and Sizes: Manholes shall be precast reinforced concrete with eccentric style cones and cast-iron frames and covers, conforming to the District's Standard Drawings.

- a. The minimum diameter of manholes, frames and covers, shall be as follows:

Manhole Depth	Inside Diameter of Shaft (inches)	Diameter of Frame & Cover (Inches)
7.5 Ft. or Less (as approved by District)	60	30 -Flat Top
5 Ft. to 12 Ft.	48*	24
12 Ft. to 16 Ft.	60	30
16 Ft. or Greater (as approved by district)	72	36
Monitoring manholes	48 or 60	30

*The maximum size sewer pipe that may be connected to a 48-inch manhole is 18 inches.

- b. Manhole steps shall be 9/16" reinforced steel re-bar with polypropylene encasement.
- c. Allowable design head losses in manholes are as follows:
 - (1) Straight run through manholes shall be based on 0.10-foot loss.
 - (2) Angle turn in manhole shall be based on 0.5 velocity head loss or 0.20 foot of head loss, whichever is greater.

H-4 SEWER CLEANOUTS

Mainline sewer cleanouts may be required at the discretion of the District as a means of providing wastewater relief from a sewage stoppage.

H-5 SEWER SERVICE LATERALS

- a. Sewer lateral shall be constructed to the property line with a standard wye and cleanout at the end of the lateral at the property line as shown on the District's Standard Drawings.

- b. There shall be one lateral for each individually owned dwelling unit, unless otherwise specified or approved by the District.
- c. Laterals shall be located at the center of each lot and shall be constructed perpendicular or radial to the property line.
- d. If the Developer desires to install a sewer lateral at a location other than in the center of a lot, the improvement plans shall indicate the centerline station of the lateral on the sewer or show a distance from a property corner.
- e. In no case shall a sewer lateral be located within 5 feet of a property line.
- f. Laterals shall have a minimum cover of 4 feet from the top of the curb to the top of the pipe at the property line.
- g. Laterals which are smaller in size than the sewer main to which they connect shall not be connected to the sewer main at a manhole.
- h. The minimum size of sewer laterals shall be as follows:
 - (1) Single family: 4 inches minimum
 - (2) All others: 6 inches minimum

H-6 COMMERCIAL/INDUSTRIAL PRIVATE SEWER SYSTEMS

H-6.1 Private Sewer Systems:

- a. All plans submitted for review and acceptance for commercial/industrial developments shall have a private onsite sewer system.
- b. The District may at the sole discretion of the District require the onsite system to be "public" if it would be of a significant benefit to the District. Each site will be reviewed on an individual basis at the time plans are submitted.
- c. As a condition of service, District will require the Owner to be responsible for payment of the sewer charges to enter into an agreement with the District acknowledging that the onsite facilities are private and will be properly maintained according to industry standards and further agree to hold the District harmless from any claims on the design, existence, maintenance and operation of the private onsite systems.
- d. Standards and standard drawings used for the private onsite system shall be in conformance with the requirements of the County of Orange and any other responsible regulatory agency.
- e. If Trabuco Canyon Water District Standard Drawings are used, sewer manholes and cleanouts shall not have "TCWD" cast into the cover.

H-6.2 Onsite Sewer Collection Systems.

- a. All onsite sewer collection systems for commercial/industrial developments shall be private and shall be owned, operated, and maintained by the property owner up to the District's sewer line in a public street. A cleanout or manhole shall be installed at the property line in accordance with District Standard Drawings.
- b. Each building onsite shall have an individual sewer lateral with a monitoring manhole. Monitoring manholes shall be installed in accordance with District criteria.
- c. All laterals from a building shall be connected to the main lateral upstream of the monitoring manhole for that building. No lateral connections are to be made downstream of the monitoring manhole.

- d. The District's authority to enter on the property for industrial waste discharge is provided in the ordinance for this item and easements for separate ingress and egress will not be required.

H-7 SEWER FORCE MAINS

All Sewer Force mains shall be designed in accordance with the following criteria:

- a. The capacity of the force main shall equal the design peak flow discharge from the lift station.
- b. Velocities at design flow:
 - (1) Desirable velocity = 3.0 fps
 - (2) Minimum velocity = 2.0 fps
 - (3) maximum velocity = 5.0 fps
- c. The minimum pipe size shall be 4 inches in diameter.
- d. The minimum cover over the pipe shall be 42 inches below the street pavement finished grade.
- e. Discharge from the force main shall be into a manhole with a smooth flow transition into a gravity sewer.

Part 3
General Technical Specifications
for
Domestic and Nondomestic Water
and
Sewer Facilities

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15100	Manual Valves	11/13/24
15112	Backflow Preventer	11/13/24
15139	Hydrants	11/13/24
15150	Meters	11/13/24
15151	Facilities Identification	11/13/24
15162	Flexible Pipe Couplings and Expansion Joints	11/13/24
16640	Cathodic Protection and Joint Bonding	11/13/24
17110	Identification	11/13/24

SECTION 01045: EXISTING FACILITIES

PART 1 - GENERAL

A. Description

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

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Chlorination of Water Mains, Wells and Reservoirs: 15041
3. Hydrostatic Testing of Pressure Pipelines: 15042
4. Leakage and Infiltration Testing: 15043
5. Manual Valves: 15100
6. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

C. Location

The Contractor shall be responsible for determining, in advance of constructing of any improvements, the location of all existing underground utilities and location of existing pipelines to which connections and/or abandonments (domestic and nondomestic and sewer facilities) are to be made.

All underground work requires "Injury Identification Number" From Underground Service Alert Regional Notification Center (Ref Government Code, Section 42165 and 4217). Call 1-800-422-4133

PART 2 - MATERIALS

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

PART 3 - EXECUTION

A. Connection to Existing Waterlines

1. Notification: The Contractor shall give the District a minimum of four (4) working days written notice before the time of any proposed shutdown of existing mains or services.
2. Notice to Proceed: Connections shall be made only in the presence of the District Representative. Connection work shall not proceed until the District Representative has given notice to proceed to the Contractor.
3. Material: The Contractor shall furnish all pipe and materials including as may be required: labor and equipment necessary to make any and all connections, all required excavation, backfill, pavement replacement, lights, barricades, water truck, highline hose, fittings, and appurtenances for making the connections. In addition, the Contractor shall assist the District in alleviating any hardship incurred during the shutdown for connections.
4. Temporary Work: Where connections are made to existing valves, the Contractor shall furnish and install all temporary blocking, steel clamps, shackles, anchors, and appurtenances as required by improvement plans and the District Representative. Valve boxes and covers shall be replaced and adjusted to the proper grade in accordance with Section 15100, Manual Valves. Contractor shall not pressure test against a closed valve.

5. Dewatering: The Contractor shall dewater existing mains, as required, in the presence of the District Representative and in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board.
6. Inadequate Progress: If progress is inadequate during the connection operations to complete the connection in the time specified, the District Representative shall order any necessary corrective measures. All costs for corrective measures shall be paid by the Contractor.
7. Connections: Connections shall be made with as little change as possible in the grade of new pipeline.
 - a. When 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.
 - b. 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 to meet the grade of the existing pipe.
 - c. 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.
 - d. Where the connection creates a high or low spot in the line, a standard air release or blowoff assembly shall be installed per TCWD Standards and as directed by the District Representative.
8. Testing: The new pipeline shall not be connected to an existing facility until the new pipeline has successfully passed all pressure and water quality tests following disinfection in accordance with Sections 15041, Chlorination of Water Mains, Wells and Reservoirs and 15043, Leakage and Infiltration Testing.

B. Removal from Service of Existing Mains and Appurtenances

1. General: Existing mains and appurtenances shall be removed from service at the locations shown on the plans or as directed by the District Representative.
2. Method of Abandonment: Existing pipe and appurtenances shall be filled with six-sack sand cement slurry, or removed from the ground, in which case all backfill, and repair of surface shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting.
 - a. Method of abandonment shall be shown on the plans or as directed by District Representative.
 - b. Where connections or stub-outs are abandoned, all valves and valve cans shall be removed, and the remaining flanged fitting shall be closed/plugged using a blind-flange fitting.
3. Storage of Removed Material: Removed pipe and appurtenances may be temporarily stockpiled on the job in a location that will not disrupt traffic as directed by the City/County, Homeowners Association, private owner, or District Representative. The Contractor shall be responsible for disposal of removed pipe at an approved location at no additional cost to the District.
4. Maintenance of Service: Prior to performing any work to replace existing pipes and/or services, the Contractor shall make proper provisions for the maintenance and continuation of water & sewer service to all customers as directed by the District Representative.

5. Abandoned Water Services: For a water service to be considered abandoned, all surface fittings, valve boxes, meter, meter box and customer service valve shall be removed. The service line and corporation stop shall be removed and the service saddle plugged with a brass plug.
 - a. If there is no corporation stop on the service, the adapter shall be removed and a brass plug installed in the service saddle.
 - b. With special permission of the District Representative, the horizontal portions of the service line may be abandoned in place by cutting and crimping the ends closed.
6. Abandoned Sewer Laterals: Sewer laterals to be removed from service shall be cut and plugged at the main as directed by the District Representative and in accordance with District Standards.
7. Abandoned Sewer Manholes: For sewer manholes to be abandoned, the manhole cover, ring, grade rings and manhole cone shall be removed and properly disposed by the Contractor. All portions of the manhole to be abandoned shall be removed to a point 8-feet below finished ground surface. All backfill and repair of surface shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting. The remaining portions of the manhole shall be filled with one-sack sand cement slurry.
8. Abandoned Meter Vaults, PRV Vaults and Other Structures and Boxes: For meter vaults, PRV vaults and other structures to be abandoned, the top hatch or covers, cover slab or hatch or box grade ring, grade rings and other structural elements shall be removed and properly disposed by the Contractor. All portions of the vault or structure to be abandoned shall be removed to the point that the vault or structure, a minimum of 6-feet below finished ground surface and as directed by District Representative shall be removed. All backfill and repair of surface shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting. The remaining portions of the vault or structure shall be filled with one- sack sand cement slurry.

END OF SECTION

SECTION 02100: CLEARING AND PREPARATION

A. Description

This section includes clearing, grubbing and preparation required prior to rough grading.

B. Related Work Specified Elsewhere

1. Earthwork and Grading: 02201
2. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and the following specifications.
2. Submit a schedule of work and a detailed description of removal and disposal techniques.

PART 2 - MATERIALS

Not applicable.

PART 3 - EXECUTION

A. Meeting

Prior to the start of clearing and grubbing operations, a field meeting shall be held a minimum of **48-hours** to the start of construction with the Contractor and District Representative to discuss limits and disposal of material.

B. Limits

Clearing and preparation operations shall be confined to the limits shown on the construction plans. Only specified access roads shall be used for operation.

C. Disposal

All brush, stumps, roots, vegetation, and debris shall be removed from the site and disposed of in a manner acceptable to agencies having jurisdiction over the work, the Soils Engineer, and the District Representative.

D. Stockpiling

Topsoil shall be stockpiled at the location shown on the plans, or as directed by the District Representative. Stockpile shall be placed, graded, and shaped to promote proper drainage of stockpile area and the erosion control and sediment plan.

E. Permits

All permit requirements per County/City shall be complied with during the course of the work including transportation and disposal of materials.

END OF SECTION

SECTION 02201: EARTHWORK AND GRADING

PART 1 - GENERAL

A. Description

This section presents general procedures and requirements for grading, subdrains, erosion sediment control, water pollution control program, and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, erosion sediment control plan and excavations.

B. Related Work Specified Elsewhere

1. Clearing and Preparation: 02100
2. Trenching, Backfilling, and Compacting: 02223
3. Erosion and Sediment Control: 02370
4. "Construction Runoff Guidance Manual" for Contractors, Project Owners and Developers, dated December 2012
5. Standard Specifications for Public Works Construction (SSPWC), Latest Edition
6. State of California Department of Transportation Standard Specifications

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and the following specifications.
2. Erosion and Sediment Control Plan (ESCP) shall be submitted with all grading and building plans regardless of size. The plan must meet the requirements in Section III(3)(C) of the Public Works, Standard Details and Specifications and be approved by the City/County prior to grading permit approval and Erosion and Sediment Control: 02370
3. Material samples and grain size analyses shall be submitted for any imported fill material used prior to placement of any material and approval of District Representative.
4. Compliance with all applicable City/County permit requirements.

D. Measurement and Payment

1. Payment for the work in this section shall be in accordance with the General Provisions and the following specifications.
2. Payment for any additional cut yardage or removal/recompaction yardage shall be at the unit-price bid amount for these items.
3. Additional cut yardage or removal/recompaction yardage may be required when field conditions dictate modifications to the original scope of the construction plans and when required by the Soils Engineer and/or the District Representative.
4. Measurement of additional yardage shall be made by the District Representative after consultation with the Soils Engineer.

E. Erosion and Sediment Control Plan

1. Contractor shall comply with the Best Management Practices (BMPs) needed to be implemented at a construction site to ensure compliance with the City/County Municipal Codes. Contractor shall utilize the California Stormwater Quality Association (CASQA) handbook that provides details about all of the recommended BMPs.
2. Contractor shall provide an Erosion and Sediment Control Plan in accordance with County of Orange requirements and the "Construction Runoff Guidance Manual" for Contractors, Project Owners and Developers, dated December 2012.

PART 2 – MATERIALS

F. Fill Material

1. General: Material to be placed as fill shall be free of organic matter and other deleterious substances and shall be approved by the Soils Engineer and the District Representative.

Expansive soils, or soils of poor gradation or strength characteristics shall either be removed from the site, and disposed of in accordance with all local regulations, or placed in areas designated by the Soils Engineer and the District Representative. or mixed with other soils to serve as satisfactory fill or soil material.
2. Override Material: Override material, defined as rock or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the Soils Engineer and the District Representative. Override disposal operations shall be such that nesting of override material does not occur, and such that the override material is completely surrounded by compacted or densified fill.

Override material **shall not** be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the Soils Engineer and/or District Representative.
3. Imported Fill Material: If importing of fill material is required for grading, the import material shall meet the requirements above.

G. Subdrain Pipe

Subdrain pipe shall be per ASTM D2751, SDR 23.5 or ASTM D1527, Schedule 40 Acrylonitrile Butadiene Styrene (ABS), or ASTM D3034 SDR 23.5 or ASTM D1785, Schedule 40 Polyvinyl Chloride Plastic (PVC) pipe, or approved equal.

H. Filter Material

Filter material shall be Class 2 permeable material per the latest edition of the State of California Department of Transportation Standard Specifications. Class 2 Base Rock is a recycled permeable product composed of 3/4" crushed concrete and minimal fine stones allowing it to be water permeable Class 2 grading material shall be as follows:

Sieve Size	Percent Passing
1"	100
3/4"	90 - 100
3/8"	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0-7
No. 200	0 - 3

I. Filter Fabric Material

Property	ASTM Method	Property Value
Weight, oz. per sq. yd., min.	D5910	4
Elongation, %, min.	D4632	30
Grab Tensile Strength, lbs., min.	D4632	90
Permittivity, Sec-1, min.	D4491	0.05
Toughness, lbs., min. (Percent Elongation x Grab Tensile Strength)	-	4000

Filter fabric shall be non-woven polyester material composed of 100% polyester filament, features high strength, density, unless specified otherwise, and conforming to the following requirements:

J. Water for Compaction

Water used to assist in compaction shall conform to Section 02223, Trenching, Backfilling, and Compacting.

PART 3 - EXECUTION

A. Earthwork Observation Testing

1. Access: Adequate access shall be provided at all times to allow the Soils Engineer and the District Representative to make observations and conduct tests to verify that the work complies with the requirements of the specifications. The District Representative shall be given assistance by the Contractor as necessary for performing test and shall be kept apprised of work schedules.
2. Methods: Adequate equipment and methods shall be employed to accomplish the work in accordance with applicable grading codes or ordinances, permit requirements, these specifications, and the approved grading plans.
3. In the opinion of the Soils Engineer and the District Representative, unsatisfactory conditions, such as questionable soil, poor moisture condition, inadequate compaction, and adverse weather, have resulted in a quality of work less than required in these specifications, the District may reject the work and recommend that construction be stopped until the conditions are corrected at no additional cost to the District.
4. Compaction Testing: Maximum dry density test used to determine the degree of compaction will be performed in accordance with ASTM Test Method D1557.

B. Preparation of Areas to be Filled

1. Clearing and Grubbing: All brush, vegetation and debris shall be removed or piled and otherwise disposed of per Section 02100, Clearing and Preparation.
2. Processing: The existing ground which is determined to be satisfactory for support of fill material by the Soils Engineer and the District Representative shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following subsections.

Scarification shall continue until the soils are broken down free of large clay lumps or clods and rocks, and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.
3. Overexcavation: Soft, dry, spongy, highly fractured, or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, as directed by the Soils Engineer and/or the District Representative.
4. Moisture Conditioning: Overexcavated and processed soils conforming to "Fill Material" specified herein, shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near the optimum moisture content prior to placement and compaction.
5. Recompaction: Overexcavated and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum of 90 percent of maximum dry density or as directed by the Soils Engineer and/or the District Representative.

6. Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm material, and shall be approved by the Soils Engineer and/or the District Representative. Other benches shall be excavated in firm material for a minimum width of 4 feet. Ground sloping flatter than 5:1 shall be benched or otherwise over-excavated when considered necessary by the Soils Engineer and/or the District Representative.
7. Approval: All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the by the Soils Engineer and the District Representative prior to fill placement.

C. Fill Placement and Compaction

1. Fill Lifts: Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness.

The District may approve thicker lifts if soils testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.
2. Fill Moisture: Fill layers having a moisture content less than optimum shall be watered and mixed. Fill layers having a moisture content greater than optimum shall be aerated by scarification and shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is plus or minus two percent of the optimum moisture content.
3. Compaction of Fill: After each layer has been evenly spread, moisture conditioned and mixed it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.
4. Fill Slopes: Fill slopes shall be overfilled and compacted, then blade cut to a firm surface. Compacting of fill slopes shall be accomplished, in addition to normal compacting procedures, by back rolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent of maximum dry density.
5. Compaction Testing: Field testing to check the fill moisture and degree of compaction shall be performed by the Soils Engineer and the District Representative. The location and frequency of tests shall be at the District Representative discretion.

In general, the tests will be taken at an interval not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment. In addition, on slope faces, at least one test shall be taken for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope.

D. Subdrain Installation

Subdrains shall consist of subdrain pipe, compacted pipe trench backfill aggregate, and filter fabric material to prevent migration of soil fines into the subdrain system.

Subdrain systems shall be installed in approved ground to conform to the size and alignment, and to the details as may be shown in the Contract Documents or as directed by the Soils Engineer and/or the District Representative.

The subdrain location or materials shall not be changed or modified without the approval of the Soils Engineer and/or the District Representative. All subdrains shall be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys to be completed, prior to commencement of filling over the subdrains.

E. Excavation

Excavations and cut slopes will be examined during grading. If directed by the Soils Engineer and/or the District Representative, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut sloped shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the Soils Engineer and/or the District Representative prior to placement of materials for construction of the fill portion of the slope.

F. Grading Code

All work shall be in accordance with the County and City grading codes and permit requirements of the agencies having authority over the work and the SSPWC. A copy of grading codes, permits, and project documents shall be retained on the job site while work is in progress.

G. Maintenance

1. Protection of Graded Areas: Newly graded areas shall be protected from traffic and erosion per the approved Erosion Control Plan. Settled, eroded, and rutted graded areas shall be repaired and re-established to specified tolerances by the Contractor and at no additional expense to the District.
2. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, these areas shall be scarified, re-shaped, and compacted to required density prior to further construction by the Contractor and at no additional expense to the District.
3. Settling: Where settling is measurable or observable at excavated areas during the project or warranty period, the surface (pavement, lawn, or other finish), shall be removed, backfill material added and compacted, and surface treatment replaced as directed by the Soils Engineer and/or the District Representative. The appearance, quality, and condition of surface or finish shall be restored to match adjacent work by the Contractor and at no additional expense to the District.

END OF SECTION

SECTION 02220: STRUCTURE EARTHWORK

PART 1 - GENERAL

A. Description

This section describes excavation, backfilling, materials, testing, and shoring for underground structures including control valve vaults, pressure reducing valve vaults, meter vaults, valve vaults, and pump vaults.

B. Related Work

C. Specified Elsewhere

1. Earthwork and Grading: 02201
2. Trenching, Backfilling, and Compacting: 02223
3. Pavement Removal and Replacement: 02578
4. Concrete Formwork: 03100
5. Concrete: 03300
6. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

D. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and the following specifications.
2. Submit six (6) copies of drawings of excavation and shoring, sheeting, or bracing for worker protection in accordance with the General Provisions and signed by a California Registered Civil Engineer.
3. Submit six (6) copies of a report from a testing laboratory verifying that gravel base and structural backfill conform to the specified gradations or characteristics.
4. Submit six (6) copies of a report from a testing laboratory verifying borrow material that conforms to the specified gradations or characteristics per Section 02201 Earthwork and Grading
5. Other tests and material reports as required.

E. Protection of Existing Utilities and Facilities

1. General: The Contractor shall be responsible for the care and protection of all existing sewer pipelines, water pipelines, gas mains, storm drains, culverts, electrical vaults or any other facilities and structures that may be encountered in or near the area of work.
2. Notification: It shall be the duty of the Contractor to notify each agency of jurisdiction and make arrangements for locating each agency's facilities at least 48-hours prior to beginning construction and in accordance with California Government Code 4216 – "DigAlert".
3. Damage: In the event of damage to any existing facilities during the progress of the work due to the failure of the Contractor to exercise the proper precautions, the Contractor shall be responsible for the cost of all repairs and protection to said facilities at no additional cost to the District. The Contractor's work may be stopped until repair operations are complete as directed by the District Representative.

F. Protection of Landscaping

The Contractor shall be responsible for the protection of all the trees, shrubs, fences, hardscape, irrigation systems, and other landscape items adjacent to or within the work area, unless directed otherwise on the plans or by the District Representative.

In the event of damage to landscape items, the Contractor shall replace the damaged items in a manner satisfactory to the District Representative and at no additional costs to the District.

PART 2 - MATERIALS

A. Definition of Zones

1. Pavement and Street Zones: Pavement and street zones shall be as defined in Section 02223: Trenching, Backfilling and Compacting.
2. Upper Backfill Zone: The upper backfill zone is defined as the backfill to the full width of the excavation from the top of the structure to the bottom of the street zone in paved areas or to the finished surface in unpaved areas.
3. Structural Backfill Zone: The structural backfill zone is defined as backfill from the top of the structure to the bottom of the excavation, extending the full width of the excavation.

B. Native Earth Backfill-Upper Backfill Zone

Native earth backfill shall be excavated and fine-grained non-organic materials free from peat, roots, debris, and rocks larger than 3 inches, can be used if the native earth backfill can be compacted within the trench to the specified relative compaction and is approved by the Soils Engineer and the District Representative.

If native earth backfill is not suitable for the project, the Contractor shall remove the materials to an approved landfill at no additional cost to the District.

C. Structural Backfill - Structural Backfill Zone

Structural backfill materials shall consist of hard, durable, and clean sand, gravel, or crushed stone which is free of organic material, clay balls, and other deleterious substances, meets the latest edition of the State of California Department of Transportation Standard requirements, and shall have the following gradation:

Sieve Size (Inches)	Percent Passing by Weight
2	100
1-1/2	95 to 100
3/4	50 to 100
3/8	15 to 55
No. 4	0 to 25
No. 8	0 to 5
No. 200	0 to 3

D. Crushed Rock Base

Crushed or natural rock shall be provided as base under the structure, meeting the latest edition of the State of California Department of Transportation Standard requirements and shall have the following gradation:

Sieve Size (Inches)	Percent Passing by Weight
2	100
1-1/2	0 to 100
3/4	60 to 100
No. 4	25 to 55
No. 8	10 to 30
No. 200	0 to 5

E. Water for Compaction

Water used to assist in compaction shall conform to Section 02223, Trenching, Backfilling, and Compacting.

PART 3 - EXECUTION

A. Testing for Compaction

Testing for compaction shall conform to Section 02223, Trenching, Backfilling, and Compacting.

B. Compaction Requirements

1. Backfill in Street Zone: 95% relative compaction.
2. Upper Backfill Zone: 90% relative compaction.
3. Structural Backfill Zone: 90% relative compaction.
4. Crushed Rock Base: 80% relative density.

C. Dewatering

1. General: Dewatering operations shall continuously remove and dispose of all water entering the excavation during construction of the structure and all backfill operations. Water shall be disposed of in a manner to prevent damage to adjacent property and pipe trenches and in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board.

Water shall not be allowed to rise in the excavation until backfilling around and above the structure is completed.
2. Notification: The District shall be notified **48 hours** prior to commencement of any dewatering operations. Methods employed shall be in conformance with the District's existing NPDES permit for contracts between District and Contractor and in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board. A copy of the District's NPDES permit is included in the appendix of the Project Manual with the project specifications.

D. Structure Excavation

1. Removal of Material: Structure excavation shall include the removal of all material necessary for the construction of underground structures and foundations and in accordance with the project specifications.
2. Clearance: Unless noted otherwise on the plans, the sides of excavations for structures shall be sufficient to leave at least a 2-foot clearance, as measured from the extreme outside of formwork or the structure or as shown on the drawings. Excavation side slopes shall be as specified in Subsection E.
3. Overdepth Excavations: Overdepth excavations shall be corrected by backfilling with crushed rock or concrete, as directed by the Soils Engineer and the District Representative. **No native earth backfill** will be permitted to correct overdepth excavation beneath structures.
4. Surplus Material: Surplus material shall be disposed of in accordance with Section 02223, Trenching, Backfilling, and Compacting.

E. Support for Excavations for Structures

1. Safety: A safe working area shall be provided for all workers. The services of a Registered Civil Engineer shall be obtained to design sheeting, shoring, bracing, or side slopes as required.

2. The requirements of CAL/OSHA and of these specifications shall be used as minimum design criteria. The Contractor shall obtain sufficient geotechnical data to provide a safe design for support of excavation for structures.
3. Side Slopes: Minimum side slope shall be per CAL/OSHA requirements, Article 6 Excavation, Section 1541, but not steeper than:
 - a. Clayey soil up to 12-foot depth: 3/4 horizontal to 1 vertical (3/4:1).
 - b. Clayey soil more than 12-foot depth: vary from 3/4:1 for 12-foot depth to 3:1 for 20-foot depth.
 - c. Gravelly soil: 2 horizontal to 1 vertical (2:1).
 - d. Flatten above slopes if groundwater is present.
4. Traffic Safety: Methods of support or side slopes shall be selected to provide sufficient clearance for public traffic safety and convenience and in accordance with CAL/OSHA requirements .
5. Design Loads: The characteristics of the soil exposed in excavation, the groundwater conditions, traffic, and other surcharge loads shall be considered when selecting lateral pressures to be used for design of soil supporting systems and in accordance with CAL/OSHA requirements.
6. Design Criteria: The following minimum design criteria for allowable lateral passive soil pressure expressed in pounds per square foot (psf) shall be used to calculate depth of penetration of isolated soldier piles or solid sheet piles. Where needed for safety, these values shall be increased.

Type	Predominant Soil Type Clayey	Granular
Isolated Soldier Piles	200 Z + 1,870	467 Z
Solid Sheet Piles	67 Z +633	300 Z

Where Z = depth in feet below bottom of excavation.

7. Verification of Soil Types: Prior to design and submittal of a support system, verification of the type of soil below the bottom of the excavation shall be made by contractor and information provided to Soils Engineer and District Representative.

F. Backfill Against Walls and Over Roof Slabs

1. Precautions
 - a. Backfill over structure shall be placed in a manner so as to not damage the roof membrane and protective cover.
 - b. Backfill shall not be placed against walls or above buried roof slabs until the concrete has obtained a comprehensive strength equal to the specified 28-day compressive strength per Concrete Section 03300.
 - c. Where backfill is to be placed on both sides of the wall, the backfill shall be placed uniformly on both sides.
 - d. Where backfill is to be placed around a structure, the backfill shall be placed at a uniform rate around the structure.
 - e. Backfill shall not be placed against the walls of structures that are laterally restrained or supported by suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength per Concrete Section 03300.

- f. When backfill is to be placed before 7-day concrete strength tests have been conducted on concrete arches for VCP sewers or thrust blocks, the concrete shall have achieved 50 percent of the specified minimum 28-day strength per Concrete Section 03300. An additional test cylinder shall be made for this test.
- 2. Equipment: Equipment for placing and compacting backfill over structures shall not exceed 15 tons total weight and a maximum wheel load of 10,000 pounds. Equipment weighing more than 10,000 pounds shall not be used closer to walls and structures than a horizontal distance equal to the depth of fill at the time.

G. Compaction

- 1. Compaction for Zones: Compaction shall be controlled to the percentage of density specified for each zone per subsection B herein.
- 2. Moisture Control: Moisture shall be controlled as follows:
 - a. Where subgrade or soil material layers must be moisture conditioned before compaction, water shall be uniformly applied to the subgrade surface or soil layer material in order to prevent free water from appearing on the surface during or subsequent to compaction operations. The moisture content of the compacted soil shall be within 3 percentage points of the optimum.
 - b. Soil material that is too wet to permit compaction to a specified density shall be removed and replaced or scarified and air dried at no additional cost to the District.
 - c. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread within an approved area and allowed to dry. Drying may be assisted by discing, harrowing, or pulverizing, until moisture content is reduced to satisfactory value.
 - d. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, or contain frost or ice.
- 3. Requirements Prior to Backfilling: Excavations shall be backfilled per County/City permit requirements, but not until completion of the following:
 - a. Acceptance of construction below finish grade by Soils Engineer and District Representative including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
 - b. Inspection, testing, approval, and recording locations of underground utilities by District Representative.
 - c. Removal of concrete formwork per Section 03100, Concrete Formwork.
 - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials per Soils Engineer and District Representative. Cut off temporary sheet piling driven below bottom of structures, will be removed in manner to prevent settlement of the structure or utilities, or leave in place, if required by District Representative.
 - e. Removal of trash and debris.
 - f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- 4. Backfill Layers: Backfill and fill materials shall be placed in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand- operated tampers.
- 5. Jetting: Unless specified otherwise, jetting techniques shall not be employed to densify granular fill materials.

6. Uniform Backfill Lifts: Backfill and fill materials shall be placed evenly adjacent to structures, to required finish elevations. Care shall be taken to prevent wedging action of backfill against structures by carrying material uniformly around structure to same elevation in each lift.

END OF SECTION

SECTION 02223: TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

A. Description

This section describes materials, testing, and performance of trench excavation, backfilling and compacting.

B. Related Work Specified Elsewhere

1. Earthwork and Grading: 02201
2. Pavement Removal and Replacement: 02578
3. Concrete: 03300.
4. Hydrostatic Testing of Pressure Pipelines: 15042
5. Standard Specifications for Public Works Construction (SSPWC) Latest Edition

C. Submittals

1. Shop drawings shall be submitted showing excavation and shoring, bracing, or sloping for worker protection in accordance with the CAL/OSHA requirements, the General Provisions, and the following specifications:
2. Six (6) copies of a report from a testing laboratory shall be submitted verifying that the backfill material conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, or rock refill for foundation stabilization, and water as specified in the Contract Documents.
3. Material samples and grain size analyses shall be submitted for any imported fill material per Earthwork and Grading: Section 02201.

D. Measurement and Payment

1. Payment for the work in this section shall be in accordance with the General Provisions and the following:

a. Foundation Stabilization:

Payment for foundation stabilization shall be made in accordance with the unit-price bid amount for any quantity of refill material from 0 to 1,000 cubic yards, based on the trench details shown on the plans. These items have been included in the bid form for work that may possibly be required to complete the project, but which cannot be reasonably predicted, and shall be the basis of payment for refill material for foundation stabilization if authorized in writing by the District.

The unit price shall be for any quantity installed, complete in place, including all additional earthwork, disposal of all excess or waste material, and placing of the refill material.

The District Representative shall be the sole judge as to the necessity, the amount and depth that may be required in any given situation. No additional payment shall be made for foundation stabilization that is not authorized by the District.

b. Drying / Blending / Transporting

All costs of drying, blending, transporting, and/or importing backfill material and all costs for the removal and disposal of unsuitable material and excess excavated material shall be included in the prices bid for the various items of work.

c. Protection of Existing Utilities / Services & Potholing

Full compensation for protection of utilities and/or replacement of utilities and street improvements including but not limited to removal and disposal and reconstruction of existing curb, gutter, spandrels, cross-gutters, sidewalks, driveway aprons, and handicapped ramps shall be included in the contract unit prices for which such work is appurtenant thereto, and no additional allowance or payment will be made, therefore.

Said various contract unit prices shall include all labor, materials, tools, and equipment necessary or incidental to the replacement work.

The same shall apply to all costs incurred in exposing or excavating existing utilities and service lines, and no additional allowance will be made therefore, as they shall be included in the prices bid for the various items of work.

E. Protection of Existing Utilities and Facilities

1. General: The Contractor shall be responsible for the care and protection of all existing sewer pipelines, water pipelines, gas mains, storm drains, culverts, electrical, street lighting or other facilities and structures that may be encountered in or near the area of work.

Prior to excavation, the Contractor shall contact the appropriate regional notification center, for Underground Service Alert, as provided in Government Code Sections 4216 et. Seq.

The Contractor shall be responsible for the location of and protect in place, all service connections.

It shall be the contractor's responsibility to make exploratory excavations (by "hand" where prudent) to determine the true location, size, material, and depth of all utilities shown on the plans. The contractor shall also determine the type of material and condition of any utility which may be affected by or affect the work.

The Contractor shall notify the District in writing and within 48-hours of any utility located that are not shown on the plans for direction.

2. Notification: It shall be the duty of the Contractor to notify each agency of jurisdiction and make arrangements for locating each agency's facilities prior to beginning construction per Government Code Sections 4216 et. seq.
3. Damage: In the event of damage to any existing facilities during the progress of the work due to the failure of the Contractor to exercise the proper precautions, the Contractor shall be responsible for the cost of all repairs and protection to said facilities. The Contractor's work may be stopped until repair operations are completed to the satisfaction of the District and/or the affected utility.

F. Protection of Landscaping

1. General: The Contractor shall be responsible for the protection of all the trees, shrubs, fences, irrigation system, hardscape, and other landscape items adjacent to or within the work area. In the event of damage to landscape or irrigation items, the Contractor shall replace the damaged items at no additional cost to the District in a manner satisfactory to the District Representative.

2. Restoration: After the completion of work in planted or improved areas within public or private easements, the Contractor shall restore such areas to original condition. Restoration shall include re-grading, placement of 6 inches of topsoil, reseeding, and replacement of landscaping, replacement of irrigation system and other appurtenances at no cost to the District and in a manner satisfactory to the District Representative.

G. Definition of Zones

1. Pavement Zone: The pavement zone shall include the asphaltic concrete and aggregate base pavement section placed over the street zone. This zone is often referred to as the "structural section" of the street or highway.
2. Trench Zone: The trench zone shall include the portion of the trench from the top of the pipe zone to the bottom of the pavement zone in paved areas or to the existing surface in unpaved areas.
3. 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 above the top of the highest or topmost pipe. This zone is also part of the "pipe bedding zone" and as such it shall be filled with bedding material identical to that which is placed in the pipe base.
4. Pipe Base: The pipe base shall be defined as a layer of material immediately below the pipe zone and extending over the full trench width. This is also part of the "pipe bedding zone".
5. Pipe Bedding Zone: The pipe bedding zone shall include the zones defined as the "pipe base" and the "pipe zone". It shall include the full width of the trench from the bottom of the trench to a point 12 inches above the top of the pipe. Unless specified otherwise the pipe bedding zone shall be from 6 inches under the pipe to 12 inches over it.

H. Testing for Compaction

1. Methods: The density of soil shall be determined in place by the sand cone method, ASTM D 1556, or by the nuclear method, ASTM D 2922, or D 3017.
2. Soil Moisture-Density Relationship: The laboratory moisture-density relations of soils shall be determined per ASTM D 1557 and in accordance with SSPWC, Subsection 211-1.
3. Cohesionless Materials: The relative density of cohesionless materials shall be determined by ASTM D 4253 and D 4254.
4. Sampling: Backfill materials provided by contractor shall be sampled per ASTM D 75. If at any time the contractor needs to change backfill suppliers, the District Representative and Soils Engineer must be notified immediately for approval and re-testing of material prior to any additional backfilling.
5. Relative Compaction: "Relative compaction" shall be expressed as the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.
6. Compaction Compliance: Compaction shall be deemed to comply with the specifications when none of the tests falls below the specified relative compaction as specified herein. When tests are conducted by the Soils Engineer and the District Representative, the Contractor shall notify the District a minimum of 24-hours in advance of when backfill lifts are ready for testing and shall pay the costs of any retesting of work not conforming to the specifications.

7. Testing Intervals: Unless noted otherwise, compaction tests shall be performed at random depths and at 200-foot intervals, and as directed by the District Representative and Soils Engineer.
8. The presence of marginal materials, poor soil conditions or a prevalence of failed test results will be cause for increasing the frequency and intervals of required testing. Alternatively, with approval of the District Representative, the trench zone may be backfilled with a 2-sack sand-cement slurry at no additional cost to the District.

PART 2 - MATERIALS

A. Pavement Zone Materials

Pavement zone materials shall be as specified in Section 02578, Pavement Removal and Replacement.

B. Native or Imported Backfill for Trench Zone

Native earth backfill shall be excavated from the trench and fine-grained non-organic materials free from peat, roots, debris, and rocks larger than 3 inches shall be removed from the site, unless native earth backfill, can be reused and compacted within the trench to the specified relative compaction. Native earth backfill shall be approved by the Soils Engineer and the District Representative prior to being used.

If native earth backfill is not suitable for the project, the Contractor shall remove the native earth backfill to an approved landfill at no additional cost to the District.

C. Backfill Material for Pipe Bedding Zone

1. Ductile iron pipe, welded steel pipe, PVC pressure pipe, and copper pipe: Unless otherwise specified or shown on the plans, the pipe base and pipe zone (a.k.a., pipe bedding zone) backfill material shall be imported sand of a gradation and composition as specified herein.
2. Vitrified clay pipe and PVC gravity pipe: Unless otherwise specified or shown on the plans, pipe base and pipe zone backfill shall be 3/4-inch crushed aggregate base (CAB) or by special permission from the District, crushed miscellaneous base (CMB) of gradation and composition as specified herein.

D. Imported Sand--Pipe Zone and Pipe Base

Imported sand used in the pipe bedding zone (pipe zone and pipe base) shall conform to the SSPWC, Section 200-1.5.1 and shall meet the following gradation:

Sieve Size	Percent Passing by Weight
3/8 - inch	100
No. 4	75 - 100
No. 30	12 - 50
No. 100	5 - 20
No. 200	0 - 11

Minimum sand equivalent shall be 30 for natural imported material and shall be 40 for screened recycled materials per ASTM D 2419.

E. Crushed Rock--Pipe Zone and Pipe Base

Crushed rock shall be crushed aggregate base (CAB) material and shall conform to the SSPWC, Section 200-1.2 and shall meet the following gradation:

Designated Material Size Percent Passing by Weight				
Sieve Sizes	1-1/2-inch	1-inch	3/4-inch	3/8-inch
2-inches	100	---	---	---
1-1/2-inches	90 - 100	100	---	---
1-inch	20 - 55	90 - 100	100	---
3/4-inch	0 - 15	30 - 60	90 - 100	---
1/2-inch	---	0 - 20	30 - 60	100
3/8-inch	0 - 5	---	0 - 20	90 - 100
No. 4	---	0 - 5	0 - 5	30 - 60
No. 8	---	---	---	0 - 10

CAB materials used for pipe bedding shall be $\frac{3}{4}$ inch, unless otherwise called for by the project plans and specifications or as directed by the District Representative.

Crushed miscellaneous base (CMB) materials may be substituted for crushed aggregate base (CAB) materials by special permission from the District. In such cases, CMB materials shall conform to the requirements of the SSPWC, Section 200-2.4, except that gradation of the materials shall still comply with the percentages by weight on the table above.

F. Re-fill Material for Foundation Stabilization

Re-fill material below the pipe shall be either material conforming to the 1- $\frac{1}{2}$ -inch size requirement for gravel or crushed rock, or naturally occurring rock having the following gradation:

Sieve Size	Percent Passing by Weight
3-inches	100
1-1/2-inches	70 - 100
3/4-inch	60 - 100
No. 4	5 - 55
No. 30	0 - 30
No. 200	0 - 10

G. Sand-Cement Slurry Refill Material for Foundation Stabilization in Pipe Base & Pipe Zone

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

H. Water for Compaction

Water used in compaction shall be Recycled Water, if available and have a maximum chloride concentration of 500 mg/l, a maximum sulfate concentration of 500 mg/l, and shall have a pH of 6.0 to 9.0. Water shall be free of acid, alkali, or organic materials injurious to the pipe coatings or the environment.

If Recycled Water is not available, then potable water shall be used. Contractor shall use water through a construction water meter to recorded water usage.

PART 3 - EXECUTION

A. Compaction Requirements

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 follows:

1. Material Testing: All imported or native materials shall be tested and results submitted to District for approval before the start of compaction operations to determine the moisture density relationship for materials with cohesive components, and the maximum density for cohesionless materials. Variations in imported or native earth materials may require a number of base curves of the moisture-density relationship.
2. Trench Zone: Backfill in trench zone **greater than** 18 inches below the pavement zone shall be compacted to not less than 90% relative compaction. Backfill **less than or equal** to 18 inches below the pavement zone shall be compacted to not less than 95% relative compaction.
3. Pipe Bedding Zone (Pipe Base and Pipe Zone): Materials placed as pipe bedding material in the pipe base and pipe zone shall be consolidated to 90% relative optimum compaction. Note that 95% relative optimum compaction shall be required in specific areas as shown on the plans and profile drawings. From time to time this higher density will be deemed necessary by the Soils Engineer, District Representative, or the local jurisdiction.
4. Foundation Stabilization: Rock re-fill material for foundation stabilization, where required shall be placed and consolidated to 90% relative optimum density.
5. Over-excavation: Rock re-fill for over-excavation shall be placed and consolidated to 90% relative optimum density.

B. Material Replacement

Trenching and backfilling material, which does not meet the specifications, shall be removed and replaced by the contractor and at no additional costs to the District.

C. Sheeting, Shoring and Bracing of Trenches

Trenches shall have sheeting, shoring and bracing conforming to the latest CAL/OSHA requirements and these General Provisions. Lateral pressures for design of trench sheeting, shoring, and bracing shall be based on type of soil exposed in the trench, groundwater conditions, surcharge loads adjacent to the trench, and type of shoring that will be used in the trench.

D. Sidewalk, Pavement and Curb Removal

Bituminous and concrete pavements regardless of the thickness and curbs and sidewalks shall be sawcut prior to excavation of the trenches in accordance with Section 02578, Pavement Removal and Replacement.

Pavement and concrete materials shall be removed from the site by the contractor and shall **not** be used for trench backfill.

E. Trench Widths

1. Trench Width Limits: Unless shown otherwise on the drawings, trench widths in the pipe zone shall be as shown on TCWD Standard Drawing Nos. W-20, RW-10, or S-4.

Trench width at the top of the trench shall not be limited, except where width of excavation would undercut adjacent structures and footings. In such cases, width of trench shall be such that there is at least 18 inches between the top edge of the trench and the structure or footing.

Excavation and trenching shall be true to line so that a clear space is provided in the pipe zone on each side of the largest outside diameter of the pipe. The largest outside diameter shall be the outside diameter of the bell section of a bell and spigot pipe.

2. Over-width Trench: Where the trench width in the pipe zone is wider than the maximum set forth above, the trench area around the pipe shall be backfilled in accordance with the directive of the Soils Engineer and/or the District Representative.

F. Grade

Trenches shall be excavated to the lines and grades as shown on the drawings with allowance for the thickness of the pipe and for the pipe base.

If the trench is excavated below the required grade by the contractor, the portion of the trench excavated below the grade shall be refilled with refill material as shown above. Refill material shall be placed over the full width of trench in compacted layers not exceeding 6 inches deep to the required grade with allowance for the pipe base.

Hard spots that would prevent a uniform thickness of pipe base shall be removed.

Before laying pipe sections, the grade shall be checked by the District Representative, and any irregularities corrected by the Contractor at no additional cost to the District. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point.

G. Pipe Base Thickness

Thickness of the pipe base shall be as shown on the drawings or as otherwise described in the specifications for the particular type of pipe installed or by the District Representative, but in no cases shall the thickness be less than 6 inches.

H. Dewatering

1. Means and Devices: Suitable means and devices shall be provided and maintained to continuously remove and dispose of **all water** entering the trench excavation during the time the trench is open, being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed.

Water shall be disposed of in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board. Trench water shall not be drained through the pipeline under construction. Groundwater shall not be allowed to rise around the pipe until pipe joints and the jointing compound is firmly set.

2. Notification: The District shall be notified a minimum of 48 hours prior to commencement of any dewatering activities. Methods employed shall be in conformance with the NPDES permit and in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board.

I. Storage of Excavated Material

During trench excavation, excavated material shall be stored only within the working area. Roadways or streets shall not be obstructed. Excavated material shall be safely stored at the end of each working day. The safe loading of trenches with excavated material shall conform to All Federal, State, and Local codes, as well as any permit requirements.

J. Length of Open Trench

The length of open trench shall be limited to 300 feet in advance of pipe laying or amount of pipe installed in (1) one working day. Backfilling and temporary and/or first layer paving shall be completed so that no more than 300 feet of trench is open in the rear of pipe laying.

Sidewalks, driveways, and other traveled ways shall be backfilled or adequately bridged with steel plates and properly delineated to provide safe access and egress at the completion of each day's work.

K. Foundation Stabilization

After the required excavation has been completed, the Soils Engineer and District Representative shall inspect the exposed trench subgrade to determine the need for any additional excavation. It is the intent that additional excavation shall be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade.

Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the pipe base and to the depth required. The presence of unacceptable material may require excavating a wider trench. The width and depth of known areas to be overexcavated shall be shown on the drawings unless it is determined in the field by the Soils Engineer and District Representative that overexcavation is required. The overexcavated portion of the trench shall be backfilled to the subgrade of the pipe base with refill material for foundation stabilization. Foundation stabilization material shall be placed over the full width of the excavation and compacted in layers not exceeding 6 inches in depth, to the required grade.

L. Trench Backfilling and Compaction

1. General: Trench backfill shall conform to requirements of the detailed piping specification for the particular type of pipe and following specifications.
2. Pipe Base: The specified thickness of pipe base material shall be placed over the full width of trench. The top of the pipe base shall be graded ahead of the pipe laying to provide firm, uniform support along the full length of pipe.
3. Bell Holes: Bell holes shall be excavated at each joint to permit proper assembly and inspection of the entire joint.
4. Pipe Zone: After the pipe has been bedded, pipe zone material shall be placed simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Material shall be carefully placed around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Particular care shall be taken in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Material placed within the pipe zone shall be compacted by hand tamping only.
5. Trench Zone: Backfill material shall be carefully deposited onto the backfill previously placed in the pipe zone. Free fall of the material shall not be permitted until at least 2 feet of cover is provided over the top of the pipe. Sharp, heavy pieces of material shall not be dropped directly onto the pipe or the tamped material around the pipe.
6. Trench Backfill: Trench backfill shall be compacted to the specified relative compaction. Compaction shall be performed by using mechanical compaction or hand tamping equipment. Unless specified otherwise, consolidation by jetting or flooding shall not be permitted. High impact hammer-type equipment shall not be used except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
7. Equipment: Axle-driven or tractor-drawn compaction equipment shall not be used within 5 feet of walls and structures.
8. Street Zone Backfill: Street zone backfill shall be done in accordance with the requirements and to the satisfaction of the permit requirements of the County or City agency having jurisdiction.

M. Compacted Embankment

Earthwork for construction of compacted embankment shall be as specified in Section 02201, Earthwork and Grading.

N. Import or Export of Backfill Material

1. Excess Material: Excess excavated soil material shall be removed and disposed of off the project site. Excess soil material shall be disposed of in accordance with local regulations and to an approved landfill.
2. Imported Material: Any additional backfill material necessary to return all grades to plus or minus 0.2 feet from the grade encountered at the beginning of construction or as shown on the contract drawings shall be imported, placed, and compacted.

O. Moisture Content of Backfill Material

During the compacting operations, optimum practicable moisture content required for compaction purposes shall be maintained in each lift of the backfill material. Moisture content throughout the lift shall be maintained at a uniform level.

If placement is discontinued and proper moisture content not maintained, the upper layer shall be brought back to proper moisture content by sprinkling, cultivating, and rolling the backfill material before placing new material.

At the time of compaction, the water content of the material shall be at optimum water content plus or minus two percentage points. Material which contains excessive moisture shall not be worked to obtain the required compaction. Material having excessive moisture content may be dried by blading, discing, or harrowing to hasten the drying process.

END OF SECTION

SECTION 02315: JACKED CASING

PART 1 - GENERAL

A. Description

This section describes tunneling or directional drilling using jacked steel casing for highway, culvert, utility and structure crossings and other shallow depth tunnels less than 500 feet in length. This section also describes carrier pipe installation within the steel casing.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Concrete: 03300
3. Hydrostatic Testing of Pressure Pipelines: 15042
4. Leakage and Infiltration Testing: 15043
5. Installation of Pressure Pipelines: 15051
6. Standard Specifications for Public Works Construction (SSPWC) Latest Edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions, shall be wet-signed and stamped by a California-licensed Civil or Structural Engineer and as specified herein.
2. Submit manufacturer's mill specification sheet listing diameter, thickness, and class of steel used in making the casing, and the mill certification.
3. Submit drawings showing the location of approach trench, jacking pit, tunnel and receiving pit, and joint type for both casing and carrier pipe. Include the details of all grout couplings and other attachments and appurtenances to the casing.
4. Submit a tunnel construction schedule which includes casing installation, carrier pipe installation, approach trench backfill, and receiving pit backfill.
5. Submit an engineered shoring plan for the bore-pit and receiving-pit. Shoring submittals shall be wet-signed and stamped by a California-licensed Civil or Structural Engineer.

D. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation (CalTrans) – “Guidelines and Specifications for Trenchless Technology Projects,” the Orange County Public Works Department, US Army Corps of Engineers, the City, or the railroad company involved per AREMA (American Railway Engineering and Maintenance of Way Association) Manual.

The Contractor shall secure all required permits for construction of casing pipe installation, provide copies to the District prior to any construction and comply with all the terms and conditions of said permits.

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.

F. Scheduling

Installation of the pipeline within the casing shall not be a continuous operation. If the pipeline is not installed within the casing as a continuous operation following completion of the jacking of the casing, the casing portals shall be bulkheaded and the approach trenches backfilled and later reopened for pipe installation.

G. Line and Grade

Contractor shall continuously survey jacked casing for conformance with design line and grade. Survey data shall be taken at a maximum of 40-foot intervals. Casing pipe is to be surveyed to top of casing.

It is the contractor's responsibility to choose a size of casing at or above the minimum specified, to ensure that the jacking is done with a high degree of accuracy to permit installation of the carrier pipe to the grades shown on the plan.

H. Inspection

On projects deemed by the District, as requiring full time inspection, the contractor is responsible for providing a third-party full-time inspector.

A full-time Safety Engineer: a Registered Structural or Civil Engineer, with a minimum of five years' experience in design or inspection of Sub-structural Projects (tunnels). Proof of experience shall be submitted or a full-time Safety Representative: State certified by Department of Industrial Relations, Cal/OSHA Mining & Tunnel Unit, proof of certification is required. California Code of Regulations 8406(f), (h).

I. Design

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

PART 2 - MATERIALS

A. Steel Casing

1. Materials: Steel casing shall be ASTM A283, Grade C, ASTM A570 Grade 30, or 33, and ASTM A36 unless noted otherwise.

The minimum inside diameter and wall thickness of the casing shall be as shown on the drawings. Greater casing thickness and diameter may be used as convenient for the method of work and loadings involved, as suitable for the site and as limited by interferences.

The Contractor shall 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 and to properly accommodate the largest dimension of the carrier pipe.

2. Joints & Welding: Casing sections shall be joined by full circumference welding. Field welds shall be full-penetration bevel welds in accordance with the standards of quality as set forth in the specifications of the American Welding Society.

All welding shall be performed by skilled welders qualified under the provisions of ANSI/AWS D1.1. Welder qualifications shall be certified by an independent local, approved testing agency not more than 6 months prior to commencing work.

Prepare ends of casings for proper bevel weld by providing a 45-degree bevel on the end of one of the two casing pieces being joined.

3. Wall Thickness: Minimum size and thickness of casing pipes for insertion of various sizes of carrier pipes shall be as shown in the TCWD Standard Drawing W-21.

B. Casing Seals

1. Casing spacers shall be bolted on style with a two piece shell made of 304 stainless steel of a minimum 14 gauge thickness.
2. 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.
3. 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).
4. The runners shall be attached mechanically by 304 stainless fasteners that are inserted through the punched riser section and welded for strength.
5. Risers shall be made of 304 stainless of a minimum 14 gauge. All risers over 2 inches in height shall be reinforced.
6. Risers shall be welded to the shell. All metal surfaces shall be fully passivated. Casing spacers shall be as specified on the plans.
7. Casing seals may be one piece with no field seams or the wrap-around style to facilitate installation after the casing and carrier pipe are already installed. Seamless style is preferred.
8. Bands and hardware for attachment to pipe and casing OD shall be stainless steel.

C. Grout

1. Exterior of Casing: Grout shall consist of an 8-sack sand slurry.
2. Interior of Casing (between carrier pipe and casing): Grout shall consist of cellular concrete. The cellular concrete shall have minimum compressive strength of 100 psi.

D. Grout Connections

1. The contractor shall provide a 1-inch diameter threaded steel half-couplings on the inside of the casing pipe at the locations, spacing and orientation called for on the plans and/or the Standard Drawings.
2. Unless noted otherwise in the plans or specifications, grout connections on the casing pipe shall be provided near the top of the casing.
3. Longitudinal spacing between grout connections along the axis of the casing pipe shall be 60 inches. This spacing may be decreased to provide more frequent grouting, but in no case shall the spacings shown on the drawings or specifications be exceeded.

PART 3 - EXECUTION

A. 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 minimum of 48-hours prior to beginning the construction of each.

B. Jacking Pit

1. Excavation Protection: 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 per Cal OSHA requirements.
2. Structural Support for Jacking Equipment: Structural steel, or concrete cradle of sufficient length shall be placed in the approach trench of the jacking pit and firmly bedded on the required line and grade to provide accurate control of jacking alignment per Cal OSHA requirements.
3. Adequate space shall be provided to permit the insertion of the lengths of casing to be jacked. The structure of structural steel sections shall be anchored to ensure action of the jacks in line with the axis of the casing. A bearing block consisting of structural steel framework shall be inserted between the jacks and the end of the casing to provide uniform end bearing over the perimeter of the casing and distribute the jacking pressure evenly.

C. Sectional Shield or Jacking Head

1. Equipment: A sectional shield or steel jacking head shall be attached to the leading section of the casing to extend around the outer surface of the upper two-thirds of the casing and to project at least 18 inches beyond the driving end of the casing. The sectional shield or jacking head shall not protrude more than 1/2-inch outside of the outer casing surface. The head shall be anchored to prevent any wobble or alignment variation during the jacking operation.
2. Removal of Excavated Material: To avoid loss of ground outside the casing, excavation shall be restricted to the least clearance necessary to prevent binding and shall be carried out entirely within the jacking head and not in advance of the head. Excavated material shall be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.

D. Control of Alignment and Grade

1. Application of jacking pressure and excavation of material ahead of the casing as it advances shall be controlled to prevent the casing from becoming earthbound or deviating from the required line and grade.
2. Allowable grade deviations in horizontal and vertical alignments shall be no greater than 0.2 feet per 100 feet in any direction over the length of the jacking and boring operation.
3. A maximum cumulative deviation shall not exceed 0.5 feet overall. Do not encroach upon the minimum annular space detailed. The District will check line and grade at intervals not exceeding 40-feet to ensure compliance with plans.

E. Grouting

1. Exterior of Casing: Immediately after completion of the jacking operation, grout shall be injected through the grout connections of casings 30-inches in diameter and larger in such a manner as to completely fill all voids outside the casing pipe resulting from the jacking operation. Where loss of ground outside the casing is suspected, additional grout connections shall be welded to the casing. Grout pressure shall be controlled to avoid deformation of the casing and/or avoid movement of the surrounding ground. After completion of grouting, the grout connections shall be closed with extra heavy black steel threaded plugs.
2. Interior of Casing (between carrier pipe and casing): After grouting the exterior of the casing and installing the carrier pipe, the interior of the casing shall be completely filled with grout if the casing depth is greater than 10-feet below the finished ground surface.

F. Installation of Carrier Pipe

1. Insertion of Carrier Pipe: After grouting the exterior of the casing pipe, the interior shall be cleaned and the carrier pipe installed. The carrier pipe shall be installed on two (2) skids of sufficient dimension to prevent the pipe bells from touching the casing pipe and to allow for proper alignment of the carrier pipe to meet the specified grade.

2. Securement: The top of the carrier pipe shall be blocked to prevent flotation. The carrier pipe shall be secured in a satisfactory manner to the On-site Safety Engineering and/or District Representative to prevent floating and subsequent change of grade.

3. Pipe Skids and Blocking: Skids and blocking shall be manufactured stainless steel casing spacers with composite runner skids.

Casing spacer skids and blocking shall be bolt-on style with a shell made of at least two halves. The band material shall be manufactured of a minimum 14 gauge T-304 stainless steel and 10 gauge T-304 stainless steel risers when needed.

All welds are to be chemically passivated. The runners shall be at least 11 inches long and shall be manufactured of high abrasion resistant and low coefficient of friction, glass filled polymer. Fasteners and hardware for securing the spacers and runners shall be stainless steel. Spacers shall be installed at mid-sections if the carrier pipe segment is over ten (10) feet long.

Detailed product submittals showing all dimensions shall be provided. Casing spacers shall have a flexible EPDM liner having a minimum thickness of 0.090-inches with a hardness of Durometer "A" 85-90. The liner shall have a rating of no less than 60,000 VPM and water absorption of 1% maximum.

Casing spacers shall be manufactured by Advance Products & Systems, Inc., Cascade Waterworks Mfg. Co., PowerSeal Pipeline Products Corp. or CCI Piping Systems or approved equal.

4. Grade Adjustment: The carrier pipe grade shall be adjusted as required by changing the height of the casing spacer riser and/or the thickness of the runner pad skids to compensate for any grade variations of the casing pipe. Care should be taken to ensure that the carrier pipe does not come in contact with and is insulated from the casing pipe.
5. Failure to Achieve Required Grade: If the alignment of the casing pipe is such that the carrier pipe grade cannot be met, the grade of the casing pipe shall, if required by the District, be adjusted.

If realignment is not deemed feasible by the District, another casing pipe meeting the required grade shall be installed. The abandoned casing pipe shall be filled with sand and the ends plugged with twelve (12) inch thick masonry plugs.

Realignment or replacement work shall in be completed by the contractor at no additional costs to the District.

6. Testing: Before backfilling the jacking and receiving pits, the carrier pipe shall have passed an initial pressure or leakage test in accordance with Section 15042 or Section 15043.

G. Closing the Jacking Pit and Receiving Pit

1. Closing the Jacking Pit and Receiving Pit: After jacking equipment and excess soil from the tunnel have been removed from the approach trench of jacking pit, the bottom of the jacking pit shall be prepared as for installation of a pipe foundation. Remove all loose and disturbed material below pipe grade to undisturbed earth and re-fill per Section 02223, Trenching, Backfilling and Compacting.
2. Backfill: The jacking pit and receiving pit represents over the width trench conditions. Backfill shall either as called for on the contract drawings, in the Special Provisions, or in Section 02223, Trenching, Backfilling and Compacting.

END OF SECTION

SECTION 02528: CONCRETE CURBS, GUTTERS, AND SIDEWALKS

PART 1 - GENERAL

A. Description

This section describes materials and construction of concrete curbs, gutters, and sidewalks.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Concrete Formwork: 03100
3. Concrete Reinforcement: 03201
4. Concrete: 03300
5. Concrete Finishing, Curing and Waterproofing: 03345
6. Standard Specifications for Public Works Construction, latest edition

C. Submittals

Shop drawings shall be submitted in accordance with the General Provisions and the requirements of Section 03300, Concrete, Part 1-C.

PART 2 - MATERIALS

A. Forms

1. General: Forms shall be as required in Section 03100, Concrete Formwork. Stakes and braces shall be provided to hold forms securely in place.
2. Sidewalk Forms: Sidewalk forms shall be 2-inch dressed lumber, straight and free from defects, or standard metal forms. Where short-radius forms are required, 1-inch dressed lumber of plywood may be used.

B. Aggregate Base Course

Crushed rock base shall be clean 3/4-inch and smaller crushed rock or crushed gravel, free from foreign material, and conforming to Crushed Aggregate Base (CAB) as specified by Standard Specifications of Public Works Construction: Section 400-2, latest edition.

C. Expansion Joint Filler

Premolded expansion joint filler shall be 1/4-inch thick for curbs and 1/4-inch thick for sidewalks, or as required or allowed by the permitting agency.

D. Concrete

Conform to Section 03300, Concrete.

E. Reinforcing Steel

Conform to Section 03201, Concrete Reinforcement.

F. Curing Compound

Conform to Section 03345, Concrete Finishing, Curing, and Waterproofing.

G. Excavation and Backfill

Conform to Section 02223, Trenching, Backfilling, and Compacting.

PART 3 - EXECUTION

A. Preparation of Subgrade

1. Subgrade shall be excavated and shaped to line, grade, and cross section.
2. The top 12-inches of subgrade shall be compacted to 90% relative compaction.

3. All soft material disclosed by excavating shall be removed and replaced with aggregate base as directed.
4. The finished subgrade shall be within a tolerance of +/-0.02 of a foot of the grade and cross section shown and shall be smooth and free from irregularities at the specified relative compaction.
5. The subgrade shall extend over the full width of the construction.
6. The Soils Engineering and/or District Representative's approval of finished subgrades must be received prior to continuance of the work.

B. Placing Aggregate Base

After the subgrade for curbs, sidewalks, and roadway slabs is compacted and accepted, the Contractor shall place and spread aggregate base material, sprinkle with water, and compact to 90% relative density. The surface of the compacted base shall be at the proper level to receive concrete. Curbs and sidewalks shall be underlain by 4-inches or more of compacted aggregate base material.

C. Setting Forms

Forms shall conform to Section 03100, Concrete Formwork. Forms for a face-of-curb shall not have any horizontal joints within 7-inches of the top of the curb. Forms shall be braced to prevent change of shape or movement in any direction resulting from the weight of the concrete. Short-radius curved forms shall be constructed to exact radius.

Tops of forms shall not depart from grade line more than 1/8-inch when checked with a 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8-inch in 10-feet.

D. Curb Construction

1. Jurisdictional Requirements: Curbs shall be reconstructed to original line and grade if removed. Curbs shall conform to the permit requirements of the respective jurisdictional agency.
2. Expansion Joints: Preformed asphalt-impregnated expansion joints shall be placed at 20-foot intervals, at the beginning and end of curved portions of the curb, at each change in thickness of section, at the end of curbs at buildings and other structures, and at connections to existing curbs.
3. Notification: The District Representative shall be notified at least 48-hours prior of planned concrete placement.
4. Concrete Finish: When the concrete has set sufficiently to support its own weight, the front form shall be removed and exposed surfaces finished. The formed face shall be finished by rubbing with a burlap sack or similar device to produce a uniformly textured surface, free of form marks, honeycomb, and other defects.

Defective concrete shall be removed and replaced by the contractor and at no expense to the District. Upon completion of the finishing, curing compound shall be applied to exposed surfaces of the curb. Curing shall continue for a minimum of five (5) days.
5. Backfill: Seven (7) days (minimum) after pouring the concrete, the curb shall be backfilled with earth free from rocks, 2-inches and larger, and other foreign material. Backfill shall be tamped firmly in place.
6. Alignment and Grade: Finished curb shall have a uniform grade and alignment. Any section of curb showing abrupt changes in alignment or grade, or which is more than 1/4-inch away from its intended location, as staked, shall be removed and reconstructed by the contractor and at no additional cost to the District.

7. Protection of Work: All concrete surfaces and/or structures shall be protected until the project containing the work is accepted.

E. Sidewalk Construction

1. General Requirements: Unless shown otherwise, sidewalks shall be placed in a single pour, 4-inches thick. Walks shall slope 1/4-inch per foot upward from the top of curb. Concrete shall be placed, processed, finished, and cured in conformance with the applicable requirements of ACI 614, latest edition.
2. New Sidewalk: Where new sidewalk is abutting existing concrete, the existing concrete shall be sawcut to a depth of 2-inches and the concrete chipped out to sound material and a plane surface. The surface shall be cleaned and neat cement paste applied just prior to pouring the new sidewalk.
3. Expansion Joints: Preformed expansion joints shall be placed at 20-foot intervals or less to match those in the adjacent sidewalk, where the sidewalk ends at a curb, and around posts, poles, or other facilities located within the sidewalk. Expansion joints shall be placed between sidewalks and buildings or other structures.
4. Contraction Joints: Contraction joints shall be provided transversely to the walks at locations opposite the contraction joints in the curb and at 10-foot intervals along the sidewalk. These joints shall be 3/16-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the top of the walk.
5. Notification: The District Representative shall be notified at least 48-hours prior of planned concrete placement.
6. Concrete Finish: The top surface of the sidewalk shall receive a broom finish with a fine-hair broom in line with the length of the walk. All edges, joints, and markings shall be tooled. The walk shall be scored transversely at 5-foot intervals with a jointing tool. Upon completion of the finishing, an approved curing compound shall be applied to exposed surfaces. Sidewalks shall be protected from damage until final acceptance.

END OF SECTION

SECTION 02578: PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

A. Description

This section describes materials, testing, removal, and replacement of asphalt concrete pavement, seal coat, aggregate base course, prime coat, tack coat, and Portland Cement Concrete (PCC) surfaces.

This Section reflects incorporation of the California and Caltrans standards (Standard Specifications) and the Standard Specifications for Public Works Construction, (SSPWC) latest edition, for specifying performance grade (PG) asphalt. The Contractor shall comply with SSPWC and the modifications to SSPWC specified herein.

For projects located within the public right-of-way, the respective City/County's pavement specification and/or approved encroachment permit requirements shall take precedence over the requirements specified herein.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Concrete Curbs, Gutters, and Sidewalks: 02528
3. Concrete Formwork: 03100
4. Concrete Reinforcement: 03201
5. Concrete: 03300
6. Concrete Finishing, Curing and Waterproofing: 03345
7. Standard Specifications for Public Works Construction, latest edition.

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Mix Design: Submit asphalt mix design data prepared within the last six (6) months by a certified laboratory acceptable to District for each asphalt concrete material type used on the project.
3. Materials Quality: Submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements above.
4. Materials Source: Submit materials certificates signed by material producer and Contractor, identifying material producer by name, location of material producing plant, and type of plant from which material will be produced and delivered. If Contractor changes Material Source, the contractor shall re-submit a new asphalt mix design data prepared within the last six (6) months by a certified laboratory acceptable to District for each asphalt concrete material type used on the project.
5. Guarantee: Submit completed manufacturer's warranty form providing an unconditional installation guarantee for a period of no less than two (2) years beginning from the date of the Notice of Completion.
6. Submit proposed pavement placement sequence and schedule.

PART 2 - MATERIALS

A. Asphalt Concrete Paving

The Dense Graded Asphalt Concrete (DGAC) material used for all areas shall comply with the requirements of the SSPWC, latest edition, and as modified herein.

The Contractor shall supply, unless otherwise instructed, a mix with less than or equal to 15% Recycled Asphalt Products (RAP). Asphalt shall be performance grade PG 64-10. Asphalt binder content in the pavement shall be in accordance with Table 203-6.4.3 in the SSPWC. The base course shall be a minimum of 3-inches thick.

The specific type of material used for each type of construction shall comply with the table below.

Requirement for Asphalt Concrete Material Type			
Pavement Thickness (inches)	≤1	>1 and ≤2	>2
SSPWC Material Type (for use in AC Cap):	T3DPG*	T3C3PG**	T3C3PG**
SSPWC Material Type (for use in AC Base):	-	-	T3B3PG***

* T3DPG: Type III D PG 64-10 Asphalt Concrete per Section 400 of the SSPWC.

** T3C3PG: Type III C3 PG 64-10 Asphalt Concrete per Section 400 of the SSPWC.

*** T3B3PG: Type III B3 PG 64-10 Asphalt Concrete per Section 400 of the SSPWC.

Warm Mix Asphalt Concrete mix may be utilized only for the asphalt concrete base courses of the project.

B. Aggregate Base Material for Asphalt Concrete

Aggregate Base Material shall be in accordance with Section 400 of the SSPWC.

C. Seal Coat

Seal coat material shall be a plant-blended product composed of mineral aggregates uniformly distributed in a petroleum-based asphalt emulsion. The asphalt emulsion shall conform to Section 203-3 of the SSPWC and shall be free of asbestos fibers or coal tar additives. Seal coat materials, undiluted except as noted, shall conform with the SSPWC Section 203-9.

In complying with the seal requirements, the seal shall have a minimum of 60% non-volatiles at the delivery from the supplier and 48% non- volatiles at the point of seal material placement.

D. Crushed Miscellaneous Base Course

All crushed miscellaneous base (CMB) material placed on site shall have a minimum R-value of 80. CMB must also meet requirements in SSPWC, Section 200. Compaction tests will be performed by the District, unless otherwise specified, and require approval by the Soils Engineer and/or the District representative before the final surface layer of asphalt concrete is placed.

E. Cement Treated Base

The use of a Cement Treated Base (CTB) shall be designed in a laboratory by an independent laboratory in accordance with Section 301-3 of the SSPWC. The determination of a design shall be performed with a minimum of four (4) soil cement mixtures in order to determine the optimum cement content for the soil. The report shall also detail the depth of mixing and compaction requirements, and a copy provided to the Soils engineer and/or the District Representative.

F. Crack Treatment

Construction materials shall consist of a combination of a crack filling emulsion and that of asphalt concrete material for filling the milled areas according to the following schedule.

1. Crack widths equal to or greater than 1/4-inch but less than 1/2-inch. A hot applied crack fill material shall be placed in all cracks.
2. Crack widths equal to or greater than 1/2-inch.
3. The crack fill material shall be a Type D2 PG 64-10 asphalt concrete material, per Section 203-6 of the SSPWC.

G. Tack Coat

The tack coat shall be diluted SS-1H Emulsion per Section 203-3 of the SSPWC.

H. Sub Drain Construction

The PVC drain pipe used in all sub drain areas shall comply with ASTM D2665 and ASTM D1785. The pipe size shall be as shown on the plans and shall be slotted and interlocking.

I. Geotextile Fabric

The geotextile fabric used in all sub drains areas shall be a Mirafi 140.

J. Engineering Fabric & Overlay

1. Binder Coat (New DGAC Overlay & Fabric to existing Asphalt Concrete) The binder coat shall be a PG 64-10 material. The Binder Coat shall be a "trackless material" capable of bonding between and through the engineering fabric and asphalt concrete overlay.
2. Fabric (New DGAC Overlay & Fabric to existing Asphalt Concrete) All engineering fabric shall conform to Section 213 of the SSPWC.

K. Portland Cement Concrete (PCC) Slab on Grade

PCC materials shall be placed in accordance with Section 303 of the SSPWC and have a maximum slump of 4-inches. PCC elements shall be protected from graffiti marks until after a set and hardened condition has occurred. Contractor shall replace any PCC elements that have been graffitied at no cost to the District.

Pavement crack control jointing for curbs and gutters shall be placed at a maximum of 8-feet on center for all slab on grade in all directions.

Slab on grade jointing and expansion joints shall be as specified on the plans. Slab on grade PCC elements construction joints shall be dowel with No. 4 bar (smooth) fixed at one end with dowel spacing of 18-inches on center and 18-inches away from every corner. Slab on grade PCC materials shall have the additive of 1.5 lbs./cy of "Buckeye UltraFiber 500" concrete reinforcing fiber additive containing the following minimum requirements.

1. Material: Alkali-resistant, virgin cellulose fibers.
2. Average Length: 2.1 mm (0.083 inch).
3. Average Denier: 2.5 g/9,000 m.
4. Average Diameter: 18 μ (0.63 x 10⁻³ inch).
5. Count: 590,000 fibers/g (720,000,000 fibers/pound).
6. Density: 1.10 g/cm³.
7. Surface Area: 25,000 cm²/g (12,200 ft²/pound).
8. Average Tensile Strength: 750 N/mm² (110 ksi).
9. Average Elastic Modulus 8,500 N/mm² (1,200 ksi).
10. Fiber Spacing: 550 μ m at 0.9 kg/m³ dosage rate (0.026 inch at 1.5 pounds/cubic yard dosage rate).

All reinforcing fibers shall be placed into the concrete mixture in accordance with manufacturer's instructions and ASTM C94. The application rate of the material shall be 1.0 pounds/cubic yard (0.6 kg/m³) of concrete directly into concrete mixer at beginning of batch cycle. The mixing process shall be a minimum of 4 minutes at mixing speed in the concrete mixer for full reinforcing fiber dispersion.

Poly Foam: Poly forms are required where there is new PCC against existing elements of PCC, stucco, brick, block, or steel materials. Abutments shall be separated during construction with the Poly Foam and removed after the PCC has set to a depth of 1/2-inch. The void area created by the removal of the Poly Foam shall then be backfilled with an approved elastomeric material of matching color for the designated area.

L. Striping

Paint shall conform to Section 214-4 of the SSPWC. Paint color and type shall be as indicated on the drawings, or if not indicated, shall match as nearly as practical the existing conditions of the site.

M. Root Barrier

The root barrier shall consist of the active chemical:

1. Trifluralin (a,a,a-Trufluro 2,6 – dinitro – N,N, - Dipropyl – p –toluidine) 17.5%.
2. Inert ingredients: 100% Spunbonded Polypropylene, polyethylene, and Carbon 82.5%.
3. Root barrier shall be Typar Biobarrier.

N. Redwood Header

Redwood headers shall comply with the material requirements of Section 212-1.5 of the SSPWC.

O. Water for Compaction

Water used to assist in compaction and subgrade preparation shall conform to Section 02223, Trenching, Backfilling, and Compacting.

PART 3 - EXECUTION

A. Pavement Removal

1. Public Safety: The Contractor shall comply with all applicable, State, County and City requirements for temporary closures of streets, parking lots, or other areas. The Contractor shall provide barriers, guards, light, signs, temporary bridges, flag persons and watch persons, advising the public of detours and construction hazards.

The Contractor shall furnish and install, and upon completion of the work, promptly remove all signs and warning devices. The Contractor shall comply with all the public safety and signing requirements specified in the SSPWC, Section 7 and the California Manual on Uniform Traffic Control Devices (MUTCD), latest edition. Should two or more specifications be in conflict, the more restrictive of the two shall be followed.

2. NPDES: Compliance with National Pollutant Discharge Elimination System (NPDES) storm water permit program shall be the responsibility of the Contractor.

The Contractor shall be required to implement and meet best practice standards for all discharge into the storm drain system, and in accordance to the latest Best Management Practices for Construction Activities per the San Diego Regional Water Quality Control Board. A copy of the District's NPDES permit is available at the TCWD's main office.

3. Project Cleanliness: The Contractor shall ensure that all areas of the site are kept clean of debris and construction materials outside of the region designated for storage and staging.

Upon the conclusion of the project, the Contractor shall ensure that all curbs, sidewalks, cross gutters, decorative slab on grade, signs, landscaping drive approaches, etc., are returned to their pre-construction condition and/or new construction status having no marks or material coatings, unless designated otherwise.

The Contractor shall clean these areas if requested to do so by the District Representative prior to the final completion of the project.
4. Asphalt Concrete Pavement Cutting Requirements: Asphalt concrete pavement shall initially be cut with a pavement cutter or other equipment at the limits of the excavation before the pavement is removed. Pavement breakers or stompers **shall not be** allowed.

Contractor shall vacuum or remove AC or concrete cuttings during the sawcutting operation and shall not be allowed to wash AC or concrete cuttings into the storm drain system.

After backfilling and compacting the excavation, asphalt concrete pavement shall be sawcut to a minimum depth of 2-inches at a point not less than 9-inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and the additional pavement removed.

If the cut is within 3-feet of an existing joint or curb and gutter, the asphalt concrete pavement shall be replaced to the joint or curb and gutter. Sawcut lines shall be parallel or perpendicular to the flow of traffic.
5. Portland Cement Concrete Pavement Cutting Requirements: Concrete pavement, cross gutters, curbs and gutters, sidewalks, or driveways, shall be sawcut to a minimum depth of 1 1/2-inches at a point 1-foot beyond the edge of the excavation and the strip of improvement removed.

Concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and the saw cut made after backfilling the excavation. If the saw cut falls within 3-feet of a concrete joint or pavement edge, the concrete shall be removed and replaced to the joint or edge.

Contractor shall vacuum or remove concrete cuttings during the sawcutting operation and shall not be allowed to wash concrete cuttings into the storm drain system.
6. Disposal of Material: All pavement and other improvements demolished shall be removed from the site and disposed of in a manner acceptable to agencies having jurisdiction over the work and to the District.
7. Final Pavement Saw Cuts: Excavation shall be regular and rectangular in shape and shall be blade-cut or saw-cut, as appropriate to the field conditions through the existing pavements. Cuts shall be made in straight lines.
8. Excavation shall be taken to the limits identified on the site drawings. Excavation material shall be hauled from the job site disposed of in a manner acceptable to agencies having jurisdiction over the work and to the District. Removal material shall be considered as Unclassified Excavation.

B. Pavement Replacement

1. General: Producing, hauling, placing, compacting, and finishing of asphalt concrete shall conform to Section 302-5 of the SSPWC.
2. Base Course, Final Course and Striping: Base course paving shall be complete at all times to a point not to exceed 1,000 feet behind any working heading.

Temporary striping shall be applied after the base course of asphalt concrete pavement has been placed, in the same configuration as the existing permanent striping, so that traffic can be returned to normal patterns. Temporary striping shall be maintained until permanent striping is applied.

C. Preparation of Subgrade

1. After rough grading has been completed, the subgrade and/or aggregate base shall be loosened to a depth of at least 6-inches. The loosened material shall be worked to a finely divided condition and all rocks larger than three 3-inches in diameter shall be removed.
2. The moisture content shall be brought to optimum by the addition of water, or by the addition and blending of suitable material or by the drying of existing material.
3. Subgrade for base material shall not vary by more than 0.04 foot from the specified grade and cross section limits. Variations within the above specified tolerances shall be compensating so that the average grade and cross section limits are met and as observed by the Soils Engineer and/or the District Representative.
4. The Contractor shall receive written approval of grade from the District Representative prior to proceeding with any subsequent work. Grade approval shall be received for both the subgrade and base grade.
5. The material shall then be compacted by approved equipment to 90% of laboratory maximum at or near optimum moisture as determined by ASTM D1557, ASTM D1556 and/or ASTM D2922. The subgrade must be firm and unyielding before the base and/or surface courses are placed. Base material shall be compacted to 95% of laboratory maximum at or near optimum moisture as determined by ASTM D1557, ASTM D1556 and/or ASTM D2922.
6. Asphalt placed on subgrade materials shall have subgrade compacted to 95 percent of laboratory maximum at or near optimum moisture as determined by ASTM D1557, ASTM D1556 and/or ASTM D2922.
7. Final grade cross fall shall be a minimum 2% from the centerline of the roadway to the edge of the gutter lip, unless otherwise specified on the plans. The grade shall be finished to permit the final PCC gutter lip finish surface at 3/8-inch above said lip.

D. Placing Aggregate Base

Aggregate base shall be placed to the thickness shown on the plans or to match existing. Aggregate base shall be compacted to 95% relative compaction and installed in maximum of 6-inch lifts in accordance with Section 301-2 of the SSPWC.

E. Placing Geotextile Fabric

The geotextile fabric shall be placed as shown on the plans, and/or only after approval has been given to proceed with trench construction by the District Representative.

The fabric shall be placed on the ground and up along the edges of the 12-inch wide by 18-inch depth trench.

The Contractor shall take care in placing the aggregate backfill in order to not puncture or tear the fabric. The fabric shall be laid over itself on the top such that the overlap is a minimum of 6-inches.

Additional aggregate shall be placed upon the top of the fabric overlap a maximum of 3-inches. This top layer of aggregate shall separate the bottom of the asphalt concrete, and the fabric overlap area.

F. Placing Portland Cement Concrete (PCC)

Placement of the PCC material shall be in accordance with Section 302-6 of the SSPWC. PCC curbs, gutters and slab on grade elements shall be constructed by use of forms, with transverse expansion and construction joints. Finish PCC surface areas, with the exception of flow line areas, shall be provided with a pavement medium broom finish surface, unless otherwise directed by the District Representative.

Where traffic loading is expected, doweling shall be required for slab on grade elements by use of approved smooth No. 4 bars, greased at one end and fixed at the other. Dowels shall be constructed at 18-inch intervals on center and no closer than 18-inches from pavement corners.

PCC elements shall be protected from graffiti marks until after a set and hardened condition has occurred. Contractors failing to protect the PCC elements from graffiti shall be liable to remove and replace each PCC element affected at no additional cost to the District.

G. Placing Tack Coat

Tack coat shall be applied at the rate of 0.05 gallons per square yard to the surfaces to receive finish pavement per Section 302-5.4 of the SSPWC. Tack coat shall be applied to existing asphalt, metal, or concrete surfaces that will be in contact with new asphalt concrete paving.

H. Placing Asphalt Concrete Material

Asphalt paving shall be applied to the thickness as shown on the plans, or as listed above, or per the applicable permit. Asphalt paving shall be installed in accordance with Section 302-5 of the SSPWC.

Asphalt concrete shall be placed in lifts having a maximum of 3-inches. Work shall be performed in accordance with Section 302-5 of the SSPWC. A tack coat of SS-1h shall be placed between all lifts and on all vertical faces.

The new finish surface of asphalt concrete shall be 3/8-inch above PCC curbs and gutters.

The asphalt concrete mat paving machine shall have a vibratory plate in operation during all of the laydown operations. In the case that the plate is non-operational, the Contractor shall increase the thicknesses to include an additional 1/16 of an inch for each inch of asphalt concrete material placed.

Use of Warm Mix Asphalt Concrete will alter the minimum permissible arrival temperature at the time of rolling. The temperature of the Warm Mix Asphalt Concrete shall be greater than 240°F at the time of placement.

I. Placing Binder and Engineering Fabric

1. Binder Coat: The entire surface to be covered shall be free of water, foreign matter, vegetation, or dust before application of the tack coat.

Hot PG 64-10 oil shall be applied prior to placing the engineering fabric. The binder coat of asphalt cement shall be placed at a uniform spread rate of 0.25 gallon per square yard (+/- 0.02 gal/yd) in areas of the project to receive the engineering fabric and subsequent overlay.

The binder coat shall be placed with the aid of a truck sprayer application. The width of the sprayer application shall be no more than 6-inches and no less than 2-inches wider than the fabric width to be placed.

2. Engineering Fabric: Engineering fabric shall be placed in accordance with SSPWC, Section 302. A binder coat shall be placed prior to the placement of the fabric. Fabric shall be placed with a minimum 6-inch overlap.

No greater area shall be treated in any one day than is planned to be covered by asphalt concrete during the same day. The engineering fabric shall overlap all transverse and longitudinal joints by a maximum of 4-inches and a minimum of 2-inches. The minimum width of a cut roll that is placed, shall be 4-feet. A cut roll may be required if it is necessary for the Contractor to overlap a joint.

The engineering fabric shall not be placed in any area where the intended of the overly thickness is less than 1 1/2-inches and shall be placed only in thicknesses as designated on the contract documents.

Fabric shall be placed with no wrinkles that lap. The test for lapping shall be made by gathering the fabric in a wrinkle. The two sides of the wrinkle shall be pressed together from pavement surface to a fold point with equal amounts of fabric on both sides of the fold point down to the pavement surface. If the height of the double portion of the extra fabric exceeds 1/2-inch, the fabric shall be cleanly cut to remove the wrinkle. The cut shall be made on the side.

Pavement fabric shall not be placed more than 600-feet in advance of the paving operations. No more fabric shall be placed than can be covered in one day.

J. Applying Seal Coat

Pavement seal coat shall be applied on existing pavement where shown on the plans and on all new pavement. Pavement seal operations shall be performed in accordance with the manufacturer's recommendations. The material spread rate shall be a minimum of 25 gallons per 1,000 square feet and shall be placed in a minimum of two coats.

The Contractor shall black out old striping prior to sealing. This procedure is intended to prevent the shadow effect that occurs due to the old lines or stripes wearing through the new sealed surface. Application of black out paint shall comply with SSPWC, Section 314.

K. Surface Tolerance

Finished grade shall not deviate more than 0.02 foot in elevation from the grade indicated on the drawings. Slopes shall not vary more than 1/8-inch in 10-feet from the slopes shown on the drawings.

L. Concrete Curbs, Gutters, and Sidewalks

Concrete curbs, gutters, and sidewalks shall be replaced in accordance with Section 02528, Concrete Curbs, Gutters, and Sidewalks.

M. Emulsion-Aggregate Slurry

Certain street sections, where shown on the plans or where required by the jurisdictional agency, may be required to receive an asphaltic slurry seal in conformance with Section 302-4, SSPWC after the final asphalt surface course.

The composition and aggregate grading for slurry shall be Type II of Subsection 203-5.3. Unless otherwise directed by the jurisdictional agency, the contractor shall wait 30 calendar days, after installing pavement, before applying the emulsion-aggregate slurry on new pavement.

N. Placing PVC drain pipe for Sub Drain System:

The PVC drain pipe shall be constructed in continuous connection from the bottom of the grade to the top of the grade away from catch basin. The pipe shall have two parallel rows of perforations (round or elongated holes) on the downside of the pipe about 120 degrees apart. The perforated pipe shall have four 4-inches of cover below the bottom of the trench.

O. Pavement Milling

Tapered Header Cuts: Areas designated for placement of a 2-inch asphalt concrete overlay shall have a minimum 6-foot tapered cut at roadway edges.

At the transition from paving to non-paving, the tapered cut shall be a minimum width of 12-feet wide. At the lip of gutter and asphalt concrete pavement interface, the asphalt concrete overlay shall be 3/8-inch higher than the lip of gutter. The milled surface within the taper shall be uniform, shall not vary from its highs and lows by more than 3/8-inch, and shall be performed in accordance with Section 302 of the SSPWC. A temporary cold mix ramp shall be constructed after the pavement is milled and before the cap is placed.

P. Slurry Cement Backfill

Slurry cement backfill patch material with a 2-sack sand-cement slurry shall be placed and constructed with care and be permitted to set and cure without being disturbed.

Q. Placing Crack Fill Materials

1. Crack widths greater than 1/4-inch but less than 1/2-inch:

A hot applied crack fill material shall be placed in all cracks. Hot rubber crack fill material shall be filled to within 1/4-inch of the finish surface. The Contractor shall take care not to excessively place crack fill material along the edges of the crack at the finish surface. Excessive crack fill over splash shall be removed under the direction of the District Representative. Crack filling operations shall only be performed during the Winter or early Spring months unless otherwise directed by the District.

2. Crack widths equal to or greater than 1/2-inch:

Prior to crack filling, the existing cracks shall be marked out. Cracked areas shall be milled out to a depth of 3-inches and a width of 18-inches. Each area shall then be cleaned, and all vertical and horizontal areas shall then be tack coated with an SS-1H material and permitted to "break" before any new asphalt concrete material is applied. The new asphalt concrete material shall be placed in one lift, compacted and brought to the finish surface of the existing pavement.

R. Painting

PCC curbs that will receive a new coat of paint shall be scraped to loosen all paint chips and debris prior to painting. Paint, except for black outline paint, shall be placed in a minimum of two coats per Section 314 of the SSPWC. The two coats shall be applied a minimum of one week apart from one another. Black out line paint shall be applied per SSPWC, Section 214.

S. Place Root Barrier

Root barrier shall be protected from ultraviolet rays and shall be stored in accordance with the manufacturers' recommendations. Materials shall not be removed from their shipping container until placement. The root barrier shall be a minimum of 18-inches deep from the finished surface.

T. Redwood Header

Redwood headers shall be placed at a maximum spacing of 48-inches on center. The placement of headers, stakes, and joint splicing shall be in accordance with Section 212-5.2 of the SSPWC.

U. Inspection and Testing

1. Conformity with Contract Documents: Work and materials shall conform to the lines, grades, cross sections, dimensions, and material requirements including tolerances shown on the plans and as specified herein.
2. Advance Notice: At least forty-eight (48) hours advance notice shall be given when requesting inspection of work. No paving or concrete operations shall be permitted except in the presence of a District Representative.
3. Access for Inspection and Testing: The Contractor and material producer shall, at all times, provide safe access for inspection of the work by the District Representative to any shops, production plants, or areas where materials or portions of the work are in progress. The District Representative shall be given assistance as necessary for performing tests and shall be kept apprised of work schedules.
4. Materials Testing: Unless otherwise specified in the General Requirements, the District will provide materials testing in accordance with the current published methods as specified and used by the following agencies:
 - a. American Society for Testing and Materials (ASTM)
 - b. American Association of State Highway and Transportation Officials (AASHTO)
 - c. Test Methods as developed by Materials and Research Department - California Department of Transportation - Division of Highways, Sacramento, California,Testing of materials shall include, but not be limited to, material gradation, binder content, and compaction. In the event of a failed test, the Contractor shall be responsible to pay for all costs associated with any re-testing required.
5. Samples: In general, samples for testing will be taken by the District Representative from material at the production plant and/or material delivered to the site of the work, and such material should be available in ample time to allow for such testing. In the event that control testing for the work is performed by a private laboratory, the District reserves the right to stipulate the number and location of the control tests which will relate to ultimate acceptance of the work by the District.
6. Removal of Rejected and Unauthorized Work: Work which has been rejected shall be remedied or removed and replaced in an acceptable manner as determined by the District Representative. Any work done beyond the lines and grades shown on the plans, established by the Engineer, or determined by the District Representative to not be of acceptable material quality, or of acceptable workmanship, or any work done without written authority shall be considered as rejected work. Upon order of the District Representative, work shall be remedied, removed, or replaced at no additional expense to the District.
7. Equipment: The Contractor shall provide adequate and suitable equipment to meet the requirements of the Contract Documents.

END OF SECTION

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 (existing sewer pipeline repair only) (VCP) and polyvinyl chloride (New Construction) (PVC).

B. Related Work Described Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Jacked Casing: 02315
3. Vitrified Clay Pipe for Gravity Sewers: Section 02710
4. PVC Pipe and Fittings for Gravity Sewers: 02715
5. Concrete: 03300
6. Precast Concrete Manholes and Bases: 03461
7. Leakage and Infiltration Testing: 15043
8. PVC Pressure Pipe and Fittings: 15064
9. Facilities Identification: 15151
10. Standard Specifications for Public Works Construction (SSPWC), latest edition.

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. An installation schedule in a tabulated layout format shall be submitted and shall include the following.
 - a. Order of installation and closures.
 - b. Pipe centerline station and elevation at each change of grade and alignment.
 - c. Locations of manholes.

PART 2 - MATERIALS

A. Installation Material

Refer to Section 02715, PVC Pipe and Fittings for Gravity Sewers for new construction and material requirements. Refer to Section 02710, Vitrified Clay Pipe for Gravity Sewers for repair of existing VCP sewer pipelines.

B. Piping Schedule

Unless noted otherwise on the plans or in the specifications, pipe shall be furnished in accordance with the following materials schedule. The minimum pipe length for SDR 35, DR 14, and DR 18 shall be 20-feet. For PVC pipe, the color shall be green.

Diameter	Acceptable Materials
4-inch through 15-inch	Extra-Strength VCP or PVC SDR 35 (Repair) PVC C900 DR 14 or DR 18 (New Construction)
16-inch through 20-inch	Extra-Strength VCP or PVC SDR 35 (Repair) PVC C900 DR 18 (New Construction)
24-inch through 42 inch	PVC C-900 DR 18 (thru 36-inch dia.). Polymer Concrete Pipe (Meyer). Fiber-Reinforced Plastic
Greater than 42-inch	Polymer Concrete Pipe (Meyer). Fiber-Reinforced Plastic

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 two weeks unless exception is approved by the District Representative in advance.
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. All plastic pipe and fittings shall be stored under a cover in a flat, horizontal position, and protected from the sun and the elements until ready for installation.
3. Use of Pipe: In no event shall the sewers be used as drains for removing water which has infiltrated into the construction trenches.

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 at no additional cost to the District. 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.
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 Base Thickness: Unless shown otherwise on the drawings, pipe base material shall be 3/4-inch crushed rock 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. For larger diameter pipe where a lever attachment is required, the necessary precautions shall be taken to ensure 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. PVC Pipe Curvature: Construction of curved reaches of PVC pipe may be accomplished by deflecting joints. Pipe deflection to achieve horizontal curves shall be limited by the manufacturer's maximum recommended limit or as follows, whichever provides the largest radius and the least deflection:

Diameter (inches)	Radius (feet)
6	210
8	280
10	350
12	420

9. Short Lengths of VCP Pipe: When using VCP, two 1-foot lengths of sewer pipe shall be used to provide curve flexibility and prevent cracking or shearing failures as shown on the plans or as may be required by the District Representative during construction. The use of short lengths of pipe is particularly required, but not necessarily limited to these locations: (1) inlets and outlets to all manholes; and (2) ends of steel casing pipe.
10. Laterals: VCP and PVC wyes, and other types of branches shall be furnished and installed along with the same pipe material (VCP or PVC) as the sewer main. Wyes sized as specified on the plans shall be installed for all sewer lateral connections and for future sewer lateral 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 vitrified clay sewer pipe. 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 lateral branch shall be placed closer than 5 feet downstream of the centerline of any structure.
11. Backfill: Backfill shall be placed and compacted in accordance with the requirements of Section 02223, Trenching, Backfilling and Compacting, and as shown in TCWD Standard Drawings.

D. Manholes and Manhole Bases

Precast concrete manholes and manhole bases shall be constructed in accordance with Section 03461, Precast Concrete Manholes and Bases, as shown in the plans or on TCWD Standard Drawings.

E. Sewer Laterals with Lateral Clean-outs

1. Locations: Sewer laterals and wye branch fittings of the size indicated on the plans shall be installed at the locations shown on the plans or at the location furnished by the District Representative.
2. Wye-Branches for Future Laterals: All branch fittings that are to be left unconnected shall be plugged with a manufactured plug as shown in TCWD Standard Drawings and as approved by the District Representative.
3. Fittings: Sewer laterals shall be joined to wye branch fittings at the sanitary sewer main as set forth above by eight bends and as shown in TCWD Standard Drawings.

4. A wye branch fitting at or near the property line (right-of-way limit) or easement boundary, shall be set on each sewer lateral to allow the clean-out riser and cover to be brought up to grade for each lateral connection.
5. Alignment: Where possible, all sewer laterals shall run perpendicular to the sewer main to the property line. All sewer lateral trenches shall be bedded the same as the sewer main.
6. Plugged Sewer Laterals: All sewer laterals shall be plugged with an approved stopper or cap at the last joint of each lateral. It shall withstand the internal pressure during the test for leakage. It shall be installed in such a manner that it may be removed without damaging the pipe.
7. Marking: The Contractor shall mark the location of each sewer lateral near its upstream end by grinding a 2-inch tall letter "S" on the face of the curb (where a curb exists). The installation of ID tape, locator tape, and tracer wire over the trench line for lateral piping is also required in accordance with Section 15151, Facilities Identification.

Where housing tracts and commercial subdivisions call for an extended time delay between District sewer construction and private on-site construction, each lateral shall be marked with a "utility marker paddle" labeled "SCO" as shown in TCWD Standard Drawing W-27, at or near the property line.
8. Chimney Connections: Chimney connections of any kind (where sewer connections drop waste directly and vertically into the sewer main) are not allowed.

F. Terminal Cleanouts

1. Limitations: The use of terminal cleanouts (not to be confused with lateral clean- outs) shall be limited to the following:
 - a. A short section (less than 250 feet) of sewer main that is to be extended.
 - b. At the end of a sewer main where the distance from the downstream manhole to the cleanout does not exceed 250 feet.

G. Installation Within Casing

1. General: Vitrified clay 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 skids, before backfilling, in such a manner as to relieve the pipe bells from any bearing loads. Pipe skids for "carrier pipe" shall be as specified in Section 02315, Jacked Casing and as shown in TCWD Standard Drawings.
3. Grouting Interior and Exterior of Casing: Refer to Section 02315, Jacked Casing for grouting requirement on the interior and exterior of the casing.
4. Testing: Before backfilling the trench and bore pits, or sealing the casing ends, the sewer carrier pipe shall pass an initial test for leakage in accordance with Section 15043, Leakage, and Infiltration Testing.

H. Concrete Slope Anchors

1. General: Concrete slope anchors shall be installed where shown on the plans in accordance with Section 03300 Concrete and as shown in TCWD Standard Drawings.
2. Slope Protection: Any required surface slope protection shall be reviewed and approved in advance by the District Representative.

3. Sand Cement Slurry: At the direction of the District Representative, a one-sack sand cement slurry encasement may be used for additional slope and erosion protection. The encasement shall extend to within 1-foot of the ground surface and to the toe of slope in which the pipe is constructed.

I. Concrete Encasement

Unless shown otherwise, concrete for encasement shall be reinforced 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 as designed on the plans, or as directed by the District Representative. Encasement is by special permission from the District and in no case shall it be installed on VCP sewer pipes.

J. Cleaning

Before testing, and after each phase of development (or tract), each pipe shall be thoroughly cleaned from manhole to manhole with a sewer scrubbing ball, all debris and trash shall be removed from each manhole and disposed by the Contractor.

K. Mandrel Test for PVC Gravity Sewers

Following placement and compaction of backfill for all utilities, and prior to the placement of permanent pavement, all sewer mains shall be cleaned and mandrel 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.

1. Labor: All labor and equipment necessary to assist the District in conducting this inspection shall be furnished by the Contractor.
2. Pull Line: A 1/4-inch diameter nylon line shall be pulled from manhole to manhole to be left for use by the District in conducting the CCTV inspection.
3. Notification: Requests for sewer line inspection shall be made to the District Representative a minimum of 48-hours in advance of the requested inspection date.

L. Leakage and Infiltration Test

The pipe, manholes, and other appurtenances shall be tested for leakage and infiltration in accordance with Section 15043 Leakage and Infiltration Testing.

M. Closed-Circuit Television Inspection

1. General: In addition to the regular leakage and infiltration test, all new sewer lines shall be inspected using closed-circuit television (CCTV) equipment. The inspection shall be conducted after all utilities have been installed and prior to paving.

The inspection shall be conducted by District staff using District furnished camera equipment at no cost to the Contractor for the initial inspection. Re-inspection shall be conducted by the District, the cost of which shall be the Contractor's responsibility.

2. Labor: All labor and equipment necessary to assist the District in conducting this inspection shall be furnished by the Contractor.
3. Notification: Requests for sewer line inspection shall be made to the District Representative a minimum of 48-hours in advance of the requested inspection date.

4. Repair of Defects: Even though the sewer line may have successfully passed the leakage and infiltration tests, any defects in the line shall be repaired to the satisfaction of the District. Following repair, mandrel testing, and CCTV inspection shall again be conducted for the repaired pipeline section and these re- inspection costs shall be the sole responsibility of the contractor.

N. Final Inspection

After paving has been completed and all manholes raised to grade (where required), 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 or jetting 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 one day advance notice.

END OF SECTION

SECTION 02710: VITRIFIED CLAY PIPE FOR GRAVITY SEWERS

PART 1 - GENERAL

A. Description:

This section describes materials, testing, and installation of vitrified clay pipe (VCP) and fittings to repair existing sanitary sewer pipelines. Sewer pipeline material for any new construction shall be polyvinyl chloride (PVC) as shown in Section 02701 - Installation of Gravity Sewer Pipelines.

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. Leakage and Infiltration Testing: 15043
7. Facilities Identification: 15151
8. Standard Specifications for Public Works Construction (SSPWC), latest edition.

C. Submittals

1. Provide certificates of compliance with all standards referenced in this section to the District.
2. Provide copies of the manufacturer's required tests to the following conducted on project pipe:
 - a. Crushing test
 - b. Record of retests and rejections

D. Inverted Siphons (For Piping with Diameter of 10-inches and Under)

Inverted siphons, where not shown on the plans, will be allowed only at locations approved by the District.

PART 2 – MATERIALS

A. Vitrified Clay Pipe

1. General: All VCP and fittings shall be of one class; designated extra strength; of the best quality; vitrified; homogenous in structure; thoroughly burned through their entire thickness; impervious to moisture; sound; and free from cracks, checks, blister, broken extremities, or other imperfections.

Pipe shall be bell and spigot pipe unless otherwise specified. Pipe ends shall be square with the longitudinal axis, and sockets shall be true, circular, and concentric with the barrel of the pipe.

The thickness of the shell, the depth of the socket, and the dimension of the annular space shall be within the limits of permissible variation to dimension standards of the specifications of ASTM C700, for the size of pipe indicated on the plans.

2. Pipe Marking: All pipe or fittings shall be clearly marked with the name of the manufacturer or with a trademark and with the size and strength of the pipe as shown on the plans and as herein specified.

3. Testing: Before being used in any work under these specifications, pipe shall be subjected to and shall meet the requirements of the following hydrostatic pressure test and loading test; these tests shall be witnessed by a reputable testing laboratory.
 - a. Pipe selected for testing shall be delivered to the place and at the time designated by the testing laboratory. All costs of furnishing, transporting, and handling the pipe for testing and conducting the tests shall be borne by the contractor.
 - b. In lieu of being witnessing by a testing laboratory, a certified statement from the pipe manufacturer may be furnished stating that all prescribed tests have been made and the pipe to be used on the project has met all requirements of the specifications.
 - c. The testing laboratory shall select, at random, for testing as herein specified, no less than 1% of the number of pipe sections in each size of pipe furnished.
 - d. The specimens selected for testing shall be sound pipe having dimensions consistent with these specifications. The lot or lots from which the tests samples are taken shall be sufficient to fill the entire order for that size of pipe used in the work under the contract and, if they pass the tests, shall be so designated, and marked.
 - e. All pipe shall be subject to inspection at the factory, trench, or other point of delivery by the District representative. The purpose of the inspection shall be to cull and reject any pipe that, independent of the physical tests herein specified, fails to conform to the requirements of these specifications or that may have been damaged during transportation or in subsequent handling.
 - f. In lieu of the standard ASTM absorption test, the ASTM C301 hydrostatic pressure test for vitrified clay pipe shall be substituted. The hydrostatic pressure test shall precede the loading test by not less than one hour or more than three hours and shall be applied to all the specimens received for test in each size of pipe.
 - g. The loading test shall be the 3-edge bearing test. The loading tests shall conform to the applicable provisions of ASTM C301 and shall be applied to all specimens selected for testing, except that loading to test ultimate strength will not be required.
 - h. If all of the minimum designated percentage or number of the specimens tested meet the requirements of the test, then all of the pipe in the lot, shipment, or delivery corresponding to the sizes and classes so tested shall be considered as complying with the test. If, however, 10% or more of the specimens tested fail to meet the requirements of the test or if more than one specimen fails to meet the requirements of the test when the number to be tested is less than ten, then a second selection of pipe shall be made for that test. The number of specimens to be tested in the second selection of pipe shall be five for each specimen of the first selection that failed to meet the requirements.
 - i. If 90% or more of the specimens tested, including those first tested, meet the requirements of the test, all the pipe in the lot, shipment, or delivery corresponding to the sizes and classes so tested shall be considered as complying with that test, otherwise all pipe of these sizes and classes shall be rejected.
4. Causes for Rejection: The following imperfections in a pipe or special fitting shall be considered injurious and cause for rejection without consideration of the test results specified above.
 - a. A single crack in the barrel of the pipe will cause rejection.

- b. Surface imperfections, such as lumps, blisters, pits, or flakes, on the interior surface of a pipe or fitting shall cause rejection.
 - c. When the bore or socket of the pipe varies from a true circle more than 3% of its nominal diameter, it shall be rejected.
 - d. The pipe or fitting shall be rejected if it is designated to be straight and it deviates from a straight line more than 1/16-inch per lineal foot. The deviation shall be measured from a straight edge at a point midway between the ends of the pipe.
 - e. A joint of pipe with a piece broken from either the socket or spigot end shall be rejected.
 - f. Pipe joints that have tramp clays, grog or other foreign matter flushed permanently to the exterior or interior surface of the pipe or fittings shall be rejected.
5. Joints: All VCP fittings shall be furnished with compression joints equal to "WedgeLock" manufactured by Pacific Clay Products or "Speed Seal" manufactured by Pacific Coat Building Projects or approved equal. The compression joint on the spigot and bell ends of the pipe shall be factory made of plastisol, polyurethane elastomer, or other approved resilient element bonded onto the outside of the spigot and the inside of the bell to the pipe and molded and cured to a uniform hardness and compressibility to form a tight compression coupling when assembled. Materials for compression joints shall conform to ASTM C425.

Where pipe from different manufacturers is to be joined together, an adapter pipe with the proper matching joint on each end for the respective manufacturer or an adapter with bushing or sleeves and stainless steel bands, matching each pipe end shall be used. Hot poured joints or concrete encasement of plain end joints shall not be permitted.

6. Branches: Branches of the type shown on the plans shall be furnished with connections of the specified sizes and shall be securely and completely fastened to the barrel of the pipe in the process of manufacture. Tee branches shall have their axis perpendicular to the longitudinal axis of the pipe. Wye branches shall have their axis approximately 45 degrees (unless otherwise specified on the plans) to the longitudinal axis of the pipe, measured from the socket end. All branches shall terminate in sockets and the barrel of the branch shall be of sufficient length to permit making a proper joint.
7. Stoppers: The stoppers for all pipe 8-inches in diameter and smaller, in which a sealing component for a flexible compression-type joint is cast, shall be neoprene, polyethylene, or polyurethane. Stoppers in all other cases shall be discs of the same material as the pipe, equal in diameter to the outside of the pipe barrel and made and installed as approved by the District representative.

Neoprene stoppers shall be manufactured from a compound containing not less than 50 percent neoprene by volume, which shall be the sole elastomer. Stoppers shall not be adversely affected when exposed to the chemical and bacteriological environments normally found in wastewater sewers. When installed and braced in place in branch spurs, stoppers shall withstand a hydrostatic pressure test of 10 psi with no leakage. When unbraced, stoppers shall remain in place when subject to a maximum air pressure test of 5 psi.

8. Manufacturers: Vitrified clay pipe shall be manufactured by Gladding McBean, Pacific Clay, Mission Clay Products, or approved equal.

B. Precast Concrete Manholes

Precast concrete manholes shall conform with Section 03461, Precast Concrete Manholes and Manhole Bases.

C. Epoxy Resin

All approved saddle connections to District VCP sewer mains shall be accomplished with an approved epoxy resin. Epoxy resin shall be Epibond 157 as manufactured by Furane Plastics, Inc., WR633 A&B as manufactured by Wyndham Chemicals, Inc., EPON 828 as manufactured by Shell Chemical Corporation, or approved equal. The epoxy resin shall be used in strict accordance with the manufacturer's specifications.

PART 3 – EXECUTION

A. Related Installation Specification

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

END OF SECTION

SECTION 02715: PVC PIPE AND FITTINGS FOR GRAVITY SEWERS

PART 1 - GENERAL

A. Description

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

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 Bases: 03461
6. Leakage and Infiltration Testing: 15043
7. PVC Pressure Pipe and Fittings: 15064
8. Facilities Identification: 15151
9. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and the following.
2. Provide materials list showing material of pipe and fittings with ASTM references and grade.
3. Provide certificates of compliance with all standards referenced in this section.

D. Application

1. Sewer Laterals: PVC pipe laterals may be used as an alternative to VCP sewer lateral.
2. Limitations: The District will permit use of PVC pipe for main line sewers on industrial, commercial, and medical installations.
3. Pipe Material Transitions: Sewer pipe material shall remain constant between manholes. Pipe material transitions shall be made only at manholes.

E. Sewer Force Mains

PVC sewer force mains shall be constructed in accordance with the requirements of Section 15064, PVC Pressure Pipe and Fittings. Pipe fittings shall be lined with or made from materials that are corrosion resistant.

F. Delivery, Storage, and Handling

1. Care shall be exercised in handling, loading, unloading, and storing PVC pipe and fittings to avoid distortion, scratches, gouges, dents, and scuffing of the ends.
2. All plastic pipe and fittings shall be stored under cover in a flat, horizontal position, and protected from the sun and the elements until ready for installation.
3. Plastic pipe shall be transported in a vehicle having a bed long enough to provide support for the full length of the pipe.
4. Any length of pipe or fitting that has been damaged or distorted shall be replaced at no additional costs to the District.
5. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth, or other substances will enter the pipe or fittings.

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 35, and shall have gasketed joints.

Pipe shall be made of PVC plastic having a cell classification of 12454 as defined in ASTM D 1784. All pipe shall be of solid wall construction with smooth interior and exterior surfaces.

Fittings shall be made of PVC plastic having a cell classification of 12454.

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 and provided to the District.
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. Fittings shall be marked with raised molding markings on two sides (diametrically opposite from each other) showing the manufacturer's identification information.

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 District Representative 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 from 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. Pipe Manufacturers: Pipe shall be manufactured by CertainTeed Corporation, Diamond Plastics Corporation, J-M Eagle, Inc. North American Specialty Products, or Vinyltech Corporation or approved equal.

8. **Fittings Manufacturers:** Fittings shall be as manufactured by GPK Products, Inc., Harco Fittings, Inc. (dba Harrington Corporation and HARCO), J-M Eagle, Inc., Multi Fittings Corporation, Plastic Trends, Inc., or Tigre PVC Fittings 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 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.
- a. 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 Method B
Tensile 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

*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:
- a. **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.
- b. **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 applicable requirements of Section 02701, Installation of Gravity Sewer Pipelines.

B. Allowable Horizontal Curve Construction

Unless noted otherwise on the Plans or Specifications, horizontal curves using PVC pipe shall not have radii less than the following:

Pipe Size (inches)	Minimum Radius (feet)
6	210
8	280
10	350
12	420

END OF SECTION

SECTION 03100: CONCRETE FORMWORK

PART 1 - GENERAL

A. Description

This section describes materials and installation of concrete forms.

B. Related Specification Sections

1. Concrete Reinforcement: 03201.
2. Concrete Joints and Waterstops: 03260.
3. Concrete: 03300.
4. Concrete Finishing, Curing, and Waterproofing: 03345.
5. Painting and Coating: 09900.
6. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and the following.
2. Submit manufacturer's literature for form ties, spreaders, corner form, form coating, and bond breakers.

PART 2 - MATERIALS

A. Form Construction and Design

1. General: Forms shall be designed according to the applicable portions of the latest edition of ACI 347, "Recommended Practice for Concrete Formwork" and all applicable regulations and codes. All concrete shall be formed unless specified otherwise.
2. Observation Points: Form windows or stage forms shall be provided to allow observation at all times before concrete is poured. Formwork and placement design shall be such as to limit free fall of concrete to a maximum of 4 feet.

B. Notification: The District's Representative shall be notified a minimum of 48-hours prior to concrete placement.

C. Classes of Forms

1. Class I Forms: Smooth-surface plywood 3/4 inch minimum thickness shall be used for straight surfaces and 1/2 inch minimum thickness for curved surfaces.
2. Class II Forms: Forms shall be made of plywood in good condition, metal, or smooth planed boards free from large or loose knots with tongue and groove or ship lap joints. Forms shall be oiled.
3. Application: Class II forms shall be used for exterior concrete surfaces which are 1 foot or more below finished grade. Class I forms shall be used for all other surfaces.

D. Form Material

1. General: Forms shall be made of plywood, lumber, or steel of sufficient strength and surface smoothness to produce the specified finish. Joints, gaps, and apertures in forms shall be taped, gasketed, plugged and/or caulked so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.
2. Lumber: Lumber used in form construction shall be standard grade Douglas fir, S4S Standard Grading and Dressing Rules No. 18, West Coast Lumber Inspection Bureau. Boards in contact with concrete shall be 6 inches or more in width.

3. Plywood: Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS 1-19.

E. Form Ties

1. General: Form ties shall be located on exposed surfaces in a uniform pattern or as indicated on the drawings. Form ties shall be constructed so that the tie remains embedded in the wall except for a removable portion at each end. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch.

Form ties shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Wire ties shall not be used. Ties shall withstand all pressures and limit deflection of forms to acceptable limits.

2. Flat Bar Ties: Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit patching of the tie hole.
3. Ties with Integral Waterstops: Ties for water-holding structures or dry structures with access, such as basement access shafts or pipe galleries, which are below finished grade, shall have an integral steel waterstop that is tightly and continuously welded to the tie.
The waterstop shall be at least two times larger in area than the tie cross-sectional area and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. Ties shall be constructed to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.
4. Tapered Form Ties: Tapered form ties shall be tapered through-bolts at least 1 inch in diameter at smallest end, or through-bolts that utilize a removable tapered sleeve of the same minimum size.

F. Bond Breaker

Bond breaker shall be a non-staining type which will provide positive bond prevention, such as Williams Tilt-Up Compound, or Silcoseal 77, or approved equal.

G. Form Release Agent

Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be non-staining and nontoxic after 30 days.

For steel forms, release agent shall prevent discoloration of the concrete due to rust.

PART 3 - EXECUTION

A. Form Tolerances

1. Rejected Work: Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the District.
2. Allowable Tolerances: The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

<u>Item</u>	<u>Maximum Tolerance</u>
Sleeves and inserts - 1/4"	-1/4"
Projected ends of anchors 1/4"	0.0"
Anchor bolt setting 1/4"	-1/4"
Finished concrete, all location 1/4"	-1/4" in, 10 feet
Finished concrete, total length	+1"

The planes or axes from which the above tolerances are to be measured shall be as follows:

- a. Sleeves and inserts: Centerline of sleeve or insert.
- b. Projected ends of anchors: Plane perpendicular to the end of the anchor as located on the drawings.
- c. Anchor bolt setting: Centerline of anchor bolt.
- d. Finish concrete: The concrete surface as located on the drawings.

Where equipment is to be installed, the manufacturer's tolerances shall be complied with if more stringent than the above.

B. Form Surface Preparation

1. Cleaning: Form surfaces to be in contact with the concrete shall be cleaned of all previous concrete, dirt, and other surface contaminants prior to preparation by the applicable method below.
2. Release Agent: Wood surfaces and steel surfaces in contact with the concrete shall be coated with a release agent prior to form installation.

C. Chamfers

1. General Dimensions: 3/4-inch bevels shall be formed at concrete edges except those on top of walls and elevated slabs and beams. Edges at top of walls, slabs, and beams shall be rounded to a 3/4-inch radius.
2. Exterior Corners: Exterior corners in concrete members shall be provided with 3/4-inch chamfers. Reentrant corners in concrete members shall not have fillets, unless otherwise shown on the drawings.

D. Form Placement

1. General: Forms shall be provided with adequate means for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. The forms shall be tight and braced in order to prevent movement and the loss of mortar and fines during placing and vibration of the concrete.
2. Inspection Openings: Cleanout and inspection openings shall be provided at the bottom of each lift of forms. There shall be one 12-inch-wide by 18-inch-high opening every 7 feet at the bottom of each lift of forms.
3. Allowable Embedment of Form Tie in Concrete: No part of any form tying device other than metal shall be embedded in the concrete.
4. Taper Tie Orientation: The large end of taper ties shall be located on the "wet" side of the wall.
5. Prevention of Spalling: Only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal shall be allowed.
6. Non-formed Concrete: Surfaces of concrete members shall be formed except where placement of the concrete against the ground as shown on the drawings.

The dimensions of concrete members shown on the drawings shall apply to formed surfaces, except where otherwise indicated. At least 2 inches of concrete shall be added where concrete is placed against trimmed undisturbed ground in lieu of forms.

Placement of concrete against the ground shall be limited to footings and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

E. Form Reuse

Only forms which maintain a uniform surface texture on exposed concrete surfaces shall be used. Light sanding shall be applied between uses to obtain uniform texture. Unused tie rod holes with corks, shaved flush, and sandpapered on the concrete surface side.

Other than filling tie rod holes, forms shall not be patched except in the case of Class II forms. Metal patching discs shall not be used on Class I forms.

F. Form Removal & Timing

1. Protection of Concrete Surfaces: Means shall be provided for removing forms without injury to the surface of the finished concrete.
2. Form Placement Duration: Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Supports shall not be removed and reshored.

The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing shall be removed:

Sides of footings and Encasements	24 hours
Walls not supporting load beams	48 hours
Girders, and similar members	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slab, beams, and girders	Until concrete reaches 28-day strength
Wall bracing	Until top or roof slab concrete reaches 2,500 psi

3. Form Placement Duration in Cold Weather: Forms shall not be removed from concrete which has been placed with outside air temperature below 50° F without first determining if the concrete has properly set without regard for time. Heavy loading shall not be applied to green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

G. Formed Openings

Openings shall be of sufficient size to permit final alignment of the items within them without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure watertightness around openings so formed.

Openings shall be provided with continuous keyways with waterstops where required, and a slight flare to facilitate grouting and the escape of entrained air during grouting.

Formed openings shall be provided with reinforcement as indicated in the typical structural details as part of the contract documents. Reinforcing shall be at least 2 inches clear from the opening.

H. Embedded Items

Anchor bolts and other embedded items shall be set accurately and held securely in position in the forms until the concrete is placed and set. All special castings, channels, or other metal parts that are to be embedded in the concrete shall be checked prior to and again after concreting.

All nailing blocks, plugs, and strips necessary for the attachment of trim finish, and similar work shall be checked prior to concreting.

I. Pipes and Wall Spools Cast in Concrete

1. Fittings Cast in Formed Concrete Structures: Wall spools, wall flanges, and wall anchors shall be installed before placing concrete. Wall spools or anchors shall not be welded, tied, or otherwise connected to the reinforcing steel.
2. Pipe Encasement: Pipe and fabricated fittings to be encased in concrete shall be supported on concrete piers or pedestals. Concrete supports shall be carried to firm foundations so that no settlement occurs during construction.

END OF SECTION

SECTION 03201: CONCRETE REINFORCEMENT

PART 1 - GENERAL

A. Description

This section describes materials, testing, and installation of reinforcing steel for concrete.

B. Related Work Specified Elsewhere

1. Concrete Formwork: 03100.
2. Concrete: 03300.
3. Standard Specifications for Public Works Construction (SSPWC), latest edition.

C. Submittals

1. Shop drawings shall be submitted in accord with the General Provisions and the following.
2. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, then provide a laboratory test to prove yield strength and bending.
3. Submit bending lists and placing drawings for all reinforcing steel. Each bending list submitted shall be complete, including corner bars as required. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accord with the details shown on the plans and as may be specified elsewhere in the contract documents.

PART 2 - MATERIALS

A. Reinforcing Steel

1. General Requirements: Reinforcing steel shall be new material conforming to ASTM A 615, Grade 60, and shall be fabricated in accord with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute.
 - a. Reinforcing steel shall be bent while cold.
 - b. Reinforcing steel, which is to be welded, shall conform to ASTM A 706, Grade 60.
2. Delivery: Reinforcing steel shall be delivered to the site bundled and with identifying tags.

B. Welded Wire Fabric

Welded wire fabric shall conform to ASTM A 185.

C. Tie Wire

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

D. Bar Supports

Bar supports in beams and slabs exposed to view after form stripping shall be non-metallic and of sufficient strength to properly secure the reinforcement bars during the placement of concrete. Concrete supports shall be used for reinforcing in concrete placed on grade.

PART 3 - EXECUTION

A. Placing

1. General: Reinforcing steel shall be placed in accord with American Concrete Institute (ACI) and the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute (CRSI).

2. Cleaning: Reinforcing steel, before being positioned, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement steel shall be cleaned by abrasive sandblasting to remove mortar, oil, dirt, excessive mill scale, scabby rust, and coatings of any character that would destroy or reduce the bonding capability.
3. Bending: Reinforcing steel shall not be straightened or reshaped in a manner that will injure the material.
 - a. Bars with bends not shown on the drawings shall not be used.
 - b. Bars that are partially embedded in concrete shall not be bent.
4. Reinforcing Steel Positioning: Reinforcing steel shall be positioned in accord with the drawings and secured by using annealed wire ties or clips at inter-sections and support by concrete or metal supports, spacers, or metal hangers.
 - a. Metal clips or supports shall not come in contact with the forms.
 - b. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
 - c. Bars in addition to those shown on the drawings, which may be found necessary or desirable for the purpose of securing reinforcement in position, may be provided at no additional expense to the District.
5. Clearance and Cover: Reinforcing steel shall be placed a minimum of 2 inches clear of any metal pipe or fittings. Unless otherwise indicated on the Plans, reinforcement shall be placed so as to provide the thickness of protective concrete covering as indicated on the Typical Details. If not indicated on the Plans or Standard Drawings, protective covering shall be in accord with latest edition of ACI 318.

B. Splices

Unless otherwise shown, splices in adjacent horizontal bars shall be staggered 48 bar diameters.

END OF SECTION

SECTION 03260: CONCRETE JOINTS AND WATERSTOPS

PART 1 - GENERAL

A. Description

This section describes materials, testing, and installation of construction and expansion joints, PVC waterstops, premolded joint filler, joint sealant, and bond breaker tape.

B. Related Work Specified Elsewhere

1. Concrete Formwork: 03100
2. Concrete Reinforcement: 03201
3. Concrete: 03300
4. Concrete Finishing, Curing, and Waterproofing: 03345
5. Standard Specifications for Public Works Construction, latest edition

C. Submittals (for Contracts between District and Contractor)

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's literature, catalog data, and statement of compliance with referenced standards and specifications.
3. Submit material samples of PVC waterstops.

PART 2 - MATERIALS

A. PVC Waterstop

1. Material: Waterstops shall be extruded from a PVC compound and shall be flat-strip ribbed type as manufactured by Sika Corporation, or J P Specialties, Inc or Kirkhill Rubber Company or approved equal. Waterstop shall comply with latest edition of the U.S. Corps of Engineers Specification CRD- C-572.

The basic resin of the material shall be PVC resin plastic, containing nonmigrating-type plasticizers, and shall not be appreciably affected by alkali, acids, or saltwater. All material shall be virgin material. The use of reworked PVC or other substitute will not be permitted.

2. Fittings: Waterstops shall be supplied and installed in accordance with the dimensions shown on the drawings and shall be made continuously by means of factory made fittings.

B. Joint Sealant for Concrete Structures

The joint sealant shall be a two-part, gray, nonstaining, non-sagging, polyurethane sealant, which cures at ambient temperature to a firm, flexible, tear-resistant rubber. The sealer shall be resilient and have excellent recovery characteristics after extended periods of compression or elongation. Sealant shall be Sikaflex 2C NS manufactured by Sika Corporation.

C. Neoprene Rods for Precast Slab Joints

Neoprene rods shall be the diameter shown on the plans and shall be 50 durometer for hardness of material.

D. Premolded Joint Filler

Joint filler shall be performed, non-extruded type, constructed of closed-cell neoprene conforming to ASTM D 1752, Type I, as manufactured by W. R. Meadows Company or approved equal.

E. Neoprene Bearing Pads

Neoprene bearing pads for precast concrete slabs shall be of the size, thickness, and length shown on the plans and shall be 60 durometer for hardness of material.

F. Bond Breaker Tape

Bond breaker tape shall be an adhesive backed glazed butyl or polyethylene, which adheres to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

PART 3 – EXECUTION

A. PVC Waterstops

1. Installation: Waterstops shall be installed in construction and expansion joints in hydraulic structures or where shown on the drawings. Forms for construction joints shall be constructed in such a manner as to prevent damage to waterstops. Waterstops shall be held securely in position in the construction joints by wire ties, continuous bars, and rings as indicated. Waterstops shall be properly heat spliced at ends and intersections to ensure continuity.
2. Field Splices: Field splices shall be made with a thermostatically controlled heating iron in conformance with the manufacturer's recommendations. At least 10 minutes shall be allowed before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80% of the unspliced materials.

B. Construction Joints

1. General: Construction joints shall be provided where shown on the drawings. In case of emergency, additional construction joints shall be placed. An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.

At the District's sole discretion, the slab of concrete placement may be rejected and be removed entirely. The costs related to such removal and replacement shall be borne by the contractor. All emergency construction joints are subject to final approval by the District.
2. Construction Joint Keyways: Construction joints shall be keyed, if indicated on the drawings. Keyways shall be formed by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25% of the area of the section.
3. Reinforcing Dowels: When an emergency joint is necessary, the joint shall be keyed and reinforcing dowels shall be furnished and placed across the joint.

These dowels shall be embedded 60 bar diameters into each side of the joint. Size and number of dowels shall match reinforcing in the member. Furnishing and placing such reinforcing steel shall be done at no additional costs to the District.
4. Joint Preparation for Adjacent Pour: After the pour has been completed to the construction joint and the concrete has hardened, the entire surface of the joint shall be thoroughly cleaned of surface laitance, loose or defective concrete, and foreign material, and clean aggregate shall be exposed by sandblasting the surface of construction joints before placing the new concrete. Horizontal construction joints shall be covered with mortar.

Mortar shall be spread uniformly and worked thoroughly into all irregularities of the surface. The mortar shall be flowable and shall consist of sand, water, and a minimum of 12 sacks of cement per cubic yard. A positive measuring device, such as a bucket, or other device shall be provided that will contain only enough mortar for depositing in one place in the wall or column to ensure that portion of the form does not receive too much mortar.

Mortar shall not be deposited from pump hoses or large concrete buckets unless inspection windows close to the joint are available to allow visual measurement of mortar thickness and means for mortar removal is available for removal of any excess. The water cement ratio of the mortar in place shall not exceed that of the concrete to be placed upon it. The consistency of the mortar shall be suitable for placing and working.

C. Installation of Premolded Joint Filler

Premolded joint filler shall be installed in joints accurately as shown. Joint filler shall be attached to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

D. Installation of Joint Sealants

1. Joint Cavity Preparation: Immediately before installing the joint sealant, the joint cavity shall be cleaned by sandblasting or power wire brushing. Bond breaker tape shall be installed per manufacturer's instructions.
2. Sealant Application: After the joints have been prepared as described above, the joint sealant shall be applied. Primer, if required, and joint sealant shall be applied only with the equipment and methods recommended by the joint sealant manufacturer. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
3. Finishing: Masking tape shall be applied along the edges of the exposed surface of the exposed joints. Joints shall be troweled smoothly with a tuck pointing tool wiped with a solvent as recommended by the sealant manufacturer.
4. Cleanup: After the sealant has been applied, masking tape and any sealant spillage shall be removed.

E. Installation of Neoprene Rods in Precast Slab Joints

Neoprene rods shall be forced down to the bottom of the shaped joint prior to placing dry pack in the joint.

F. Installation of Neoprene Bearing Pads

Neoprene bearing pads shall be placed in the indicated position on the concrete walls and glued to the wall with suitable adhesive.

END OF SECTION

SECTION 03300: CONCRETE

PART 1 - GENERAL

A. Description

This section describes materials, mixing, and placing of concrete and grout.

B. Related Work Specified Elsewhere

1. Concrete Formwork: 03100
2. Concrete Reinforcement: 03201
3. Concrete Joints and Waterstops: 03260
4. Concrete Finishing, Curing, and Waterproofing: 03345
5. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

C. Submittals (for Contracts between District and Contractor)

1. Shop drawings shall be submitted in accordance with the General Provisions, ACI 318 and as specified herein.
2. Mix design with proof of design by laboratory for a 7-day and 28-day compressive tests, or test reports of 7-day and 28-day compressive tests of the mix where the same mix was used on two (2) previous projects, shall be submitted in writing for review and approval by the District at least 21 calendar days before placing of any concrete.
3. Certificate that cement used in the concrete complies with ASTM C150 and these specifications shall be submitted.
4. Aggregates: Certificate of compliance with ASTM C 33 shall be provided. Weathering region limits of coarse aggregates: severe, moderate, or negligible shall be stated. Basis of determining that potential reactivity is negligible shall be stated.
5. Ready Mix Concrete: Delivery tickets or weighmasters certificate per ASTM C 94, including weights of cement and each size aggregate, volume of water in the aggregate, and volume of water added at the plant shall be provided. The volume of water added on the job shall be written on the ticket or certificate.
6. Concrete admixtures: Manufacturer's certificate of compliance with these specifications shall be provided.
7. Epoxy Bonding Compound: Manufacturer's specific instructions for use shall be provided.
8. Non Shrink Grout: Manufacturer's certificate of compliance with these specifications and specific instructions for use shall be provided.
9. Placement Drawings:
 - a. Composite concrete placement drawings for each individual placement shall be submitted, indicating location and sizes of pipe sleeves, conduits, inserts, relets, anchor bolts, openings, recesses, construction joints, expansion joints, and other embedded items. Placement drawings shall be coordinated with drawings. Placement drawings shall show where each mix will be used.
 - b. Each drawing shall show only one placement. Match-lines shall reference adjoining placement drawings, and an index shall be provided on each sheet showing the location of the placement in the overall structure.
 - c. The Contractor shall submit a copy of the sequence of placement in advance of actual placement.

PART 2 - MATERIALS

A. Cement

Cement shall conform to ASTM C150, Type II or Type V. The content of tricalcium aluminate shall not exceed 6% and the content of alkalis shall not exceed 0.6%.

B. Aggregates

Aggregates shall comply with ASTM C33 and shall be free from any substances that will react with the cement alkalis.

C. Water and Ice

Water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and any other impurities which might reduce the strength, durability, and quality of the concrete mix shall be used in the concrete mix.

D. Color Additive

For exterior electrical duct concrete encasements, a color additive shall be used for identification purposes.

Color additive shall be: brick red "Colorful," as manufactured by Sika Corporation; "Red" or for Contracts between District and Contractors or approved equal.

The color additive shall be added while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

E. Concrete Admixtures

1. Air-Entraining Admixture: Concrete may contain an air-entraining admixture which shall conform to ASTM C260, except it shall be nontoxic after 30 days and shall contain no chlorides. Admixture shall be Grace Construction Products, Master Builders, Sika, or for contracts between District and Contractor, approved equal.
2. Water-Reducing Admixture: Concrete may contain a water-reducing admixture which shall conform to ASTM C494, Type A or Type D, except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixture. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixture shall be GCP Applied Technologies, Master Builders Solutions, Pozzolith 400, or Sika Corporation, or for contracts between District and Contractor, or approved equal.
3. Admixture Restrictions: Accelerating water-reducing admixtures or any other type of admixture that contains chlorides or other corrosive elements **shall not** be used in any concrete.
4. High-Early Strength Concrete: Admixtures for high-early strength concrete shall be non-chloride admixtures which meet the requirements of ASTM C 494. Acceptable products are GCP Applied Technologies, Master Builders Solutions, or Sika Corporation, or District approved equal. Concrete shall reach 2,500 psi compressive strength within eight (8) hours of being placed.

F. Non Shrink Grout

Non-shrink grout shall conform to the Army Corps of Engineers Specification for Non Shrink Grout, CRD-C588-78, ASTM C1107, and to these specifications. Use a non gas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency.

Grout shall be Sika Corporation, Master Builders Solutions - Master Flow 713, or for contracts between District and Contractor, or approved equal. All components shall be inorganic.

G. Ordinary Type Grout (Dry Pack)

Ordinary type grout shall consist of one part Portland Cement to two parts sand (100% passing a No. 8 sieve). Sufficient water shall be added to produce damp formable consistency.

H. Epoxy Bonding Compound

Manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions shall be provided. Bonding compound shall be Concresive 1001 LPL, Adhesive Engineering Company, Sikadur Hi-Mod by Sika Chemical Corporation or for contracts between District and Contractor, or, approved equal.

I. Concrete Mix Design

1. General: Concrete mix design shall conform to ASTM C94 and ACI 318, except as modified by these specifications.
2. Fly Ash: Fly ash shall not be used in the mix as a partial substitute for cement.
3. Air Content: Air content as determined by ASTM C 231 shall be 4% $\pm$ 1%.
4. Water-Cement Ratio: Maximum water-cement ratio for Class A concrete shall not exceed 0.44 by weight.
5. Classes: Classes of concrete shall be used as described in the following table:

Class	Type of Work	28-Day Compressive Strength (psi)	Minimum Cement Content (lbs. per CY)
A	All curbing, sidewalks, manhole bases, thrust blocks, and structures unless specified elsewhere.	3,250	560 = 6 sack
B	Where shown on plans or TCWD std. drawings	2,500	470 = 5 sack
C	Fill for structure foundations, cradles, supports across pipe trenches, anchors, and miscellaneous unreinforced concrete	2,000	376 = 4 sack

6. Slump: Slump shall be measured in accordance with ASTM C143. Slump shall be as follows:

Slab on grade or heavy sections	3-inch maximum wider (in plan view) than 3 feet.
Footings, walls, suspended	4-inch maximum slabs, beams, and columns.

Concrete shall be proportioned and produced to have a maximum slump as shown. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit.

Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

7. **Aggregate Size:** Aggregate size shall be 1-inch maximum for slabs and sections that are 8 inches thick and less. Aggregate size shall be 1 1/2-inch maximum for all larger slabs and sections. For manhole bases maximum aggregate size, refer to Section 03461 Precast Concrete Manholes and Bases. Combined aggregate grading shall be as shown in the following table:

Maximum Aggregate Size Percentage Passing by Weight		
Sieve Sizes	1 1/2-inch	1-inch
2"	100	---
1 1/2"	90-100	100
1"	50-86	95-100
3/4"	45-75	77-93
3/8"	38-55	50-70
No. 4	30-45	39-51
No. 8	23-38	31-41
No. 16	17-33	22-32
No. 30	10-22	12-22
No. 50	4-10	3-15
No. 100	1-3	0-5
No. 200	0-2	0-2

8. **Pumped Concrete Design Mix:** Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void volume of the coarse aggregate.

J. Workability

1. **General:** Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive spading and without permitting the materials to segregate or free water to collect on the surface. The proportions shall be adjusted to secure a plastic, cohesive mixture, and one which is within the specified slump range.
2. **Aggregate:** To avoid unnecessary changes in consistency, aggregate shall be obtained from a source with uniform quality, moisture content, and grading. Materials shall be handled in such a manner that variations in moisture content will not interfere with production of concrete of the specified degree of uniformity and slump.

PART 3 - EXECUTION

A. Site-Mixed Concrete

1. **General:** Site-mixed concrete shall conform to ACI 304 as modified by these specifications.
2. **Batching and Mixing Equipment:** A batch-type mixer shall be used that is capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and discharging the mixture without segregation. Supporting equipment shall be used that can accurately proportionate the cement, the coarse and fine aggregates, the admixtures, and the water which enters the mixing drum. Cement and aggregate shall be proportioned by weight.

Each entire batch shall be discharged before recharging. The volume of the mixed materials per batch shall not be allowed to exceed the manufacturer's rated capacity of the mixer.

3. Mixing Time: Mixing time shall be as follows:
 - a. For mixer of a capacity of 1 cubic yard or less, one and one-half minutes after batching is completed.
 - b. For mixers of capacities larger than 1 cubic yard, one and one-half minutes plus one-half minute for each additional 1/2-cubic-yard capacity or fraction thereof in excess of 1 cubic yard.
 - c. The mixer shall revolve at a uniform rate as specified by the manufacturer for the mixing equipment.

B. Ready-Mixed Concrete

1. General: Ready-mixed concrete shall conform to ASTM C94 as modified by these specifications.
2. Haul Time Requirements: The haul time of ready-mixed concrete shall be limited so that the specified slump is attained without the onsite addition of water, which may cause the mix design water-cement ratio to be exceeded.

In no case shall the time between the time when the concrete is batched, and it is placed exceed 90 minutes. When haul time is excessive, truck-transported, dry-batched concrete shall be used and mixed on the jobsite. Partially hardened concrete shall not be retempered.

C. Placing Concrete

1. General: Concrete placement shall conform to ACI 304 as modified by these specifications.
2. Placement Sequence: The sequence of concrete placement shall be coordinated in advance of actual placement to ensure that construction joints will occur only as designed on the plans. Alternate sections of concrete walls and slabs shall be placed monolithically. Concrete for walls and slabs shall not be placed until seven (7) days after placement of concrete for adjacent walls and slabs.
3. Notification: The District Representative shall be notified at a minimum of 48-hours prior of readiness, not just intention, to place concrete in any portion of the work. This notification shall be such time in advance of the operation as the District Representative deems it necessary for him to observe the preparations at the location of the proposed concrete placing.

All forms, steel, screeds, anchors, ties, inserts and other items to be embedded shall be in place before notification of readiness is given to the District Representative.

4. Equipment Readiness: Sufficient primary and backup equipment shall be scheduled for continuous concrete placement and anticipate what actions will be taken during any and all interruption. Extra concrete vibrators shall be provided. Concrete vibrators shall be tested the day before placing concrete.
5. Removal of Water from Areas to Receive Concrete: Concrete shall not be placed until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes or other means and carried out of the forms, clear of the work.

Concrete shall not be placed underwater, nor shall it be placed in still water and be allowed to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the newly deposited concrete in such manner and of such velocity that will damage the surface finish.

6. Moisture Barriers: Where a moisture barrier is installed, the moisture barrier shall not be punctured by stakes or any other concrete accessories.
7. Concrete Pours and Freefall: Concrete shall be deposited at or near its final position to avoid segregation caused by rehandling or flowing. Concrete shall not be deposited in large quantities in one place to be worked along the forms with a vibrator. Concrete shall not be dropped freely into place from a height greater than 4 feet. Tremies shall be used where the drop could exceed these limits.
8. Consolidation of Concrete: Mechanical vibrators shall be used while placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture.

Vibrators shall be of the high-frequency internal type, and the number in use shall be able to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms.

In all cases, at least two (2) vibrators shall be available at the site. External vibrators shall be used for consolidating concrete only when the concrete is otherwise inaccessible for adequate internal consolidating.

9. Protection of Concrete: Concrete shall not be placed during rainstorms. Concrete placed immediately before rain shall be protected to prevent rainwater from coming in contact with it. Sufficient protective covering shall be kept on hand at all times for this purpose. Any concrete damaged by rainwater shall be replaced by the contractor at no additional cost to the District.

D. Concrete Testing (For Contracts between the District and Contractor)

1. General: Strength tests shall be performed on the concrete by the District Representative as follows:
 - a. Mold and cure five concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Mold and cure the cylinders in accordance with ASTM C31.
 - b. Test cylinders in accordance with ASTM C 39. Test one (1) cylinder at 7 days for information. Test one (1) cylinder at 14 days for information. Test two (2) cylinders at 28 days for acceptance. Hold one (1) cylinder for verification.
 - c. The test results shall be the average of the strengths of the two (2) cylinders tested at 28 days. If a one cylinder test manifests evidences of improper sampling, molding, or testing, other than low strength, discard it and use the fifth cylinder for the test result.
 - d. Determine slump of the concrete using ASTM C143 for each strength test sample and as required to establish consistency.
 - e. Determine air content of the concrete using ASTM C231 for each strength test sample and as required to establish consistency.

2. Notification and Handling of Samples: To facilitate testing and inspection:
 - a. The District shall be advised in advance (at least 7 days) of concrete placing operations to allow for completion of quality tests.
 - b. Labor necessary to assist the District Representative in obtaining and handling samples at the project shall be furnished by the Contractor.
 - c. Facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C31 shall be provided and maintained by the Contractor for the sole use of the District.
3. Requirements for Attainment of Compressive Strength: Concrete shall attain the 28-day strength as specified below:
 - a. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength.
 - b. Not more than 10% of the tests shall be less than the specified 28-day strength.
 - c. No test shall be less than 90% of the specified 28-day strength.
4. Failure to Attain Specified Strength: If the 28-day tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one (1) set of three (3) cores from each area may be taken as selected by the District Representative and in accordance with ASTM C42.

If the average compressive strength of the set of three concrete cores fails to equal 90% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective and shall be removed and replaced by the contractor and at no cost to the District. Costs of coring, testing of cores, and all required repairing pertaining thereto shall be the responsibility of the Contractor.

E. Pumping Concrete

1. Equipment Capacity Requirements: Pump size shall be determined by the rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete.

Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:

1-inch-max aggregate:	2 inches min ID
1 1/2-inch-max aggregate:	4 inches min ID
2. Disallowance of Aluminum Pipe: Aluminum pipes **shall not** be used for delivery of concrete to the forms.
3. Priming: Before pumping is started, the delivery pipe or hose shall be primed by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Mortar shall be pumped to waste, not deposited in the forms, and disposed by the contractor.

F. Hot Weather Requirements

1. General: During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 305R-20. There shall be no additional reimbursement for costs to the contractor incurred for placing concrete in hot weather.

2. Cooling Methods: When the weather is such that the temperature of the concrete as placed would exceed 90°F, ice, or other effective means of cooling the concrete during mixing and transportation shall be used so that the temperature of the concrete as placed will not exceed 90°F.
3. Prevention Against Early Setting of Concrete: Precautions shall be taken when placing concrete during hot, dry weather to eliminate early setting of concrete.

This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the day, and the proper and timely application of specified curing methods.

G. Cold Weather Requirements

1. General: Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306R-16. There shall be no additional reimbursement for costs to the contractor incurred for placing concrete during cold weather.
2. Heated Mixing Water: When the temperature of the surrounding atmosphere is 40°F or is likely to fall below this temperature, the mixing water shall be heated to, but not exceed, 140°F. The heated water **shall not be allowed** to come in contact with the cement before the cement is added to the batch.
3. Temperature Requirements: When placed in the forms during cold weather, the concrete temperature shall be maintained at not less than 55°F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.
4. Curing Requirements: The air and the forms in contact with the concrete shall be maintained at temperatures above 40°F for the first five (5) days after placing, and above 35°F for the remainder of the curing period. The Contractor shall provide thermometers to indicate the ambient temperature and the temperature 2 inches inside the concrete surface.

H. Bonding to Existing Concrete

Existing concrete to which new concrete is to be bonded shall have the contact surfaces coated with epoxy bonding compound. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

I. Grouting Machinery Foundations

During placement of machinery, concrete shall be blocked out or finished off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the drawings. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable non shrink grout.

END OF SECTION

SECTION 03345: CONCRETE FINISHING, CURING, AND WATERPROOFING

PART 1 - GENERAL

A. Description

This section describes materials and methods of concrete finishes, curing, repair of defects, surface protection, and waterproofing.

B. Related Work Specified Elsewhere:

1. Concrete Formwork: 03100
2. Concrete Reinforcement: 03201
3. Concrete Joints and Waterstops: 03260
4. Concrete: 03300
5. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals (for Contracts between District and Contractor)

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Curing Compound: Submit manufacturer's statement of compliance with these specifications and recommended coverage to meet or exceed the specified tests. Submit manufacturer's application instructions.

PART 2 - MATERIALS

A. Curing Compound

1. General: Curing compound shall conform to ASTM C309, Type 2, Class B, and shall be compatible with required finishes and coatings.
2. Manufacturers: Curing compound shall be: Kure-N-Seal manufactured by BASF or Super Diamond Clear 350 manufactured by Euclid Chemical Co or for contracts between District and Contractor, or, approved equal.

B. Mortar for Repair of Concrete

Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted, and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume.

The quantity of mixing water shall be no more than necessary for handling and placing.

C. **Roof Membrane for Underground Reservoirs**

1. **General Requirements:** The reinforced membrane shall be a compounded Hypalon rubber elastomer-coated fabric conforming to the following requirements:

Property	Std/Test Method	Minimum Specification
Thickness: Total, overall Minimum over scrim	ASTM D751 Optical Method	41 mils 11 mils
Tensile Properties (each direction): Breaking strength Fabric Membrane rupture Elongation at break Fabric Membrane rupture	ASTM D751 Grab Method	90 lbs. 120 lbs. 15% 150%
Tear Propagation	ASTM D 751 Tongue Tear (8" X 8" sample)	16 lbs.
Hydrostatic Resistance	ASTM D 751 Method A Procedure 1	140 psi
Puncture Resistance	FTMS D5635 Method 2031	180 lbs.
Bonded Seam Strength	ASTM D751 Modified (12 in./min)	96 lbs.
Ply Adhesion	ASTM D413 Machine Method Type A (12 in./min)	10 lbs./in- width (or film tearing bond)
Ozone Resistance	ASTM D1149 1/8" bent loop, 100 pphm, 104°F, seven days	No cracks at 7X magnification
Low Temperature	ASTM D2136 1/8" mandrel, four hours at -40°F	Pass

2. **Cover Material and Supporting Fabric:** The thermoplastic elastomer cover material shall be manufactured totally by calendaring, with each ply of rubber laminated to the next ply through the openings in the scrim weave to produce a pinhole-free construction.

The open-weave polyester supporting fabric (scrim) shall have a 16 X 8, 2:1 leno weave 140 warp/250 fill denier with an 8 X 8-250d apparent construction. The two plies of supporting fabric shall be totally encapsulated within three plies of rubber, giving a five-ply construction of nominal 45-mil thickness. Exposed fabric or indication of delamination will not be permitted.
3. **Cover Material Elastomer:** The thermoplastic elastomer cover material shall be manufactured from a synthetic rubber compound designed to contain Hypalon Type 45 synthetic rubber as the sole elastomer and formulated in accordance with the recommendations of E. I. DuPont Company.
4. **Sheet Size:** Basic calendared sheet size shall be 54-inch-minimum width and fabricated at the membrane manufacturer's plant into one sheet to fit membrane size identified on the drawings.

5. Color: The material shall be furnished with the exposed side black. The color shall be "built in" to the material.

D. Protective Cover For Roof Membranes

Protective cover shall be 1/2-inch thick fiberboard treated to resist decay from earth materials and groundwater. Provide largest size sections that are available.

E. Crystalline Waterproofing

Waterproofing shall be "XYPEX" crystalline waterproofing as manufactured by Cystallization Co.

PART 3 - EXECUTION

A. Concrete Finishes

Concrete surfaces shall be completed in accordance with the following schedule:

Concrete Finishes		
Finish Designation	Applicable Surfaces	Requirements
E-1	Exposed edges of slabs, floors, footings, and tops of walls.	Shall be finished with a 3/4-inch-radius edger, where chamfer is not indicated.
F-1	Exterior walls exposed to water or groundwater, and interior of tank walls.	Concrete surface defects shall be repaired, fins exceeding 1/4-inch in height shall be chipped or rubbed off, depressions 1/4-inch or deeper shall be filled, and form-tie holes shall be filled.
F-2	Walls, structures, or building walls exposed to view. Underside of formed floors or slabs.	In addition to repairs of Finish F-1, depressions, and air holes 1/4-inch or deeper shall be opened by whip-blasting and filled with mortar. Surfaces shall be dampened and a slurry consisting of one part cement and one and one-half part sand by damp loose volume shall be spread over the surface with clean burlap pads or sponge rubber floats. Any surplus shall be removed by scraping and then rubbing with clean burlap.
S-1	Non-water bearing slabs and floors	Non-water bearing slabs and floors shall receive a light broom finish.

B. Finishing of Formed Surfaces

1. Curing Requirement: Surfaces shall be water cured until finishing and repairing are completed.
2. Repair of Surface Defects: Immediately after forms are removed, fins and irregularities shall be removed by grinding or rubbing. Depressions deeper than specified shall be filled with mortar, and form-tie holes filled.
3. Form-Tie Holes: Form-tie holes shall be reamed with toothed reamers until surface of hole is rough and clean. Surface shall be coated with epoxy bonding compound and filled with mortar. Tapered form-tie holes shall be finished as follows:
 - a. Form-tie holes shall be sandblasted and blown clean prior to filling.
 - b. A rubber plug, with one end open, shall be driven to the center of the hole. Plug size shall be larger in diameter than the diameter of the hole at the center of the wall.
 - c. The entire annular surface of the hole shall be coated with epoxy prior to filling with mortar. Epoxy shall be applied in accordance with manufacturer's instructions.
 - d. Each side of hole shall be filled with mortar. Mortar shall be applied to the "wet" side of the wall first. Mortar shall be solidly consolidated into the hole.

- e. The District Representative shall be notified in advance of the form-tie hole filling schedule.

C. Repair of Surface Defects

1. Repair Limits: Honeycombed and other defective concrete shall be removed down to sound concrete. Edges shall be perpendicular to surface. Surfaces to receive repair shall be sandblasted.
2. Bonding Compound: Sandblasted surface shall be coated with epoxy bonding compound.
3. Mortar Placement: Mortar shall be placed in layers having a compacted thickness of 3/8-inch. The surface of each layer shall be scratched to promote bonding with next layer. Finish repair shall match adjacent concrete, and cure as specified.
4. Repair of Large Defective Areas: Defective areas of more than 1 foot square and deeper than the reinforcing steel shall be repaired as above, with the exception that the area shall be filled with pneumatically applied concrete.

D. Curing

1. Allowable Curing Methods: Concrete surfaces shall be cured by water curing or by use of sprayed curing compound at the Contractor's option. Where wooden forms are used, the forms shall be wet immediately before concreting and keep moist by sprinkling until removed. All exposed surfaces of formed concrete shall be kept moist until curing compound is applied.
2. Curing Compound Method
 - a. Concrete shall cure for not less than 10 days after placement and before removing forms.
 - b. The surface shall be sprayed with two coats of liquid curing compound. Curing compound shall be applied in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly. A second coat shall be applied at 90 degrees to the direction of spray for the first coat.
 - c. Curing compound shall be applied immediately after completion of the finish on unformed surfaces, and within two (2) hours after removal of forms on formed surfaces.
 - d. Formed surfaces shall be repaired within the said two-hour period; provided, however, that any such repairs which cannot be made within the said two-hour period shall be delayed until after the curing compound has been applied.
When repairs are to be made to an area on which curing compound has been applied, the area shall first be sandblasted to remove the curing compound, then repaired.
 - e. Wherever curing compound may have been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, the curing compound shall be removed entirely by sandblasting prior to the placing of new concrete.
 - f. Care shall be taken to avoid damaging the seal during the curing period. Damaged or broken seals shall be repaired immediately by the application of additional curing compound and at no additional cost to the District.

E. Roof Membrane

1. Factory Seams: All factory seams for either fabrication or repairs shall provide a minimum overlap of the reinforcing fabric of 1 inch and shall extend to the edge of the sheet so that no loose edge is present on the top side of the sheet.

A loose edge on the underside of the sheet is permissible as long as the 1-inch-minimum overlap of the reinforcing fabric is maintained, and a minimum of 1-inch bonded seam is maintained within the overlap.

2. Field Seams: Field seam, if required, shall provide a minimum overlap of the reinforcing fabric of 2 inches and shall extend to the edge of the sheet so that no loose edge is present on the top side of the sheet. A loose edge on the underside of the sheet is permissible as long as the 2-inch-minimum bonded overlap of the reinforcing fabric is maintained. A nominal 6-inch overlap of liner panels shall be allowed to keep dirt out of the field seams.
3. Surface Preparation: Concrete surfaces that are to receive Hypalon adhesive shall be thoroughly cleaned. Adhesive shall be applied in accordance with manufacturer's recommendations.

F. Protective Cover for Roof Membranes

Boards shall be butted tightly and shall cover the entire membrane surface and overlap beyond the end of the membrane as indicated. Suitable adhesive shall be applied to the prepared concrete surface at the ends of the boards.

G. Crystalline Waterproofing

1. General: Preparation of and application to concrete surface shall be in accordance with manufacturer's recommendations.
2. Application Rate: Waterproofing shall consist of one coat of XYPEX "Concentrate" applied at the rate of 1-1/2 pounds per square yard of concrete surface, followed by one coat of XYPEX "Modified" applied at the rate of 1-1/2 pounds per square yard of concrete surface.
3. Areas to be Waterproofed: Waterproofing shall be applied to all walls from the top of the footing to top of walls (except wall areas receiving membrane and protective cover).

END OF SECTION

SECTION 03461: PRECAST CONCRETE MANHOLES & BASES

PART 1 - GENERAL

A. Description

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

B. Related Work Specified Elsewhere

1. Structure Earthwork: 02200
2. Trenching, Backfilling, and Compacting: 02223
3. Pavement Removal and Replacement: 02578
4. Concrete: 03300
5. Painting and Coating: 09900
6. Leakage & Infiltration Testing: 15043
7. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. 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.

PART 2 - MATERIALS

A. Precast Concrete Manholes

1. General: Precast reinforced concrete manholes shall comply with ASTM C478, with a minimum wall thickness of 6-inches and TCWD Standard Drawings. The ASTM standard and manufacturer shall be stamped on the interior and exterior of all manhole shafting and cone.
2. Design Load: Manhole components shall be designed for H-20 highway loads and site soil conditions.
3. Concrete: Precast reinforced concrete manhole risers and tops shall be constructed of Class A concrete with Type II or Type V cement in accordance with Section 03300, Concrete.
4. Manhole Section Configuration: Manholes shall be fabricated only from eccentric taper sections and standard cylinder units of the proper internal diameter.
5. Manhole Section Dimensions: Unless noted otherwise, minimum diameter and wall thickness of manholes and manhole sections shall be as follows:

Depth of Cover (feet)	Manhole Diameter (inches)	Manhole Section Wall Thickness (inches)
0 - 15	48	6
15.5 - 22	60	6
Greater than 22.5	72	7

Depth of cover shall be measured from proposed finish surface elevation to the elevation of the top of the manhole base.

6. Steps: Manhole sections shall be cast without steps.
7. Drop Manholes: Drop manholes shall **not** be allowed.
8. Manufacturers: Precast reinforced concrete manholes shall be manufactured by Oldcastle Infrastructure, Manhole Builders, Inc., Olson Precast Company, Precon Products, CalPortland, or approved equal.
9. Warning Signs: Warning signs shall be stenciled onto the vertical wall of the uppermost cone section of every manhole, as shown on TCWD Standard Drawing S-1.

B. Manhole Frames and Covers

1. General Requirements: Manhole frames and covers shall be made of ductile iron conforming to ASTM A536, Class 400, or cast iron conforming to ASTM A48, Class 30 minimum. 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.
2. Fit and Matchmarking: 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.
3. Cover Inscription: Covers shall have the words "TCWD," and "SEWER" cast thereon as shown in TCWD Standard Drawing S-1 or on the plans. No other lettering on the top side shall be permitted.
4. Cast letters shall be 3-inches and the relief depth shall be at least 3/16-inch. Top surface of the letters and diamond tread pattern shall be flush with the outer ring edge and the frame top surfaces.
5. Inspection and Coating: Before leaving the foundry, castings shall be cleaned and subjected to a hammer inspection. Castings shall then be dipped twice in preparation of asphalt 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.
6. Manufacturers: Manhole frames and covers shall be manufactured by EJ Company, or National Casting Corporation, or Neenah Foundry Company, or South Bay Foundry, Inc or approved equal.

C. Imported Sand

Imported sand shall comply with Section 02223, Trenching, Backfilling, and Compacting.

D. Crushed Rock

Crushed rock shall comply with Section 02223, Trenching, Backfilling, and Compacting. Crushed rock shall be the same material as the pipe bedding. Crushed rock base material shall extend 1 foot beyond the outside edge of the concrete manhole base.

E. Manhole Bases

Concrete used in pouring the manhole base shall be Class A concrete, Type II, or Type V cement per in accordance with Section 03300, Concrete and in accordance with TCWD Standard Drawing S-1.

F. Cement-Mortar Grout

Grout for grade-ring joints between precast sections shall be composed of one part Portland Cement to two parts of clean well-graded sand of such size that all pass a No. 8 sieve. Cement, aggregate, and water for mortar shall conform to the applicable provisions of Section 03300, Concrete.

G. Epoxy Grout

Epoxy grout shall be used in repairing manhole and manhole base surfaces. Epoxy grout shall be made with epoxy and sand. The sand shall be clean, bagged, graded, and kiln dried silica sand. The prepared grout shall wet the contact surface and provide proper adhesion, or a coat of epoxy shall be applied prior to placing the epoxy grout. The epoxy bonding compound shall be in accordance with Section 03300, Concrete.

H. Plastic Joint Sealing Compound

Preformed, cold-applied, ready-to-use, plastic joint sealing compound for water-tight joints shall be Quick-Seal as supplied by Associated Concrete Products or approved equal and shall be used on all manhole joints unless otherwise directed by the District Representative.

PART 3 - EXECUTION

A. Work Within Existing or Proposed Manholes

Any proposed work inside an existing or proposed manhole, 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.

B. Excavation

Excavation for the precast concrete manhole shall be in accordance with Section 02223, Trenching, Backfilling, and Compacting.

C. Manhole Base

1. General: Manhole bases shall be poured in place against undisturbed soil with Class A concrete having 1-inch maximum size aggregate and a slump of not greater than 4-inches. The manhole base shall be poured as one monolithic pour. Specifications for ready-mixed concrete are set forth in Section 03300.

If soil conditions are not adequate as determined by the Soils Engineer and/or District Representative, a specified depth of over-excavation shall be required, and the re-fill material shall be placed in accordance with Section 02223 prior to the placement of concrete.

2. Manhole Stub Placement: The manhole stubs and sewer main shall be set before the concrete is placed and shall be rechecked for alignment and grade before the concrete has set. The various sized inlets and outlets to the manhole shall be constructed as shown in TCWD Standard Drawing S-1.
3. Matching Pipe Crown Elevations: Invert elevations of connecting sewers may vary depending upon sizes. The crown elevation of all pipes shall be the same as the crown elevation of the largest pipe unless otherwise indicated on the plans.
4. Channel Configuration: 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 12-inches below the bottom of the lowest pipe.

5. Transitions: All transitions shall be smooth and of the proper radius to give an uninterrupted transition of flow.
6. Finishing: The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets.
7. Curing Time Before Further Construction: Unless approved otherwise by the District, in advance, the bases shall set a minimum of 24 hours before the manhole construction is continued.

D. Installing Manholes

1. General: Manholes shall be constructed as shown on TCWD Standard Drawing S-1. Manholes for larger diameter sewers shall be constructed as shown on the plans.
2. Joints for Grade-Rings: Precast concrete manhole units shall be set in a bed of grout to make a watertight joint at least 1/2-inch thick with the concrete base or with the preceding unit. Manhole sections shall be set perfectly plumb. Joints shall be pointed, trowelled, and smoothed inside and outside of the manhole shaft joint. The excess grout shall be wiped off and removed.
3. Finish Elevation of Manhole Covers: 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 of grade ring unless otherwise instructed by the District Representative.
 - a. Paved Area: Top of cover shall be flush with the paving surface.
 - b. Un-paved Areas: Top of cover shall be flush with the existing surface where it is in the "traveled way" or shoulder and the concrete pad shall be 2 inches above the adjacent unpaved surface.
4. Manhole Frame and Cover: The manhole frame shall be secured to the grade ring with grout and cement mortar. 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. The manhole frame and cover shall be constructed per TCWD Standard Drawing S-1 at interim and final condition.
5. Watertightness: It is the intent of these specifications that manholes and appurtenances be watertight and free from infiltration. Enough cold-applied, preformed, plastic joint sealing compound shall be applied such that the compressed material protrudes from the interior and exterior of each manhole joint. The excess material on the interior shall be trimmed flush.
6. Where called for on the plans or supplemental or project technical specifications, manholes that are to be given a protective lining or coating shall be free of any seeping or surface moisture. The adequacy of manholes and appurtenances as to watertightness shall be determined by the District Representative and shall be tested in accordance with Section 15043, Leakage, and Infiltration Testing.
7. Stubs: Sewer pipe shall be furnished and installed in manholes at the locations shown and in conformance with the detail drawings and plans. All stubs shall be plugged with stoppers as shown on the plans for various sizes of pipe.

8. 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 broken brick and mortar. Installation of these plugs shall be approved by the District Representative. Plugs shall be removed at the time of final inspection or as directed by District Representative.
9. Bulkheads: Brick and mortar bulkheads shall be installed at the downstream end of all unused stub channels 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.
10. New Connections to Existing Manholes: 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 Representative.
11. Backfill: Backfill around the precast concrete manhole shall be imported sand and shall be placed and compacted in accordance with Section 02223, Trenching, Backfilling, and Compacting.
12. Concrete Collar: Class B concrete collar shall be cast around manhole frames that are flush with the surface. The collar shall be placed with each lift.
13. Pavement Replacement: Replacement of bituminous or concrete pavement shall be in accordance with Section 02578, Pavement Removal and Replacement.

E. Manhole and Manhole Base Repairs

Manhole sections and bases that exhibit defects in the concrete surface may be rejected for the reasons such as exposure of reinforcement, shattered concrete or cracks having a width of 0.01 inch or more throughout a continuous length of 1 foot or more. Contractor shall replace the rejected manhole sections and base at no additional cost to the District.

Defective concrete surfaces of manhole sections and bases not rejected 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 at no additional cost to the District. Epoxy grout shall be applied to the surface to be repaired in accordance with the manufacturer's instructions.

The grout shall wet the contact surface and provide proper adhesion, or a coat of epoxy shall be applied prior to placing the epoxy grout.

F. Manhole Coatings

Where called for in the plans or supplemental specifications, manhole coatings shall be provided. The requirement for manhole coatings shall be in accordance with Section 09900, Painting and Coating.

END OF SECTION

SECTION 03462: PRECAST CONCRETE VAULTS AND METER BOXES

PART 1 - GENERAL

A. Description

This section describes the materials, manufacture, and installation of precast concrete vaults and meter boxes.

B. Related Work Specified Elsewhere

1. Structure Earthwork: 02220
2. Trenching, Backfilling and Compacting: 02223
3. Concrete Joints and Waterstops: 03260
4. Concrete: 03300
5. Structural Steel and Miscellaneous Metalwork: 05120
6. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals (for Contracts between District and Contractor)

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's catalog data on precast concrete vaults and meter boxes. Show dimensions and materials of construction by ASTM reference and grade.

PART 2 - MATERIALS

A. Precast Concrete Vault

1. Manufacturers: Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose and shall conform to the size, shape and dimensions indicated on the detailed plans. The ASTM standard and manufacturer shall be stamped on the interior and exterior of vault. Vaults and covers shall be Christy Concrete, Oldcastle Infrastructure, Eisel Enterprises, Inc., J & R Concrete Products, Inc., Jensen Precast, or Olson Precast or approved equal.
2. Design: Loads: 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 based on H-20 continuous loading per AASHTO standard specifications for highway bridges. Design wheel load shall be 16 kips. The live load shall be that which produces the maximum shear and bending moments in the structure.
3. Concrete: Concrete for vaults and meter boxes units shall be Class A in accordance with Section 03300, Concrete.
4. Sectional Vaults: Sectional precast concrete vaults may be used only where specified on the drawings or approved by the District Representative.

B. Precast Meter Boxes and Covers

1. Materials: These boxes and covers shall be reinforced polymer/plastic mortar.
2. Meter Box Covers: Meter box covers with reading lid shall be manufactured of reinforced polymer/plastic mortar in two separate rectangular pieces.
3. Traffic Covers: Meter box covers within roadways or driveways shall be cast- iron or steel designed to withstand continuous H-20 highway loading. "TCWD" shall be welded on the inner lid. The covers shall have a hinged metal reading lid only where specified on the plan or approved by the District Representative.

1. Manufacturers: Meter boxes shall be manufactured of reinforced polymer/plastic mortar by Armorcast Products Company, J & R Concrete Products, Inc., or approved equal.

Item	Meter Size (inches)	Meter Size (inches)
Meter Box Size	3/4-inch to 1-inch	1 1/2-inch & 2-inch
Nominal inside dimensions	13" wide x 24" long x 12" deep	17" wide x 30" long x 12" deep

C. Vault Frames and Covers

Unless noted otherwise, vault access hatches, access ladders, and frames shall be fabricated in accordance with the requirements of Section 05120, Structural Steel and Miscellaneous Metalwork.

D. Joint Sealing Compound

The joint sealing compound shall be permanently adhesive flexible plastic material complying with Federal Specification SS-S-00210 (GSA-FSS). Joint sealing compound shall be Quickseal by Associated Concrete Products or approved equal.

PART 3 - EXECUTION

A. Earthwork

1. General: Excavation and backfill for precast concrete vaults and meter boxes shall be in accordance with Section 02220, Structure Earthwork, and the requirements herein.
2. Excavation limits shall be large enough to accommodate the structure and permit grouting of openings and backfilling operations.
3. Sub-base: The bottom of the structure shall be placed on compacted, crushed rock sub-base, graded level and to the proper elevation as shown in the Standard Drawings or on the plans, and shall conform to the specifications in Section 02220, Structure Earthwork.

B. Vault Installation

1. Vault Wall Openings: Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Wall penetrations shall be as shown in the TCWD Standard Drawings.
2. Openings less than 2-1/2 inches: Upon completion of installation, all penetrations or openings in the vault walls that are less than 2 1/2-inches in diameter shall be filled with non-shrink Class A concrete or mortar, using an epoxy for bonding concrete surfaces, as specified in Section 03300, Concrete. Pipe or conduits shall be wrapped in "swell-stop" prior to the placement of non-shrink grout.
3. Backfill: After the structure and all appurtenances are in place and approved, backfill shall be placed to the original groundline or to the limits designated on the plans.
4. Watertightness: All joints between precast concrete vault sections shall be made watertight. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint. Pipe and conduit penetrations shall also be water-tight.

5. Installed Elevation: Vaults shall be built up so that the cover is 0.1 foot above the surrounding surface, unless otherwise specified on the drawings or directed by the District Representative in the field. The Contractor is responsible for placing the cover at the proper elevation and slope where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.

C. Meter Box Installation

1. Line and Grade: Meter boxes shall be set true to line and to the grade of the top of the curb, sidewalk.

For landscaped, or other unpaved surfaces, the meter box shall be set with the top 0.1 foot above the adjacent surrounding area, or as directed by the District Representative in the field.

The Contractor is responsible for placing the cover at the proper elevation and slope and shall make all necessary adjustments so that the cover meets these requirements.

2. Sequence of Installation: Meter boxes shall not be set until fine grading or landscape grading in the vicinity has been completed.

END OF SECTION

SECTION 05120: STRUCTURAL STEEL AND MISCELLANEOUS METALWORK

PART 1 - GENERAL

A. Description

This section describes materials and installation of structural steel, connecting bolts, stainless-steel fasteners, ladders, access hatches, and gratings.

B. Related Work Specified Elsewhere

1. Concrete: 03300
2. Painting and Coating: 09900
3. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit drawings of fabricated items, such as pipe supports, bolts, ladders, concrete anchors, grating, and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

A. Structural Steel

Material for all-purpose bolted or welded construction shall conform to ASTM A36 or approved equal.

B. Aluminum

Structural shapes shall conform to ASTM B308, Alloy 6061-T6. Plates and sheets shall conform to ASTM B209. Tubing shall conform to ASTM B241.

C. Nuts, Bolts and Washers

Except where otherwise specified, washers shall be Type 316, ASTM A167. Bolts shall be ASTM A193, Grade B8M. Nuts shall be ASTM A194, Grade 8M.

D. Galvanizing

Zinc coating for all plates, bolts, anchor bolts, and threaded parts shall be hot-dipped coated in accordance with ASTM A153. Structural steel and pipe shall be zinc coated in accordance with ASTM A123.

E. Stainless Steel

Stainless steel plate, members, and washers shall be Type 316, ASTM A167, except where otherwise specified.

F. Welding Electrodes

Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series. Welding electrode for aluminum shall be 4043 filler metal and Type 347 electrode for stainless steel.

G. Ladders

1. General: Ladders shall be fabricated as shown on the drawings and shall comply with the latest OSHA Safety Standards. Ladders shall be of welded steel construction and hot-dip galvanized after fabrication or stainless steel where indicated on the drawings.

2. Safety Devices: When indicated on the plans, a safety climb device (ladder fall prevention device) shall be provided, consisting of a SAF-T-NOTCH rail, standard attaching parts, Saf-T-Grip sleeve, SAF-T-CLIMB removable extension, and two complete safety belt assemblies.

The device shall comply with the latest OSHA Standard 3277 and shall be SAF-T-CLIMB as manufactured by Honeywell or approved equal. All safety climb device assemblies and parts shall be fabricated of Type 316 stainless steel.

3. Center Safety Post: All ladders shall have a center post ("ladder up") extension attached to the ladder in accordance with the TCWD Standard Drawing G-5. The ladder up shall be manufactured by Bilco or approved equal.

H. Concrete Anchors

Drilled anchors shall be Type 316 stainless steel wedge anchors, unless otherwise indicated on the project plans, as manufactured by Phillips Drill Company. Where steel anchors are indicated, they shall be one-piece design with expander ring consisting of steel zinc coated and chrome plated as manufactured by Kwik Bolt, McCullough Industries, Inc or approved equal.

I. Access Hatches

Hatches may be of aluminum or stainless-steel construction, as called for and specified on the project plans.

In general, aluminum hatches maybe used in applications of parkway loading (i.e., low-volume traffic with H-5 loading) where a severe corrosion environment is not present, (i.e., non-wastewater applications).

Aluminum or stainless-steel access hatches shall be of the size and type indicated on the drawings. Hardware shall be Type 316 stainless steel and shall include but not be limited to hinges, threaded pieces, connectors, hold-open arms, springs, and spring covers. Hatches shall be equipped with extruded aluminum channel trough frames with 1-1/2-inch drain coupling, flush aluminum drop handles which do not protrude above the cover, a recessed padlock box and stainless-steel staple sized for a No. 5 padlock, and shall be as manufactured by Bilco, or U. S. Foundry or approved equal.

J. Metallic Grating

Metallic grating shall be aluminum, unless noted otherwise on the drawings. Main bars shall be of the size and thickness as indicated on the drawings.

PART 3 - EXECUTION

A. Fabrication and Erection

1. General: Miscellaneous metal items shall be fabricated to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Permanent connections shall be welded continuously along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth.

Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections.

Fastenings shall be concealed wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.

All boltholes shall be 1/16-inch in diameter larger than bolt size. Cast-in-place bolt locations shall be measured in the field before drilling companion holes in structural steel beam or assembly.

2. Surfaces in Contact with Concrete: Surfaces of metalwork to be in contact with concrete shall be cleaned of rust, dirt, grease, and other foreign substances before placing concrete.
3. Embedded Metalwork: Embedded metalwork shall be set accurately in position when concrete is placed and supported rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300, Concrete.

B. Ladders

Ladder rungs shall be 3/4-inch round. The distance between rungs, cleats, and steps shall be spaced 12-inches on center. Ladders shall be mounted to provide clearance in back of ladder so that the distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7-inches. Refer to TCWD Standard Drawing G-5.

C. Common Machine Bolts and Nuts

1. General: Bolts shall be inserted accurately into the bolt holes without damaging the thread. Boltheads shall be protected from damage during driving. Boltheads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a normal plane to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut.
2. Bolt Insertion: Bolts shall be of the length that will extend entirely through but not more than 1/4-inch beyond the nuts. Boltheads and nuts shall be drawn tight against the work.

D. Anchor Bolts and Anchors

1. General: Bolts and anchors shall be preset by the use of templates. Concrete anchors shall not be used where cast-in-place anchor bolts are called for on the drawings.
2. Protection of Anchor Bolts: After anchor bolts have been embedded, bolt threads shall be protected by applying anti-seize compound and by placing the nuts on the treaded bolt end until the time of installation of the equipment or metalwork.

E. Control of Flame Cutting

The use of a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing **shall not** be permitted. A flame-cutting torch shall be used only on minor members when the member is not under stress.

F. Repair of Galvanized Surfaces

Damaged galvanized metal surfaces shall be repaired or replaced by the contractor and at no additional cost to the District. Repair of galvanized surfaces shall be accomplished by use of Cold Galvanizing Repair Compound as manufactured by Rust-Oleum, applied in accordance with the manufacturer's instructions.

G. Storage of Materials

All material, either plain or fabricated, shall be stored above ground on platforms, skids, or other supports. Material shall be kept free from dirt, grease, and other foreign matter and protected from corrosion.

H. Welding

1. Steel: Welding of steel shall be performed by the Shielded Metal Arc Welding (SMAW) process. Welding procedures shall comply with AWS D1.1.
2. Aluminum: Welding of aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) process, per the AWS Welding Handbook.

I. Grating

1. Measurement: Grated areas shall be field measured for proper size.
2. Banding: Grating shall be completely banded.
3. Grating Angles: Seat angles for grating shall be set so that the top of the vertical leg is flush with the concrete floor. Seat angles and anchors shall be stainless steel.

J. Corrosion Protection

Aluminum surfaces that are in contact with concrete shall be coated in accordance with Section 09900, Painting and Coating. Coating shall be allowed to dry before placing in or against concrete.

END OF SECTION

SECTION 09900: PAINTING AND COATING

PART 1 - GENERAL

A. Description

This section describes materials and application of painting and coating systems for submerged metal surfaces, exposed metal surfaces, buried metal surfaces, metal surfaces in contact with concrete, submerged concrete, exposed PVC and Fiberglass Reinforced Plastic (FRP) pipe, and valves.

Coating thicknesses specified herein are given as "dry-film thickness" in mils. Mil thicknesses specified are minimums.

B. Related Work Specified Elsewhere

1. Structural Steel and Miscellaneous Metalwork: 05120
2. Carbon Steel Pipe and Fittings: 15053
3. Ductile-Iron Pipe and Fittings: 15056
4. Combination Air Release and Vacuum Relief Valves: 15089
5. Manual Valves: 15100
6. Hydrants: 15139
7. Flexible Pipe Couplings and Expansion Joints: 15162
8. Standard Specifications for Public Works Construction (SSPWC), latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's data sheets showing the following information:
 - a. Recommended surface preparation.
 - b. Minimum recommended dry-film thicknesses per coat for prime and finish coats.
 - c. Percent solids by volume.
 - d. Recommended thinners.
 - e. Statement that the selected prime coat is recommended by the manufacturer for use with the selected finish coats.
 - f. Application instructions including recommended application, equipment, humidity, and temperature limitations.
3. Submit certification that all coatings conform to latest South Coast Air Quality Management District Rules and Regulations for products and application.

D. Pre-Submittal Meeting

For contracts between the District and Contractor, a pre-submittal meeting shall be conducted at least two (2) weeks prior to the submittal of coating shop drawings, and/or at the discretion of the District Representative. The meeting shall be attended by the painting and coating (sub) contractor.

E. Air Quality Requirements

Materials shall comply with South Coast Air Quality Management District's Rule 1107, Coating of Metal Parts and Products and Rule 1113, Architectural Coating.

F. Painting Systems

All paints shall be delivered to the jobsite in original, unopened containers. All materials of a specified painting system, including primer, 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.

PART 2 - MATERIALS

A. Color System for Coatings and Coating System Summary

1. Color for surfaces: colors for surfaces that are to be coated shall be defined as follows, unless noted otherwise on the drawings:

Color	Pantone ID Number (closest match in sunlight)	Amersfield Designation
Brown	PMS 1405 C	PMS 1405
Dark Blue	2766 C	Newport Coast #33
Factory Finish	N/A	No Color Coating
Light Blue	2925 C	1159 Light Blue
Medium Bronze	N/A	Medium Bronze
Olive Light	451 C	PMS 451 C
Purple	512 C	PMS 512 C
Safety Green	348 U	1135 Safety Green
Safety Orange (TCWD Orange)	021 C	OR-2 Safety Orange
Safety Red	485 C 2X	RO-1 Bright Red
Safety Yellow	U2X	Safety Yellow

2. Coating System: Coating system is a complete system or requirement of the number of coatings and types to be applied to a substrate in accordance with the specifications or procedures. The following table provides a summary of the coating systems and the various surfaces to be coated:

Application	Utility	System No.											
		A-1	B-1	B-2	B-3	B-4	C-1	C-2	D-1	E-1	F-1	G-1	G-2
Public Hydrants	Potable	X											
Submerged Metal	Potable			X									
Submerged Metal	Recycled		X										
Submerged Metal	Raw Water		X										
Submerged Metal	Raw Sewage				X								
Concrete Sewer Manhole & Submerged Concrete	Raw Sewage					X							
Exposed Metal	All						X	X					
Buried Metal	All								X				
Metal in Contact with	All									X			
Exposed PVC/FRP	All										X		
Valves	All											X	X

B. Specialty Items

All surfaces shall be coated as described below:

1. Valve Can & Test Box Lids: Valve cans and test box lids shall be coated per System No. C-2.
2. Buried Items: Buried flanges, nuts and bolts, flexible pipe couplings, exposed rebar from thrust blocks, and valve boxes shall be coated per System No. D-1 unless otherwise specified in the particular specifications for these items.
3. Above Ground Structural Steel and Structural Steel in Vaults: Above ground structural steel or structural steel located in vaults and steel structures shall be coated as described in the exposed metal coating system sections herein.
4. Pipe Supports: All non-galvanized and non-stainless steel pipe supports in vaults shall be coated the same as the adjacent piping. If pipe is PVC, pipe supports shall be coated per System No. C-1.
5. Exposed Indoor Galvanized Electrical Conduit: Exposed indoor galvanized electrical conduit shall only be coated when specified in the project technical specifications. When specified, coating System No. C-3 shall be used.
6. Mechanical Equipment: Mechanical equipment, such as motors, shall be coated as described in the exposed metal coating system sections herein.
7. Pumps: The interior and exterior of the pump discharge head, suction bell, or elbow and bowls, or volute shall be coated per System No. G-1 for pumps in wells, sewage lift stations, domestic water pump stations, and recycled water pump stations. Impellers for pumps at sewage lift stations shall be coated per System G-1.

The pump column shall be coated as follows:

- a. Flanged Column – System No. G-1, interior and exterior.
 - b. Threaded Column – No coating is required.
 - c. PVC Column – No coating is required.
8. Concrete Sewer Manholes: Concrete sewer manholes shall be coated with System No. B-4 if any of the following conditions exist.
 - a. If any sewer line connecting to a manhole has a slope of 7 percent or greater.
 - b. Wherever there is a change in slope, from steep to flat of 5 percent or greater, the manhole at the grade change and the next manhole upstream shall be coated.
 - c. All manholes at the terminus of sewer force mains.
 - d. As specified in the District's Procedural Guidelines and General Design Requirements.
 9. Concrete Sewer Manholes Covers and Frames: Surface preparation for concrete sewer manhole covers and frames shall be in accordance with Society for Protective Coatings (SSPC) SP3. One coat of black Carboline 890 VOC or equivalent with a minimum total dry film thickness of 5 mils shall be applied to the top surface of manhole covers and frames.

C. Public Hydrant Coating Systems

1. System No. A-1--Public Hydrants
 - a. Type: Water-based low Volatile Organic Compound (VOC) acrylic coating. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 5 mils.

- b. Surface preparation: Remove all oil, grease, and chalking. Abrade existing paint and visible rust areas. Do not sandblast or prepare more surface area than can be coated in one day. Surface preparation shall conform to SSPC specifications as follows: SP-1 Solvent Tool Cleaning; SP-2 Hand Tool Cleaning; and SP-3 Power Tool Cleaning
- c. Color: Safety Orange - See color schedule herein.
- d. Prime Coat: Apply to a dry-film thickness of 2 to 3 mils. Primer shall be synthetic.
Approved manufacturers for coating over previously painted surfaces include:
 - i. Carboline - Sanitile 120.
 - ii. Sherwin Williams with Zero VOC Acrylic.
 - iii. Tnemec Series - 1028 Enduratone; or
 - iv. International/Devoe - Devflex 4216 HP.
 Approved manufacturers for coating over bare metal surfaces include:
 - i. Carboline - Sanitile 120.
 - ii. Sherwin Williams - Pro Industrial Pro-Cryl Universal Primer.
 - iii. Tnemec Series - 94-H2O Hydro-zinc; or
 - iv. International/Devoe - Devflex 4216 HP.
- e. Finish Coat: Apply to a dry-film thickness of 3 to 4 mils. The finish coat shall be applied in the field just prior to final inspection.
Approved manufacturers for finish coats include:
 - i. Carboline - Carbocrylic 3359 MC.
 - ii. Sherwin Williams with Zero VOC Acrylic.
 - iii. Tnemec Series - 1028 Enduratone; or
 - iv. International/Devoe - Devflex 4216 HP.

D. Submerged Metal and Concrete Coating Systems

- 1. System No. B-1 - Submerged Metal, Recycled, and Raw Water
 - a. Type: Two-part low VOC epoxy-polyamide. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 20 mils.
 - b. Service Conditions: Shall be used on metal structures, pipes, or equipment including, but not limited to tanks, clarifier mechanisms, scum troughs, slide gates and other miscellaneous metal exposed to recycled water or raw water.
 - c. Surface Preparation: SSPC SP-10
 - d. Prime Coat: Apply to a dry-film thickness of 8 mils.
Approved manufacturers for prime coat include:
 - i. PPG - Amerlock 2 VOC or 400 VOC.
 - ii. Carboline - Carboguard 890 VOC.
 - iii. Tnemec - Series L69 Hi-build Epoxoline II; or
 - iv. International/Devoe - 233H.
 - e. Finish Coats: Apply two coats, each with a 6 mil dry-film thickness to achieve the total dry-film thickness. The coating material shall be the same material as the prime coat.

2. System No. B-2 - Submerged Metal, Potable Water
 - a. Type: Two-part low VOC epoxy-polyamide, or two-part amido-amine epoxy. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 15 mils. Coating shall be NSF 61 approved.
 - b. Service Conditions: Shall be used on surfaces including, but not limited to, structural steel, tank interiors and piping exposed to potable water.
 - c. Surface Preparation: SSPC SP-10
 - d. Prime Coat: Apply to a dry-film thickness of 5 mils.
Approved manufacturers for prime coats include:
 - i. Tnemec - Series L140F Pota Pox.
 - ii. Sherwin Williams - Macropoxy 646-100PW.
 - iii. PPG Ameron - Amerlock 2 VOC or 400 VOC; or
 - iv. International/Devoe - 233H.
 - e. Finish Coats: Apply two coats, each with a 5-mil dry-film thickness, to achieve the total dry-film thickness. The coating material shall be the same material as the prime coat.
3. System No. B-3 - Submerged Metal, Raw Sewage
 - a. Type: 100% solids epoxy for metal surfaces. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 40 mils.
 - b. Service Conditions: Shall be used on metal structures or pipes exposed to raw sewage.
 - c. Surface Preparation: Surface preparation shall be SSPC SP-10 for steel surfaces. Surface preparation shall be NAPF 500-03-05 Clean No. 2 for ductile iron or cast-iron surfaces.
 - d. Prime Coat: Apply to a dry-film thickness of 5 mils.
Approved manufacturers include:
 - i. Tnemec - Series 435 Perma-Glaze.
 - ii. International - Enviroline 224.
 - iii. Sherwin Williams - Fast Clad ER; or
 - iv. Carboline - Plasite 4550.
 - e. Finish Coat: Apply one coat with a 35 mil dry-film thickness, to achieve the total dry-film thickness. The coating material shall be the same material as the prime coat.
4. System No. B-4 - Manholes and Submerged Concrete, Raw Sewage
 - a. Type: 100% solids polyurethane system for concrete surfaces. A total dry- film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 125 mils.
 - b. Service Conditions: Shall be used on concrete structures or pipes exposed to raw sewage including, but not limited to, junction structures, wet wells, manholes, and sumps.
 - c. Surface Preparation: Surface preparation shall be SSPC SP-13 for concrete surfaces. If the coating terminates mid-wall, the Contractor shall sawcut a termination strip 1/4-inch deep and 1/4-inch wide. Newly placed concrete shall cure for a minimum of 28 days before preparing the surface for coating.

- d. Prime Coat: Apply to a dry-film thickness of 2 mils.

Approved manufacturers include:

- i. Zebron - epoxy primer; or
- ii. Sancon - 100 epoxy primer.

- e. Finish Coat: Apply one coat to achieve the total dry-film thickness.

Approved manufacturers include:

- i. Zebron - Polyurethane System; or
- ii. Sancon - 100 Polyurethane.

E. Exposed Metal Coating Systems

1. System No. C-1 - Exposed Metal, Severely Corrosive Environment

- a. Type: Low VOC Inorganic zinc prime coat with low VOC epoxy-polyamide finish coat. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 12 mils.
- b. Service Conditions: Shall be used on metal surfaces including, but not limited to, structures, piping, fittings, pumps, and appurtenances subjected to continuous water condensation, occasional immersion, or splashing. Below grade vaults shall be considered as severely corrosive environments.
- c. Surface Preparation: Surface preparation shall be SSPC SP-10 for steel surfaces. Surface preparation shall be NAPF 500-03-05 Clean No. 2 for ductile iron or cast iron surfaces.
- d. Prime Coat: Apply to a dry-film thickness of 3 mils. For ductile iron surfaces, the ductile iron shall have an asphaltic free surface with a factory applied prime coat the same as the finish coat. For all other surfaces, a two-component inorganic zinc rich primer shall be used with a minimum zinc content of 14 pounds per gallon. Approved zinc primer manufacturers include:
 - i. Ameron - Amercoat 68HS VOC.
 - ii. Tnemec - Series 94-H2O Hydro-zinc.
 - iii. International/Devoe - Cathacoat 302V.
 - iv. Sherwin Williams - Zinc Clad XI; or
 - v. Carboline - Carbozinc 11.
- e. Finish Coats: Apply two coats, each with a 4 to 5 mil dry-film thickness, to achieve the total dry-film thickness. Approved manufacturers include:
 - i. Ameron - Amerlock 2 VOC or 400 VOC.
 - ii. Tnemec - Series L69 Hi-build Epoxoline II.
 - iii. International/Devoe - Devran 224HS VOC.
 - iv. Sherwin Williams - Macropoxy 646-100; or
 - v. Carboline - Carboguard 890 VOC.

2. System No. C-2 - Exposed Metal, Atmospheric Weathering Environment

- a. Type: Low VOC Aliphatic Polyurethane with low VOC epoxy-polyamide or amido-amine epoxy primer. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 8 mils.

- b. Service Conditions: Shall be used on metal surfaces including, but not limited to, structures, piping, fittings, pumps, and appurtenances subjected to atmospheric elements and weathering.
- c. Surface Preparation: Surface preparation shall be SSPC SP-6 for steel surfaces. Surface preparation shall be NAPF 500-03-05 Clean No. 2 for ductile iron or cast-iron surfaces. Surface preparation shall be SSPC SP-1 for galvanized surfaces and shall be brush blasted or acid etched surface prior to application of prime coat.
- d. Prime Coat: Apply one or two coats to a dry-film thickness of 5 mils. For ductile iron surfaces, the ductile iron shall have an asphaltic free surface with a factory applied prime coat the same as the finish coat. Approved manufacturers include:
 - i. Ameron - Amerlock 2 VOC or 400 VOC.
 - ii. Tnemec - Series 135 Chembuild with low VOC thinner or L69 Epoxyline.
 - iii. International/Devoe - BarRust 231.
 - iv. Sherwin Williams - Macropoxy 646-100; or
 - v. Carboline - Carboguard 890 VOC.
- e. Finish Coat: Apply one coat to a dry-film thickness of 3 mils to achieve the total dry-film thickness. Approved manufacturers include:
 - i. Ameron - Amershield VOC.
 - ii. Tnemec - Series 1095 Endura-shield.
 - iii. Devoe - Devthane 379; Sherwin Williams - Hi-Solids Polyurethane 100.
 - iv. Carboline - Carboguard 134 MC.

F. Buried Metal Coating Systems

- 1. System No. D-1 - Buried Metal
 - a. Type: Low VOC epoxy coating. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 24 mils.
 - b. Service Conditions: Shall be used to coat buried metal including, but not limited to, valves, flanges, bolts and nuts, fittings, flexible pipe couplings, and structural steel.
 - c. Surface Preparation: SSPC SP-10
 - d. Prime Coat: Apply to a dry-film thickness of 8 mils. Approved manufacturers include:
 - i. Ameron - Amerlock 2 VOC or 400 VOC.
 - ii. Tnemec - Series L69F.
 - iii. International/Devoe - Bar-Rust 231; or
 - iv. Carboline - Carboguard 890 VOC.
 - e. Finish Coats: Apply two coats, each with an 8 mil dry-film thickness, to achieve the total dry-film thickness. The coating material shall be the same material as the prime coat.

G. Coating System for Metal in Contact with Concrete

- 1. System No. E-1 - Aluminum and Galvanized Surface in Concrete
 - a. Type: Low VOC epoxy coating. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 15 mils.

- b. Service Conditions: Shall be used to coat areas including, but not limited to, gates, stairs, or structural members in contact with concrete.
- c. Surface Preparation: Apply synthetic resin wash primer (phosphoric acid or vinyl butyral acid) to surface. Surface preparation shall comply with SSPC SP-1.
- d. Prime Coat: Apply to a dry-film thickness of 5 mils. Approved manufacturers include:
 - i. Ameron - Amerlock 2 VOC or 400 VOC
 - ii. Tnemec - Series L69F.
 - iii. International/Devoe - Bar-Rust 231; or
 - iv. Carboline - Carboguard 890 VOC.
- e. Finish Coats: Apply two coats, each with a 5 mil dry-film thickness, to achieve the total dry-film thickness. The coating shall be the same material as the prime coat.

H. PVC and FRP Pipe Coating System

- 1. System No. F-1 - PVC and FRP Pipe, Atmospheric Weathering Environment
 - a. Type: Low VOC Aliphatic Polyurethane with low VOC epoxy-polyamide primer. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 6 mils.
 - b. Service Conditions: Shall be used to coat PVC or FRP piping exposed to atmospheric elements and weathering.
 - c. Surface Preparation: Surfaces shall be cleaned and dried prior to application of coating.
 - d. Prime Coat: Apply one coat to a dry-film thickness of 3 mils. Approved manufacturers include:
 - i. Ameron - Amerlock 2 VOC or 400 VOC.
 - ii. Tnemec - Series 135 Chembuild with low VOC thinner or L69 Epoxyline.
 - iii. International/Devoe - BarRust 231.
 - iv. Sherwin Williams - Macropoxy 646-100; or
 - v. Carboline - Carboguard 890 VOC.
 - e. Finish Coat: Apply one coat to a dry-film thickness of 3 mils to achieve the total dry-film thickness. Approved manufacturers include:
 - i. Ameron - Amershield VOC.
 - ii. Tnemec - Series 1095 Endura-shield.
 - iii. International/Devoe - Devthane 379.
 - iv. Sherwin Williams - Hi-Solids Polyurethane 100; or
 - v. Carboline - Carboguard 134 MC.

I. Valve Coating System

- 1. System No. G-1 - Surface of Ferrous-Metal Valves
 - a. Type: Thermosetting powdered epoxy coating.
 - b. Service Conditions: Shall be used to coat interior surfaces of ferrous metal valves, excluding seating areas and bronze and stainless steel pieces.
 - c. Surface Preparation: Protuberances which may produce pinholes in the coating shall be removed. Sharp edges shall be rounded. Surface contaminants which may prevent bonding of the coating shall be removed. Surface preparation shall comply with SSPC SP-5.

- d. Coating: Apply to a total dry-film thickness of 12 mils in accordance with manufacturer's recommendation. Approved manufacturers include:
 - i. 3M - Scotchkote 134.
- 2. System No. G-2 - Surfaces of Ferrous-Metal Valves (Alternative)
 - a. General: This is an alternative to System No. G-1 when specified in technical specifications.
 - b. Type: Two-part low VOC epoxy-polyamide coating. A total dry-film consisting of the combined thickness of both a prime coat and finish coat is described herein. The total dry-film thickness of this system shall be 15 mils.
 - c. Service Conditions: Shall be used to coat interior surfaces of ferrous metal valves, excluding seating areas and bronze and stainless steel pieces.
 - d. Surface Preparation: Protuberances which may produce pinholes in the coating shall be removed. Sharp edges shall be rounded. Surface contaminants which may prevent bonding of the coating shall be removed. Surface preparation shall comply with SSPC SP-10.
 - e. Prime Coat: Apply to a dry-film thickness of 5 mils in accordance with manufacturer's recommendation. Approved manufacturers include:
 - i. Tnemec - Series L140F Pota Pox.
 - ii. Sherwin Williams - Macropoxy 646-100PW.
 - iii. Ameron - Amerlock 2 VOC or 400 VOC; or
 - iv. International/Devoe - 233H.
 - f. Finish Coats: Apply two coats, each with a 5 mil dry-film thickness, to achieve the total dry-film thickness. The coating material shall be the same material as the prime coat.

PART 3- EXECUTION

A. General

- 1. Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application, and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and acceptable professional standards and are approved by the District.
- 2. Work accomplished in the absence of the District's representative or District's coating inspection may be required to be removed and replaced under the proper inspection, and the entire cost of removal and replacement, including the cost of all materials which may be furnished by the District and used in the work thus removed, shall be borne by the Contractor, regardless of whether the work removed is found to be defective or not.

Work covered up without the authority of the District, shall, upon order of the District, be uncovered to the extent required, and the Contractor shall similarly bear the entire cost of accomplishing all the work and furnishing all the materials necessary for the removal of the covering and its subsequent replacement, as directed and approved by the District.
- 3. The District will make, or have made, such tests as it deems necessary to assure the work is being accomplished in accordance with the requirements of the Contract Documents. Unless otherwise specified, the cost of such testing will be borne by the District.

In the event such tests reveal non-compliance with the requirements of the Contract Documents, the Contractor shall bear the cost of such corrective measures deemed necessary by the District, as well as the cost of subsequent retesting and re-inspection. Tests shall not constitute acceptance of any portion of the work, nor relieve the Contractor from compliance with the terms of the Contract Documents.

4. Application: No coating shall be applied under the following conditions:
 - a. When the surrounding air temperature or the temperature of the surface to be coated or painted is below 55°F for epoxy coatings, below 45 °F for epoxy low temperature cure coatings, or above 125°F for all materials.
 - b. To wet or damp surfaces or in the rain, snow, fog, or mist.
 - c. When the air temperature is less than 5°F above the dewpoint.
 - d. When it is expected the air temperature will drop below 55°F for epoxy coating; or 45°F. for epoxy low temperature cure coatings or less than 5°F above the dewpoint within two hours after application of coatings or paints.
 - i. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer manual or electronic in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables or equivalent.
 - ii. If dehumidification is used, equipment must run continuously during all phases of the contract, except disinfection phase.
 - iii. If above conditions are prevalent, coating application shall be delayed or postponed until conditions are favorable. The day's application shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.
5. Overspray and Dust Control: The Contractor shall conduct all operations so as to confine abrasive blasting debris and coating and paint overspray to within the bounds of the site. The Contractor shall take all precautions necessary to prevent adverse off-site consequences of application operations. Any complaints received by the District relating to any such potential off-site problems will be immediately delivered to the Contractor. The Contractor shall immediately halt blast cleaning or application work and shall take whatever corrective action is required to mitigate any such problems. All costs associated with protection of off-site properties and/or correction of damage to property as a result of blast cleaning or application operations shall be borne directly by the Contractor at no additional expense to the District.
6. Inspection Devices: Contractor shall furnish, until final acceptance of coatings and paints, inspection devices in good working condition for detection of holidays and measurement of dry-film and wet-film thickness. Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of thickness gauges. Dry film thickness gauges and holiday detectors shall be available at all times until final acceptance of application. Inspection devices shall be operated by, or in the presence of the District with location and frequency basis determined by the District. The District is not precluded from furnishing their own inspection devices and rendering decisions based solely upon their tests.

7. All surface preparation, coating and paint application shall conform to applicable standards of the Society for Protective Coating, the District and the manufacturer's printed instructions. Material applied prior to approval of the surface, by the District, shall be removed and reapplied to the satisfaction of the District at the expense of the Contractor.
8. All work shall be accomplished by skilled craftsmen qualified to accomplish the required work in a manner comparable with the best standards of practice. Resumes of personnel to be used on the project shall be made available upon request. Continuity of personnel shall be maintained, and transfers of key personnel shall be coordinated with the District.
9. The Contractor shall provide a supervisor to be at the work site during cleaning and application operations. The supervisor shall have the authority to sign change orders, coordinate work and make other decisions pertaining to the fulfillment of the Contract Documents.
10. The Contractor's equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Blotter test shall be accomplished at each start-up period and as deemed necessary by the District Representative.

Contractor's equipment shall be subject to approval of the District. This approval does not relieve the Contractor's responsibility for the safe operation of the equipment or its performance.

- a. Cleanliness of compressed air supply shall be verified daily, and as deemed necessary by the District Representative, by directing a stream of air, without abrasive, from the blast nozzle onto a white blotter or cloth for twenty seconds. If oil or water appears on the blotter or cloth, all traps and separators shall be blown down until two subsequent twenty-second tests show no further oil or water.
11. Because of presence of moisture and possible contaminants in the atmosphere, care shall be taken to ensure previously coated or painted surfaces are protected or re-cleaned prior to application of subsequent coat(s). Methods of protection and re-cleaning shall be approved by the District.
 - a. The project is subject to intermittent shutdown if, in the opinion of the District, cleaning and application operations are creating a localized condition detrimental to ongoing facility activities, personnel or adjacent property.
 - b. In the event of emergency shutdown by the District, Contractor shall immediately correct deficiencies. All additional costs created by shutdown shall be borne by Contractor.

B. Surface Preparation

1. General: Sandblast or prepare only as much surface area as can be coated in one day. All sharp edges, burrs, and weld spatter shall be removed. Epoxy-coated pipe that has been factory coated shall not be sandblasted.
2. Society for Protective Coatings (SSPC) Specifications: Wherever the words "solvent cleaning", "hand tool cleaning", "wire brushing", "blast cleaning", or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Society for Protective Coatings, Surfaces Preparation Specifications, ANSI A159.1) specifications listed below:

SP-1	Solvent Cleaning
SP-2	Hand Tool Cleaning
SP-3	Power Tool Cleaning
SP-5	White Metal Blast Cleaning
SP-6	Commercial Blast Cleaning
SP-7	Brush-Off Blast Cleaning
SP-8	Pickling
SP-10	Near White Blast Cleaning

3. The Contractor shall provide suitable enclosure, exhaust system, and bag house for sandblasting operations to prevent violations of applicable air quality requirements.
4. Surface preparation shall be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces", SSPC-Vis 1, ASTM Designation D2200, NACE Standard TM-01-70.

Anchor profile for prepared surfaces shall be measured by using a non-destructive instrument such as a K-T Surface Profile Comparator or Testex Press-O-Film System. Temperature and dewpoint requirements shall apply to all surface preparation operations.
5. Dust, dirt, oil, grease, or any foreign matter which will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved commercial cleaning solution, rinsed with clean water, and wiped dry with clean rags.

Abrasive blasting nozzles shall be equipped with "deadman" emergency shut-off nozzles. Blast nozzle pressure shall be a minimum of 95 psi and shall be verified by using an approved nozzle pressure gage at each start-up period or as directed by the District Representative.

Number of nozzles used during all blast cleaning operations must be sufficient to ensure timely completion of project, subject to designation and approval by the District.
6. All blast hose connections shall be tethered and secured to prevent separation during blast cleaning operations and shall be taped with duct tape prior to pressurizing. All taped connections shall be visually inspected for leaks within five minutes after start of blast cleaning operations and at the end of blast cleaning operations. Leaking connections shall be immediately repaired to prevent further damage.
7. Particle size of abrasives used in blast cleaning shall be that which will produce a 2-mil surface profile or in accordance with recommendations of the manufacturer of the specified coating system to be applied, subject to approval of the District.
8. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants which would interfere with adhesion of coatings and shall not be reused unless specifically approved by the District. Abrasives shall be certified for unconfined dry blasting pursuant to the California Administrative Code, Section 92520 of Subchapter 6, Title 17, and shall appear on the current listing of approved abrasives. Invoices or load sheets confirming above shall be submitted to the District upon request.
9. During blast cleaning operations, caution shall be exercised to ensure existing coatings and paint are not exposed to abrasion from blast cleaning.
10. Blast cleaning from rolling scaffolds shall only be accomplished within confines of interior perimeter of scaffold. Reaching beyond limits of perimeter will be allowed only if blast nozzle is maintained in a position which will produce a profile acceptable to the District.

11. The Contractor shall keep the area of his work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the prosecution of the work or the operation of the existing facilities. Spent abrasives and other debris shall be removed at the Contractor's expense as directed by the District Representative.
12. Blast cleaned and coated/painted surfaces shall be cleaned prior to application of specified coatings/paints via a combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by the District. Air hose for blowing shall be at least 1/2-inch in diameter and shall be equipped with a shut-off device. Tests on surfaces of abrasively blast cleaned steel shall be accomplished to detect oil and other contaminants which might be deposited on surfaces. This will include chemical tests or ultraviolet (black light) tests, as required.

C. Application

1. Multiple-component coatings shall be prepared using all the contents of each component container as packaged by the paint manufacturer. Partial batches **shall not** be used.

Multiple-component coatings that have been mixed beyond their pot life shall not be used. Small quantity kits for touch-up painting and for painting other small areas shall be provided. Only the components specified and furnished by the paint manufacturer shall be mixed. For reasons of color or otherwise, additional components shall not be intermixed even within the same generic type of coating.
2. Application of the first coat shall follow immediately after surface preparation and cleaning within an eight (8) hour working day. Any cleaned areas not receiving first coat within an eight (8) hour period shall be re-cleaned prior to application of first coat.
3. Coating and paint application shall conform to the requirements of the SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting," the District, the manufacturer of coating and paint materials printed literature and as specified herein.
4. All coating components shall be mixed in exact proportions as specified by the manufacturer. Care shall be exercised to ensure all material is removed from containers during mixing and metering operations.
5. All coatings shall be thoroughly mixed, utilizing an approved slow-speed power mixer until all components are thoroughly combined and are of a smooth consistency.
6. Thinning shall only be permitted as recommended by the manufacturer and approved by the District Representative and shall not exceed limits set by applicable regulatory agencies. If the Contractor applies any materials which have been modified or thinned to such a degree as to cause them to exceed established VOC levels, the Contractor shall be responsible for any fines, costs, remedies, or legal action and costs that may result.
7. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs and no evidence of poor workmanship. Care should be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.
8. Protective coverings or drop cloths shall be used to protect floors, fixtures, equipment, prepared surface and applied coatings or paints. Care shall be exercised to prevent coating or paint from being spattered onto surfaces which are not to be coated or painted. Surfaces from which such material cannot be removed satisfactorily shall be refinished as required to produce a finish satisfactory to the District.

9. All welds and irregular surfaces specified by the District shall receive a brush coat of the specified product prior to application of each complete coat. Coating shall be brushed in multiple directions to ensure penetration and coverage, as directed by the District. Care shall be exercised to ensure dry film thickness of coatings and paints do not exceed the maximum thickness allowed by the manufacturer of the specific product being applied.
10. At conclusion of each day's blast cleaning and coating operations, a 6-inch wide strip of blast cleaned substrate shall remain uncoated to facilitate locating point of origin for successive day's blast cleaning operations.
11. Epoxy coated surfaces or other multi-component materials exposed to excessive sunlight or an excessive time element beyond manufacturer's recommended recoat cycle, shall be scarified by Brush-Off Blast Cleaning (SSPC SP-7) or methods approved by Engineer, prior to application of additional coating or paint.

Scarified coating or paint shall have sufficient depth to assure a mechanical bond of subsequent coat.
12. When two or more coats are specified, where possible, each coat shall contain sufficient approved color additive to act as an indicator of coverage or the coats must be of contrasting color.
13. Care shall be exercised during spray operations to hold the spray nozzle perpendicular and sufficiently close to surfaces being coated, to avoid excessive evaporation of volatile constituents and loss of material into the air or the bridging of cracks and crevices. Reaching beyond limits of scaffold perimeter shall not be permitted. All overspray identified by the District shall be removed by hand or pole sanding prior to application of subsequent coat.

D. Surfaces Not To Be Painted

Unless noted otherwise, the following surfaces shall **not be painted** and shall be fully protected when adjacent areas are painted.

1. Mortar-coated pipe and fittings.
2. Stainless Steel surfaces (excluding stainless steel bolts, nuts, and washers which shall be painted).
3. Aluminum guardrails and handrails.
4. Galvanized pipe supports and ladders.
5. Nameplates and grease fittings.
6. Aluminum grating.
7. Brass and copper pipe.

E. Protection of Surfaces Not To Be Painted

Hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent paint materials from falling on or marring adjacent surfaces.

Working parts of mechanical and electrical equipment shall be protected from damage during surface preparation and painting process. Openings in motors shall be safely masked to prevent paint and other materials from entering the motors. All masking materials shall be completely removed and surfaces cleaned at completion of painting operations.

F. Color Schedule

1. Definitions:

At Grade: Facilities that are flush with streets, sidewalks, parking lots, green belts, or graded areas. This also includes pipelines and other facilities that are protruding through and are located above finished grade, out of doors and not enclosed by a shelter, cover, vault, or housing.

Enclosed: Pipeline and other facilities that are located above or below grade and are enclosed within a shelter, covers, or vaults.

N/A: Not Applicable.

I.D. Mark: System identification marker as described herein. The I.D. Mark shall identify the system of which the facility is a part.

2. Color Guidelines: Unless noted otherwise, surfaces that are to be coated and that require a color designation for any of the following uses, shall be coated to match the colors listed below. **Final color selection shall be determined by District Representative.**

3. Potable Water System:

Facility	Enclosed	At Grade
Air Vac Release Assemblies	Dark Blue	Olive Light w/I.D. Mark
Detector Check Valves	Olive Light	Olive Light
Electric Motors	Olive Light	Olive Light w/I.D. Mark
Electrical Enclosures	Factory Finish	Camel (Sherwin Williams – PP9297R)
Fire Hydrants	N/A	Safety Orange (Public) (Dunn-Edwards EXQT10-0-U-1EXQT) Safety Red (Private) (Dunn-Edwards DEA104)
Piping	Light Blue w/I.D. Mark	Light Blue w/I.D. Mark
Pressure Vessels	Light Blue w/I.D. Mark	Light Blue w/I.D. Mark
Pump & Pump Bases	Light Blue	Light Blue
Valves (all types)	Light Blue	Light Blue
Valve Can Lids: Normally Open	N/A	Dark Blue
Valve Can Lids for fire hydrants Normally Open	N/A	Dark Blue
Normally Closed (at zone breaks)	N/A	Safety Red

4. Recycled Water System:

Facility	Enclosed	At Grade
Air Vac Release Assemblies	Purple	Purple w/I.D. Mark
Air Vac Covers (metallic only)	N/A	Purple w/I.D. Mark
Electric Motors	Olive Light	Olive Light
Electrical Enclosures	Factory Finish	Purple
Hydrants	N/A	Purple
Piping	Purple w/I.D. Mark	Purple w/I.D. Mark
Pressure Vessels	Purple w/I.D. Mark	Purple w/I.D. Mark
Pump & Pump Bases	Purple	Purple
Valves (all types)	Purple	Purple
Valve Can Lids: Normally Open Normally Closed (at zone breaks)	N/A	Purple (open) Safety Red (closed)

5. Sewer Collection System:

Facility	Enclosed	At Grade
Air Vac Release Assemblies	Safety Green	Grey w/I.D. Mark
Air Vac Covers (metallic only)	N/A	Grey w/I.D. Mark
Electric Motors	Grey	Grey
Electrical Enclosures	Factory Finish	Grey (PPG – PCT 70157)
Manhole Covers & Frames	Black	Black
Piping	Olive Light w/I.D. Mark	Grey w/I.D. Mark
Pump & Pump Bases	Olive Light	Grey
Valves (all types)	Olive Light	Grey
Valve Can Lids	N/A	Safety Green

6. Raw Water System:

Facility	Enclosed	At Grade
Airvac Assemblies	Light Blue	Olive Light w/I.D. Mark
Airvac Covers (metallic only)	N/A	Olive Light w/I.D. Mark
Electric Motors	Light Blue	Light Blue
Electrical Enclosures	Factory Finish	Camel (Sherwin Williams – PP9297R)
Hydrants	N/A	Safety Orange (Public) (Dunn-Edwards EXQT10-0-U-1EXQT) Safety Red (Private) (Dunn-Edwards DEA104)
Piping	Light Blue w/I.D. Mark	Light Blue w/I.D. Mark
Pressure Vessels	Light Blue w/I.D. Mark	Light Blue w/I.D. Mark
Pump & Pump Bases	Light Blue	Light Blue
Valves (all types)	Light Blue	Light Blue
Valve Can Lids	N/A	Light Blue

7. Test station box lids for cathodic protection shall be painted Trabuco orange. Refer to Section 16640, Cathodic Protection and Joint Bonding for test box specifications.

8. Identification (I.D.) Mark

Certain facilities listed above to be coated shall have an identification system applied by the Contractor at the District's direction.

Vault hatches (coated or uncoated) shall be identified with the TCWD initials and the system the facility serves (recycled water, raw water, potable water, sewer). The identification mark shall be able to stand up to traffic and not pose a tripping hazard.

Other facilities listed above that are to be coated and/or provided with an I.D. mark shall receive a District supplied identification decal that consists of the District's logo, phone number, system identification color, and the system the facility serves.

G. Field Touch Up of Shop-Applied Prime Coats

1. Organic Zinc Primer: Surfaces that are shop primed with inorganic zinc primers shall receive surface preparation and a field touchup of organic zinc primer to cover all scratches or abraded areas. Organic zinc primer system shall have a minimum volume solids of 70%.

Finish coats shall be in accordance with System No. C-1. Organic zinc primer shall be manufactured by the prime coat and finish coat manufacturer.

2. Other Surfaces: Other surfaces that are shop primed shall receive surface preparation and a field touchup of the same primer used in the original prime coat.

H. Dry-Film & Wet-Film Thickness Testing

1. Coating Thickness Testing: Coating thickness specified herein is "dry-film thickness" in mils. Mil thicknesses specified are minimums. Coating thickness specified for steel surfaces shall be measured with a magnetic-type dry-film thickness gage. Dry-film thickness gage shall be provided as manufactured by Elcometer, Mikrotest, Positector, or Quanix.

For System No. B-4 only, wet-film thickness testing may be used. Wet-film thickness gage shall be provided as manufactured by Tinker and Rasor. Coating thickness specified herein is "wet-film thickness" in mils. Mil thicknesses specified are minimums.

Each coat shall be checked for the correct dry-film thickness. Measurement shall not be made until a minimum of eight hours after application of the coating. Non- magnetic surfaces shall be checked for coating thickness by micrometer measurement of cut and removed coupons. Contractor shall repair coating at all locations where coupons are removed.

2. Holiday Testing: The finish coat (except zinc primer and galvanizing) shall be tested for holidays and discontinuities using only the specified high voltage instrument, with a wire brush electrode, at a minimum of 100 volts per mil in accordance with AWWA Standard C203, latest revision. Detector shall be provided as manufactured by Tinker and Rasor, Models AP and AP-W holiday detectors.
3. Repair: If a surface has an improper finish color, insufficient film thickness, or holidays, the surface shall be cleaned and top-coated with the specified paint material to obtain the specified color and coverage. Visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas 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 15040: INTERIOR INSPECTION FOR CEMENT-MORTAR LINED STEEL PIPE

PART 1 - GENERAL

A. Description

This section describes the inspection required for the acceptance and verification of cement-mortar lined steel pipe for diameters 4-inch through 30-inch and for other sections of pipe deemed not readily accessible for inspection personnel to enter the pipe.

B. Related Work Specified Elsewhere

1. Chlorination of Water Mains for Disinfection: 15041
2. Hydrostatic Testing of Pressure Pipelines: 15042
3. Installation of Pressure Pipelines: 15051
4. Cement Mortar Lined and Coated Steel Pipe: 15076

C. Submittals

1. The Contractor shall submit video camera equipment cutsheets and product information for review and approval.
2. The CCTV inspection work must be completed by a certified National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) trained operator(s) using established PACP coding and observations.
3. For video inspection of potable water systems, the Contractor shall submit documentation that confirms the CCTV equipment **is only used on potable water systems** and is not used on other systems, such as, but not limited to, sewer, recycled water, or storm drain systems.
4. After completing the video inspection, the Contractor shall submit the inspection video and documentation to the District.

D. Interior Joint Inspection

1. After backfilling and compacting around the pipeline and prior to testing and disinfecting the pipeline, the Contractor shall obtain the services of an independent third party to perform a closed circuit television (CCTV) inspection to document the condition within the pipeline, and to verify the condition of the lining after installation for all cement-mortar lined (CML) pipe with diameters of 4-inches up to and including 30-inches in diameter. Payment for the video inspection shall be included in the unit price for the pipeline.
2. All video inspections shall be recorded on a CD, DVD or USB Flash Drive. All original video CD's, DVD's, USB Flash Drives, log sheets, notes and reports shall be submitted to and become the property of the District.
3. Any work found in non-compliance with the Contract Documents and rejected shall be repaired and re-televised at the Contractor's expense.
4. If the quality of the CD or DVD is deemed unacceptable by the District's representative, the pipeline shall be re-televised at no additional cost to the District.

PART 2 - MATERIALS

A. Ventilation for Confined Space Safety

The Contractor shall provide access points and ventilation for the video inspection of the interior of the pipeline as part of the confined space permit. Ventilation shall be sufficient to permit entry for personnel if it is deemed necessary.

PART 3 - EXECUTION

A. General

1. CCTV Equipment:

- a. CCTV equipment shall include television cameras, a video monitor, cables, power sources and other equipment necessary to perform and record a video camera inspection.
- b. The cameras shall meet Cal-OSHA requirements for operating in a water environment.
- c. The cameras shall have Pan-and-Tilt capabilities and shall have a minimum of 360 x 270 degree rotation and illumination sensitivity shall be three lux or less and provide a minimum of 460 lines of resolution.
- d. Focal distance shall be adjustable through a range from 1-inches to infinity.
- e. During CCTV inspection, lighting intensity shall be adjusted to minimize glare. Lighting and picture quality shall be adjusted to provide a clear, in focus picture of the entire periphery of the pipeline for all conditions encountered.
- f. The remote reading footage counter shall be accurate to less than 1-percent error over the length of the particular section of pipeline being inspected.
- g. Video files shall have a minimum resolution of 352 x 240 pixels and an interlaced frame rate at a minimum of 24 frames per second.
- h. Video camera shall be mounted on a transporter or skid system.
- i. Lighting for the camera shall minimize reflective glare. Lighting and picture quality shall be suitable to provide a clean, in focus picture of the entire periphery of the pipeline.
- j. A padded seat that will accommodate at least one (1) Inspector and one (1) District Representative shall be located behind the TV operator in-line with the video monitor. This seat may be used by the Inspector or District Representative to monitor the video inspection.
- k. CCTV inspection shall be performed utilizing a camera and cable that is exclusively used for potable water applications.

2. Communications Equipment:

- a. Telephones, radios, or other suitable means of communication shall be set up to ensure that adequate communication exists between members of the CCTV crew.

B. Field Inspection

1. CCTV Field Inspection: CCTV Field inspection shall be performed such that:

- a. The camera shall be moved through the pipeline in one direction, no skipping or changing of directions will be allowed.
- b. The camera shall move at a uniform rate, stopping, when necessary, but in no case shall the television camera be pulled at a speed greater than 30 feet per minute.
- c. The camera shall stop at each joint and the camera lens rotated to inspect each joint.
- d. During the CCTV inspection, the camera shall stop at all defects and significant observations to ensure a clear and focused view of the pipe condition and shall rotate the camera head at the defect to allow for adequate evaluation at a later time.

- e. All CML steel pipe joints shall have "mark numbers" on interior joints as well as exterior joints.
- i. The operator shall focus on the joint and pan 360 degrees around the finished joint to verify that there are:
 - (a.) no gaps or voids in the lining:
 - (b.) smooth transitions of the cement mortar lining.

C. Inspection Documentation

- 1. Inspection Documentation:
 - a. Documentation shall consist of a color CD, DVD, or MPEG 4 format video file, log sheets and a written report detailing the condition found at the joints.
 - b. Distances shall correspond to the pipeline stationing shown on the plans.
 - c. The report shall note the time and date of video inspection, street name, pipeline station, direction of view, pipeline length, pipe section length, pipe size, pipe material, laterals, videotape number, counter number and a detailed logging of defects encountered.
 - d. A final copy of the report shall be submitted to District after completion of the CCTV inspection.

END OF SECTION

SECTION 15041: CHLORINATION OF WATER MAINS, WELLS AND RESERVOIRS

PART 1 - GENERAL

A. Description

This section describes the disinfection of potable water mains, wells and well-head facilities, reservoirs, services, appurtenances, and connections by chlorination, in accordance SWRCB, DDW requirements, per the latest edition of AWWA B300, B301, C651, and C652 as specified herein.

B. Related Work Specified Elsewhere

1. Hydrostatic Testing of Pressure Pipelines: 15042.
2. NSF/ANSI 60: Drinking Water Treatment Chemicals
3. AWWA Standards AWWA B300, B301, C651, and C652, latest edition

C. Submittals

The Contractor shall submit certification indicating either the calcium hypochlorite or sodium hypochlorite to be used for disinfecting potable water mains, wells, and reservoirs meets the requirements of NSF/ANSI 60: Drinking Water Treatment Chemicals.

D. Job Conditions

Discharge of chlorinated water into watercourses or surface waters is regulated by the Regional Water Quality Control Board - San Diego Region and Orange County Municipal Storm Water Permit, Order No. R3-2013-0001 for National Pollutant Discharge Elimination System (NPDES).

1. The rate of flow and locations of discharges shall be coordinated with the District and the Regional Water Quality Control Board – San Diego Region and scheduled in advance to permit review and coordination with District and cognizant regulatory authorities, including the following:
 - a. Orange County Public Works.
 - b. City in which the project is located.
2. Potable water shall be used for chlorination.
3. Requests for use of water from District waterlines shall be submitted at least 48 hours prior to any discharge to the District Representative.
4. Chlorination shall be performed prior to any hydrostatic testing. See Part 3, Paragraph A-9 for concurrent hydrostatic testing and chlorination of smaller diameter pipelines.

PART 2 - MATERIALS

A. Calcium Hypochlorite (Dry)

Calcium Hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300, shall be NSF 60 certified, and shall be dissolved in water to a known concentration in a container and shall be injected with a solution feed chlorinator and a water booster pump or a sufficiently pressurized source of water to provide an adequate flow to inject and disperse the chlorine solution into the water main.

B. Sodium Hypochlorite (Solution)

Sodium Hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300, shall be NSF 60 certified, and be diluted in water to desired concentration and shall be injected with a solution feed chlorinator and a water booster pump or a sufficiently pressurized source of water to provide an adequate flow to inject and disperse the chlorine solution into the water main.

C. Calcium Hypochlorite Tablets and Adhesive

1. Chlorine Content: The tablets shall have an average weight of 5 grams each and shall contain not less than 70% of available chlorine.
2. Adhesive: Adhesive shall be a type that will not impart taste, odor, or detrimental compounds to the water supply.
3. Storage: Proper care shall be taken to store calcium hypochlorite tablets in tightly closed containers where they will not be accessible to children or unauthorized persons.

D. Chlorine Residual Test Kit

For measuring chlorine concentration, Contractor shall use a colorimeter, which is an instrument that compares the amount of light getting through a solution with the amount that can get through a sample of pure solvent. The kit shall be capable of determining free and total chlorine concentration in the range 1.0 to 25 mg/L. Test kits shall be Hach, DR300 Pocket Colorimeter or Hanna Instruments Hanna Free and Total Chlorine Portable Photometer HI97771 or equal. . An adequate number of kits shall be maintained by the Contractor in good working order and available for immediate test of residuals at points of sampling.

PART 3 - EXECUTION

A. Pipelines

1. General: Before being placed into service, all pipelines and appurtenances shall be chlorinated in accordance with AWWA C651 and as described herein.
 - a. Pipelines with a diameter of 10-inches or less shall be disinfected by either direct chlorine solution injection or by use of calcium hypochlorite tablets.
 - b. Pipelines with a diameter of 12-inches and larger shall be disinfected by direct chlorine solution injection.
 - c. Steel pipelines shall be disinfected by continuous feed chlorine solution injection. All Bacteriological water quality testing after disinfection shall be performed by the District.
2. Chlorination Contractor: Chlorination shall be performed by a certified chlorination and testing Contractor. Chlorination shall be in accordance with the instructions of the chlorinator manufacturer and be performed by a Class A or C-34 licensed contractor.
3. Groundwater: In the event groundwater is encountered and it is impossible to prevent its entrance into the mains, or the mains are not free from dirt, they shall be thoroughly flushed prior to disinfection. Disinfection shall be by continuous feed chlorine solution injection.
4. Services: Every service connection served by a water main being disinfected shall be tightly shut off at the curb stop before water is applied to the main. Care shall be taken to expel all air from the main and services during the filling operation.
5. Pipeline Flushing: Pipe flushing shall be performed in accordance with Section 15042, Hydrostatic Testing of Pressure Pipelines.
6. Disinfection by Continuous Feed: Chlorine Solution Injection Method
 - a. Chlorine solution shall be applied by means of a vacuum-operated chlorinator and a booster pump or a sufficiently pressurized source of water to provide an adequate flow to operate the eductor system and properly disperse the chlorine solution. Direct-feed chlorinators, which operate from gas pressure in the chlorine cylinder without a vacuum regulator, **shall not** be used for application of a chlorine solution.

- b. Chlorine solution shall be applied at the beginning of the section to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed and removed by the Contractor.
 - c. Potable water shall be introduced into the pipeline at a constant measured flowrate. Chlorine solution shall be injected into the potable feed water at a measured rate. The two rates shall be proportioned so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L to 100 mg/L, with a chlorine residual of 25 mg/L after 24 hours in the pipe. The concentration at points downstream shall be checked periodically during the filling to confirm that sufficient chlorine is being added.
7. Disinfection by Calcium Hypochlorite Tablets: The use of calcium hypochlorite tablets will be permitted in pipe sizes 4- through 10-inches only and when directed by the District Representative. The tablets shall be attached by means of an NSF 60 approved adhesive to the inside top of the lengths of pipe as they are being laid. The amount of adhesive shall be limited to the smallest practicable amount applied to one side of the tablet only.

The following table shows the number of tablets to be used per length of pipe of various sizes to provide the required chlorine residual:

Inside Diameter of Pipe (Inches)	No. of 5 gram Hypochlorite Tablets per Length of Pipe (ft)		
	10'	18' & 20'	40'
4	1	1	1
6	1	1	2
8	1	2	4
10	2	3	5

8. Disinfection of Valves and Appurtenances: During the period that the chlorine solution is in the section of pipeline, valves shall be opened and closed to obtain a chlorine residual at hydrants and other pipeline appurtenances. Care shall be taken to ensure that no chlorinated water enters any active pipeline.
9. Concurrent Testing (for Pipelines with Diameter of 10-inches or Less): Disinfecting mains and appurtenances, and hydrostatic testing may run concurrently for the required 24-hour test period. In the event there is leakage and repairs are necessary, disinfection of the pipeline shall be repeated by injection of chlorine solution into the line as provided in this section.
10. Confirmation of Residual: After the chlorine solution applied by the continuous feed method has been retained in the pipeline for a minimum of 24 hours, water samples shall be taken at air valves and other points of access to confirm that a chlorine residual of 25 mg/L minimum exists along the pipeline.

11. Water Quality Samples and Testing: The contractor shall provide adequate and convenient means for the District Representative to collect an appropriate number of water samples for each segment of pipeline tested. A bacteriologic and physical water quality test will be performed by the District to demonstrate the absence of coliform organisms in each separate section of the pipeline after chlorination and refilling.
12. Pipeline Flushing: After confirming the chlorine residual, excess chlorine solution shall be flushed from the pipeline and dechlorinated per NPDES permit requirements until the chlorine concentration in the water leaving the pipe is within 0.5 mg/L of the replacement water.
13. Bacteriological Tests: On two (2) consecutive days, bacteriological water samples shall be taken by the District and sent to a certified laboratory for results. Samples shall be tested for coliform bacteria and heterotrophic plate count. All coliform test results must be negative and heterotrophic plate counts must be less than 500 colonies/mL prior to placing the water main into service.
14. Repetition of Procedure: If the initial or second water quality sample fails to produce the required chlorine residuals and bacteriologic results, chlorination and testing shall be repeated by the contractor until two (2) consecutive satisfactory results are obtained at no additional cost to the District.
15. Test Facility Removal: After satisfactory disinfection, all temporary disinfection and test facilities shall be removed and restored by the Contractor and to the satisfaction of the District Representative.

B. Wells, Well-Heads and Pump Stations

1. General: The well and well head piping shall be disinfected as a complete unit. Adequate bracing shall be provided to resist any thrust forces during testing.
2. Depth of Disinfection: The well shall be disinfected to its full depth. A double capped, perforated pipe container filled with granular chlorine compound shall be moved up and down the entire water-filled casing and screen section until all the chlorine compound has dissolved.
3. Pump Column Disinfection: The pump column shall be washed with a chlorine solution, containing at least 12.5% chlorine, as the pump column is lowered into the well or pump can.
4. Mixing: After the well pump has been placed into position, it shall be turned on and off several times so as to thoroughly mix the disinfectant with the water in the well. The flow control valve shall be set at a minimum pumping rate of 2 cfs. The pump shall be run until the water discharged has the odor of chlorine. This procedure shall be repeated several times at one-hour intervals. Discharge water shall be disposed of per NPDES permit requirements.
5. Disinfection Time: After mixing, the well shall be shutdown and allowed to stand without pumping for 24 hours.
6. Flushing: Well water shall be pumped to waste per NPDES permit requirements and until the presence of chlorine is no longer detectable, as determined by testing for available chlorine residual using a test kit. After well is flushed, allow the well to shut down and stand without pumping for 24 hours. See Part 3, Execution, Sub-part D, Disposal of Chlorinated Water for other requirements.

7. Bacteriological Tests: On two (2) consecutive days, bacteriological samples shall be taken by the District Representative for testing and sent to the District's laboratory. Water quality samples shall be tested by the District's laboratory for coliform bacteria and heterotrophic plate count. All coliform test results must be negative and heterotrophic plate counts must be less than 500 colonies/mL prior to placing the well into service with approval from DDW.
8. Repetition of Procedure: If the laboratory analysis shows the water samples are not free of bacterial contamination, the disinfection procedure shall be repeated. Depending on the level of contamination, it may be necessary to use a higher concentration chlorine solution. The water shall then be re-tested. Two (2) consecutive samples must pass the bacteriological tests before the well can be placed in service and with approval from DDW.

C. Reservoirs:

1. General: The Contractor shall make all necessary provisions for conveying water from the District designated supply source to the points of use.
2. Facilities to be Disinfected: All hydraulic structures and appurtenant pressure piping shall be tested; those for potable water shall also be disinfected. In the case of a reservoir, testing and disinfecting operations shall be combined. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be done in the presence of the District Representative.
3. Scheduling: Disinfection operations shall be scheduled by the Contractor as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the work is accepted by the District.
4. Bacteriological Testing: Bacteriological testing shall be performed by the District's laboratory. Results of the bacteriological testing shall be satisfactory to the State Department of Health or other appropriate regulatory agency. Passing tests on two consecutive days for heterotrophic plate count (<500 cfu/mL) and absence from coliform bacteria must be achieved prior to placing the reservoir into service.
5. Release of Disinfection Water: Prior to the contractor releasing water from the reservoir and after the contractor completes testing and disinfecting of the structure, the District shall approve the release of water.
6. Preliminary Cleaning and Flushing: Prior to both testing and disinfecting, all hydraulic structures shall be cleaned by thoroughly hosing down all surfaces with a high pressure hose and nozzle of sufficient size to deliver a minimum flow of 50 gpm. All water, dirt, and foreign material accumulated in this cleaning operation shall be discharged from the structure or otherwise removed.
7. Disinfection of Hydraulic Structures and Appurtenant Pipelines: All hydraulic structures, which store or convey potable water, shall be disinfected by chlorination. Chlorination of hydraulic structures shall be performed in accordance with the requirements of ANSI/AWWA C652.
 - a. Chlorination: A strong chlorine solution (about 200 mg/L) shall be sprayed on all interior surfaces of the structure. Following this, the structure shall be partially filled with water to a depth of approximately one foot. During the partial filling operation, a chlorine-water mixture shall be injected by means of a solution feed chlorinating device in such a way as to give a uniform chlorine concentration during the entire filling operation. The point of application shall be that the chlorine solution will mix readily with the in-flowing water.

The dosage applied to the water shall be sufficient to provide a chlorine residual of at least 50 mg/L upon completion of the partial filling operation. Precaution shall be taken to prevent the strong chlorine solution from flowing back into the lines supplying the water. After the partial filling has been completed, sufficient water shall be drained from the lower ends of appurtenant piping to ensure filling the lines with the heavily chlorinated water.

- b. Retention Period: Chlorinated water shall be retained in the partially filled structure and appurtenant piping long enough to destroy all non-spore forming bacteria, and in any event, for at least 24 hours. After the chlorine- treated water has been retained for the required time, the free chlorine residual in the structure and appurtenant piping shall be at least 25 mg/L. All valves shall be operated while the lines are filled with heavily chlorinated water.
- c. Final Filling of Structure: After the free chlorine residual has been checked, and has been found to satisfy the above requirement, the water level in the structure shall be raised to its final elevation by addition of potable water. Before final filling is commenced, the concentration of heavily-chlorinated water remaining in the structure and piping shall, unless otherwise acceptable to the District's Representative, be sufficient to produce a free chlorine residual of between 1 and 2 mg/L when the water level is raised to its final elevation. After the structures have been filled, the strength of the chlorinated water shall be determined. If the free chlorine residual is less than one mg/L, an additional dosage shall be applied to the water in the structure. If the free chlorine residual is greater than 2 mg/L, the structure shall be partially emptied, and additional potable water added. In no case shall water be released prior to the expiration of the required retention period.
- d. Connections to Existing System: Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed. Thorough flushing shall be started as soon as the connection is completed and shall be continued until all discolored water is eliminated.

D. Disposal of Chlorinated Water

1. Disposal to District's Sewage Collection System: Recycled water shall be disposed of into the District's sewage collection system. Unless noted otherwise in the Contract Documents, or directed by the District Representative, chlorinated water from potable or untreated water pipelines shall be disposed of into the District's sewage collection system.
2. Dechlorination Prior to Disposal: If discharge from potable or untreated water pipelines to the sewage collection system is not permitted, then chlorinated water shall be dechlorinated prior to disposal. Dechlorination shall be performed by a certified chlorination and testing company. Dechlorinated water shall have a total chlorine residual concentration of less than 0.1 mg/L.

END OF SECTION

SECTION 15042: HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 - GENERAL

A. Description

This section describes pressure and leakage testing of all pressure pipelines, in accordance with SWRCB requirements and the Hydrostatic Testing section of AWWA C600 as specified herein.

B. Related Work Specified Elsewhere

1. Chlorination of Water Mains, Wells and Reservoirs: 15041.
2. AWWA Standard C-600

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

D. Job Conditions

1. For potable and untreated water pipelines, obtain and use only potable water for hydrostatic testing.
2. For recycled water and sewage pipelines, obtain and use only recycled water for hydrostatic testing.
3. Submit request for use of District water to the District Representative, at least 48-hours in advance of filling the pipeline.
4. Hydrostatic testing shall be successfully completed before any new pipelines are connected to existing District water mains.

E. Testing Company

1. All testing shall be performed by independent testing companies with a Class A license, and/or who are certified and District-approved to perform the required pressure testing and disinfection.
2. Testing companies will be required to provide the District Representative with certified testing results. The testing company shall provide good working equipment, gauges and meters which have been calibrated and certified at least quarterly.

PART 2 - MATERIALS

A. Test Bulkheads

Test bulkheads shall be designed and tested in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code prior to installation.

Bulkhead design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Stress shall be limited to 70% of yield strength of the bulkhead material at the bulkhead design pressure.

Air-release assemblies and water service connections shall be included when pressure testing.

B. Manual Air-Release Valves

Temporary manual air-release valves shall be provided where necessary for pipeline test. The number and location of release valves shall be subject to the review and approval of the District Representative.

The pipe outlet shall be constructed in the same manner as for a permanent air valve. After use, the connection shall be sealed with a blind flange, pipe cap, or plug in a manner and with the fittings satisfactory to the District Representative.

All connections and exposed fittings which are installed shall be coated equivalently to the adjacent pipe and in accordance with the District specifications.

C. Water

The same water used for chlorination of the pipeline shall be used to fill the line for testing.

PART 3 - EXECUTION

A. General

All labor, materials, tools, and equipment necessary for testing shall be furnished by the Contractor. The test shall be conducted with valves in the test section open. Ends of each test section, open ends of pipes, valves, and fittings shall be suitably closed. Valves in the test section shall be operated during the test period. Closed valves shall not be used for pressure testing.

B. Testing and Disinfection Sequence

The testing and disinfection sequence shall comply with Section 15041, Chlorination of Water Mains, Wells and Reservoirs.

C. Isolation of Test Pipe Section from Existing Pipelines

Test bulkheads, valves, connections to existing pipelines, and other appurtenances shall be located and installed in a manner to provide an air gap separation between existing water pipelines and pipeline being tested.

D. Length of Test Section

1. The maximum test section length for pipe of 12 inches or smaller shall be 3,500 feet.
2. For pipe larger than 12 inches the maximum test section length shall be 1 mile.
3. Test bulkheads shall be provided where the distance between valves exceeds these limits.

E. Requirements Prior to Testing

1. Backfill: The pipe trench shall be backfilled with a minimum of 2½ feet of material.
2. Concrete Anchor and Thrust Blocks: All concrete anchor blocks shall be installed and allowed to cure a sufficient time to develop the designed minimum strength before testing.
3. Mortar Lining: 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. Cement-mortar lined pipe shall not be filled with water until a minimum period of eight (8) hours has elapsed after the last joint in any section has been made.

F. Field Test Procedure

1. Filling Rate: The pipeline shall be filled at a rate such that the average velocity of flow is no greater than 2 fps. At no time shall the maximum velocity of flow exceed 2 fps.

The following table gives filling rates to provide 2 fps velocity for pipe diameters up to 18-inch. Contractor shall submit calculations for pipe diameter greater than 18-inches.

Filling Flowrates for 2 FPS Velocity	
Nominal Pipe Size (Inches)	Filling Rates to achieve velocity of 2 fps (gpm)
4	80
6	180
8	320
10	490
12	700
16	1,250
18	1,580

2. Air Removal: All air should be purged from the pipeline before checking for leaks or performing pressure tests on the system. To accomplish this, if air valves or hydrants or other outlets are not available at high points, taps shall be made to expel the air, and these taps shall be tightly plugged after testing.
3. Pressurization: After the pipeline has been filled and allowed to sit a minimum of 48 hours (72 hours for mortar-lined pipelines), the pressure in the pipeline shall then be pumped up to the specified test pressure. If a large quantity of water is required to increase the pressure during testing, entrapped air, leakage at joints, or a broken pipe may be suspected. If a large quantity of water is required to increase the pressure during the test, the test shall be discontinued until the source of issue is identified and corrected.
4. Flushing: Pipelines shall be flushed with water after hydrostatic testing and disinfection to remove dirt and debris. For domestic water and untreated water systems, potable water shall be used for flushing and for recycled water and sewage systems, recycled water shall be used for flushing. Flushing should be performed via the District Flush-out assemblies constructed in accordance with drawing W-12 of the TCWD Standard Drawings. Velocities shall be sufficient to achieve a minimum of 2 fps velocity in the pipeline. Pipe shall be flushed for a minimum time period as calculated from the following formula.

$$T = 2/3 L$$

$$T = \text{flushing time (seconds)} \quad L = \text{pipe length (feet)}$$

G. Test Pressure and Allowable Leakage

1. The test pressure for hydrostatic testing shall be 50 psi above the design pressure of the pipeline with the minimum allowable test pressure being 200 psi. Test pressure readings shall be taken at the lowest point in the section of pipe being tested.
2. When the test pressure has been reached, pumping shall be discontinued until the pressure in the line has dropped 5 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of the four-hour period, the pressure shall be pumped up to the test pressure for the last time.

3. The leakage shall be considered as the total amount of water pumped into the pipeline during the four-hour period, including the amount required in reaching test pressure for the final time.
4. The following table indicates the leakage allowance for various sizes of pipe for various test pressures.

LEAKAGE ALLOWANCES		
Pipe Size (Inches)	Allowable Leakage for 200 psi Test Pressure (Gallons per four hours per 1,000 feet of pipe)	Allowable Leakage for 250 psi Test Pressure (Gallons per four hours per 1,000 feet of pipe)
4	0.38	0.43
6	0.57	0.64
8	0.76	0.85
10	0.96	1.07
12	1.15	1.28
16	1.53	1.71
18	1.72	1.92

5. PVC Force Mains and Pressure Pipelines
 - a. The required test pressure shall be maintained for the following specified durations by restoring it whenever it falls by an amount of 5 psi: pipe of 18 inches in diameter and smaller, 4 hours; over 18 inches to 36 inches in diameter, 8 hours; and over 36 inches in diameter, 24 hours.
 - b. For non-PVC pipe, a minimum of three days shall be allowed for the filled pipeline to soak and to release entrapped air. The test pressure shall be applied with a positive displacement pump. A snubber and dampener shall be provided between the pump and the pipeline to reduce instantaneous pressure pulses to 10% of the specified test pressure. Water shall be drawn from containers in which the volume of water can be readily measured or through a positive displacement meter.
 - c. The amount of water used to maintain the test pressure during the test period shall be considered the leakage. The allowable leakage shall be determined by the above "Leakage Allowances" table or the following formula:

$$L = \frac{ND(P)^{1/2}}{7400}$$

L = Allowable leakage (gallons per hour)

N = Number of rubber-gasketed pipe joints in the test section

D = Inside pipe test diameter (inches)

P = Pipe test pressure (psig), which is defined as the average of the highest and lowest test pressures in the pipe section being tested.

- d. Note the allowable leakage rate for pipeline sections with flanged, welded, and/or grooved-end joints shall be zero.

H. Repetition of Test

If the actual leakage exceeds the allowable leakage, the faulty work shall be located and corrected and the test repeated. The work shall be restored, and all damage resulting from leaks repaired. All visible leakage shall be eliminated.

I. Bulkhead and Test Facility Removal

After a satisfactory test, water shall be drained to the sewage collection system, test bulkheads and other test facilities removed, and pipe coatings restored.

END OF SECTION

SECTION 15043: LEAKAGE & 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. Hydrostatic Testing of Pressure Pipelines: Section 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 water tightness 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 trenches are compacted. A memorandum from the Soils Engineer referencing all compaction test results shall be submitted to the District representative.
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 re-install by the Contractor at no additional costs to the District.
7. Acceptance: The sewer will not be accepted until the leakage or infiltration rate, as determined by these tests, is less than the maximum allowable.
8. Sewer Laterals: When sewer laterals are added after the sewer main has been constructed by connecting to a previously installed wye fitting or to a newly cut- in wye-branch fitting, the new sewer lateral shall be plugged at the sewer main by use of a test plug and air tested to the satisfaction of the District Representative.

PART 2 - MATERIALS

A. General

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

B. Water for Testing Manholes

Recycled water shall be used for testing manholes as described herein.

PART 3 - EXECUTION

A. Air Test for VCP 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. All test plugs shall be secured in place to prevent movement or slippage.

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 Time for Allowable Pressure Drop: The time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig shall be measured and the results compared with the minimum permissible pressure holding times indicated in the following tables.
5. Retest: If the pressure drops from 3.5 psig to 2.5 psig occurs in less time than specified, the pipe shall be repaired and, if necessary, replaced and re-laid until the joints and pipe shall hold satisfactorily under this test.

Air Test Tables

(courtesy of National Clay Pipe Institute)

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ TO 2½ PSIG

(For Use When Testing One Diameter Only)

Length (ft)	Pipe Diameter (Inches) (For Use When Testing One Diameter Only)													
	4	6	8	10	12	15	18	21	24	27	30	33	36	39
25	4	10	18	28	40	62	89	121	158	200	248	299	356	418
50	9	20	35	55	79	124	178	243	317	401	495	599	713	837
75	13	30	53	83	119	186	267	364	475	601	743	898	1020	1105
100	18	40	70	110	158	248	356	485	634	765	851	935	1020	1105
125	22	50	88	138	198	309	446	595	680	765	851	935	1020	1105
150	26	59	106	165	238	371	510	595	680	765	851	935	1020	1105
175	31	69	123	193	277	425	510	595	680	765	851	935	1020	1105
200	35	79	141	220	317	425	510	595	680	765	851	935	1020	1105
225	40	89	158	248	340	425	510	595	680	765	851	935	1020	1105
250	44	99	176	275	340	425	510	595	680	765	851	935	1020	1105
275	48	109	194	283	340	425	510	595	680	765	851	935	1020	1105
300	53	119	211	283	340	425	510	595	680	765	851	935	1020	1105

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 6" Diameter Main Line in Feet

Length of 4" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	14	24	34	44	54	64	74	84	94	103	113	123	163	168
50	19	29	39	48	58	68	78	88	98	108	118	128	166	167
75	23	33	43	53	63	73	83	92	102	112	122	132	164	165
100	28	37	47	57	67	77	87	97	107	117	127	136	162	163
125	32	42	52	62	72	81	91	101	111	121	131	141	160	162
150	36	46	56	66	76	86	96	106	116	125	135	145	159	161
175	41	51	61	70	80	90	100	110	120	130	140	150	157	159
200	45	55	65	75	85	95	105	114	124	134	144	153	156	158
225	50	59	69	79	89	99	109	119	129	139	149	151	154	157
250	54	64	74	84	94	103	113	123	133	143	149	150	153	156
275	58	68	78	88	98	108	118	128	138	146	147	149	152	155
300	63	73	83	92	102	112	122	132	142	145	146	147	151	154

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 8" Diameter Main Line In Feet

Length of 4" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	22	40	57	75	92	110	128	145	163	180	198	216	223	224
50	26	44	62	79	97	114	132	150	167	185	202	218	220	221
75	31	48	66	84	101	119	136	154	172	189	207	214	217	219
100	35	53	70	88	106	123	141	158	176	194	209	211	214	216
125	40	57	75	92	110	128	145	163	180	198	206	207	211	214
150	44	62	79	97	114	132	150	167	185	201	202	204	209	212
175	48	66	84	101	119	136	154	172	189	197	199	201	206	210
200	53	70	88	106	123	141	158	176	192	194	197	199	204	208
225	57	75	92	110	128	145	163	180	189	192	194	196	202	206
250	62	79	97	114	132	150	167	183	186	189	191	193	200	204
275	66	84	101	119	136	154	172	181	184	187	189	191	198	202
300	70	88	106	123	141	158	174	178	181	184	187	189	196	200

Minimum Holding Time In Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 8" Diameter Main Line In Feet

Length of 6" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	28	45	63	80	98	116	133	151	168	186	204	221	224	225
50	37	55	73	90	108	126	143	161	178	196	214	220	222	223
75	47	65	83	100	118	135	153	171	188	206	217	217	220	221
100	57	75	93	110	128	145	163	181	198	214	214	215	218	220
125	67	85	102	120	138	155	173	190	208	211	212	213	216	218
150	77	95	112	130	148	165	182	200	207	209	210	211	214	217
175	87	105	122	140	157	175	192	204	206	207	208	209	213	215
200	97	114	132	150	167	185	201	202	204	205	206	207	211	214
225	107	124	142	160	177	195	199	201	203	204	205	206	210	213
250	117	134	152	169	187	195	198	199	201	202	203	204	209	212
275	127	144	162	179	192	194	196	198	200	201	202	204	208	210
300	136	154	172	187	190	192	195	196	198	200	201	202	207	209

Minimum Holding Time In Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 10" Diameter Main Line In Feet

Length of 4" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	32	59	87	114	142	169	197	224	252	277	277	278	279	280
50	36	64	91	119	146	174	201	229	256	271	272	273	275	277
75	41	68	96	123	151	178	206	233	261	265	267	268	272	274
100	45	73	100	128	155	183	210	238	258	260	262	264	268	271
125	50	77	105	132	160	187	214	242	253	255	257	259	264	268
150	54	81	109	136	164	191	219	244	248	251	253	255	261	265
175	58	86	113	141	168	196	223	239	243	246	249	251	258	262
200	63	90	118	145	173	200	228	235	239	242	245	248	255	260
225	67	95	122	150	177	205	226	231	235	239	242	244	252	257
250	72	99	127	154	182	209	222	227	231	235	238	241	249	255
275	76	103	131	158	186	211	218	223	228	231	235	238	247	253
300	80	108	135	163	190	208	214	220	224	228	232	235	244	250

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 10" Diameter Main Line In Feet

Length of 6" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	37	65	92	120	147	175	202	230	257	277	278	278	279	280
50	47	75	102	130	157	185	212	240	267	271	272	273	276	277
75	57	85	112	140	167	195	222	250	265	266	267	269	272	274
100	67	95	122	150	177	205	232	257	260	262	263	265	269	271
125	77	105	132	160	187	215	242	253	255	257	259	261	266	269
150	87	114	142	169	197	224	245	248	251	254	256	257	263	266
175	97	124	152	179	207	234	241	245	248	250	252	254	260	264
200	107	134	162	189	217	233	237	241	244	247	249	251	258	262
225	117	144	172	199	225	230	234	238	241	244	246	248	255	260
250	127	154	182	209	222	227	231	235	238	241	243	246	253	258
275	136	164	191	213	219	224	229	232	236	238	241	243	251	256
300	146	174	201	211	217	222	226	230	233	236	239	241	249	254

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 12" Diameter Main Line In Feet

Length of 4" Lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	44	84	123	163	202	242	282	321	332	333	334	334	336	336
50	48	88	128	167	207	246	296	323	324	326	327	328	331	333
75	53	92	132	172	211	251	290	316	317	319	321	323	327	339
100	57	97	136	176	216	255	295	308	311	313	316	317	323	326
125	62	101	141	180	220	260	297	301	304	308	310	312	319	323
150	66	106	145	185	224	264	290	295	299	302	305	308	315	319
175	70	110	150	189	229	268	283	289	293	297	300	303	311	316
200	75	114	154	194	233	271	277	283	288	292	296	299	308	313
225	79	119	158	198	238	265	272	278	283	288	291	295	304	310
250	84	123	163	202	242	259	267	273	278	283	287	291	301	308
275	88	128	167	207	244	254	262	269	274	279	283	287	298	305
300	92	132	172	211	239	249	257	264	270	275	279	283	295	302

Minimum Holding Time in Seconds Required for Pressure to Drop from 3½ to 2½ PSIG
Length of 12" Diameter Main Line In Feet

Length of 6" lateral (ft)	25	50	75	100	125	150	175	200	225	250	275	300	400	500
25	50	89	129	168	208	248	287	327	331	332	333	333	335	336
50	59	99	139	178	218	257	297	321	323	325	326	327	330	332
75	69	109	149	188	228	267	307	314	316	318	320	321	326	328
100	79	119	158	198	238	277	302	306	309	312	314	316	321	325
125	89	129	168	208	248	287	295	300	303	306	309	311	317	321
150	99	139	178	218	257	284	289	294	298	301	304	306	314	318
175	109	149	188	228	267	278	284	289	293	296	299	302	310	315
200	119	158	198	238	265	272	278	284	288	292	295	298	306	312
225	129	168	208	248	260	268	274	279	284	288	291	294	303	309
250	139	178	218	246	255	263	269	275	280	284	287	290	300	306
275	149	188	228	242	251	259	266	271	276	280	284	287	297	304
300	158	198	227	238	248	255	262	268	272	277	281	284	294	301

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. All test plugs shall be secured in place to prevent movement or slippage.
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: The time in minutes that is required for the internal air pressure to drop from 3.5 psig to 3.0 psig shall be measured. The results shall not be less than the minimum permissible duration for air test pressure drop as shown in Table I.

TABLE I
Minimum Duration for Air Test Pressure Drop

Pipe Size (Inches)	Time (Minutes)
4	2 1/2
6	4
8	5
10	6 1/2
12	7 1/2
15	9 1/2

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 re-laid 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 flexible and semi-rigid 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% of the specified average inside pipe diameter of the pipe.

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.
2. Plugs: All manhole inlets and outlets shall be plugged with approved stoppers or plugs.
3. Fill Level: The manhole shall be filled with water to 2-inches below the bottom of the tapered cone section, with a minimum depth of 4 feet and a maximum depth of 20 feet. The water shall stand in the manhole for a minimum of one hour to allow the manhole material to reach maximum absorption. Before the test is begun, the manhole shall be refilled to the original depth as needed.
4. Test Requirements: The drop-in water surface shall be recorded after a period of from 15 minutes to one hour. The time of the test shall be determined by the District Representative and may be varied to fit the various field conditions. The maximum Allowable drop in the water surface shall be 1/2 inch for each 15-minute period of testing.
5. Visible Leaks: Even though the leakage is less than the specified amount, the Contractor shall stop any leaks that may be observed to the satisfaction of the District Representative.

END OF SECTION

SECTION 15051: INSTALLATION OF PRESSURE PIPELINES

PART 1 - GENERAL

A. Description

This section describes the installation of: pressure pipelines fabricated of polyvinyl chloride, ductile iron, and welded steel, including pipeline closures and connections and pipeline encasement.

B. Related Work Described Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Concrete: 03300
3. Painting and Coating: 09900
4. Chlorination of Water Mains, Wells and Reservoirs: 15041
5. Hydrostatic Testing of Pressure Pipelines: 15042
6. Ductile-Iron Pipe and Fittings: 15056
7. Combination Air-Release and Vacuum Relief Valves: 15089
8. Facilities Identification: 15151
9. Cathodic Protection and Joint Bonding: 16640
10. Standard Specifications for Public Works Construction (SSPWC), Latest Edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. An installation schedule (tabulated layout) shall be submitted which includes:
 - a. Order of installation and closures.
 - b. Pipe centerline station and elevation at each change of grade and alignment.
 - c. Elements, curves, and bends, both in horizontal and vertical alignment including elements of the resultant true angular deflections in cases of combined curvature.
 - d. The location, length, size, design designation, and number designation of each pipe section and pipe special.
 - e. Locations of junction structures.
3. Welder qualification certificates shall be submitted.

PART 2 - MATERIALS

A. Installation Material

Refer to the various referenced sections on pipe by type 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	Domestic Water	Recycled Water	Sewer Force Main
2-inch and smaller	Copper	Copper	--
4-inch through 12-inch	PVC C900 or DIP	Purple PVC C900 or DIP	PVC C900 or Fusion Welded HDPE
14-inch through 24-inch	PVC C905 or DIP or CML & C Steel	Purple PVC C905 or DIP or CML & C Steel	PVC C905 or Fusion Welded HDPE
Above 24-inch and through 36-inch	PVC C905 or DIP or CML & C Steel	PVC C905 or DIP or CML & C Steel	PVC C905 or CCFRPM (Hobas) Pressure Pipe
42-inch and larger	DIP or CML & C Steel	DIP or CML & C Steel	Special design
Notes:			
1. Copper, Type K - Per Section 15057			
2. DIP - Ductile iron pipe per Section 15056			
3. PVC C900 & PVC C905 pressure pipe per Section 15064.			
4. CML&C - Cement mortar lined and coated steel pipe per Section 15076. Fully welded joints for diameters $\geq 24"$.			

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.
2. Care of Pipe: Care shall be taken to avoid cracking of the cement mortar coating and/or lining on steel pipe. If necessary, plastic sheet caps shall be used to close pipe ends and keep coatings and linings moist.

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. Internal Pipe Braces: Internal braces placed in steel pipes shall be maintained until backfilling and compaction are completed.
3. Pipe Caps: Plastic caps placed over the ends of steel pipe shall not be removed 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.
4. 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: Dewatering, excavation, shoring, sheeting, bracing, backfilling material placement, material compaction, compaction testing, and pipe laying requirements and limitations shall be in accordance with Section 02223, Trenching, Backfilling and Compacting.
2. Sanitation of Pipe Interior: During laying operations, tools, clothing, or other materials shall not be placed inside the pipe.
3. Prevention of Entry into Pipe: When pipe laying is not in progress, including lunch-hour, the ends of the pipe shall be closed using plugs constructed in a manner to prevent entry by any debris, animal, or vermin.
4. Laying Pipe on Grades over 5 Percent: Pipes shall be laid uphill with the bell or collared joints on the uphill end of each pipe length, whenever the grade exceeds five percent.
5. Pipe Base Thickness: Pipe base thickness shall be as specified in Section 02223, Trenching, Backfilling, and Compacting.
6. Depressions at Joints and Pipe Sling Points: Depressions shall be dug into pipe base material to accommodate the pipe bell and external joint filler form ("diapers"), and to permit removal of the pipe handling slings.
7. Placement of Pipe on Pipe Base: Pipe shall be lowered onto the bedding and installed to line and grade, its full length on firm bearing backfill material except at the bell and at sling depressions. Unless specified otherwise, the tolerance on grade shall be 1/4- inch; the tolerance on line shall be 1-inch. Grade shall be measured along the pipe invert.
8. Pipe Installation: Pipe shall be installed without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Precautions shall be taken to prevent pipe from being displaced by water entering trench. Damaged or displaced pipe shall be replaced or returned to specified condition and grade.
9. Trench Curvature and Pipe Deflection: The radius of curvature of the trench shall be determined by the maximum length of pipe section that can be used without exceeding the allowable deflection at each pipe joint and without causing deviation from the District's trench width requirements.
 - a. Refer to the various referenced sections on pipe by type for allowable deflection.
 - b. The deflection at any flexible joint shall not exceed that prescribed by the manufacturer of the pipe.
 - c. The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed.
10. Equipment for Installation of Pipe: Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the Contractor for safe and efficient execution of the work.

All pipe, fittings, valves, and accessories shall be carefully lowered into the trench using suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
11. Cutting and Machining Pipe: Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or produce ragged, uneven edges.

D. Assembling Rubber-Gasketed Joints

1. Cleaning Ends of Pipe: The ends of the pipe to be joined shall be cleaned of foreign material.
2. Lubrication: After placing pipe in trench, a nontoxic water-soluble vegetable soap solution shall be applied to the inside of the bell of the pipe in the trench and to the rubber gasket and spigot of the pipe to be installed. The rubber gasket shall be stretched into the groove in the bell-end of the pipe and distributed uniformly around the circumference.
3. Joint Assembly: Without tilting the pipe to be installed, the spigot shall be inserted into the bell of the pipe. Come-a-longs or pipe jacks shall be used to drive spigot end into the bell until properly seated. The joint recess recommended by pipe manufacturer for made-up joints shall be maintained. Where deflections at joints are required for curved alignment, the manufacturer's recommended allowable joint opening on one side shall not be exceeded. A feeler gauge shall be used to verify proper placement of each gasket.

E. Flanged Connections

1. Bolt hole Alignment: Pipe shall be set with flange bolt holes straddling the pipe horizontal and vertical centerlines.
2. Nuts and Bolts: Nuts and bolts shall be lubricated with anti-seize prior to installation.
3. Flange Wrapping: Flanges which connect with buried valves or other equipment shall be wrapped with sheet polyethylene film as specified for the valves and equipment in Section 15056, Ductile-Iron Pipe and Fittings. The wrap shall be extended over the flanges and bolts and secured around the adjacent pipe circumference with tape. For insulating joints, wrapping shall comply with Section 16640, Cathodic Protection and Joint Bonding.

F. Installation of Bends, Tees, and Reducers

1. Fittings shall be installed utilizing standard installation procedures.
2. Fittings shall be lowered into trench by means of rope, cable, chain, or other acceptable means without damage to the fittings. Cable, rope, or other devices used for lowering fitting into trench, shall be attached around exterior of fitting for handling.
3. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling.
4. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to ensure a sound and proper joint.

G. Installing Threaded Piping

Threaded piping shall be reamed, deburred, and cleaned before making up joints. Thread lubricant approved by the District's representative shall be applied to threaded pipe ends before installing fittings, couplings, unions, or joints.

H. Completion of Interior Joints for Mortar-Lined Pipes for 18-Inches in Diameter and Smaller

1. Preparation: A tight-fitting swab or squeegee shall be inserted in the joint end of the pipe to be joined.
2. Application of Cement Mortar: When ready to insert the spigot, the face of the cement mortar lining at the bell shall be coated with a sufficient amount of stiff cement mortar to fill the space between adjacent mortar linings of the two pipes to be joined.

3. Removal of Excess Mortar: Immediately after joining the pipes, the swab or squeegee shall be drawn through the pipe to remove all excess mortar and expel it from the open pipe end.

I. Completion of Interior Joints for Mortar-Lined Pipes 24-Inches in Diameter and Larger

1. Backfill Requirement: The trench shall be backfilled, compacted, and meet compaction requirements before applying mortar at joints.
2. Cleaning and Application of Cement Mortar: Working inside the pipe, foreign substances which adhere to the steel joint rings shall be removed, the surface cleaned, and stiff cement mortar packed into each joint. The mortar shall be finished with a steel trowel to match the lining in the adjoining pipes.
3. Removal of Excess Mortar: Excess mortar and other construction debris shall be removed from the pipe interior.

J. Pipeline Closure Assemblies

1. General: Pipeline closure assemblies shall be employed to unite sections of pipeline laid from opposite directions; to adjust the field length of the pipeline to meet structures, other pipelines, and points established by design stations; and to close areas left open to accommodate temporary test bulkheads for hydrostatic testing. Either follower ring design or butt strap design shall be used. Follower ring closures shall be installed as recommended by the pipe manufacturer.
2. Butt Straps: As shown in the TCWD Standard Drawings, shaped steel butt straps a minimum of 10-inches in width and shall be centered over the ends of the pipe sections they are to join.

For pipelines 39 inches in diameter and smaller: Butt straps shall be welded to the outside of the pipes with complete circumferential fillet welds equal in size to the thinnest part being joined.

The details shown on the drawings shall be referred to when joining 39-inch or larger pipes.

3. General Requirements for Cement Mortar Lining for Closure Assemblies: Closure assemblies shall be cement-mortar lined to a mortar thickness at least equal to the adjoining standard pipe sections.
 - a. The steel shall be cleaned with wire brushes and a cement and water wash coat applied prior to applying the cement mortar.
 - b. Where more than a 4-inch joint strip of mortar is required, welded wire mesh reinforcement having a 2-inch by 4-inch pattern of No. 13 gage shall be placed over the exposed steel.
 - c. The mesh shall be installed so that the wires on the 2-inch spacing run circumferentially around the pipe.
 - d. The wires on the 4-inch spacing shall be crimped to support the mesh 3/8 inch from the metal surface.
 - e. The interior mortar shall have a steel-trowel finish to match adjoining mortar lined pipe sections.
4. Lining Closure Assemblies: Butt straps with 5-inch diameter hand holes shall be provided for lining of closure assemblies on pipelines and as shown on the TCWD Standard Drawings.

5. Mortar Coating Exterior Surfaces of Closure Assemblies: The exterior of closure assemblies shall be reinforced with wire mesh as described in Paragraph 3 above.
 - a. The surface shall be coated with mortar, or a poured concrete encasement to cover all steel to a minimum thickness of 1 1/2 inches.
 - b. Exterior mortar shall be protected to retard drying while curing.
 - c. Concrete shall be poured and vibrated on one side of the closure assembly only, until mortar is visible on the opposite side, after which the coating can be completed over the top of the assembly.

K. Welded Joints

1. Locations: Welded joints shall be provided where detailed on the plans and in every location where the operating pressure shall be greater than 150 psi.
2. Reference Standard: Welding shall be in accordance with AWWA C206. Welder's qualification shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Current certifications shall be provided for all welders.
3. Sequence: Interior joints shall not be welded before backfilling, compaction, and compaction testing are successfully completed.
4. Joint Rings: Joint rings (butt-straps or weld collars) that are rusted or pitted where weld metal is to be deposited shall be cleaned by brushing or sand blasting.
5. Restrictions: Concrete or other coating adjacent to the joint rings shall not be heated.
6. Cleaning Requirements: Each layer of deposited weld metal shall be cleaned using a power-driven wire brush or grinder prior to depositing the next layer of weld metal.

L. Operations Incidental to Joint Completion

1. Hydrostatic Testing: Joint completion shall be planned to accommodate temporary test bulkheads for hydrostatic testing.
2. Bonding Pipe: Metallic jumper bonds or bars shall be installed on all metallic pipe, as shown on plans, and as specified within Section 16640, Cathodic Protection and Joint Bonding.

M. Completion of Exterior Pipe Joint for Cement-Mortar Coated Pipe

Outside joint recess shall be filled with cement-mortar grout using a fabric form (joint diaper) placed around the joint and secured with steel straps. Grout shall be poured and rodded from one side only until it is visible on the opposite side. After approximately one hour, the joint shall be topped off with additional grout. District representative shall inspect each exterior joint prior to backfilling.

N. Thrust Restraint and Anchor Blocks

1. Location: Thrust restraint and anchor blocks shall be provided on all pressure pipelines. shall be installed as shown on the plans and at all rubber gasketed fittings that are not otherwise restrained. Thrust restraint blocks or anchor blocks shall be installed at all valves, tees, crosses, ends of pipelines, and at all changes of direction of the pipeline greater than 10 degrees deflection either vertically or horizontally, when joints are not otherwise restrained.
2. General Requirements: Thrust restraint and anchor blocks shall be of not less than 3,250 psi concrete (Class C) and shall provide a thrust bearing area to resist horizontal or downward thrust per TCWD standard W-19.

Thrust restraint and anchor blocks shall also be of sufficient gross weight and area to give bearing against undisturbed vertical earth banks sufficient to absorb the thrust, allowing an earth bearing of 1,500 pounds per square foot maximum. Thrust protection shall be set and cured prior to pressurizing the line.

3. Thrust Restraint not Called for on the Plans: Thrust restraint elements, where not called for on the plans, shall be sized for 150 percent of operating pipeline pressure or the pipeline test pressure, whichever is greater. Prior to construction, thrust and anchor block sizing shall be submitted to the District for approval.
4. Concrete Placement: Concrete shall be placed against wetted and undisturbed soil, and the exterior of the fitting shall be cleaned and wetted to provide a good bond with the concrete. The concrete interface with the fitting shall be an area of not less than the projected area of the fitting normal to the thrust resultant and centered on the resultant.
5. Accessibility to Joints and Fittings: Unless otherwise directed by the District, thrust restraint and anchor blocks shall be placed so that the pipe and fitting joints are accessible for repair. Placement shall include isolation of adjacent utilities and shall ensure that bearing is against undisturbed soil.
6. Harness and Tie-Rods: Metal harness or tie-rods and pipe clamps shall be used to prevent movement if shown on the plans or directed by the District. The rods and clamp harnessing arrangement shall be installed utilizing flanged harness hold-downs or lugged fittings and pipe with saddle clamps placed (where feasible and practical) to bear against the pipe bells. Saddle clamps around the barrel of the pipe, which depend on friction to prevent sliding of the clamp, are acceptable.

However, restraints with pointed set-screws which bear into the pipe wall, are not acceptable and shall not be used.

All surfaces of exposed and buried steel rods, reinforcing steel, bolts, clamps, and other metal work shall be coated prior to backfilling, and touched up after assembly as specified in Section 09900, Painting and Coating, System D-1, "Buried Metal Coating Systems".

7. In-line Valves: Reinforcing steel tiedown rods shall be used on all in-line valves. Refer to the TCWD Standard Drawings for typical valve anchor and thrust restraint details. Exposed metal portions shall be coated with bitumastic material as specified in Section 09900, Painting and Coating, System D-1, "Buried Metal Coating Systems".

O. Blowoff Assemblies

1. General: In-line type or end-of-line type blowoff assemblies shall be installed in accordance with the plans and TCWD Standard Drawings at locations noted, and at such additional locations as required by the District for removing water or sediment from the pipeline.
2. Location: The assembly shall be installed in a level section of pipe. The tap for blowoff 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 asbestos cement pipe.
3. Restrictions: Blowoffs shall not be connected to any sewer, submerged in any stream, or installed in any manner that will potentially allow back siphoning into the distribution system.

P. Combination Air and Vacuum Release Valves

1. General: 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 per TCWD Standard Drawings or as specified by the District, and in accordance with Section 15089, Combination Air- Release and Vacuum Relief Valves.
2. Location: 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 asbestos cement pipe.

Q. Above-ground Piping Installation/Support

1. General: Installation of aboveground pipeline materials and appurtenances include requirements for buried pipeline materials and appurtenances as applicable.
2. Supports: All exposed pipe shall be adequately supported with devices of appropriate design. Where details are shown, the supports shall conform thereto and shall be placed as indicated per TCWD Standard Drawings; provided that the support for all piping shall be complete and adequate as herein specified, whether or not supporting devices are specifically called for.
3. Grooved-End Pipe and Fittings: Grooved-end pipe and fittings shall be installed in accordance with the coupling manufacturer's recommendations and the following:
 - a. Loose scale, rust, oil, grease, and dirt shall be cleaned from the pipe or fitting groove. Lubricate the coupling gasket in accordance with the manufacturer's recommendations.
 - b. Coupling shall be tightened alternately and evenly until coupling halves are seated properly.

R. ID and Locator Tape

The pipe identification shall be in accordance with Section 15151, Facilities Identification.

S. Disinfection

All potable water pipelines shall be disinfected in accordance with Section 15041, Chlorination of Water Mains, Wells and Reservoirs.

T. Testing

All piping shall be hydrostatically pressure tested in accordance with Section 15042, Hydrostatic Testing of Pressure Pipelines.

END OF SECTION

SECTION 15053: CARBON STEEL PIPE AND FITTINGS

PART 1 - GENERAL

A. Description

This section describes materials and installation of steel pipe and fittings. This pipe may serve general purposes such as for compressed air, and miscellaneous piping applications where Section 15076, Cement-Mortar Lined and Coated Steel Pipe does not apply. This section applies to piping applications that have a 300 psi or less operating pressure.

B. Related Work Specified Elsewhere

1. Painting and Coating: 09900
2. Installation of Pressure Pipelines: 15051
3. Cement-Mortar Lined and Coated Steel Pipe: 15076

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit materials list showing material of pipe and fittings with ASTM reference and grade.

D. Measurement and Payment

1. Payment for the work in this section shall be in accordance with the General Provisions and the following.
2. Payment shall be by the linear foot for each diameter and for each pipe strength designation measured horizontally over the pipe centerline, exclusive of the distance between the inside faces of junction or other structures.

E. Inspection

The District reserves the right to inspect materials, production, or testing of pipe at the manufacturer's plant.

PART 2 - MATERIALS

A. Pipe

Pipe shall be black carbon steel, conforming to ASTM A53, Type E or S, Grade A or ASTM A135, Grade A.

- i. Pipe 12-inches in diameter and smaller shall be Schedule 40 or 80, as shown on plans, per ANSI B36.10.
- ii. Pipe larger than 12-inches in diameter shall be standard weight per ANSI B36.10. Design thickness of the pipe shall be Schedule 40 at a minimum.
- iii. Pipe shall conform to AWWA C200, AWWA M11, with a minimum wall thickness of 0.2500 inches and as specified herein.

B. Threaded Nipples

Threaded nipples shall be of the same material as the pipe. Threads shall conform to ANSI B2.1.

C. Fittings and Joints

1. 3-Inches in Diameter and Smaller: Fittings 3-inches in diameter and smaller shall be threaded forged steel fittings (ASTM 05) conforming to ANSI B16.11, Class 3000.

2. Buried Fittings: Fittings for buried pipe larger than 3-inches in diameter shall be flanged or butt-welded, conforming to ANSI B16.9. Material shall conform to ASTM A234, Grade WPB. Wall thickness shall be the same as the pipe.
3. Above Ground Fittings Larger than 3-Inches in Diameter: Fittings for above ground or exposed pipe larger than 3-inches in diameter shall be grooved end or flanged, conforming to ANSI B16.9. Material shall conform to ASTM A234, Grade WPB. Wall thickness (except for grooved ends) shall be the same as the pipe. Grooved- end joints shall comply with AWWA C606. Smooth radius forged steel fittings are required in-lieu of fabricated steel fittings.

D. Unions

Unions shall be Class 300, malleable iron (ASTM A47, Grade 35018) brass to iron seat, conforming to ANSI B16.39. Ends shall be threaded per ANSI B1.2.01.

E. Grooved-End Couplings

Grooved-end couplings shall be ductile iron, ASTM A536, Grade 65-45-12 or greater. Gaskets shall be EPDM and shall conform to ASTM D2000. Couplings shall be flexible type, square cut groove, per AWWA C606. Couplings for pipe 24-inches in diameter and smaller shall be flexible type, square cut groove, per AWWA C-606, and shall be Victaulic Style 77.

F. Thread Lubricant

Teflon thread lubricating compound or Teflon tape shall be used for threaded joints.

G. Pipe Lining and Coating

1. Cement Mortar Lining and Coating: Where indicated on the plans, buried and exposed pipe shall be cement-mortar lined and coated in the shop per AWWA C205, and as specified in Section 15076, Cement Mortar Lined and Coated Steel Pipe.
2. Buried Piping: Where indicated on the plans, buried pipe shall be factory lined and coated per Section 09900, Painting and Coating.
3. Exposed Piping: Piping located above ground or in vaults and structures shall be coated per Section 09900, Painting and Coating.

H. Flanges

1. General: Weld-neck flanges (conforming to ANSI B16.5) shall be provided for piping 3-inches in diameter and smaller to connect to flanged valves, fittings, or equipment. Slip-on or weld-neck flanges shall be provided for piping larger than 3-inches in diameter. Flanges shall match the connecting flanges on the adjacent fitting, valve, or piece of equipment. Flange material shall conform to ASTM A105, A 181, or A 182. Flanges shall be flat face.
2. Pressure Class: For test pressures 200 psi and less, Class 150 flanges, ANSI B16.5 shall be used. For test pressures greater than 200 psi, Class 300 flanges, ANSI B16.5 shall be used.

I. Bolts and Nuts

1. Bolts and nuts for flanged valves and flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts. For grooved-end fittings, bolts shall be Type 316 stainless steel and conform to ASTM F593 or ASTM A183 and have a minimum tensile strength of 100,000 psi.
2. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.

3. The length of each bolt or stud shall be such that between 1/4 inch and 1/2 inch will project through the nut when drawn tight.

J. Gaskets for Flanges

Gaskets shall be composed of synthetic fiber with rubber binder and shall be full face, 1/8-inch thick Garlock 3400, Anchor 441 conforming dimensionally to ANSI B16.21. Ring gaskets extending to the inner edge of flange bolts may be used where a raised face flange is present.

K. Outlets

1. Outlets 2-Inches in Diameter and Smaller: Outlets, which are 2-inches in diameter and smaller, shall be made by welding on an extra-heavy steel weld-o-let threaded coupling. Refer to TCWD Standard Drawing details for water service connections to steel pipe.
2. Outlets Larger than 2-Inches in Diameter: For outlets larger than 2-inches in diameter, flanged tees with flanged nozzle outlets shall be used. Tee fittings shall be fabricated in accordance with the applicable portions of the latest revision of the AWWA Manual M11, "Steel Pipe – A Guide for Design and Installation".

Smooth radius forged steel fittings are required in-lieu of fabricated steel fittings. By special permission from the District, when the duration of shutdown is critical, outlets for connection to existing steel water pipelines may be made using fabricated steel nozzles. In such cases nozzle outlets shall be fabricated in accordance with the applicable portions of the latest revision of the AWWA Manual M11, "Steel Pipe – A Guide for Design and Installation".

In all cases, a full-wrap reinforcing plate shall be welded around the outside of the pipe section; and (on the nozzle-size) a circular annular reinforcing collar plate (with minimum 1/4-inch thickness) shall be welded over the top of the steel wrapper pad, around the base of the nozzle opening. Refer to TCWD Standard Drawings for welding and plate details.

PART 3 - EXECUTION

A. Fabrication

1. Fabrication: Fabrication shall comply with ANSI B31.3, Chapter V.
2. Butt-Welded Joints: Beveled ends for butt-welding shall conform to ANSI B16.25. Slag shall be removed by chipping or grinding. Surfaces shall be clean of paint oil, rust, scale, slag, and other material detrimental to welding.
3. Weld Passes: The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inches)	Minimum Number of Passes for Welds
0.2500	2
0.2501 through 0.3750	3
0.3751 through 0.5000	4
0.5001 and greater	Requires design review & District approval

All welds shall be continuous and fully circumferential.

4. Welding Process: The shielded metal arc welding (SMAW) process shall be used for welding.
5. Welding Preparation: Welding preparation shall comply with ANSI B31.3, paragraph 328.4. Limitations on imperfections in welds shall conform to the requirements in ANSI B31.3, Tables 341.3.2 and 341.3.2B, and paragraph 341.4 for visual examination.
6. Weld Identification: Welds shall be identified in accordance with ANSI B31.3, paragraph 328.5.
7. Cleaning Welds: Each layer of deposited weld metal, including the final pass, shall be cleaned with a power-driven wire brush prior to depositing the next layer of weld metal.
8. Welding Electrodes: Welding electrodes shall comply with AWS A5.1 or A5.5.

END OF SECTION

SECTION 15056: DUCTILE-IRON PIPE AND FITTINGS

A. Description

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

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Painting and Coating: 09900
3. Chlorination of Water Mains, Wells and Reservoirs: 15041
4. Hydrostatic Testing of Pressure Pipelines: 15042
5. Installation of Pressure Pipelines: 15051
6. Manual Valves: 15100
7. Flexible Pipe Couplings and Expansion Joints: 15162
8. Cathodic Protection and Joint Bonding: Section 16640
9. AWWA Standards: C104, C105, C110, C111, C115, C150, C151, and C153, latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Affidavits of compliance with standards referenced in this specification, e.g., AWWA C151, shall be provided.
3. Layout drawings showing the locations and dimensions of pipe and fittings shall be submitted where the proposed pipeline is to be placed along streets or alignments with a radius of curvature which dictates the use of shorter-than- standard pipe lengths.

In cases where restrained joint pipe is specified, lay drawings shall clearly identify the joints, lengths, fittings, and deviations from the curved centerline of the pipe trench.

Consideration for adjacent parallel utility conduits is important in developing the conduit lay drawings to avoid conflicts and encroaching into adjacent trench areas.
4. Lining, coating, and wall thickness for all piping shall be provided.
5. Joint details for all types of joints used shall be submitted.
6. Calculations and/or test data proving that each proposed restrained joint arrangement can transmit the required forces shall be submitted.

D. Measurement and Payment

1. Payment for the work in this section shall be in accordance with the General Provisions and the following.
2. Payment shall be by the linear foot for each diameter and for each pipe strength designation measured horizontally over the pipe centerline, exclusive of the distance between the inside faces of junctions or other structures.

E. Inspection

The District reserves the right to inspect materials, production, and testing of pipes, fittings, and special pieces at the manufacturer's plant.

F. Delivery, Storage, and Handling

1. Care shall be exercised in handling, loading, unloading, and storing ductile-iron pipe and fittings to avoid distortion, scratches, gouges, dents, and, in particular, scuffing of the ends.
2. All ductile-iron pipe and fittings shall be stored under cover in a flat, horizontal position, and protected from the sun and the elements until ready for installation.
3. Ductile-iron pipe shall be transported in a vehicle having a bed long enough to provide support for the full length of the pipe.
4. Any length of pipe or fitting that has been damaged or distorted shall be replaced at no additional cost to the District.
5. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth, or other substances will enter the pipe or fittings.

PART 2 - MATERIALS

A. Ductile-Iron Pipe

1. AWWA Reference Standard: Ductile-iron pipe shall be manufactured in accordance with ANSI/AWWA C151/A-21.51.
2. Minimum Wall Thickness: The minimum wall thickness for ductile-iron pipe shall be as specified in AWWA C150 for the design pressure class, and thickness. Class 53 pipe shall be used for flanged spools, unless indicated otherwise on the plans or in the Project Technical Specifications.
3. Joints: Unless otherwise called out on the plans or in the Project Technical Specifications, push-on type joints shall be used.

The joint dimension and gasket shall be as specified in ANSI/AWWA C111/ A-21.11.

All pipe joints shall be bonded to provide electrical continuity for corrosion monitoring and future cathodic protection.

For joint-bonding details and requirements refer to the TCWD Standard Drawings and to Section 16640, Cathodic Protection and Joint Bonding.
4. Flanges:
 - a. Flanges for ductile-iron pipe shall be per ANSI/AWWA C110/A21.10 and C153/A21.53 standards conform to the drilling and facing of ANSI B16.1 Class 125 flanges.
 - b. ANSI/AWWA C110/A21.10 flanged fittings are rated for 350 psi operating pressure for 3" through 12" sizes and 250 psi operating pressure for 14" through 48" sizes.
 - c. ANSI/AWWA C153/A21.53 fittings are rated for 150 psi operating pressure for 54" through 64" sizes.
 - d. These ratings are at ambient temperatures with at least a 2:1 factor of safety.
 - e. Gaskets: Special gaskets such as U.S. Pipe's FULL FACE FLANGE-TYTE™ Gaskets or RING FLANGE-TYTE™ Gaskets are required for operating pressures greater than 250 psi.
 - f. Flanges of Ductile Iron fittings meeting the requirements of ANSI/AWWA C110/A21.10 cannot be joined with Class 250 ANSI B16.1 flanges. When required as shown on the plans, shall be "screwed-on" type in accordance with ANSI/AWWA C115/A-21.15.

5. Manufacturers: Ductile-iron pipe shall be as manufactured by American Cast Iron Pipe Company, McWane Cast Iron Pipe Company/McWane Ductile, or U.S. Pipe and Foundry Company.
6. Restrained Joints: Where called for on the plans, pipe and fittings shall be restrained. Restrained joints shall be as specified in this Section and shall be one of the following types:
 - a. Flanged fittings – See above.
 - b. Manufactured locking restraint pipe with fittings.
 - i. Acceptable products and manufacturers include: TR-Flex by U.S. Pipe & Foundry Company, Flex Ring by American Cast Iron Pipe, Megalug - EBAA Iron, Sales Inc. or Thrust-Lock by Pacific States Cast Iron Pipe Company.
 - ii. Field welding of ductile iron restrained joint or ductile iron components is **not acceptable**.
 - c. Mechanical Joints with Mechanical Joint Restraints.
 - d. Push-on joint pipe with restrained harness assembly. Restraint of push-on joints shall only be used where specifically called for on the plans. Shop drawings reflecting every part, material and dimension of the restraint assembly shall be submitted to the District for approval prior to ordering pipe or installation.
 - i. Restraint systems using lugs integral to the pipe shall be cast with the pipe or fitting by the pipe manufacturer. Attachment of angle iron; angle-clips; harness-lugs or tabs by field welding to the ductile iron pipe or fitting is strictly prohibited. (a.) All threaded harness parts shall be manufactured of type 316 stainless steel.
 - ii. Restraint of push-on joints shall be of the type utilizing cast lugs, or retainer rings bearing against the pipe shoulders at the bell or fitting.
 - e. Grooved pipe and fittings (for above grade or in vaults).

B. Ductile-Iron Fittings

1. AWWA Reference Standard: Ductile-iron fittings shall be manufactured in accordance with ANSI/AWWA C110/A-21.10 or ANSI/AWWA C153/A-21.53.
2. Push-on Joints: All pipe fittings shall be made with push-on joints designed for use with the type of pipe to be joined unless noted otherwise on the plans.
3. Restrained Joints: Restrained joints shall be as called for on the plans. Joint restraint type shall be as specified in this Section for ductile iron pipe, and shall be as specified under Part 2, A above.
4. Bell Ends: Bell ends shall be compatible with the pipe ends so as to provide confinement of the rubber rings and prevent damage to the ends of the pipe. Ring grooves and interior surfaces of the bell shall be smooth and free from ridges, notches, or uneven surfaces.
5. Mechanical Joints: Mechanical joint fittings will be allowed only in areas specifically called for on the project plans or as approved by the District as a substitute for other types of fittings.

Mechanical joint fittings will be used in areas where there is limited room for a thrust block or in cases where the pipeline needs to be activated in a short period of time.

These ductile iron fittings shall comply with ANSI / AWWA C111/A-21.11, with a pressure rating of 250 psi and an ANSI Class 125 and Class 150 bolt pattern. Tee-bolts for mechanical joint fittings shall be Type 316 stainless steel.

Field applications where speed of construction to facilitate tie-ins and where there is limited space available for concrete thrust blocks, are examples of where mechanical joint fittings with retainer glands are appropriate.

6. Mechanical Joint Restraint Systems: Mechanical joints with retainer gland fittings will only be allowed in areas specifically called for on the project plans or as approved by the District as a substitute for other types of fittings.

Mechanical joint fittings shall meet or exceed the ASTM A536 requirements. Torque off bolts shall be tightened per manufacturer's recommendations and shall be inspected by the District prior to backfill. Approved manufacturers include: MEGALUG - EBAA Iron, Uni-Flange Pipe Restraint - Ford Meter Box, Sigma One-Lok, or RomaGrip - Romac Industries Inc.

7. Flanged Fittings: Unless otherwise indicated on the drawings, all fittings with flanged ends shall comply with ANSI/AWWA C110/A21.10, with a pressure rating of 250 psi and a Class 125 ASME/ANSI B-16.1 flange or an ANSI/AWWA C115/A-21.15 Class 125 flange.

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.

In addition, all flanges shall meet the following tolerances:

Description	Tolerance (inches)
Bolt circle drilling	0.06250
Bolt hole spacing	0.03125
Eccentricity of bolt-circle & facing with respect to bore center	0.03125

8. Manufacturers: Fittings shall be manufactured by American Cast Iron Pipe, McWane Ductile, Sigma, SIP Industries, Star Pipe Products, Tyler Union, or U.S. Pipe.

C. Gaskets

1. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8-inch thick and be made of Ethylene Propylene Diene Monomer (EPDM), or synthetic fiber. Gaskets shall be suitable for a water pressure of 350 psi at a minimum temperature of 180°F.

Gaskets shall be NSF 61 certified for potable water applications. For potable and non-potable water applications, gaskets shall be compatible with water that may have a chlorine residual of 25 mg/L.

2. Full Face Type Gaskets or Ring Gaskets for Flanged Joints:

- Full face type gaskets with pre-punched holes shall be used where both flanges are flat face.
- Ring gaskets extending to the inner edge of the bolts may be used where a raised face flange is present.

3. Gaskets for Push-on, Mechanical, and Restrained Joints: Gaskets for push-on, mechanical, and restrained joints shall be synthetic or natural rubber in accordance with AWWA C111.

4. Manufacturers: Gaskets shall be Garlock Style 3000, 3760, 8314, and 98206; Klinger C-4401, Teadit Style NA 1002, or U.S. Pipe Flange-Tyte.

D. Bolts, Nuts, and Washers

1. Bolts and nuts for flanged valves and flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts.
For grooved-end fittings, bolts shall be Type 316 stainless steel and conform to ASTM F593 or ASTM A183 and have a minimum tensile strength of 100,000 psi.
2. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.
3. The length of each bolt or stud shall be such that between 1/4 inch and 1/2 inch will project through the nut when drawn tight.

E. Grooved-End Fittings and Couplings

1. Grooved-end fittings shall conform to AWWA C606, rigid radius-cut groove.
2. Grooved-end couplings shall be ductile iron, ASTM A536, Grade 65-45-12. Gaskets shall be EPDM and shall conform to ASTM D2000.
3. Coupling shall be Victaulic - Style 31, or Grinnell – Style 772. All of the threaded parts shall be Type 316 stainless steel and shall be lubricated with anti-seize compound.
4. Where the restrained joint is of the grooved type, the wall thickness beneath the groove shall be equal to or greater than the minimum specified wall thickness and shall be sufficient to meet the maximum pressure.

F. Lining for Pipe and Fittings

The interior of all pipe and fittings shall be lined with cement-mortar per ANSI/AWWA C104/A-21.4. Lining shall be the double thickness listed in AWWA C104, Section 4.8. Lining materials shall conform to ASTM C150, Type II.

G. Coating for Pipe and Fittings

Exterior surfaces of buried pipe and fittings shall be coated with an asphaltic material in conformance with ANSI/AWWA C110/A-21.10, and ANSI/AWWA C151/A-21.51. The coating shall be free from blisters and holes and shall adhere to the metal surface at ambient temperatures encountered in the field.

H. Polyethylene Encasement

Unless specified otherwise, pipe and fittings shall be polyethylene encased in accordance with ANSI/AWWA C105/A-21.5.

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 in Section 15051, Installation of Pressure Pipelines.

B. Installation

1. Allowable Joint Deflection for Restrained Joint Pipe and Fittings: For restrained joints, deflection of the joint shall not exceed the manufacturer's recommended maximum deflection.

2. Acceptable Line and Grade for Piping: The pipe shall be laid true to the line and grade shown on the plans within acceptable tolerances. The tolerance on grade is 1-inch or 0.08" from design. The tolerance line is 2-inches or 0.13" from design.
3. Touch-Up Coating: All exposed flanges and other metal surfaces and all damaged coatings shall be coated after assembly per Section 09900, Painting and Coating.

C. Wrapping pipe with Polyethylene Encasement

1. All ductile-iron pipe and fittings buried underground shall be protected with a polyethylene encasement wrap in accordance with AWWA C105.
2. Wrap shall be a loose 8-mil-thick LLD polyethylene tube or a 4-mil thick HDCL polyethylene tube.
3. All joints between plastic tubes shall be wrapped with 2-inch-wide, 10-mil thick, polyethylene adhesive tape, Polyken 900, or Scotchwrap 50.
4. Installation of plastic film shall conform to the following.
 - a. Placement of Polyethylene Encasement: Using a sling, the pipe shall be picked up with a crane at the side of the trench and raised about 3 feet off the ground. The polyethylene tube, cut approximately 2 feet longer than the length of pipe, shall be slipped over the spigot end of the pipe and bunched up, accordion fashion, between end of the pipe and the sling.
 - b. Placement of Pipe into Trench: The pipe shall be lowered into the trench after the pipe is wrapped. The spigot shall be seated into the bell of the adjacent installed pipe, and the pipe lowered into the trench bottom. A shallow bell hole shall be provided in the trench bottom to facilitate the wrapping of the joint.
 - c. Joint Assembly: The pipe joint shall then be made up as described herein.
 - d. Adjustment of Polyethylene Encasement: The sling shall be removed from the center of the pipe and hooked into the bell cavity. The bell shall be raised approximately 12 inches and the tube of polyethylene film slipped along the full length of the pipe barrel. Enough of the film shall be left bunched up, accordion fashion, at each end of the pipe to overlap the adjoining pipe about 1 foot. Care shall be taken to ensure that soil that adheres to the pipe is removed as the polyethylene film is placed around the pipe.
 - e. Overlapped Joints: To make the overlapped joint wrap, the film shall be pulled over the bell of the pipe, folded around the adjacent spigot, and wrapped with about three circumferential turns of the plastic adhesive tape in order to seal the tube of film to the pipe. The tube on the adjacent pipe shall be then pulled over the first wrap on the pipe bell and sealed in place behind the bell, using about three circumferential turns of the polyethylene adhesive tape.
 - f. Attachment of Encasement: The resulting loose wrap on the barrel of the pipe shall be pulled snugly around the barrel of pipe, the excess material folded over the top and the fold held in place by means of short strips of the 2-inch wide, 10-mil thick adhesive tape at intervals 5 feet apart along the pipe barrel.

D. Flanged Connections

Flanged pipe and fittings shall be shop fabricated, not field fabricated per AWWA C110. Threaded flanges shall comply with AWWA C115 and shall be individually fitted and machine tightened in the shop.

E. Mechanical Joint Connections with Retainer Gland Restraints:

1. Mechanical joint connections with retainer glands shall be assembled in accordance with the manufacturer's recommendations and TCWD Standards for the specific fitting and retainer gland.
2. Torquing of break-off gland bolts shall be done in the presence of the District Representative.
3. Each fitting shall be observed by the District Representative prior to bagging and backfill.
4. Any such fittings not observed by the District Representative shall be excavated and exposed for detailed re-inspection of the fitting and bolt torque.

END OF SECTION

SECTION 15057: COPPER PIPE AND FITTINGS

PART 1 - GENERAL

A. Description

This section describes materials, installation, and testing of copper and brass pipe, copper, and brass fittings, and all appurtenances.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Painting and Coating: 09900
3. Hydrostatic Testing of Pressure Pipelines: 15042
4. Installation of Pressure Pipelines: 15051
5. Manual Valves: 15100
6. AWWA Standard: C800, latest edition

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit detailed layout if pipe runs in copper exceed 50 linear feet.
3. Submit catalogue order sheets for materials of pipe, flanges, flange insulation kits, companion flanges and unions, as well as showing metal composition and conformance to industry standards (ASTM, etc.) specified. The material data sheets shall indicate NSF certification for materials used on the potable water system.

PART 2 - MATERIALS

A. Copper Pipe and Tubing

1. Copper piping shall conform to ASTM B88. Copper pipe and tubing shall be cylindrical, of uniform wall thickness, and shall be free from any cracks, seams, or other defects.
2. Piping located above floors or suspended from ceilings shall be Type L.
3. Piping buried or located beneath floor slabs shall be Type K Soft or Type K Rigid as shown on TCWD Standard Drawings.
4. Copper pipe shall be as manufactured by Cambridge-Lee Industries, Inc., Cerro Flow Products LLC, or Mueller Streamline Co or approved equal.

B. Copper Fittings

Copper fittings shall be copper conforming to ASTM B75 and ANSI B16.22, with lead-free solder end joints. Fittings 3/8-inch and smaller may have flared end connections or compression joint connections.

C. Solder

Solder shall be tin-silver solder conforming to ASTM B32, latest revision, Grade Sn94, Sn95 or Sn96. Cored solder shall not be used. Solder and flux used in joints of potable waterlines shall contain no more than 0.2 percent lead.

D. Brass Pipe and Nipples

Short threaded nipples and brass pipe shall conform to ASTM B43, regular wall thickness, except that nipples and pipe of sizes 1-inch and smaller shall be extra strong. Threads shall conform to ANSI B1.20.1.

E. Brass Appurtenances

1. General: All items specified herein shall be manufactured of brass conforming to AWWA C800 and shall meet NSF 61 requirements where the product is used on potable water.
2. Service Saddles: Service saddle bodies shall be manufactured of brass, stainless steel or nylon-coated malleable iron as called for in TCWD Standard Drawings for the various types of pipe connections.

Saddles shall be tapped with a female iron pipe thread outlet with 316 stainless steel saddle bolts.

The seal with the outer wall of the pipe shall be affected with either a rubber gasket or an O-ring, except for the stainless steel full-circle style repair clamp connection, which shall have a full-circle rubber gasket.

Service saddles shall be manufactured by Ford Meter Box Company, Jones Water Products, or Mueller Company.

- a. PVC C900 Pipe: Service saddles shall be 2-piece bronze service saddle with double strap type for OD controlled PVC Pipe with 1" FIPT outlet with 316 stainless steel saddle bolts.
- b. Asbestos-Cement Pipe: Service saddles shall be 2-piece bronze service saddle with double strap type with 1" FIPT outlet with 316 stainless steel saddle bolts for all pipe sizes.
- c. Steel Pipe: Service saddles shall be:
 - i. 3/16" or Thinner Steel Wall thickness: 1/4" thick, 2-piece, 6" wide rolled steel wedding band reinforcing strap with extra heavy welded steel outlet (Thread-O-Let) Coupling and 1" F.I.P.T. outlet with 316 stainless steel saddle bolts.
 - ii. 1/4" or Thicker Steel Wall thickness: 3" Wide, 2-Piece steel annular reinforcing collar with 1/4" thick plate, rolled to fit pipe OD radius extra heavy welded steel outlet (Thread-O-Let) coupling and 1" FIPT outlet with 316 stainless steel saddle bolts.
- d. Ductile Iron Pipe: Service saddles shall be either:
 - i. Full circle repair coupling with 1" bronze ball corporation stop and MIPT x Compression Fitting.
 - ii. Nylon coated malleable iron body service saddle with double stainless steel straps and 1" FIPT outlet.

Service saddles for use on 10-inch and 12-inch diameter pipe shall have a brass top section and flat 316 stainless steel straps on the bottom of the saddle.

Each saddle shall accurately fit the contour of the pipe O.D. without causing distortion of the pipe.

The sections shall be securely held in place with type 316 stainless steel hex-head screws or bolts. The casting sections shall be tapped to receive the screws or bolts.

3. Corporation Stops: Corporation stops shall be manufactured of brass. The inlet fitting shall be a male iron pipe thread (MIPT) when used with saddle and the outlet connection shall be a compression type, refer to TCWD Standard Drawings for details.
4. Corporation stops shall be "ball style" manufactured by A.Y. McDonald Mfg. Co, Ford Meter Box Company, Jones Water Products or Mueller Company.

5. Angle Meter Stops: Angle meter stops shall be of the "ball valve" style and shall be manufactured of brass. The inlet connection shall be an iron-pipe thread, and the outlet fitting shall be a meter flange or meter coupling, refer to TCWD Standard Drawings for details.

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 top of the fitting to operate the shutoff mechanism.

Two-inch angle meter stops shall be with "slotted" holes for 1 1/2-inch or 2-inch meters.

Angle meter stops shall be of the "ball valve" style and shall be as manufactured by A.Y. McDonald Mfg. Co, Ford Meter Box Company, Jones Water Products, or Mueller Company, LLC.

6. Ball Valves for Flush-outs: Ball valves shall be in accordance with Section 15100, Manual Valves or Ford Meter Box BLA18-777-TA-NL. Ford Meter Box valves shall include a PVC threaded cap to protect the male threads on the outlet of the valve. Ball Valves for Flush-Outs shall be installed in accordance with the TCWD Standard Drawings.
7. Customer Service Valve: Customer service valves shall be "ball valve" style manufactured of brass with lever-type turn handle, refer to TCWD Standard Drawings for details.
 - a. The inlet connection shall be a meter flange or a meter coupling and the outlet female iron pipe thread.
 - b. Customer service valves shall be of the insulating style as manufactured by Mueller - Proline Series.
 - c. Customer service valves shall be purchased from the District.

F. Connections & Cathodic Insulation

1. Underground Pipe Connections:
 - a. For connections to underground piping, refer to the TCWD Standard Drawings for water service connections.
 - b. Details are provided in TCWD Standard Drawings to address the appropriate connection method for each different type of piping material being connected for cathodic protection.
 - c. Those details provide for insulation and address cathodic protection concerns. In general, the practice of using threaded PVC or nylon bushings shall not be allowed.
2. Aboveground & Exposed Pipe Connections (In Vaults):
 - a. Pipe, fittings, and appurtenances (air vacs, pressure gauges, etc.) made of dissimilar metals shall be isolated from each other. Refer to TCWD Standard Drawings.
 - b. For applications where pipeline pressures exceed 150 psi, and where the pipe tap for the appurtenance into the main is larger than 1-inch in diameter.
 - i. A 2-½-inch extra heavy carbon steel coupling shall be provided as the outlet.
 - ii. The fitting and appurtenances shall be isolated from the main by means of a 2-½-inch by 2-inch - 316 stainless steel bushing, a 2-inch 316 stainless steel nipple, and a 2-inch stainless steel ball valve. Refer to TCWD Standard Drawings.

G. Flanges, Gaskets, Bolts and Nuts

1. Flanges for Valves and Fittings: Copper pipe shall be connected to flanged valves and fittings with bronze companion flanges conforming to ANSI B16.24, Class 125 (150 lb. Rating) to match the connecting flange.

Solder end companion flanges shall be used for copper and threaded companion flanges shall be used for brass, or stainless-steel pipe connections.
2. Gaskets: Gaskets for flanged-end fittings shall be made of synthetic rubber binder and shall be full-face, 1/8-inch thick as manufactured by Ford Meter Box Company or equal.
3. Flanged Connections: All flanged connections shall be made using Type 316 stainless-steel bolts and nuts conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts. Washers shall be provided for each nut. Washers shall be of the same material as the nuts.
4. Flange Insulating Kits: Flange insulation kits, suitable for the design pressure of the pipeline, shall be provided where shown on the drawings and/or wherever pipelines of dissimilar metals are joined together. Refer to TCWD Standard Drawings.

H. Unions

Unions for copper piping systems (non-buried applications) shall conform to the following.

1. Unions shall be the same size as the pipe, and shall be of the three-part type, with silver soldered "sweat" hub-end connections.
2. Unions shall be brass conforming to AWWA C800. Unions shall be manufactured by A.Y. McDonald Mfg. Co, Ford Meter Box Company, Jones Water Products, or Mueller Company.

PART 3 - EXECUTION

A. General

Pipe shall be installed without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Pipe hangers and supports, and pipe penetrations through walls, slabs, and floors shall be as detailed on the drawings or TCWD Standard Drawings.

B. Installing Flange Bolts and Nuts

1. Bolt Thread Lubrication: Bolt threads shall be lubricated with an anti-seize compound prior to installation. Anti-seize compound shall be manufactured by Tri-Flow, Permatex or Crouse-Hinds.
2. Flange Alignment: Flanged pipe shall be set with the flange bolt holes straddling the pipe's horizontal and vertical centerlines. This is referred to as the "two holing" procedure.

C. Installation

1. Related Installation Specification: Pipe shall be installed in accordance with the requirements of Section 15051, Installation of Pressure Pipelines.
2. Pipe/Tubing Preparation: Tubing shall be cut square and burrs removed. Both the inside and outside of fitting and pipe ends shall be cleaned with steel wool and muriatic acid before soldering. Care shall be taken to prevent annealing by overheating of fittings and tubing when making connections. Miter joints shall not be permitted in lieu of elbows. Notching straight runs of pipe in lieu of tees shall not be permitted.

3. Pipe Bends: Bends in soft copper tubing shall be in long sweep. Bends shall be shaped with shaping tools. Bends shall be formed without flattening, buckling, or thinning the tubing wall at any point.
4. Brazing: Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Solder shall penetrate to the full depth of the bell in joints and fittings. Solders shall comply with ANSI B31.3, paragraph 328.
5. Pipe Flexibility and Minimum Cover for Service Laterals: 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 42-inches below the finished street grade shall be adhered to per TCWD Standard Drawings. The tubing is to be bedded and covered with sand or select material in accordance with Section 02223, Trenching, Backfilling, and Compaction.
6. Copper Service Laterals: All service laterals shall be either 1-inch diameter or 2-inch diameter copper, Type K. Refer to the TCWD Standard Drawings.

End connections for the corporation stop shall be compression type fittings. All other couplings, fittings and joints shall be silver soldered. Piping for 2-inch size services shall be installed with straight lengths of soft copper water tube Type K.

D. Service Saddles

1. Proximity to Valves, Couplings, Joints, and Fittings: Service saddles shall be no closer than 18-inches to valves, couplings, joints, or fittings unless they are at the end of the main. The installation of a service saddle on any machined section of asbestos cement pipe will not be permitted.
2. Pipe Surface Preparation: The surface of the pipe shall be cleaned, smoothed and deburred to remove all loose material and to provide a hard, clean surface before installing of any service saddle.
3. Installation: The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of the pipe by over-tightening.
4. Pipe Tap: The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation. Tap hole diameter shall be 7/8-inch for 1-inch service taps and shall be 1 7/8-inch for 2-inch service taps per TCWD Standard Drawings.

END OF SECTION

SECTION 15064: PVC PRESSURE PIPE AND FITTINGS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of polyvinyl chloride (PVC) pipe for 4-inch through 36-inch diameter domestic water lines, recycled water lines, and sewer force mains, in accordance with the applicable provisions of AWWA C900.

B. Related Work Specified Elsewhere

1. Existing Facilities: 01045
2. Trenching, Backfilling, and Compacting: 02223
3. Chlorination of Water Mains, Wells and Reservoirs: 15041
4. Hydrostatic Testing of Pressure Pipelines: 15042
5. Installation of Pressure Pipelines: 15051
6. Ductile-Iron Pipe and Fittings: 15056
7. Copper Pipe and Fittings: 15057
8. Facilities Identification: 15151
9. AWWA Standards: C900 and C905

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit materials list showing material of pipe and fittings with AWWA and/or ASTM reference and grade.

D. Measurement and Payment

1. Payment for work in this section shall be in accordance with the General Provisions and the following.
2. Payment shall be by the linear foot for each diameter and for each pipe strength designation measured horizontally along the pipe centerline.

E. Delivery, Storage, and Handling

1. Care shall be exercised in handling, loading, unloading, and storing PVC pipe and fittings to avoid distortion, scratches, gouges, dents, and, in particular, scuffing of the ends. Discolored pipe shall be rejected.
2. All plastic pipe and fittings shall be stored under cover in a flat, horizontal position, and protected from the sun and the elements until ready for installation. The covering shall be placed in such a way as to allow adequate air circulation between the cover and the pipe.
3. Plastic pipe shall be transported in a vehicle having a bed long enough to provide support for the full length of the pipe. The shipping company shall protect the loaded pipe to avoid vehicle exhaust during transit.
4. Any length of pipe or fitting that has been damaged or distorted shall be replaced by the contractor and at no additional cost to the District.
5. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth, or other substances will enter the pipe or fittings.

PART 2 - MATERIALS

A. PVC Pipe

1. General: PVC pipe shall be manufactured in accordance with AWWA C900 and shall be of the sizes and pressure classes shown on the plans. The dimension ratio (DR) for C900 PVC pressure pipe shall be DR-14 or thicker walled (lower DR). The pipe shall have gasketed bell end or plain end with elastomeric gasketed coupling as shown on the plans.
2. Material: Material used to produce the pipe and couplings shall be made from Class 12454-A or B virgin compounds as defined in ASTM D1785, with an established hydrostatic design basis rating of 4,000 psi for water at 73.4°F (23°C).
3. Pipe Lengths: Laying lengths shall be 20 feet with the manufacturer's option to supply up to 15% random lengths (minimum length 10 feet).
4. Pipe Marking: Each pipe length shall be marked showing the date of manufacture, nominal pipe size and O.D. base, the AWWA DR, and the AWWA specification designation (AWWA C900). For potable water application, the seal of the testing agency that verified the suitability of the material for such service shall be included.
5. Manufacturers: Pipe shall be manufactured by Diamond Plastics Corporation, Ipex, Inc., Vinyltech Corporation., or JM Eagle.

B. Fittings

1. Materials: Fittings shall be ductile-iron conforming to Section 15056, Ductile Iron Pipe and Fittings.
2. Bell Sizes: Bell size shall be for Class 235 (DR 18) and Class 305 (DR 14) iron-pipe-size equivalent PVC pipe, including the rubber-ring retaining groove.
3. Reference Standard: All castings shall be marked "DI" or "Ductile" and ANSI/AWWA C153/A21.53.

C. Rubber Rings

Rubber rings for use in couplings and fittings shall conform to the requirements of ASTM F477. Rubber rings shall be stored out of direct sun light, clearly labeled with the material type, and protected in a manner to prevent deterioration.

D. Service Saddles

1. Service saddles for 1-inch and 2-inch diameter outlets shall be designed for use on C900 PVC pipe and shall conform to the requirements of Section 15057, Copper Pipe and Fittings.
2. Service saddles may be used on PVC pipe sizes up to and including 16-inches.
3. For outlets of larger than 2-inch diameter and for all outlets on larger diameter pipelines, ductile iron tees with flanged outlets shall be used. Refer to the TCWD Standard Drawings.

PART 3 - EXECUTION

A. General

1. Related Installation Specification: PVC pipe shall be installed in accordance with the requirements of Section 15051, Installation of Pressure Pipelines.

2. Restrictions: When pipe is to be installed in new streets or when street improvements require placement and/or replacement of curbs, piping shall not be installed until new curbs are in place, unless special approval by the District is obtained. If any curbing is damaged during piping installations, the damaged portions shall be repaired or replaced by the Contractor and to the satisfaction of the agency having jurisdiction at no additional cost to the District.
3. Closure Sections: Where closure sections are required, the sections shall be installed in accordance with the applicable portions of these specifications. Closures shall be made using gasketed-PVC closure collars.
4. Cover: The pipe sections shall be laid in the trench to true alignment and grade in accordance with the drawings. Where the grade is not shown, pipe shall have a cover of 42-inches in paved areas and unpaved areas. The pipe grade shall be approved by the District Representative in the field.
5. Curved Alignment: The pipe shall not be laid along curves at a radius less than that listed below. The minimum-radius curves are determined by the limit of 2-degree deflection for PVC pipe joints with factory-assembled bell couplings:

<u>Length of Pipe Section</u>	<u>Minimum Curve Radius</u>
20 feet	573 feet
10 feet	287 feet

For integral bell PVC pipe, the minimum radius curves obtained by deflecting joints shall not exceed the manufacturer's recommendation (which may be less than 2 degrees).

Pipe may not be offset to a degree such that the spigot end of the pipe deflects (touches) against the end of the pipe bell. Pipe sections shall not be bent to achieve a curve.

B. Installation

1. Pipe Cutting: 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 or shop to create a beveled end equal in workmanship 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 Representative before installation.
2. Joints: Connecting parts of pipe, rings, couplings, and castings shall be cleaned before assembly. After bearing has been obtained, couplings shall be assembled in a workmanlike manner. 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.

C. Pipe Identification

ID and locator tape shall be installed on all recycled water pipelines and potable water pipelines in accordance with Section 15151, Facilities Identification.

END OF SECTION

SECTION 15076: CEMENT-MORTAR LINED AND COATED STEEL PIPE

PART 1 - GENERAL

A. Description

This section describes materials, fabrication, installation, and testing of cement-mortar lined and coated steel pipe, in accordance with the applicable requirements of AWWA C200, C205, C206, C207 and C208.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, and Compacting: 02223
2. Painting and Coating: 09900
3. Interior Inspection for Cement-Mortar Lined Steel Pipe: 15040
4. Chlorination of Water Mains, Wells and Reservoirs: 15041
5. Hydrostatic Testing of Pressure Pipelines: 15042
6. Installation of Pressure Pipelines: 15051
7. Ductile-Iron Pipe and Fittings: 15056
8. AWWA Standards: C200, C205, C206, C207, C208, C219, C221, C227, C228, & C231

C. Submittals

Shop drawings shall be submitted in accordance with the General Provisions and the following:

1. Piping layout drawings showing location and dimensions of all pipe and fittings. Include lay lengths of valves, meters, and other equipment which determine piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:
 - a. Materials of construction, including references to industry standards being met (i.e., ASTM, ANSI, AWWA, and other related standards).
 - b. Inside diameter, steel wall thickness, internal design pressure (cement-mortar lining and coating thicknesses) for each class of pipe to be furnished.
 - c. Order of installation and closure locations for length adjustment and for construction convenience.
 - d. Pipe invert station and elevation of each change of grade and alignment.
 - e. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
 - f. Paint primer type and thickness where joints and other cement-mortar holdbacks occur.
 - g. Call out types and sizes, and dimensions of grooved-end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.
 - h. Limits of each reach of field-welded joints and of concrete encasement.
 - i. Locations of manholes and other points of access.
 - j. Location of valves and other mechanical equipment.
 - k. Locations of bulkheads for field hydrostatic testing of pipeline.
2. Manufacturer's certificates of compliance with prescribed industry standards (i.e., AWWA C200, C205, C206, C207 and C208, ASTM C150, and other related industry standards)
3. Detail drawings of:
 - a. Fittings
 - b. Joints
 - c. Butt Straps
 - d. Bulkheads and means of attachment to pipe.
4. Mill test reports on each heat from which steel is rolled.

5. Test reports on physical properties of elastomeric material used in gaskets.

D. Measurement and Payment

1. Payment for the work in this section shall be in accordance with the General Provisions and the following.
2. Payment shall be by the linear foot for each diameter and for each pipe strength designation measured horizontally over the pipe centerline, exclusive of the distance between inside faces of junction or other structures.

E. Inspection

The District reserves the right to inspect materials, production, or testing of pipe at the manufacturer's plant.

PART 2 - MATERIALS

A. Steel Pipe

1. Pipe shall conform to AWWA C200, AWWA M-11, latest edition. Steel shall be ASTM A36, ASTM A1011 or A1018, Grade 36, having a 0.25% maximum carbon content.
2. Steel cylinder thickness shall be as shown on the plans, but in no case, shall the pipe thickness be less than the following.
 - a. For pipe less than 30-inches in diameter: Steel cylinder wall thickness shall be a minimum of 10 gauge (0.1345 inches) for straight runs of distribution and transmission pipe.
 - b. For pipe large than 30-inches in diameter: Steel cylinder wall thickness shall be a minimum of 1/4-inch (0.2500 inches) for straight runs of distribution and transmission pipe.
 - c. For all pipe, regardless of the diameter: Steel cylinder wall thickness shall be 1/4-inch (0.2500 inches) within 10 feet on all sides of the following conditions.
 - i. Wherever the pipe is connecting to structures, vaults and other significant pipe appurtenances including, but not limited to, blow- offs, fittings, manways, PRV vaults, valve vaults, meter vaults, lift stations.
 - ii. Fittings shall include reducers, tees, and bends 45° degrees and greater. For grooved-end fittings, refer to the "Grooved-End Fittings" section herein for the pipe thickness requirements.
 - iii. Wherever the pipe is to be installed or jacked inside pipe casings.
 - iv. Wherever pipe penetrations are required.

B. Cement

Cement for cement-mortar lining shall be per ASTM C150, Type II or V and AWWA C205. Cement for cement-mortar coating shall be per ASTM C150, Type V and AWWA C205.

C. Fittings

1. Definition: A fitting shall be defined as a piece of pipe other than a straight full length joint. Elbows, tees, manhole sections, reducers, and sections of pipe with outlets shall be considered fittings. Dimensions shall be per AWWA C208.

2. Pressure Rating: Fittings 4 through 10-inches in diameter shall be designed for 250 psi and conform to ANSI B16.9. Fittings 12-inches in diameter and larger shall comply with AWWA C208.
3. Materials: Material for fittings 4 through 10-inches shall comply with ASTM A234, Grade WPB. Material for fittings larger than 10-inches but less than or equal to 30-inches in diameter shall be the same as the pipe. Cement-mortar lining and I.D. dimensions shall be the same as the specified pipe.
4. Allowable Stresses: Minimum wall thickness of steel fitting shall be the same as the pipe of same size per ANSI B36.10 and as required in Section A, herein, above.
 - a. Allowable circumferential stress at the design internal pressure shall not exceed 40% of minimum yield stress.
 - i. Outlet reinforcement at branches and openings shall be determined by the procedure given in ANSI B31.3, paragraph 304.3, and Appendix H. If reinforcement is required, it shall be accomplished as described below. The type of reinforcement for fittings with outlets shall be selected from following table:

R	Type of Reinforcement
Max. 0.5	Collar
Max. 0.7	Wrapper Plate
To 1.0	Crotch Plate

$$\text{Calc. } R = \frac{\text{I.D. outlet}}{\sin(\beta)}$$

$$\text{I.D. main run} \times \sin(\beta)$$

Where β = the angle between the longitudinal axis of the main run and the branch.

- ii. For collar reinforcement, select an effective shoulder width " $\ddot{W}_s$ " 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, which should be selected such that:

$$\ddot{W}_s = \left(\frac{1}{3} \text{ to } \frac{1}{2}\right) \times \text{I.D. outlet} \sin(\beta)$$

The minimum thickness "T" of the collar is determined by:

$$T = \frac{P \times \text{I.D. main run} \times \text{I.D. outlet} \times [2 - \sin(\beta)]}{4 \times F \times W \times \sin(\beta)}$$

Where: P = Design internal pressure, psi.

F = Allowable design stress = 40% of min. yield stress β = As defined in part C.i., above

Collars may be oval in shape or rectangular with rounded corners.

- iii. For a wrapper plate, the above collar formula shall be used except that the wrapper is of thickness "T", its total width " $\hat{W}_t$ " is determined by:

$$\hat{W}_t = 2\ddot{W} + \text{I.D. outlet}$$

$\sin(\beta)$ and it wraps entirely around the main pipe.

- iv. Base crotch plate design on Swanson, H. S. et al., *Design of Wye Branches for Steel Pipes*, summarized in AWWA Manual M-11.

v. Long Radius Curves and Vertical Curves:

For curved alignment, straight or beveled pipe of normal or 1/2 normal lengths pulled partially open on one side of the joint may be used with a welded mitered bend of up to 10 degrees next to the joint ring. Pipes with a bend in excess of 10 shall be designed as fittings. Joints shall not be pulled more than one-half of the watertight extensibility provided by the bell and spigot design.

5. Grooved-End Fittings: Fittings 24-inches diameter and smaller with grooved ends shall have square cut grooves, flexible type, with dimensions as shown in AWWA C606, Table 3. Steel wall thickness shall be standard weight, ANSI B36.10. Cement-mortar lining and I.D. dimensions shall be the same as for the specified pipe.
6. Welding Fittings: Welding fittings shall be standard weight, Tube Turns.

D. Flanges

Flanges shall be AWWA C207, Class D, flat face, except where Class E or Class F flanges are required.

E. Gaskets

1. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8-inch thick and be made of Ethylene Propylene Diene Monomer (EPDM), or synthetic fiber. Gaskets shall be suitable for a water pressure of 350 psi at a minimum temperature of 180°F. Gaskets shall be NSF 61 certified for potable water applications. For potable and non-potable water applications, gaskets shall be compatible with water that may have a chlorine residual of 25 mg/L.
2. Full Face Type Gaskets or Ring Gaskets for Flanged Joints: Full face type gaskets with pre-punched holes shall be used where both flanges are flat face. Ring gaskets extending to the inner edge of the bolts may be used where a raised face flange is present.
3. Gaskets for Push-on, Mechanical, and Restrained Joints: Gaskets for push-on, mechanical, and restrained joints shall be synthetic or natural rubber in accordance with AWWA C111.
4. Manufacturers: Gaskets shall be Garlock Style 3000, 3760, 8314, or 98206; Klinger Style 4401, Teadit Style NA 1002, or U.S. Pipe Flange-Tyte.

F. Bolts, Nuts, and Washers

1. Bolts and nuts for flanged valves and flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts.
2. For grooved-end fittings, bolts shall be Type 316 stainless steel and conform to ASTM F593 or ASTM A183 and have a minimum tensile strength of 100,000 psi.
3. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.
4. The length of each bolt shall be such that between 1/4-inch and 1/2-inch will project through the nut when drawn tight. Studs may be used instead of bolts only where approved by the District Representative.
5. Bolts for Flange Insulation Kits: Bolts and nuts for flange insulation kits shall conform to the same requirements as outlined in paragraph 2.F.1 above.

G. Flange Insulation Kits

Flange insulation kits suitable for the design pressure of the pipeline shall be provided where shown on the drawings.

H. Grooved-End Couplings

Grooved-end couplings shall be ductile iron, ASTM A536, Grade 65-45-12 or greater. Bolts and nuts for couplings shall be type 316 stainless steel and shall conform to ASTM A193 and A-194. Gaskets shall be EPDM and shall conform to ASTM D2000.

Couplings for pipe 24-inches in diameter and smaller shall be flexible type, square cut groove, per AWWA C606, and shall be Victaulic Style 77.

I. Outlets

1. Outlets 2-inches in Diameter and Smaller: Outlets of sizes 2-inches in diameter and smaller shall be of the "Thread-o-let" type, per AWWA Manual M-11, Figure 13.26.
Outlets shall be 3,000-pound WOG forged steel per ASTM A105 or ASTM A216, Grade WCB. Threads shall comply with ANSI B2.1. Outlets shall be Bonney Forge Co. "Thread-o-let" or approved equal.
2. Outlets larger than 2-inches in Diameter: For outlets larger than 2-inches in diameter, flanged tees shall be used.

J. Length of Pipe Sections

Pipe sections shall be limited to 40 feet or less. For sections longer than 30 feet, spreader beams, and lifting straps shall be used to lift pipe sections at the third points.

K. Joints

1. Above Ground Joints: Joints above ground or in vaults and structures shall be flanged or grooved end, unless specifically indicated otherwise on the project plans.
2. Buried Joints: Buried joints shall be:
 - a. Bell-and-spigot lap welded.
 - b. Butt-strap joints. Closure pieces may also require butt-strap joints with "hand-holes" and threaded-steel plugs welded into place (for proper repair of the lining of the interior pipe joints.)
3. Grooved-End Joints: Grooved-end joints shall be flexible, square-cut grooved, per AWWA C606, Table 5.

L. Product Marking

Each length of straight pipe shall be plainly marked inside and out at the bell end to identify the design pressure or head, the steel wall thickness, the date of manufacture, and the proper location of the pipe item by reference to the layout schedule. For beveled pipe, the degree of bevel and the point on the circumference to be laid uppermost shall be shown.

M. Painting and Coating

1. General: Unless noted otherwise, buried pipe shall be cement-mortar coated per AWWA C205.
2. Exposed Pipe: Pipe located above ground or in vaults and structures shall be painted in accordance with Section 09900, Painting and Coating. Primer shall be shop applied.
3. Grooved-End Couplings: Grooved-end couplings shall be coated the same as the adjacent pipe.

N. Lining

Unless noted otherwise, pipe and fittings shall be cement-mortar lined per AWWA C205.

PART 3 - EXECUTION

A. Fabrication

1. Reference Standards: Fabrication shall comply with ANSI B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME Boiler and Pressure Vessel Code.
2. Welding
 - a. The pipe cylinder shall be fabricated by butt welding, spiral seam, or straight seam. Girth welds shall be limited to two per pipe section, butt welded. Longitudinal welds shall be limited to one seam. Longitudinal joints of adjacent shell courses shall be staggered.
 - b. For field welding, the shielded metal arc welding (SMAW) process shall be used. For the shop fabrication of special fittings and appurtenances, the submerged arc welding (SAW) process and the flux cored arc welding (FCAW) process are acceptable alternates. All welding shall be done by qualified certified welder.
 - c. Welds shall be in accordance with ANSI B31.3, paragraph 327.4.
 - d. Welding preparation shall comply with ANSI B31.3, paragraph 327.3. Limitations on imperfections in welds shall conform to the requirements in ANSI B31.3.
 - e. For the SMAW process, welding electrodes shall comply with AWS A5.1. For the SAW process welding electrodes shall comply with AWS A5.17. For the FCAW process welding electrodes shall comply with AWS A5.20.
 - f. Each layer of deposited weld metal shall be cleaned using a power-driven wire brush prior to depositing the next layer of weld metal. The final pass shall be cleaned by a power-driven wire brush.
 - g. For field welds using the SMAW process, a minimum of three passes shall be used for welded joints on pipes 36-inches in diameter and larger pipes. Welds shall be full circumferential.
 1. For controlled shop welding processes using SAW or FCAW, weld joints may be made with two passes.
 - h. Beveled ends for butt welding shall conform to ANSI B16.25. Slag shall be removed by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, slag shall be chipped out before welding.

B. Joint Ring Protective Coating

The exposed portion of joint rings shall be coated with a 3-mil minimum thickness organic zinc pigmented coating meeting U.S. Federal Specification TT-P-641.

C. Shop Hydrostatic Test

The steel cylinder with joint rings shall be stressed to 75% of the minimum yield stress of the steel.

D. Shop Testing of Fittings

1. Dye Penetrant Test: Seams in fittings which have not been previously shop hydrostatically tested shall be tested by the dye penetrant method as described in ASME Boiler and Pressure Vessel Code Section VIII, Appendix B.

2. Air-Soap Test: In addition to the dye penetrant method of testing, the air-soap method with air at 5 psi shall be used on joints susceptible to being tested by such a method.
3. Pressure Test in Lieu of Dye Penetrant Test: In lieu of the dye penetrant method of testing, completed fittings may be hydrostatically tested using the field hydrostatic test pressure or 125% of the design pressure, whichever is higher.

E. Delivery of Small Parts

Small parts, consisting of gaskets, bolts, nuts, washers, jumper rods, and flange insulation kits, shall be delivered to the job site in suitable containers, each marked to identify the contents.

F. Installation

Pipe shall be installed in accordance with the requirements of Section 15051, Installation of Pressure Pipelines.

G. Field Inspection of Cement Mortar Lining and Interior Pipe Joints

The contractor shall perform closed circuit television (CCTV) inspection of the interior of all pipeline segments with diameters less than 30-inches; and for all sections of pipe, regardless of diameter, which are deemed not readily accessible for inspection by the District Representative. Interior pipe inspection shall be in accordance with the requirements of Section 15040, Interior Inspection for Cement-Mortar Lined Steel Pipe.

END OF SECTION

SECTION 15089: COMBINATION AIR RELEASE AND VACUUM RELIEF VALVES

PART 1 - GENERAL

A. Description

This section describes materials and installation of combination air release and vacuum relief valves, hereafter referred to as "valves," for 4-inch and smaller valves used for potable and non-potable water systems.

B. Related Work Specified Elsewhere

1. Painting and Coating: 09900
2. Hydrostatic Testing of Pressure Pipelines: 15042
3. Copper Pipe and Fittings: 15057
4. Manual Valves: 15100
5. AWWA Standard: C512

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's catalog data. Show dimensions, materials of construction by ASTM reference and grade, and protective coating and lining.

PART 2 - MATERIALS

A. Valves

1. Valves shall be 1-inch or 2-inch in diameter as shown on the plans and shall include the following:
 - a. A float assembly and large venting orifice to exhaust large quantities of air from pipelines when being filled and to admit large quantities of air when pipelines are being drained.
 - b. Valves shall have a body with a flanged or threaded top containing the air release orifice. The float shall rise with the water level in the valve body to close the orifice by sealing against a synthetic rubber seat. The float shall withstand an external pressure of 1,000 psig without collapsing.
 - c. 1-inch and 2-inch valves shall include a 3/8-inch threaded outlet with stainless steel plug in the top cover or near the bottom of the valve body.
 - d. 3-inch and 4-inch valves shall include a 1-inch threaded outlet with stainless steel plug near the bottom of the valve body or on the side of the valve body above the minimum water level.

Item	Material	Specification
Body and cover	Cast iron or stainless steel with reinforced nylon	ASTM A 126, Class B
Float	Stainless steel or foamed polypropylene	Stainless steel: AISI Type 316, ASTM A 240 or A 276 Foamed Polypropylene: ASTM- 1895-89
Guide rod, guide bushings	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Seat	EPDM	---
Valve trim	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Cover bolts	Stainless steel	AISI Type 316, ASTM A 193, GR B8M

2. Materials of construction for valves shall be as follows:
3. 3-inch & 4-inch valves as shown on the plans shall be approved by District in advance.
4. Valves shall be designed for an operating pressure of 150 psi unless otherwise specified in the plans or specifications.
5. Valves shall be APCO Series 140C or 150C, Crispin UL series, Val-Matic Model 200C series, or approved equal.

B. Valve End Connections

1. Applications: 1-inch and 2-inch valves shall have threaded ends at the bottom of the body.
2. Threaded Connections: Threaded ends shall comply with ANSI B1.20.1.

C. Bolts and Nuts for Flanged Valves

1. Bolts and nuts for flanged valves and flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.
2. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.
3. The length of each bolt or stud shall be such that between 1/4-inch and 1/2-inch will project through the nut when drawn tight.

D. Gaskets

Gaskets for flanged end valves shall be as described in the individual piping specifications and per TCWD Standard Drawings.

E. Coating

Valves shall be coated on the exterior in accordance with Section 09900, Painting and Coating. Prime coat shall be shop-applied at the place of manufacture. Finish coat shall be applied in the field. Color of finish coat shall match the color of the adjacent piping.

F. Lining

Interior surfaces of the valves shall be coated in accordance with Section 09900, Painting and Coating, System No. G-1. Seating areas and plastic, stainless steel, or other high alloy parts shall not be coated.

G. Vented Cover

1-inch and 2-inch valves shall be enclosed inside a removable vented cover as shown in the TCWD Standard Drawings. Vented covers shall be manufactured of linear-low-density polyethylene (HDPE) as a solid piece and as made by Pipeline Products, Inc. and the integral color shall be sandstone for water and green for sewer.

PART 3 - EXECUTION

A. Installation

Valves shall be installed in accordance with the TCWD Standard Drawings.

1. Tap: The tap for the valves shall be made in a level section of pipe no closer than 18 inches to a bell, coupling, joint, or fitting.

2. Threaded Connections: Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.
3. Flanged Connections: Flanges shall be cleaned by wire brushing before installing flanged valves. Flange bolts and nuts shall be cleaned by wire brushing, and threads shall be coated with anti-seize compound. Nuts shall be tightened uniformly, and in the sequence pattern and torque setting recommended by the manufacturer. If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket reseated or replaced, the bolts and nuts reinstalled or retightened, and joints retested. Joints shall be watertight.

B. Valve Pressure Testing

Valves shall be pressure tested at the same time that the connecting pipelines are pressure tested. See Section 15042, Hydrostatic Testing of Pressure Pipelines, for pressure testing requirements. Valves, operators, or control and instrumentation systems whose pressure rating is less than the test pressure shall be protected or isolated during pressure testing.

END OF SECTION

SECTION 15100: MANUAL VALVES

PART 1 - GENERAL

A. Description

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

B. Related Work Specified Elsewhere

1. Painting and Coating: 09900
2. Hydrostatic Testing of Pressure Pipelines: 15042
3. Backflow Preventers Section 15112
4. AWWA Standards: C504, C507, C508, C509, and C541

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submittals shall include the following information at a minimum. Factory signed and dated certification of compliance shall accompany all submittals. Signatures of agents or distributors of the factory will not be accepted.
 - a. Manufacturer's catalog data and detail construction sheets showing all valve parts and describing materials of construction by material and specification (such as AISI, ASTM, SAE, or CDA).
 - b. Valve dimensions including laying lengths.
 - c. Dimensions and orientation of valve actuators, as installed on the valves.
 - d. Valve linings and coatings.
 - e. Factory torque sheets minimally supplying actuator output and valve input torque requirements. Method for calculating input torque shall be the same as per AWWA Class 150B designation.
 - f. Manufacturer's warranty: Where electric motor actuators are used, the valve manufacturer shall include the electric motor actuator warranty and shall be the responsible party for both the valve and the electric actuator. Electric motor actuators shall be installed by the valve manufacturer to maintain both manufacturer warranties.

D. Valve Selection Criteria

Selection of the type of valve for a given application within TCWD's distribution and transmission system shall follow the criteria defined below.

Selection Criteria			
Nominal Valve Diameter (inches)	Normal System Static Operating Pressure (0 to 100 psi)	Normal System Static Operating Pressure (100 to 150 psi)	Normal System Static Operating Pressure (150 to 250 psi)
3 and smaller	Ball	Ball	Ball
4	Gate	Gate	Gate
6	Gate	Gate	Gate
8	Gate	Gate	Gate
10	Gate	Gate	Gate
12 and larger	Butterfly	Butterfly	CL 250 Butterfly

PART 2 - MATERIALS

A. General

Valves shall be provided complete with operating hand-wheels, levers, chain-wheels, extension stems, floor stands, worm gear actuators, operating nuts, chains, and wrenches as required for operation.

Valves shall have the name of the manufacturer, and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached corrosion-resistant plate.

B. Resilient Seated Gate Valves - 4-inch through 10-inch:

Resilient seated wedge-type, gate valves shall conform to AWWA C509 and the following requirements.

1. Valves shall have a wedge-type resilient seat with the gate fully encapsulated in peroxide-cured EPDM rubber.
2. Valves shall be designed for a minimum working pressure of 200 psi, unless specified on drawings. See Section 15112, Backflow Preventers, for resilient seated gate valves on backflow prevention assemblies.
3. Valves shall have non-rising stems fabricated of Type 304 or 316 stainless steel. Stem nuts shall be independent of the gate and shall be made of bronze.
4. Valve ends shall be as shown on the drawings and in all cases shall match the class rating of the valve per TCWD Standard Drawings.
5. Materials of construction shall be as follows:

Component	Material	Specification
Body, Operating Nut, Bonnet, Seal Plate	Ductile Iron	ASTM A536, Grade 65-45-12
Gate	Ductile Iron	ASTM A536, Grade 65-45-12
Stem	Stainless Steel	AISI 430F; ASTM A582 or Type 316
Stem Nut	Bronze	ASTM B62
Nuts & Bolts	Stainless Steel	ASTM A193/194, Type 316
Valve Seat	EPDM Rubber	ASTM D412
O-Rings	Synthetic Rubber	ASTM D2000

6. Low friction, torque reduction thrust bearings shall be provided both above and below the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in stem above thrust collar.
7. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
8. Valves shall be manufactured by American AVK Co. – Series 45, Mueller Company - A-2362, or U.S. Pipe - A-USP2, Clow Valve, or equal.

C. Butterfly Valves - 4-inch and Larger:

1. Butterfly valves shall be short body, flanged type, conforming to AWWA C504, Class 150B. Wafer style valves shall not be used.
2. Unless otherwise noted, minimum working differential pressure across the valve disc shall be 150 psi.
3. Valve ends shall be as shown on the drawings and in all cases shall match the class rating of the valve. For example, Class 150 valves shall have 150-lb flanges and Class 250 valves shall have 250-lb flanges. Flanged ends shall be Class 125 drill pattern, ANSI B- 16.1 unless otherwise specified.
4. All butterfly valves 12-inch in diameter and larger are required to have flanged ends to meet the requirements for valve leakage testing. Refer to Part 3, sub-section D, paragraph 2 for testing requirements.
5. Valve shafts shall be Type 304 or 316 stainless steel for Class 150 valves and Type 630 stainless steel for Class 250 valves. Valve shafts may be a stub shaft or one-piece units extending completely through the valve disc.
6. Materials of construction shall be as follows:

Component	Material	Specification
Body	Ductile Iron	ASTM A536, Grade 65-45-12
Valve Shaft (CL 150)	Stainless Steel	Type 304 or Type 316
Valve Shaft (CL 250)	Stainless Steel	Type 630
Exposed body cap screws, bolts & nuts (including squeeze-pins)	Stainless Steel	ASTM A276, Type 316
Discs	Ductile Iron Stainless Steel	ASTM A536, Grade 65-45 Type 316
Valve Seat	EPDM Rubber	ASTM D412
O-Rings	Synthetic Rubber	ASTM D2000

7. The rubber seat shall be made from peroxide-cured EPDM rubber and shall be fastened integrally within the valve body. Rubber seats fastened to the disc by any means shall not be allowed.
8. Valves shall be manufactured by DeZurik , Mueller Company, or Pratt - AWWA Rubber-Seated or equal.

D. Other Types of Valves

The following valves shall be used as specified in the Contract Documents.

1. **Ball Valves: 3-inch and Smaller:**
 - a. Ball valves shall be used for non-buried valves 3-inch and smaller.
 - b. Ball valves for water service shall be the three-piece body style and shall be Type 316 stainless steel. Ball valves shall be NSF 61 certified.

- c. The minimum design operating pressure rating shall be 300 psi WOG at a temperature of 150° F.
- d. Valves shall have plastic coated stainless-steel lever actuators with a locking mechanism. Valves shall have full-bore ports, female iron pipe thread screwed ends, and non-blowout stems.
- e. Materials of construction shall be as follows:

Component	Material	Specification
Body, Ball, Stem	Stainless Steel Brass	Type 316, ASTM A276 Lead Free Brass, C27451
Seat, Seals	Teflon	--

Valves shall be Muller Insulated MUELLER® 300TM Ball Valve, Apollo Valve System, ASC Engineered Solutions – Sharpe – Series 10, or Stockham Style T-285.

2. **Ball Valves: 4-inch through 12-inch:**

Ball valves 4-inch through 12-inch shall be rated for a minimum working pressure of 150 psi. Ball valves shall meet or exceed the requirements of AWWA C504 and C507 and shall have flanged ends. Valves shall have Proof of Design testing with documentation per AWWA C507.

Valves shall be of the "double-seated" style and shall provide drip-tight closure in both directions.

Materials of construction shall be as follows:

Component	Material	Specification
Body, Ball	Ductile Iron	ASTM A536, 65-45-12; ASTM A395/395M
Stem, Shaft	Stainless Steel	18-8 Type 304 or 17-4 Type 630
Seat, Seals	EPDM Rubber	--

External valve trim and all exposed threaded components shall be corrosion resistant alloys of stainless steel, Type 316L.

Valves shall be Jamesbury Series 9000 flanged ball valve, or Pratt rubber-seated ball valve.

3. **Plug Valves: 6-inch through 20-inch:**

- a. Lubricated plug valves of sizes 6-inch through 20-inch shall have cast iron (ASTM A126, Class B) bodies and plugs.
- b. Valves shall be of the regular pattern with bolted glands and resilient packing.
- c. Plug coating shall be Teflon, permanently bonded to the plug. Unless noted otherwise on the drawings, valve ends shall be flanged, with face-to-face dimensions conforming to ANSI B-16.1, Class 125.
- d. Valve shall have a pressure rating of 200-psi WOG.
- e. Valves shall be enclosed worm gear operated and watertight for submerged service. Valves shall be lubricated with the manufacturer's recommended lubricant for cold-water service.

External valve trim and all exposed threaded components shall be corrosion resistant alloys of stainless steel, Type 316L.

Valves shall be Galli & Cassina Type API 6D or Nordstrom Type API 6D.

4. **Eccentric Plug Valves: 4-inch through 12-inch:**

Eccentric plug valves, 4-inch through 12-inch shall be of the non-lubricated type and as shown on the plans. Minimum pressure rating shall be 175 psi. Unless noted otherwise on the drawings, ends shall be flanged, Class 125 per ANSI B-16.1.

Plugs shall be provided with Polytetrafluoroethylene (PTFE) grit excluders to protect the upper and lower journal bearings.

Materials of construction shall be as follows:

Component	Material	Specification
Body	Ductile Iron	ASTM A536, Grade 65-45-12
Plug	Ductile Iron	ASTM A536, Grade 65-45-12
Journal Bearings	Sintered Stainless Steel	ANSI 316

Plugs shall have neoprene, Buna-N facing to provide drip-tight shutoff.

Valve body seats shall have a raised welded-in overlay of not less than 90 percent nickel. Plug shall be of the one-piece design. Proof of design shall accompany submittals and leak tests shall accompany shipment.

External valve trim and all exposed threaded components shall be corrosion resistant alloys of stainless steel, Type 316.

Valves shall be Dezurik PEF 100% Port Eccentric Plug Valve Only

5. **Check Valves: 4-inch and Larger:**

- a. **Swing Check Valves:** Swing check valves shall conform to AWWA C508, and shall be iron body, mounted with the following materials of construction:

Component	Material	Specification
Disc	Ductile Iron	ASTM A536, Grade 65-45-12
Body and Cap	Ductile Iron	ASTM A536, Grade 65-45-12
Hinge or Arm	Cast Iron	ASTM A126, Class B
Hinge Pin	Stainless Steel	ASTM A276, Type 303, 304 or 410
Cover Bolts & Nuts	Stainless Steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M

Ends shall be flanged, Class 125, ANSI B-16.1. Valves shall be designed for a minimum working pressure of 150 psi.

Except for the Val-Matic Surge Buster, valves shall be equipped with outside lever and spring.

Valves shall be Clow Style 1106SL, M&H Style 259, Pratt Series 8001, or Val- Matic Style - Surgebuster.

- b. Silent Check Valves: Silent check valves shall be designed to be installed between the flanges of the adjoining pipe. Valves shall be equipped with a spring mechanism to provide for non-slam closure of the valve without backflow, in any position, and shall not be dependent on gravity or backflow for closure.

Materials of construction shall be as follows.

Component	Material	Specification
Body	Ductile Iron	ASTM A536, Grade 65-45-12
Disc	Aluminum bronze	ASTM B148
Spring, Pin, Stops	Stainless Steel	ANSI Type 316
Seat	EPDM Rubber	ASTM D412

Valves shall be Val-Matic – Series 1800, APCO - Series 600, Pratt - Series 821, or Titan Flow Control - CV 50-DI-B.

6. Solenoid Valves 1-1/2-inch and Smaller:

- a. Solenoid valves of sizes 1/4-inch through 1-1/2-inch for water and air service shall have forged brass (Alloy C-23000) or bronze (ASTM B62) bodies with Teflon main seats.
- b. Valve components in contact with potable water shall be NSF 61 certified.
- c. Internal plunger, core tube, plunger spring, and cage assembly shall be stainless steel (Types 302, 304, or 305).
- d. Solenoid enclosures shall be NEMA Type 4. Valve actuators shall be 120-volt AC, or 24-volt DC as stated on the plans.
- e. Seals shall be Teflon. Valves shall have a maximum operating pressure and a maximum differential pressure of 250 psi.
- f. Solenoid valves shall be energized to open or close, as required.
- g. Valves shall be ASCO "Red Hat" with Red Hat software, no equal.

7. Tapping Valves & Sleeves:

a. Tapping Valves:

- i. Shall conform with the requirements for resilient wedge gate valves 4-inch and larger, conform to AWWA C509, and as shown in Section B above.
- ii. Valve ends shall be flanged, and the flange at one end shall have slotted bolt holes to fit standard tapping machines.
- iii. Seat rings shall be oversized to permit the use of full-size cutters.
- iv. Tapping valves shall be Kopple, Clow, Kennedy or Mueller or approved equal.

b. Tapping Sleeves:

- i. Shall be full circumferential seal, all stainless steel tapping sleeve with side lifter bars and meets the requirements of AWWA C223.
- ii. All buried bolts shall be stainless steel, Type 316 and coated with anti-seize compound or approved equal.
- iii. Tapping sleeve shall be Kopple, Clow, Kennedy, Mueller, American Flow Control, Romac, or approved equal.

E. Valve Actuators

1. General Requirements for Gear Actuators:

- a. Gear actuators shall be enclosed, suitable for operating in grease with seals provided on shafts to prevent entry of dirt and water into the actuator.
 - i. External trim and all threaded parts of the actuator shall be Type 316 stainless steel material.
- b. Gear actuators shall be of the totally enclosed design, proportioned to permit operation of the valve under full operating head in either direction, with a maximum pull of 80 pounds on the handwheel or with a maximum input of 150 ft-lbs. applied to the AWWA wrench nut. Design and torque capacity shall consider flow and shut-off in "BOTH" directions.
- c. Actuators shall be provided with "open" and "closed" position stop limiting devices. Actuators shall be of the self-locking type to prevent the valve disc or plug from creeping.

2. Standard Opening Direction: Valve actuators, handwheels, or levers shall open by turning counterclockwise. (Commonly stated as, "open-left – close-right".)

3. AWWA wrench nut: Valves for buried and submerged applications shall be provided with a 2-inch square AWWA wrench nut. The wrench nut shall have an arrow cast thereon, indicating the direction of opening. The wrench nut shall be suitably fastened to the actuator input shaft.

If the shaft is smooth, the wrench nut shall be fastened to the input shaft by means of a 5/16-inch diameter stainless steel pin passing entirely through the shaft and the wrench nut. Key with keyway shall also be acceptable. If the shaft is split, then the wrench nut shall be formed to fit the splined shaft.

- a. Operating Torque Requirement: The actuator shall be designed to produce the specified torque with a maximum input of 150 ft-lbs. applied to the wrench nut (at the maximum rated pressure and a velocity of 16 cfs.)

4. Handwheels: Valves for aboveground applications shall be provided with a handwheel with a minimum diameter of 12-inches. The handwheel shall have an arrow thereon, indicating the direction of the opening. The handwheel shall be suitably fastened to the actuator input shaft.

- a. Operating Torque Requirement: Actuators equipped with handwheels shall be designed to produce the specified torque with a maximum pull of 80 pounds of the handwheel rim.

5. Position Indicators: Valve position indicators shall be provided for all above ground valves. Submerged and buried valves shall have a watertight seal plate in place of the valve position indicator. No rotating part indicating position shall be allowed for valves intended for buried service.

6. Operators for Exposed Valves Smaller than 6-inch: Unless otherwise called for on the plans or specifications, lever or wrench actuators having adjustable, open stop memory positions shall be provided for exposed valves smaller than 6-inch.

7. Actuators for Valves 4-inch and Larger
 - a. Butterfly Valves:
 - i. 4-inch through 20-inch diameter butterfly valves shall have gear actuators of the "traveling nut type". Traveling nut actuators shall be furnished on all valves in this size range unless torque or pressure conditions dictate a "worm gear type."
 - ii. The actuator shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C504, AWWA C507, and AWWA C541.
 - iii. 24-inch through 54-inch diameter butterfly valves shall have gear actuators of the "worm gear type". Worm gear actuators shall be furnished on all valves in this size range.
 - b. Ball and Plug Valves:
 - i. Ball and plug valves 6-inch and larger shall have actuators of the "worm gear type".
 - ii. The actuator shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C504, AWWA C507, and AWWA C517.
8. Requirements for Traveling Nut Gear Actuators
 - a. Traveling nut actuators shall withstand 450-foot pounds of input torque against the stop limiting devices without causing damage.
 - b. Signed factory compliance shall accompany submittals stating that these specifications and applicable standards have been adhered to.
 - c. All exposed threaded parts, including cap screws, case bolts, carriage bolts, cover screws, machine screws, set screws, bonnet bolts on the housing or any other exterior location on the actuator, its cover or housing shall be Type 316 stainless steel.
 - d. Traveling nut type gear actuators shall be able to rotate the valve element (disc, plug, or ball) from the fully "closed" position to the fully "open" position with a number of turns of the actuator nut or wheel.
 - i. For 4-inch through 10-inch valves: the number of turns shall not be fewer than twenty nine (29) turns.
 - ii. For 12-inch through 20-inch valves: the number of turns shall not be fewer than twenty-nine (29) turns and not more than three (3) times the number of diameter inches.
 - iii. Where the number of turns may fall outside of the range for turn limits, the use of a factory attached spur gear reducer shall be used to provide the appropriate number of rotations from the fully "open" to the fully "closed" position. Spur gear assemblies shall be mounted integrally to the actuator by approved means and shall meet all of the other component and torque requirements listed herein.
 - e. Actuators shall be Val-matic, Flomatic Valves, Dezurik LA-Series, Mueller MDT Series, or Pratt MDT Series.

- f. Refer to the following table for actuator selection and characteristics for traveling nut gear operators for 150 and 250 psi:

Valve Actuator Selection – Traveling Nut							
Nominal Valve Diameter (inches)	TCWD Specified Range of Valve Turns (number)	Dezurik Actuator Model	Actuator Turns – Open to Close (number)	Mueller Actuator Model	Actuator Turns – Open to Close (number)	Pratt Actuator Model	Actuator Turns – Open to Close (number)
4	29	MB-3	29	MDT-2S	32	MDT2S	32
6	29	MB-3	29	MDT-2S	32	MDT2S	32
8	29	MB-3	29	MDT-2S	32	MDT2S	32
10	29	MB-3	29	MDT-2S	32	MDT2S	32
12	29 - 36	MB-3	29	MDT-2S	32	MDT2S	32
14	29 - 42	MB-3	29	MDT-3S	30	MDT3S	30
16	29 - 48	MB-7	42	MDT-3S	30	MDT3S	30
18	29 - 54	MB-7	42	MDT-4S	40	MDT4S	40
20	29 - 60	MB-7	42	MDT-4S	40	MDT4S	40

9. Requirements for Worm Gear Actuators

- a. Worm gears shall be of the "self-locking" one-piece design of gear bronze material (ASTM B427), accurately machine cut.
- b. The worm shall be hardened alloy steel (ASTM A322, Grade G 41500; or ASTM A148, Grade 105-85), with threads ground and polished.
 - i. The reduction gearing shall run in a proper lubricant inside a ductile iron housing.
- c. All exposed (at the exterior of the actuator) threaded parts, including cap screws, case bolts, carriage bolts, cover screws, machine screws, set screws, bonnet bolts on the housing or any other exterior location on the actuator, its cover or housing shall be Type 316 stainless steel.
- d. Actuator components shall be designed to withstand a pull of 200 pounds for handwheel or chain wheel actuators between the input and stop limiting devices without damage, and an input torque of 300-foot-pounds for operating nuts when operating against the stops.
- e. Gear actuators shall be able to rotate the valve element (disc, plug, or ball) from the fully "closed" position to the fully "open" position with a number of turns of the actuator nut or wheel, not fewer than one-and-a-half (1.5) times the number of diameter inches and not more than three (3) times the number of diameter inches.
 - i. Where the number of turns may fall outside of the range for turn limits, the use of a factory attached spur gear reducer shall be used to provide the appropriate number of rotations from the fully "open" to the fully "closed" position. Spur gear assemblies shall be mounted integrally to the actuator by approved means and shall meet all of the other component and torque requirements listed herein.
- f. Actuators shall be Auma GS Series, EIM Model WB Series, or Limitorque Model HBC or PT Series, no equals.
- g. Refer to the following tables for actuator selection and characteristics for worm gear actuators for 150 psi valves and for 250 psi valves:

150 psi Valve Actuator Selection – Worm Gear							
Nominal Valve Diameter (inches)	TCWD Specified Range of Turns (number)	AUMA Make & Model (model/gear)	Turns Open - Close (Number)	EIM Make & Model	Turns Open - Close (Number)	Limatorque Make & Model (model/gear)	Turns Open - Close (Number)
24	36 - 72	GS125.3	* 13	EIM WB52	64	PTA30/3.5	60
30	45 - 90	GS 160.3/GZ 160.3 4:1	* 54.5	EIM WB52	64	PTA65/3.1	47
36	54 - 108	GS 160.3/GZ 160.3 4:1	* 54.5	EIM WB54	70	PTA120/6.3	95
42	63 - 126	GS 200.3/GZ 200.3 8:1	* 108.5	EIM WB54	70	PTA120/6.3	95
48	72 - 144	GS 250.3/GZ 250.3 8:1	* 103	EIM WB65	* 148	PTA250/6	96
54	81 - 162	GS 250.3/GZ 250.3 8:1	* 103	EIM WB65	148	PTA250/18	* 288

AND

250 psi Valve Actuator Selection – Worm Gear							
Nominal Valve Diameter (inches)	TCWD Specified Range of Turns (number)	AUMA Make & Model (model/gear)	Turns Open - Close (Number)	EIM Make & Model	Turns Open - Close (Number)	Limatorque Make & Model (model/gear)	Turns Open - Close (Number)
24	36 - 72	GS125.3	* 13	EIM WB52	64	PTA30/3.5	60
30	45 - 90	GS 160.3/GZ 160.3 4:1	* 54.5	EIM WB52	64	PTA65/3.1	47
36	54 - 108	GS 160.3/GZ 160.3 4:1	* 54.5	EIM WB54	70	PTA120/6.3	95
42	63 - 126	GS 200.3/GZ 200.3 8:1	* 108.5	EIM WB65	* 148	PTA120/6.3	95
48	72 - 144	GS 250.3/GZ 250.3 8:1	* 103	EIM WB65	* 148	PTA250/6	96
54	81 - 162	GS 250.3/GZ 250.3 8:1	* 103	EIM WB74	* 270	PTA250/18	* 288

* Indicates number of turns does not meet TCWD requirement and spur-gear reduction is required to correct. Spur-gear submittal is required. See paragraph 9.e.i above.

F. Valve Boxes, Risers, and Lids for Buried Valves

1. General:

Valve riser shall be 8-inch SDR 35 PVC pipe.

2. Manufacturers:

Valve boxes for Potable Water, Recycled Water or Raw Water shall be triangle in shape and shall be:

- a. Bingham & Taylor - Model No. Mark V Triangle
- b. Brooks Products - Model No. No. 4-TT
- c. Eisel Enterprises - Model No. No. 4TT,
- d. South Bay Foundry - Model No. SBF 1237.

The Contractor shall use Bingham & Taylor valve boxes, for projects on arterial roadways consisting of two or more lanes in each direction.

Pavement restoration work that requires replacing existing valve boxes to be raised grade shall use only Bingham & Taylor valve boxes, no equal, unless Bingham & Taylor boxes are already installed, in which case, they shall be reused if the valve box is in acceptable condition as determined by the District Representative.

3. Valve Boxes:

Valve box lids shall be cast-iron and shall be designed to rest with or without a frame on a cast-in-place concrete ring surrounding the valve extension pipe. The lids shall be in accordance with TCWD Standard Drawing W-25.

Valve Box manufactured by Brooks Products, Eisel Enterprises, or South Bay Foundry: The lid skirt shall be 6 inches deep. The minimum weight of nominal 10-inch lid shall be a minimum of 28 pounds for circular valve covers and a minimum of 18 pounds for triangular valve covers. Lids shall be coated per Section 09900, Painting and Coating, System No. C-1.

Valve Box manufactured by Bingham & Taylor: The lid skirt shall be 4 3/8-inch inches deep. The minimum weight of nominal 10-inch lid shall be a minimum of 20 pounds for circular valve covers and a minimum of 20 pounds for triangular valve covers. Lids and frame shall be coated per Section 09900, Painting and Coating, System No. C-1.

G. Extension Stems for Buried Valve Operators

1. Where the depth of the valve is such that its operating nut is more than 6 feet below finished grade, a valve operating extension stems shall be provided to bring the operating nut to a point that is between 24 to 30 inches below the surface of the ground and/or box cover.
2. Extension stems shall be solid steel and shall be complete with 2-inch square operating nut.
3. No pinned couplings, hollow tubes or pipe are allowed.
4. Extension stems shall conform to TCWD Standard Drawing W-25.

H. Bolts, Nuts, and Washers for Flanged Valves

1. Bolts and nuts for flanged valves and flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, for bolts and ASTM A194, Grade 8M, for nuts.
2. Washers shall be provided for each nut, shall be of the same material as the nut, and shall be installed adjacent to the nut, between the nut and the flange.

3. The length of each bolt or stud shall be such that between 1/4 inch and 1/2 inch will project through the nut when drawn tight.

I. Gaskets for Valves

Gaskets for flanged end valves shall be as described in the individual piping specifications.

J. Painting and Coating for Valves and Extensions:

1. Exterior Coating:

Metal valves (except bronze and stainless-steel valves) shall be coated in accordance with Section 09900, Painting and Coating, and shall be holiday free.

- a. The specified prime coat shall be applied at the place of manufacture.
- b. Finish coat shall match the color of the adjacent piping.
- c. Exposed portions of the valve shaft shall not be coated.

2. Interior Coating:

Metal valves shall be coated on the interior metal parts, excluding seating areas and bronze and stainless-steel pieces, per Section 09900, Painting & Coating, System No. G-1, or System No. G-2.

- a. Coating shall be factory applied by the valve manufacturer.
- b. Valve coatings will be field spark tested and shall be holiday-free.

PART 3 - EXECUTION

A. Joints

1. Flanged Joints: Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Flanges shall be cleaned by wire brushing before installing flanged valves. Flange bolts and nuts shall be cleaned by wire brushing, threads shall be lubricated with anti-seize compound, and nuts shall be tightened uniformly and progressively.

If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket shall be reseated or replaced, the bolts and nuts shall be reinstalled or re-tightened, and the joint retested. Joints shall be watertight.

2. Threaded Joints: Threaded joints shall be cleaned by wire brushing or swabbing. Teflon joint compound or Teflon tape shall be applied to pipe threads before installing threaded valves. Joints shall be watertight.

B. Valve Installation

1. Valves in Vertical Piping: Valves on vertical runs of pipe that are next to walls shall be installed with their stems in the horizontal position, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems in the horizontal position, oriented to facilitate valve operation.
2. Buried Valves: Buried valves shall be wrapped with two layers of 8-mil polyethylene wrap per AWWA C105.
3. Valve Supports: Valves shall be anchored in concrete as shown on TCWD Standard Drawing W-19. Supports are not required for buried valves bolted to flanged pipe or other fixed or supported fittings. Supports shall be installed prior to pressurizing the system.

C. Valve Boxes

Valve boxes shall be firmly supported and shall be kept centered and plumb over the operating nut of the valve.

Beveled sections of pipe shall not be allowed at the top of the valve riser pipe. The top cut shall be square, and machine made.

In new tracts, and where pavement has not been placed, the valve extension risers for "key valves" shall extend well above the ground level to permit ease of location in the event of the need for emergency shut-off. The final valve box elevation shall be flush with the finished pavement surface, or at the level shown on TCWD Standard Drawing W-25.

D. Valve Leakage Testing

1. Field Hydrostatic Testing: Valves shall be tested for leakage at the same time that the connecting pipelines are hydrostatically tested. See Section 15042, Hydrostatic Testing of Pressure Pipelines, for pressure testing requirements.

2. Pressure Testing:

All butterfly valves 8-inch in diameter and larger, shall be flanged to facilitate testing. Valves 8-inch through 30-inch in diameter shall be tested in a horizontal position.

Valves 36-inch in diameter and larger shall be tested in the vertical position (valve flange face oriented 90 degrees from the horizontal ground surface plane; with the shaft axis parallel to the ground).

All valves shall be tested bi-directionally after the actuator is installed and the adjustment stops are set. Each side of the valve shall be tested for a duration of at least 5 minutes at the pressure class rating of the valve with zero loss or leakage. Valve bodies shall be tested at a pressure equal to twice the design working pressure.

The pressure test shall be witnessed by the District Representative. Final tests shall be performed at the project site. The Contractor shall provide a minimum of 72 hours' notice to District Representative in advance of the pressure test.

Factory hydrostatic testing shall be conducted in advance of the final leakage testing. The District shall be given an opportunity to send a representative to witness the factory test. The Contractor shall notify the District Representative in writing 28 calendar days in advance of all factory leakage tests.

END OF SECTION

SECTION 15112: BACKFLOW PREVENTERS

PART 1 - GENERAL

A. Description

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

B. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit certification that backflow device meets the requirements of the State Water Resources Control Board, Cross-Connection Control Policy Handbook dated July 1, 2024.
3. Submit certification showing that the backflow device is approved by the Foundation for Cross-Connection Control and Hydraulic Research, a Division of the University of Southern California.

PART 2 - MATERIALS

A. Backflow Prevention Assembly

Backflow prevention assemblies shall conform to the following:

1. AWWA Standards: C510 and C511, latest edition
2. State Water Resources Control Board, Cross- Connection Control Policy Handbook dated July 1, 2024.
3. "Manual of Cross-Connection Control", Foundation for Cross-Connection Control and Hydraulic Research, a Division of the University of Southern California.
4. AWWA M14 Backflow Prevention and Cross-Connection Control: Recommended Practices, Fifth Edition

B. Backflow Prevention Assembly

Prior to placing the backflow prevention assembly into service, the Contractor shall:

1. Submit a fire line meter application to the District for the by-pass meter.
2. Perform backflow testing per TCWD requirements and provide certified backflow testing documentation prior to fire service being put back into service.

PART 3 - EXECUTION

A. Installation

Installation shall comply with the requirements of the TCWD Standard Specifications and Standard Drawings, State Water Resources Control Board, Cross- Connection Control Policy Handbook, the latest edition of the Manual of Cross-Connection Control, AWWA M-14 manual, and the latest plumbing codes and applicable local agency requirements.

B. Testing

Prior to being placed in service, a test shall be performed, and a certificate of adequacy and operational compliance shall be furnished to the District. The test shall be performed by an approved tester by the Orange County Health Care Agency.

END OF SECTION

SECTION 15139: HYDRANTS

PART 1 - GENERAL

A. Description

This section includes materials, installation, and testing of wet-barrel type fire hydrants for potable water and wharf type hydrants for recycled water.

B. Related Work Specified Elsewhere

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. PVC Pressure Pipe and Fittings: 15064
7. Copper Pipe and Fittings: 15057
8. Manual Valves: 15100
9. AWWA Standards: C503, latest edition

C. Submittals

Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.

PART 2 - MATERIALS

i. Fire Hydrants for Potable Water System

1. Fire Hydrant Top Section

- a. General: Fire hydrants shall be of the wet-barrel type, with individual valves for each outlet, and shall conform to the requirements of AWWA C503.
- b. Outlets: Fire hydrants for residential shall have one 2 1/2-inch outlet and one 4-inch outlet. Fire hydrants for industrial or commercial shall have one 2 1/2-inch inch outlet and two 4-inch outlets. All outlets shall be removable and have National Standard Hose Threads.
- c. Materials of Construction: The fire hydrant top section shall be manufactured of bronze conforming to ASTM B-62 or type 304 stainless steel conforming to CF-8 ASTM A-351. All interior working parts, including stems, shall be of bronze containing no more than 7% zinc or 2% aluminum.
- d. Operating Nuts: Fire hydrants shall be provided with 1 1/2-inch sized pentagon-shaped operating nut and 1 1/2-inch cap nuts.
- e. Outlet Caps: Plastic outlet nozzle caps shall be provided for all outlets.
- f. Flanges: Fire hydrant flanges shall be drilled with a 6-hole pattern. The flange shall be drilled with 3/4-inch diameter holes located on a 9 - 3/8-inch bolt circle.
- g. Manufacturer Identification: Fire hydrants shall have the name of the manufacturer cast or welded onto the fire hydrant body.

2. Bury Section

- a. Materials: The bury section shall be ductile iron with cement lined and epoxy coating in conformance with Section 15056, Ductile Iron Pipe and Fittings.

- b. Inlet Connection: Inlet size shall be a 6-inch push-on joint for short-side hydrant installations and shall be 6-inch flanged for long-side hydrant installations, unless otherwise specified on the plans.
 - c. Bury Depth: Bury depth shall be 42-inches for distribution mains and 48- inches for transmission mains. Field conditions may require different depth fire hydrant buries to fit abnormal pipe, as approved by the District Representative.
 - d. Flanges: Bury flanges shall be drilled with a 6-hole pattern. The flange shall be drilled with 3/4-inch diameter holes located on a 9 - 3/8-inch bolt circle.
 - e. Break-Away Check Valve: Ductile iron break-away spools shall be provided for each hydrant installation as shown on the TCWD Standard Drawings.
 - i. Each spool shall have a scored groove placed circumferentially around the spool near the hydrant end of the spool.
 - ii. The score shall be placed above grade.
 - iii. Only one score shall be made in the hydrant break-away spool piece.
 - iv. Spool flanges shall be a 6-hole pattern to match both the hydrant and the bury.
 - f. Approved Manufacturers: Bury and extension sections shall be as manufactured by Clow Valve Company or approved equal.
- 3. Break-Away Bolts: Type 316 stainless steel break-away bolts shall be used to join the break-away spool section to the hydrant top section.
 - 4. Isolation Valve: The isolation valve on the fire hydrant assembly shall be a gate valve per Section 15100, Manual Valves.
 - 5. Gaskets: Gaskets shall be full face 1/8-inch thick and of rubber composition. Full face type gaskets with pre-punched holes shall be used where both flanges are flat face. Ring gaskets extending to the inner edge of the bolts may be used where a raised face flange is present.
 - 6. Manufacturers:
 - a. Residential Use: For residential applications, fire hydrants shall be Clow Valve Company - Series Model 850 only.
 - b. Commercial and Industrial Use: For commercial and industrial applications, fire hydrants shall be Clow Valve Company – Series 865 only.

PART 3 - EXECUTION

A. General

Hydrant assemblies shall be installed in accordance with TCWD Standard Drawing W-11, detail drawings, and as specified herein.

B. Location

Hydrant assemblies shall be located as shown on TCWD Standard Drawings, or as approved by the District Representative.

C. Valve and Valve Box

The valve and valve box shall be installed in accordance with Section 15100, Manual Valves.

D. Break-Away Bolts

Break-away bolts shall be installed with threads toward the top of the hydrant. Bolts shall be packed with clear silicon sealant.

E. Concrete

The concrete pad and thrust blocks shall be Class C concrete placed per Section 03300, Concrete.

F. Painting

All above ground portions of the hydrant, bury, and flanged spools shall be painted in accordance with Section 09900, Painting and Coating.

G. Testing

Hydrants shall be tested at the same time that the connecting pipeline is pressure tested. See Section 15042, Hydrostatic Testing of Pressure Pipelines, for pressure testing requirements.

END OF SECTION

SECTION 15150: METERS

PART 1 - GENERAL

Description

This section describes the materials, installation, and testing of meter assemblies.

A. Related Work Specified Elsewhere

1. Structure Earthwork: 02220
2. Concrete: 03300
3. Precast Concrete Vaults and Meter Boxes: 03462
4. Painting and Coating: 09900
5. Hydrostatic Testing of Pressure Pipelines: 15042
6. Installation of Pressure Pipelines: 15051
7. Ductile-Iron Pipe and Fittings: 15056
8. Copper Pipe and Fittings: 15057
9. Manual Valves: 15100
10. AWWA Standards: C700, C701, C707, C710, C715 and C751

B. Submittals

Water meters will be purchased from TCWD and provided to Contractor for TCWD Improvement Projects. Contractor to purchased water meters from TCWD for any development project.

C. Measurement and Payment

1. For contracts between Contractor and District, payment for the work in this section shall be in accordance with the General Provisions.
2. For contracts between Contractor and an entity (Developers, other agencies, etc.) other than the District, meters shall be furnished in accordance with the requirements of the District's Procedural Guidelines and General Design Requirements.

PART 2 - MATERIALS

A. General

This specification covers Positive Displacement Meters, Turbine Meters, and Electromagnetic Flow Meters.

1. Positive Displacement Meters: shall be used for small diameter applications (3/4-inch through 2- inch) requiring very accurate low-flow ranges.
2. Turbine Meters: Meters with high-flow and continuous average flow applications (such as irrigation) shall be metered with Turbine Meters.
3. Electromagnetic Flow (Mag) Meters: Meters For larger connections (2-inch through 6- inch) with low-and high flow applications.

All meters shall be new and of current design, and all parts of the meters of the same size and model shall be interchangeable. All meters shall be NSF 61 approved.

B. Meter Registers:

1. Reading Dials: Register shall have straight reading dial with 360° test circle(s), sweep hand(s), low flow (leak) detector and E-Coder – E900i.
2. Registration Units:
 - a. Register shall be calibrated to read in cubic feet increments.
 - b. 3/4-inch, and 1-inch meters shall measure at a minimum 1 cubic foot volume per sweep hand revolution.

- c. 1 1/2-inch through 6-inch, meters shall measure at a minimum 10 cubic feet volume per sweep hand revolution.
3. **Totalizer Display:**
 - a. Register shall be direct read and shall measure volume in hundred cubic-feet (HCF) increments.
 - b. Meter display shall be with a E-Coder – E900i from Neptune.

This may require the stamping of a zero or zeroes on the register dial face. The last two digits including the zero or zeroes stamped on the register dial face shall be easily distinguishable from the balance of the digits either by contrast of white numbers on black, red numbers on white, or silver numbers on black.
4. **Registers:** Registers for all meters shall be hermetically sealed and shall not have replaceable change gears.
5. **Gears:** Register gears shall be self-lubricating molded plastic or brass unless stated otherwise.
6. **Drives:** Registers shall be driven by magnetic coupling or directly shaft driven.
7. **Lenses:** All register lenses shall be tempered glass.
8. **Serial Number:** The serial number of each meter shall be imprinted on both the register box cover and the main casing.

C. End Connections

All meters shall have standard flanged connections, with Type 316 stainless steel bolts, nuts, cap screws, studs, and washers, unless otherwise specified on the plans or herein.

D. Communications

1. All meters shall include a Neptune E-Coder R900i or R900 external antenna to provide RF communications to the AMI network.
2. Contractor shall work with District to set up protocol and confirm communication between the meter and the network.

E. Positive Displacement Meters (5/8-Inch through 2-Inch)

1. **General:** Meters shall conform to the material and performance requirements of AWWA C700 as applicable and the specifications herein.
2. **Certification:** The manufacturer shall furnish certified results for each meter showing that it has been tested for accuracy of registration according to the manufacturer specifications. Meter shall be $\pm 1.5\%$ for the normal flow range when tested in accordance with AWWA Manual M6.
3. **Materials:** Meter bodies shall be lead-free bronze. Casing bolts shall be stainless steel or bronze. All internal hardware shall be stainless steel.
4. **End Connections:** 5/8-inch through 1-inch meters shall have external straight threads. 1 1/2-inch through 2-inch meters shall have flanged ends.

5. Dimensions: The face to face length of the meter shall be as follows:

Meter Size (inches)	Face-to-Face Dimensions (inches)
5/8	7-1/2
3/4	9
1	10-3/4
1-1/2	13
2	17

6. Measuring Chamber: Measuring chambers shall be non-hydrolyzing synthetic polymer.
7. Pistons or Disks: Pistons or nutating disks shall be vulcanized rubber or plastic.
8. Strainers: If recommended by the manufacturer, meters shall have plastic or stainless-steel strainers. If a strainer is not required, manufacturer must explicitly state this in the warranty certificate.
9. Register and Register Box Connection to Meter Case: Registers and register boxes shall be secured to the main case by acceptable tamper-proof means.
Safety wiring of standard bolts and screws is not considered an acceptable method of tamper proofing. Register boxes and covers shall be either bronze or a suitable synthetic material.
10. Warranty: Positive Displacement Meters shall be supplied with the following guarantee:
- Guaranteed new-meter accuracy ($\pm 1.5\%$) for 5 years.
 - Measuring chambers and disks or pistons guaranteed for 15 years.
 - Registers guaranteed for 25 years.
11. Acceptable Manufacturers: Positive Displacement meters shall be Neptune T-10 with E-Coder, no equal.

F. Turbine Meters (2-Inch through 10-Inch)

1. General: Meters shall conform to the material and performance requirements of AWWA C701 Class II as applicable and the specifications herein.
2. Certification: The manufacturer shall furnish certified test results for each meter showing that it has been tested for accuracy of registration according to manufacturer's specifications. Meter shall be $\pm 1.5\%$ for the normal flow range when tested in accordance with AWWA Manual M6.
3. Materials: Meters shall have bronze or ductile iron main cases.
4. End Connections: End connections shall be per TCWD Standard Drawing W-5.
5. Dimensions: The maximum face to face length of the meter and strainer shall be as follows:

Meter Size (inches)	Face-to-Face Dimensions (inches)
2	17
3	18
4	21-1/2
6	27
8	30
10	41

6. Straightening Vanes: Straightening vanes shall be provided in the main case.
7. Calibration Adjusting Vane: A calibration-adjusting vane located in the measuring chamber shall be provided.
8. Rotors and Shafts: Rotors shall be thermoplastic or stainless steel with graphite or tungsten carbide bearings rotating on a stainless-steel shaft. Motion shall be transmitted from the rotor to the register through a magnetic coupling or directly driven shaft. Worm gears shall not be permitted.
9. Register and Register Box Connection to Meter Case: Register guaranteed and register boxes shall be secured to the main case by acceptable tamper-proof means. Safety wiring of standard bolts and screws is not considered an acceptable method of tamper proofing. Register boxes and covers shall be either bronze or a suitable synthetic material.
10. Strainers: Meters shall be equipped with strainers.
 - a. The strainer body and cover shall be bronze or ductile iron.
 - b. Ductile iron strainers shall be epoxy lined in accord with Section 09900, Painting and Coating, System No. G-1.
 - c. Strainers shall be furnished with stainless steel screens with an effective open area at least double the area of the meter.
 - d. Strainers shall be from same manufacturer as the water meter.
11. Measuring Chamber and Strainer Cover: Measuring chamber and strainer cover shall be Type 316 stainless steel or epoxy coated ductile iron.
12. Warranty: Turbine Meters shall be supplied with the following guarantee:
 - a. Guaranteed new-meter accuracy ($\pm 1.5\%$) for 5 years.
 - b. Measuring chambers and disks or pistons are guaranteed for 15 years.
 - c. Registers guaranteed for 25 years.
13. Acceptable Manufacturer: Turbine Meters shall be Neptune - High Performance Turbine Meter, no equal.
14. Application: Turbine Meters shall be used only in constant high flow conditions as determined by the District.

G. Electromagnetic Flow (Mag) Meters (2-Inch through 10-Inch)

1. General: Meters shall conform to the material and performance requirements of AWWA C715 as applicable and the specifications herein.
2. Certification: The manufacturer shall furnish certified test results for each meter showing that it has been tested for accuracy of registration according to manufacturer's specifications. Meter shall be $\pm 1.5\%$ for the normal flow range when tested in accordance with AWWA Manual M6.
3. Materials: Meters shall have bronze or ductile iron main cases.
 - a. The meter main case shall be made cast from NSF/ANSI 61 certified lead free alloy containing a minimum of 85% copper. Plastic main cases or flow tubes are not acceptable as the spuds are susceptible to cross-threading or breaking during installation, or from pipe stress over time.
 - b. The serial number should be displayed in a permanent location on the register.
 - c. Meter markings shall indicate size, model, direction of flow, and NSF 61 certification.

- d. All lead free maincases shall be guaranteed free from manufacturing defects in workmanship and material for the warranted life of the meter.
 - e. All maincase screws or bolts shall be of 300 series non-magnetic stainless steel to prevent corrosion.
- 4. Electronic Register: The solid state meter electronic enclosure shall be constructed of a durable engineered composite designed to last the life of the meter. The meter shall provide a fully potted wire connection for use with AMR/AMI devices.
- 5. End Connections: End connections shall be per TCWD Standard Drawings.
- 6. Dimensions: The maximum face to face length of the meter shall be per manufacturer's specifications.
- 7. Warranty: Meters shall be supplied with the following guarantee:
 - a. Guaranteed new-meter accuracy ($\pm 1.5\%$) for 5 years.
 - b. Measuring chambers and disks or pistons are guaranteed for 15 years.
 - c. Registers guaranteed for 25 years.
- 8. Acceptable Manufacturer: Electromagnetic Flow Meters shall be a Neptune Mach 10 Meter, no equal.
- 9. Application: Electromagnetic Flow Meters shall be used only in constant flow conditions as determined by the District.

H. Totalizer Flow - Transmitter

- 1. General: Totalizer Flow - transmitters shall be furnished with all necessary mounting hardware for operation from the meter.
- 2. Operation: The transmitter shall have integrally mounted electronic circuitry to convert to both a true 2-wire 4-20 mA DC output linear to flow rate and a true 2-wire scaled pulse.
 - a. The 4-20 mA DC output shall operate from an external regulated 18-30 volt DC power supply with load capacity of 575 ohms at 28 volts DC. The accuracy of the 4-20 mA output shall be better than $\pm 0.5\%$ of scale.
 - b. The pulse output shall operate from an external regulated 10-30 volts DC power supply which can be either the 4-20 mA DC power supply or a separate power supply. The pulse circuit voltage drop across the transmitter shall be 3-volt DC or less. Each pulse shall represent the volume of the least significant totalizer digit.

I. Manual Valves

Valves shall be per TCWD Standard Drawings and conform with Section 15100, Manual Valves. Valves on by-pass shall be lockable in the closed position.

PART 3 - EXECUTION

A. Meter Installations

- 1. Residential Meters: Residential meters shall be installed as shown on the plans, or per TCWD Standard Drawings W-1 through W-5.
- 2. 3-inch and Larger Meters: 3-inch and larger meters shall be installed as shown on the plans or per TCWD Standard Drawings W-7 & W-8.

B. Service Piping

All piping for service lines and by-pass lines shall be installed in conformance with Section 15057, Copper Pipe and Fittings, and Section 15051, Installation of Pressure Pipelines.

C. Test Tap

On services 3-inch and larger, a 2-inch service saddle and corporation stop shall be installed on the spool downstream of the meter per TCWD Standard Drawings W-7 & W-8.

The tap shall be located a minimum of two pipe diameters downstream of the meter.

D. Painting and Coating

Exposed and buried piping, and meter lids on all potable and recycled water services shall be painted or coated in accordance with Section 09900, Painting and Coating.

E. Testing

Meter services shall be hydrostatically pressure tested during the testing of pipeline in accordance with Section 15042, Hydrostatic Testing of Pressure Pipelines.

3-inch and larger will be tested by the District to verify accuracy prior to being placed water service into service.

END OF SECTION

SECTION 15151: FACILITIES IDENTIFICATION

PART 1 - GENERAL

A. Description

This section describes materials and installation of potable and recycled water facilities identification for pipe, valves, valve boxes, and other pipeline appurtenances.

B. Related Work Specified Elsewhere

1. Painting and Coating: 09900
2. PVC Pressure Distribution Pipe and Fittings: 15064
3. Manual Valves: 15100

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit material samples of ID and locator tape.
3. Submit drawings showing location and size of labels and signs.

PART 2 - MATERIALS

A. Buried Piping ID Tape, Locator Tape, and Tracer Wire

1. ID Tape: Identification tape shall be an inert plastic film specifically formulated for prolonged underground use. The minimum thickness shall be 4 mils, and the overall width of the tape and lettering size shall be in accordance with the following table.

Pipe Size (inches)	ID Tape Width (inches)	Locator Tape Width (inches)	Min. Lettering Size (inches)
2 and less	2	3	1-1/2
greater than 2 and less than 8	6	3	2
8 and larger	12	3	2

a. Potable Water Pipelines:

- i. Blue ID tape with black lettering identifying the potable waterline, shall be used on all pipelines 1-inch and larger.
- ii. Copper Pipe Services: ID tape shall be placed over the top of the pipe and shall be taped to the copper pipe at 2-foot intervals.
- iii. The ID tape shall extend up into the air-vacuum release assembly or other appurtenances a minimum of 12-inches, so that it can be read clearly by opening the box or enclosure.
- iv. ID tape wording shall read: "CAUTION: DOMESTIC WATERLINE BURIED BELOW".

b. Recycled Water Pipelines:

- i. Purple ID tape with black lettering identifying the recycled waterline, shall be used on all pipelines 1-inch and larger.
- ii. Copper Services: ID tape shall be placed over the top of the pipe and shall be taped to the copper pipe at 2-foot intervals.

- iii. The ID tape shall extend up into the air-vacuum release assembly or other appurtenances a minimum of 12-inches, so that it can be read clearly by opening the box or enclosure.
 - iv. ID tape wording shall read: "CAUTION: RECYCLED WATER – DO NOT DRINK".
 - c. Sewer Pipelines:
 - i. Green ID tape with black lettering identifying the sewer line and shall be used on all pipelines 1-inch and larger.
 - ii. ID tape wording shall read: "CAUTION: SEWER LINE BURIED BELOW."
 - d. Other Pipelines:
 - i. Identification of all exposed pipe shall be accomplished by color coding with bands and by process descriptions. Color band stickers shall be adhered directly upon the pipe.
 - ii. Each pipe identification shall identify the name of the process liquid in the pipe and the direction of flow. All labels shall be preprinted on pressure-sensitive adhesive-backed vinyl cloth or plastic tape. Arrows shall be die-cut of the same type of material as the labels.
 - iii. Letter sizes and colors for lettering, arrows, and background shall conform to ANSI A13.1.
 - iv. Preprinted identification devices shall be manufactured by Brady, or Seton.
 - v. Existing Identification Systems: In installations where existing piping identification systems have been established, the Contractor shall continue to use the existing system. Where existing identification systems are incomplete, the Contractor shall utilize the existing system as far as practical and supplement with the specified system. The objective is to fully identify all new piping, valves, and appurtenances to the level specified herein.
- 2. Locator Tape: Locator tape shall have a minimum thickness of 6 mils. Locator tape shall be installed over non-metallic pipe, shall be similar to ID tape, and shall include a metallic substance that can be registered by a magnetic field location device.
- 3. ID tape and locator tape shall be as supplied by Christy's Detectable Tape, Northtown Company - Hytech Detectable Tape, Reef Industries - Terra Tape or equal.
- 4. Tracer Wire: Where shown on the plans, tracer wire shall be installed instead of locator tape on non-metallic pressurized pipes sizes 6-inches and greater.
 - a. Tracer wire shall be installed in accordance with the TCWD Standard Drawings.
 - b. The tracer wire shall consist of a #8 AWG Type UF (direct burial) stranded single conductor cable with high density polyethylene (HDPE) or high molecular weight polyethylene (HDPE) insulation.
 - c. The insulation shall be black in color. The tracer wire shall be taped to top of pipe every ten feet.

B. Warning Encasement for Underground Recycled Metallic Water Pipelines

Unless otherwise specified, pipe and fittings shall be polyethylene encased in accordance with AWWA/ANSI C105/A-21.5 and shall be "purple" in color and shall bear the water identification markings called for in Section D, Labels and Tags, sub-paragraph 2, Recycled Water Identification.

C. Purple PVC Pipe for Recycled Water Pipelines

- 1. General: PVC pipe used for recycled water use shall conform to the requirements of Section 15064, PVC Pressure Distribution Pipe and Fittings, and shall be colored purple.

2. PVC Pipe Coloring and Markings: PVC pipe shall be purple and shall be marked on both sides of the pipe with the wording: "CAUTION: RECYCLED WATER - DO NOT DRINK."
Lettering shall be a minimum of 1/2-inch high black letters and shall be repeated every 12-inches. The purple pipe color shall be achieved by adding pigment to the PVC material as the pipe is being manufactured.

D. Labels and Tags

Labels shall be inert plastic film specifically formulated for prolonged exposure. The minimum thickness shall be 4 mils for adhesive backed labels and 10 mils for tag type labels.

Tag type labels shall have reinforced tie holes and shall be attached with heavy-duty nylon fasteners.

The size, type of label and location shall be dictated by each individual application and subject to acceptance by the District Representative.

1. Potable Water Identification: Labels shall be prepared on a blue field and shall have the words: "POTABLE WATER" printed on the field in black letters, as directed by the District Representative. Minimum letter height shall be 1/2-inch.
2. Recycled Water Identification: Labels shall be prepared on a purple field and shall have the words: "CAUTION: RECYCLED WATER - DO NOT DRINK" printed on the field in black letters, as directed by the District Representative. Minimum letter height shall be 1/2-inch.
3. Water Service Meter Identification Tags: The water service meter identification tag shall identify the address or unit number served by the meter.

The identification tag shall be rotary engraved with identifying letters and numbers. The circular plastic tag shall be 1/16-inch thick, 2-inch diameter, and the exterior shall be UV resistant 3 ply (color on both sides) lamicoid plastic by Rowmark, or Gravoply or equal.

Color shall be:

- a. Blue with a white core for potable water.
- b. Purple with a white core for recycled water.
- c. Light Blue with white core for untreated water
- d. Green with white core for sewer.

TCWD shall provide the un-engraved plastic tags to the Contractor for engraving. The Contractor shall engrave the address and/or unit number into the plastic tag.

4. Other Tagging: When Process and Instrumentation Diagrams (P&ID's) are included in the drawings, tags shall be provided for all items including, but not limited to, valves, instruments, and equipment shown on the P&ID's.

Tagging conventions shall be as shown on the drawings, unless otherwise specified by the District.

The identification tag shall be rotary engraved with white identifying letters and numbers. The circular plastic tag shall be 1/16-inch thick, 2-inch diameter, and the exterior shall be UV resistant 3 ply (color on both sides) lamicoid plastic by Rowmark, or Gravoply or equal.

Tag color shall be black with white core. Contractor shall provide plastic tags with engraving.

PART 3 - EXECUTION

A. Installation of Pipe ID Tape, Locator Tape and Tracer Wire

1. ID Tape: ID tape shall be installed directly on the top of the pipe longitudinally and shall be centered.

The ID tape shall be installed continuously for the entire length of the pipe and shall be fastened to each pipe length by plastic adhesive tape banded around the pipe and ID tape at no more than 2-foot intervals.

Taping attached to the sections of pipe before laying in the trench shall have 5-foot minimum overlap for continuous coverage.

All risers between the main line and control valves shall be installed with ID tape.
2. Locator Tape: Locator tape shall be installed directly on top of the pipe zone backfill layer and shall be centered over non-metallic pipelines.
3. Tracer Wire: Tracer wire shall be installed on top of the pipe and over the ID tape.

Wire shall be continuous strand. Crimpable copper butt splice kits are permitted in valve cans only.

For main line valve cans, wire shall be routed up the outside of the valve riser, into the valve can at the top, 12-inch looped, and back down the outside of the valve riser.

B. Installation of Labels and Signs

1. Method of Attachment: Labels shall be firmly attached using heavy-duty nylon fasteners and shall be sized and installed at locations as shown on the plans.
2. Equipment Requiring Labels or Tags: Labels shall be installed on all appurtenances in vaults, such as, but not limited to, air release valves, blowoffs, and meters, and on designated facilities, such as, but not limited to, controller panels and washdown or blowoff hydrants for water trucks and temporary construction services.

Pumps and pipe shall be identified with a painted label.

Within a fenced area, at least one sign shall be posted on the fence which can be readily seen.
3. Painted Labels: Painted labels may, at the District Representative's discretion, be acceptable in lieu of plastic labels.

C. Installation of Water Identification Tags

Identification tags shall be securely attached to water meters using UV rated zip ties rated to hold up to 50 pounds.

END OF SECTION

SECTION 15162: FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 - GENERAL

A. Description

This section describes materials and installation of flexible gasket sleeve-type compression pipe couplings for steel, asbestos cement pipe and ductile iron pipe.

B. Related Work Specified Elsewhere

1. Painting and Coating: 09900
2. Hydrostatic Testing of Pressure Pipelines: 15042

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's catalog data on flexible pipe couplings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.
3. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible gasket sleeve-type compression pipe couplings.
4. Show materials of construction by ASTM reference and grade. Show dimensions.
5. Show number, size, and material of construction of the rods and lugs for each thrust harness.

PART 2 - MATERIALS

A. Flexible Pipe Couplings for Steel Pipe

1. General: Steel couplings shall have center sleeves made of steel conforming to ASTM A36, A-53 (Type E or S), or A-512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A47, Grade 32510), ductile iron (ASTM A536), or steel (ASTM A108, Grade 1018, or ASTM.

A510, Grades 1018 or 1021). Follower ring material shall match that of the pipe being joined. For example, steel follower rings shall be used on steel pipe and malleable iron rings shall be used on ductile iron pipe. Minimum center sleeve lengths shall be per the table below.

Minimum Center Sleeve Length (inches)	Pipe Sizes (inches)
5	1 - 3
7	4
10	6 - 24
Submit for Approval	Larger than 24

2. Sleeve Bolts: Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi, and shall be fabricated of Type 316 stainless steel conforming to ASTM A193 (Grade B8M) for bolts and ASTM A194 (Grade B8M) for nuts and shall conform to AWWA C111.
3. Manufacturers: Flexible pipe couplings for steel pipe shall be steel, and shall be Dresser Couplings, Ford Meter Box, Romac Industries, or Smith-Blair.

B. Joint Harness

1. Tie Bolts or Studs: Tie bolts or studs shall be as shown in AWWA Manual M-11, Table 13-6, 13-7, and 13-7A.

Bolt or stud material shall conform to ASTM B193, Grade B8. Nuts shall conform to ASTM A194, Grade B8M.

Lug material shall conform to ASTM A36, ASTM A283, Grade B, C, or D, or ASTM A285, Grade C. Lug dimensions, plate thickness, number of bolts, and weld dimensions shall be as shown in AWWA Manual M-11, Figure 13-17.

The minimum numbers and sizes of tie bolts or studs shall be as shown in the table below.

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS

Nominal Pipe Size (inches)	150 psi		250 psi	
	No. of Bolts or Studs	Size (inches)	No. of Bolts or Studs	Size (inches)
2	2	5/8	2	5/8
3	2	5/8	2	5/8
4	2	5/8	2	5/8
6	2	5/8	2	5/8
8	2	5/8	2	5/8
10	2	5/8	2	5/8
12	2	3/4	2	7/8
14	2	3/4	2	1
16	2	7/8	2	1 1/8
18	2	1	2	1 1/4
20	2	1	2	1 1/4
24	4	7/8	4	1 1/8

2. Criteria for Number and Size of Tie Bolts or Studs: The number and size of bolts shall be selected based on the test pressure shown in Section 15042, Hydrostatic Testing of Pressure Pipelines.

For test pressures less than 150 psi, the 150 psi design in the table above shall be used or for contracts between District and Contractor, approved equal.

For test pressures between 150 and 250 psi, the 250 psi design in the table above shall be used.

3. Washers: Stainless steel, type 316 washers shall be provided for each lug. Washer material shall be the same as the nuts. Minimum washer thickness shall be 1/8-inch.
4. Wall Thickness Requirement for Welded Lugs: Pipe wall to which lugs are welded shall be adequate to resist stresses. If necessary, the pipe wall thickness shall be increased.

C. Flexible Pipe Couplings for Asbestos-Cement Pipe

1. General: Flexible pipe couplings for asbestos-cement pipe shall be ductile iron, with long-style center sleeves a minimum of 7-inches in length and shall have corrosion resistant Type 316 stainless steel nuts, bolts, and washers. Center sleeve and follower rings shall be epoxy coated and holiday free.

2. Sleeve Bolts: Sleeve bolts shall be corrosion resistant type 316 stainless steel with a minimum yield strength of 45,000 psi and shall conform to ASTM A193 and AWWA C111.
3. Manufacturers: Flexible pipe couplings for asbestos-cement pipe shall be Dresser Couplings - Style 40, Ford Meter Box - Style FRR, Romac Industries - Style 501, or Smith-Blair - Type 442.

D. Flexible Couplings for Ductile Iron Pipe

1. General: Ductile iron pipe couplings shall have center sleeves of ASTM A126 Class B ductile iron with a minimum yield strength of 30,000 psi.
Follower rings shall be malleable iron ASTM A47 Grade 32510 or ductile iron ASTM A536.
Minimum center sleeve length shall be 7-inches for pipe sizes up to 6-inches and shall be a minimum of 10-inches for larger pipe diameters.
2. Sleeve Bolts: Sleeve bolts shall be corrosion resistant type 316 stainless steel with a minimum yield strength of 45,000 psi and shall conform to ASTM A193 and AWWA C111.
3. Manufacturers: Flexible couplings for ductile iron pipe shall be ductile iron, Dresser Couplings - Style 153, Ford Meter Box - Style FCI, Romac Industries - Style 501, or Smith-Blair - Type 442.

E. Transition Couplings

1. Steel Pipe and Concrete Cylinder Pipe: Transition couplings for connecting steel pipe and concrete cylinder pipe having different outside diameters shall be steel: Baker Series 212 or 240, Dresser Style 62 or 162, or Smith-Blair Type 413.
2. Ductile Iron Pipe, PVC Pipe, and Asbestos Cement Pipe: Transition couplings for connecting ductile iron pipe, PVC pipe, and asbestos cement pipe having different outside diameters shall be ductile iron, and shall be Baker Coupling Products - Series 236, Dresser Couplings, Ford Meter Box - Style FC2A, Smith-Blair - Type 441, or Romac Industries.
3. Sleeve Bolts: Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi, shall be Type 316 stainless steel conforming to ASTM A193 (Grade B8M) for bolts and ASTM A194 (Grade B8M) for nuts, and shall conform to AWWA C111.

F. Flanged Coupling Adapters

Flanged coupling adapters may be used, where detailed on the approved plans, to install valves, meters, and other types of flanged fittings to plain end pipe of diameter 10-inches and smaller.

Flanged coupling adapters shall be or Romac Industries – Style 604, Dresser Couplings - Style 127, Ford Meter Box - Style FFCA, or Smith-Blair - Type 913.

G. Expansion Joints

1. General: Expansion joints shall have body, flanges, and slip pipe of carbon steel.
 - a. Packing shall consist of a minimum of four rubber rings, each separated by jute packing.
 - b. For installation on steel pipelines, expansion joint shall have plain ends and be beveled for welding.
 - c. For installation in ductile iron pipelines, expansion joint shall have plain ends.
 - d. Slip pipe shall have a machined surface, and body shall be equipped with pipe stops.
 - e. Where called for on the plans, limit or stop rings and limit rods shall be provided to prevent the slip pipe from pulling out of the joint.

2. Limit Rods and Body Studs, Bolts and Nuts: Limit rods and body studs, bolts, and nuts shall be Type 316 stainless steel conforming to ASTM A193 (Grade B8M) for rods and bolts, and ASTM A194 (Grade B8M) for nuts.
3. Manufacturers: Expansion joints shall be Baker Couplings Products - Series 403 or 404 or Smith-Blair - Type 611 or 612.

H. Sleeve Bolts and Nuts for Flanges

1. Stainless Steel Bolts: Bolts and nuts for buried and submerged flanges, flanges in underground vaults and structures, and flanges located outdoors above ground shall be Type 316 stainless steel conforming to ASTM A193 (Grade B8M) for bolts and ASTM A194 (Grade B8M) for nuts.
2. Washers: Type 316 stainless steel washers shall be provided for each nut. Washers shall be of the same material as nuts.

PART 3 - EXECUTION

A. Installation of Flexible Pipe Couplings and Expansion Joints

1. General: Oil, scale, rust, and dirt shall be cleaned from pipe ends. Gaskets in flexible pipe couplings shall be cleaned before installing. Expansion joints shall be installed per manufacturer's recommendations. Expansion joints shall be installed so that 50% of total travel is available for expansion and 50% is available for contraction.
2. Bolt Thread Lubrication: Bolt threads shall be lubricated with anti-seize compound prior to installation.

B. Painting and Coating

1. Flexible Couplings: Flexible pipe couplings (including joint harness assemblies), transition couplings, flanged coupling adapters, and expansion joints shall be coated per Section 09900, Painting and Coating; sleeves shall be coated per System G-1. After installation, couplings shall be wrapped with 8-mil polyethylene wrap per AWWA C105.
2. Interior Surface Coating: Interior surfaces of flexible coupling and transition coupling sleeves, and the body of expansion joints shall be coated per Section 09900, Painting and Coating, System G-1.

C. Bonding Flexible Pipe Couplings

Buried flexible pipe couplings that are connected to ductile-iron, cast-iron, or steel pipe shall be bonded to adjacent piping.

END OF SECTION

SECTION 16640: CATHODIC PROTECTION AND JOINT BONDING

PART 1 - GENERAL

A. Description

This section describes materials and installation of cathodic protection and testing equipment including wiring, zinc anodes, joint bonding, test stations, reference cells, alumino-thermic welds, and flange insulation kits.

B. Related Work Specified Elsewhere

1. Trenching, Backfilling, & Compacting: 02223
2. Concrete: 03300
3. Painting & Coating: 09900
4. Facilities Identification: 15151

C. Submittals

1. Shop drawings shall be submitted in accordance with the General Provisions and as specified herein.
2. Submit manufacturer's catalog data on wire and cables, test stations, reference cells, thermic welds, insulation kits, dielectric coatings, and anodes.
3. Submit qualifications of company performing required testing and record keeping. The testing shall be performed under the direction and oversight of a registered corrosion engineer or certified NACE Cathodic Protection (CP) specialist.

PART 2 - MATERIALS

A. Alumino-Thermic Weld Materials

Cartridges and sleeves for welding test lead wires, joint bonding wires and anode lead wires to the pipe, shall be "Cadweld," or "Thermoweld." Based on the type of pipe (steel, ductile iron, or cast iron) to which the wire is to be welded, the cartridge type, size and weight shall be as recommended by the manufacturer.

B. Alumino-Thermic Weld Caps

Alumino-thermic weld caps shall incorporate a high-density polyethylene plastic sheet that has minimum thickness of 10 mils with a 165 mils thick protective adhesive as manufactured by Farwest Corrosion Control Company or Chase Corporation's Royston Products.

1. Design shall incorporate an elastomeric or a mastic-filled dome and a tunnel portion to contain lead wire from the alumino-thermic weld connection.
2. The mastic coating shall be Carboline Bitumastic 50, Royston Products, Tnemec 46-465, or Tnemec 46H-413.
3. Prior to application of the mastic coating, the manufacturer's recommended primer shall be applied to exposed metal.

C. Coating Selection

Alumino-thermic connection coating shall be in accordance with the following.

Pipe Material	Connection Coating
Cement-mortar coated steel	Carboline Carboguard 890 VOC and mortar.
Carbon steel, Ductile iron	Thermic weld cap with mastic, Royston Handy Cap XL IP or Royston Handy Cap IP.

D. Test Station Boxes

1. Test station boxes shall be a minimum 10-inch diameter, 12-inch deep, precast concrete with a cast iron lid designed for H-20 traffic loading.
2. "CPTS" shall be cast on the lid. Test boxes shall be Brooks Products 3-RT, Christy G05T, or Eisel Enterprises.
3. Test boxes with terminal boards for anodes shall be rectangular in accordance with Section 03462, Precast Concrete Vaults, and Meter Boxes.
4. Test box lids shall be painted in accordance with Section 09900, Painting and Coating.

E. Pipe Leads

1. Pipe leads shall be stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for cathodic protection service and suitable for direct burial in corrosive soil or water, Unless noted otherwise,
2. Wire gauge shall be as shown on TCWD Standard Drawings.
3. Polyethylene insulation shall conform to ASTM D1248, Type I, Class C, Grades E-4 & E-5.
4. Each pipe lead shall be of sufficient length to extend from the attachment to the pipe to the test box or anode test box without a splice.
5. Wires with cut or damaged insulation shall be rejected. Insulation color shall be as shown on the plans or TCWD Standard Drawings.

F. Joint Bonding Wires

1. Pipe joint bonding wires shall be AWG No. 4 stranded copper wire with minimum 7/64-inch-thick high molecular weight polyethylene (HMW/PE) insulation rated for 600 volts.
2. The number of conductors shall be as shown on the plans and/or TCWD Standard Drawings.
3. Polyethylene insulation shall conform to ASTM D1248, Type I, Class C, Grade 5.
4. Each bond wire shall be 18 inches in length for 18-inch pipes or less and 24 inches for pipes larger than 18-inch.

G. Flange Insulation Kits

Insulating material shall be of the type designated by the manufacturer as suitable for the operating temperature and pressure of the service. Flange insulation kits shall consist of:

1. Insulating Gaskets: Gaskets shall be Type E full-faced, 1/8-inch minimum thickness, dielectric neoprene faced phenolic. Gaskets shall be Advance Products & Systems, Inc. (APS), George Fischer Central Plastics, or Pipeline Seal & Insulator, Inc. (PSI).
2. Insulating Sleeves and Washers: Insulating stud sleeves and washers shall be one-piece and full-length, made of Minlon or Mylar. One 1/8-inch-thick gasket shall be attached to the sleeve, while the other shall be loose. Single insulating washers and sleeves shall be used on buried insulating flanges. Double insulating washers and sleeves shall be used on insulating flanges above ground, in structures, or in vaults.
3. Insulating Washers for Bolts: Insulating washers shall be 1/8-inch-thick glass-clad phenolic. Single insulating washers shall be used on buried insulating flanges. Double insulating washers and full-length sleeves shall be used on insulating flanges above ground, in structures, or in vaults.

4. Steel Washers Over Insulating Washer: Steel backing washers shall be 1/8-inch-thick Type 316 stainless steel.
5. Compatibility with Valves: Insulating flange kits are not compatible with most valve flanges. Where cathodic isolation is required near a valve, a flanged spool shall be installed adjacent to the valve; and the required insulating joint shall be installed at the opposite end of the spool from the valve. Refer to the project plans for specific details.
6. Manufacturers: Flange insulation kits shall be manufactured by Advance Products & Systems, Inc. (APS), George Fischer Central Plastics, or Pipeline Seal & Insulator, Inc. (PSI).

H. Buried Insulating Flange External Coating

1. Primer: Primer shall be a blend of microcrystalline waxes, plasticizers and corrosion inhibitors having a paste-like consistency. The material shall have the following properties:

Pour Point	100°F -115°F
Flash Point	350°F min
Coverage (approx.)	1 gallon/100 sq. ft.
Color	Brown

The primer shall be Trenton Wax-Tape Primer.

2. Wax-Tape: Flange covering material shall be a plastic-fiber felt tape, saturated with a blend of microcrystalline waxes, plasticizers and corrosion inhibitors that is easily formable over irregular surfaces. The tape shall have the following properties:

Tape Width	6-inches
Saturant Pour Point	115°F - 125°F
Thickness	70 - 90 mils
Dielectric Strength	170 Volts/mil
Weight	4 lbs./sq yd
Color	Brown

The Wax-Tape shall be Trenton #1 Wax-Tape.

3. Outer Covering: The primed and wax-tape wrapped flange shall be covered with a plastic wrapper consisting of three each of 50 gauge, clear, polyvinylidene chloride, high cling membranes wound together as a single sheet. The material shall have the following properties:

Width	6-inches
Thickness	1 1/2 mils
Dielectric Strength	2000 Volts/mil
Water Absorption	negligible
Color	Clear

The outer covering shall be Trenton Poly-Ply.

I. Internal Insulating Flange Coating

Coating for the interior lining of the pipeline at the insulating flange shall be a two-part smooth white, thixotropic liquid epoxy consisting of 100 percent solids. Coating shall be Aquatapoxxy Paint as manufactured by American Chemical Corporation.

J. Zinc Anodes

1. Zinc Anode: Anode shall conform to ASTM B418, Type II and shall be a prepackaged zinc alloy ingot having a chemical composition not exceeding the following limits:

Lead	0.003% Max.
Aluminum	0.005% Max.
Cadmium	0.003% Max.
Iron	0.0014% Max.
Copper	0.002% Max.
Zinc	Remainder

2. Anode Weight and Dimensions: Ingot weight and dimensions of the pre- packaged zinc anode shall be as listed in the table below. Weights are minimum.

Zinc Anode Sizes for 1-Inch & 2-Inch Bare Copper Pipe Services			
Copper Pipe Sizes (inches)	Copper Pipe Length (feet)	Zinc (Bare) Anode Size (inches)	Zinc (Bare) Anode Weight (lbs.)
1	0 to 45	1.4 x 1.4 x 30	15
1	45 to 90	2.0 x 2.0 x 30	30
2	0 to 22	1.4 x 1.4 x 30	15
2	22 to 45	2.0 x 2.0 x 30	30
2	45 to 70	2.0 x 2.0 x 48	45
2	70 to 90	2.0 x 2.0 x 60	60

Note: For copper pipe length greater than that listed above, additional Zinc Anodes of appropriate size shall be added as approved by the District.

3. Anode Backfill: Each zinc anode shall either be prepackaged in a permeable cloth bag with backfill of the following composition or installed bare and backfilled with material having the following composition:

Hydrated Gypsum	75%
Powdered Bentonite	20%
Sodium Sulfate	5%

- a. Backfill grains shall be capable of 100% passing through a 20 mesh screen and 50% passing through a 100 mesh screen.
 - b. The backfill shall be firmly packed around the anode by mechanical vibration, which will maintain the zinc ingot in the center of the cloth bag and surrounded by at least 1-inch of backfill. The packaged weight of the zinc anode and backfill shall be approximately twice the weight of the zinc anode ingot weight.
4. Steel Core: Anode shall be cast full length with an electro-galvanized 1/4-inch diameter steel core, which shall be exposed at one end for connection of the anode lead wire.
 5. Anode Lead Wire: Anode lead wire shall be AWG No. 8 stranded copper wire with high-molecular weight polyethylene (HMW/PE) insulation suitable for direct burial use.
 - a. HMW/PE insulation shall conform to ASTM D1248, Type 1, Class "C", Category 5, Grades E4 and E5 with tensile strengths J1, J3.
 - b. Wire shall be attached to the steel core with silver solder by the anode manufacturer.
 - c. The connection shall be encapsulated in a heat-shrinkable sleeve.

- d. Anode lead wire shall be a minimum of 15 feet long and shall be of sufficient length to extend from the anode to the designated termination point without a splice and 3-feet of coiled wire shall be provided in the test box.
 - e. Wires with cut or damaged insulation shall be rejected and replacement of the entire lead shall be required at the Contractor's expense.
 2. Anode Manufacturer's: Pre-packaged anodes with lead wire and bagged backfill shall be supplied by Northtown Company, Far West Corrosion Control Company, or Galvotech Alloys, Inc.

K. Identification Tags

1. The identification tag shall be rotary engraved with identifying letters and numbers.
2. The circular plastic tag shall be 1/16-inch thick, 2-inch diameter, and the exterior shall be UV resistant 3 ply (color on both sides) lamicaid plastic by Rowmark or Gravoply.
3. Color shall be Blue with a white core for potable, Purple with a white core for recycled, Light- Blue with white core for untreated, or Green with white core for sewer.

L. ID Tape

ID tape shall comply with Section 15151, Facilities Identification and per the TCWD Standard Drawings.

M. Mortar

Mortar used to repair concrete coated pipe after attachment of the various bond or test wires, which shall be fast drying, non-shrinkable type. Refer to Section 03300, Concrete.

N. Marker Paddles – Utility Marker

1. Brown colored polycarbonate marker paddles shall be installed adjacent to the location of each test station, anode bed, shunt box, and reference cell location.
2. Marker paddles shall be manufactured by Carsonite Composites, a Phillips Group Brand.
3. Marker paddles shall have an TCWD logo and 1-inch-high yellow letters affixed, indicating the particular cathodic appurtenance.
4. Both logos and decal letters are available from the District upon request.

O. Pipe Clamps

Pipe clamps used to attach the zinc anode lead wire to the above ground copper riser portion of the copper water tubing shall be brass or copper and of a size to fit the tubing. The pipe clamp shall have a screw terminal suitable for an AWG No. 8 copper stranded wire.

P. Insulating Blanket

The insulating blanket shall be a 1/8-inch-thick neoprene or butyl insulating material. The width and length of the blanket will vary due to diameter of the pipelines to be insulated. The width and length shall be 12-inches larger than the diameter of the largest pipeline to be insulated.

Q. Casing Seal

The casing seal shall be composed of an irradiated, semi-rigid polyolefin sleeve which when exposed to temperatures in excess of 250°F will shrink from its original diameter to a predetermined recovered diameter.

Casing seal shall be manufactured by Advance Products & Systems, Inc. (APS) or Pipeline Seal & Insulator, Inc. (PSI).

R. Reference Electrodes

1. Reference electrodes shall be copper-copper sulfate type, suitable for direct burial, and shall remain stable for at least ten years. The reference cell shall be capable of maintaining a potential within 15 millivolts of a freshly made cell while drawing 2 microamperes.
2. Reference cells shall contain a barrier to inhibit migration of chloride ions from the soil into the reference cell.
3. Reference cell lead wires shall be AWG No. 8, stranded copper wire with high-molecular weight polyethylene (HMW/PE) insulation suitable for direct burial use. HMW/PE insulation shall conform to ASTM D1248, Type 1, Class "C", Category 5, Grades E4 and E5 with tensile strengths J1, J3.
4. The lead wire shall be silver soldered to the copper core of the reference cell with the connection epoxy sealed according to the manufacturer's recommendations. Copper-copper sulfate reference cells shall be located next to the pipe in "native soil" near the "spring line" of the pipe.
5. The reference cells shall be EDI Model UI-CUG manufactured by Electrochemical Devices, Inc., IonX40 Catalogue No. 14669 by M. C. Miller Company, Model CU1-UG by GMC Electrical, Inc., or Stelth Model SRE-002-CFY by Borin Manufacturing, Inc.

PART 3 - EXECUTION

A. General

Cathodic protection installation shall conform to NACE Publication RP0169 (Latest Revision) – *"Recommended Practice, Control of External Corrosion on Underground and Submerged Metallic Piping Systems"* and to NACE Publication RP0286 (Latest Revision) – *"Recommended Practice, Electrical Insulation of Cathodically Protected Pipelines"*.

B. Wire Attachments

Wire leads shall be attached to the pipe and shall terminate at the test box without a splice. A minimum of 3-feet of slack wire from each lead shall be coiled and remain in each test box.

C. Attachment of Wire to Pipe

1. Surface Preparation for Alumino-Thermic Welding: Any existing coating on the pipe shall be removed by making a 3-inch square window in the coating. The exposed metal surface shall be cleaned to produce a bright metal finish, equivalent to SSPC SP-10, "near-white".
2. Alumino-Thermic Weld: The attachment of copper wire shall be made using an alumino-thermic weld as shown on TCWD Standard Drawings. Remove only enough insulation from the wire to allow the weld connection to be made. The wire shall be held at a 30°-45° angle to the surface when welding. One wire shall only be attached to each weld.
3. Weld Test: As soon as the weld is cool, the weld shall be tested by striking a sharp blow with a 3-pound hammer while pulling firmly on the wire. All unsound welds shall be rewelded and retested.
4. Wire Locations: Wires shall be attached to the top (horizontal) surface of the pipe. Where two or more wires are required, welds shall be at least 6-inches apart.
5. Alternative Attachment Methods: The weld mold may not fit between the pretension bars of concrete cylinder pipe, depending on the diameter and pressure class of the pipe. Alternate methods of attachment may include:
 - a. Thermite welding the test wire to the bell ring at a joint; or
 - b. Arc welding a 1/4-inch diameter steel bar, with test wire pre-attached, to the steel cylinder between pretension bars.

D. Dielectric Coating Over Thermic Weld Connection

After completing the thermic weld connection between the wire and the pipe, the connection shall be coated. Repairs to the cement mortar coating shall be of the same material and thickness as specified for the pipe.

E. Backfill Over Wire

1. Buried wires shall be installed at a minimum depth of cover of 36-inches below the street section, or 36-inches below finished grade for unpaved areas.
2. The trench bottom shall be level and free of exposed rocks. The first 12-inches of backfill above and the first 12- inches below the cable shall be sand per District bedding requirements.
3. The remainder of the trench zone shall be backfilled in accordance with Section 02223, Trenching, Backfilling and Compaction.
4. Plastic ID tape shall be installed 12-inches above the wire.

F. Test Stations

1. Test Station Boxes: Test boxes shall be located as shown on the plans or TCWD Standard Drawings and shall be positioned in the parkway or raised median, as close to above the pipeline as practical. Boxes shall be installed in accordance with the TCWD Standard Drawings.
2. Two-Wire Test Station Spacing: Two-wire test stations with boxes shall be placed at intervals not to exceed 500 feet and at the endpoints of all metallic pipelines and casings.

G. Joint Bonding Wires

1. Joint bonding wires shall be installed on ferrous metal pipelines at all unwelded joints, fittings, valves, and flanges (excluding insulated flanges)
2. Two bond wires shall be welded across each joint for pipe diameters less than 18-inches.
3. Three bond wires shall be welded across joint for pipe diameters 18-inches and larger.
4. Bond wires shall be attached using the alumino- thermic weld process.
5. Bond wires shall not be attached to valve bodies, but instead to the valve flanges.

H. Flange Insulation Kits

1. Flange insulation kits shall be installed as follows:
 1. Cleaning: Faces of flange pairs shall be cleaned of all dirt, rust or fouling materials which would interfere with a watertight joint and insulating properties of the flange kit.
 2. Alignment: Alignment pins shall be used to properly align the flange and gasket. The manufacturer's recommended bolt tightening sequence shall be followed. Bolt insulation sleeves shall be centered within the insulation washers so that the insulating sleeve is not compressed or damaged.
 3. Locations: A bonding test station shall be installed at each buried flange insulation. Two test wires shall be installed on each side of the buried insulator according to the details of the plans, these specifications, and TCWD Standard Drawings.
 4. Insulation Kits at Valves: Flange insulation kits shall not be installed directly against valve flanges. A 24-inch-long spool shall be installed adjacent to the valve so that the insulating flange kit may be installed on a standard pair of flanges.

I. External Insulating Flange Coating

1. Buried Insulating Flange Coating:

- a. Primer: Surface shall be cleaned of all dirt, dust, and loose rust or mill scale by wire brush and by wiping with a clean cloth. The surface shall be dry. Apply primer by hand or brush. A thick coating of primer shall be worked into all crevices, around bolts and in threads, and shall completely cover all exposed metal surfaces. The primer should overlap the pipe coating by 3- inches minimum.
- b. Wax-Tape: The wax-tape can be applied immediately after primer application. Short lengths of tape shall be cut and formed completely around each individual bolt and stud-end. After all bolts are covered, the tape shall be applied circumferentially and formed by hand into all voids and spaces. There shall be no gaps or air spaces under the tape. The tape shall be applied with at least 55% overlap.
- c. Outer Covering: The clear plastic outer covering shall be applied by hand such that the material conforms and adheres to the wax-tape surface. Two layers of plastic outer wrapping shall be applied.

2. Above Ground Insulating Flange Tape Coating: All flange and pipe surfaces shall be clean and free of all dirt, grease, water, and other foreign material prior to installation of tape coating. The two separate tapes shall be half-lapped twice over the outer surface of the flange.

J. Internal Coating at Insulating Flange

The interior of the pipeline shall be coated for a distance of two pipe diameters in each direction away from the insulating flange. At an insulated valve flange, interior of pipeline shall be coated away from the valve for a distance of two pipe diameters.

Coating shall be in accordance with Section 09900, Painting and Coating, System No. B-1, or B-2 as appropriate.

1. Surface Preparation: The surface preparation of the mortar lining shall consist of wire brushing to remove all loose mortar to provide a suitable surface for adhesion of the coating.
2. Application: Coating shall be applied by brushing until a minimum coating thickness of 20 mils is achieved. Each ensuing coat shall be applied before subsequent coat cures, usually within 3 to 6 hours after subsequent coat has been applied.

K. Zinc Anodes

Where called for on the drawings, prepackaged zinc anodes shall be installed in excavated, drilled, or punched holes a minimum of 3-inches larger in diameter than the prepackaged anode diameter. Anodes shall be installed below the level of the service main, with a minimum separation of 2-feet between the copper water tubing and the zinc anode maintained at all times. Anodes shall not be lowered, transported, handled, or lifted by the lead wire.

1. Backfilling: After the prepackaged anode is placed in the hole, water shall be poured into the hole so that the anode is completely covered with water. Stone- free native soil shall then be used to backfill the anode hole in accordance with Section 02223, Trenching, Backfilling and Compacting. Imported sand shall not be used for backfilling.

The anode hole shall be backfilled in stages and carefully compacted to ensure that no voids exist around the bag and that the bag and anode wire are not damaged.

After backfill is level with the top of the anode, a minimum of 15 gallons of water shall be poured into the hole to completely saturate the soil backfill. More water shall be added if it is suspected that the backfill is not completely saturated. Care shall be taken to avoid damage to the anode and anode lead wires.

2. Anode Lead Wire: The anode lead wire shall run to the point of connection at the end of the pipe run in the meter box. The anode lead wire shall be clamped to the copper-tubing riser. Sufficient slack shall be provided in the wire, and it shall be coiled in the meter box for attachment to a future point of connection at the water meter. At combination air release and vacuum relief valves the anode lead wire shall run through the concrete pad and shall be clamped to the riser as shown in the TCWD Standard Drawings. At blow-offs and manual air releases, anode lead wire shall be coiled in the valve box and clamped to the riser.

L. Identification Tags

Identification tags shall be securely attached to each of the wires in the test box using UV rated zip ties rated to hold 50 pounds.

M. Marker Paddles – Utility Markers

Utility markers shall be installed per TCWD Standard Drawing or as directed by the District Representative.

N. Insulating Blanket

Install an insulating blanket as shown in the Project Plans between any metallic pipelines that cross or parallel each other when the distance between the two pipelines is less than 18-inches.

O. Earthwork

Trenching, backfilling, and compacting shall be in accordance with Section 02223, Trenching, Backfilling, & Compacting.

P. Required Test and Record Keeping

The Contractor shall furnish all necessary equipment, material and qualified personnel required to perform all tests described herein.

1. Continuity Tests: The Contractor shall notify the District Representative when continuity bonding has been completed, and all test boxes have been completed. A registered corrosion engineer or certified NACE CP specialist retained by the Contractor shall oversee and certify the testing and measuring of the electrical continuity of metallic pipelines. The pipeline shall be considered electrically continuous when the measured longitudinal resistance of the pipeline between each pair of adjacent test stations is no greater than 20 percent higher than the theoretical resistance of that section of pipeline.

If tests indicate that adequate electrical continuity has not been achieved, the Contractor shall excavate to investigate and locate improperly bonded joints and shall make repairs until electrical continuity is achieved to the satisfaction of the District.

2. Test Stations: The Contractor shall notify the District Representative when test station wires are ready for testing. The wires shall remain disconnected to facilitate testing. A registered corrosion engineer or certified NACE CP specialist retained by the Contractor shall oversee and certify the tests to certify that none of the wires were damaged during the installation. If the test indicates damage, the entire wire shall be replaced and retested at the Contractor's expense.

Records shall be made of all test stations and reference electrodes tested and submitted to the District.

3. Insulation Joints: The Contractor shall test each insulated joint with the insulator tester in accordance with the manufacturer's written instructions. All damaged or defective insulation parts shall be replaced and retested. Records shall be kept of all insulated joint tests and shall be submitted to the District.
4. Anode and Pipe Lead Wire Integrity Tests: After the pipe and anodes are buried, the pipe lead wire and anode lead wire trenches are backfilled, and the test boxes are installed, the Contractor shall notify the District Representative that the anode and pipe lead wires are ready for testing. The wires shall remain disconnected to facilitate testing. A registered corrosion engineer or certified NACE CP specialist retained by the Contractor shall oversee and certify the tests to confirm that none of the anode wires or pipe lead wires were damaged during the installation. Each anode lead wire will be tested for electrical continuity to the anode by measuring the anode's potential with respect to a copper copper-sulfate reference electrode. The measured open circuit potential of the anode shall be as specified in the table below or as specified by the manufacturer and approved by the District Representative.

Measured Open Circuit Potential for Anodes	
Anode Type	Minimum Measured Open Circuit Potential (Volts)
High Potential Magnesium Anode	1.7
Standard Magnesium Anode	1.4
Zinc Anodes	1

5. Acceptance: The Contractor shall submit a certified report by the corrosion engineer stating that the facilities are performing satisfactorily.
 - a. All tests done must be reviewed and approved by the District before the corrosion control work is accepted.
 - b. The District reserves the right to spot check any or all tests performed by the Contractor.
 - c. All construction defects must be repaired and retested before final acceptance is made.
 - d. All unacceptable tests must be re-performed by the Contractor at no additional cost to the District.
 - e. Contractor shall hook up all lead wires after testing is completed.

END OF SECTION

SECTION 17110: IDENTIFICATION TAGS

PART 1 - GENERAL

A. Description

This section includes requirements for materials and installation of identification tags for instrumentation and control systems.

B. Related Work Specified Elsewhere

1. General Electrical requirements: 16010
2. General Instrumentation Control Requirements: 17000

C. Submittals

Submit shop drawing in accordance with the General Provisions and Sections 16010 and 17000.

PART 2 - MATERIALS

A. Designations of Components

1. Metal Tags and Backplates:

Style S1

Material: Stainless steel, Type 316 Thickness: 0.040"

Size: 2 3/8" x 3/4" (± 0.1")

Holes: 2 each, diameter = 0.12".

Letter size: 3/16" high, 1/8" wide (no more than 12 characters in one line)

Characters shall be engraved in the center of the tag with a minimum depth of 0.009" or more and filled with Black enamel paint.

Manufacturer for S1: McMaster-Carr or equal

2. Backplate

Material: Stainless steel, type 316 Thickness: 0.040"

Size: **Style B1:** 8 1/2" x 5 1/2" (+- 0.1")

Style B2: 8 1/2" x 11" (+- 0.1")

Style B3: To be cut to fit.

Holes: 2 each, diameter = 0.12"

3. Plastic Tags

a. Style L1

Material: Laminated Plastic with UV inhibitor Thickness: 1/16"

Color: White plastic behind and Black on front. Size: 2 3/8" x 3/4" (+- 0.1")

Letter size: 3/16" high, 1/8" wide and 0.01" deep (one line with 12 characters maximum)

b. Style L2

Material: Laminated Plastic with UV inhibitor Thickness: 1/16"

Color: White plastic behind and Black on front. Size: 2" x 3/8" (+- 0.1")

Letter size: 5/32" high, 1/8" wide and 0.010" deep (one line with 12 characters maximum)

c. Style L3 Plastic

Material: Laminated Plastic with UV inhibitor Thickness: 1/16"

Color: White plastic behind and Black on front. Size: 3" x 3/4" (+- 0.1")

Holes: One each, diameter = 3/16"

Manufacturer for L1, L2 & L3: Nu-Way or Dreiling Manufacturing or equal.

4. Plastic Backplate

Material: Laminated Plastic with UV inhibitor Thickness: 1/16"

Color: White plastic behind and Black on front.

Size: **Style B1:** 8½" x 5½" (+- 0.1")

Style B2: 8½" x 11" (+- 0.1")

Style B3: To be cut to fit.

Holes: 2 each, diameter = 3/16"

5. Aluminum Foil Tags

Material: Aluminum Thickness: 0.003"

Size: 1.375" x 0.437"

Corners: 3/32" 1/8" serialization.

Color: #31 Dark Green Background with # 10 Aluminum Text. Characters: 1/8".
Variable number printed on each label.

Adhesive: 3M 467

Manufacturer: Lustre-Cal (Lodi, CA) or Express (La Jolla, CA) or equal.

PART 3 - EXECUTION

A. Adhesive

Use Silicone II from GE (General Electric)

B. SST Wire

1. Lead seal and 12" Monel wire from BRADY Signmark Division. Catalog number 23302.

Use the hand sealing press Catalog number 23300 for this wire.

2. Nylon Coated stranded stainless steel wire alloy 316 from BRADY Signmark Division.
Catalog number: 23310.

Use Brass wire clamp – double ferrule design Catalog number 23312.

Use clamping tool Catalog number 23311 for this wire.

END OF SECTION

Part 4
Standard Drawings
for
Domestic and Nondomestic Water
and
Sewer Facilities

Leave Blank

Part 4

Standard Drawings

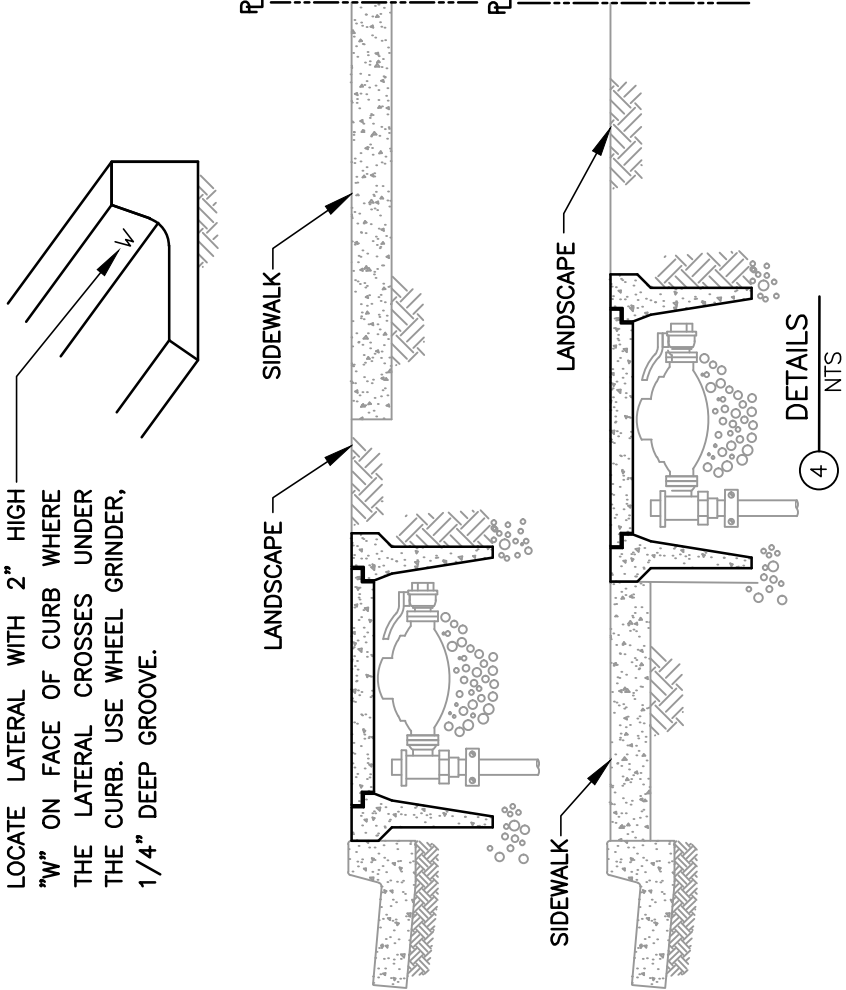
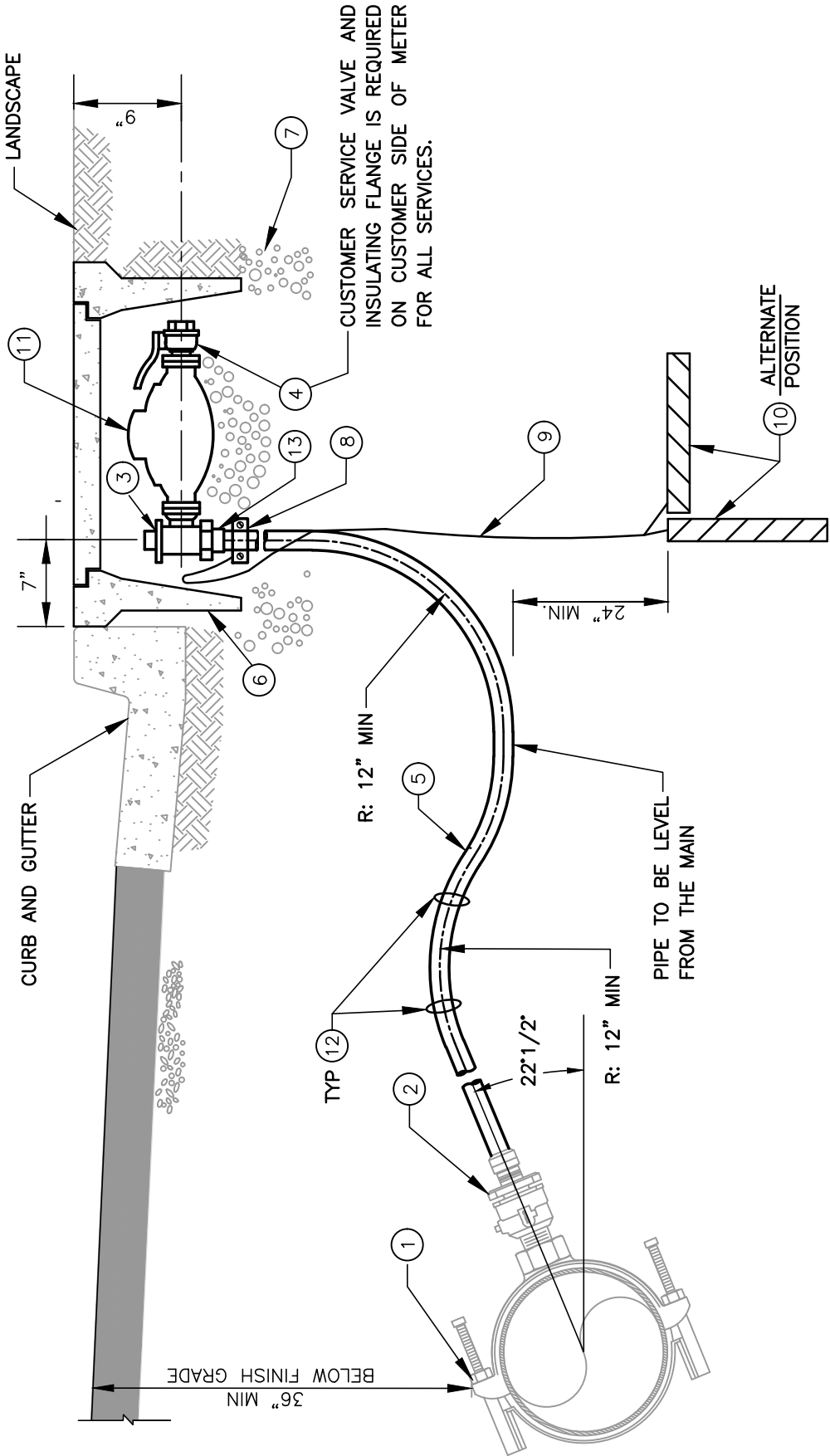
For

Domestic Water Facilities

Domestic Water Standard Drawings

W-1	1-inch Copper Service with 3/4-inch Meter
W-2	1-inch Copper Service with 1-inch Meter
W-3	2-inch Copper Service with 1-1/2-inch Meter
W-4	2-inch Copper Service with 2-inch Meter
W-5	1-inch or 2-inch Water Service Connection to PVC, ACP, Steel, or Ductile Iron Pipe
W-6	1-inch or 2-inch Water Service Manifold for Multi-Meters
W-7	3-inch or 4-inch Water Service Meter Assembly
W-8	6-inch, 8-inch or 10-inch Water Service Meter Assembly
W-9	2-inch and Smaller - Reduced Pressure Backflow Assembly
W-10	3-inch and Larger - Double Check Backflow Assembly
W-11	Fire Hydrant
W-12	Residential Domestic Fire Sprinkler and Water Shut Off Valve
W-13	Water Sampling Station
W-14	1-inch or 2-inch Air Release & Vacuum Assembly (PVC, Steel, or Ductile Iron Pipe)
W-15	2-inch and Larger Temporary Flush Out Assembly
W-16	2-inch and Larger Flush Out Assembly
W-17	Blowoff/Bottom Drain Assembly & Location Plan
W-18	Pipe Support
W-19	Thrust Block
W-20	Water Main Trench (Typical)
W-21	Water and Sewer Pipeline Separation Standards
W-22	Cut in Tee for PVC, ACP & Ductile Iron Pipe
W-23	Mortar Lined and Coated Steel Pipe Joints
W-24	Steel Casing for Water Pipe
W-25	Valve Box and Valve Extension
W-26	Retaining Wall
W-27	Utility Marker

Leave Blank



LOCATE LATERAL WITH 2" HIGH "W" ON FACE OF CURB WHERE THE LATERAL CROSSES UNDER THE CURB. USE WHEEL GRINDER, 1/4" DEEP GROOVE.

ITEM	MATERIALS
①	1" SERVICE SADDLE PER TCWD STD. W-5.
②	1" BALL CORPORATION STOP PER TCWD STD. W-5.
③	1" x 3/4" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
④	1" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
⑤	1" COPPER SERVICE PIPE TYPE "K" SOFT.
⑥	METER BOX W/READING LID. COMPOSITE POLYMER CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1). "TCWD" SHALL BE STAMPED ON INNER LID.
⑦	6" THICK BASE OF 3/4" CRUSHED ROCK.
⑧	WIRE CLAMP (SEE NOTE 8)
⑨	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
⑩	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
⑪	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER), (SEE NOTE 1)
⑫	IDENTIFICATION TAPE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
⑬	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

ZINC ANODE SIZES FOR 1-INCH COPPER SERVICES

COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 45	1.4×1.4×30	15
45 TO 90	2.0×2.0×30	30

NOTES:

- METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
- SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
- INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
- SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
- NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
- ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
- BACKFLOW PREVENTION SHALL BE INSTALLED PER TCWD STD. W-9 AND PRIOR TO ACTIVATION OF WATER METER.
- MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.
- METER SIZE WILL BE DETERMINED BY CUSTOMERS CIVIL OR MECHANICAL ENGINEER.
- IF METER DOWNSIZING IS REQUESTED ON FIRE SPRINKLER STRUCTURE, OCFA APPROVAL IS REQUIRED.

1-INCH COPPER SERVICE WITH 3/4-INCH METER

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	



TCWD
STD.DWG.
W-1

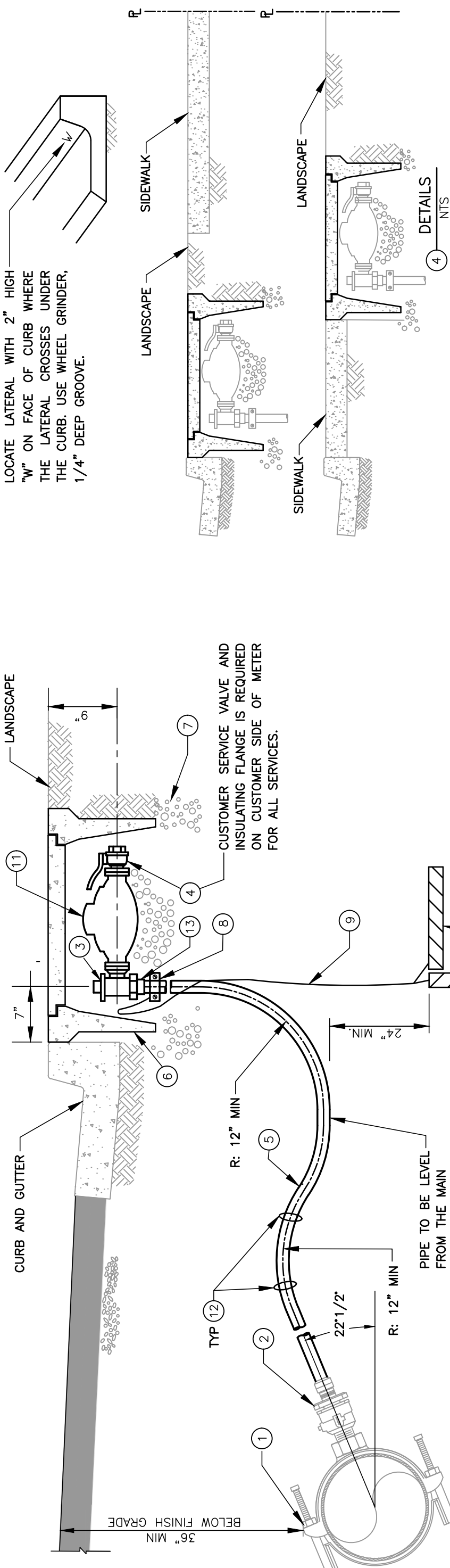
SHEET 1 OF 1

Lorrie Lausten
LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24
DATE

1. METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
2. SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
3. INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
4. SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
5. THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
6. METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
7. NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
8. ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
9. BACKFLOW PREVENTION SHALL BE INSTALLED PER TCWD STD. W-9 AND PRIOR TO ACTIVATION OF WATER METER.
10. MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.
11. METER SIZE WILL BE DETERMINED BY CUSTOMERS CIVIL OR MECHANICAL ENGINEER.
12. IF METER DOWNSIZING IS REQUESTED ON FIRE SPRINKLED STRUCTURE, OCA APPROVAL IS REQUIRED.

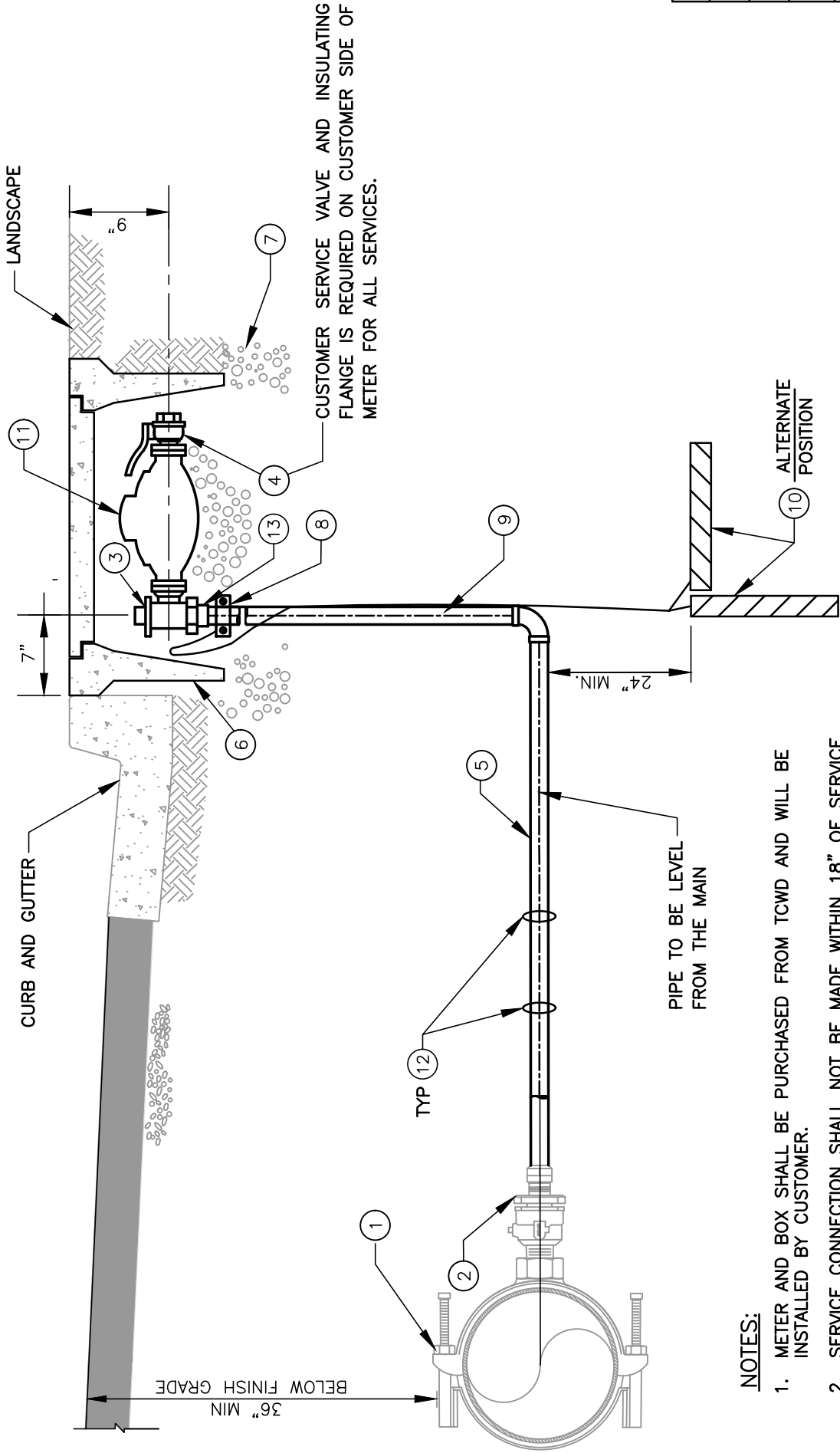
<u>ZINC ANODE SIZES FOR 1-INCH COPPER SERVICES</u>		
COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 45	1.4×1.4×30	15
45 TO 90	2.0×2.0×30	30



ITEM	MATERIALS
①	1" SERVICE SADDLE PER TCWD STD. W-5.
②	1" BALL CORPORATION STOP PER TCWD STD. W-5.
③	1" x 1" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
④	1" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
⑤	1" COPPER SERVICE PIPE TYPE "K" SOFT.
⑥	METER BOX W/READING LID. COMPOSITE POLYMER CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1). "TCWD" SHALL BE STAMPED ON INNER LID.
⑦	6" THICK BASE OF 3/4" CRUSHED ROCK.
⑧	WIRE CLAMP (SEE NOTE 8)
⑨	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
⑩	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
⑪	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER), (SEE NOTE 1)
⑫	IDENTIFICATION TAPE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
⑬	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

1-INCH COPPER SERVICE WITH 1-INCH METER

REVISION				APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-2
NO.	DATE	APPROVED	DATE			
1	11/06/24	LL				SHEET 1 OF 1
				11/21/24 LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER		



LOCATE LATERAL WITH 2" HIGH "W" ON FACE OF CURB WHERE THE LATERAL CROSSES UNDER THE CURB. USE WHEEL GRINDER, 1/4" DEEP GROOVE.

LANDSCAPE

LANDSCAPE

LANDSCAPE

LANDSCAPE

LANDSCAPE

CUSTOMER SERVICE VALVE AND INSULATING FLANGE IS REQUIRED ON CUSTOMER SIDE OF METER FOR ALL SERVICES.

TYP

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NOTES:

- METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
- SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
- INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
- SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
- NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
- ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
- BACKFLOW PREVENTION SHALL BE INSTALLED PER TCWD STD. W-9 AND PRIOR TO ACTIVATION OF WATER METER.
- MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.
- METER SIZE WILL BE DETERMINED BY CUSTOMERS CIVIL OR MECHANICAL ENGINEER.
- IF METER DOWNSIZING IS REQUESTED ON FIRE SPRINKLED STRUCTURE, OCFA APPROVAL IS REQUIRED.

ZINC ANODE SIZES FOR 2-INCH COPPER SERVICES

COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 15	1.4 X 1.4 X 9	5
15 TO 45	1.4 X 1.4 X 30	15
45 TO 90	2.0 X 2.0 X 30	30

ITEM	MATERIALS
1	2" SERVICE SADDLE PER TCWD STD. W-5.
2	2" BALL CORPORATION STOP PER TCWD STD. W-5.
3	2" X 1 1/2" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
4	2" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
5	2" COPPER SERVICE PIPE TYPE "K" SOFT.
6	METER BOX W/READING LID. COMPOSITE POLYMER CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1).
7	"TCWD" SHALL BE STAMPED ON INNER LID.
8	6" THICK BASE OF 3/4" CRUSHED ROCK.
9	WIRE CLAMP (SEE NOTE 8)
10	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
11	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
12	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER), (SEE NOTE 1)
13	IDENTIFICATION TAPE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
14	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

2-INCH COPPER SERVICE WITH 1-1/2-INCH METER

REVISION		APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-3
NO.	DATE	APPROVED	DATE	
1	11/06/24	L.L.		



TRABUCO CANYON
WATER DISTRICT

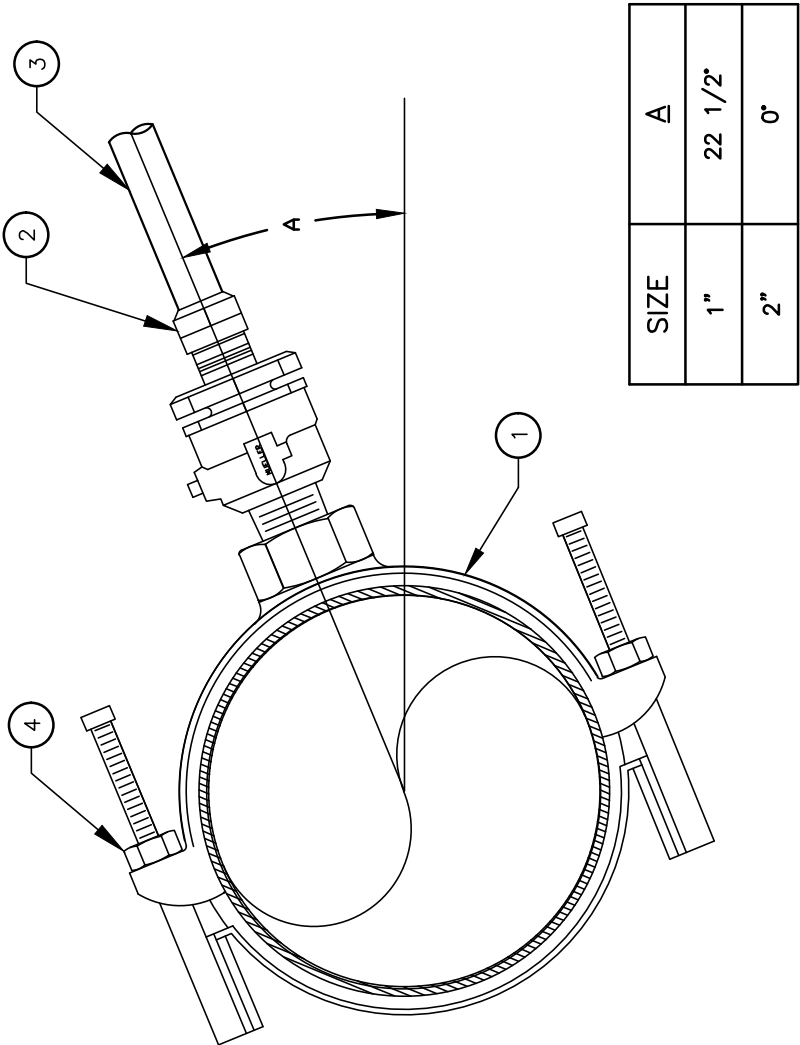


LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

DATE

SHEET 1 OF 1



ITEM	MATERIALS
①	2-PIECE BRONZE SERVICE SADDLE FOR O.D. CONTROLLED P.V.C. PIPE WITH 1" OR 2" F.I.P.T. OUTLET.
②	1" OR 2" BRONZE BALL CORPORATION STOP, M.I.P.T. X COMPRESSION.
③	1" OR 2" COPPER SERVICE PIPE, TYPE "K" SOFT.
④	2 EACH-TYPE 316 STAINLESS STEEL SADDLE BOLTS.

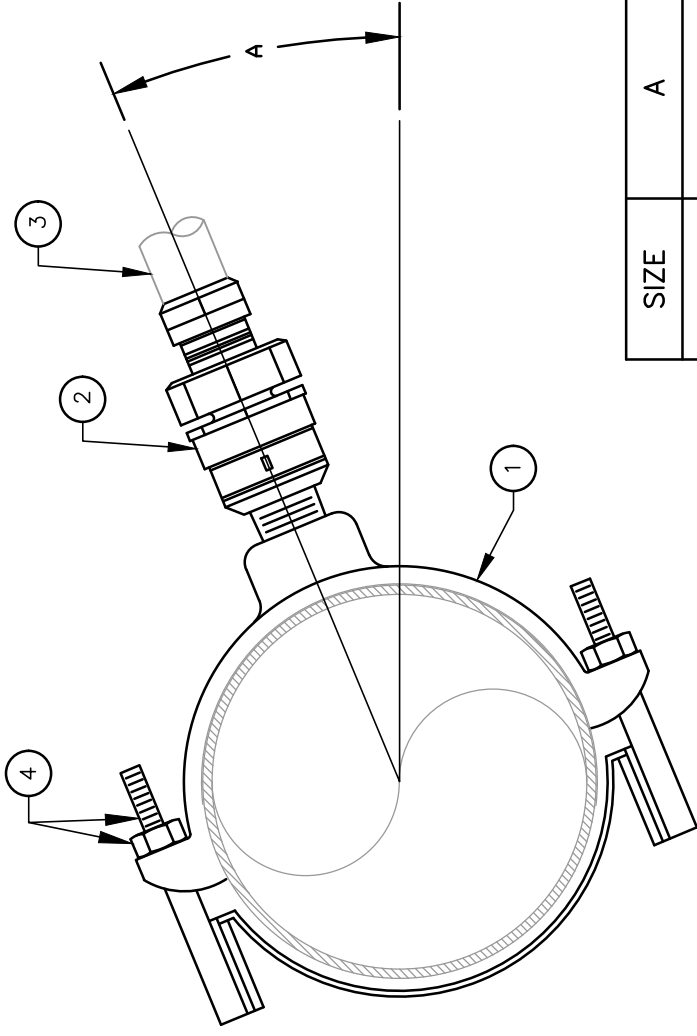
NOTE:

1. SADDLE CONNECTION MAY USED ON P.V.C. PIPE SIZES UP TO AND INCLUDING 16-INCHES.
2. FOR SIZES GREATER THAN 16-INCHES, SERVICE CONNECTIONS AND OTHER APPARATUS SHALL BE CONNECTED VIA DUCTILE IRON TEE FITTINGS WITH FLANGED OUTLET.
3. ALL TAPS SHALL BE HOT TAPPED WITH A TAPPING MACHINE. LATERAL SHALL BE AIR TESTED PRIOR TO TAPPING.

1-INCH OR 2-INCH SERVICE CONNECTION FOR PVC PIPE

APPROVED BY ENGINEERING DEPARTMENT			TCWD STD.DWG. W-5
 LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER			
REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

SHEET 1 OF 4



SIZE	A
1"	22 1/2"
2"	0"

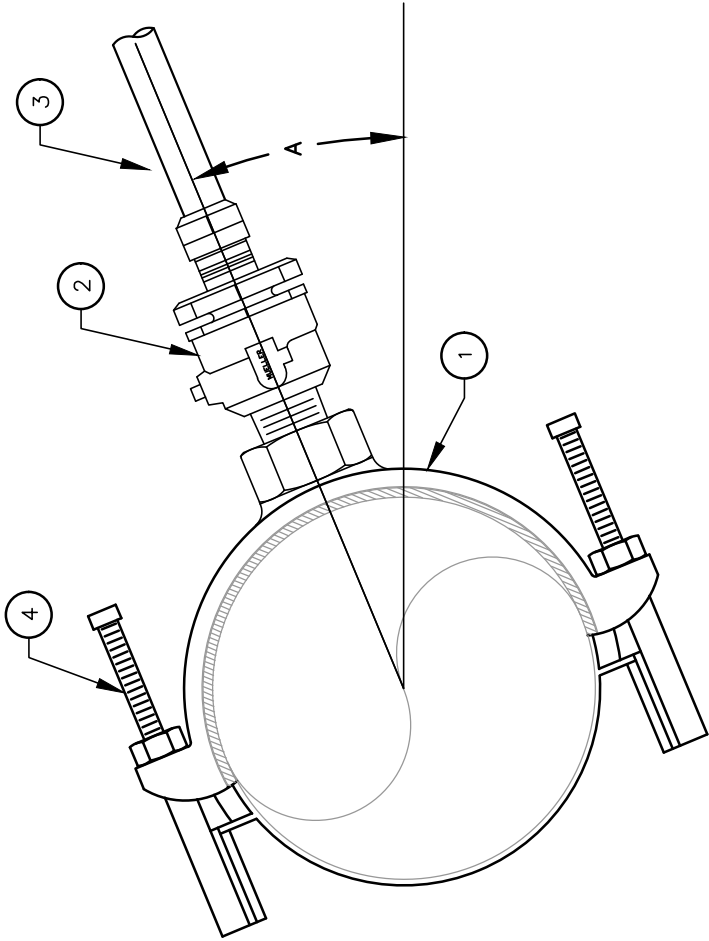
ITEM	MATERIALS
①	2-PIECE BRONZE SERVICE SADDLE WITH DOUBLE STAINLESS STEEL STRAP AND 1" OR 2" F.I.P.T. OUTLET
②	2-PIECE 1" OR 2" BRONZE BALL CORPORATION STOP, M.I.P.T. X COMPRESSION.
③	1" OR 2" COPPER SERVICE PIPE, TYPE "K" SOFT.
④	2 EACH-TYPE 316 STAINLESS STEEL SADDLE BOLTS AND NUTS.

NOTE:

1. SADDLE CONNECTION MAY USED ON AC PIPE SIZES UP TO AND INCLUDING 16-INCHES.
2. FOR SIZES GREATER THAN 16-INCHES, SERVICE CONNECTIONS AND OTHER APPARATUS SHALL BE CONNECTED VIA DUCTILE IRON TEE FITTINGS WITH FLANGED OUTLET.
3. ALL TAPS SHALL BE HOT TAPPED WITH A TAPPING MACHINE. LATERAL SHALL BE AIR TESTED PRIOR TO TAPPING.

1-INCH OR 2-INCH SERVICE CONNECTION FOR AC PIPE

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	
		APPROVED BY ENGINEERING DEPARTMENT  11/21/24 DATE	
		LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER	
			
		TCWD STD.DWG. W-5	
		SHEET 2 OF 4	



FULL-CIRCLE COUPLING

ITEM	MATERIALS
①	FULL CIRCLE STAINLESS STEEL SERVICE STEEL WITH 1" OR 2" F.I.P.T. OUTLET BUSHING.
②	1" OR 2" INSULATING BRONZE BALL CORPORATION STOP, M.I.P.T. X COMPRESSION.
③	1" OR 2" COPPER SERVICE PIPE, TYPE "K" SOFT.
④	TYPE 316 STAINLESS STEEL SADDLE NUT AND BOLT.

SIZE	A
1"	22 1/2"
2"	0"

NOTE:

1. SADDLE CONNECTIONS MAY BE USED ON DUCTILE IRON PIPE SIZES UP TO AND INCLUDING 16-INCHES.
2. FOR SIZES GREATER THAN 16-INCHES, SERVICE CONNECTIONS AND OTHER APPARATUS SHALL BE CONNECTED VIA DUCTILE IRON TEE FITTINGS WITH FLANGED OUTLET.
3. ALL TAPS SHALL BE HOT TAPPED WITH A TAPPING MACHINE. LATERAL SHALL BE AIR TESTED PRIOR TO TAPPING.

1-INCH OR 2-INCH SERVICE CONNECTION FOR DUCTILE IRON PIPE

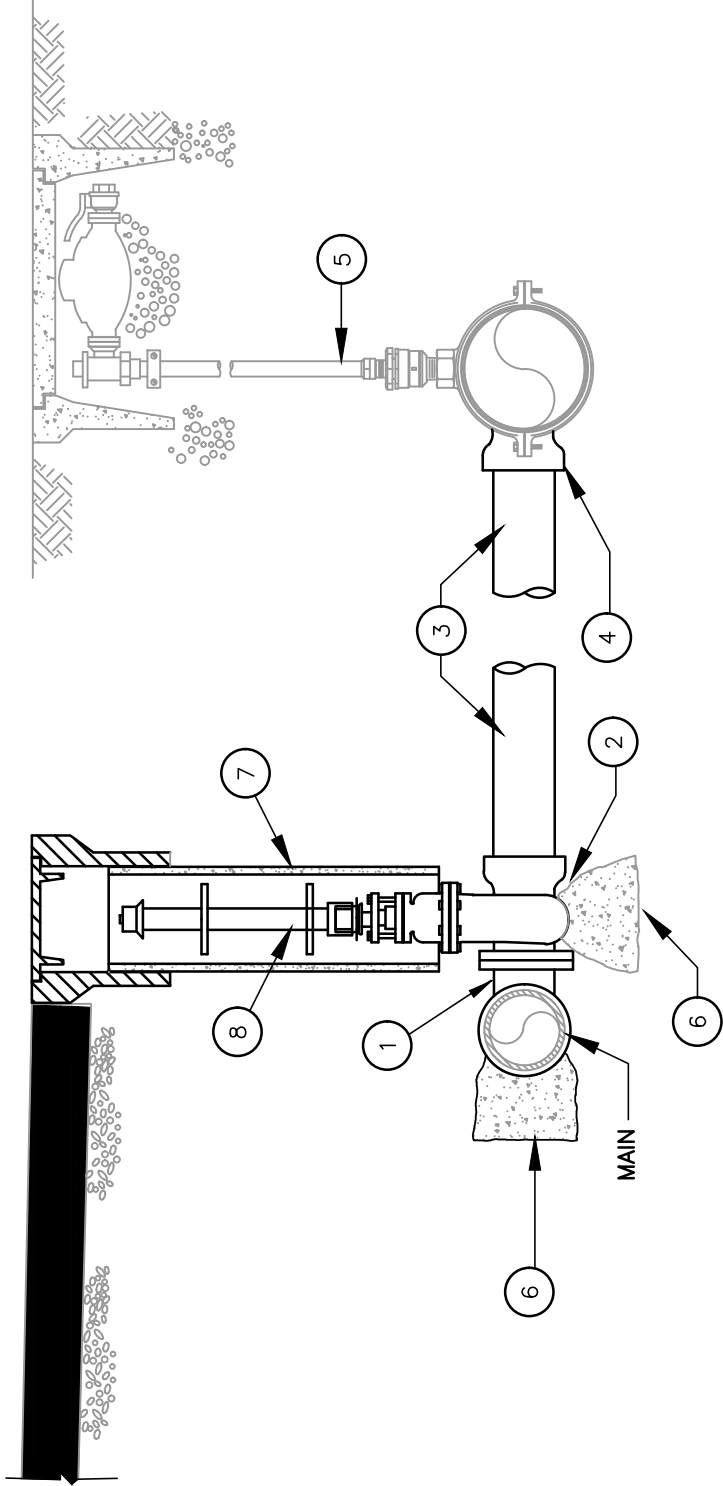
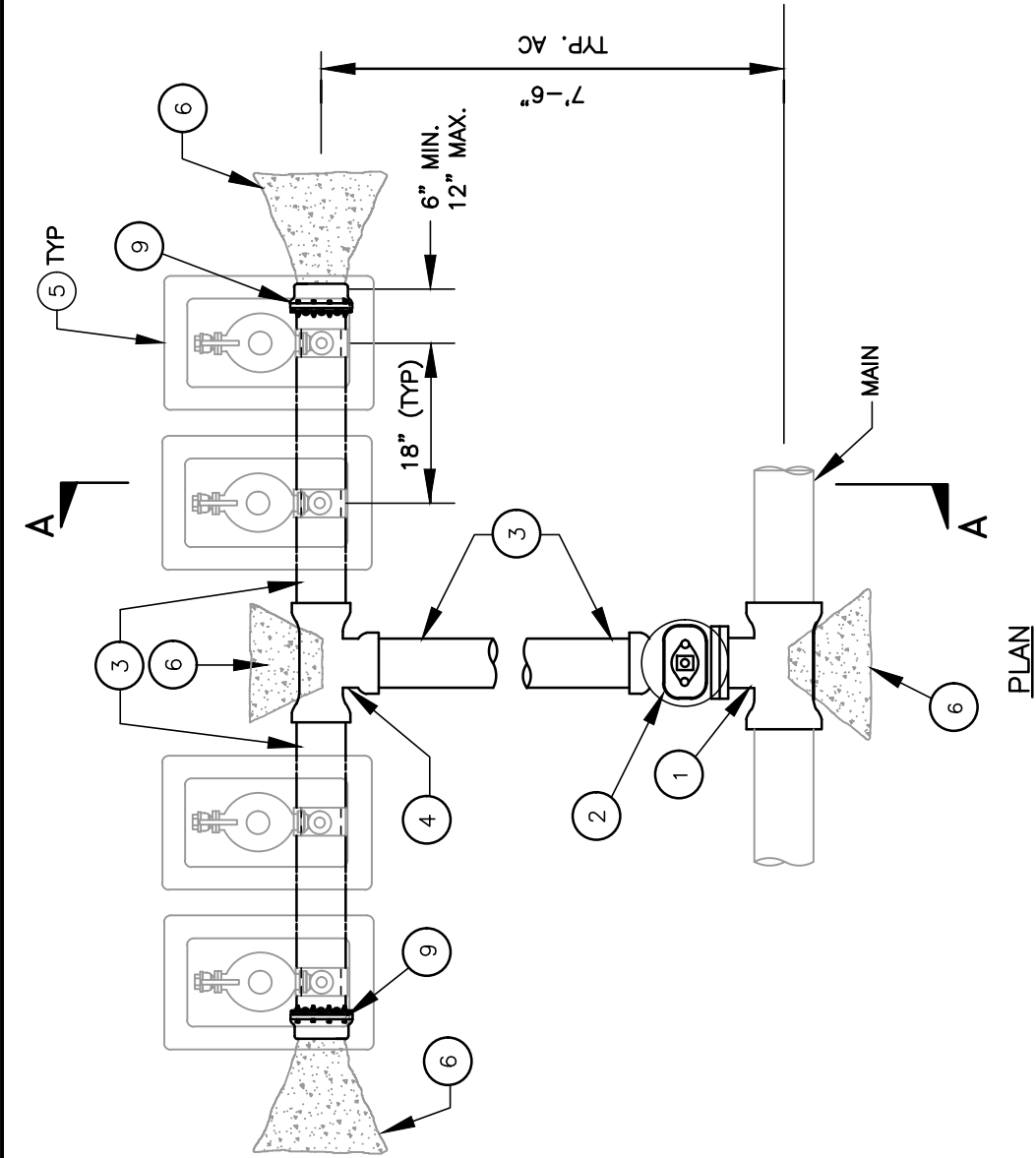
REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

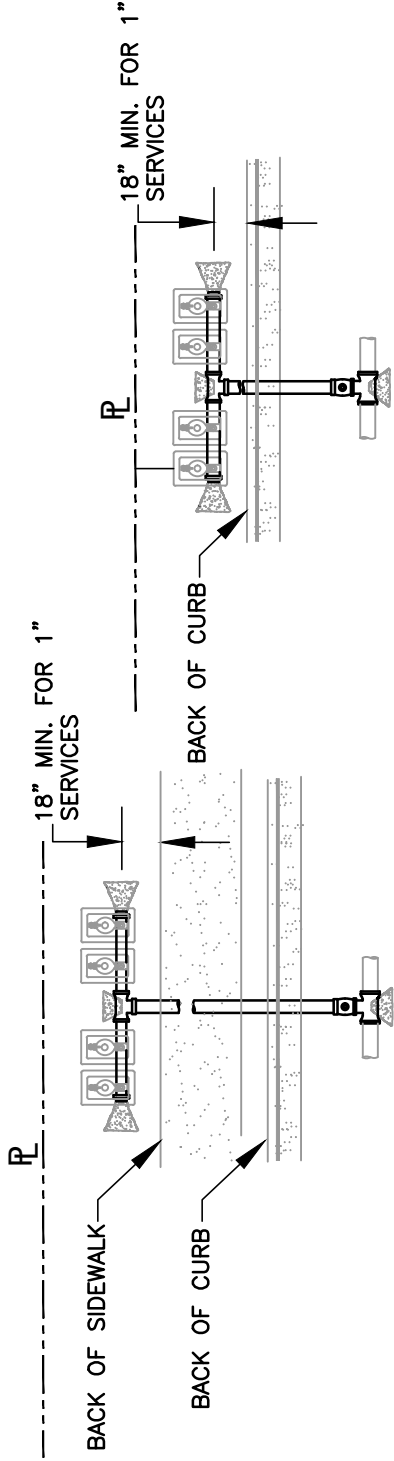


TCWD
STD.DWG.
W-5



ITEM	MATERIALS
1	MAIN SIZE X 4" D.I. TEE, M.J. X F.E. PER TCWD STD. W-22
2	4" RW GATE VALVE, F.E. X M.J. RESTRAINED
3	4" C-900 P.V.C. PIPE, CL 200.
4	4" X 4" D.I. TEE, MJ X MJ
5	3/4" OR 1" SERVICE PER TCWD STD. DWG. W-1 OR W-2.
6	THRUST BLOCK PER TCWD STD. DWG. W-19.
7	VALVE BOX PER TCWD STD. DWG. W-25.
8	VALVE STEM EXTENSION PER TCWD STD. DWG. W-25, WHEN APPLICABLE.
9	4" D.I. M.J. CAP WITH RETAINER GLAND.

SECTION A-A



MANIFOLD ADJACENT TO SIDEWALK

MANIFOLD ADJACENT TO CURB NO SIDEWALK

NOTES:

1. THIS ASSEMBLY SHALL NOT BE USED FOR FEWER THAN 4 OR MORE THAN 10 SERVICE CONNECTIONS.
2. SERVICE CONNECTIONS FOR FIRE SPRINKLER SYSTEMS SHALL NOT BE PERMITTED ON THE MANIFOLD.
3. IF REQUIRED, BACKFLOW PREVENTION SHALL BE INSTALLED PER TCWD STD. W-9 AND CERTIFIED PRIOR TO ACTIVATION OF WATER METER.

1-INCH SERVICE MANIFOLD FOR MULTI-METERS

NO.	REVISION		APPROVED BY ENGINEERING DEPARTMENT	
	DATE	APPROVED	DATE	
1	11/06/24	L.L.		

Lorrie Lausten

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

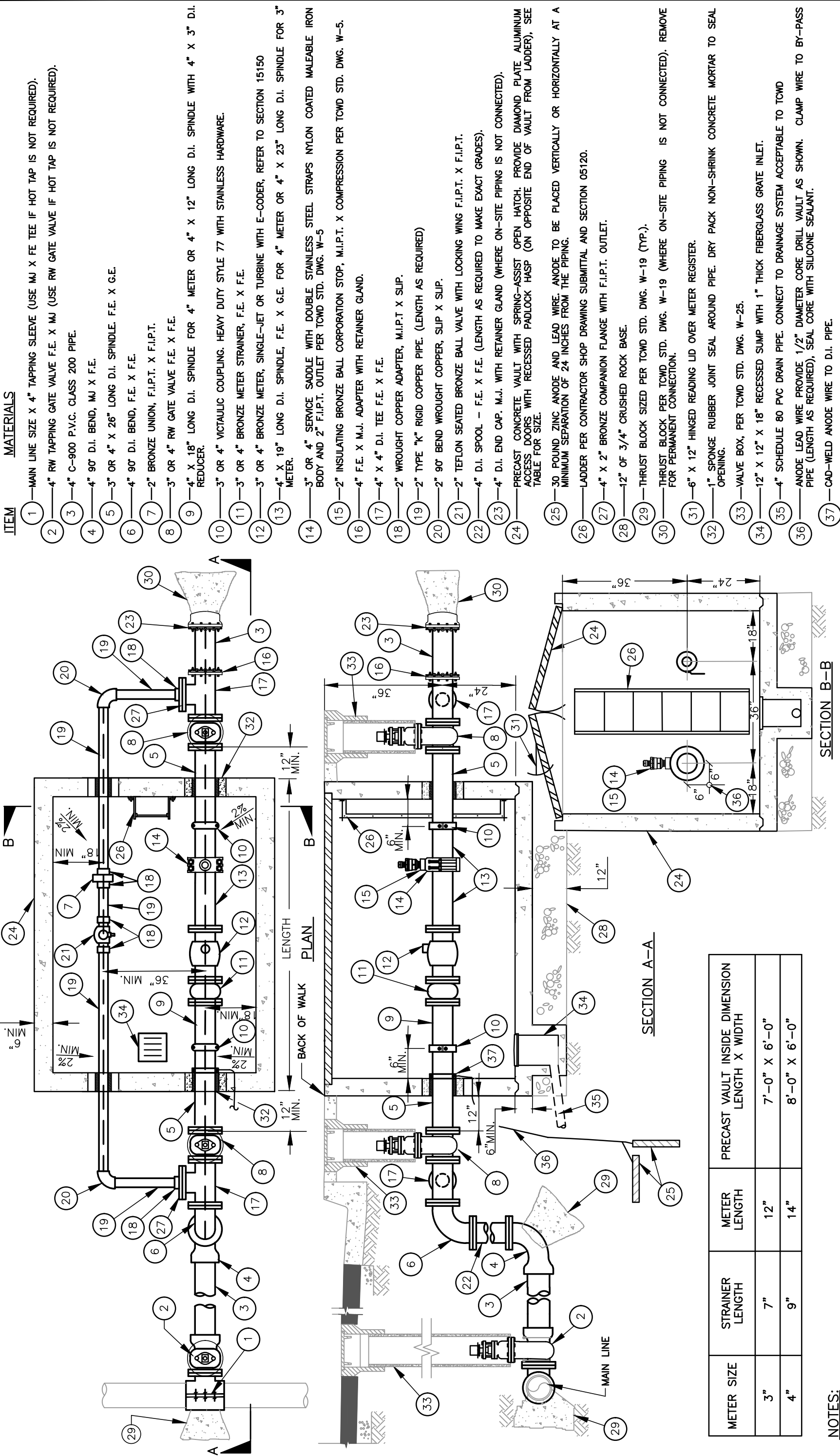
DATE



TCWD
STD.DWG.

W-6

SHEET 1 OF 1



NOTES:

1. ANODE LEAD WIRE SHALL BE CAD-WELDED TO THE D.I. PIPE, AND SHALL BE TESTED PER SECTION 16640.
2. EASEMENT NOTE: METER INSTALLATION IMPROVEMENTS BEYOND THE CITY / COUNTY RIGHT-OF-WAY REQUIRE AN EASEMENT AS DIRECTED BY TCWD.
3. RETAINING WALL: WHEN RETAINING WALL IS REQUIRED TO ACCOMMODATE GRADE VARIATIONS THE WALL SHALL BE CONSTRUCTED PER TCWD STD. W-26 AND SHOULD PROVIDE PROPER CLEARANCE FROM THE IMPROVEMENTS.

METER SIZE	STRAINER LENGTH	METER LENGTH	PRECAST VAULT INSIDE DIMENSION LENGTH X WIDTH
3"	7"	12"	7'-0" X 6'-0"
4"	9"	14"	8'-0" X 6'-0"

3-INCH OR 4-INCH METER ASSEMBLY

REVISION		APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-7	SHEET 1 OF 1
NO.	DATE	APPROVED	DATE		
1	11/06/24	L.L.			

APPROVED BY ENGINEERING DEPARTMENT

LORRIE LAUSTEN, P.E. 67027

DISTRICT ENGINEER

11/21/24

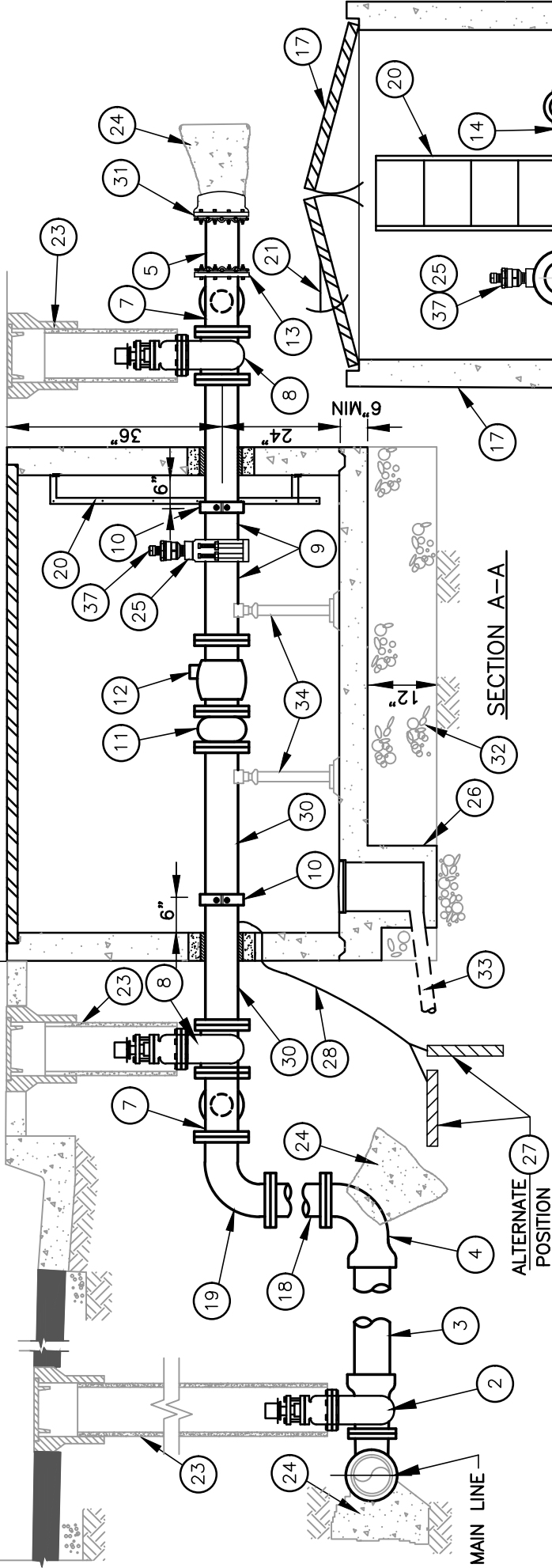
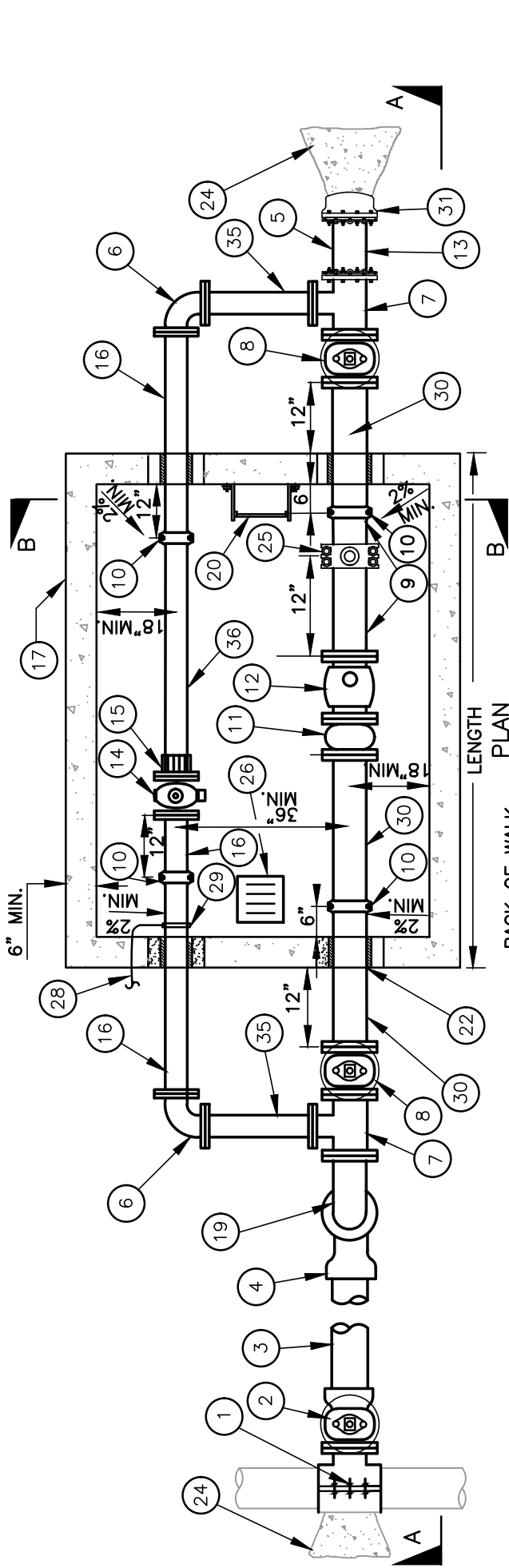
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ITEM

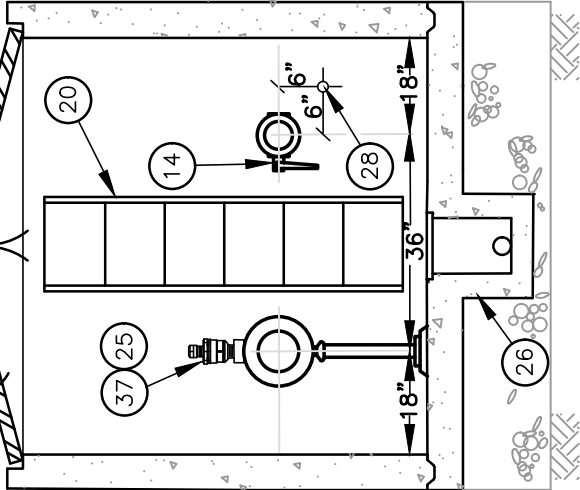
MATERIALS

- 1
- MAIN LINE SIZE X METER SIZE TAPPING SLEEVE (USE PUSH-ON X F.E. TEE. IF HOT TAP IS NOT REQUIRED). FULL SIZE HOT TAPS ARE NOT ALLOWED.
- 2
- RW TAPPING VALVE METER SIZE F.E. X P.O. (USE RW GATE VALVE IF HOT TAP IS NOT REQUIRED).
- 3
- METER SIZE C-900 P.V.C. CLASS 200 PIPE.
- 4
- METER SIZE 90° D.I. BEND P.O. X F.E.
- 5
- METER SIZE C-900 PVC, CLASS 200 PIPE 18-INCHES LONG.
- 6
- 4" 90° D.I. BEND F.E. X F.E.
- 7
- METER SIZE X 4" D.I. TEE F.E. X F.E.
- 8
- METER SIZE RW GATE VALVE F.E. X F.E.
- 9
- METER SIZE D.I. SPINDLE, F.E. X G.E. (33" LONG FOR 6"; 30" LONG FOR 8"; AND 19" LONG FOR 10").
- 10
- G.E. VICTALUC COUPLING, HEAVY DUTY STYLE 77 WITH STAINLESS STEEL HARDWARE.
- 11
- BRONZE METER STRAINER F.E. X F.E.
- 12
- BRONZE METER, SINGLE JET OR TURBINE WITH E-CODER. REFER TO METER SECTION 15150.
- 13
- METER SIZE F.E. X M.J. ADAPTER WITH RETAINER GLAND.
- 14
- 4" LEVER-OPERATED BUTTERFLY VALVE WITH LOCKING MECHANISM, F.E. X F.E.
- 15
- 4" FLANGED COUPLING ADAPTER (FE X PE).
- 16
- 4" D.I. SPINDLE, F.E. X G.E. (LENGTH AS REQUIRED).
- 17
- PRECAST CONCRETE VAULT WITH SPRING-ASSIST OPEN HATCH. PROVIDE DIAMOND PLATE ALUMINUM ACCESS DOORS WITH RECESSED PADLOCK, HASP (ON OPPOSITE END OF VAULT FROM LADDER), PER TCWD STD. SECTION 03462. SEE TABLE FOR SIZE.
- 18
- METER SIZE X D.I. SPOOL F.E. X F.E. (LENGTH AS REQUIRED TO MAKE EXACT GRADE).
- 19
- METER SIZE 90° D.I. BEND, F.E. X F.E.
- 20
- LADDER PER CONTRACTOR SHOP DRAWINGS SUBMITTAL AND SECTION 05120.
- 21
- 6" X 12" HINGED READING LID OVER METER REGISTER.
- 22
- 1" SPONGE RUBBER JOINT SEAL AROUND PIPE. DRY PACK NON-SHRINK CONCRETE MORTAR TO SEAL OPENING.
- 23
- VALVE BOX, PER TCWD STD. DWG. W-24.
- 24
- THRUST BLOCK PER TCWD STD. DWG. W-19. WHEN ONSITE PIPING IS NOT INSTALLED, REMOVE THRUST BLOCK WHEN ONSITE PIPING IS INSTALLED.
- 25
- 2" SERVICE SADDLE WITH DOUBLE STAINLESS STEEL STRAPS NYLON COATED COATED MALLEABLE IRON BODY AND 2" F.I.P.T. OUTLET, PER TCWD STD. DWG. W-5.
- 26
- 12" X 12" X 18" RECESSED SUMP WITH 1" THICK FIBERGLASS GRATE INLET.
- 27
- 30 POUND ZINC ANODE AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24 INCHES FROM THE PIPING.
- 28
- ANODE LEAD WIRE PROVIDE 1/2" DIAMETER CORE DRILL VAULT AS SHOWN. CLAMP WIRE TO BY-PASS PIPE (LENGTH AS REQUIRED), SEAL CORE WITH SILICONE SEALANT.
- 29
- CAD-WELD ANODE WIRE TO D.I.P. PER TCWD STD. SPEC. SECTION 05120, REFER TO CAD-WELD PROCEDURE.
- 30
- METER SIZE X D.I. SPINDLE, F.E. X G.E.
- 31
- METER SIZED D.I. END CAP, M.J. WITH RETAINER GLAND (WHERE ON-SITE PIPING IS NOT CONNECTED).
- 32
- 12" OF 3/4" CRUSHED ROCK BASE PER SECTION 02220.
- 33
- 4" SCHEDULE 80 PVC DRAIN PIPE. CONNECT TO DRAINAGE SYSTEM ACCEPTABLE TO TCWD.
- 34
- ADJUSTABLE PIPE SUPPORT FOR ASSEMBLIES 8" DIAMETER AND LARGER PER TCWD STD. DWG. W-18.
- 35
- 4" D.I. SPOOL F.E. X F.E., LENGTH 21 1/2" FOR 6" DIA., 20 1/2" FOR 8" DIA. AND 18 1/2" FOR 10" DIA.
- 36
- 4" D.I. PIPE P.E. X G.E., LENGTH AS REQUIRED.
- 37
- 2" INSULATING BRONZE BALL CORPORATION STOP, M.I.P.T. X COMPRESSION PER TCWD STD. DWG. W-5.



METER SIZE	STRAINER LENGTH	METER LENGTH	PRECAST VAULT INSIDE DIMENSION LENGTH X WIDTH
6"	9"	18"	8'-0" X 6'-0"
8"	10"	20"	8'-0" X 6'-0"
10"	15"	26"	8'-0" X 6'-0"

SECTION B-B



NOTES:

1.
- ANODE LEAD WIRE SHALL BE CAD-WELDED TO THE BY-PASS PIPE, AND SHALL BE TESTED PER TCWD REQUIREMENTS.
2.
- EASEMENT NOTE: METER INSTALLATION IMPROVEMENTS BEYOND THE CITY / COUNTY RIGHT-OF-WAY REQUIRE AN EASEMENT AS DIRECTED BY TCWD.
3.
- RETAINING WALL: WHEN RETAINING WALL IS REQUIRED TO ACCOMMODATE GRADE VARIATIONS THE WALL SHALL BE CONSTRUCTED PER TCWD STD. W-25 AND SHOULD PROVIDE PROPER CLEARANCE FROM THE IMPROVEMENTS.

6-INCH, 8-INCH, OR 10-INCH METER ASSEMBLY

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

Donie Jacob

LORRIE LAUSTEN, P.E. 67027

11/21/24

DATE

DISTRICT ENGINEER



TCWD
STD.DWG.

W-8

SHEET 1 OF 1

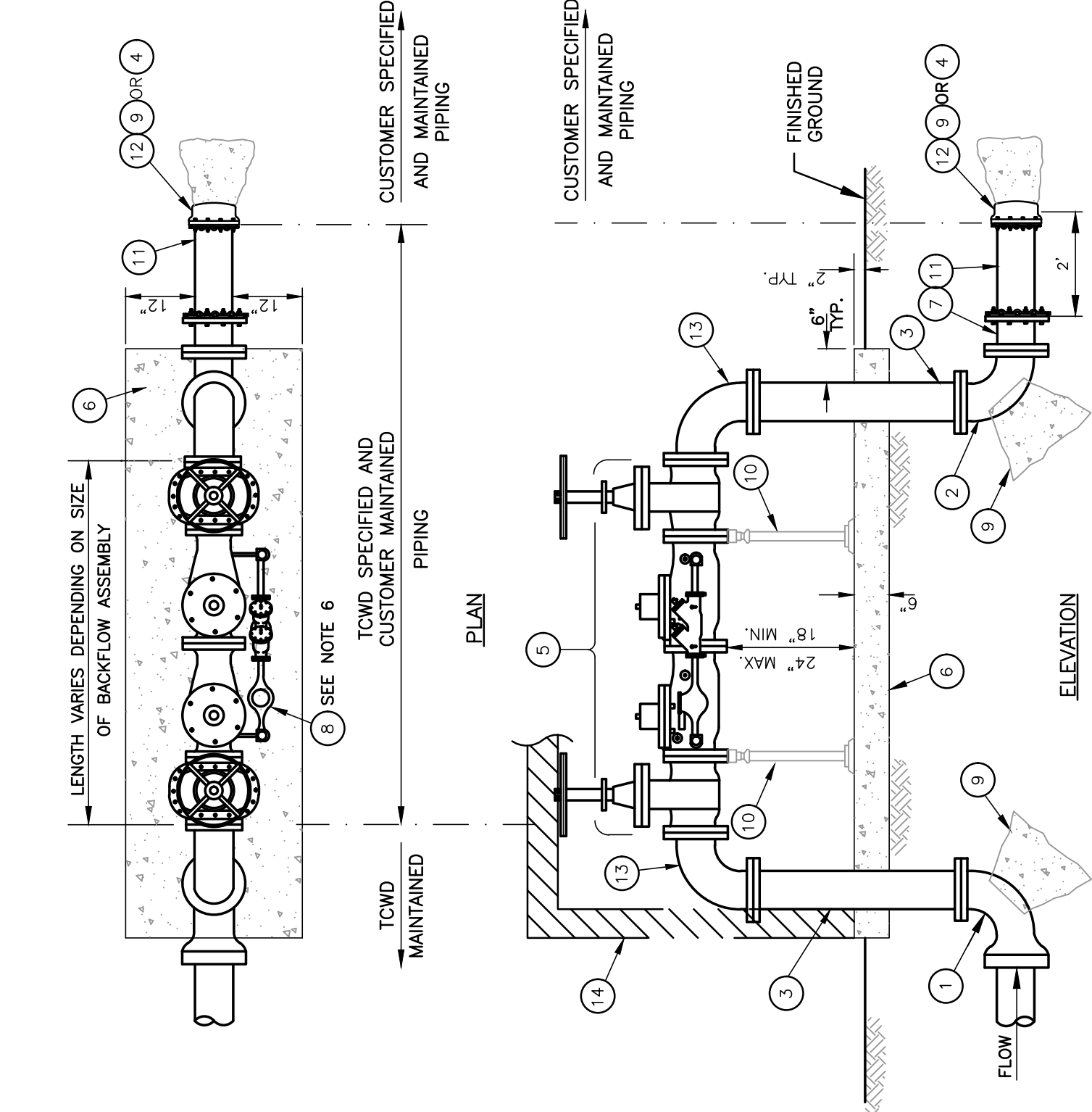
1. BACKFLOW PREVENTORS ARE TO BE INSTALLED AS CLOSE TO THE METER AS POSSIBLE AND LOCATION TO BE DETERMINED BY TCWD INSPECTOR.
2. AT NO POINT SHALL ANY PART OF THE BACKFLOW ASSEMBLY DEVICE BE CLOSER THAN 36" AWAY FROM ANY STRUCTURE, FACE OF CURB, BACK OF SIDE WALK, OR LANDSCAPING.
3. BACKFLOW ASSEMBLY AND TCWD PIPING SHALL BE WITHIN A DEDICATED TCWD EASEMENT OR PUBLIC RIGHT-OF-WAY.
4. PLACE BRASS PLUGS IN ALL TEST VALVE OUTLETS.
5. SIZE OF DEVICE MUST MATCH SIZE OF WATER METER.
6. BACKFLOW SHALL BE TESTED AND CERTIFIED BEFORE WATER WILL BE TURNED ON BY TCWD.
7. PROVIDE AN USC APPROVED BACKFLOW PREVENTION ASSEMBLY.
8. TCWD MAINTENANCE RESPONSIBILITY STOPS AT THE METER. THE CUSTOMER IS RESPONSIBLE TO TEST AND MAINTAIN THE BACKFLOW PREVENTION ASSEMBLY. CERTIFICATION SHALL BE DELIVERED TO TCWD.
9. BACKFLOW CERTIFICATION TESTING IS REQUIRED ANNUALLY AT A MINIMUM BUT MAY BE MORE FREQUENT AS DEEMED NECESSARY BY TCWD. CERTIFICATION TESTING IS REQUIRED IMMEDIATELY AFTER AN ASSEMBLY IS RELOCATED, REPLACED, AND REPAIRED.
10. NO OUTLETS, TEES, OR CONNECTIONS SHALL BE ALLOWED BETWEEN THE METER AND THE BACKFLOW PREVENTION ASSEMBLY.

11. BACKFLOW PREVENTION ASSEMBLIES SHALL MAINTAIN A VERTICAL CLEARANCE FROM THE LOWEST POINT OF 12" (MIN.) TO 24" (MAX.) ABOVE FINISHED GRADE, WITH SIDE AND TOP CLEARANCES OF 12" (MIN.) FOR ANY OBSTRUCTIONS IN ALL DIRECTIONS.
12. PARALLEL INSTALLATIONS OF THE SAME TYPE OF BACKFLOW PREVENTION ASSEMBLIES ARE RECOMMENDED FOR ALL FACILITIES REQUIRING UNINTERRUPTED WATER SUPPLY, SUCH AS, HOSPITALS AND SCHOOLS.
13. THEFT PREVENTION DEVICES ARE RECOMMENDED FOR BRASS ASSEMBLIES ALLOWING ADEQUATE ACCESS TO THE ASSEMBLY FOR TESTING, MAINTENANCE, AND PROPER DRAINAGE

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

2 INCH AND SMALLER REDUCED PRESSURE BACKFLOW

	TCWD STD.DWG. W-9	SHEET 1 OF 1



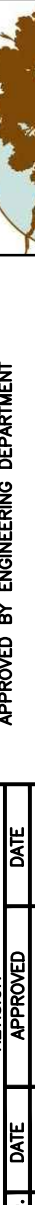
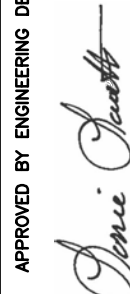
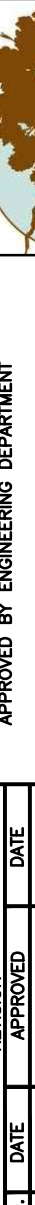
ITEM	MATERIALS
①	D.I. 90° BEND F.E. X M.J.
②	D.I. 90° BEND F.E. X F.E.
③	D.I. SPOOL F.E. X F.E. LENGTH AS REQUIRED.
④	TRANSITION COUPLING. (BY OTHERS, FOR ON-SITE CONNECTION WHEN ON-SITE PIPING EXISTS.)
⑤	TCWD APPROVED DOUBLE CHECK VALVE BACKFLOW PREVENTION ASSEMBLY WITH RISING STEM RESILIENT WEDGE GATE VALVES, VALVES SHALL BE PROVIDED AS AN INTEGRAL PART OF BACKFLOW ASSEMBLY.
⑥	6" THICK P.C.C. SLAB, REINFORCE WITH W.W.F. 1.6 X 1.6
⑦	F.E. X M.J. ADAPTER WITH RETAINER GLAND.

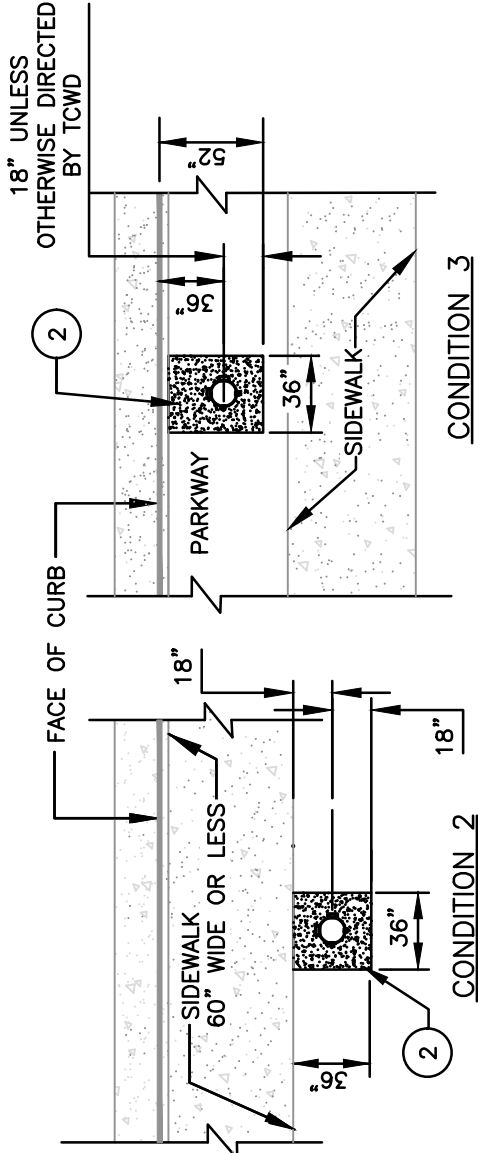
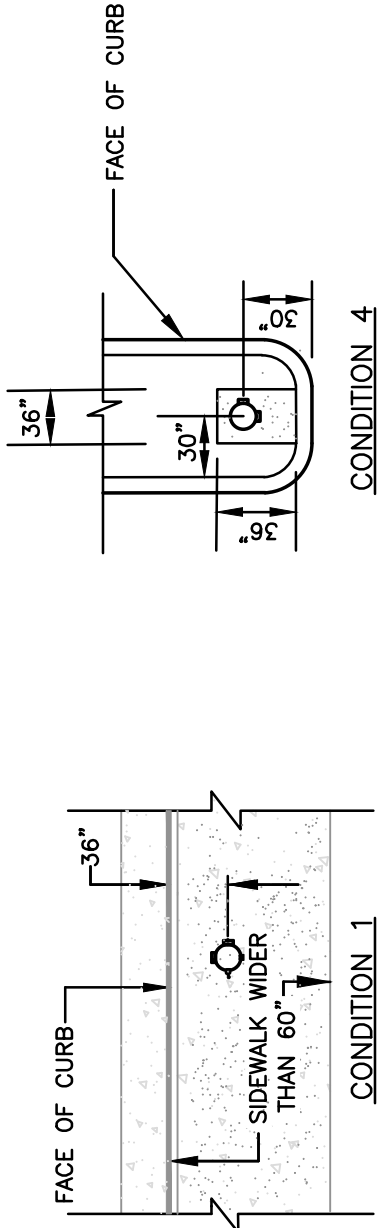
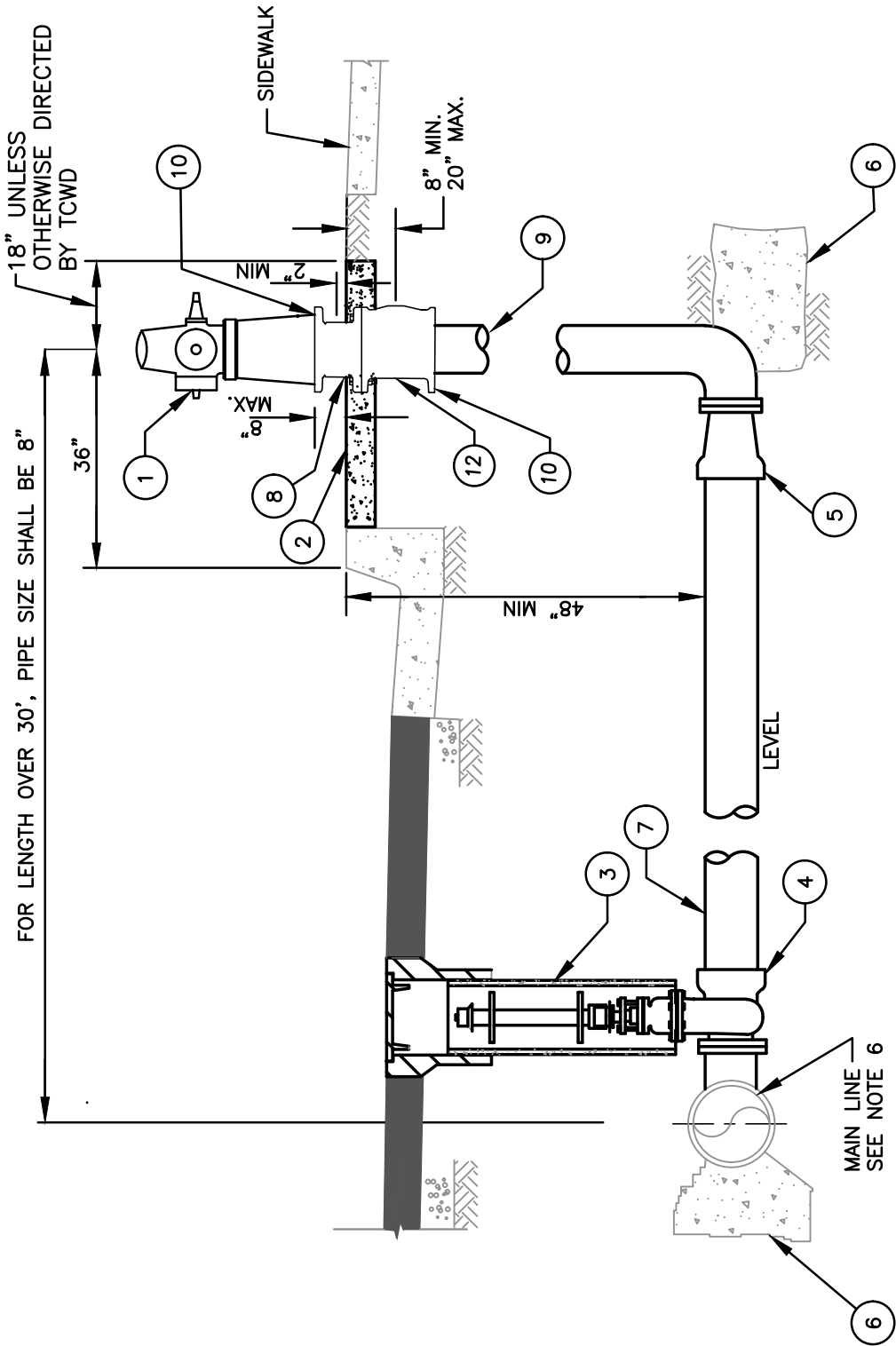
ITEM	MATERIALS
⑧	FACTORY INSTALLED BY-PASS METER ASSEMBLY CONSISTING OF APPROVED POSITIVE DISPLACEMENT METER, DOUBLE CHECK VALVE AND ASSOCIATED PIPING. BY-PASS METER TO BE SUPPLIED BY TCWD.
⑨	THRUST BLOCK PER TCWD STD. DWG. W-19.
⑩	ADJUSTABLE PIPE SUPPORT FOR ASSEMBLIES 8" DIAMETER AND LARGER PER TCWD STD. DWG. W-18.
⑪	C-900 P.V.C. PIPE SECTION, CL. 200, 24" LONG.
⑫	END CAP. M.J. WITH RETAINER GLAND.
⑬	D.I. 90° BEND F.E. X F.E. (FOR 3" DOUBLE CHECK BACKFLOW ASSEMBLY USE 4" X 3" D.I. 90° REDUCING BEND F.E. X F.E.)
⑭	INSTALL PROTECTIVE CAGE OVER BACKFLOW PER SECTION 15112.

NOTES:

1. PROVIDE A FOUNDATION FOR CROSS-CONNECTION AND HYDRAULIC RESEARCH, USC, AND SWRCB, CROSS CONNECTION CONTROL POLICY HANDBOOK APPROVED BACKFLOW PREVENTION ASSEMBLY.
2. TCWD MAINTENANCE RESPONSIBILITY STOPS AT THE CONNECTION TO THE BACKFLOW. THE CUSTOMER IS RESPONSIBLE TO TEST AND MAINTAIN THE BACKFLOW PREVENTION ASSEMBLY. CERTIFICATION SHALL BE DELIVERED TO TCWD.
3. BACKFLOW CERTIFICATION TESTING IS REQUIRED ANNUALLY AT A MINIMUM BUT MAY BE MORE FREQUENT AS DEEMED NECESSARY BY TCWD. CERTIFICATION TESTING IS REQUIRED IMMEDIATELY AFTER AN ASSEMBLY IS RELOCATED, REPLACED, AND REPAIRED AND BEFORE WATER IS TURNED ON.
4. BACKFLOW PREVENTION ASSEMBLY SIZE SHALL MATCH THE DIAMETER OF THE METER
5. BACKFLOW PREVENTION ASSEMBLY INSTALLATIONS INCLUDING ALL APPURTENANCES FOR THE SUPPLY OF DOMESTIC WATER SHALL COMPLY WITH THE REQUIREMENTS OF THE CALIFORNIA LEAD-FREE ACT AB1953.
6. BACKFLOW PREVENTION ASSEMBLY SHALL BE LOCATED AS CLOSE AS PRACTICAL TO THE WATER METER BOX BUT NOT FURTHER THAN 12" UNLESS A VARIANCE IS OBTAINED FROM TCWD PRIOR TO INSTALLATION.
7. NO OUTLETS, TEES OR CONNECTIONS SHALL BE ALLOWED BETWEEN THE METER AND THE BACKFLOW PREVENTION ASSEMBLY.
8. BACKFLOW PREVENTION ASSEMBLIES SHALL MAINTAIN A VERTICAL CLEARANCE FROM THE LOWEST POINT OF 18" (MIN.) TO 24" (MAX.) ABOVE FINISHED GRADE, WITH SIDE AND TOP CLEARANCES OF 18" (MIN.) FOR ANY OBSTRUCTIONS IN ALL DIRECTIONS.
9. PARALLEL INSTALLATIONS OF THE SAME TYPE OF BACKFLOW PREVENTION ASSEMBLIES ARE RECOMMENDED FOR ALL FACILITIES REQUIRING UNINTERRUPTED WATER SUPPLY, SUCH AS, HOSPITALS AND SCHOOLS.
10. BACKFLOW SHALL BE TESTED AND CERTIFIED BEFORE WATER WILL BE TURNED ON BY TCWD.

3 INCH AND LARGER DOUBLE CHECK BACKFLOW ASSEMBLY

REVISION				APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-10
NO.	DATE	APPROVED	DATE			
1	11/06/24	L.L.				TCWD STD.DWG. W-10
				APPROVED BY ENGINEERING DEPARTMENT		SHEET 1 OF 1
				LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER		
				11/21/24		SHEET 1 OF 1
				DATE		



MATERIALS

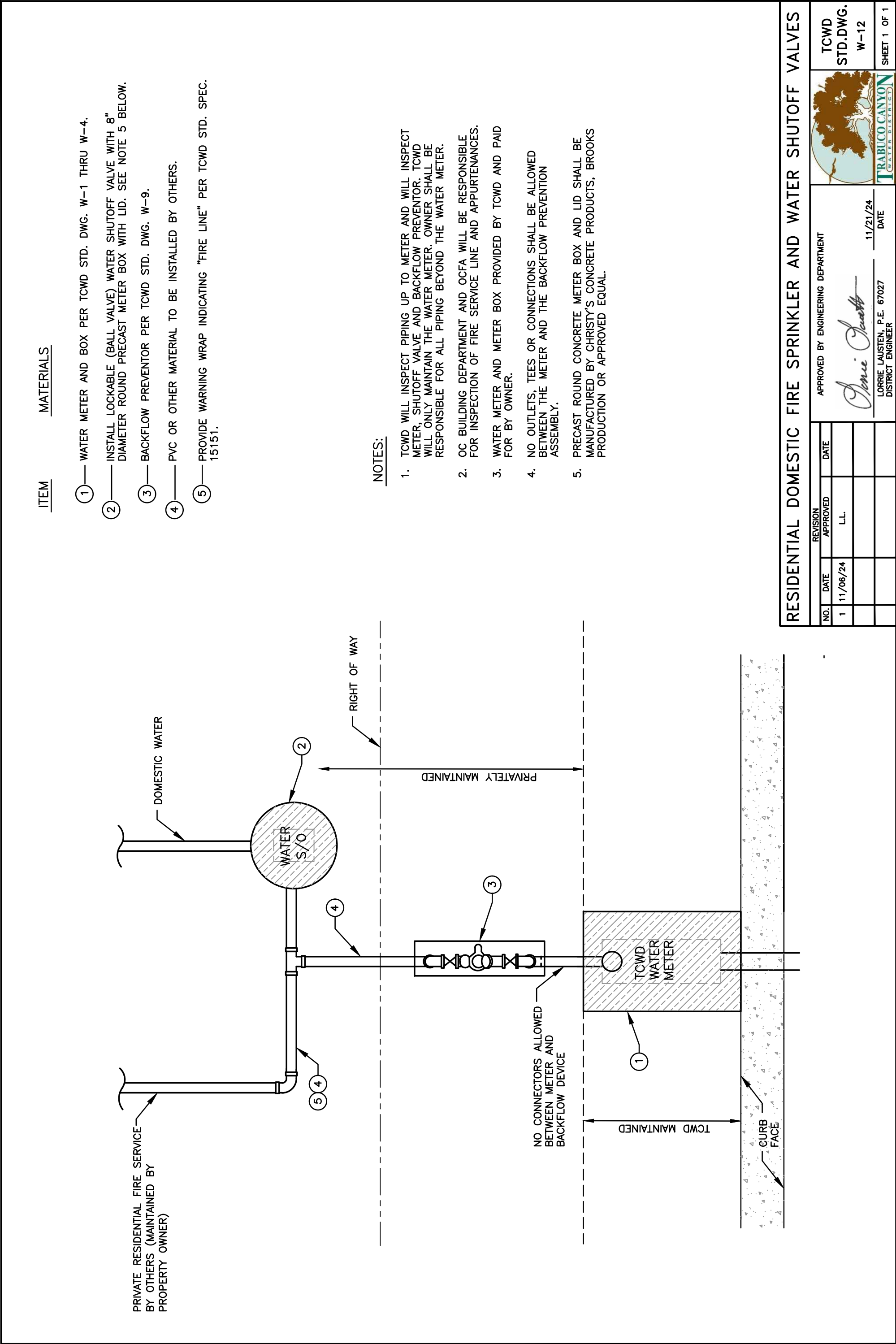
1	RESIDENTIAL HYDRANT WITH (1) 4" & (1) 2 1/2" FIRE HOSE OUTLETS. NON-RESIDENTIAL HYDRANT WITH (2) 4" AND (1) 2 1/2" FIRE HOSE OUTLETS.
2	CONSTRUCT 48"x36"x6" THICK OR 36"x36"x6" THICK CONCRETE PAD REINFORCED WITH W.W.F. 1.6x1.6. SEE HYDRANT LOCATION PLANS BELOW FOR APPLICABLE CONDITION.
3	VALVE BOX AND EXTENSION PER TCWD STD. DWG. W-25.
4	6" OR 8" GATE VALVE F.E. X P.O.
5	8"x6" REDUCER ON LONG SIDE OF STREET P.O. X F.E. WITH FLANGE BURY. (WHERE REQUIRED)
6	THRUST BLOCK PER TCWD STD. DWG. W-19.
7	C-900 P.V.C. PIPE, OR D.I.P. (WHERE REQUIRED)
8	DOUBLE GROOVE BREAK OFF RISER.
9	FIRE HYDRANT BURY. (LENGTH DETERMINED IN FIELD)
10	STAINLESS STEEL F.H. BREAK-AWAY BOLTS AT HYDRANT FLANGE.
11	VALVE STEM EXTENSION PER TCWD STD. DWG. W-25. (WHERE REQUIRED)
12	BREAK OFF CHECK VALVE. (CLOW VALVE, MODEL LBI 400A)

NOTES:

- SEE TCWD STD. SPEC. SECTION 15139 FOR APPROVED HYDRANT TYPES AND ADDITIONAL REQUIREMENTS.
- HYDRANTS TO BE PAINTED ACCORDING TO PAINT SCHEDULE PER TCWD STD. SPEC. SECTION 09900.
- HYDRANT FLANGE GASKET SHALL BE "FULL FACE" WITH RUBBER COMPOSITION, 1/8" THICK.
- LOCATE 4" OUTLET PERPENDICULAR TO THE CURB LINE.
- COMMERCIAL PROPERTY FIRE HYDRANT ORIENTATION OF OUTLETS SHALL BE DETERMINED BY DISTRICT REPRESENTATIVE.
- MAIN LINE TEE SHALL BE FLANGED.
- AT NO POINT SHALL ANY PART OF THE FIRE HYDRANT BE CLOSER THAN 36" AWAY FROM ANY STRUCTURE OR LANDSCAPING.
- ALL BURIED BOLTS SHALL BE TYPE 316 STAINLESS STEEL OR APPROVED EQUAL.

FIRE HYDRANT

REVISION				APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-11	SHEET 1 OF 1
NO.	DATE	APPROVED	DATE				
1	11/06/24	LL				TCWD STD.DWG. W-11	SHEET 1 OF 1



ITEM MATERIALS

- ①— WATER METER AND BOX PER TCWD STD. DWG. W-1 THRU W-4.
- ②— INSTALL LOCKABLE (BALL VALVE) WATER SHUTOFF VALVE WITH 8" DIAMETER ROUND PRECAST METER BOX WITH LID. SEE NOTE 5 BELOW.
- ③— BACKFLOW PREVENTOR PER TCWD STD. DWG. W-9.
- ④— PVC OR OTHER MATERIAL TO BE INSTALLED BY OTHERS.
- ⑤— PROVIDE WARNING WRAP INDICATING "FIRE LINE" PER TCWD STD. SPEC. 15151.

NOTES:

- 1. TCWD WILL INSPECT PIPING UP TO METER AND WILL INSPECT METER, SHUTOFF VALVE AND BACKFLOW PREVENTOR. TCWD WILL ONLY MAINTAIN THE WATER METER. OWNER SHALL BE RESPONSIBLE FOR ALL PIPING BEYOND THE WATER METER.
- 2. OC BUILDING DEPARTMENT AND OCFA WILL BE RESPONSIBLE FOR INSPECTION OF FIRE SERVICE LINE AND APPURTENANCES.
- 3. WATER METER AND METER BOX PROVIDED BY TCWD AND PAID FOR BY OWNER.
- 4. NO OUTLETS, TEES OR CONNECTIONS SHALL BE ALLOWED BETWEEN THE METER AND THE BACKFLOW PREVENTION ASSEMBLY.
- 5. PRECAST ROUND CONCRETE METER BOX AND LID SHALL BE MANUFACTURED BY CHRISTY'S CONCRETE PRODUCTS, BROOKS PRODUCTION OR APPROVED EQUAL.

RESIDENTIAL DOMESTIC FIRE SPRINKLER AND WATER SHUTOFF VALVES

REVISION			APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. W-12	SHEET 1 OF 1
NO.	DATE	APPROVED				
1	11/06/24	L.L.			TCWD STD.DWG. W-12	SHEET 1 OF 1
			LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER			



- ITEM
- MATERIALS
- 1

1" SERVICE CONNECTION PER TCWD STD. DWG. W-2.
- 2

1" TYPE "K" COPPER TUBING PER TCWD STD. DWG. W-2.
- 3

POLYMER CONCRETE METER BOX WITH READING LID PER TCWD STD. DWG. W-2.
- 4

SAWCUT OR CORE DRILL METER BOX FOR 1" PIPE.
- 5

3/8" DIA X 4" LONG STAINLESS STEEL J ANCHOR BOLT CAST IN SLAB (3 EACH AT 120" APART WITH STAINLESS STEEL NUTS AND WASHERS) INSTALL WITH RUBBER GROMMET UNDER ANCHOR CLIPS TO PROVIDE 1/4" GAP.
- 6

LOCK HASP FOR #5 LOCK, SEE LID DETAIL HEREON.
- 7

3/8" TYPE "K" SOFT COPPER SPIGOT BEND TO 120" FOR DOWNWARD OPENING.W/ CAP.
- 8

5/16" DIA. U-BOLT ASSEMBLY SIZED FOR 1" DIA. PIPE, STAINLESS STEEL.
- 9

3/4" CRUSHED ROCK PLACE TO DEPTH 6" BELOW CONCRETE METER BOX.
- 10

ZINC ANODE AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MIN. SEPARATION OF 24" FROM THE COPPER PIPE, SEE TCWD W-2 FOR SIZE OF ZINC ANODE.
- 11

1/2" X 3/8" COPPER TUBE FLARE NUT X M.I.P.T. ADAPTER
- 12

LINEAR LOW DENSITY POLYETHYLENE SAMPLE STATION COVER 12" DIAMETER X 36" HIGH. SEE NOTE 3 AND 4.
- 13

1/2" STAINLESS STEEL TEFLON SEATED BALL VALVE, F.I.P.T. X F.I.P.T. (ORIENT VALVE HANDLE TOWARD FRONT OF SAMPLE STATION.)
- 14

1" X 1/2" BRASS BUSHING, M.I.P.T. X F.I.P.T.
- 15

1/2" M.I.P.T. X FEMALE FLARE FITTING.
- 16

4" THICK CLASS "B" CONCRETE.
- 17

3 ANCHOR CLIPS WITH 1/2" HOLES AT 120" SPACING.
- 18

3/4" GRAVEL, 12" DEEP IN BOTTOM OF CAN.
- 19

1" PVC SCH. 80 COUPLING, F.I.P.T. X F.I.P.T.
- 20

1" METER NUT BY F.I.P.T. ADAPTER.
- 21

1" RED BRASS NIPPLE, T.B.E., 6" LONG.
- 22

1" BRASS 90° BEND F.I.P.T. X F.I.P.T.
- 23

1" RED BRASS NIPPLE, T.B.E.
- 24

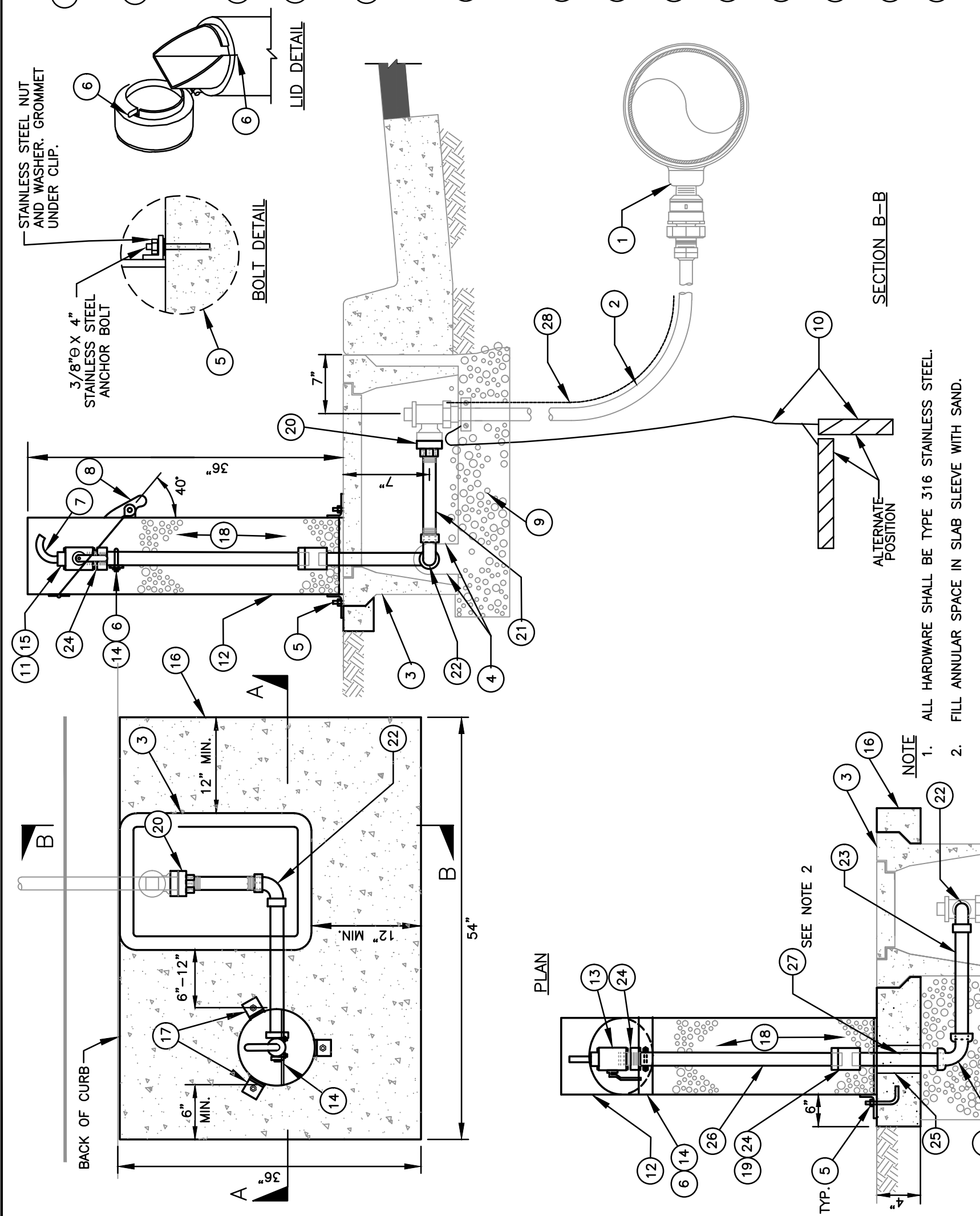
1/2" SWEAT X M.I.P.T. ADAPTER.
- 25

2" SCHEDULE 80 PVC SLEEVE.
- 26

1/2" TYPE "K" RIGID COPPER PIPE.
- 27

1" RED BRASS NIPPLE, TBE, 10" LONG.
- 28

IDENTIFICATION TAPE PER TCWD STD. SPEC. SECTION 15151. TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.



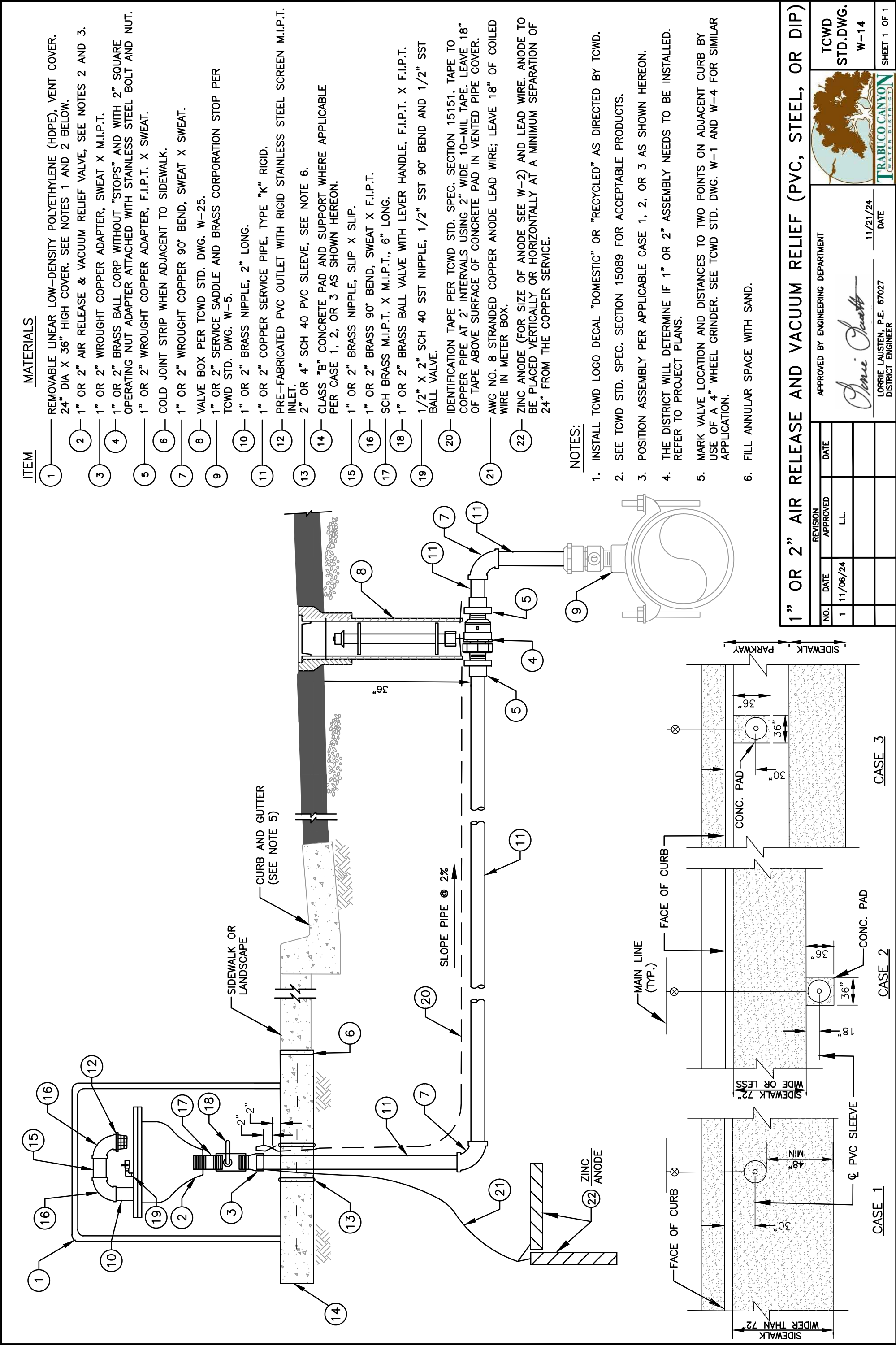
WATER SAMPLE STATION

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	LL	



TCWD
STD.DWG.
W-13
SHEET 1 OF 1

APPROVED BY ENGINEERING DEPARTMENT
Donie Jacob
11/21/24
DATE
LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

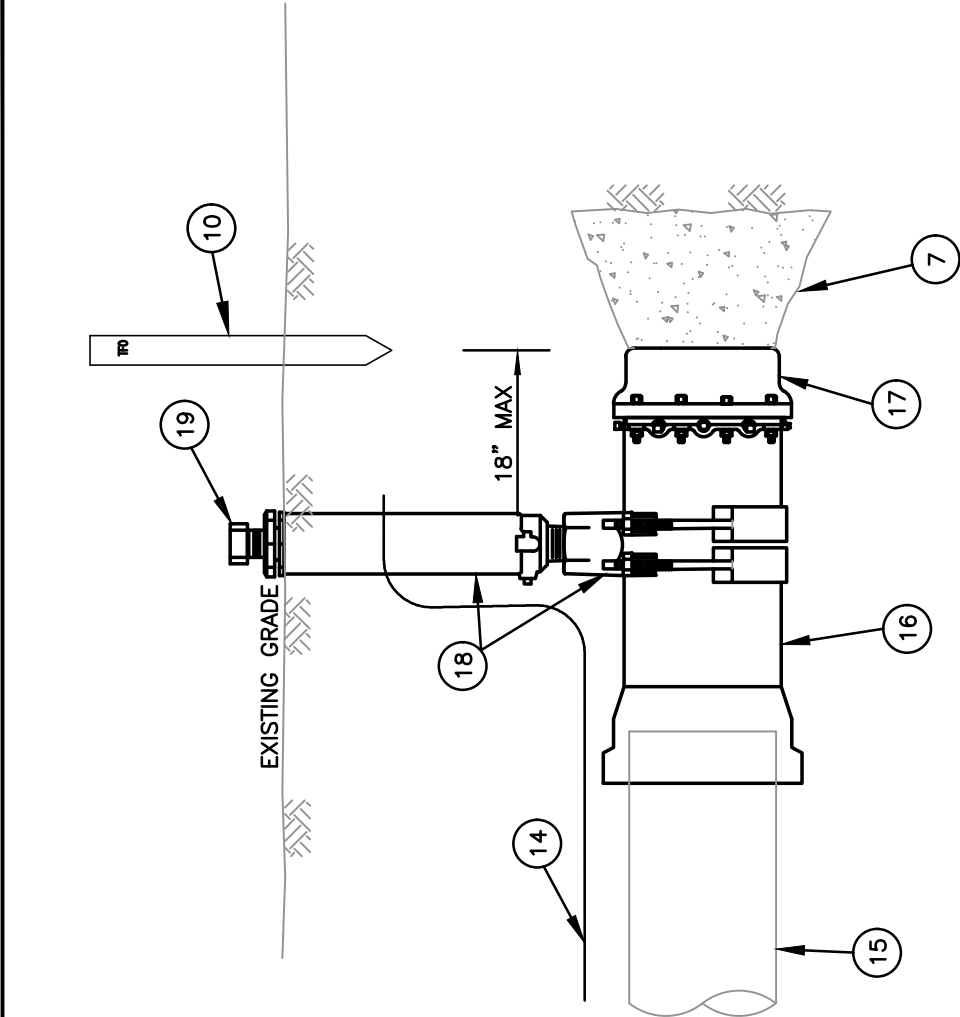


ITEM MATERIALS

MAIN SIZE	
4"	-
18"	-
- 1 VALVE BOX AND VALVE STEM EXTENSION PER TCWD STD. DWG. W-25.
 - 2 NOT USED.
 - 3 GATE VALVE, F.E. X P.O. (SIZE PER PLAN)
 - 4 C-900 DR 14 (SIZE PER PLAN) P.V.C. PIPE (SEE 9 ALSO).
 - 5 D.I. 90° BEND F.E. X F.E.
 - 6 D.I.P. (SIZE ACCORDING TO CHART) F.E. X F.E. SPOOL.
THRUST BLOCK PER TCWD STD. DWG. W-19.
 - 8 2" STAINLESS STEEL CLOSE NIPPLE, M.I.P.T., T.B.E.
 - 9 D.I. CONCENTRIC REDUCER, P.O. X F.E. (FOR EXISTING PIPE
CONNECTION USE F.E. X F.E. REDUCER AND A SLIP ON WELD FLANGE)
 - 10 UTILITY MARKER PER TCWD STD. DWG. W-27. INDICATING LOCATION OF
BURIED ASSEMBLY LABELED "TFO". LOCATED WITHIN 12" OF RISER.
 - 11 2" STAINLESS STEEL BALL VALVE WITH LEVER HANDLE, F.I.P.T. X F.I.P.T.
 - 12 2" THREADED STAINLESS STEEL PLUG.
 - 13 D.I. BLIND FLANGE (SIZE PER PLAN) TAPPED WITH 2" OUTLET F.I.P.T.
 - 14 IDENTIFICATION TAPE PER TCWD STD. SPEC. SECTION 15151. TAPE TO
PIPE AT 5' INTERVALS USING 2" WIDE 10-MIL TAPE.

1. WHERE MAIN LINE PIPE MATERIAL (4) IS STEEL, USE STEEL FITTINGS FOR (5) (6) (9) AND (17) IS PERMITTED.

2. TEMPORARY FLUSH-OUT ASSEMBLY REQUIRED AT ALL DEAD END LINES.
3. FOR FILLING OF NEW MAIN LINES, USE BACKFLOW DEVICE (CERTIFIED ANNUALLY). BACKFLOW DEVICE MUST BE DISINFECTED PRIOR TO USE AND PLACE 18" MIN. ABOVE FINISHED SURFACE.



TEMPORARY FLUSH OUT ASSEMBLY FOR 4-INCH, 6-INCH, 8-INCH, OR 12-INCH

ITEM

- 15—C-900 P.V.C. DR 14 (SIZE PER PLAN) PIPE.
- 16—P.V.C. PIPE DR 14 PIPE (SIZE PER PLAN). SHORT PIECE (18" TO 24" LONG) WITH BELL END.
- 17—M.J. END CAP. (SIZE PER PLAN)
- 18—2" SERVICE SADDLE AND BRONZE CORP STOP PER TCWD STD. DWG. W-5.
- 19—2" BRONZE CAP, F.I.P.T.

NOTES:

1. TEMPORARY FLUSH-OUT ASSEMBLY REQUIRED AT ALL DEAD END LINES.
2. FOR FILLING OF NEW MAIN LINES, USE BACKFLOW DEVICE (CERTIFIED ANNUALLY). BACKFLOW DEVICE MUST BE DISINFECTED PRIOR TO USE AND PLACED 18" MIN. ABOVE FINISHED SURFACE.

TEMPORARY FLUSH OUT ASSEMBLY FOR 2-INCH, 4-INCH, 6-INCH, 8-INCH, OR 12-INCH

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

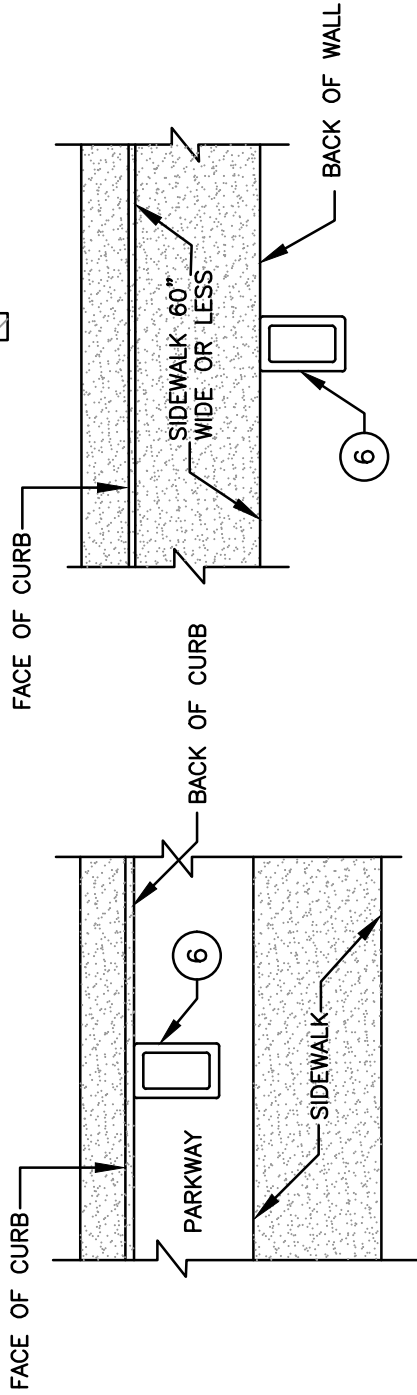
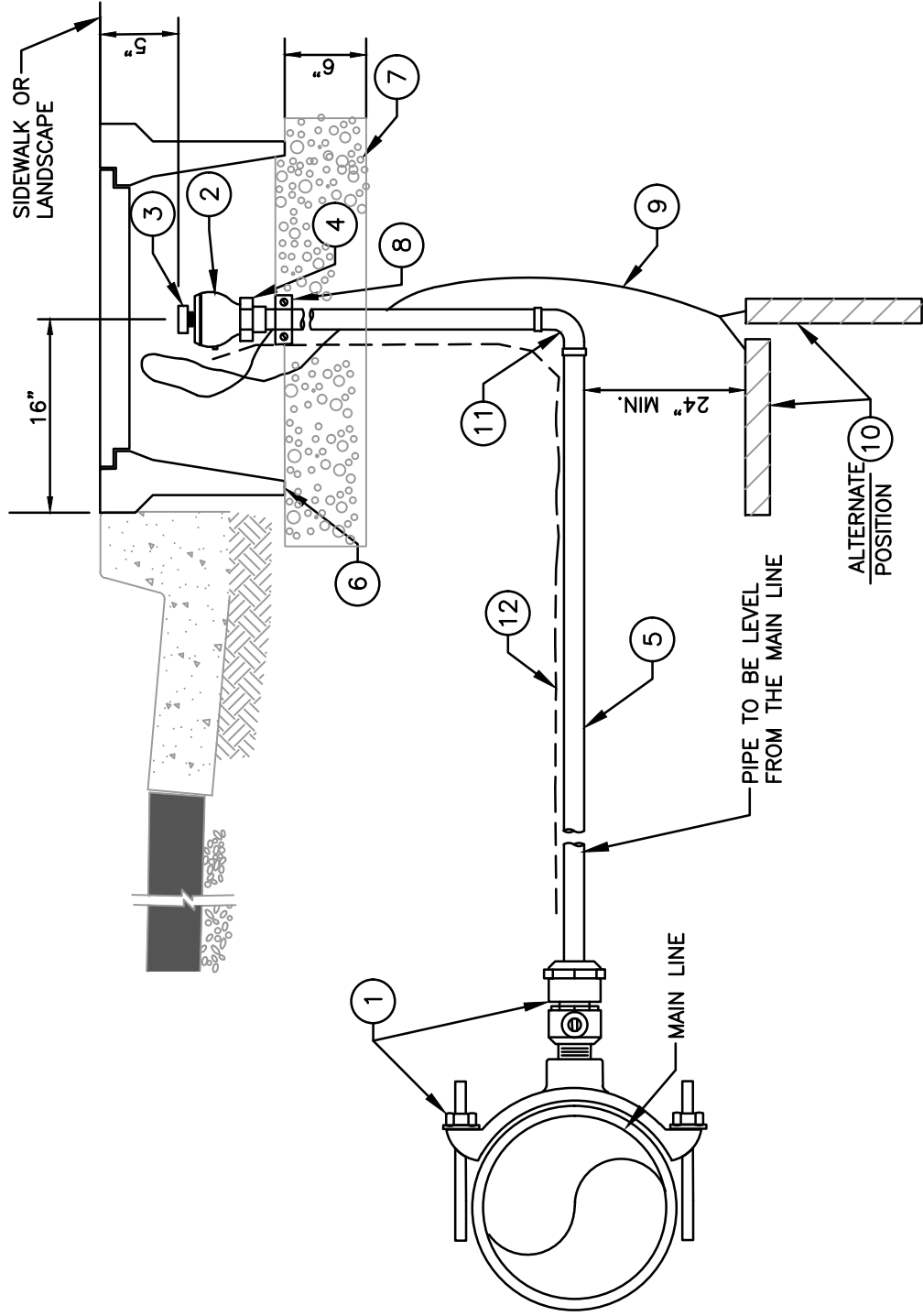
APPROVED BY ENGINEERING DEPARTMENT

Donie Jewett

**LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER**

11/21/24

DATE _____



<u>CONDITION 1</u>	<u>CONDITION 2</u>
2" FLUSH-OUT ASSEMBLY LOCATION PLANS	

NOTES:

1. SERVICE CONNECTION SHALL BE INSTALLED 18" FROM END OF MAIN LINE.
2. SET TOP OF METER BOX FLUSH WITH SIDEWALK OR CURB AS SHOWN.
3. THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
4. METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK PER CONDITION 1 OR 2.
5. ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT CURIAL TYPE OF RD BRASS WITH STAINLESS STEEL SCREWS AND SHALL B TESTED PER TCWD. STD. SPEC. SECTION 16640. (SEE TABLE THEREON FOR ZINC ANODE SIZES)
6. SEE SHEET 2 FOR 4-INCH AND LARGER FLUSH-OUT ASSEMBLY.

LOCATE LATERAL WITH 2" HIGH "W" ON FACE OF CURB WHERE THE LATERAL CROSSES UNDER THE CURB. USE WHEEL GRINDER, 1/4" DEEP GROOVE.

COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 22	1.4 X 1.4 X 30	15
22 TO 45	2.0 X 2.0 X 30	30
45 TO 70	2.0 X 2.0 X 48	40
70 TO 90	2.0 X 2.0 X 60	60

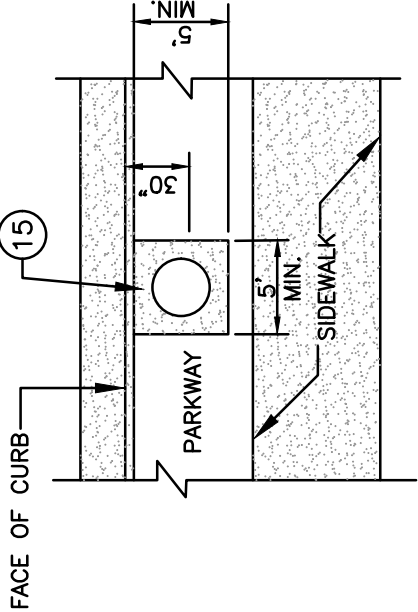
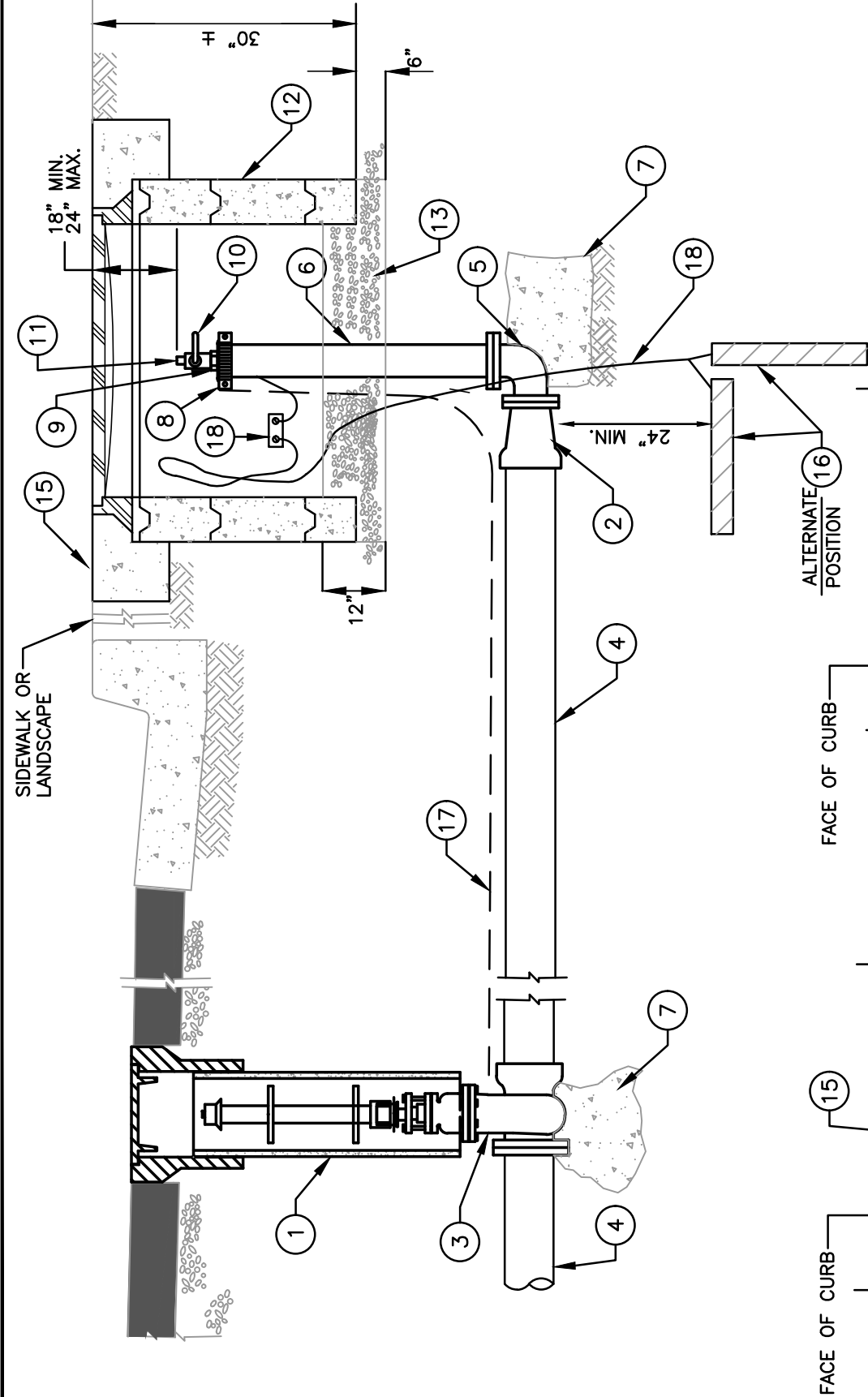
ITEM	MATERIALS

MATERIALS

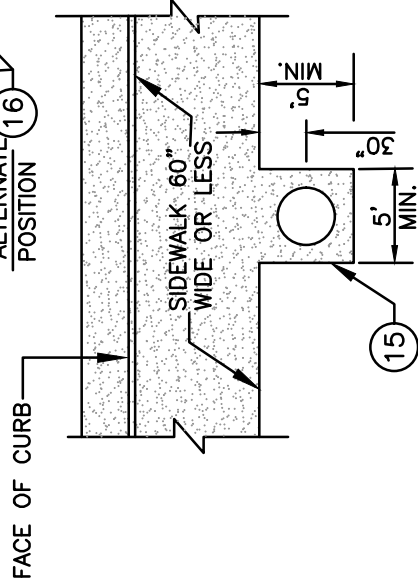
- 1 — 2" SERVICE CONNECTION PER TCWD STD. DWG. W-4.
- 2 — 2" BRASS BALL CORPORATION STOP M.I.P.T. X M.I.P.T. (NORMALLY CLOSED) WITH 2" SQUARE OPERATING NUT ADAPTER ATTACHED WITH STAINLESS STEEL BOLT AND NUT.
- 3 — 2" SCH 80 P.V.C. CAP, F.I.P.T.
- 4 — 2" COPPER SWEAT X F.I.P.T. ADAPTER
- 5 — 2" COPPER SERVICE PIPE TYPE "K" SOFT
- 6 — METER BOX ONE PIECE LID. COMPOSITE POLYMER CONCRETE BOX AND LID PER TCWD. SPEC. SECTION 03462.
- 7 — 6" THICK BASE OF 3/4" CRUSHED ROCK.
- 8 — WIRE CLAMP (SEE NOTE 5)
- 9 — AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
- 10 — ZINC ANODE (SEE TABLE HEREON FOR SIZE OF ANODE) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MIN. SEPARATION OF 24" FROM THE COPPER SERVICE.
- 11 — 2" WROT COPPER 90° BEND, SWEAT X SWEAT.
- 12 — IDENTIFICATION TAPE PER TCWD STD. SPEC. SECTION 15151. TAPE TO PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.

2-INCH FLUSH-OUT ASSEMBLY

				REVISION		APPROVED BY ENGINEERING DEPARTMENT				TCWD STD.DWG. W-16	
NO.	DATE	APPROVED	DATE					11/21/24 DATE			
1	11/06/24	L.L.									
				LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER				SHEET 1 OF 2			



CONDITION 1



CONDITION 2

FLUSH-OUT ASSEMBLY LOCATION PLANS

NOTES:

- FLUSH-OUT ASSEMBLIES SHALL BE INSTALLED ON DEAD END PIPE WHERE FIRE HYDRANT ASSEMBLIES ARE NOT PRACTICAL.
- MANHOLE SHALL BE WITHIN A DEDICATED TCWD EASEMENT OR PUBLIC RIGHT-OF-WAY.
- PAINT EXPOSED RISER PIPING PER TCWD SPEC. SECTION 09900.
- WHERE MAIN LINE PIPE MATERIAL (4) IS STEEL, USE STEEL FITTINGS FOR (2) (5) (6) AND (8) IS PERMITTED.
- WHERE VAULTS OR MANHOLE FRAMES ARE OFFSET FROM CURB OR SIDEWALK, OR PLACED IN PARKWAYS, SET 2" ABOVE FINISHED SURFACE (EXPECT WHEN FULLY OR PARTIALLY PLACED IN SIDEWALK).
- SEE SHEET 1 FOR 2-INCH FLUSH-OUT ASSEMBLY.

MAIN	OUTLET
4" – 6"	SEE NOTE 4
8" – 16"	4"
18" – 24"	6"
30"	8"
36" – 48"	12"

ITEM MATERIALS

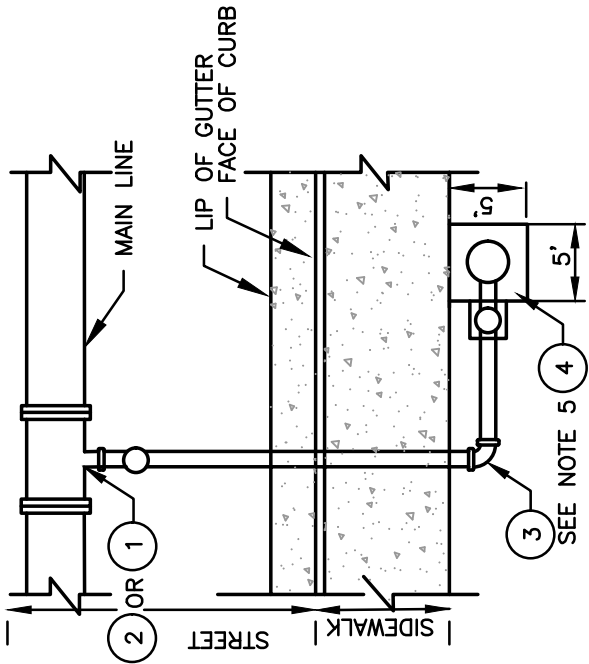
- VALVE BOX AND VALVE STEM EXTENSION PER TCWD STD. DWG. W-25.
- D.I. CONCENTRIC REDUCER, P.O. X F.E. (WHERE REQUIRED)
- GATE VALVE, F.E. X P.O. (SIZE PER PLAN)
- C-900 P.V.C. DR 14 PIPE, SEE TABLE HERE ON FOR PIPE SIZE.
- D.I. 90° BEND, F.E. X F.E.
- D.I. (SIZE ACCORDING TO TABLE) F.E. X F.E. SPOOL (LENGTH AS REQUIRED).
- THRUST BLOCK PER TCWD STD. DWG. W-19. (USE ONLY IF VALVE IS NOT BOLTED TO A FITTING)
- D.I. COMPANION FLANGE. (MAIN LINE SIZE X 2" OUTLET)
- 2" STAINLESS STEEL CLOSE NIPPLE M.I.P.T., THREADED BOTH ENDS.
- 2" STAINLESS STEEL BALL VALVE PER TCWD STD. SPEC. SECTION 15100.
- 2" THREADED STAINLESS STEEL PLUG.
- 30" MANHOLE WITH FRAME AND COVER WITH GRADE RINGS PER TCWD STD. DWG. S-1, WITH COVER MARKED "TCWD DOMESTIC WATER" OR "TCWD RECLAIMED WATER".
- 12" BASE OF 3/4" CRUSHED ROCK. (EXTEND BEDDING 6" INTO VAULT)
- NOT USED.
- 5' X 5' CONCRETE PAD 6" THICK WITH W.F.F. 1.6 X 1.6.
- ZINC ANODE (60 LB.) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MIN. SEPARATION OF 24" FROM THE PIPE.
- IDENTIFICATION TAPE PER TCWD STD. SPEC. SECTION 15151. TAPE TO PIPE AT 2' INTERVALS USING 2" WIDE 10- MIL TAPE.
- AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE, PROVIDE AND CONNECT TO SHUNT, LEAVE 36" OF COILED WIRE BEFORE SHUNT IN VAULT. ALUMINO-THERMIC WELD PER TCWD STD SPEC. SECTION 16640.

4-INCH AND LARGER FLUSH-OUT ASSEMBLY

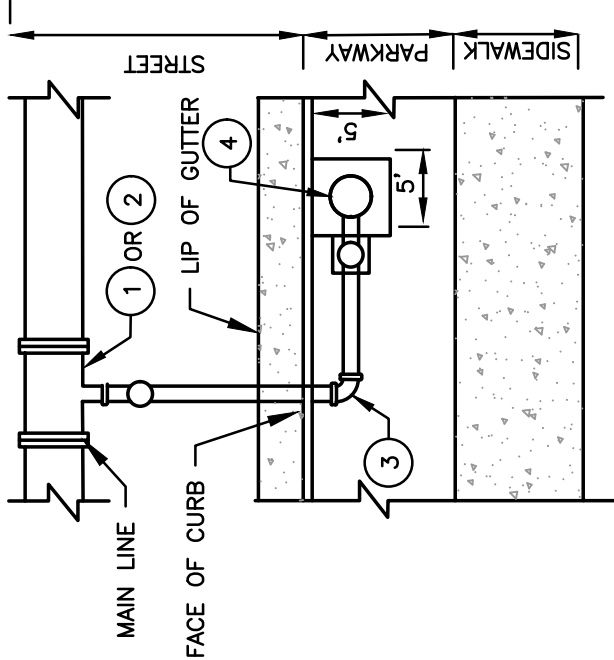
REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	LL	



TCWD
STD.DWG.
W-16



CASE 2



CASE 4



- ① ——— PIPE DIA. X D.I. FLANGED TEE AND FLANGED OUTLET, SEE PIPE SIZE PER TABLE ON SHEET 1 OF 2.
- ② ——— SHOP FABRICATED CML&C STEEL FLANGED OUTLET, SEE PIPE SIZE PER TABLE ON SHEET 1 OF 2.
- ③ ——— THRUST BLOCKS PER TCWD STD. DWG. W-19.
- ④ ——— 5' X 5' CONCRETE PAD MIN. 6" THICK WITH W.W.F.-1.6 X 1.6.

1. POSITION ASSEMBLY PER APPLICABLE CASE 1, 2 , 3 OR 4 AS SHOWN HEREON.
2. ONE VALVE REQUIRED FOR MAIN LINES LESS THAN 24 INCHES IN DIAMETER.
3. MANHOLE FRAME, COVER, GRADE RING, AND SHAFT SHALL BE LOCATED BEYOND THE SIDEWALK OR BEHIND CURB.
4. MARK VALVE LOCATIONS AND DISTANCES TO TWO POINTS ON ADJACENT CURB BY USE OF A 4" WHEEL GRINDER. SEE DETAIL HEREON.
5. BLOWOFF/BOTTOM DRAIN ASSEMBLY INSTALLATION IMPROVEMENTS BEYOND THE PUBLIC RIGHT-OF-WAY REQUIRES AN EASEMENT AS DIRECTED BY TCWD.

BLOWOFF/BOTTOM DRAIN ASSEMBLY LOCATION PLAN			
REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

Lorrie Lausten

11/21/24

DATE

11/21/24

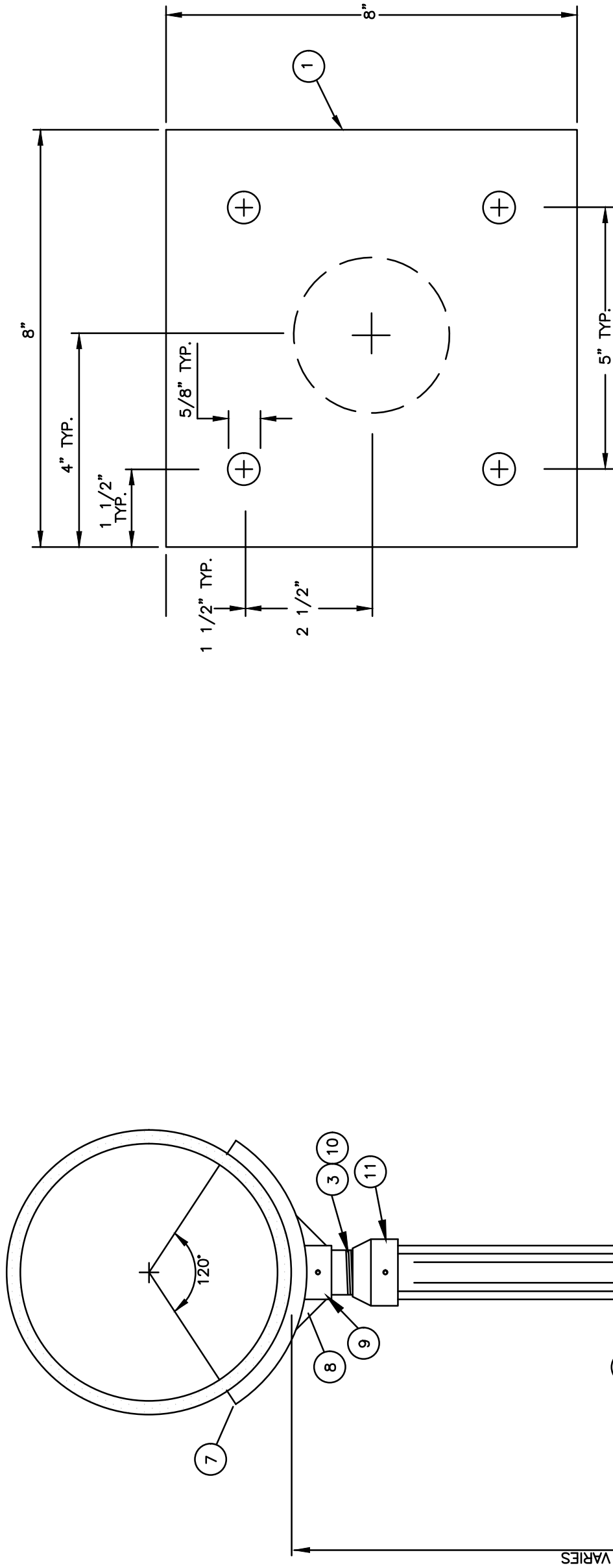
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SHEET 2 OF 2



TRABUCO CANYON
(WATER DISTRICT)

BLOWOFF/BOTTOM DRAIN LOCATION PLANS



ITEM

MATERIALS

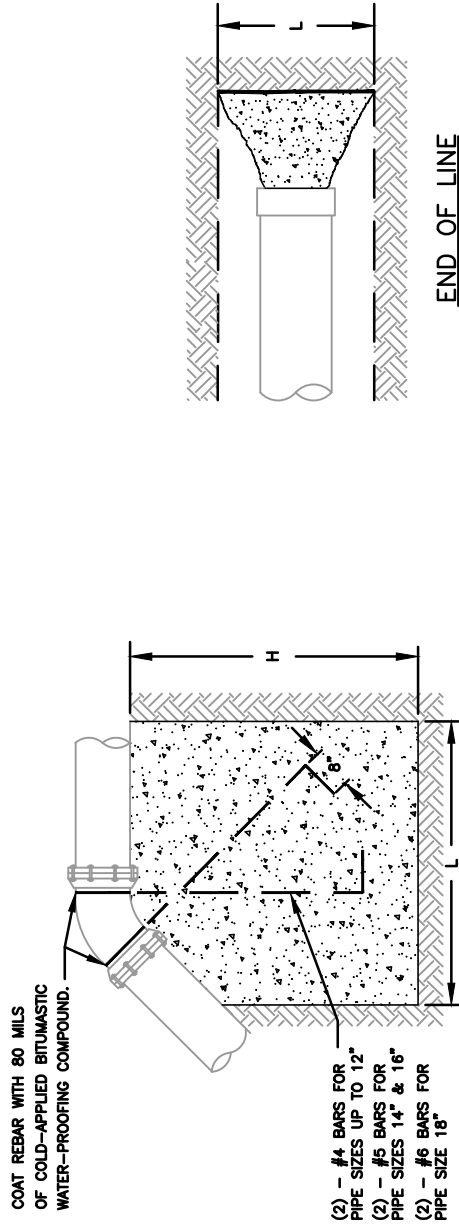
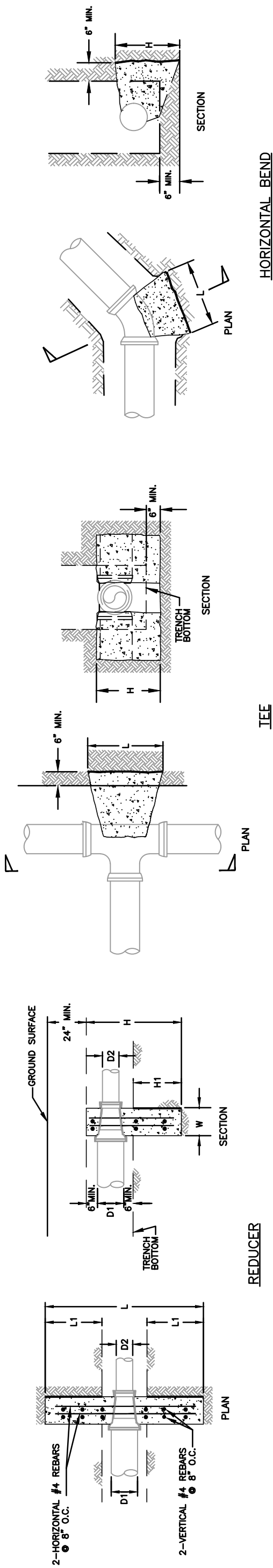
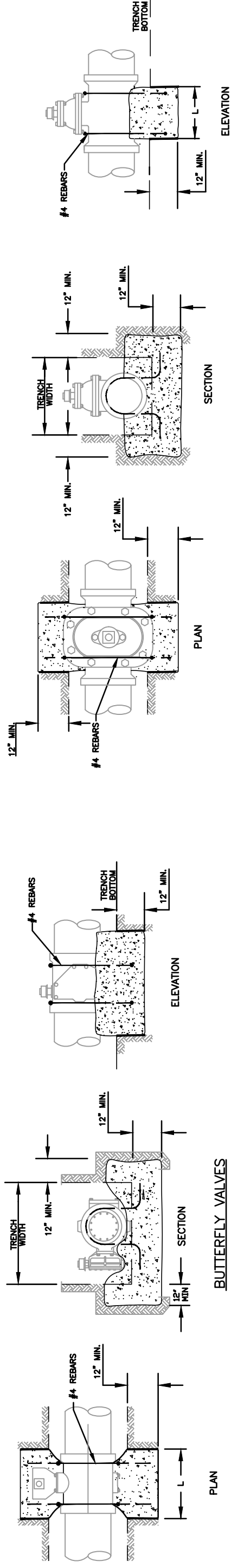
- ① — 8" X 8" X 1/2" BLACK STEEL BASE PLATE WITH 4 - 5/8" BOLT HOLES.
- ② — 3" DIAMETER SCH. 40 BLACK STEEL PIPE WELDED TO BASE PLATE, STOCKED @ 15" LONG, TO BE CUT TO SIZE IN THE FIELD.
- ③ — COAT THREADS WITH LIBERAL AMOUNTS OF ANTI-SEIZE COMPOUND.
- ④ — 5/8" DIAMETER RED HEAD STAINLESS STEEL CONCRETE ANCHOR BOLT WITH 5/8" DIAMETER STAINLESS STEEL HEX HEAD ANCHOR NUT, AND 1" X 5/8" HEAVY STAINLESS STEEL WASHER DRILL AND MOUNT INTO CONCRETE PAD OR VAULT FLOOR.
- ⑤ — 1" THICK NON-SHRINK GROUT LEVELING COURSE.
(CONCRETE FLOOR ONLY)
- ⑥ — CONCRETE VAULT FLOOR OR 6" BASE OF 3/4" CRUSHED ROCK.
- ⑦ — 3/8" THICK X 4" WIDE STAINLESS STEEL SADDLE ASSEMBLY. PRE-COAT WITH POLYURETHANE SPRAY COATING. 40 MILS THICK. TOP AND SIDE SURFACES ONLY.
- ⑧ — 3/8" GUSSET THICK STAINLESS STEEL GUSSET PLATE.
- ⑨ — 3" DIAMETER SCH. 80 STAINLESS STEEL RECEIVER TUBE WITH 1/2" STAINLESS STEEL ALLEN SET SCREW.
- ⑩ — 2 1/2" DIAMETER SCH. 40 STAINLESS STEEL THREADED RISER, PROVIDES APPROX. 6" OF ADJUSTMENT.
- ⑪ — 3" DIAMETER STAINLESS STEEL HEAVY THREADED ADJUSTMENT COUPLING WITH 1/2" DIAMETER STAINLESS STEEL SET SCREW.
- ⑫ — 1" STAINLESS STEEL SPACER.
- ⑬ — CONCRETE PAD 12" X 12" X 6".

NOTES

1. ALL PIPE SUPPORT COMPONENTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION, WITH THE EXCEPTION OF THE THREADED STAINLESS STEEL PARTS.

PIPE SUPPORT

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	
APPROVED BY ENGINEERING DEPARTMENT		 LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER	
		11/21/24	
		DATE	
			
		TCWD STD.DWG. W-18	
		SHEET 1 OF 1	



THRUST BLOCKS

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

June Scott

**LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER**

11/21/24
DATE

DATE _____

TCWD
STD.DWG.

SHEET 1 OF 2



1. ALL WORK SHALL BE PER TCWD STD. SPEC. SECTION 02223 AND CITY/COUNTY PERMIT REQUIREMENTS.
2. PIPE BASE SHALL BE A MINIMUM OF 6" IN DEPTH. PIPE BEDDING MATERIAL SHALL BE PER TCWD STD. SPEC. SECTION 02223 AND SHALL INCLUDE BOTH PIPE BASE AND PIPE BEDDING ZONE.
3. CONTRACTOR SHALL PROVIDE HAND EXCAVATED "BELL HOLE" FOR EACH PIPE JOINT SO THAT THE WEIGHT OF PIPE DOES NOT BEAR ON THE BELL. CONTRACTOR SHALL RE-FILL AND HAND-TAMP EACH "BELL HOLE" PRIOR TO COMPLETING THE PLACEMENT OF PIPE BEDDING.
4. IF UNSTABLE SOIL IS ENCOUNTERED, THE DISTRICT REPRESENTATIVE SHALL DETERMINE OVEREXCAVATION DEPTH AND FOUNDATION RE-FILL MATERIAL PER TCWD STD. SPEC SECTION 02223.
5. WHERE CONTRACTOR FAILS TO MAINTAIN PROPER TRENCH WIDTH LIMITS, SPECIAL BACKFILL SUCH AS ONE-SACK SLURRY AND BEDDING SHALL BE USED AS DETERMINED IN THE FIELD BY THE DISTRICT REPRESENTATIVE.
6. PIPE IDENTIFICATION TAPE SHALL BE INSTALLED PER TCWD STD. SPEC. SECTION 15151. TAPE SHALL BE FASTENED TO THE PIPE WITH 2" WIDE 10 MIL PIPE WRAP TAPE AT 5' INTERVALS. PIPE WRAP TAPE SHALL BE WRAPPED AROUND THE ENTIRE CIRCUMFERENCE OF THE PIPE.
7. THE MIN DEPTH OF COVER FROM FINISH GRADE TO THE TOP OF THE PIPELINE SHALL BE AS FOLLOWS UNLESS OTHERWISE APPROVED BY THE DISTRICT ENGINEER:
 - DOMESTIC WATER PIPELINE (1" TO 10" DIA.) = 42"
 - DOMESTIC WATER PIPELINE (>10" DIA.) = 48"
 - RECYCLED WATER PIPELINE (ALL DIA.) = 60"

WATER MAIN TRENCH

REVISION					
NO.	DATE	APPROVED	DATE		
1	11/06/24	L.L.			
				APPROVED BY ENGINEERING DEPARTMENT _____ LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER	
				11/21/24 DATE	
					
				TCWD STD.DWG. W-20	
				SHEET 1 OF 1	

BASIC SEPARATION STANDARDS

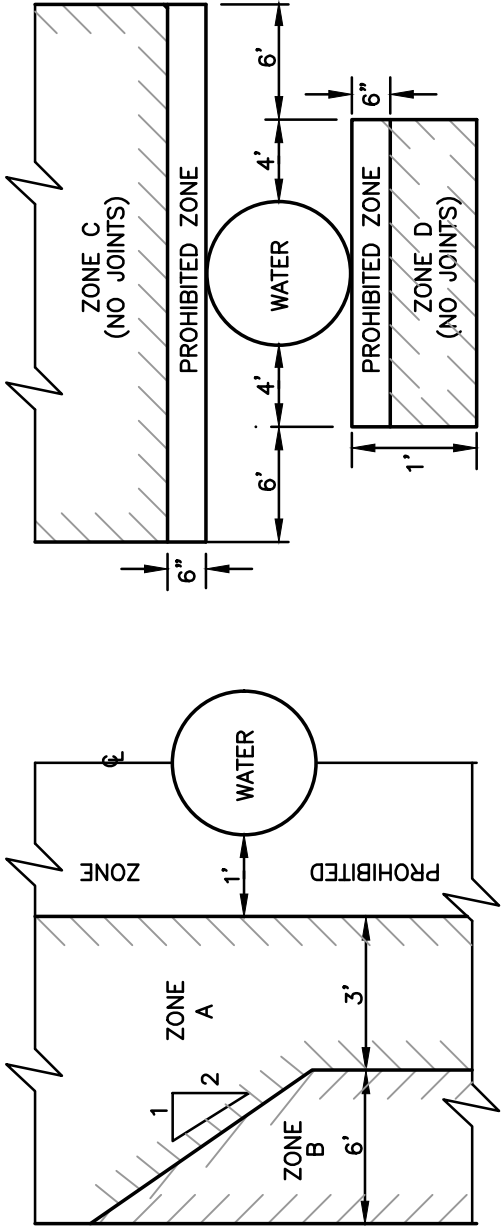
- 1. PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN DOMESTIC WATER AND RECLAIMED WATER LINES AND SEWER LINES SHALL BE AT LEAST 10 FEET, OUTSIDE OF PIPE TO OUTSIDE OF PIPE.
- 2. PERPENDICULAR CONSTRUCTION (CROSSING): WATER LINES SHALL BE AT LEAST ONE FOOT ABOVE SEWER AND RECLAIMED WATER LINES WHERE THESE LINES MUST CROSS.
- 3. SPECIAL PROVISIONS: WHERE THE BASIC SEPARATION STANDARDS CANNOT BE ATTAINED ALTERNATIVE CONSTRUCTION CRITERIA ARE SHOWN BELOW:

GENERAL NOTES

- 1. NO PIPE JOINTS SHALL BE PERMITTED WITHIN ZONE D.
- 2. NO JOINTS ARE PREFERRED WITHIN ZONE C. IF THAT CANNOT BE ACCOMPLISHED, THE NEW LINE SHALL BE ENCASED IN CONCRETE FOR THE FULL LENGTH OF ZONE C.
- 3. SEWER FORCE MAINS SHALL NOT BE PERMITTED IN ZONES A THROUGH D.
- 4. THE MATERIALS OF NEW LINES AT CROSSINGS SHALL BE CONSISTENT WITH OTHER NEW MATERIALS, I.E., STEEL ON A STEEL LINE.
- 5. THESE CONSTRUCTION CRITERIA APPLY TO SEWER LATERALS THAT CROSS ABOVE A WATER LINE, BUT NOT TO THOSE THAT CROSS BELOW A WATER LINE.

SITUATION 1:

LOCATION OF NEW SEWER & RECLAIMED WATER LINES TO EXISTING DOMESTIC WATER LINE.



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY SEWER OR RECLAIMED WATER PIPELINES ARE TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

ZONE SEWER

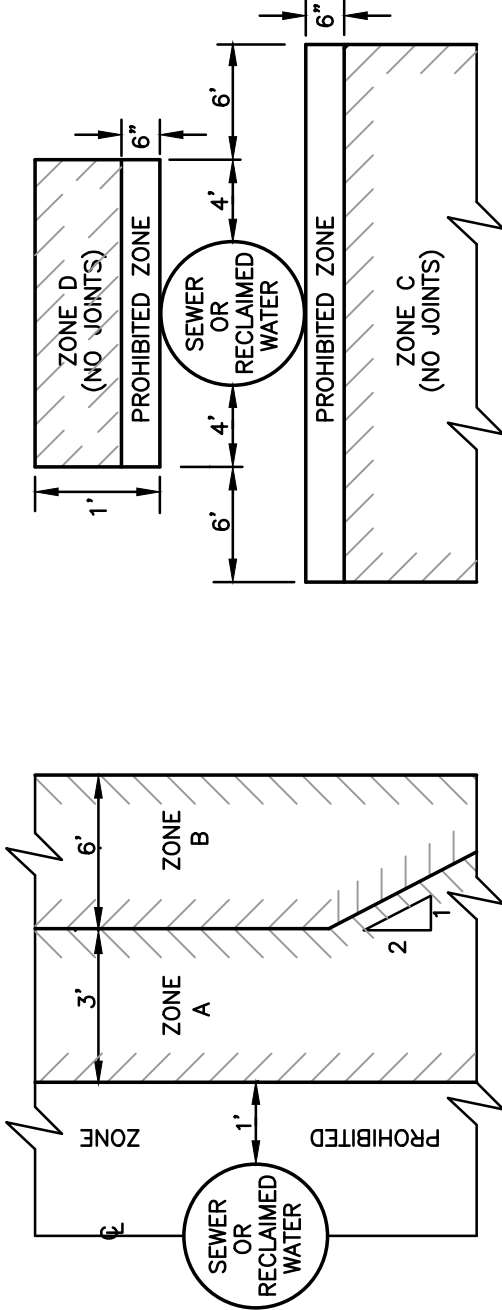
- A DO NOT LOCATE ANY PARALLEL SEWER OR RECLAIMED WATER LINES IN THIS AREA WITHOUT STATE WATER RESOURCES CONTROL BOARD APPROVAL.
- B USE VCP, DR14 PVC – AWWA C-900 OR DIP WITH COMPRESSION JOINTS.
- C USE DR 14 PVC – AWWA C-900
- D USE DR 14 PVC – AWWA C-900

RECLAIMED WATER

- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900
- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900
- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900

SITUATION 2:

LOCATION OF NEW DOMESTIC & RECLAIMED WATER LINES TO EXISTING SEWER & RECLAIMED WATER LINES



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY WATER LINE IS TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

ZONE DOMESTIC WATER

- A DO NOT LOCATE ANY PARALLEL DOMESTIC WATER LINE IN THIS AREA WITHOUT PRIOR STATE WATER RESOURCES CONTROL BOARD APPROVAL.
- B USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.
- C USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.
- D USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.

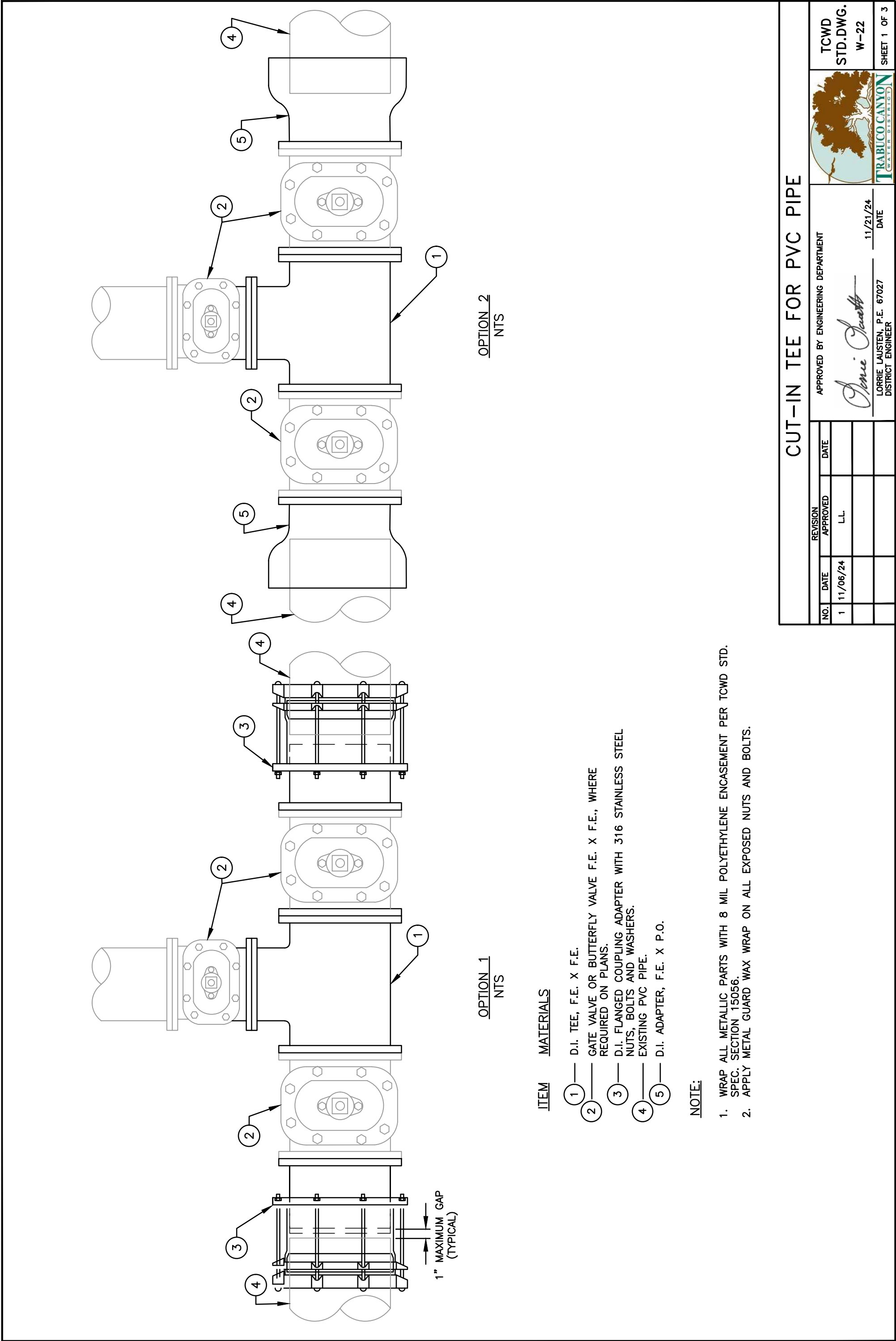
WATER AND SEWER SEPARATION STANDARDS

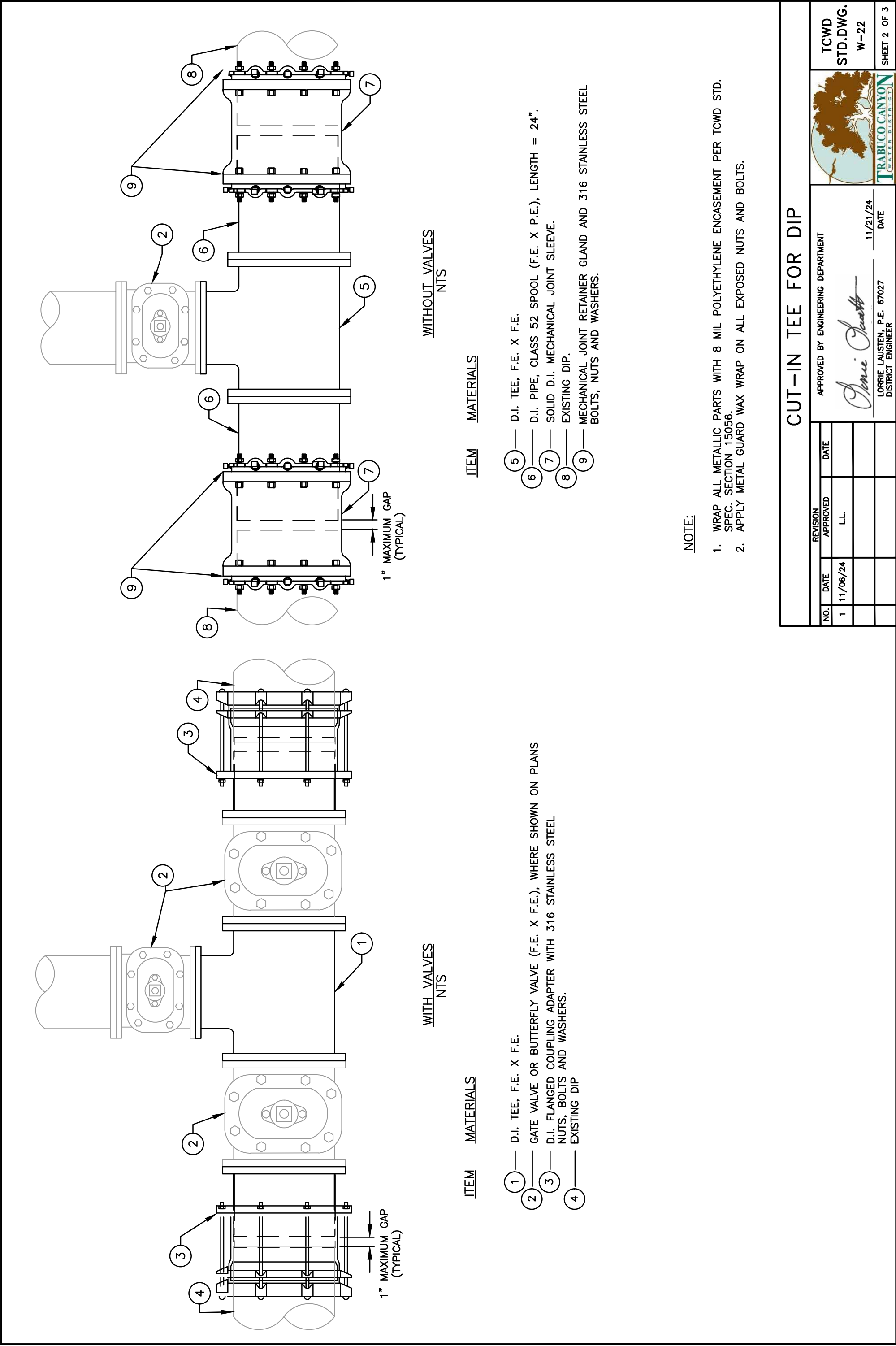
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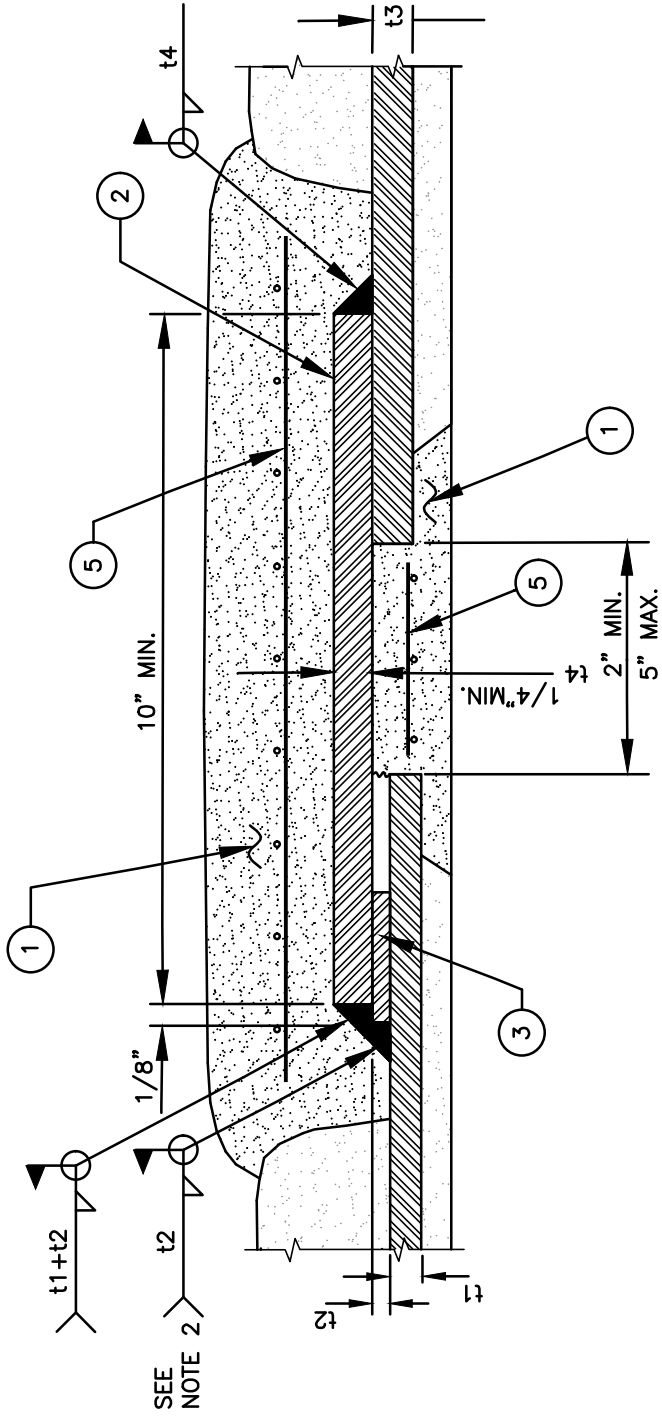


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SHEET 1 OF 1







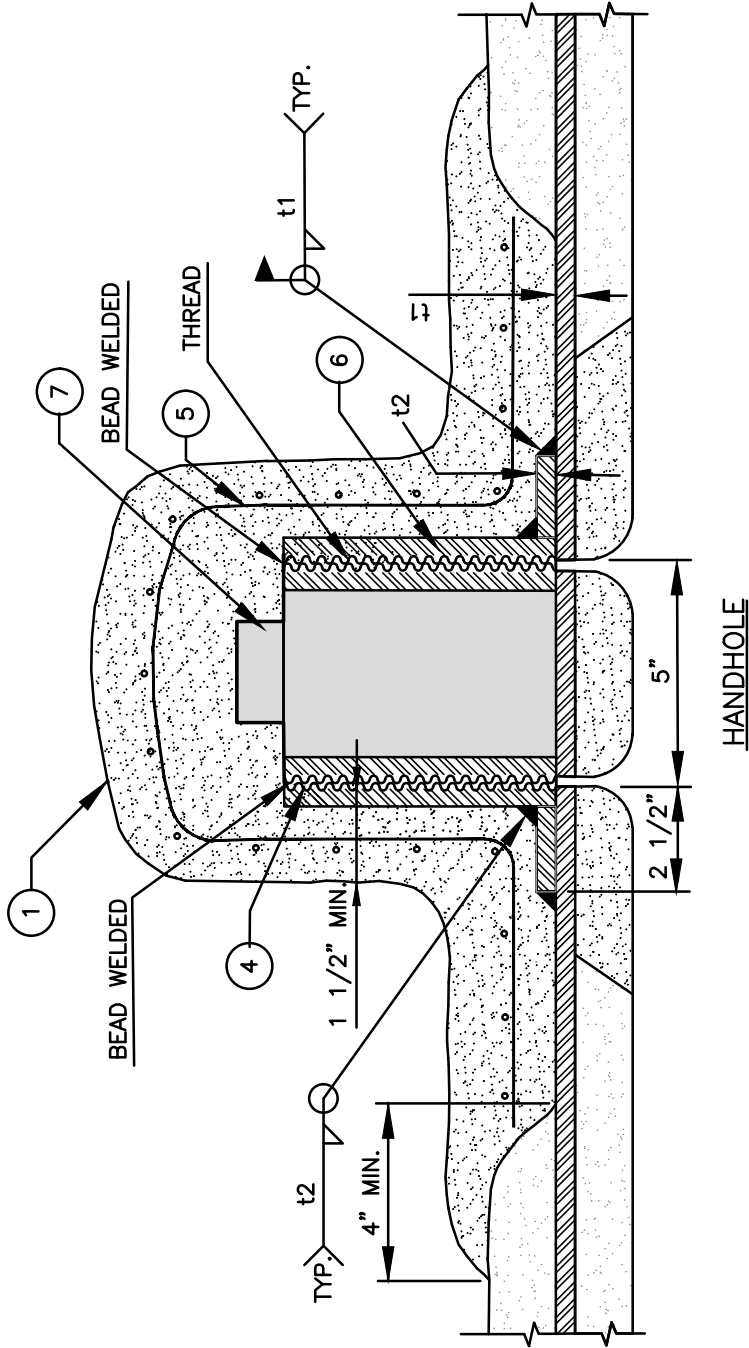
WELDED COLLAR JOINT

ITEM

- 1—FIELD APPLIED CEMENT MORTAR PER TCWD STD SPEC. SECTION 15076.
- 2—10" MIN. WIDTH ROLLED STEEL BUTTSTRAP 2-PIECE COLLAR. MIN. PLATE THICKNESS OF 1/4" OR THINNEST PIPE WALL THICKNESS (t1 OR t3) BEING JOINED, WHICHEVER IS GREATER. CENTER BUTTSTRAP COLLAR OVER PIPE JOINT.
- 3—FILLER BAR (WHERE NECESSARY) TO FILL GAP BETWEEN PIPE WALL AND WELD COLLAR. SEE NOTES 1 AND 2. ROLL TO MATCH PIPE RADIUS.
- 4—WELD PLUG TO COUPLING ENTIRE CIRCUMFERENCE.
- 5—2" X 2" W.W.M. 12" GAUGE BOTH WAYS.
- 6—5" EXTRA HEAVY STEEL COUPLING.
- 7—HEAVY STEEL THREADED PLUG WITH 2-INCH SQUARE DRIVING NUT, TIGHTEN PLUG INTO THREADED COUPLING. LEAVE SEVERAL THREADS EXPOSED TO ALLOW PROPER WELD SURFACE.

MATERIALS

- 1—FIELD APPLIED CEMENT MORTAR PER TCWD STD SPEC. SECTION 15076.
- 2—10" MIN. WIDTH ROLLED STEEL BUTTSTRAP 2-PIECE COLLAR. MIN. PLATE THICKNESS OF 1/4" OR THINNEST PIPE WALL THICKNESS (t1 OR t3) BEING JOINED, WHICHEVER IS GREATER. CENTER BUTTSTRAP COLLAR OVER PIPE JOINT.
- 3—FILLER BAR (WHERE NECESSARY) TO FILL GAP BETWEEN PIPE WALL AND WELD COLLAR. SEE NOTES 1 AND 2. ROLL TO MATCH PIPE RADIUS.
- 4—WELD PLUG TO COUPLING ENTIRE CIRCUMFERENCE.
- 5—2" X 2" W.W.M. 12" GAUGE BOTH WAYS.
- 6—5" EXTRA HEAVY STEEL COUPLING.
- 7—HEAVY STEEL THREADED PLUG WITH 2-INCH SQUARE DRIVING NUT, TIGHTEN PLUG INTO THREADED COUPLING. LEAVE SEVERAL THREADS EXPOSED TO ALLOW PROPER WELD SURFACE.



HANDHOLE

HANDHOLE NOTES

1. ONE HANDHOLE IS REQUIRED FOR PIPE DIAMETER 16" OR LESS. SEE BELOW FOR ORIENTATION.
2. TWO HANDHOLES ARE REQUIRED FOR PIPE DIAMETER 18" TO 24" . SEE BELOW FOR ORIENTATION.
3. FOUR HANDHOLES ARE REQUIRED FOR PIPE DIAMETER 30" & LARGER. SEE BELOW FOR ORIENTATION.
4. HANDHOLES ARE NOT REQUIRED FOR PIPELINES 24" DIA. AND LARGER IF MANWAYS ARE PROVIDED WITHIN 1,000 FEET.

LEGEND

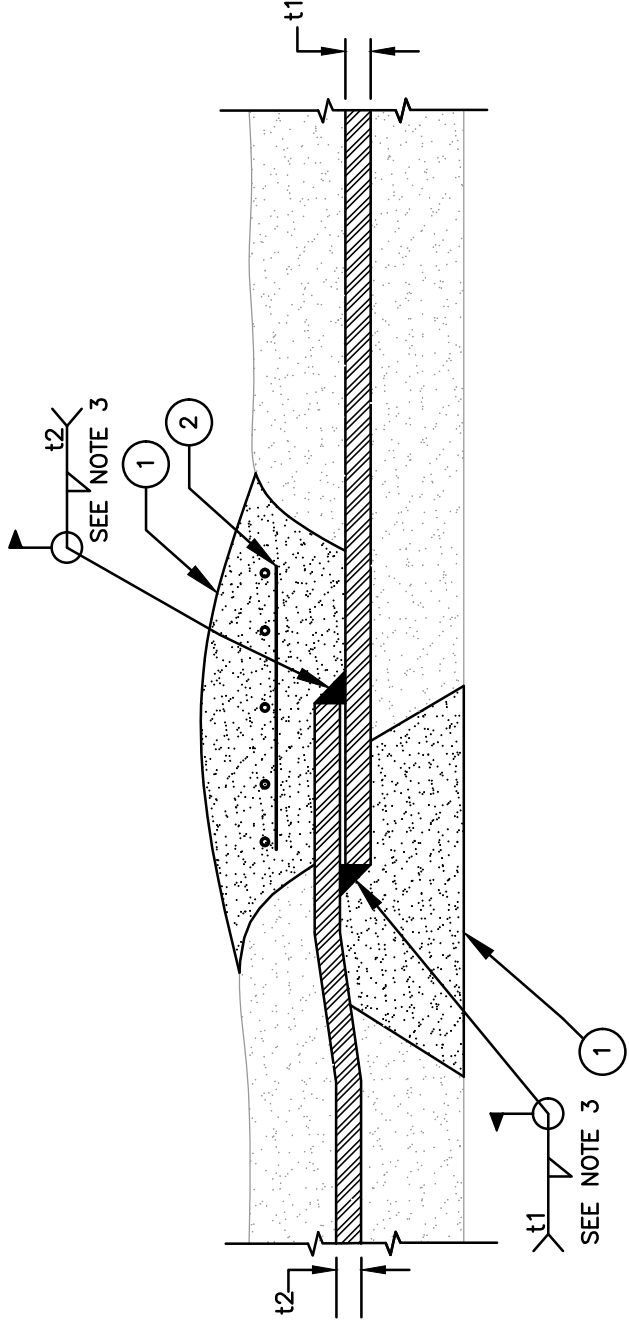
ONE HANDHOLE	TWO HANDHOLES	FOUR HANDHOLES	LEGEND
			■ BUTT WELD LOCATION JOINING COLLAR PIE  HANDHOLE LOCATION

GENERAL NOTES

1. ROLLED STEEL WELD COLLARS ("BUTT STRAPS") SHALL NOT BE HEATED OR HAMMERED TO FIT O.D. OF SMALLER PIPE. USE FILLER BAR AS SHOWN, WHERE NECESSARY.
2. WELD IS REQUIRED ONLY WHERE FILLER BAR IS USED.
3. FOR 18" DIA. AND LARGER, GROUT ALL HAND-HOLE OPENINGS FULL OF GROUT AND FINISH FLUSH AND CURVED TO MIMICK FACTORY CEMENT MORTAR LINING.
4. SEE TCWD STD. SPEC. SECTION 15076 FOR STEEL PIPE SHELL THICKNESS AND MORTAR LINING AND COATING THICKNESS.

MORTAR LINED & COATED STEEL PIPE JOINTS

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1	11/06/24	L.L.			
			APPROVED BY ENGINEERING DEPARTMENT _____ 11/21/24 DATE LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER		
			 TRABUCO CANYON (WATER DISTRICT)		
			TCWD STD.DWG. W-23		
			SHEET 1 OF 2		



LAP WELDED SLIP JOINT

ITEM	MATERIALS

- ① — FIELD APPLIED CEMENT MORTAR PER TCWD STD SPEC SECTION 15076.
- ② — 2" X 2" W.W.M. 12 GAUGE BOTH WAYS.

NOTES

1. SEE TCWD STD. SPEC. SECTION 15076 FOR STEEL PIPE SHELL THICKNESS AND MORTAR LINING AND COATING THICKNESS.
2. APPLY WELD MATERIAL WITH A MINIMUM OF TWO WELD PASSES FOR EACH WELD JOINT FOR PIPE DIAMETER LESS THAN 36". USE A MINIMUM OF THREE WELD PASSES FOR PIPE DIAMETER 36" AND LARGER.
3. PIPE DIA. <24": OUTSIDE WELD REQUIRED
PIPE DIA. 24"–30": INSIDE WELD OR OUTSIDE WELD, AT CONTRACTORS OPTION.
PIPE DIA. >30": INSIDE WELD REQUIRED.
4. WHERE $t_2 \neq t_1$, WELD DIMENSION SHALL BE EQUAL TO THE THICKEST PIPE WALL.

MORTAR LINED & COATED STEEL PIPE JOINTS

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1	11/06/24	L.L.			

APPROVED BY ENGINEERING DEPARTMENT



 LORIE LAUSTEN, P.E. 67027
 DISTRICT ENGINEER

11/21/24

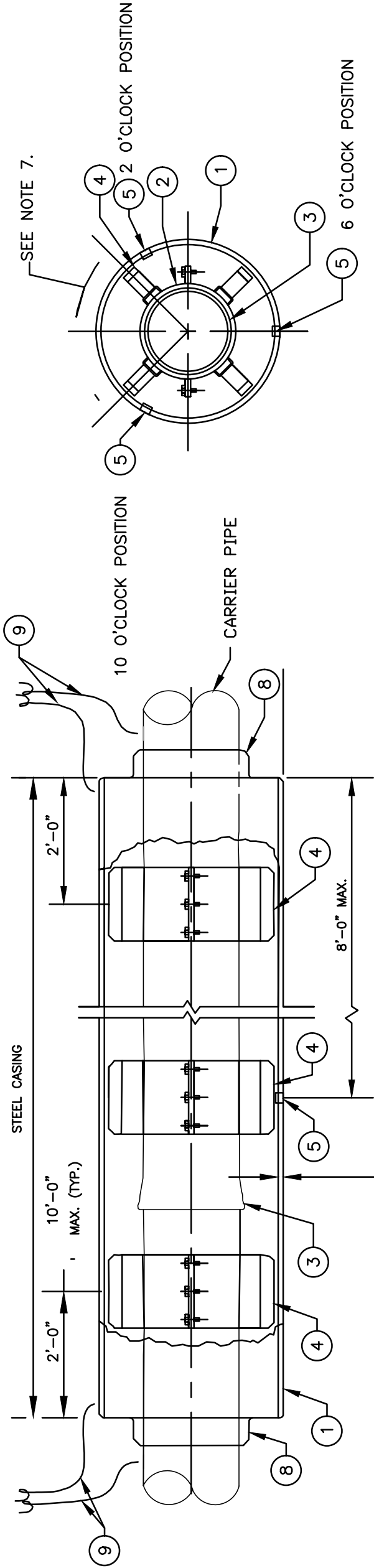
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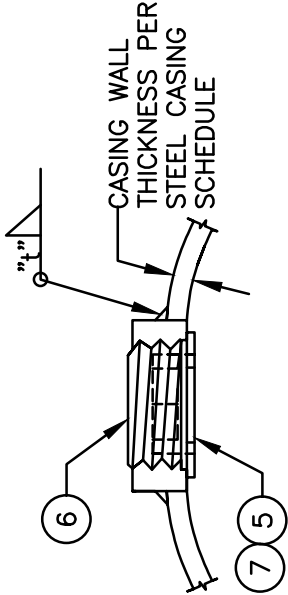


TRABUCO CANYON
(WATER DISTRICT)

SHEET 2 OF 2



CROSS-SECTION



GROUT FITTING DETAIL

STEEL CASING SCHEDULE			
NOMINAL CARRIER PIPE SIZE	MINIMUM CASING SIZE (NOMINAL)	MINIMUM WALL THICKNESS	
4"	12"	1/4"	
6"	16"	5/16"	
8"	16"	5/16"	
10"	18"	5/16"	
12"	20"	3/8"	
16"	24"	3/8"	
18"	30"	1/2"	
24"	42"	1/2"	

NOTES:

- CASING SHALL BE INSTALLED BY THE BORE, JACK AND/OR TUNNEL METHOD, OR OPEN TRENCH. SEE TCWD STD. SPEC. SECTIONS 02315 AND 02316. BEDDING MATERIAL FOR OPEN TRENCH CASING INSTALLATION SHALL CONSIST OF 6" THICK OF 3/4" CRUSHED ROCK.
- SIZE AND THICKNESS OF CASING SHALL BE AS SHOWN IN STEEL CASING SCHEDULE HEREON. FOR LONG BORES OR SPECIAL SITUATIONS GREATER WALL THICKNESS THAN SHOWN IN SCHEDULE MAY BE REQUIRED.
- ALL STEEL CASING PIPE FIELD JOINTS SHALL BE WELDED FULL-CIRCUMFERENCE.
- CARRIER PIPE SHALL BE PRESSURE TESTED PRIOR TO SEALING ENDS OF CASING.
- EACH END OF CASING SHALL BE SEALED WITH APPROVED RUBBER CASING END SEALS.
- BACKFILL FOR CASING IN OPEN CUT SHALL BE PER TCWD STD. DWG. W - 19.
- NUMBER AND PLACEMENT OF SPACERS ON CARRIER PIPE SHALL BE PER MANUFACTURER'S SPECIFICATIONS.
- ALL CARRIER PIPE JOINTS INSIDE THE STEEL CASING AND A MIN. 5' OUTSIDE THE STEEL CASING SHALL BE RESTRAINED.
- CATHODIC PROTECTION REQUIRED FOR STEEL CASING 40 FEET IN LENGTH AND LONGER ONLY.
- REFER TO TABLE IN TCWD STD. SPEC. SECTION 02315 AND 02316 FOR ANNULAR SPACE FILL REQUIREMENTS.

STEEL CASING FOR WATER PIPE

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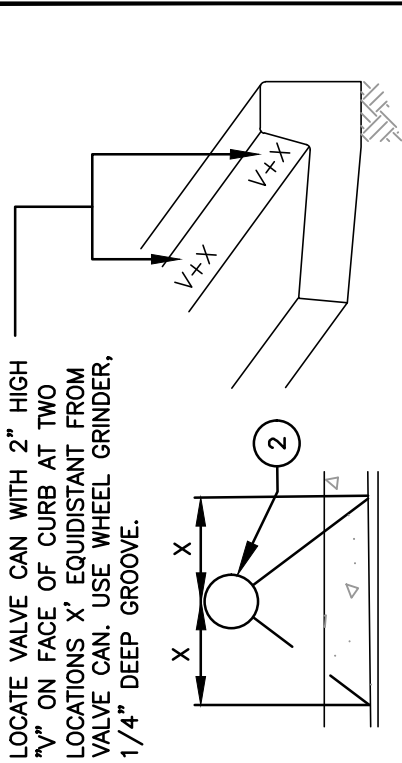
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TRABUCO CANYON
WATER DISTRICT

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

DATE
11/21/24

SHEET 1 OF 1



VALVE BOX TIE-DOWN

ITEM	MATERIALS

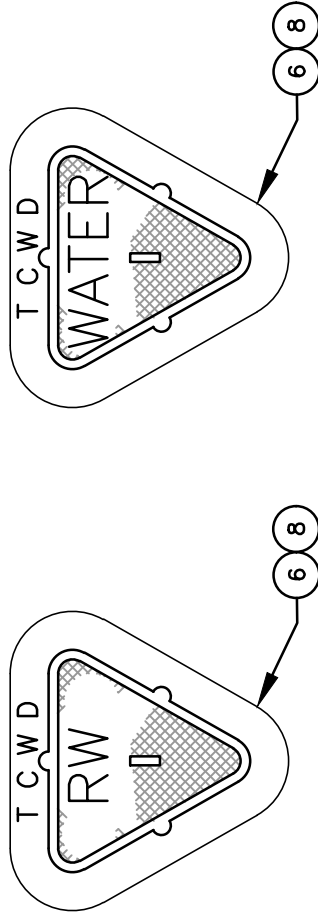
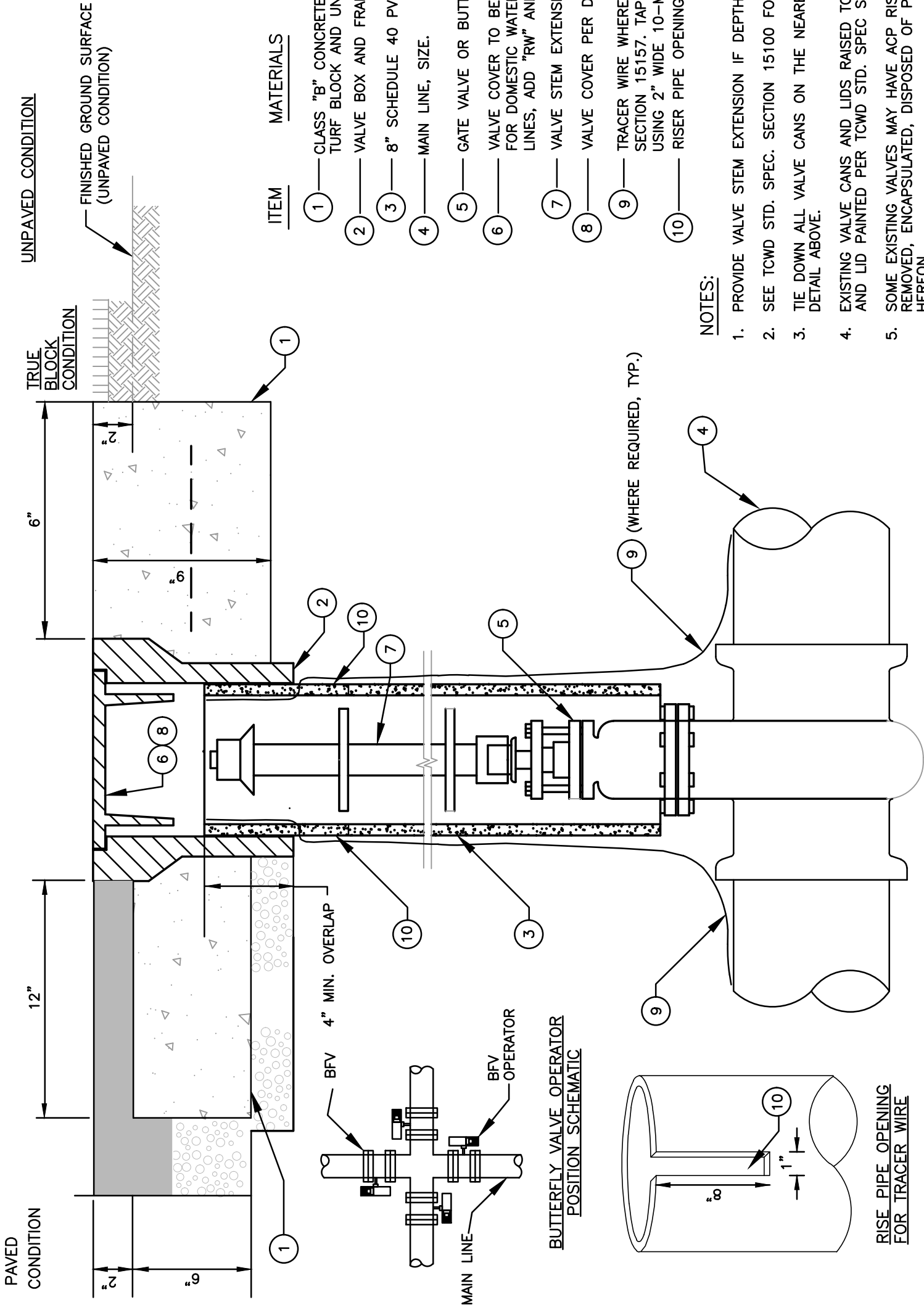
- ① — CLASS "B" CONCRETE COLLAR. REINFORCE WITH W.W.F. 1.6" X 1.6" TURF BLOCK AND UNPAVED CONDITIONS.
- ② — VALVE BOX AND FRAME PER TCWD STD. SPEC. SECTION 03462.
- ③ — 8" SCHEDULE 40 PVC RISER PIPE.
- ④ — MAIN LINE, SIZE.
- ⑤ — GATE VALVE OR BUTTERFLY VALVE.
- ⑥ — VALVE COVER TO BE IRON WITH LETTERS "TCWD" CAST THEREON. FOR DOMESTIC WATER LINES ADD "WATER". FOR RECLAIMED WATER LINES, ADD "RW" AND PAINT LID PURPLE.
- ⑦ — VALVE STEM EXTENSION PER TCWD STD. SEE SHEET 2.
- ⑧ — VALVE COVER PER DETAIL HEREON.
- ⑨ — TRACER WIRE WHERE REQUIRED ON PLANS PER TCWD STD. SPEC. SECTION 15157. TAPE TRACER WIRE TO PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
- ⑩ — RISER PIPE OPENING FOR TRACER WIRE.

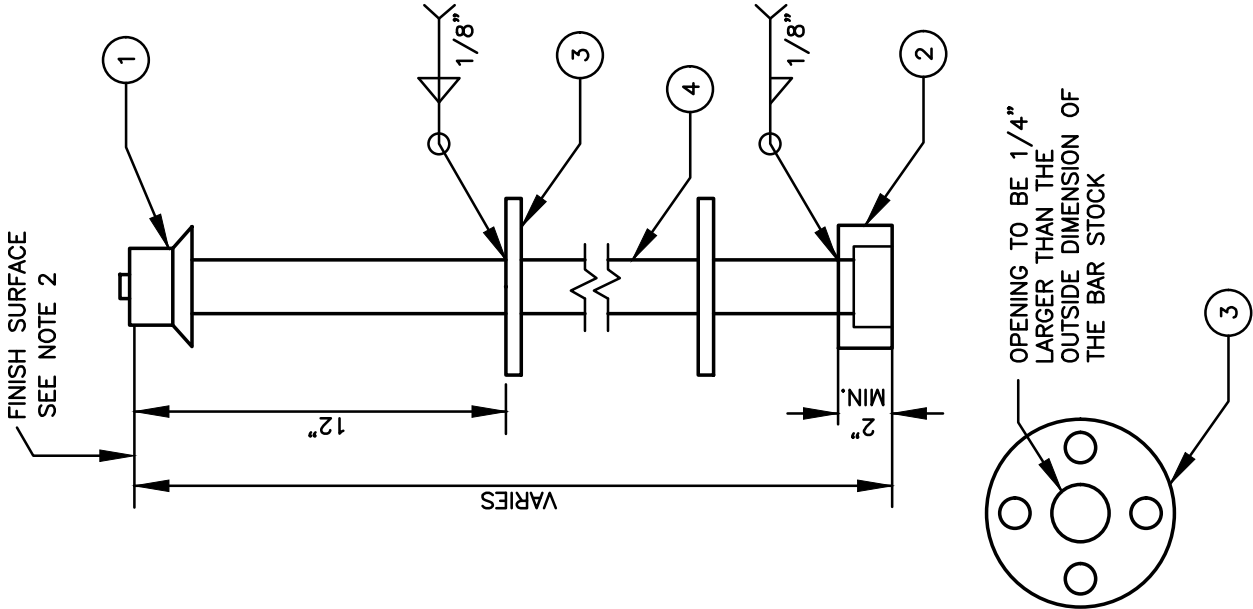
NOTES:

1. PROVIDE VALVE STEM EXTENSION IF DEPTH TO VALVE NUT EXCEEDS 72". SEE SHEET 2.
2. SEE TCWD STD. SPEC. SECTION 15100 FOR VALVE LID COVER REQUIREMENTS.
3. TIE DOWN ALL VALVE CANS ON THE NEAREST CURB FACE BY MEANS OF A 4-INCH WHEEL GRINDER, SEE DETAIL ABOVE.
4. EXISTING VALVE CANS AND LIDS RAISED TO GRADE SHALL BE REMOVED AND REPLACED WITH NEW, SET, AND LID PAINTED PER TCWD STD. SPEC SECTION 09900.
5. SOME EXISTING VALVES MAY HAVE ACP RISER PIPE, WHEN ENCOUNTERED, THE ACP RISER PIPE SHALL BE REMOVED, ENCAPSULATED, DISPOSED OF PER REGULATIONS, AND REPLACED WITH NEW PVC AS SHOWN HEREON.
6. VALVE BOX MUST BE CONSTRUCTED AS SHOWN HEREON REGARDLESS OF CONSTRUCTION PHASE. NO INTERIM CONDITIONS WILL BE ACCEPTED.
7. DO NOT WRAP VALVES WITH POLYETHYLENE WRAP.

VALVE BOX AND VALVE STEM EXTENSION

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ITEM MATERIAL

- 1 A.W.W.A. 2" SQUARE OPERATING NUT
- 2 A.W.W.A. SOCKET FOR 2" SQUARE OPERATING NUT
- 3 (6) 1/2" DIA. X 3/16" SPACER PLATE
- 4 (1) 1/4" SOLID, ROUND OR SQUARE STEEL BAR STOCK (PINNED COUPLERS ARE NOT ALLOWED, HOLLOW TUBE OR PIPE ARE NOT ALLOWED).

NOTES:

- 1. PROVIDE VALVE STEM EXTENSION WHEN DEPTH TO OPERATING NUT EXCEEDS 72" (FABRICATE EXTENSION TO FIELD MEASUREMENT - SEE NOTE 2).
- 2. TERMINATE EXTENSION 24" TO 30" FROM FINISHED GRADE.
- 3. PROVIDE ADDITIONAL SPACER PLATE(S) WHEN DISTANCE TO BOTTOM SOCKET EXCEEDS 60" BEYOND LOWEST PLATE.

VALVE STEM EXTENSION

VALVE BOX AND VALVE STEM EXTENSION

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APPROVED BY ENGINEERING DEPARTMENT

Lorrie Lausten

LORRIE LAUSTEN, P.E. 67027

DISTRICT ENGINEER

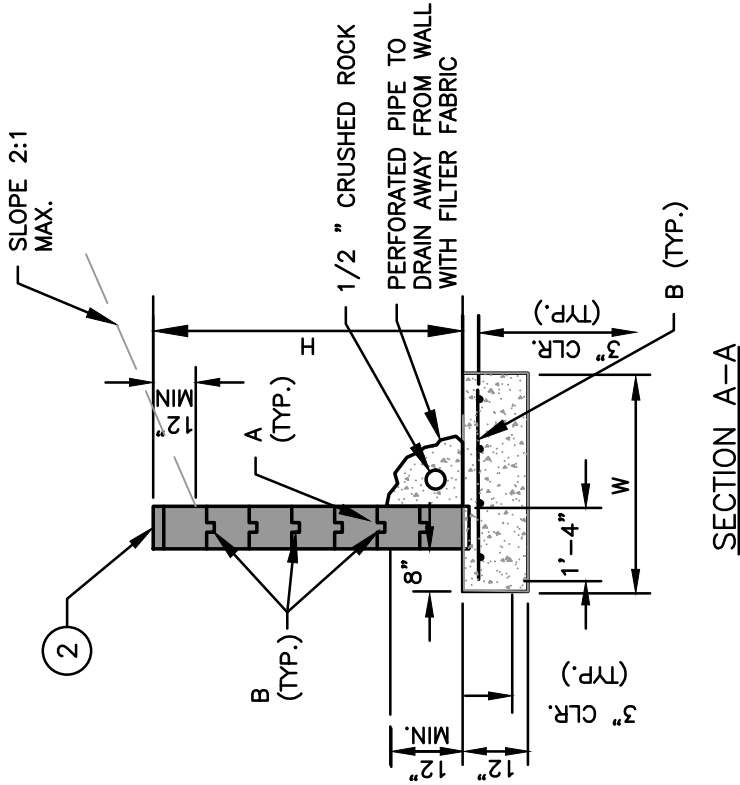
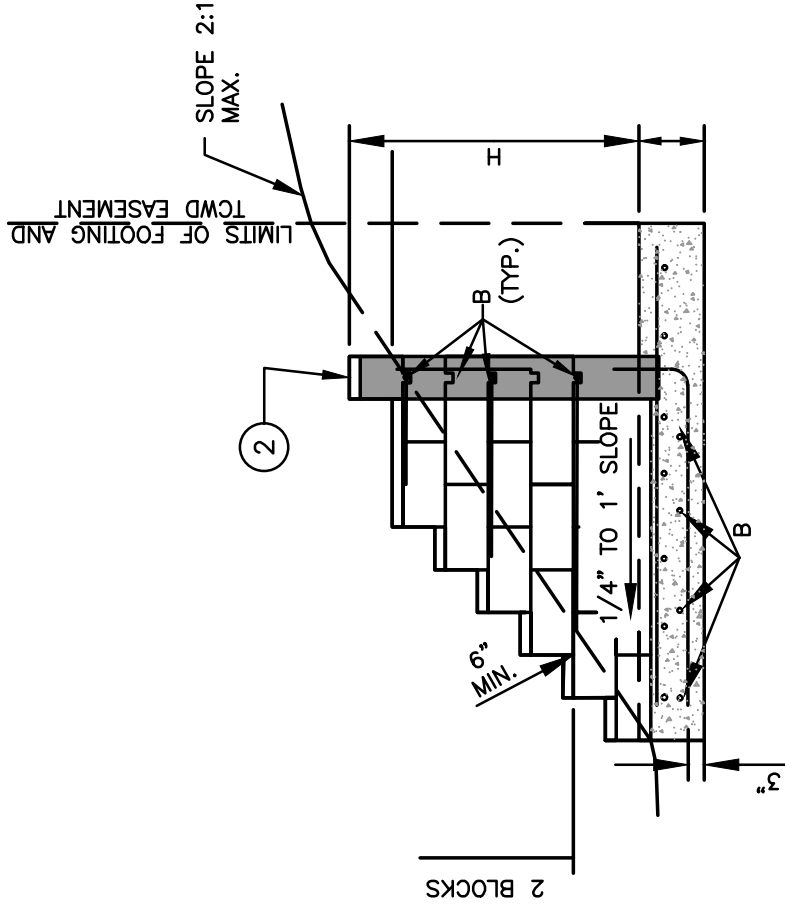
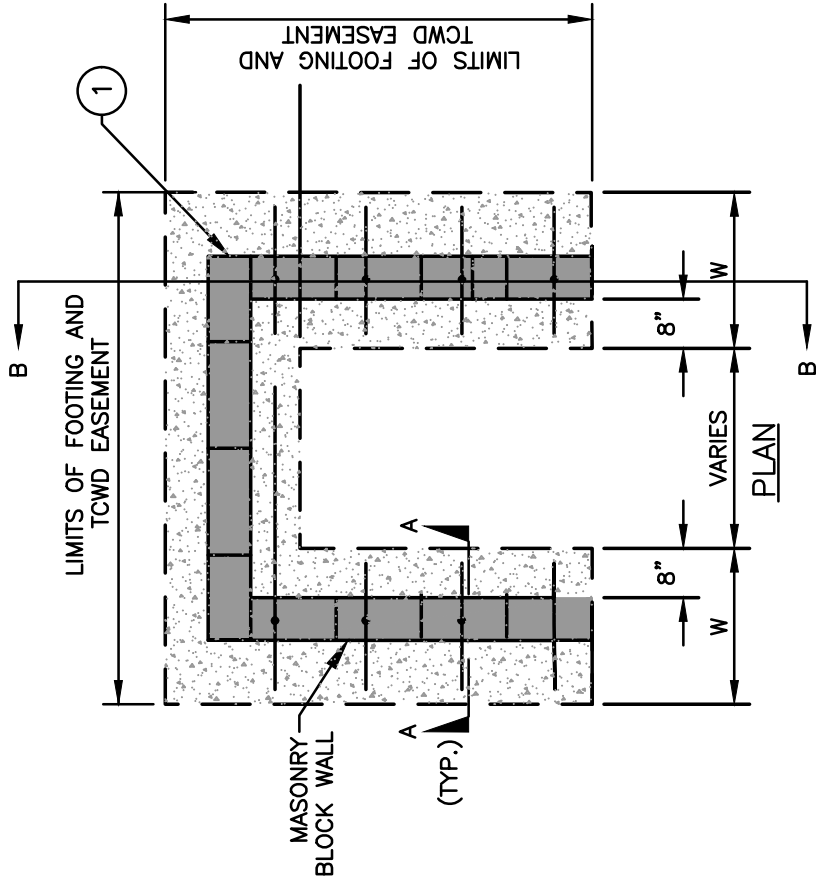
11/21/24

DATE



TCWD
STD.DWG.
W-25

SHEET 2 OF 2



REINFORCEMENT TABLE						
DESIGN H	3'-4"	4'-0"	4'-8"	5'-4"	6'-0"	
DESIGN W	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	
A VERT. REINF.	#4@16"	#4@16"	#5@16"	#6@16"	#6@16"	
B VERT. REINF.	#4@16"	#4@16"	#5@16"	#6@16"	#6@16"	

DESIGN CRITERIA:

1. EQUIVALENT FLUID PRESSURE= 35 PCF (TOE AND HEEL)
2. ALLOWABLE BEARING CAPACITY = 1500 PSF

ITEM	MATERIALS

- 1 — MASONRY BLOCK WALL. SEE NOTE 2.
- 2 — BLOCK CAP. MATCH MASONRY BLOCK WALL STYLE AND COLOR.

NOTES:

1. RETAINING WALL TO BE CONSTRUCTED AROUND ALL TCWD APPURTENANCES WHEN A SLOPE EXISTS AT THE LOCATION OF THE APPURTENANCES. EXAMPLES INCLUDE CLEAN-OUTS, BACKFLOW DEVICES, FIRE HYDRANTS, AIR/VACS, FLUSH-OUTS, METERS, PRV STATIONS, TEST STATIONS, MANHOLES, VAULTS, VALVES AND WHEREVER REQUIRED BY THE DISTRICT.
 - A. CLEARANCE BETWEEN SIDE WALL FACE AND TCWD APPURTENANCE SHALL BE 36" MIN.
 - B. FOR POWERED APPURTENANCES, SUCH AS TRANSFORMERS, REFER TO THE SCE MIN. CLEARANCE REQUIREMENTS.
 - C. SEWER MANHOLES REQUIRE ADDITIONAL WALL LENGTH TO PROVIDE EQUIPMENT ACCESS. MIN. INSIDE LENGTH, FROM WALL FACE TO WALL FACE IS 13'.
2. MASONRY BLOCK SHALL BE 8" X 8" X 16" UNITS CONFORMING TO ASTM C-9D CLASS "S" AND CONCRETE MASONRY ASSOCIATION STANDARDS. BLOCK SHALL BE "SPLIT FACE" BEIGE COLOR FINISH ON ALL EXPOSED FACES. FILL ALL CELLS WITH GROUT.
3. MORTAR AND GROUT SHALL MATCH BLOCKWORK AND BE IN CONFORMANCE WITH TCWD STD. SPECIFICATIONS AND SECTION 202-2 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
4. OMIT MORTAR FROM THE FIRST VERTICAL JOINT OF THE BLOCK COURSE ABOVE FINISH GRADE TO PROVIDE WEEP HOLES FOR SUB-DRAINAGE PURPOSES.
5. CONCRETE SHALL BE CLASS 560-C-3250.
6. WALL CONSTRUCTION SHALL MEET TCWD STD. SPECIFICATIONS.
7. PROVIDE RAILING ON TOP OF WALL WHEN REQUIRED BY OSHA AND APPROPRIATE CODES.
8. PROVIDE WATERPROOFING ON EXTERIOR OF BURIED PORTION OF WALL PER TCWD STD. SPEC. SECTION 03345.
9. ANY WALL HEIGHT GREATER THAN 6' REQUIRE PLANS SIGNED BY R.C.E. AND APPROVED BY DISTRICT.

SECTION B-B

RETAINING WALL

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

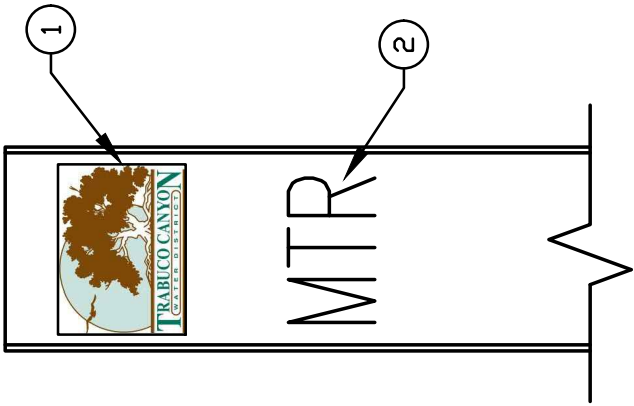
APPROVED BY ENGINEERING DEPARTMENT

Donie Scott

11/21/24

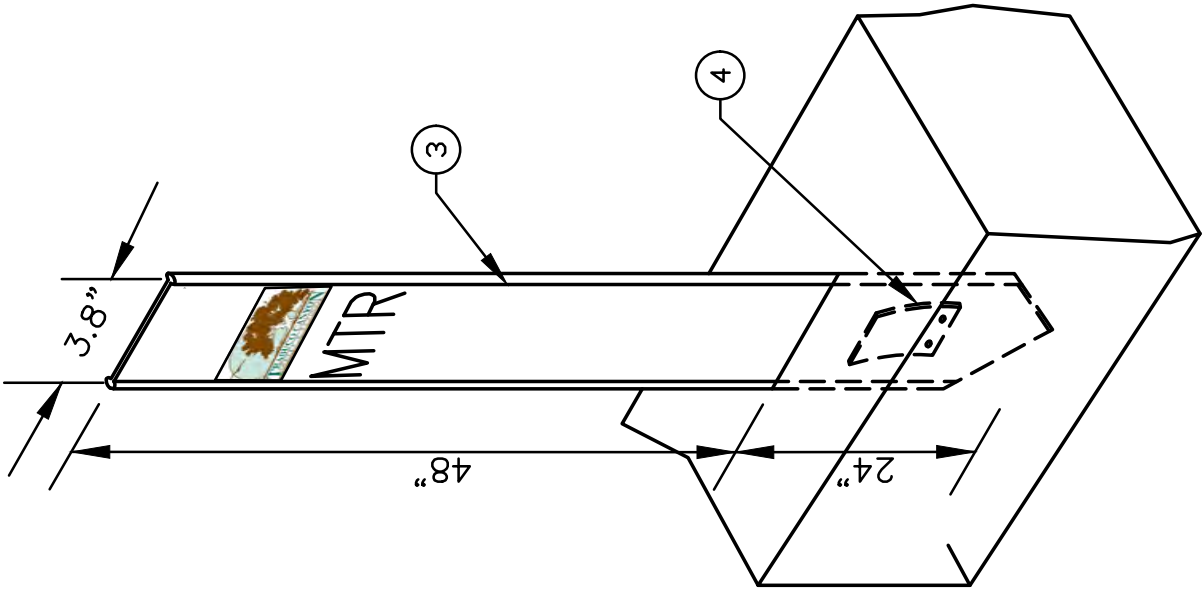
DATE _____

TCWD
STD.DWG.



ABBREVIATIONS

- AVR AIR AND VACUUM RELEASE VALVE
- BO BLOW OFF
- CBL DIRECT BURIED CABLE
- EPB ELECTRICAL PULL BOX
- FO FLUSH-OUT
- IJ INSULATING JOINT
- MH MANHOLE
- MTR METER
- PRV PRESSURE REGULATING VALVE
- SCO SEWER CLEAN OUT
- SWR SEWER MAIN
- TFO TEMPORARY FLUSH-OUT
- TPB TELEMETRY PULL BOX
- TW TEST WELL
- VLT VAULT
- VLV VALVE
- WTR MAIN
- WQS WATER QUALITY SAMPLE STATION



MATERIALS

- 1 TCWD LOGO DECAL 3.25" HIGH X 2.75" WIDE. SEE TCWD FOR EXAMPLE.
- 2 2 OR 3 CHARACTER FACILITY LABEL. YELLOW LETTERS (1" HIGH) ON A CLEAR SELF ADHESIVE (USE ABBREVIATIONS HEREON).
- 3 POST SHALL BE "CARSONITE"
MODEL: CIB-380
MATERIAL: COLORED FIBERGLASS COMPOSITE
WIDTH: 3.8"
LENGTH: 72"
COLOR: BROWN
- 4 SPRING-LOADED STEEL BARB ANCHOR, FACTORY ATTACHED WITH RIVETS.

UTILITY MARKER

NO.	REVISION	
	APPROVED	DATE
1	LL	11/06/24

APPROVED BY ENGINEERING DEPARTMENT
Lorrie Lausten
LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

DATE



TCWD
STD.DWG.
W-27

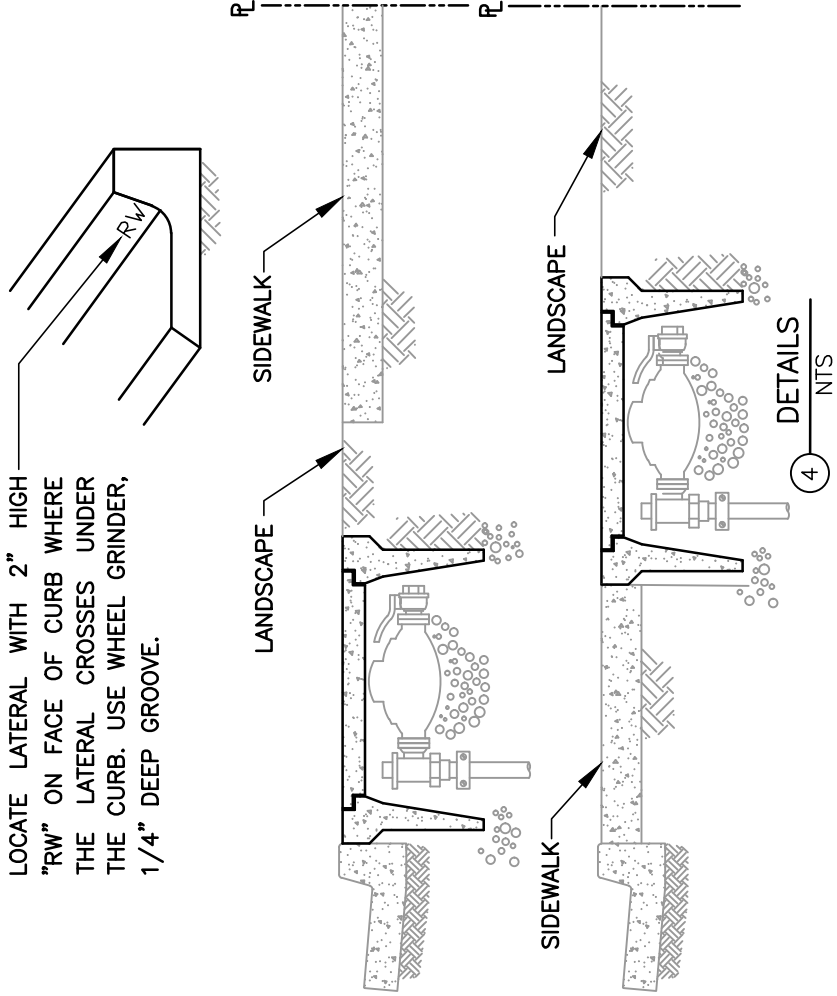
SHEET 1 OF 1

Part 4
Standard Drawings
For
Nondomestic (Recycled) Water Facilities

Recycled Water Standard Drawings

RW-1	1-inch Recycled Water Service with 3/4-inch Meter
RW-2	1-inch Recycled Water Service with 1-inch Meter
RW-3	2-inch Recycled Water Service with 1-1/2-inch Meter
RW-4	2-inch Recycled Water Service with 2-inch Meter
RW-5	3-inch or 4-inch Recycled Water Service Meter Assembly
RW-6	1-inch or 2-inch Recycled Water Air Release & Vacuum Assembly
RW-7	2-inch and Larger Temporary Recycled Water Flush Out Assembly
RW-8	2-inch and Larger Recycled Water Flush Out Assembly
RW-9	Recycled Water Blowoff/Bottom Drain Assembly & Location Plan
RW-10	Recycled Water Main Trench (Typical)
RW-11	Water, Recycled Water and Sewer Pipeline Separation Standard
RW-12	Cut in Tee for Recycled Water - PVC, ACP & Ductile Iron Pipe
RW-13	Recycled Water Valve Box and Valve Extension
RW-14	Recycled Water Utility Marker

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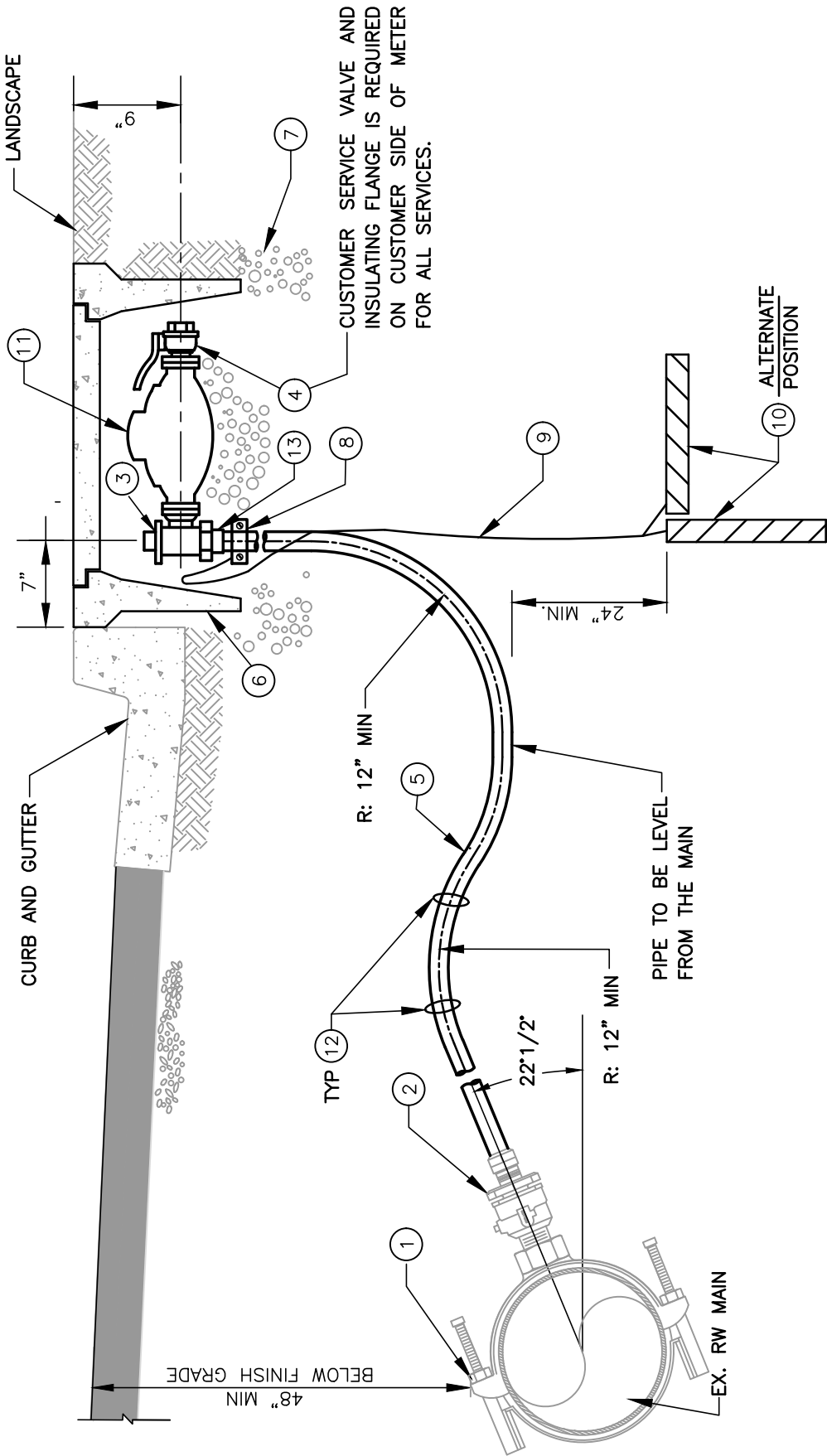
ITEM	MATERIALS
①	1" SERVICE SADDLE PER TCWD STD. W-5.
②	1" BALL CORPORATION STOP PER TCWD STD. W-5.
③	1" x 3/4" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
④	1" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
⑤	1" COPPER SERVICE PIPE TYPE "K" SOFT.
⑥	METER BOX W/READING LID. COMPOSITE PURPLE POLYMER CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1). "TCWD" SHALL BE STAMPED ON INNER LID.
⑦	6" THICK BASE OF 3/4" CRUSHED ROCK.
⑧	WIRE CLAMP (SEE NOTE 8)
⑨	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
⑩	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
⑪	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER). (SEE NOTE 1)
⑫	IDENTIFICATION TAPE TO BE PURPLE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
⑬	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

<u>ZINC ANODE SIZES FOR 1-INCH COPPER SERVICE</u>		
COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 45	1.4×1.4×30	15
45 TO 90	2.0×2.0×30	30

1. METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
2. SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
3. INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
4. SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
5. THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
6. METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
7. NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
8. ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
9. MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.

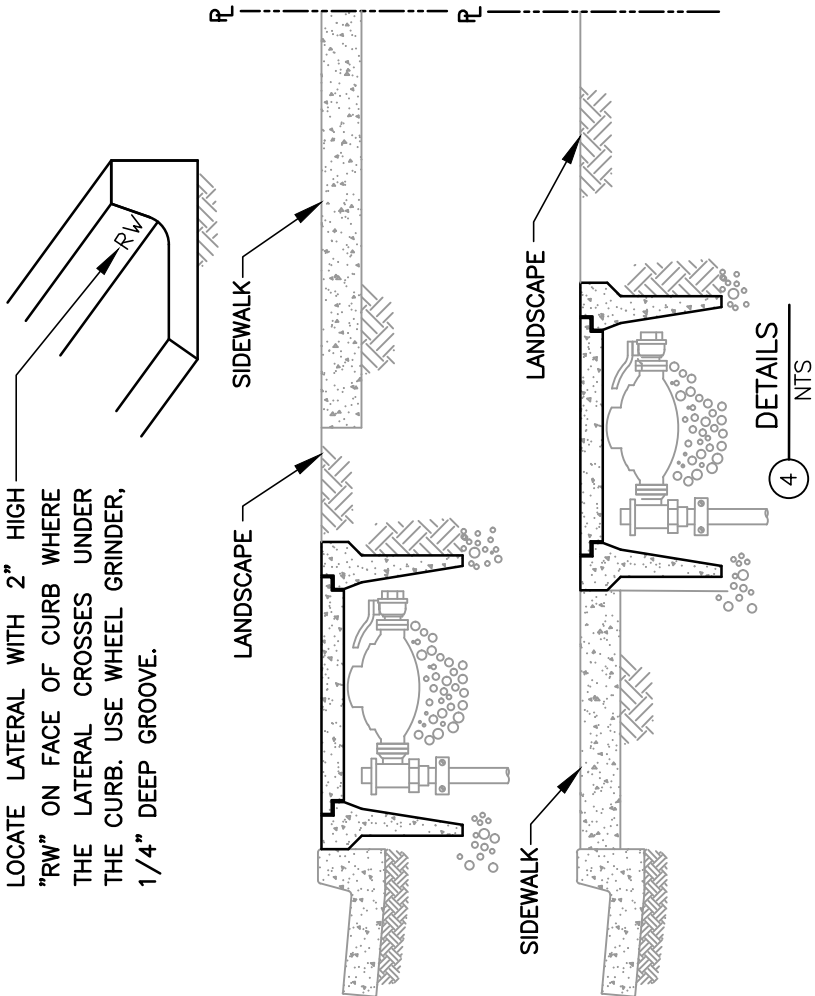
1-INCH RECYCLED WATER SERVICE WITH 3/4-INCH METER

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	
APPROVED BY ENGINEERING DEPARTMENT  11/21/24 DATE LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER			
		TCWD STD.DWG. RW-1	
		SHEET 1 OF 1	



NOTES:

- METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
- SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
- INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
- SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
- NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
- ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
- MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.



ITEM	MATERIALS
①	1" SERVICE SADDLE PER TCWD STD. W-5.
②	1" BALL CORPORATION STOP PER TCWD STD. W-5.
③	1" x 1" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
④	1" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
⑤	1" COPPER SERVICE PIPE TYPE "K" SOFT.
⑥	METER BOX W/READING LID. COMPOSITE POLYMER PURPLE CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1)."TCWD" SHALL BE STAMPED ON INNER LID.
⑦	6" THICK BASE OF 3/4" CRUSHED ROCK.
⑧	WIRE CLAMP (SEE NOTE 8)
⑨	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
⑩	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
⑪	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER), (SEE NOTE 1)
⑫	IDENTIFICATION TAPE TO BE PURPLE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
⑬	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

ZINC ANODE SIZES FOR 1-INCH
COPPER SERVICES

COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 45	1.4×1.4×30	15
45 TO 90	2.0×2.0×30	30

1-INCH RECYCLED WATER SERVICE WITH 1-INCH METER

REVISION		APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. RW-2
NO.	DATE	APPROVED	DATE	
1	11/06/24	L.L.		

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

DATE

SHEET 1 OF 1

LANDSCAPE

6"

7"

7

4

3

11

13

8

9

10

ALTERNATE POSITION

24" MIN.

PIPE TO BE LEVEL FROM THE MAIN

5

12

TYP

1

2

EX. RW MAIN

48" MIN

BELOW FINISH GRADE

CURB AND GUTTER

CUSTOMER SERVICE VALVE AND FLANGE IS REQUIRED ON CURB METER FOR ALL SERVICES.

NOTES:

1. METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE

NOTES:

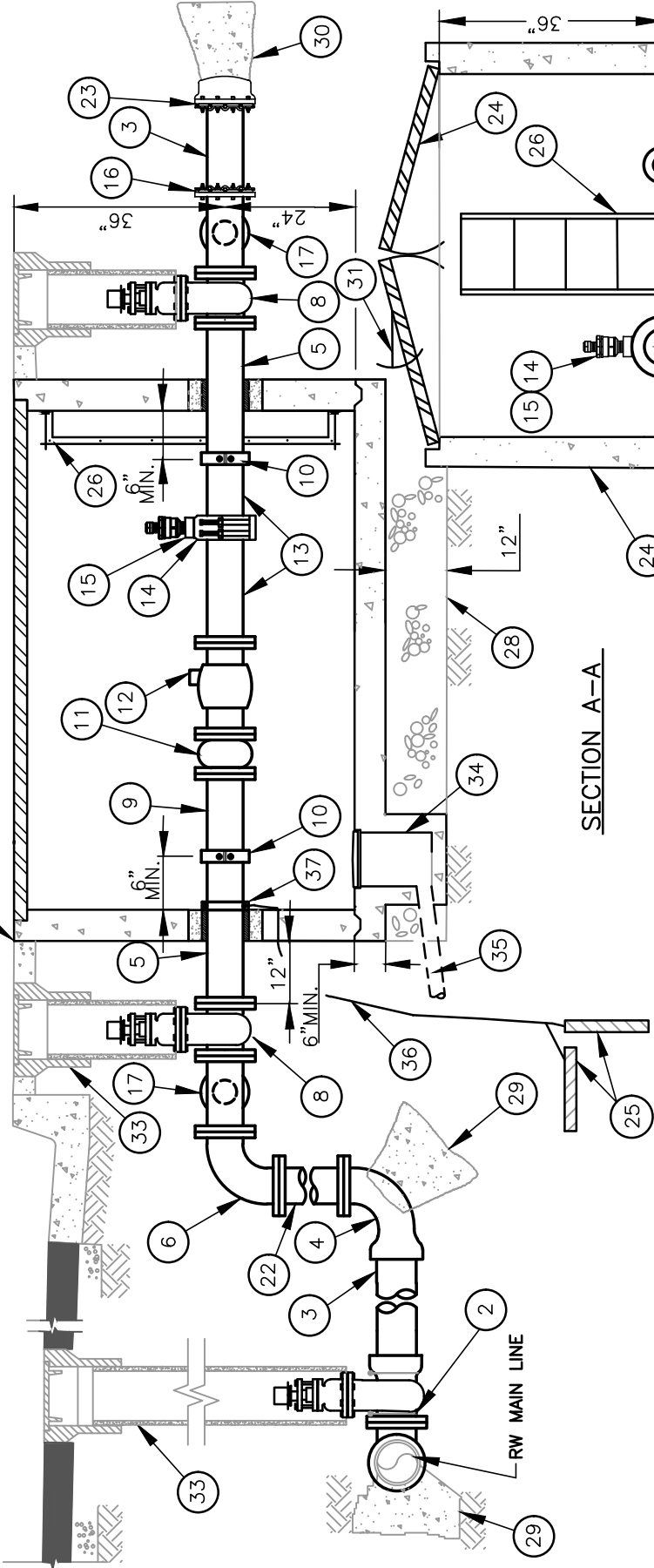
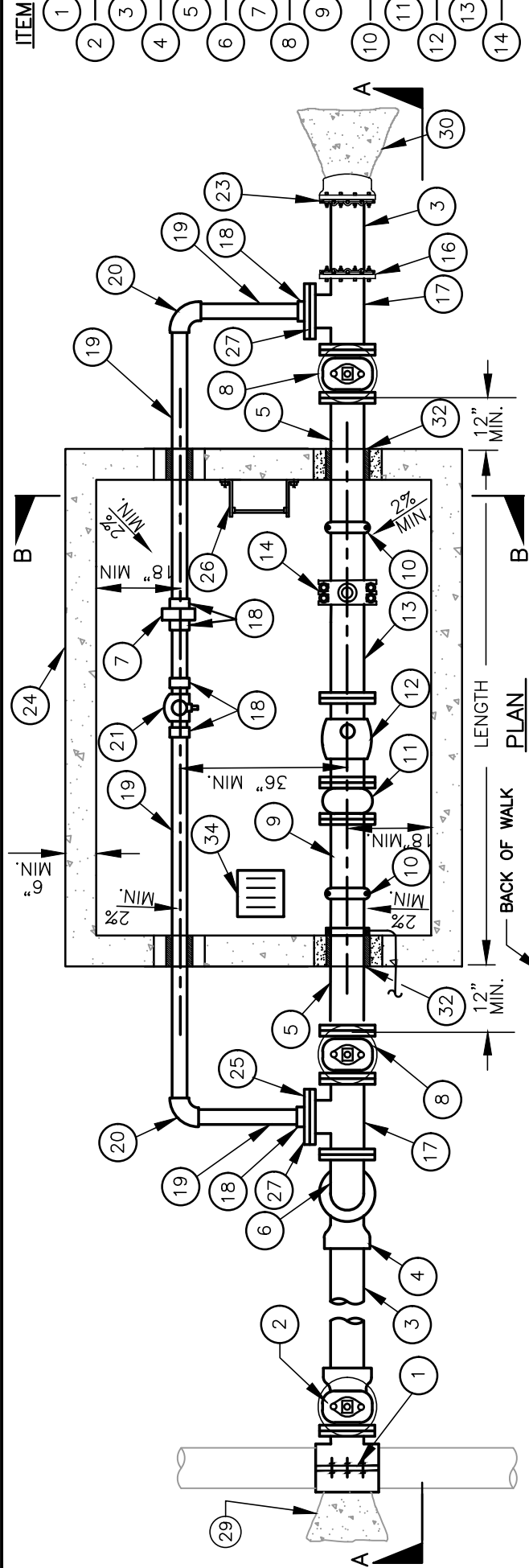
1. METER AND BOX SHALL BE PURCHASED FROM TCWD AND WILL BE INSTALLED BY CUSTOMER.
2. SERVICE CONNECTION SHALL NOT BE MADE WITHIN 18" OF SERVICE, VALVE, COUPLING, JOINT OR FITTING.
3. INSTALL CORPORATION STOP WITH KEY SIDEWAYS IN OPEN POSITION.
4. SET TOP OF METER BOX FLUSH WITH LANDSCAPE AS SHOWN ON DETAIL 4 HEREON.
5. THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
6. METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK. METER SHALL BE CENTERED IN BOX.
7. NO SPLICES WILL BE PERMITTED BETWEEN CORPORATION STOP AND ANGLE METER STOP EXCEPT WHEN SERVICE RUN EXCEEDS 60 FEET, IN WHICH CASE, A SILVER SOLDER COUPLING SHALL BE USED.
8. ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AND SHALL BE TESTED (SEE TABLE FOR ZINC ANODE SIZES HEREON). EACH LATERAL SHALL HAVE A SEPARATE ANODE.
9. MARK LOCATION OF LATERAL ON CURB FACE PER DETAIL HEREON.

<u>ZINC ANODE SIZES FOR 2-INCH COPPER SERVICE</u>		
COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 15	1.4 X 1.4 X 9	5
15 TO 45	1.4 X 1.4 X 30	15
45 TO 90	2.0 X 2.0 X 30	30

ITEM	MATERIALS
①	2" SERVICE SADDLE PER TCWD STD. W-5.
②	2" BALL CORPORATION STOP PER TCWD STD. W-5.
③	2" X 2" ANGLE METER STOP WITH LOCKING WING AND F.I.P.T. INLET CONNECTION.
④	2" CUSTOMER SERVICE INSULATING BALL VALVE, METER NUT X F.I.P.T.
⑤	2" COPPER SERVICE PIPE TYPE "K" SOFT.
⑥	METER BOX W/READING LID. COMPOSITE PURPLE POLYMER CONCRETE BOX AND LID PER TCWD SPECIFICATIONS SECTION 03462 (SEE NOTE 1). "TCWD" SHALL BE STAMPED ON INNER LID.
⑦	6" THICK BASE OF 3/4" CRUSHED ROCK.
⑧	WIRE CLAMP (SEE NOTE 8)
⑨	AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
⑩	ZINC ANODE (FOR SIZE OF ANODE SEE TABLE HEREON) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24" FROM THE COPPER SERVICE.
⑪	METER SHALL BE NEPTUNE T-10 WITH E. CODER (REGISTER), (SEE NOTE 1)
⑫	IDENTIFICATION TAPE TO BE PURPLE PER TCWD STD. SPECIFICATIONS SECTION 15151 TAPE TO COPPER PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.
⑬	WROUGHT COPPER ADAPTER, SWEAT X M.I.P.T.

2-INCH RECYCLED WATER SERVICE WITH 2-INCH METER

		REVISION					
NO.	DATE	APPROVED	DATE				
1	11/06/24	L.L.					
				APPROVED BY ENGINEERING DEPARTMENT  11/21/24 DATE			
				LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER			
						TCWD STD.DWG. RW-4	
				SHEET 1 OF 1			



METER SIZE	STRAINER LENGTH	METER LENGTH	PRECAST VAULT INSIDE DIMENSION LENGTH X WIDTH
3"	7"	12"	7'-0" X 6'-0"
4"	9"	14"	8'-0" X 6'-0"

NOTES:

1. ANODE LEAD WIRE SHALL BE CAD-WELDED TO THE D.I. PIPE, AND SHALL BE TESTED PER SECTION 16640.
2. EASEMENT NOTE: METER INSTALLATION IMPROVEMENTS BEYOND THE CITY / COUNTY RIGHT-OF-WAY REQUIRE AN EASEMENT AS DIRECTED BY TCWD.
3. RETAINING WALL: WHEN RETAINING WALL IS REQUIRED TO ACCOMMODATE GRADE VARIATIONS THE WALL SHALL BE CONSTRUCTED PER TCWD STD. W-25 AND SHOULD PROVIDE PROPER CLEARANCE FROM THE IMPROVEMENTS.
4. 6-INCH THROUGH 10-INCH RECYCLED WATER METER ASSEMBLY SHALL REQUIRE SEPARATE PLAN AND APPROVAL FROM TCWD.

ITEM MATERIALS

- 1—MAIN LINE SIZE X 4" TAPPING SLEEVE (USE MJ X FE TEE IF HOT TAP IS NOT REQUIRED).
- 2—4" RW TAPPING GATE VALVE F.E. X MJ (USE RW GATE VALVE IF HOT TAP IS NOT REQUIRED).
- 3—4" C-900 P.V.C. CLASS 200 PIPE.
- 4—4" 90° D.I. BEND, MJ X F.E.
- 5—3" OR 4" X 26" LONG D.I. SPINDLE. F.E. X G.E.
- 6—4" 90° D.I. BEND, F.E. X F.E.
- 7—2" BRONZE UNION, F.I.P.T. X F.I.P.T.
- 8—3" OR 4" RW GATE VALVE, F.E. X F.E.
- 9—4" X 18" LONG D.I. SPINDLE FOR 4" METER FOR 4" X 12" LONG D.I. SPINDLE OR 4" X 3" D.I. F.E. X F.E. REDUCER FOR 3" METER.
- 10—VICTAULIC COUPLING. HEAVY DUTY STYLE 77 WITH STAINLESS HARDWARE.
- 11—3" OR 4" BRONZE METER STRAINER, F.E. X F.E.
- 12—3" OR 4" METER, WITH E-CODER, REFER TO SECTION 15150
- 13—4" X 19" LONG D.I. SPINDLE, F.E. X G.E. (23" LONG FOR 3" SERVICE).
- 14—2" SERVICE SADDLE WITH DOUBLE STAINLESS STEEL STRAPS NYLON COATED MALEABLE IRON BODY AND 2" F.I.P.T. OUTLET PER TCWD STD. DWG. W-5
- 15—2" INSULATING BRONZE BALL CORPORATION STOP, M.I.P.T. X COMPRESSION PER TCWD STD. DWG. W-5.
- 16—4" F.E. X M.J. ADAPTER WITH RETAINER GLAND.
- 17—3" OR 4" X 4" D.I. TEE F.E. X F.E.
- 18—2" WROUGHT COPPER ADAPTER, M.I.P.T X SLIP.
- 19—2" TYPE "K" RIGID COPPER PIPE. (LENGTH AS REQUIRED)
- 20—2" 90° BEND WROUGHT COPPER, SLIP X SLIP.
- 21—2" TEFLON SEATED BRONZE BALL VALVE WITH LOCKING WING F.I.P.T. X F.I.P.T.
- 22—4" D.I. SPOOL - F.E. X F.E. (LENGTH AS REQUIRED TO MAKE EXACT GRADES).
- 23—4" D.I. END CAP. M.J. WITH RETAINER GLAND (WHERE ON-SITE PIPING IS NOT CONNECTED).
- 24—PRECAST CONCRETE VAULT WITH SPRING-ASSIST OPEN HATCH. PROVIDE DIAMOND PLATE ALUMINUM ACCESS DOORS WITH RECESSED PADLOCK HASP (ON OPPOSITE END OF VAULT FROM LADDER), SEE TABLE FOR SIZE.
- 25—30 POUND ZINC ANODE AND LEAD WIRE ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 24 INCHES FROM THE PIPING.
- 26—LADDER PER CONTRACTOR SHOP DRAWING SUBMITTAL AND SECTION 05120.
- 27—4" X 2" BRONZE COMPANION FLANGE WITH F.I.P.T. OUTLET.
- 28—12" OF 3/4" CRUSHED ROCK BASE.
- 29—THRUST BLOCK SIZED PER TCWD STD. DWG. W-19 (TYP.).
- 30—THRUST BLOCK PER TCWD STD. DWG. W-19 (WHERE ON-SITE PIPING IS NOT CONNECTED). REMOVE FOR PERMANENT CONNECTION.
- 31—6" X 12" HINGED PURPLE READING LID OVER METER REGISTER.
- 32—1" SPONGE RUBBER JOINT SEAL AROUND PIPE. DRY PACK NON-SHRINK CONCRETE MORTAR TO SEAL OPENING.
- 33—VALVE BOX, PER TCWD STD. DWG. RW-13.
- 34—12" X 12" X 18" RECESSED SUMP WITH 1" THICK FIBERGLASS GRATE INLET.
- 35—4" SCHEDULE 80 PVC DRAIN PIPE. CONNECT TO DRAINAGE SYSTEM ACCEPTABLE TO TCWD.
- 36—ANODE LEAD WIRE PROVIDE 1/2" DIAMETER CORE DRILL VAULT AS SHOWN. CLAMP WIRE TO BY-PASS PIPE (LENGTH AS REQUIRED), SEAL CORE WITH SILICONE SEALANT.
- 37—CAD-WELD ANODE WIRE TO D.I. PIPE.

3-INCH OR 4-INCH RECYCLED WATER METER ASSEMBLY

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	



TCWD
STD.DWG.

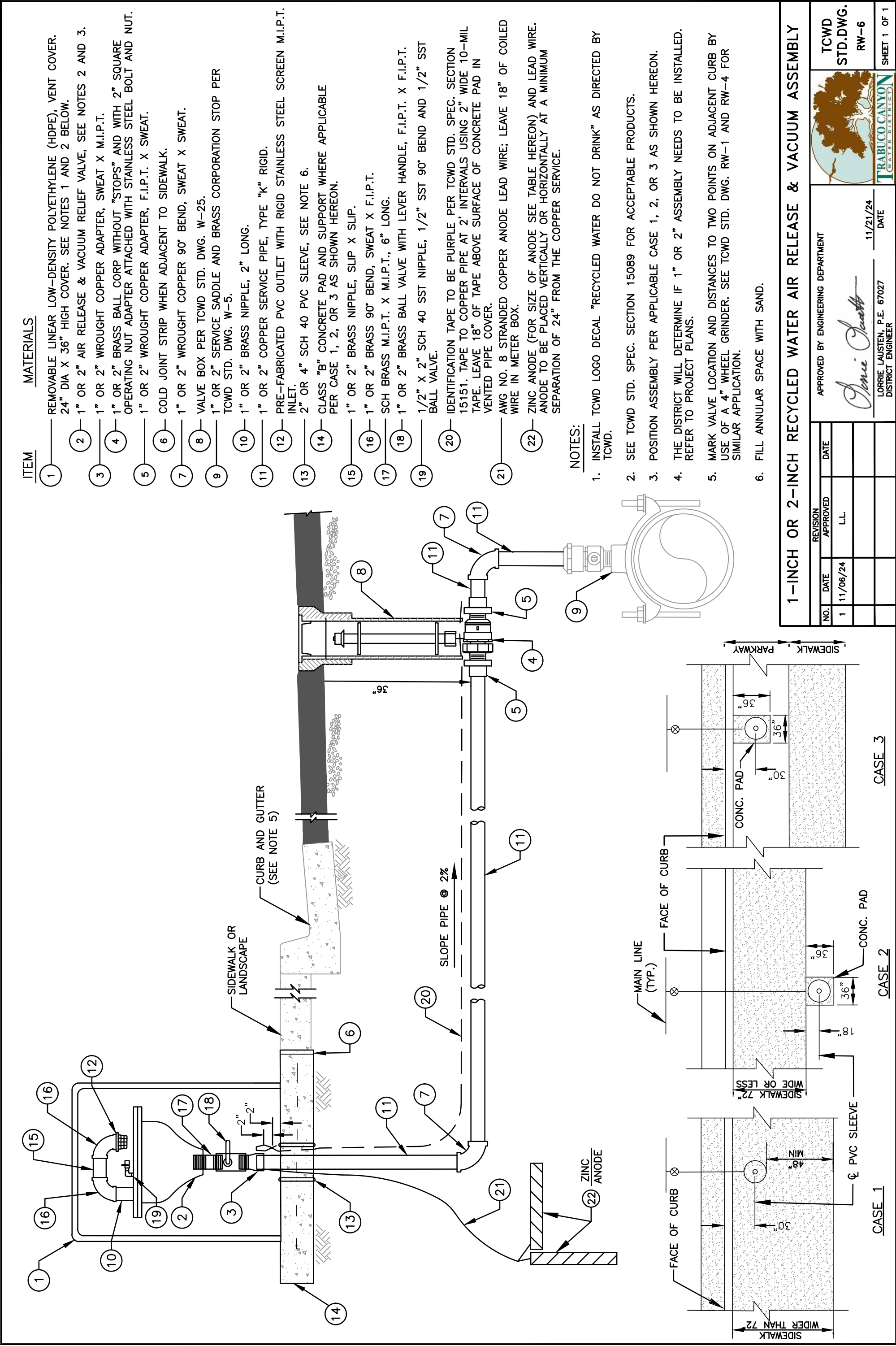
RW-5

SHEET 1 OF 1

Donie Jacob

11/21/24
DATE

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

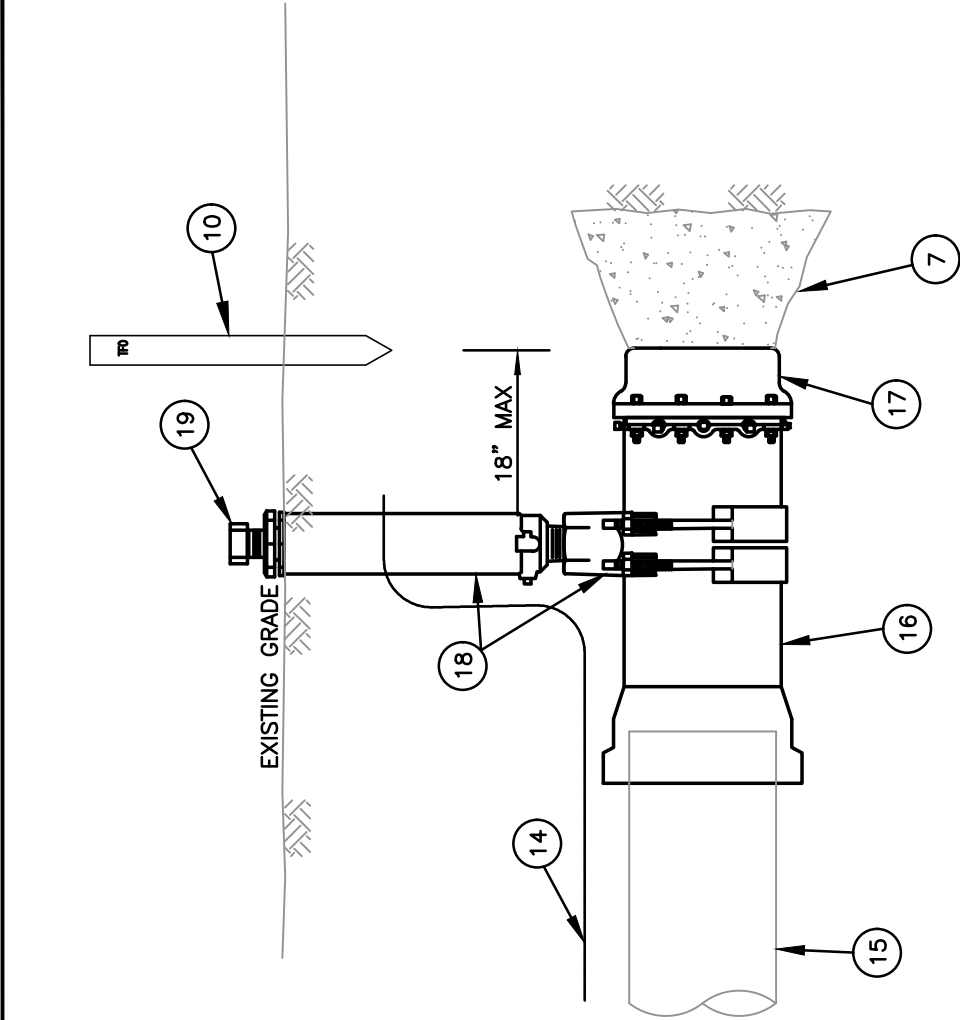


ITEM	MATERIALS

- NOTES:

1. WHERE MAIN LINE PIPE MATERIAL (4) IS STEEL, USE OF STEEL FITTINGS FOR (5) (6) (9) AND (13) IS PERMITTED.
2. TEMPORARY FLUSH-OUT ASSEMBLY MAY BE REQUIRED AT ALL RECYCLED WATER DEAD END LINES.

DIP SIZE	
MAIN SIZE (INCH)	OUTLET
4" - 16"	4"
18" - 24"	6"



TEMPORARY FLUSH OUT ASSEMBLY FOR RECYCLED WATER MAINS (SIZES VARIES)

ITEM	MATERIALS

- 15—C-900 P.V.C. DR 14 (SIZE PER PLAN) PIPE.
- 16—P.V.C. PIPE DR 14 PIPE. (SIZE PER PLAN) SHORT PIECE (18" TO 24" LONG) WITH BELL END.
- 17—M.J. END CAP P.O. (SIZE PER PLAN).
- 18—2" SERVICE SADDLE AND BRONZE CORP STOP PER TCWD STD. DWG. W-5.
- 19—2" BRONZE CAP, F.I.P.T.

NOTES:

1. TEMPORARY FLUSH-OUT ASSEMBLY MAYBE REQUIRED AT ALL RECYCLED WATER DEAD END LINES.
2. FOR FILLING OF NEW MAIN LINES, USE BACKFLOW DEVICE (CERTIFIED ANNUALLY). BACKFLOW DEVICE MUST BE DISINFECTED PRIOR TO USE AND PLACED 18" MIN. ABOVE FINISHED SURFACE.

TEMPORARY FLUSH OUT ASSEMBLY FOR RECYCLED WATER MAINS (SIZE VARIES)			
NO.	REVISION		DATE
	DATE	APPROVED	
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

Lorrie Lausten

11/21/24

DATE

LORRIE LAUSTEN, P.E. 67027

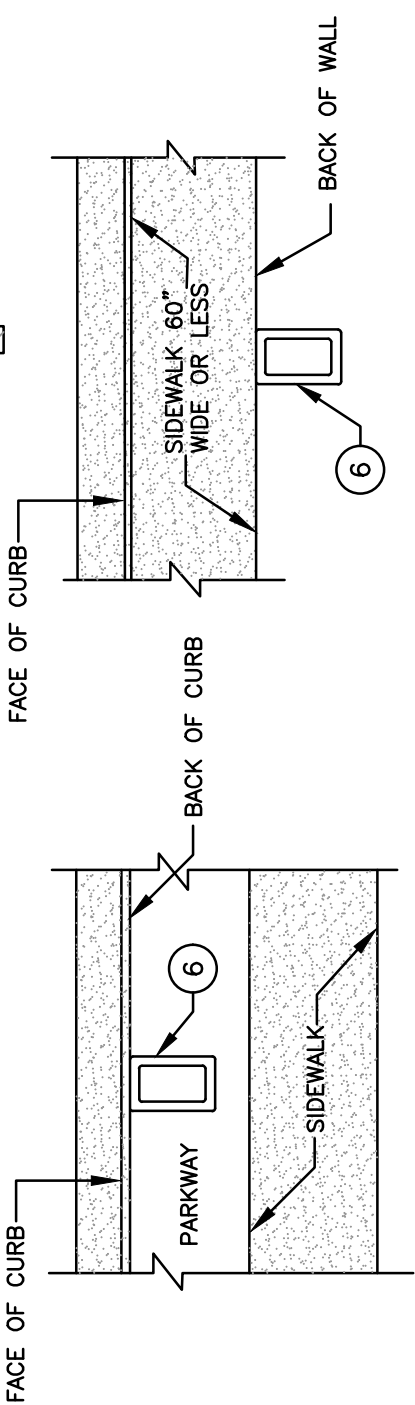
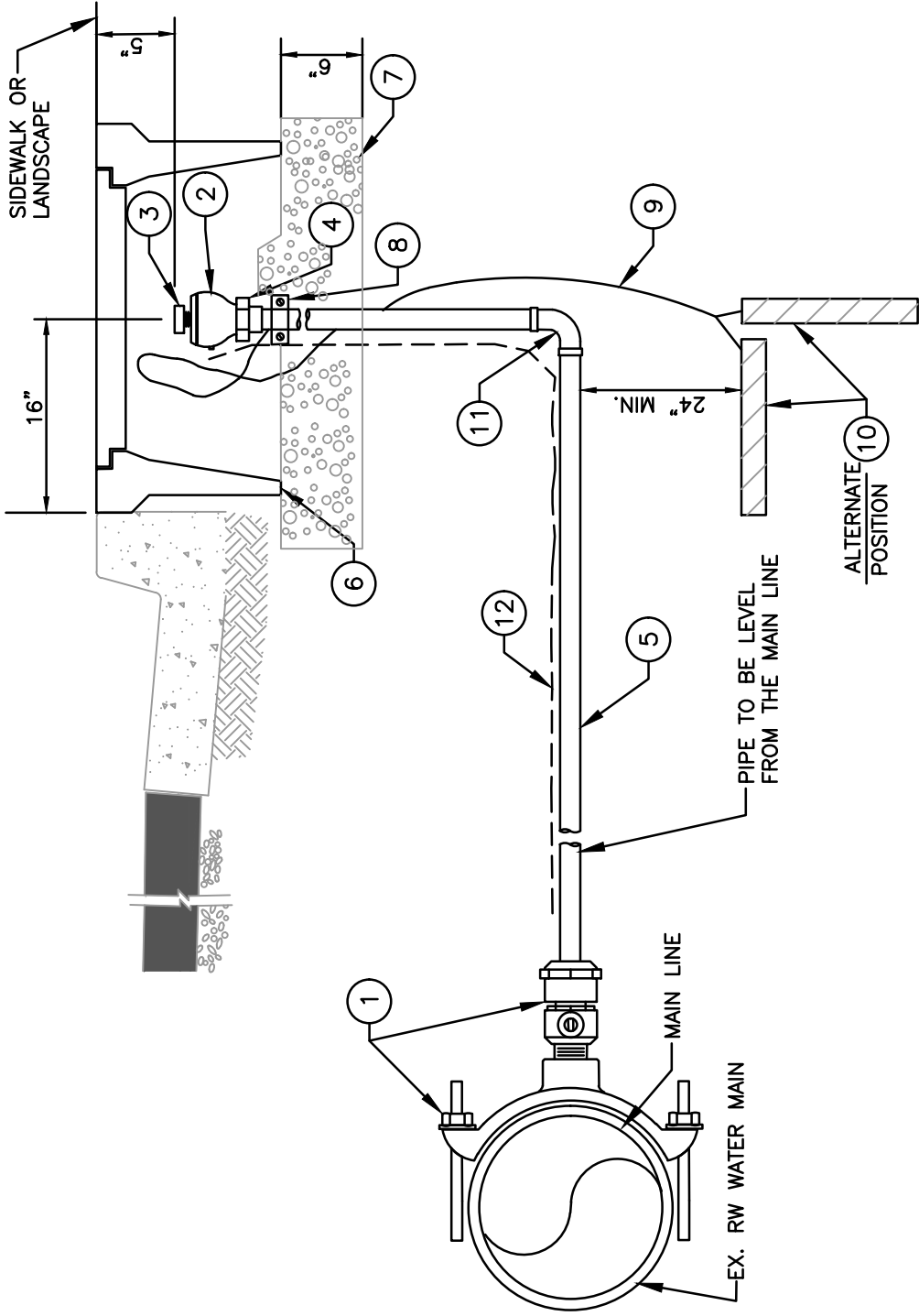
DISTRICT ENGINEER

TCWD
STD.DWG.
RW-7



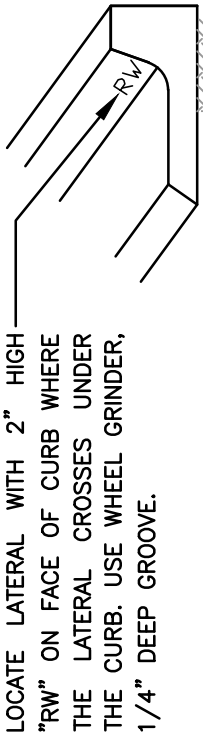
TRABUCO CANYON
(WATER DIST.)

SHEET 1 OF 1



NOTES:

- SERVICE CONNECTION SHALL BE INSTALLED 18" FROM END OF MAIN LINE.
- SET TOP OF METER BOX FLUSH WITH SIDEWALK OR CURB AS SHOWN.
- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK.
- ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT CURIAL TYPE OF RD BRASS WITH STAINLESS STEEL SCREWS AND SHALL BE TESTED PER TCWD. STD. SPEC. SECTION 16640. (SEE TABLE THEREON FOR ZINC ANODE SIZES)
- SEE SHEET 2 FOR 4-INCH AND LARGER RECYCLED WATER FLUSH-OUT ASSEMBLY.



COPPER PIPE LENGTH (FEET)	ZINC ANODE SIZE (INCHES)	ZINC ANODE WEIGHT (LBS)
0 TO 22	1.4 X 1.4 X 30	15
22 TO 45	2.0 X 2.0 X 30	30
45 TO 70	2.0 X 2.0 X 48	40
70 TO 90	2.0 X 2.0 X 60	60

ITEM

MATERIALS

- 2" SERVICE CONNECTION PER TCWD STD. DWG. RW-4.
- 2" BRASS BALL CORPORATION STOP M.I.P.T. X M.I.P.T. (NORMALLY CLOSED) WITH 2" SQUARE OPERATING NUT ADAPTER ATTACHED WITH STAINLESS STEEL BOLT AND NUT.
- 2" SCH 80 P.V.C. CAP, F.I.P.T.
- 2" COPPER SWEAT X F.I.P.T. ADAPTER
- 2" COPPER SERVICE PIPE TYPE "K" SOFT
- METER BOX ONE PIECE LID, COMPOSITE PURPLE POLYMER CONCRETE BOX AND LID PER TCWD. SPEC. SECTION 03462.
- 6" THICK BASE OF 3/4" CRUSHED ROCK.
- WIRE CLAMP (SEE NOTE 5)
- AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE; LEAVE 18" OF COILED WIRE IN METER BOX.
- ZINC ANODE (SEE TABLE HEREON FOR SIZE OF ANODE) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MIN. SEPARATION OF 24" FROM THE COPPER SERVICE.
- 2" WROUGHT COPPER 90° BEND, SWEAT X SWEAT.
- IDENTIFICATION TAPE TO BE PURPLE PER TCWD STD. SPEC. SECTION 15151. TAPE TO PIPE AT 2' INTERVALS USING 2" WIDE 10-MIL TAPE.

2-INCH RECYCLED FLUSH-OUT ASSEMBLY

REVISION			APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE	
1	11/06/24	L.L.		

Janie Jacob

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

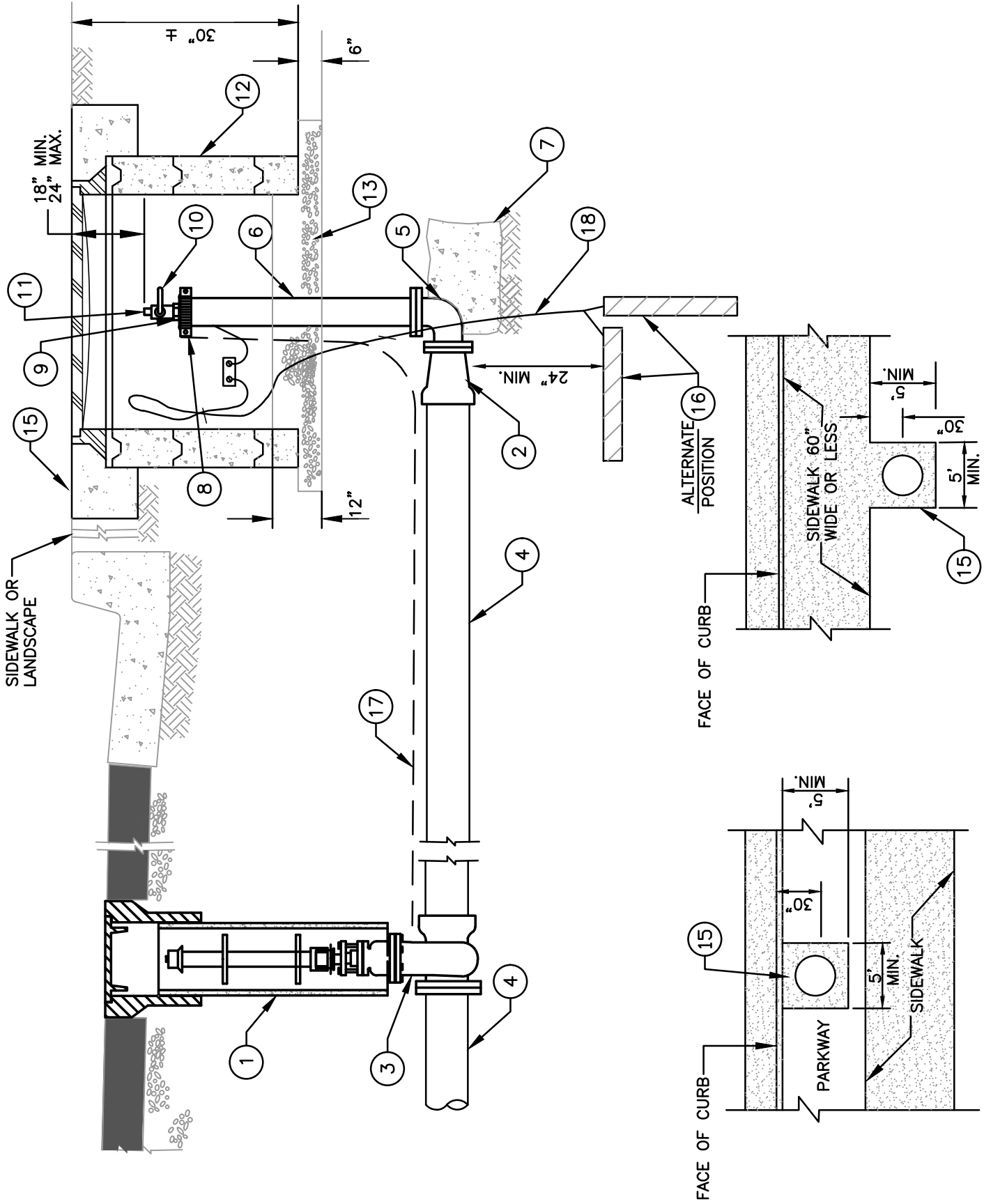
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RW-8

SHEET 1 OF 2



CONDITION 1

FLUSH-OUT ASSEMBLY LOCATION PLANS

NOTES:

- FLUSH-OUT ASSEMBLIES SHALL BE INSTALLED ON RECYCLED WATER DEAD END PIPE.
- MANHOLE SHALL BE WITHIN A DEDICATED TCWD EASEMENT OR PUBLIC RIGHT-OF-WAY.
- PAINT EXPOSED RISER PIPING PER TCWD SPEC. SECTION 09900.
- WHERE MAIN LINE PIPE MATERIAL IS STEEL, USE FOR STEEL FITTINGS FOR 2 5 6 AND 8 IS IN LIEU OF DUCTILE IRON PIPE FITTING.
- WHERE VAULTS OR MANHOLE FRAMES ARE OFFSET FROM CURB OR SIDEWALK, OR PLACED IN PARKWAYS, SET 2" ABOVE FINISHED SURFACE (EXPECT WHEN FULLY OR PARTIALLY PLACED IN SIDEWALK).
- SEE SHEET 1 FOR 2-INCH RECYCLED WATER FLUSH-OUT ASSEMBLY.

CONDITION 2

MAIN	OUTLET
4" – 6"	SEE NOTE 4
8" – 16"	4"
18" – 24"	6"
30"	8"
36" – 48"	12"

MATERIALS

- VALVE BOX AND VALVE STEM EXTENSION PER TCWD STD. DWG. RW-13.
- D.I. CONCENTRIC REDUCER, P.O. X F.E. (WHERE REQUIRED)
- GATE VALVE, F.E. X P.O. (SIZE PER PLAN)
- C-900 P.V.C. DR 14 PIPE, SEE NOTE 4.
- D.I. 90° BEND, F.E. X F.E.
- D.I. (SIZE ACCORDING TO CHART) F.E. X F.E. SPOOL (LENGTH AS REQUIRED).
- THRUST BLOCK PER TCWD STD. DWG. W-19. (USE ONLY IF VALVE IS NOT BOLTED TO A FITTING)
- D.I. COMPANION FLANGE. (MAIN LINE SIZE X 2" POST)
- 2" STAINLESS STEEL CLOSE NIPPLE M.I.P.T., THREADED BOTH ENDS.
- 2" STAINLESS STEEL BALL VALVE PER TCWD STD. SPEC. SECTION 15100.
- 2" THREADED STAINLESS STEEL PLUG.
- 30" MANHOLE WITH FRAME AND COVER WITH GRADE RINGS PER TCWD STD. DWG. S-1, WITH COVER MARKED "TCWD RECLAIMED WATER" IN LIEU OF "SEWER". FOR 16" OUTLET, CHANGE TO 4'x4' VAULT.
- 6" BASE OF 3/4" CRUSHED ROCK. (EXTEND BEDDING 6" INTO VAULT)
- NOT USED.
- 5' X 5' CONCRETE PAD 6" THICK WITH W.W.F. 1.6 X 1.6. FOR 4' X 4' VAULT USE 7' X 7' PAD.
- ZINC ANODE (60 LB.) AND LEAD WIRE. ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MIN. SEPARATION OF 24" FROM THE PIPE.
- IDENTIFICATION TAPE TO BE PURPLE PER TCWD STD. SPEC. SECTION 15151. TAPE TO PIPE AT 2' INTERVALS USING 2" WIDE 10- MIL TAPE.
- AWG NO. 8 STRANDED COPPER ANODE LEAD WIRE, PROVIDE AND CONNECT TO SHUNT, LEAVE 36" OF COILED WIRE BEFORE SHUNT IN VAULT. ALUMINO-THERMIC WELD PER TCWD STD SPEC. SECTION 16640.

4-INCH AND LARGER RECYCLED WATER FLUSH-OUT ASSEMBLY

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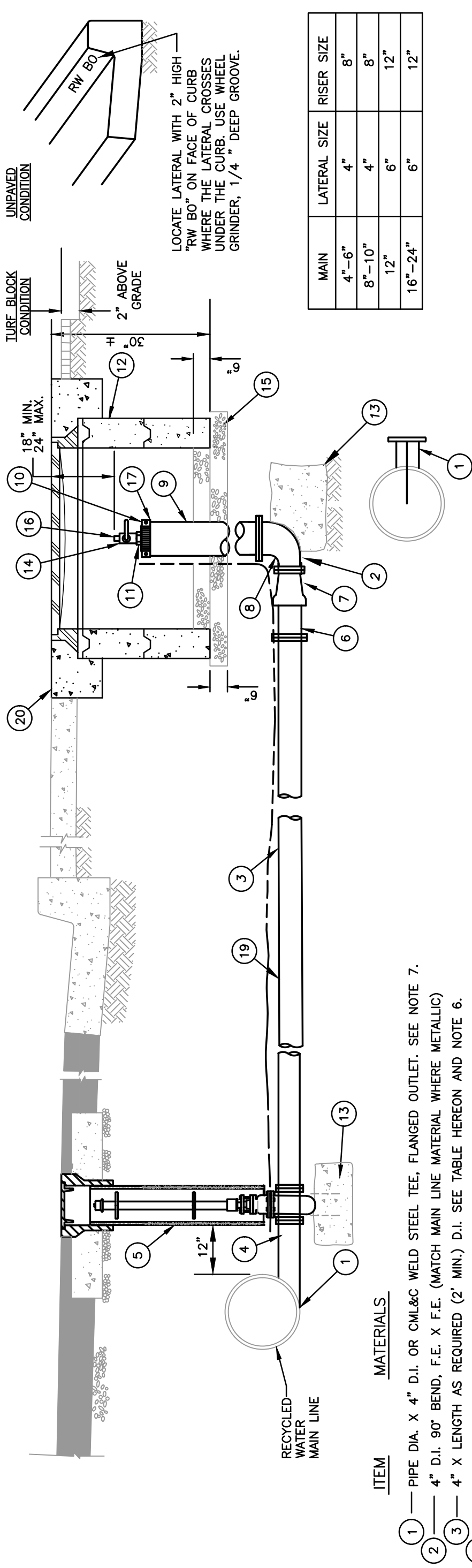


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RW-8

SHEET 2 OF 2

APPROVED BY ENGINEERING DEPARTMENT
Lorrie Lausten
LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER
11/21/24
DATE



NOTES:

1. IN UNPAVED AREAS TOP OF MANHOLE SHALL BE RAISED TO MINIMUM 2" ABOVE FINISHED GRADE.
2. ONE VALVE REQUIRED FOR MAIN LINES LESS THAN 24 INCHES IN DIAMETER, TWO VALVES ARE REQUIRED FOR MAIN LINES LESS THAN 24" IN DIA., VALVE SHALL BE INSTALLED 12" FROM OUTLET FLANGE AS SHOWN ABOVE.
3. MANHOLE FRAME AND COVER, GRADE RING AND SHAFT BE LOCATED BEYOND THE SIDEWALK.
4. INSTALL PIPE WITH ZERO SLOPE (LEVEL).
5. BLOWOFF ASSEMBLY PIPING MATERIALS SHALL MATCH THE TYPE OF MAIN LINE PIPING MATERIAL IF MAIN LINE IS PVC, THEN USE DUCTILE IRON.
6. SEE DETAIL HEREON FOR DIP CONNECTION TO PVC OR DIP MAIN LINE DETAIL.
7. SEE SHEET 2 OF 2 FOR BLOWOFF/BOTTOM DRAIN LOCATION PLANS.
8. PAINT EXPOSED RISER PIPE PER TCWD STD. SPEC SECTION 09900.
9. ALL JOINTS SHALL BE BONDED PER TCWD STD. SPEC SECTION 15051.
10. AT NO POINT SHALL ANY PART OF THE BLOWOFF ASSEMBLY BE CLOSER THAN 36" AWAY FROM ANY STRUCTURE OR LANDSCAPE.

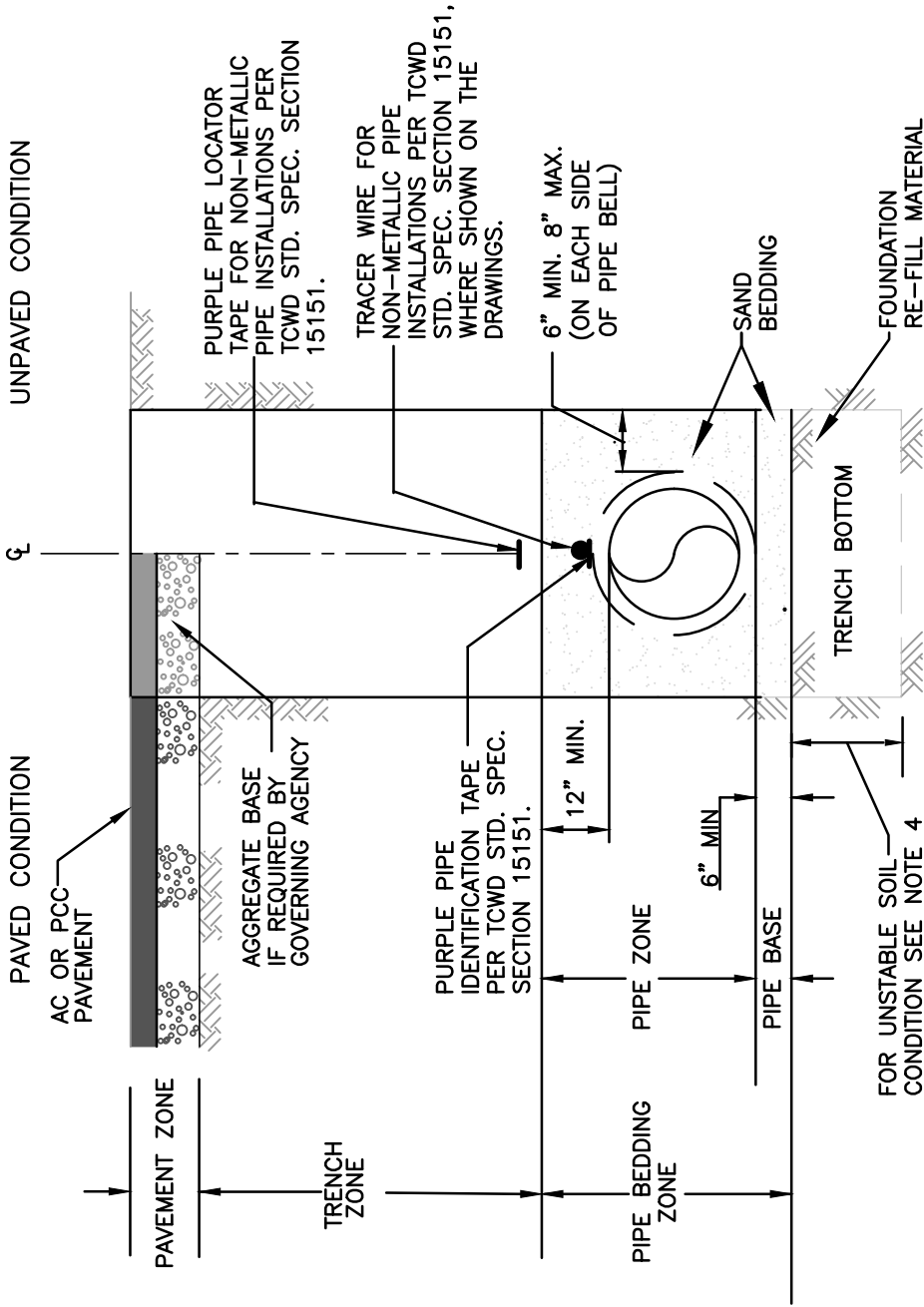
RECYCLED WATER BLOWOFF / BOTTOM DRAIN ASSEMBLY

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NO.	DATE	APPROVED	DATE
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STD.DWG.

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SHEET 1 OF 2



NOTES:

1. ALL WORK SHALL BE PER TCWD STD. SPEC. SECTION 02223 AND CITY/COUNTY PERMIT REQUIREMENTS.
2. PIPE BASE SHALL BE A MINIMUM OF 6" IN DEPTH. PIPE BEDDING MATERIAL SHALL BE PER TCWD STD. SPEC. SECTION 02223 AND SHALL INCLUDE BOTH PIPE BASE AND PIPE BEDDING ZONE.
3. CONTRACTOR SHALL PROVIDE HAND EXCAVATED "BELL HOLE" FOR EACH PIPE JOINT SO THAT THE WEIGHT OF PIPE DOES NOT BEAR ON THE BELL. CONTRACTOR SHALL RE-FILL AND HAND-TAMP EACH "BELL HOLE" PRIOR TO COMPLETING THE PLACEMENT OF PIPE BEDDING.
4. IF UNSTABLE SOIL IS ENCOUNTERED, THE DISTRICT REPRESENTATIVE SHALL DETERMINE OVEREXCAVATION DEPTH AND FOUNDATION RE-FILL MATERIAL PER TCWD STD. SPEC SECTION 02223.
5. WHERE CONTRACTOR FAILS TO MAINTAIN PROPER TRENCH WIDTH LIMITS, SPECIAL BACKFILL SUCH AS ONE-SACK SLURRY AND BEDDING SHALL BE USED AS DETERMINED IN THE FIELD BY THE DISTRICT REPRESENTATIVE.
6. PIPE IDENTIFICATION TAPE SHALL BE PURPLE AND INSTALLED PER TCWD STD. SPEC. SECTION 15151. TAPE SHALL BE FASTENED TO THE PIPE WITH 2" WIDE 10 MIL PIPE WRAP TAPE AT 5' INTERVALS. PIPE WRAP TAPE SHALL BE WRAPPED AROUND THE ENTIRE CIRCUMFERENCE OF THE PIPE.
7. THE MIN DEPTH OF COVER FROM FINISH GRADE TO THE TOP OF THE PIPELINE SHALL BE AS FOLLOWS UNLESS OTHERWISE APPROVED BY THE DISTRICT ENGINEER:
RECYCLED WATER PIPELINE (ALL DIA.) = 60"

RECYCLED WATER MAIN TRENCH

REVISION				APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. RW-10	SHEET 1 OF 1
NO.	DATE	APPROVED	DATE				
1	11/06/24	L.L.					
							
				LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER	11/21/24		
					DATE		

BASIC SEPARATION STANDARDS

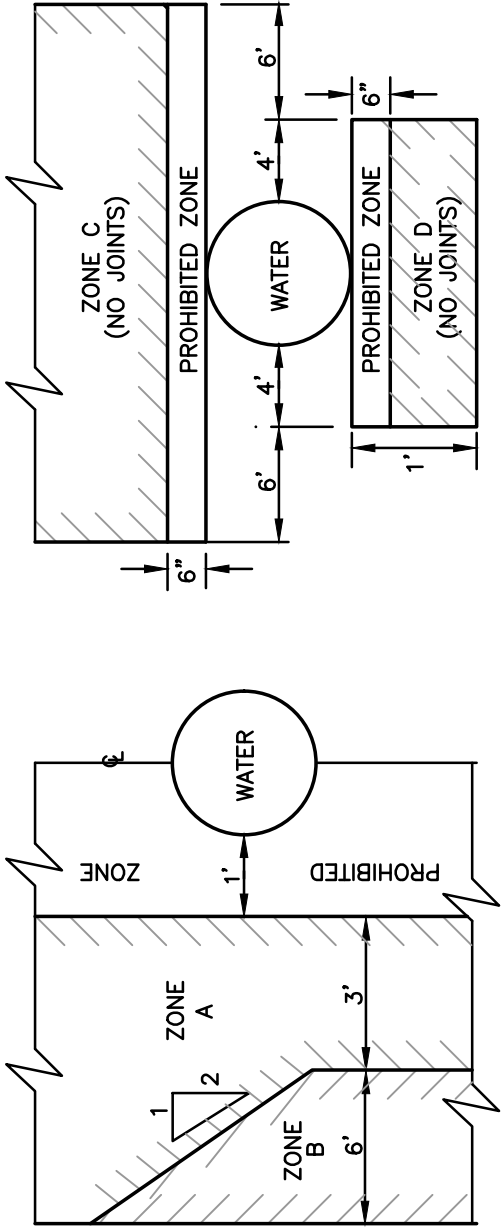
- 1. PARALLEL CONSTRUCTION: THE HORIZONTAL DISTANCE BETWEEN DOMESTIC WATER AND RECYCLED WATER LINES AND SEWER LINES SHALL BE AT LEAST 10 FEET, OUTSIDE OF PIPE TO OUTSIDE OF PIPE.
- 2. PERPENDICULAR CONSTRUCTION (CROSSING): WATER LINES SHALL BE AT LEAST ONE FOOT ABOVE SEWER AND RECYCLED WATER LINES WHERE THESE LINES MUST CROSS.
- 3. SPECIAL PROVISIONS: WHERE THE BASIC SEPARATION STANDARDS CANNOT BE ATTAINED ALTERNATIVE CONSTRUCTION CRITERIA ARE SHOWN BELOW:

GENERAL NOTES

- 1. NO PIPE JOINTS SHALL BE PERMITTED WITHIN ZONE D.
- 2. NO JOINTS ARE PREFERRED WITHIN ZONE C. IF THAT CANNOT BE ACCOMPLISHED, THE NEW LINE SHALL BE ENCASED IN CONCRETE FOR THE FULL LENGTH OF ZONE C.
- 3. SEWER FORCE MAINS SHALL NOT BE PERMITTED IN ZONES A THROUGH D.
- 4. THE MATERIALS OF NEW LINES AT CROSSINGS SHALL BE CONSISTENT WITH OTHER NEW MATERIALS, I.E., STEEL ON A STEEL LINE.
- 5. THESE CONSTRUCTION CRITERIA APPLY TO SEWER LATERALS THAT CROSS ABOVE A WATER LINE, BUT NOT TO THOSE THAT CROSS BELOW A WATER LINE.

SITUATION:

LOCATION OF NEW SEWER & RECLAIMED WATER LINES TO EXISTING DOMESTIC WATER LINE.



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY SEWER OR RECYCLED WATER PIPELINES ARE TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

ZONE SEWER

- A DO NOT LOCATE ANY PARALLEL SEWER OR RECYCLED WATER LINES IN THIS AREA WITHOUT STATE WATER RESOURCES CONTROL BOARD APPROVAL.

- B USE VCP, DR14 PVC – AWWA C-900 OR DIP WITH COMPRESSION JOINTS.

- C USE DR 14 PVC – AWWA C-900

- D USE DR 14 PVC – AWWA C-900

RECYCLED WATER

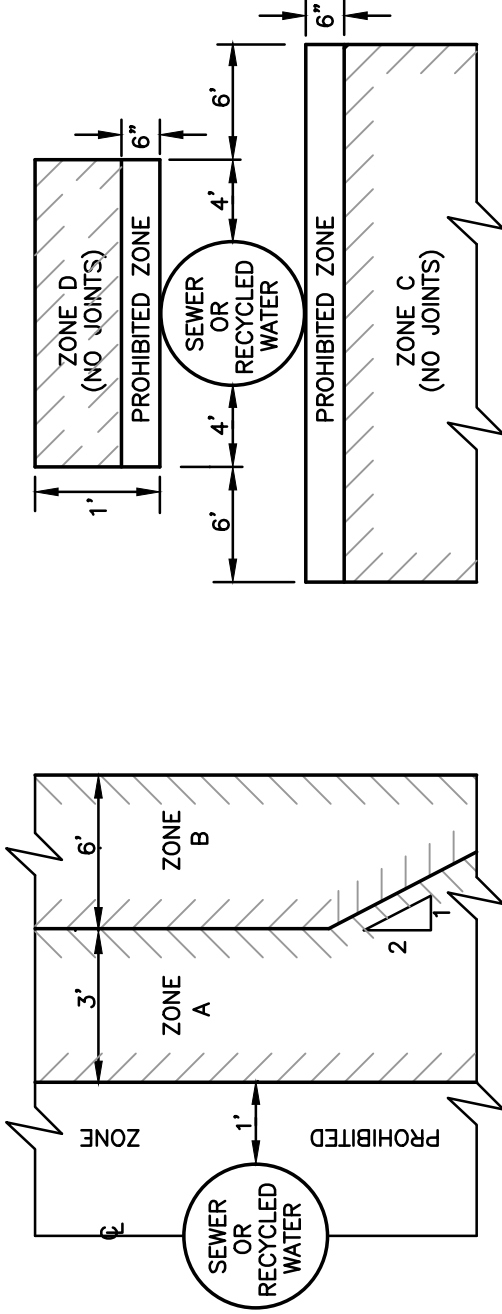
- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900

- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900

- USE DIP, WELDED CML&C STEEL, OR DR 14 PVC – AWWA C-900

SITUATION:

LOCATION OF NEW DOMESTIC & RECLAIMED WATER LINES TO EXISTING SEWER & RECLAIMED WATER LINES



PARALLEL CONSTRUCTION

PERPENDICULAR CROSSING

IF ANY WATER LINE IS TO BE CONSTRUCTED WITHIN ANY OF THE ABOVE INDICATED ZONES, SPECIAL CONSTRUCTION SHALL BE REQUIRED AS DESCRIBED BELOW.

ZONE DOMESTIC WATER

- A DO NOT LOCATE ANY PARALLEL DOMESTIC WATER LINE IN THIS AREA WITHOUT PRIOR STATE WATER RESOURCES CONTROL BOARD APPROVAL.

- B USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.

- C USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.

- D USE DIP, WELDED CML&C STEEL OR DR 14 PVC – AWWA C-900.

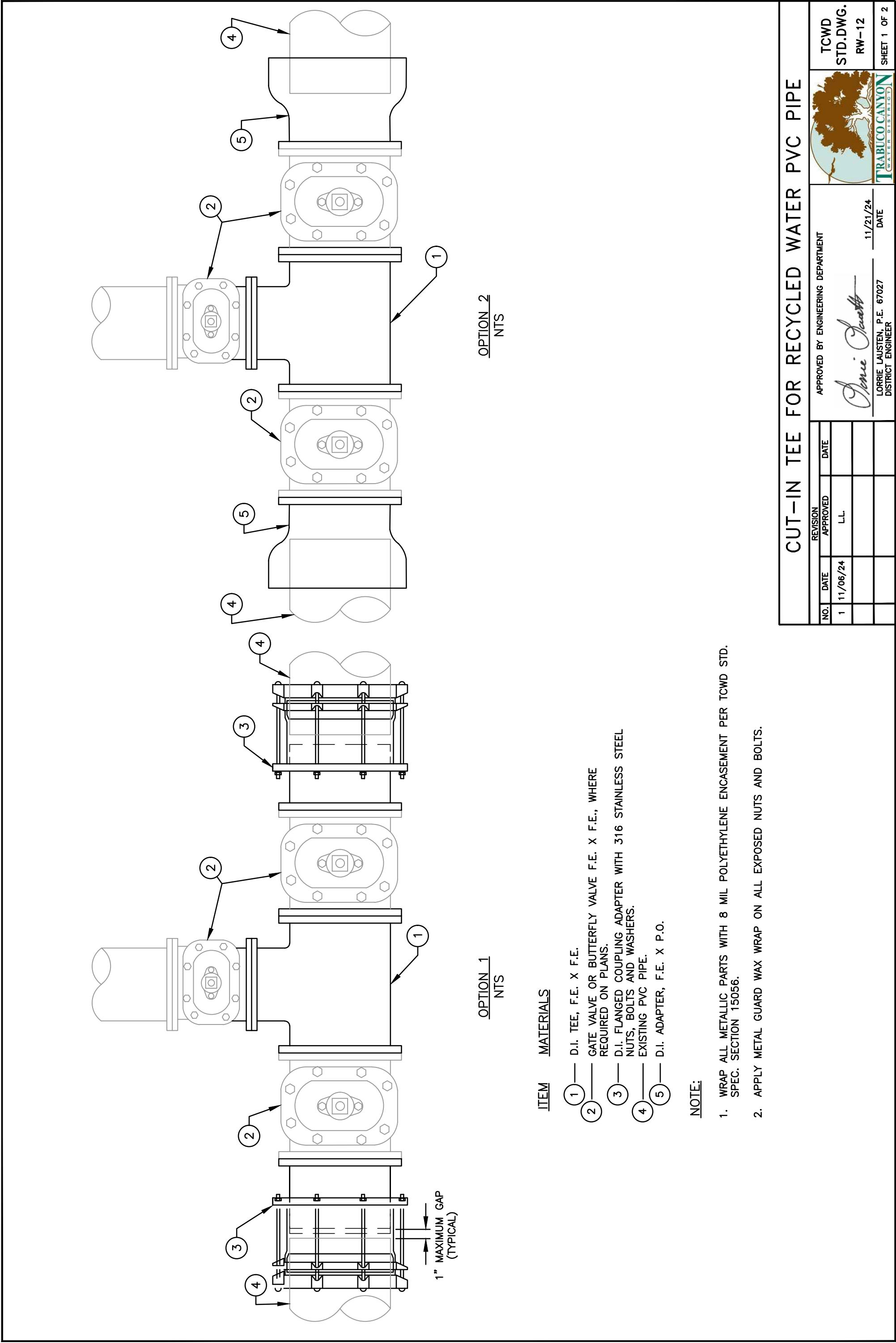
RECYCLED WATER AND SEWER SEPARATION STANDARDS

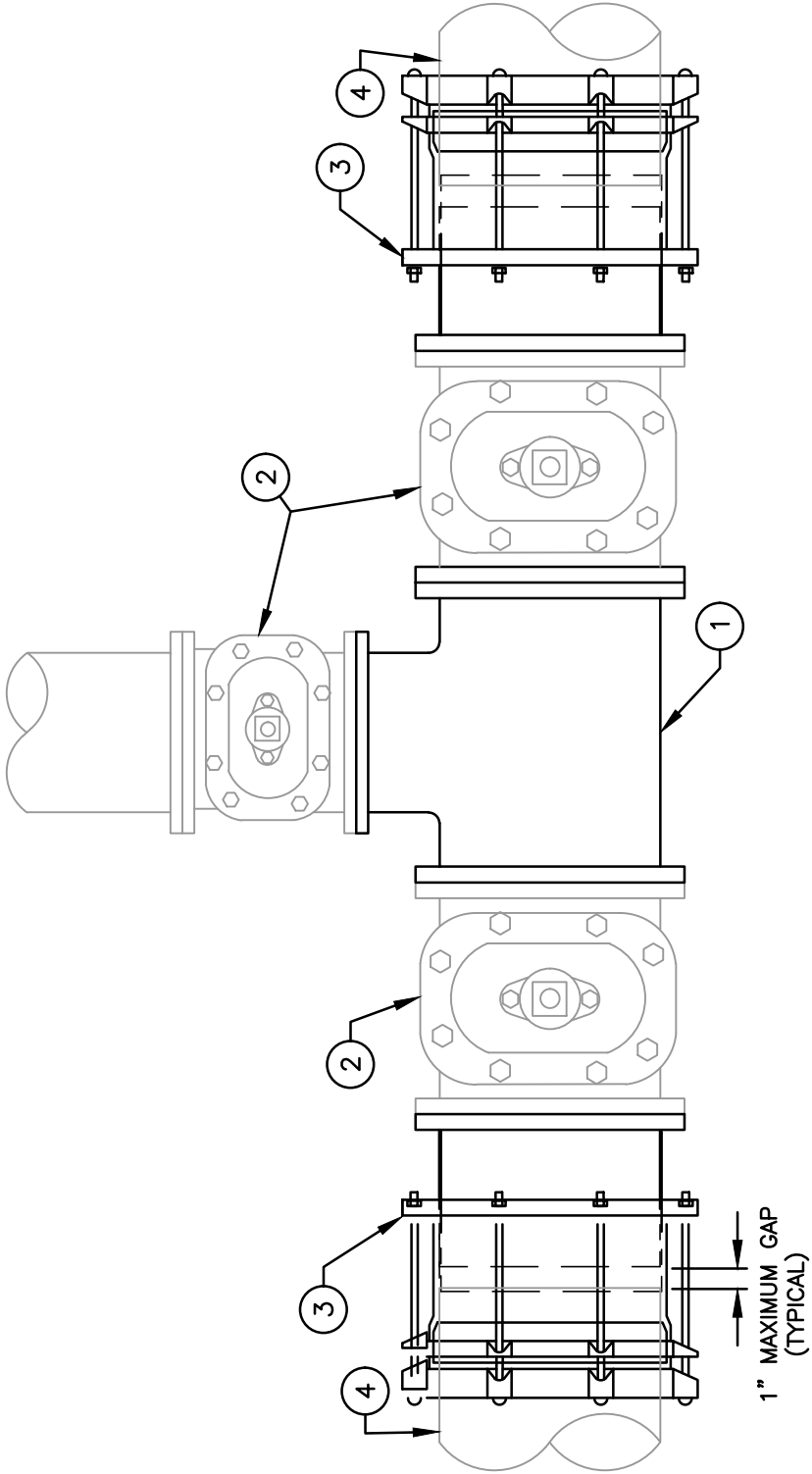
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	DATE	APPROVED	DATE	
1	11/06/24	L.L.		



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RW-11

SHEET 1 OF 1

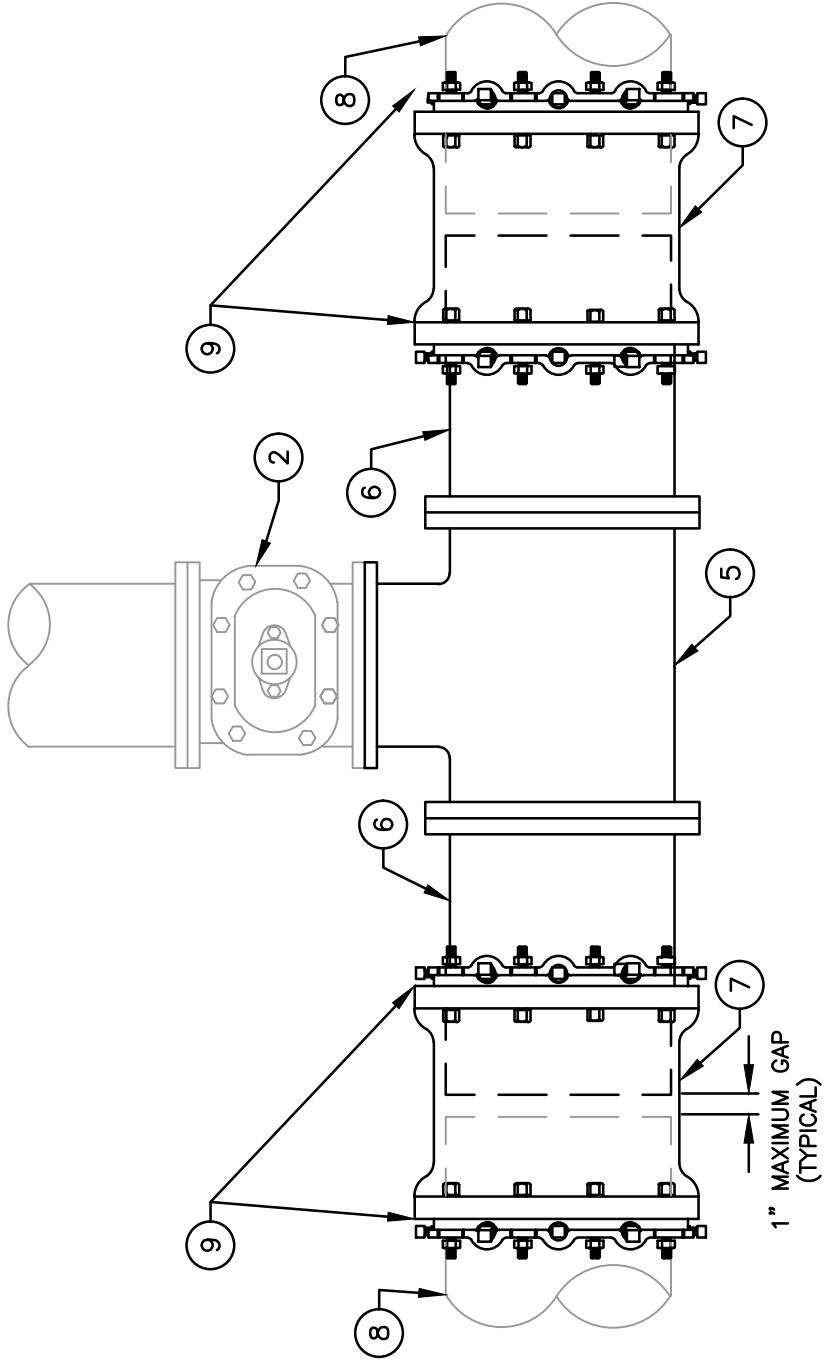




WITH VALVES
NTS

ITEM MATERIALS

- 1 — D.I. TEE, F.E. X F.E.
- 2 — GATE VALVE OR BUTTERFLY VALVE (F.E. X F.E.), WHERE SHOWN ON PLANS
- 3 — D.I. FLANGED COUPLING ADAPTER WITH 316 STAINLESS STEEL NUTS, BOLTS AND WASHERS.
- 4 — EXISTING DIP



WITHOUT VALVES
NTS

ITEM MATERIALS

- 5 — D.I. TEE, F.E. X F.E.
- 6 — D.I. PIPE, CLASS 52 SPOOL (F.E. X P.E.), LENGTH = 24"
- 7 — SOLID D.I. MECHANICAL JOINT SLEEVE.
- 8 — EXISTING DIP.
- 9 — MECHANICAL JOINT RETAINER GLAND AND 316 STAINLESS STEEL BOLTS, NUTS AND WASHERS.

NOTE:

1. WRAP ALL METALLIC PARTS WITH 8 MIL POLYETHYLENE ENCASEMENT PER TCWD STD. SPEC. SECTION 15056.
2. APPLY METAL GUARD WAX WRAP ON ALL EXPOSED NUTS AND BOLTS.

CUT-IN TEE FOR RECYCLED WATER DIP

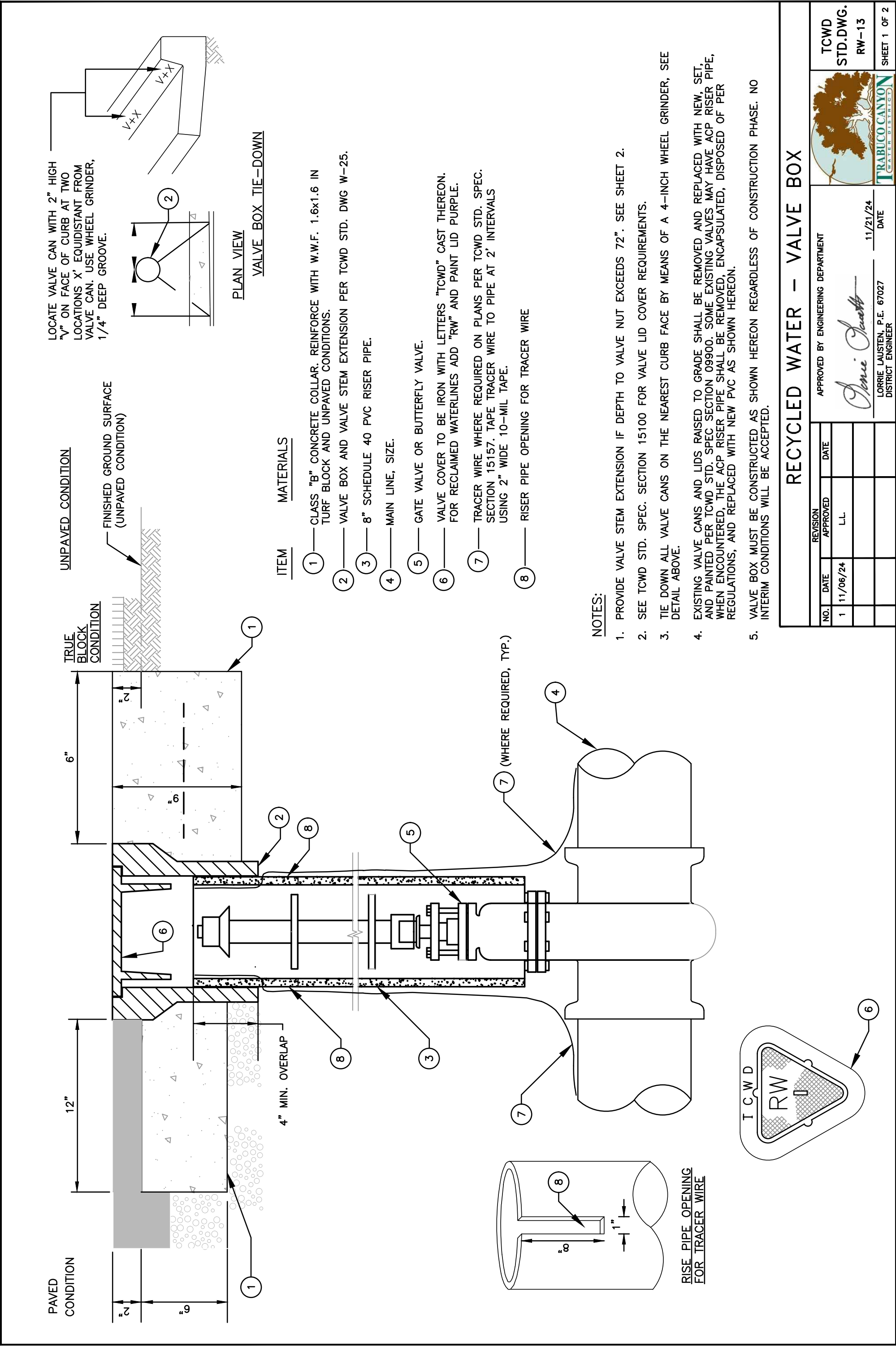
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NO.	DATE	APPROVED	DATE		
1	11/06/24	L.L.			

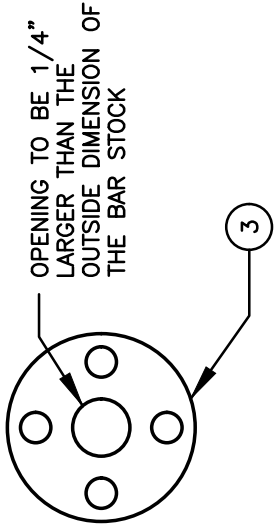
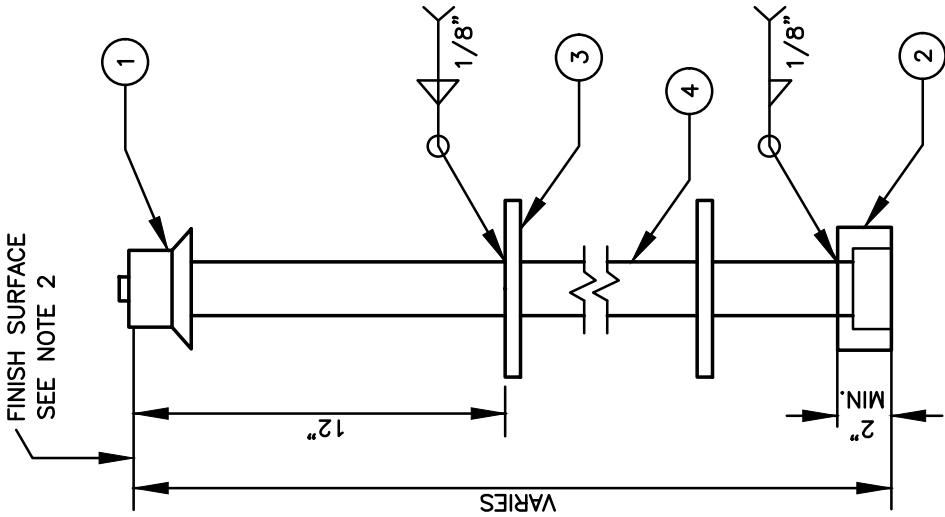


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RW-12

SHEET 2 OF 2





ITEM MATERIAL

- 1

A.W.W.A. 2" SQUARE OPERATING NUT
- 2

A.W.W.A. SOCKET FOR 2" SQUARE OPERATING NUT
- 3

(6) 1/2" DIA. X 3/16" SPACER PLATE
- 4

(1) 1/4" SOLID, ROUND OR SQUARE STEEL BAR STOCK (PINNED COUPLERS ARE NOT ALLOWED, HOLLOW TUBE OR PIPE ARE NOT ALLOWED).
1.

PROVIDE VALVE STEM EXTENSION WHEN DEPTH TO OPERATING NUT EXCEEDS 72" (FABRICATE EXTENSION TO FIELD MEASUREMENT - SEE NOTE 2).
2.

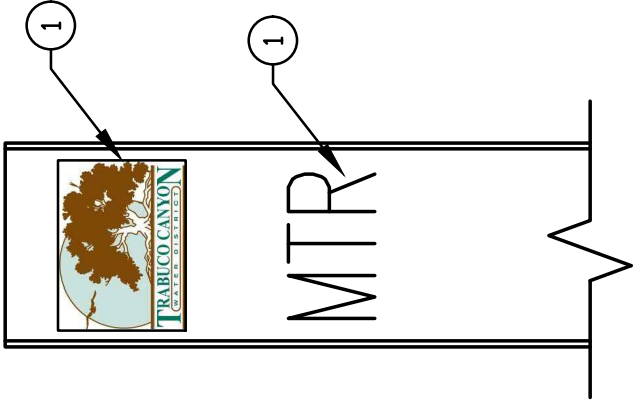
TERMINATE EXTENSION 24" TO 30" FROM FINISHED GRADE.
3.

PROVIDE ADDITIONAL SPACER PLATE(S) WHEN DISTANCE TO BOTTOM SOCKET EXCEEDS 60" BEYOND LOWEST PLATE.

VALVE STEM EXTENSION

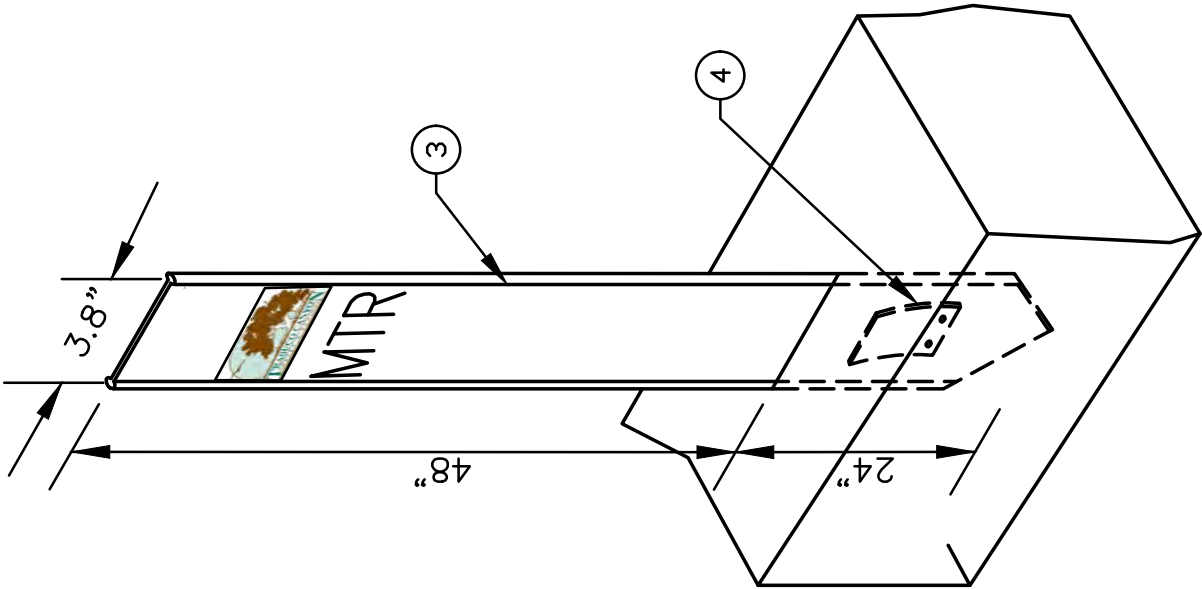
RECYCLED WATER VALVE BOX AND VALVE STEM EXTENSION

REVISION				APPROVED BY ENGINEERING DEPARTMENT		TCWD STD.DWG. RW-13
NO.	DATE	APPROVED	DATE			
1	11/06/24	L.L.				
				 LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER	11/21/24 DATE	SHEET 2 OF 2



ABBREVIATIONS

- AVR AIR AND VACUUM RELEASE VALVE
- BO BLOW OFF
- CBL DIRECT BURIED CABLE
- EPB ELECTRICAL PULL BOX
- FO FLUSH-OUT
- IJ INSULATING JOINT
- MH MANHOLE
- MTR METER
- PRV PRESSURE REGULATING VALVE
- RW RECYCLED WATER
- SCO SEWER CLEAN OUT
- SWR SEWER MAIN
- TFO TEMPORARY FLUSH-OUT
- TPB TELEMETRY PULL BOX
- TW TEST WELL
- VLT VAULT
- VLV VALVE
- WTR MAIN



MATERIALS

- 1 TCWD LOGO DECAL 3.25" HIGH X 2.75" WIDE.
- 2 2 OR 3 CHARACTER FACILITY LABEL. YELLOW LETTERS (1" HIGH) ON A CLEAR SELF ADHESIVE (USE ABBREVIATIONS HEREON).
- 3 POST SHALL BE "CARSONITE"
MODEL: CIB-380
MATERIAL: COLORED FIBERGLASS COMPOSITE
WIDTH: 3.8"
LENGTH: 72"
COLOR: BROWN
- 4 SPRING-LOADED STEEL BARB ANCHOR, FACTORY ATTACHED WITH RIVETS.

RECYCLED WATER UTILITY MARKER

			APPROVED BY ENGINEERING DEPARTMENT			TCWD STD.DWG. RW-14
REVISION			DATE			
NO.	DATE	APPROVED	DATE			
1	11/06/24	L.L.	11/21/24			
			DATE			
			LORRIE LAUSTEN, P.E. 67027			
			DISTRICT ENGINEER			

Part 4

Standard Drawings

For

Sewer Facilities

Sewer Standard Drawings

S-1	Sewer Manhole
S-2	Sewer Lateral
S-3	Cut in Wye Connection
S-4	Sewer Trench
S-5	Steel Casing for Sewer Pipe

Leave Blank

MANHOLE

ITEM MATERIALS

- 1—STENCILED WARNING SIGN WITH WHITE BACKING.. SEE DETAIL ON SHEET 2.
- 2—FRAME AND COVER PER TCWD STD SPEC SECTION 03461—SEE DETAIL ON SHEET 2.
- 3—ROUND CLASS "B" CONCRETE COLLAR AND AC PAVEMENT.
- 4—SQUARE CLASS "B" CONCRETE PAD REINFORCE WITH 6" X 6" W.W.F 10 GAUGE CENTERED IN CONCRETE. SHAFT JOINT WITH JOINT SEALING COMPOUND. SEE NOTE 8 ON SHEET 2.
- 6—CONCRETE MANHOLE BASE, CAST IN PLACE PER TCWD STD. SPEC. SECTION 03300. SEE NOTES 6 AND 7 ON SHEET 2.
- 7—CONCRETE BLOCK AND/OR BRICK SUPPORT. SEE NOTE 4 ON SHEET 2.
- 8—MANHOLE LINER PER TCWD. STD. SECTION 09900. APPLY NON SKID SURFACE ON TOTAL SHELF AREA.
- 9—PRECAST CONCRETE MANHOLE SHAFT, MIN WALL THICKNESS PER TCWD STD SPEC SECTION 03461 AND AS NOTED BELOW:
 - 48" DIA MANHOLE 6" WALL THICKNESS
 - 60" DIA MANHOLE 6" WALL THICKNESS
 - 72" DIA MANHOLE 7" WALL THICKNESS
- 10—INSTALL 16" LONG VCP THROUGH THROUGH MANHOLE BASE FOLLOWED BY A 12" LONG VCP, AS SHOWN FOR FLEXIBILITY.
- 11—INSTALL TEMPORARY PLUG IN PIPE BELL-JOINT.
- 12—FOR SDR-35 PVC PIPE, GASKETED SDR-35 (SDR 26 FOR 15" THROUGH 18") PVC MANHOLE COUPLING WITH EPOXY RESIN SAND COATING ON EXTERIOR SURFACE. FOR C900 PVC DR 14 PIPE: GASKETED C900 PVC DR 14 MANHOLE COUPLING WITH EPOXY RESIN SAND COATING ON EXTERIOR SURFACE.
- 13—SDR-35 PVC PIPE OR C900 PVC DR 14 PIPE.

MANHOLE BASE WITH VCP CONNECTION

MANHOLE CHANNEL

SHAFT JOINT

SECTION A-A

PLAN

PVC PIPE CONNECTION

REVISION

NO.	DATE	APPROVED	DATE
1	11/06/24	LL	

APPROVED BY ENGINEERING DEPARTMENT

TCWD STD.DWG. S-1

TRABUCO CANYON WATER DISTRICT

DATE 11/21/24

DATE 11/21/24

NOTE SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

TERMINATE LINING AT 5 AND 7 O'CLOCK POSITIONS

PAVED CONDITION

TURF BLOCK UNPAVED CONDITION

AC PAVEMENT

WARNING SIGN

PIPE O.D.

2% SLOPE MAX R=4"

8" MIN (TYP.)

30" MIN

18" MAX.

18"

9"

2" ABOVE GRADE MIN

SEE NOTE 3 ON SHEET 2.

4'-0" MIN.

24" MIN.

1'-0

PIPE O.D. + 2"

8

9

10

11

12

13

6

7

5

4

3

2

1

FLOW

MANHOLE OPENING (ABOVE)

R= 2 X PIPE DIA.

GASKET (TYP.)

TAPER PIPE AT SPIGOT

SECTION A-A

PLAN

PVC PIPE CONNECTION

SHAFT JOINT

MANHOLE CHANNEL

SECTION A-A

REVISION

NO.	DATE	APPROVED	DATE
1	11/06/24	LL	

APPROVED BY ENGINEERING DEPARTMENT

TCWD STD.DWG. S-1

TRABUCO CANYON WATER DISTRICT

DATE 11/21/24

DATE 11/21/24

NOTE SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

TERMINATE LINING AT 5 AND 7 O'CLOCK POSITIONS

PAVED CONDITION

TURF BLOCK UNPAVED CONDITION

AC PAVEMENT

WARNING SIGN

PIPE O.D.

2% SLOPE MAX R=4"

8" MIN (TYP.)

30" MIN

18" MAX.

18"

9"

2" ABOVE GRADE MIN

SEE NOTE 3 ON SHEET 2.

4'-0" MIN.

24" MIN.

1'-0

PIPE O.D. + 2"

8

9

10

11

12

13

6

7

5

4

3

2

1

FLOW

MANHOLE OPENING (ABOVE)

R= 2 X PIPE DIA.

GASKET (TYP.)

TAPER PIPE AT SPIGOT

SECTION A-A

PLAN

PVC PIPE CONNECTION

SHAFT JOINT

MANHOLE CHANNEL

SECTION A-A

MANHOLE

ITEM MATERIALS

- 1—STENCILED WARNING SIGN WITH WHITE BACKING.. SEE DETAIL ON SHEET 2.
- 2—FRAME AND COVER PER TCWD STD SPEC SECTION 03461—SEE DETAIL ON SHEET 2.
- 3—ROUND CLASS "B" CONCRETE COLLAR AND AC PAVEMENT.
- 4—SQUARE CLASS "B" CONCRETE PAD REINFORCE WITH 6" X 6" W.W.F 10 GAUGE CENTERED IN CONCRETE. SHAFT JOINT WITH JOINT SEALING COMPOUND. SEE NOTE 8 ON SHEET 2.
- 6—CONCRETE MANHOLE BASE, CAST IN PLACE PER TCWD STD. SPEC. SECTION 03300. SEE NOTES 6 AND 7 ON SHEET 2.
- 7—CONCRETE BLOCK AND/OR BRICK SUPPORT. SEE NOTE 4 ON SHEET 2.
- 8—MANHOLE LINER PER TCWD. STD. SECTION 09900. APPLY NON SKID SURFACE ON TOTAL SHELF AREA.
- 9—PRECAST COONCRETE MANHOLE SHAFT, MIN WALL THICKNESS PER TCWD STD SPEC SECTION 03461 AND AS NOTED BLOW:
48" DIA MANHOLE 6" WALL THICKNESS
60" DIA MANHOLE 6" WALL THICKNESS
72" DIA MANHOLE 7" WALL THICKNESS
- 10—INSTALL 16" LONG VCP THROUGH THROUGH MANHOLE BASE FOLLOWED BY A 12" LONG VCP, AS SHOWN FOR FLEXIBILITY.
- 11—INSTALL TEMPORARY PLUG IN PIPE BELL-JOINT.
- 12—FOR SDR-35 PVC PIPE, GASKETED SDR-35 (SDR 26 FOR 15" THROUGH 18") PVC MANHOLE COUPLING WITH EPOXY RESIN SAND COATING ON EXTERIOR SURFACE. FOR C900 PVC DR 14 PIPE: GASKETED C900 PVC DR 14 MANHOLE COUPLING WITH EPOXY RESIN SAND COATING ON EXTERIOR SURFACE.
- 13—SDR-35 PVC PIPE OR C900 PVC DR 14 PIPE.

PVC PIPE CONNECTION

PLAN

SECTION A-A

SHAFT JOINT

MANHOLE BASE WITH VCP CONNECTION

TURF BLOCK UNPAVED CONDITION

PAVED CONDITION

NOTE
SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

11/21/24 DATE

LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER

TCWD STD.DWG. S-1

SHEET 1 OF 2

MATERIALS

ITEM 1—STENCILED WARNING SIGN WITH WHITE BACKING.. SEE DETAIL ON SHEET 2.

ITEM 2—FRAME AND COVER PER TCWD STD SPEC SECTION 03461—SEE DETAIL ON SHEET 2.

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ITEM 6—CONCRETE MANHOLE BASE, CAST IN PLACE PER TCWD STD. SPEC. SECTION 03300. SEE NOTES 6 AND 7 ON SHEET 2.

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ITEM 13—SDR-35 PVC PIPE OR C900 PVC DR 14 PIPE.

MANHOLE

APPROVED BY ENGINEERING DEPARTMENT

LORRIE LAUSTEN, P.E. 67027

DATE 11/21/24

TCWD STD.DWG. S-1

SHEET 1 OF 2

TRABUCO CANYON WATER DISTRICT

REVISION NO. DATE APPROVED DATE

1 11/06/24 L.L.

NOTE SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

PAVED CONDITION

TURF BLOCK UNPAVED CONDITION

AC PAVEMENT

WARNING SIGN

PIPE O.D. + 2"

4'-0" MIN.

24" MIN.

18" MAX.

18"

2"

30" MIN

2" ABOVE GRADE MIN

9"

18"

PIPE O.D.

2% SLOPE MAX R=4"

8" MIN (TYP.)

SEE NOTE 3 ON SHEET 2.

(TYP.)

SHAFT JOINT

PLAN

SECTION A-A

GASKET (TYP.)

TAPER PIPE AT SPIGOT

MANHOLE CHANNEL

MANHOLE BASE WITH VCP CONNECTION

MANHOLE OPENING (ABOVE)

FLOW

R= 2 X PIPE DIA.

TERMINATE LINING AT 5 AND 7 O'CLOCK POSITIONS

MANHOLE

ITEM MATERIALS

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MANHOLE BASE WITH VCP CONNECTION

MANHOLE CHANNEL

SHAFT JOINT

SECTION A-A

PLAN

PVC PIPE CONNECTION

REVISION

NO.	DATE	APPROVED	DATE
1	11/06/24	LL	

APPROVED BY ENGINEERING DEPARTMENT

TCWD STD.DWG. S-1

TRABUCO CANYON WATER DISTRICT

DATE 11/21/24

DATE 11/21/24

NOTE
SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

TERMINATE LINING AT 5 AND 7 O'CLOCK POSITIONS

PAVED CONDITION

TURF BLOCK UNPAVED CONDITION

AC PAVEMENT

WARNING SIGN

PIPE O.D.

2% SLOPE MAX R=4"

8" MIN (TYP.)

30" MIN

18" MAX.

18"

9"

2" ABOVE GRADE MIN

SEE NOTE 3 ON SHEET 2.

4'-0" MIN.

24" MIN.

1'-0"

MANHOLE

ITEM MATERIALS

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MANHOLE BASE WITH VCP CONNECTION

MANHOLE CHANNEL

SHAFT JOINT

SECTION A-A

PLAN

PVC PIPE CONNECTION

REVISION

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TCWD STD.DWG. S-1

TRABUCO CANYON WATER DISTRICT

DATE 11/21/24

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NOTE
SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES

TERMINATE LINING AT 5 AND 7 O'CLOCK POSITIONS

PAVED CONDITION

TURF BLOCK UNPAVED CONDITION

AC PAVEMENT

WARNING SIGN

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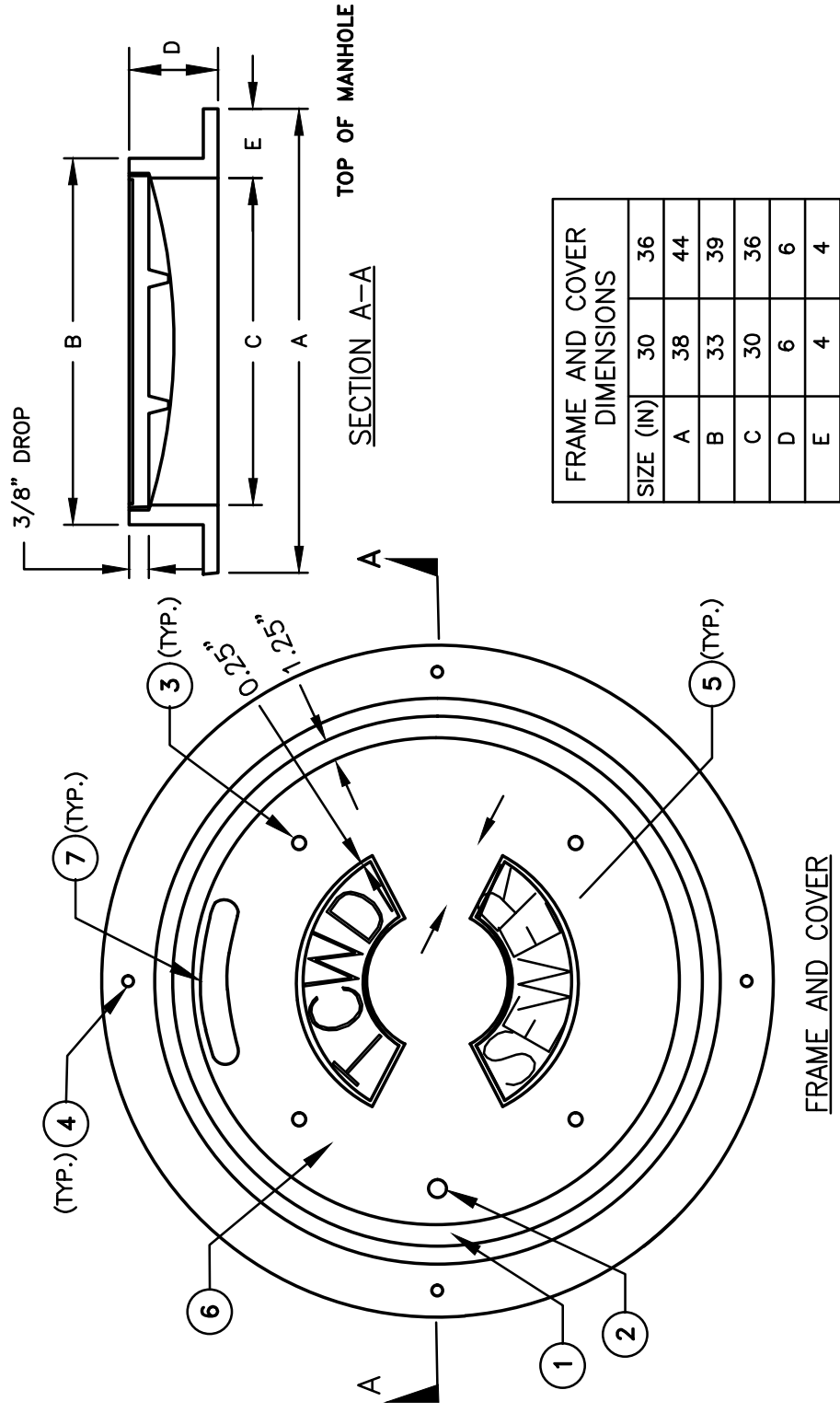
2" ABOVE GRADE MIN

SEE NOTE 3 ON SHEET 2.

4'-0" MIN.

24" MIN.

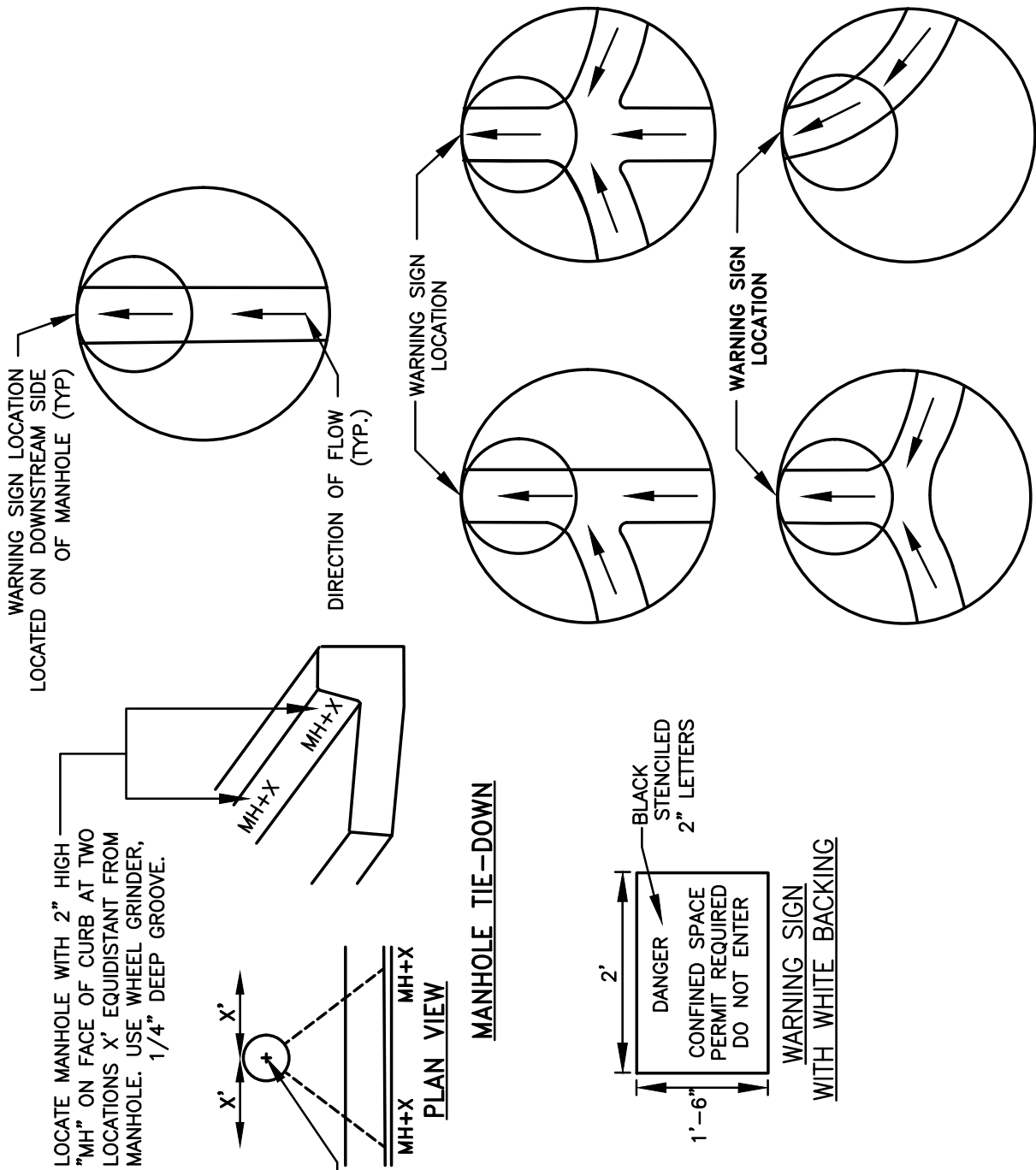
1'-0"



FRAME AND COVER DIMENSIONS		
SIZE (IN)	30	36
A	38	44
B	33	39
C	30	36
D	6	6
E	4	4

NOTES

1. 48" AND 60" MANHOLES SHALL HAVE 30" FRAME AND COVER. 72" MANHOLES SHALL HAVE 36" FRAME AND COVER.
2. COAT FRAME AND COVER PER TCWD STD. SPEC. SECTION 09900.
3. PLACE TWO HALF MOON SHAPED PLYWOOD COVERS (5/8" THICK MIN.) ON BOTTOM OF MANHOLE AFTER SHAFT HAS BEEN SET TO KEEP DEBRIS FROM ENTERING SEWER. REMOVE PLYWOOD PRIOR TO FINAL ACCEPTANCE.
4. ALL INLET AND OUTLETS SHALL BE SUPPORTED WITH CONCRETE BLOCK AND/OR BRICK SUPPORTS PRIOR TO POURING MANHOLE BASE TO PREVENT PIPE MOVEMENT DURING CONSTRUCTION OF MANHOLE BASE.
5. ALL PRECAST CONCRETE MANHOLE SHAFTS SHALL BE MANUFACTURED PER TCWD STD. SPEC. SECTION 03461.
6. MANHOLE BASE SHALL BE POURED AGAINST UNDISTURBED SOIL. IF SOIL IS DISTURBED, OR IF GROUND WATER EXISTS, CRUSHED ROCK SHALL BE INSTALLED BENEATH BASE PER TCWD STD. SPEC. SECTION 02223.
7. CLASS "A" CONCRETE BASE, CAST IN PLACE MONOLITHICALLY PER TCWD STD SPEC. SECTION 03300.
8. COLD-APPLIED READY-TO-USE PLASTIC JOINT SEALING COMPOUND SHALL BE USED FOR ALL MANHOLE JOINTS. REMOVE EXCESS FROM SURFACES INSIDE MANHOLE.
9. RETAINING WALLS SHALL BE INSTALLED AROUND MANHOLE WHEN THERE IS AN ADJACENT SLOPE. CONSTRUCT RETAINING WALL PER TCWD STD. DWG. W-26
10. MANHOLES SHALL NOT BE PLACED IN SIDEWALKS WITHOUT PRIOR WRITTEN APPROVAL FROM DISTRICT.
11. MANHOLES DEEPER THAN 20'-0" TO TOP OF PIPE SHALL BE DESIGNED BY A REGISTERED CIVIL ENGINEER AND APPROVED BY DISTRICT.
12. TIE DOWN ALL MANHOLES ON THE NEAREST CURB FACE BY MEANS OF A 4-INCH WHEEL GRINDER, PER DETAIL ABOVE.
13. INSTALL UTILITY MARKER (IF NECESSARY) PER TCWD STD. DWG. W-27.
14. ALL PAINTED WARNING SIGNS SHALL HAVE WHITE BACKGROUND AND BLACK LETTERS.
15. MANHOLE MUST BE CONSTRUCTED AS SHOWN HEREON REGARDLESS OF CONSTRUCTION PHASE. NO INTERIM CONDITIONS WILL BE ACCEPTED BY THE DISTRICT.



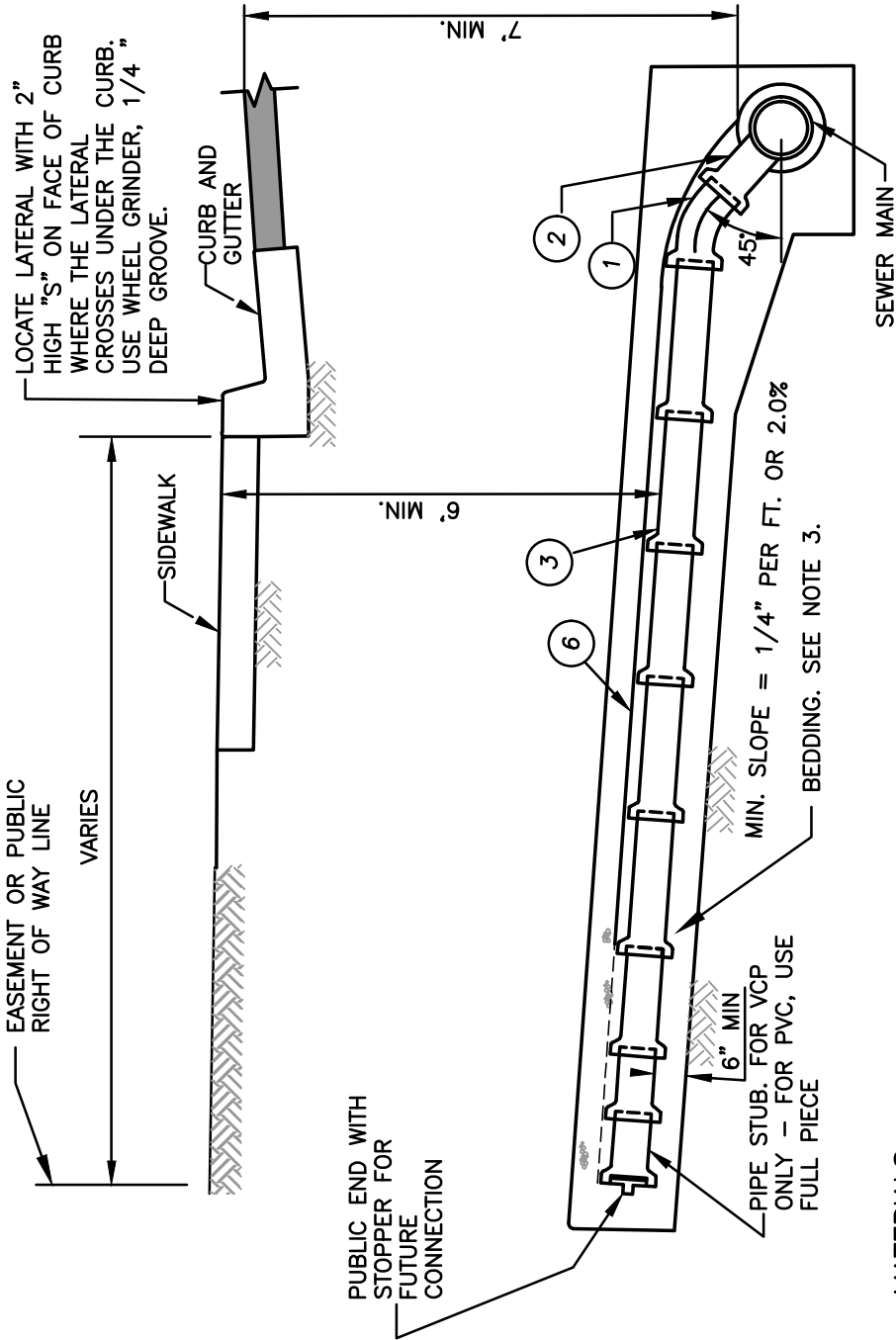
ORIENTATION OF MANHOLE COVER TO MANHOLE BASE

ITEM	MATERIALS

- 1 — 1-1/2" LIFTING SLOT
- 2 — 1" THRU HOLE (ONE PLACE).
- 3 — 3/4 " THRU HOLE (FOUR PLACES).
- 4 — 5/8 "DIA. HOLES CORED IN FRAME (FOUR PLACES).
- 5 — CAST 3" LETTERS 3/8 " THICK RAISED 3/16", OFFSET 0.25" FROM 0.25" THICK RAISED 3/16 " RIBBON EDGE.
- 6 — 3/16 " RAISED DIAMOND TREAD SURFACE PATTERN.
- 7 — MANUFACTURER AND COUNTRY OF ORIGIN STAMP, CAST 1" LETTERS, ORIENTATION AS SHOWN.

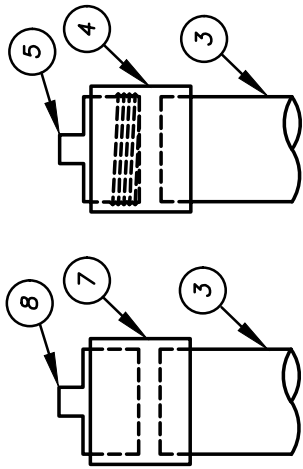
MANHOLE

		REVISION		APPROVED BY ENGINEERING DEPARTMENT			TCWD STD.DWG. S-1
NO.	DATE	APPROVED	DATE				
1	11/06/24	L.L.					
							
				LORRIE LAUSTEN, P.E. 67027 DISTRICT ENGINEER			SHEET 2 OF 2



ITEM MATERIALS

- 1 — 1/8 BEND (OR OTHER FITTING NECESSARY TO ADJUST TO PROPER GRADE).
- 2 — PVC OR VCP PIPE WYE BRANCH FITTING.
- 3 — VCP OR PVC PIPE. LATERAL MATERIAL SHALL MATCH MAIN MATERIAL.
- 4 — SOLVENT WELD X F.I.P.T. SCH 40 PVC COUPLING.
- 5 — PVC SCH. 40 STOPPER M.I.P.T. PLUG WITH MALE SQUARE NUT.
- 6 — PIPE LOCATOR FOR NON-METALLIC PIPE INSTALLATIONS IDENTIFICATION TAPE PER TCWD STD. SPEC. SECTION 15151.
- 7 — BANDED RUBBER COUPLING.
- 8 — PLASTIC PLUG.



NOTES:

- LATERAL SIZE TO BE DETERMINED ON THE BASIS OF TOTAL NUMBER OF FIXTURE UNITS, BUT IN NO CASE SHALL THE LATERAL DIA. BE LESS THAN 4" FOR SINGLE FAMILY RESIDENTIAL BUILDINGS, OR LESS THAN 6" FOR MULTIPLE FAMILY RESIDENTIAL, COMMERCIAL, OR INDUSTRIAL BUILDINGS.
- TCWD WILL BE RESPONSIBLE FOR REPAIRS OF SEWER MAIN WITHIN THE PUBLIC RIGHT-OF-WAY OR EASEMENT AREA.
- PLACE 3/4" CRUSHED ROCK BEDDING PER TCWD STD. SPEC. SECTION 02223.
- PLUG WYE BRANCH WITH ABS STOPPER FOR FUTURE CONNECTIONS.
- CONNECTIONS TO THE RISER PIPE ARE NOT PERMITTED.
- PROPERTY OWNER IS REQUIRED TO MAINTAIN AND REPAIR LATERAL FROM PROPERTY LINE TO THE SEWER MAIN PER TCWD RULES & REGULATIONS, CHAPTER 7.

SEWER LATERAL

REVISION			
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

APPROVED BY ENGINEERING DEPARTMENT

Lorrie Lausten

LORRIE LAUSTEN, P.E. 67027

DISTRICT ENGINEER

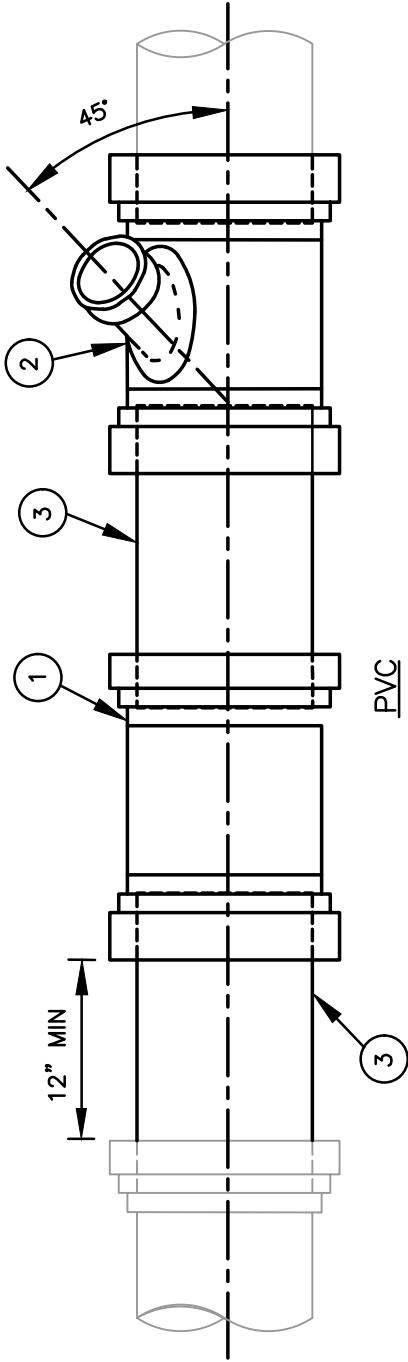
11/21/24

DATE



TCWD
STD.DWG.
S-2

SHEET 1 OF 1



ITEM MATERIALS

- 1 GASKETED PVC PIPE COUPLING, REPAIR STYLE.
- 2 GASKETED PVC WYE FITTING.
- 3 SDR-35 PVC PIPE (PUP), MIN. LENGTH: 12 inch.

NOTES:

- WHEN 12 inch MIN. SPACE BETWEEN EDGE OF COUPLING AND BELL CANNOT BE PROVIDED, CUT-OUT NEAREST BELL JOINT AND INSERT PLAIN-END PIPE.
- ALL DEBRIS SHALL BE KEPT OUT OF THE SEWER. THE PIPE REACH SHALL BE CUT-INTO, CLEANED AND BALLED, IF NECESSARY, AS DIRECTED BY TCWD.
- ANY DAMAGED PIPE SHALL BE REPLACED AS DIRECTED BY TCWD.
- SADDLE-TYPE CONNECTIONS SHALL ONLY BE USED FOR SPECIAL SITUATIONS, AND SHALL NOT BE CONSTRUCTED WITHOUT PRIOR DISTRICT APPROVAL.
- 8 inch AND LARGER DIA. LATERALS SHALL BE CONNECTED TO MAINLINE VIA MANHOLE ONLY, PER TCWD STD. DWG. S-1.

CUT IN WYE CONNECTION

REVISION		APPROVED BY ENGINEERING DEPARTMENT	
NO.	DATE	APPROVED	DATE
1	11/06/24	L.L.	

Denise Jacobs

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24
DATE

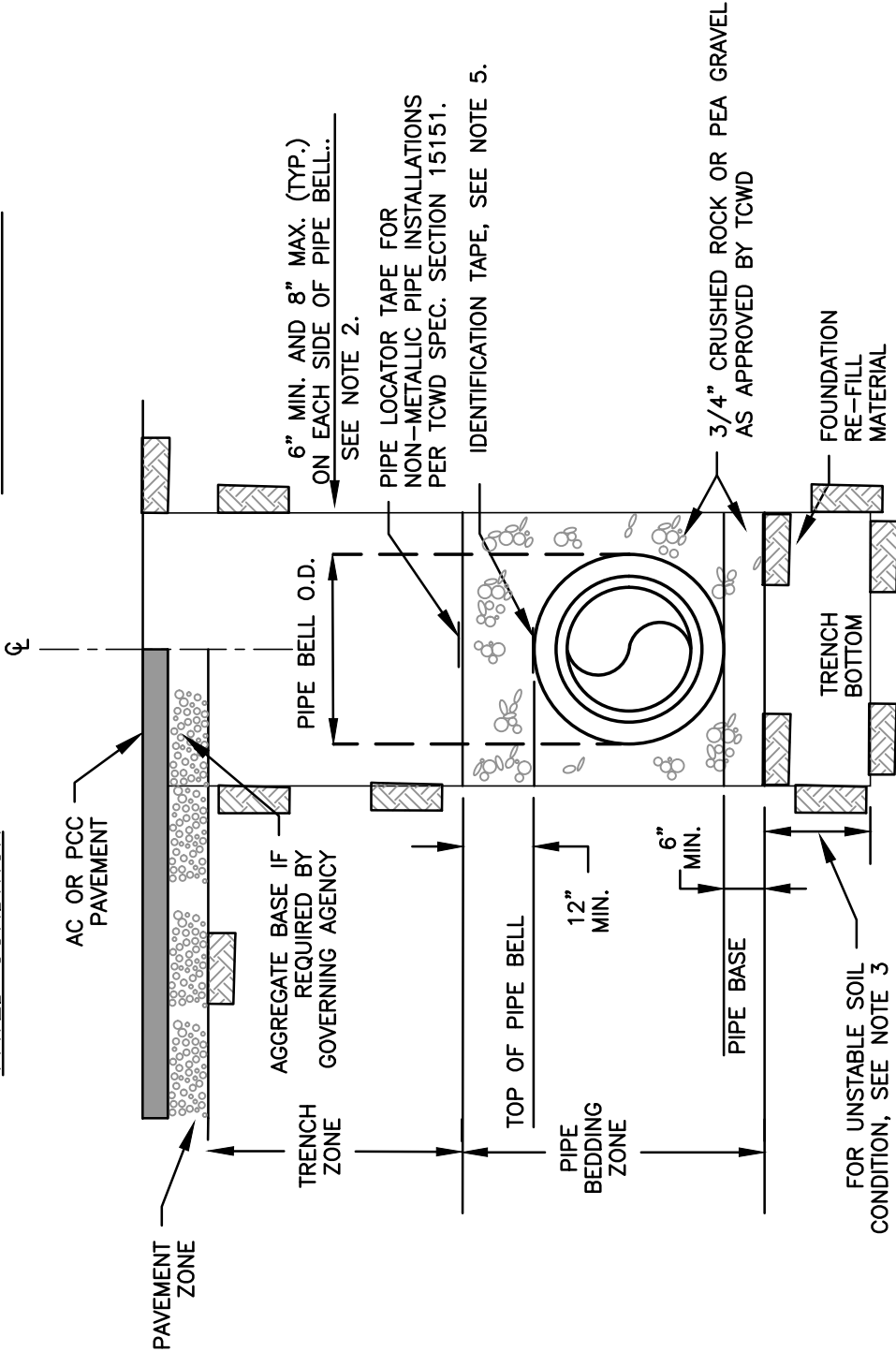


TCWD
STD.DWG.
S-3

SHEET 1 OF 1

PAVED CONDITION

UNPAVED CONDITION



NOTES:

1. ALL WORK SHALL BE ACCORDANCE WITH TCWD STD. SPEC. SECTION 02223.
2. WHERE CONTRACTOR FAILS TO MAINTAIN PROPER TRENCH WIDTH LIMITS, SPECIAL BACKFILL (SUCH AS ONE-SACK SLURRY) AND BEDDING SHALL BE REQUIRED AS DETERMINED IN THE FIELD BY THE DISTRICT REPRESENTATIVE.
3. IF UNSTABLE SOIL IS ENCOUNTERED, TCWD SHALL DETERMINE OVEREXCAVATION DEPTH AND FOUNDATION RE-FILL MATERIAL PER TCWD STD. SPEC. SECTION 02223.
4. CONTRACTOR SHALL PROVIDE HAND EXCAVATED "BELL HOLE" FOR EACH PIPE JOINT SO THAT THE WEIGHT OF PIPE DOES NOT BEAR ON THE BELL. CONTRACTOR SHALL RE-FILL AND HAND-TEMP EACH "BELL HOLE" PRIOR TO COMPLETING THE PLACEMENT OF PIPE BEDDING.
5. PIPE IDENTIFICATION TAPE (LABELED SEWER) SHALL BE INSTALLED PER TCWD STD. SPEC SECTION 15151. TAPE SHALL BE FASTENED TO THE PIPE WITH 2" WIDE 10 MIL PIPE WRAP AT 5' INTERVALS. PIPE WRAP TAPE SHALL BE WRAPPED AROUND THE ENTIRE CIRCUMFERENCE OF THE PIPE.
6. THE MIN. DEPTH OF COVER FROM INVERT TO THE TOP OF THE SEWER MAIN SHALL BE SEVEN (7') FEET UNLESS OTHERWISE APPROVED BY THE DISTRICT.

SEWER TRENCH

REVISION		
NO.	DATE	APPROVED
1	11/06/24	L.L.

APPROVED BY ENGINEERING DEPARTMENT

Denise Swartz

LORRIE LAUSTEN, P.E. 67027
DISTRICT ENGINEER

11/21/24

DATE



TCWD
STD.DWG.
S-4

SHEET 1 OF 1

Appendix A

**DOMESTIC AND NONDOMESTIC WATER AND SEWER
DESIGN
&
CONSTRUCTION MANUAL**

Leave Blank

Appendix A-1
Application and Agreement
for
Domestic Water and Nondomestic Water
and Sewer Service

Leave Blank

TRABUCO CANYON WATER DISTRICT

Appendix A-1

Application and Agreement for Domestic Water and Nondomestic Water and Sewer Service for Residential Developments of 2 Dwelling Units (DU) or less

The undersigned, hereinafter referred to as "Applicant." Hereby requests installation of a new water and/or sewer service or upgrading an existing water and/or sewer service by the Trabuco Canyon Water District, hereinafter referred to as the "District" in accordance with the latest edition of the TCWD's Domestic and Nondomestic and Sewer Design and Construction Manual including Standard Technical Specifications and Standard Drawings for Construction (the "Manual").

PROJECT INFORMATION:

Property Address: _____

Legal Description: to that certain real property of said District, in the County of Orange, State of California, consisting of approximately _____ acres, and described as follows:

Applicant hereby applies for domestic and nondomestic water and sewer services, which can be provided by the facilities described below:

Applicant hereby represents that Applicant is the Owner/Developer/Consultant (Circle one) of the above described real property (the "Property").

Applicant estimates that total number of domestic and nondomestic water service, fire service and sewer service accounts required of the District upon ultimate development of the Property is as follows:

Domestic Water	_____	Accounts
Nondomestic Water	_____	Accounts
Fire Service	_____	Accounts
Sewage	_____	Accounts

Applicant shall review and comply with the "Process for Procuring Water and Sewer Service for Development Projects" (Appendix A-9 of the Manual) requirements as they relate to this agreement.

APPLICANT INFORMATION:

Applicant Name _____ Company Name _____

Company Address _____

Phone Number _____ Email Address _____

OWNER/DEVELOPER INFORMATION:

Owner/Developer Name _____ Company Name _____

Company Address _____

Phone Number _____ Email Address _____

Upon acceptance of this application by the District, as evidenced by the execution and delivery to Applicant of a copy hereof, the District and Applicant agree as follows

1. The District shall issue a "Will Serve Letter" in accordance with the General Policy and Rules and Regulations of TCWD ("Rules and Regulations"), which are fully incorporated herein by this reference, and in accordance with and subject to the terms and conditions set forth in this Agreement.
2. Applicant shall build or cause the following facilities to be built as described below:

3. Applicant shall pay all costs for installation of the facilities above including, but not limited to, any cost of labor, materials, equipment and Contractor's expense and profit. In addition, Applicant shall pay all costs for any land and easement acquisition required for the project.
4. Applicant shall pay all of the following TCWD Fees and Capacity Charges and any other applicable fees and charges as established by the District's Board of Directors:
 - a. Hydraulic Analysis Fee (if required)
 - b. Capacity Charges
 - i. Capital Improvement Charge
 - ii. Supplemental Water Capacity Charge
 - iii. In-Lieu Water Storage Charge
 - iv. Service Connection Charge
 - c. Plan Review Fees
 - d. Inspection Fees
 - e. Other fees for the Development

The applicant shall also pay all fees and charges as set forth in this section as a condition of approval by the District of the improvement plans for the proposed development. In the event the Applicant fails to pay said charges as specified herein, this Agreement shall be void and of no further force and effect.

5. Applicant affirms that the facilities described herein shall be constructed in accordance with plans approved by the District, District standard drawings, and applicable specifications of the District by a Contractor licensed by the State of California.
6. Applicant guarantees the facilities constructed under this Agreement against defects in workmanship and materials for one year warranty period after the date of acceptance by the District.
7. Applicant guarantees that these facilities will be restored to full compliance with the requirements of the plans and specifications previously referred to in this Agreement, including any testing requirements, if any portion of such facilities that during the one-year warranty period is found to be deficient with respect to any provisions of the plans or specifications. This guarantee is in addition to all other warranties, express or implied, with respect to those facilities.
8. Applicant shall provide the District with a complete "Cost of Construction Statement" for the proposed domestic and nondomestic water and sewer facilities including engineering services (See Appendices A-5 through A-7) to calculate Plan Review and Inspection Fees subject to the following conditions:
 - a. If both water transmission and water distribution facilities are to be built under this Agreement, Applicant shall submit to the District separate reporting forms for the transmission facilities and the distribution facilities.
 - b. If both sewer trunk and sewer non-trunk facilities are to be built under this Agreement, Applicant shall submit to the District separate reporting forms for the non-trunk facilities and the trunk facilities.

9. Applicant shall grant to the District all necessary water and sewer easements for any on-site facilities, any off-site facilities, and any facilities located on privately owned land for the construction, installation, and maintenance of said facilities.
- Applicant shall assure that all easements are shown on separate easement documents or on a Proposed Tract Map and that the documents or map is submitted to the District during the plan review process for review and approval. The easement documents must be in a form and provide a condition of title satisfactory to the District.
- Applicant shall ensure that the final easement documents are signed and notarized by the Property Owner. After receiving the receipt of properly signed and notarized documents, District will present the Agreement and Easement Documents to its Board of Directors for review and approval. If approved, the District will sign this Agreement and maintain two copies of the Agreement with an additional copy to be returned to the Applicant.
- District will forward any original grant of easement documents to the County of Orange Recorder's office for recording. District will pay all recording costs and will provide a recorded copy to the Applicant.
10. Applicant shall provide to the District, before the acceptance of the facilities described in this Agreement, a complete set of reproducible plans for signature, and AutoCAD files of said facilities, signed by the State of California Registered Civil Engineer who prepared the drawings, and showing the following:
- a. Domestic Water and Nondomestic Water System Facilities:
 - i. The location, size, and type of material of all water pipelines.
 - ii. The location of all valves, fire hydrants, and other appurtenances.
 - iii. The location, with respect to right-of-way, all water and fire services and meters.
 - iv. The location of the limits of the public rights-of-way, and easements to be granted to the District if the water facilities are not located within public street rights-of-way.
 - b. Sewer System Facilities:
 - i. The location, size, and type of material of all sewer pipelines.
 - ii. The location of all manholes, lateral, wyes, and other appurtenances by stationing.
 - iii. The location, with respect to right-of-way all sewer laterals and cleanouts.
 - iv. The location of the limits of the public rights-of-way, and easements granted to the District if the sewer facilities are not located within public street rights-of-way.
11. Applicant shall submit the Project's Bill of Sale information on District's forms (See Appendices A-2 through A-4 to this Manual) based on the actual cost of construction of water and sewer facilities installed to the District. District will present the Bill of Sale and Certificate of Acceptance of Facilities to Board of Directors for review and approval.
- Applicant shall disclaim in favor of the District all right, title, an interest in and to said systems, appurtenances, and easements; and Applicant shall execute and deliver to the District any and all documents required to complete the transfer of said facilities concurrently with the acceptance by the District.
- The Applicant acknowledges that it holds any title to said facilities pending acceptance by the District, as trustee, and that Applicant is obligated to complete said facilities as provided in this Agreement and to transfer the same debt-free to the District.
12. The foregoing provisions of this Agreement will not preclude the use of said facilities by Applicant (property owner) within the developed area or outside of said development prior to the delivery of a bill of sale to the District as provided in Section 11 above on the condition that the quality of the water and sewage to be used by Applicant is acceptable to the District's Rules and Regulations.

13. The Applicant's use of the facilities is conditioned upon the District's approval for Applicant to connect to said facilities or to existing facilities.
14. Use of the facilities included in this Agreement by the Applicant, or the transferee or assignee of the Applicant, or others within the District, will not constitute acceptance of such facilities by the District.
15. Applicant hereby holds the District harmless from any expense or liability resulting from construction of the facilities described herein and to indemnify the District and its agents, employees, officers, and representatives ("Indemnified Parties") and hold such Indemnified Parties free and harmless from and against any and all liabilities for death, injury, loss damage, or expense (including reasonable attorney's fees) to person or property which may arise or is claimed to have arisen as a result of any work or action performed by Applicant or on behalf of Applicant with respect to the construction and in the installation or repair of such facilities. The Applicant will not be responsible for claims resulting from District's sole negligence.
16. Upon completion and transfer to the District of the facilities, and payment of all fees and charges for and conveyance to the District of all easements for said facilities, the District will issue a Certificate of Acceptance for any water, nondomestic water and sewer services included within Applicant's application in accordance with and subject to the Rules and Regulations of the District as they may be hereinafter amended from time to time.
17. Applicant shall to accept the following conditions of pressure and service as provided for by District's sewer and water supply systems at the location of all proposed connections thereto and to hold the District harmless from and against all damages, liability, and expense arising out of high or low-pressure conditions with respect thereto or from interruptions of service.
18. The Applicant may only assign any rights for water and sewer service only after giving written notice to and receiving written acceptance from the District.
19. Applicant shall pay all attorneys' fees incurred by the District if the District employs an attorney to enforce this Agreement unless Applicant is contesting one or more of the provisions of the Agreement, and a court of competent jurisdiction rules in Applicant's favor on all of its contention..
20. Prior to completion and transfer to the District of the facilities, the District may, upon 72 hours prior written notice to Applicant, enter upon the Property for the purpose of ascertaining whether the Applicant is following the provisions of this Agreement.
21. Applicant will not itself be responsible for the failure of its successors or assignors to comply with any of the provisions of this Agreement.

IN WITNESS WHEREOF, the parties have duly caused their authorized signatures to be attached hereto.
SIGNATURES MUST BE NOTARIZED.

APPLICANT:

By _____

By _____

Date _____

PROPERTY OWNER:

By _____

By _____

Date _____

TRABUCO CANYON WATER DISTRICT

By _____

General Manager

Date _____

APPROVED AS TO FORM:

TRABUCO CANYON WATER DISTRICT

Appendix A-2

BILL OF SALE

DOMESTIC WATER SYSTEM FACILITIES

For good and valuable consideration, receipt of which is hereby acknowledged, the undersigned hereby transfers and conveys to the Trabuco Canyon Water District, a County Water District organized under California Law, and its successors and assigns, all right, title, and interest in and to the water installation, including pipelines, valves, service connections, fire hydrants, meters, other appurtenances to said water installation, constructed, installed, and located in the property described below, and further warrants that the same is free and clear of any encumbrances.

Said property is described as follows: _____

Executed this _____ day of

Company or Corporation Name:

By _____
President

By _____
Secretary

CERTIFICATE OF ACCEPTANCE

As per Resolution No. _____ as set forth in the minutes of a meeting of the Board of Directors of the Trabuco Canyon Water District held on _____ the above Bill of Sale of Domestic Water System Facilities, dated _____ is hereby accepted by order of the Board of Directors of the Trabuco Canyon Water District, a County Water District organized under State Law.

Date of Acceptance

By _____
General Manager
TRABUCO CANYON WATER DISTRICT

TRABUCO CANYON WATER DISTRICT

Appendix A-3

BILL OF SALE

NONDOMESTIC WATER SYSTEM FACILITIES

For good and valuable consideration, receipt of which is hereby acknowledged, the undersigned hereby transfers and conveys to the Trabuco Canyon Water District, a County Water District organized under California Law, and its successors and assigns, all right, title, and interest in and to the nondomestic water installation, including pipelines, valves, service connections, fire hydrants, meters, other appurtenances to said nondomestic water installation, constructed, installed, and located in the property described below, and further warrants that the same is free and clear of any encumbrances.

Said property is described as follows: _____

Executed this _____ day of

Company or Corporation Name:

By _____
President

By _____
Secretary

CERTIFICATE OF ACCEPTANCE

As per Resolution No. _____ as set forth in the minutes of a meeting of the Board of Directors of the Trabuco Canyon Water District held on _____ the above Bill of Sale of Nondomestic Water System Facilities, dated _____ is hereby accepted by order of the Board of Directors of the Trabuco Canyon Water District, a County Water District organized under State Law.

Date of Acceptance By _____

By _____
General Manager
TRABUCO CANYON WATER DISTRICT

TRABUCO CANYON WATER DISTRICT

Appendix A-4

BILL OF SALE

SEWER SYSTEMS FACILITIES

For good and valuable consideration, receipt of which is hereby acknowledged, the undersigned hereby transfers and conveys to the Trabuco Canyon Water District, a County Water District organized under California Law, and its successors and assigns, all right, title, and interest in and to the sewer installation, including mains, manholes, laterals and other appurtenances to said sewer installation, constructed, installed, and located in the property described below, and further warrants that the same is free and clear of any encumbrances.

Said property is described as follows: _____

Executed this _____ day of

Company or Corporation Name:

By _____
President

By _____
Secretary

CERTIFICATE OF ACCEPTANCE

As per Resolution No. _____ as set forth in the minutes of a meeting of the Board of Directors of the Trabuco Canyon Water District held on _____ the above Bill of Sale of Domestic Sewer System Facilities, dated _____ is hereby accepted by order of the Board of Directors of the Trabuco Canyon Water District, a County Water District organized under State Law.

Date of Acceptance

By _____
General Manager
TRABUCO CANYON WATER DISTRICT

TRABUCO CANYON WATER DISTRICT
Appendix A-5
COST OF CONSTRUCTION STATEMENT
DOMESTIC WATER SYSTEM

Developer's Name: _____

Tract No: _____ Date Prepared: _____

"SAMPLE FORM" (Please enter Work Items and Quantities per Development)

Item No.	Item	Quantity		Unit Price	Total Cost
1	Excavation		CY		
2	Installation of 1-inch Water Service		EA		
3	Installation of 8-inch Water Main		LF		
4	Installation of Air Release Assembly		EA		
5	Installation of Blow Off		EA		
6	Trenching		LF		
7	Water Main Disinfection and Testing		EA		
8	Connection to Existing Water		EA		
	GRAND TOTAL INSTALLATION COST*				

* Excludes fees paid directly to Trabuco Canyon Water District.

Prepared by: _____

My signature as witnessed here below attests that the above statement is true and correct to the best of my knowledge.

Date: _____

By _____
Developer

By _____
Official Title

TRABUCO CANYON WATER DISTRICT

Appendix A-6

COST OF CONSTRUCTION STATEMENT

NONDOMESTIC WATER SYSTEM

Developer's Name: _____

Tract No: _____ Date Prepared: _____

Quantity

"SAMPLE FORM" (Please enter Work Items and Quantities per Development)

Item No.	Item	Quantity		Unit Price	Total Cost
1	Excavation		CY		
2	Installation of 1-inch Irrigation Service		EA		
3	Installation of 8-inch Recycled Water Main		LF		
4	Installation of Air Release Assembly		EA		
5	Installation of Blow Off		EA		
6	Trenching		LF		
7	Connection to Existing Recycled Water		EA		
	GRAND TOTAL INSTALLATION COST*				

* Excludes fees paid directly to Trabuco Canyon Water District.

Prepared by: _____

My signature as witnessed here below attests that the above statement is true and correct to the best of my knowledge.

Date: _____

By _____

Developer

By _____

Official Title

TRABUCO CANYON WATER DISTRICT

Appendix A-7

COST OF CONSTRUCTION STATEMENT

SEWER SYSTEM

Developer's Name: _____

Tract No: _____ Date Prepared: _____

Quantity

"SAMPLE FORM" (Please enter Work Items and Quantities per Development)

Item No.	Item	Quantity	Unit Price	Total Cost
1	Excavation	CY		
2	Installation of 8-inch Sewer Main	LF		
3	Installation of Sewer Lateral	LF		
4	Installation of Sewer Manhole	EA		
5	Trenching	LF		
6	Sewer Main Testing	LS		
	GRAND TOTAL INSTALLATION COST*			

* Excludes fees paid directly to Trabuco Canyon Water District.

Prepared by: _____

My signature as witnessed here below attests that the above statement is true and correct to the best of my knowledge.

Date: _____

By _____
Developer

By _____
Official Title

TRABUCO CANYON WATER DISTRICT

Appendix A-8

**AN ORDINANCE OF THE TRABUCO CANYON WATER DISTRICT INSTITUTING
A CROSS-CONNECTION CONTROL PROGRAM TO PROTECT THE PUBLIC WATER SYSTEM**

To be effective date by July 1, 2025

The Trabuco Canyon Water District does ordain as follows:

SECTION I -PURPOSE

The purpose of this ordinance is the following:

1. To protect the public water supply against actual or potential cross connection by isolating within the premise contamination that may occur because of some undiscovered or unauthorized cross-connection on the premises.
2. To eliminate existing connections between drinking water systems and other sources of water that are not approved as safe and potable for human consumption.
3. To eliminate cross-connections between drinking water system and sources of contamination
4. To prevent the making of cross-connections in the future.

These regulations are adopted pursuant to the State Water Resource Control Board, **Cross-Connection Control Policy Handbook (CCCPH)**, Standard and Principles for California's Public Water Systems, dated July 1, 2024.

The CCCPH provides the basis for regulating the use and management of cross-connection control programs and BPAs in PWSs, and related requirements for supporting programs and policies. Activities or uses outside of the scope of the authority of the State Water Board to regulate PWSs are not regulated by the CCCPH, including California Plumbing Code requirements and definitions not related to PWSs.

It is unlawful for any person, firm, or corporation at any time to make or maintain or cause to be made or maintained, temporarily or permanently, for any period of time whatsoever, any cross- connection between plumbing pipes or water fixtures being served with water by the District and any other source of water supply or to maintain any sanitary fixture or other appurtenances or fixtures which by reason of their construction may cause or allow backflow of water or other substances into the water supply system of the District and/or the service of water pipes or fixtures of any consumer of the District.

SECTION II - DEFINITIONS

- A. **Air-gap separation** or AG: means a physical vertical separation of at least two (2) times the effective pipe diameter between the free-flowing discharge end of a potable water supply pipeline and the flood level of an open or non-pressurized receiving vessel, and in no case less than one (1) inch.
- B. **Approved Water Supply**: means a water source that has been approved by the State Water Board for domestic use in a public water system and designated as such in a domestic water supply permit issued pursuant to section 116525 of the CHSC.
- C. **Auxiliary Water Supply**: means a source of water, other than an approved water supply, which is either used or equipped, or can be equipped, to be used as a water supply and is located on the premises of, or available to, a water user.
- D. **Atmospheric Vacuum Breaker**: also known as the 'non-pressure type vacuum breaker' shall mean an assembly containing a float-check, a check seat, and an air inlet port. The flow of water into the body causes the float to close the air inlet port. When the flow of (water stops the float falls and forms a check valve against back siphonage and at the same time opens the air inlet port to allow air to enter and satisfy the vacuum.

- E. Backflow: means an undesired or unintended reversal of flow of water and/or other liquids, gases, or other substances into a public water system's distribution system or approved water supply. The term "backflow" shall mean the undesirable reversal of flow of water or mixtures of water and other liquids gases or other substances into the distribution pipes of the potable supply of water from any source or sources.
- F. Backflow Prevention Assembly or BPA: means a mechanical assembly designed and constructed to prevent backflow, such that while in-line it can be maintained and its ability to prevent backflow, as designed, can be field tested, inspected, and evaluated.
- G. Backflow Prevention Assembly Tester: means a person who is certified as a backflow prevention assembly tester.
- H. Community Water System: means a public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 yearlong residents of the area served by the system.
- I. Contact Hour: means not less than 50 minutes of a continuing education course.
- J. Continuing Education Course: means a presentation or training that transmits information related to cross-connection control programs and backflow prevention and protection.
- K. Cross-Connection: means any actual or potential connection or structural arrangement between a public water system, including a piping system connected to the public water system located on the premises of a water user or available to the water user, and any source or distribution system containing liquid, gas, or other substances not from an approved water supply.
- L. Cross-Connection Control Specialist: means a person who is certified as a cross- connection control specialist.
- M. Distribution System: has the same meaning as defined in section 63750.50 of CCR, Title 22, Division 4, Chapter 2.
- N. Double Check Detector Backflow Prevention Assembly or DCDA: means a double check valve backflow prevention assembly that includes a bypass with a water meter and double check backflow prevention assembly, with the bypass's water meter accurately registering flow rates up to two gallons per minute and visually showing a registration for all rates of flow. This type of assembly may only be used to isolate low hazard cross-connections. See Diagram 1, Appendix C.
- O. Double Check Detector Backflow Prevention Assembly – Type II or "DCDA-II": means a double check valve backflow prevention assembly that includes a bypass around the second check, with the bypass having a single check valve and a water meter accurately registering flow rates up to two gallons per minute and visually showing a registration for all rates of flow. This type of assembly may only be used to isolate low hazard cross-connections. See Diagram 2, Appendix C.
- P. Double Check Valve Backflow Prevention Assembly or DC: means an assembly consisting of two independently acting internally loaded check valves, with tightly closing shut-off valves located at each end of the assembly (upstream and downstream of the two check valves) and fitted with test cocks that enable accurate field testing of the assembly. This type of assembly may only be used to isolate low hazard cross-connections. See Diagram 3, Appendix C.
- Q. Existing Public Water System or Existing PWS: means a public water system initially permitted on or before July 1, 2024, as a public water system by the State Water Board.
- R. Hazard Assessment: means an evaluation of a user premises designed to evaluate the types and degrees of hazard at a user's premises.

- S. High Hazard Cross-Connection: means a cross-connection that poses a threat to the potability or safety of the public water supply. Materials entering the public water supply through a high hazard cross-connection are contaminants or health hazards. See Appendix D for some examples.
- T. Low Hazard Cross-Connection: means a cross-connection that has been found to not pose a threat to the potability or safety of the public water supply but may adversely affect the aesthetic quality of the potable water supply. Materials entering the public water supply through a low hazard cross-connection are pollutants or non-health hazards.
- U. New Public Water System Or New PWS: means a public water system permitted after July 1, 2024, as a public water system by the State Water Board. A new public water system includes a public water system receiving a new permit because of a change in ownership.
- V. Noncommunity Water System: means a public water system that is not a community water system.
- W. Nontransient Noncommunity Water System: means a public water system that is not a community water system and that regularly serves at least 25 of the same persons over six months per year.
- X. Premises Containment: means protection of a public water system's distribution system from backflow from a user's premises through the installation of one or more air gaps or BPAs, installed as close as practical to the user's service connection, in a manner that isolates the water user's water supply from the public water system's distribution system.
- Y. Pressure Vacuum Breaker Back Siphonage Prevention Assembly or PVB: means an assembly with an independently-acting internally-loaded check valve and an independently-acting loaded air inlet valve located on the discharge side of the check valve; with test cocks and tightly closing shutoff valves located at each end of the assembly that enable accurate field testing of the assembly. This type of assembly may only be used for protection from back siphonage and is not to be used to protect from back pressure. See Diagram 4, Appendix C.
- Z. Public Water System or PWS: has the same meaning as defined in section 116275(h) of the CHSC.
- AA. Recycled Water: is wastewater which as a result of treatment is suitable for uses other than potable use.
- BB. Reduced Pressure Principle Backflow Prevention Assembly or RP: means an assembly with two independently acting internally-loaded check valves, with a hydraulically operating mechanically independent differential-pressure relief valve located between the check valves and below the upstream check valve. The assembly shall have shut-off valves located upstream and downstream of the two check-valves, and test cocks to enable accurate field testing of the assembly. See Diagram 5, Appendix C.
- CC. Reduced Pressure Principle Detector Backflow Prevention Assembly or RPDA: means a reduced pressure principle backflow prevention assembly that includes a bypass with a water meter and reduced pressure principle backflow prevention assembly, with the bypass's water meter accurately registering flow rates up to two gallons per minute and visually showing a registration for all rates of flow. See Diagram 6, Appendix C.
- DD. Reduced Pressure Principle Detector Backflow Prevention Assembly – Type II or RPDA-II: means a reduced pressure principle backflow prevention assembly that includes a bypass around the second check, with the bypass having a single check valve and a water meter accurately registering flow rates up to two gallons per minute and visually showing a registration for all rates of flow. See Diagram 7, Appendix C.

- EE. Spill-Resistant Pressure Vacuum Breaker Back Siphonage Prevention Assembly or SVB: means an assembly with an independently-acting internally-loaded check valve and an independently-acting loaded air inlet valve located on the discharge side of the check valve; with shutoff valves at each end and a test cock and bleed/vent port, to enable accurate field testing of the assembly. This type of assembly may only be used for protection from back siphonage and is not to be used to protect from back pressure. See Diagram 8, Appendix C.
- FF. State Water Board: unless otherwise specified, means the State Water Resources Control Board or the local primacy agency having been delegated the authority to enforce the requirements of the CCCPH by the State Water Resources Control Board.
- GG. Swivel-Ell: means a reduced pressure principle backflow prevention assembly combined with a changeover piping configuration (swivel-ell connection) designed and constructed pursuant to this Chapter. See design and construction criteria, as well as Diagrams 9a and 9b, Appendix C.
- HH. Transient Noncommunity Water System: means a noncommunity water system that does not regularly serve at least 25 of the same persons over six months per year.
- II. User premises: means the property under the ownership or control of a water user and is served, or is readily capable of being served, with water via a service connection with a public water system.
- JJ. User's Service Connection: means either the point where a water user's piping is connected to a water system or the point in a water system where the approved water supply can be protected from backflow using an air gap or backflow prevention assembly.
- KK. User Supervisor: means a person designated by a water user to supervise the project.

SECTION III - CROSS-CONNECTION PROTECTION REQUIREMENTS

A. General Provisions

1. Unprotected cross-connections with the public water supply are prohibited.
2. Whenever backflow protection has been found necessary, the District will require the water user to install an approved backflow prevention device by and at his/her expense for continued services or before a new service will be granted.
3. Wherever backflow protection has been found necessary on a water supply line entering a water user's premises, then all water supply lines from the District's mains entering such premises, building, or structures shall be protected by an approved backflow prevention device. The type of device to be installed will be in accordance with the requirements of this ordinance.

B. Where Protection is Required

1. Each service connection from the District water system for supplying water premises having an auxiliary water supply shall be protected against backflow of water from the premises into the public water system unless the auxiliary water supply is accepted as an additional source by the District, and is approved by the public health agency having jurisdiction
2. Each service connection from the District water system for supplying water to any premises on which any substance is handled in such fashion as may allow its entry into the water system shall be protected against backflow of the water from the premises into the public system. This shall include the handling of processed waters and waters originating from the District water system which have been subjected to deterioration in sanitary quality.

3. Backflow prevention devices shall be installed on the service connection to any premises having (a) any internal cross-connections that cannot be permanently corrected and controlled to the satisfaction of the State or local health department and the District, or (b) intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not cross-connections exist.

C. Type of Protection Required

1. The type of protection that shall be provided to prevent backflow into the approved water supply shall be commensurate with the degree of hazard that exists on the consumer's premises.
2. The type of protective device that may be required (listing in an increasing level of protection) includes Reduced Pressure Principle-Detector Assembly (RPO), Reduced Pressure Principal Backflow Prevention Device (RP), and an Air-gap separation (AG).
3. The water user may choose a higher level of protection than required to protect the approved water supply at the user's water connection to premises with varying degrees of hazard are given in Table 1.
4. Situations which are not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the District or health agency.

TABLE 1
TYPE OF BACKFLOW PROTECTION REQUIRED

	Degree of Hazard	Minimum Type of Backflow Prevention
a.	Sewage and Hazardous Substances	
1	Premises where the public water system is used to supplement the reclaimed water supply.	AG
2	Premises where there are wastewater pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. An RP may be provided in lieu of an AG if approved by the health agency and the District.	AG
3	Premises where reclaimed water is used and there is no interconnection with the potable water system. An RP may be provided in lieu of an AG if approved by the health agency and the District.	AG
4	Premises where hazardous substances are handled in any way the substances may enter a potable water system. This does not include a single-family residence that has a sewage lift pump. An RP may be provided in lieu of an AG if approved by the health agency and District.	AG
5	Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.	RP
b.	Auxiliary Water Supplies	
1	Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. An RP may be provided in lieu of an AG if approved by the health agency and the District.	AO
2	Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system.	RP
c.	Fire Protection Systems	
1	Premises where the fire system is directly supplied from public water system and interconnected with an unapproved auxiliary water supply.	RPD
2	Premises where the fire system is supplied from public water system and interconnected with an unapproved auxiliary water supply. An RP may be provided in lieu of an AG if approved by the health agency and District.	AG
3	Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from the private reservoirs or tanks are used.	RPO
d.	Dockside Watering Point and Marine Facilities	
1	Pier hydrants for supplying water to vessels for any purpose.	RP
2	Premises where there are marine facilities	RP
e.	Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to ensure that cross-connections do not exist.	RP
f.	Premises where there is a repeated history of cross-connections being established or re-established.	RP

2. Two or more services supplying water from different street mains to the same building, structure, or premises through which an interstream main flow may occur, shall have at a standard check valve on each water service to be located adjacent to and on the property side of the respective meters. Such check valve shall not be considered adequate if backflow protection is deemed necessary to protect the District's mains from pollution or contamination; in such cases the installation of approved backflow devices at such service connections shall be required.

SECTION IV - BACKFLOW PREVENTION DEVICES

A. Approved Backflow Prevention Devices

1. Only backflow prevention devices which have been approved by the District shall be acceptable for installation by a water user connected to the District's potable water system.
2. The District will provide, upon request, to any affected customer, a list of approved backflow prevention devices.

B. Backflow Prevention Device Installation

1. Backflow prevention devices shall be installed in a manner prescribed in State Water Resource Control Board, **Cross-Connection Control Policy Handbook (CCCPH)**, Standard and Principles for California's Public Water Systems, dated July 1, 2024. Location of the devices should be as close as practical to the user's connection. The District shall have the final authority in determining the required location of a backflow prevention device.
 - a. Air Gap separation (AG): The air gap separation shall be located on the user's side of and as close to the service connection as is practical. All piping from the service connection to the receiving tank is above grade and is entirely visible. **NO** water use shall be provided from any point between the service connection and the air-gap separation.
 - b. The water inlet piping shall terminate at a distance of at least two (2) pipe diameters of the supply inlet, but in no case less than one (1) inch above the overflow rim of the receiving tank.
 - c. Reduced Pressure Principal Backflow Prevention Device (RP): The approved reduced pressure principal backflow prevention device shall be installed on the user's side of and as close to the service connection as practical. The device shall be installed at a minimum of twelve (12) inches above grade and not more than thirty-six inches above grade measured from the bottom of the device and with a minimum of twelve (12) inches side clearance. The device shall be installed so that it is readily accessible for maintenance and testing. Water supplied from any point between the service collection and the RP device shall be protected in a manner approved by the District.
 - d. Reduced Pressure Principle Detector Assembly (RPD): The approved reduced pressure principle-detector assembly shall be installed on the user's side of and as close to the service connection as is practical. The device shall be installed at a minimum of twelve (12) inches above grade and not more than thirty-six inches above grade measured from the bottom of the device and with a minimum of twelve (12) inches side clearance. The assembly shall be installed so that it is readily accessible for maintenance and testing. Water supplied from any point between the service connection and the RPD assembly shall be protected in a manner approved by the District.

C. Backflow Prevention Device Testing and Maintenance

1. The owners of any premises on which, or on account of which backflow prevention devices are installed, shall have the devices tested by a person who has demonstrated their competency in testing of these devices to the District. Backflow prevention devices must be tested at least annually and immediately after installation, relocation, or repair.

The District may require a more frequent testing schedule if it is determined to be necessary. No device shall be placed back in service unless it is functioning as required. A report in the form acceptable to the District shall be filed with the District each time a device is tested, relocated, or repaired. These devices shall be serviced, overhauled, or replaced whenever they are found to be defective and all costs of testing, repair and maintenance shall be borne by the water user.

2. The District will supply affected water users with a list of persons acceptable to the District to test backflow prevention devices. The District will notify affected customers by mail when annual testing of a device is needed and supply users with the necessary forms which must be filled out each time a device is tested or repaired.

D. Backflow Prevention Device Removal

1. Approval must be obtained from the District before a backflow prevention device is removed, relocated, repaired, or replaced.
 - a. Removal: The use of a device may be discontinued, and the device removed from service upon presentation of sufficient evidence to the District to verify that a hazard no longer exists or is not likely to be created in the future.
 - b. Relocation: A device may be relocated following confirmation by the District that the relocation will continue to provide the required protection and satisfy installation requirements. A retest will be required following the relocation of the device.
 - c. Repair: A device may be removed for repair, provided the water use is either discontinued until repair is completed, and the device is returned to service, or the service connection is equipped with other backflow protection approved by the District. A retest will be required following the repair of the device; and
 - d. Replacement: A device may be removed and replaced provided the water use is discontinued until the replacement device is installed. All replacement devices must be approved by the District and must be commensurate with the degree of hazard involved.

SECTION V- USER SUPERVISOR

General:

1. At each premises where it is necessary, in the opinion of the District, a user supervisor shall be designated by and at the expense of the water user.
2. This user supervisor shall be responsible for the monitoring of the back flow prevention devices and for avoidance of cross connections.
3. In the event of contamination or pollution of the drinking water system due to a cross-connection on the premises, the District shall be promptly notified by the user supervisor so that appropriate measures may be taken to overcome the contamination.
4. The water user shall inform the District of the user supervisor's identity on, as a minimum, an annual basis, and Backflow Prevention whenever a change occurs.

SECTION VI-ADMINISTRATIVE PROCEDURES

A. Water System Survey

1. **Request:** The District shall review all requests for new services to determine if backflow protection is needed. Plans and specifications must be submitted to the District upon request for review of possible cross-connection hazards as a condition of service for new service connections.

If it is determined that a backflow prevention device is necessary to protect the public water system, the required device must be installed before water service will be granted.

2. **Notice:** The District will notify each affected water user when it is time for the backflow prevention device installed on their service connection to be tested. This written notice shall give the water user a minimum of 30 calendar days to have the device tested and supply the water user with the necessary form to be completed and resubmitted to the District.
3. **Second Notice:** A second notice shall be sent to each water user who does not have his/her backflow prevention device tested as prescribed in the first notice within the 30 - day period allowed.

The second notice will give the water user a 14-calendar day period to have his/her backflow prevention device tested. If no action is taken within the 14-calendar day period, the District may terminate water service to the affected water user until the subject device is tested.

SECTION VII – WATER SERVICE TERMINATION

A. General

When the District encounters water uses that represent a clear and immediate hazard to the potable water supply that cannot be immediately abated, the District shall institute the procedure for discontinuing the water service to the property.

B. Basis for Termination

Conditions or water uses that create a basis for water service termination shall include, but are not limited to the following items:

1. Refusal to install a required backflow prevention device,
2. Refusal to test a back flow prevention device,
3. Refusal to repair a faulty backflow prevention device,
4. Refusal to replace a faulty back flow prevention device,
5. Direct or indirect connection between the public water system and a sewer line,
6. Unprotected direct or indirect connection between the public water system and a system or equipment containing contaminants,
7. A situation which presents an immediate health hazard to the public water system.

C. Water Service Termination Procedures

1. For conditions 1, 2, 3 or 4, the District will terminate service to a customer's premises after two (2) written notices have been sent specifying the corrective action needed and the period in which it must be done. If no action is taken within the allowed time, the water service may be terminated.
2. Conditions 5, 6, or 7, the District will take the following steps:
 - a. Make reasonable effort to advise the water user of intent to terminate water service.
 - b. Terminate water supply and lock service valve. The water service will remain inactive until correction of violations has been approved by the District.

SECTION VIII-SEVERABILITY

If any section, subsection, subdivision, paragraph, sentence, clause, or phrase herein, or any part thereof, is for any reason held to be invalid, such decision shall not affect the validity of the remaining portions of Section VI or any part thereof. The subsection, subdivision, paragraph, sentence, clause, or phrase thereof, irrespective of the fact that any one or more sections, subdivisions, paragraphs, sentences, clauses, or phrases be declared invalid.

TRABUCO CANYON WATER DISTRICT

Appendix A-9

**SUMMARY OF STEPS REQUIRED TO OBTAIN "WILL SERVE" LETTER
AND PROCESS IMPROVEMENT PLANS**

The purpose of this summary is to describe the steps and their sequence necessary for an Applicant to obtain District approvals for domestic and nondomestic water and sewer service for a residential development or commercial/industrial development. These steps are described in detail within this document including:

- a. Trabuco Canyon Water District's Rule and Regulations
- b. Procedures and Design Criteria for Domestic and Nondomestic Water and Sewer Facilities.
- c. Flow Chart for Procuring Water and Sewer Service for Development Projects.
- d. Special Provisions for Domestic & Nondomestic Water and Sewer Construction
- e. Standard Drawings for Domestic & Nondomestic Water and Sewer Construction.
- f. Rules and Regulations for Nondomestic Water Service.

It is recommended that copies of these documents be downloaded from District's website and reviewed by Applicant. Please contact the District at (949) 858-0277 or see website at www.tcwd.com.

PROCURING WATER AND SEWER SERVICE FOR DEVELOPMENT PROJECTS

PROJECT KICKOFF (Step 1)

1. **Project Kickoff Meeting**: The Owner/Developer (Applicant) to request a Project Kickoff Meeting with District staff to discuss the project. Applicant shall provide the following information to the District prior to the meeting.
 - a. Type of Development
 - b. Project Site Map
 - c. Project Description
 - d. Project Development Plans
 - e. Project Status
 - f. Project Schedule
 - g. Contact Information
2. **Development Letter**: The District will provide a Development Letter to the Applicant after the Project Kickoff Meeting, which will include the following project requirements:
 - a. Project Water and Sewer Parameters
 - b. Sub-Area Master Plan (SAMP) Requirements
 - c. Required Easements
 - d. Off-site Facilities
 - e. Other Project Parameters
 - f. A Developer Deposit Fee for work to be conducted by TCWD and its Consultants on the SAMP.

PLANNING & CAPACITY CHARGES (Step 2)

1. **Sub-Area Master Plan (SAMP)**: Upon receipt of Developer Deposit Fee, District will retain a consultant to prepare the SAMP for the project.

SAMP will be required for residential developments with three (3) or more dwelling units (DU's) or a commercial/industrial development. District will retain a Consultant of their choosing to prepare the SAMP.
2. **Project Design Data & Information**: The Application to submit design data, drawings, and any information as required for preparation of the SAMP. District will use the SAMP to determine projected water, and sewer demands and required infrastructure for the Development.

3. **Capacity Charges:** District will use the SAMP to calculate the following Capacity Charges per Section 5.11 of TCWD's Rules and Regulations:
 - a. Water System Charges
 - i) Capital Improvement Charges
 - ii) Supplemental Water Capacity Fee
 - iii) Water Storage Fee
 - iv) Water Transmission Main Fee
 - b. Sewer System Charges
 - i) Wastewater Treatment System Fee
 - ii) Sewer Collection System Fee
 - c. Reclaimed Water System Charges
 - i) Reclaimed Water Distribution Fee
 - ii) Reclaim Water Storage Fee

The rates for the Capacity Charges and the calculation shall be as determined by the Board of Directors. The District reserves the right to determine the methodology or calculation of each and every Capacity Charge.

3. **Draft SAMP:** District will coordinate meetings and project information with Applicant for review, comments, and approval of the Draft SAMP.
4. **Pre-Approval of SAMP:** District will present the Draft SAMP to TCWD's Engineering and Operations Committee for review and recommendations after District and Applicant have agreed on the Draft SAMP.
5. **Final Approval of SAMP:** District will present the Pre-Approved SAMP with the Engineering and Operations Committee recommendations to TCWD's Board of Directors for review and approval.

WILL SERVE LETTER (Step 3)

1. **Request for Will Serve Letter:** The Applicant (on Applicant's letterhead) shall submit a formal written request to District requesting a "Will Serve Letter" for the proposed development after final approval of the SAMP. Applicant will provide the following information:
 - a. Type of service requested (Domestic or Nondomestic Water or Sewer)
 - b. Type of development
 - c. Project site location map and site layout
 - d. Vesting Tentative Tract map with limits of work
 - e. Contact information
 - f. Project status
 - g. Project schedule
2. **Preparation of Will Serve Letter:** District staff to prepare a Will Serve Letter for signature by the Applicant and the District, after approval of SAMP and all associated capacity charges and fees have been paid by the Applicant per Section 5.4 of TCWD's Rules and Regulations.
3. **Board Authorization to Issue Will Serve Letter:** District staff to present the Will Serve Letter to the Board for review and approval of issuance of the Will Serve Letter. After Board approval, District staff to issue the Will Serve Letter to Applicant. Will Serve Letter will expire after 45 calendar days after issuance, if Applicant does not sign the Will Serve Letter and/or any fees have not been paid.
4. **Final Approval of Will Serve Letter:** The Applicant shall sign the Will Serve Letter and paid **All** associated charges and fees prior to the District staff presenting the Will Serve Letter request to TCWD's Board of Directors for review and approval. The Will Serve Letter will expire within 365 calendar days after approval date if Applicant does not begin and complete the project construction.

5. **Request for New Will Serve Letter:** The Applicant can request a new Will Serve Letter after the expiration date of the original Will Serve Letter. In the New Will Serve Letter, the Project may be subjected to any new conditions or charges as identified by District.

AGREEMENTS & EASEMENTS (Step 4)

1. **Development Agreement:** District to prepare an “Development Agreement for Construction of On-Site and Off-Site Water and Sewer Facilities” (Agreement) upon receipt of the signed Will Serve Letter, payment of all Capacity Charges, and per Section 5.7 of TCWD’s Rules and Regulations.
2. **Required Water and Sewer Easements:** The Applicant to prepare easement documents for approval by District. The easement documents shall be for any off-site facilities or any facilities on privately owned land. On-site easements may be either shown on separate easement documents or can be shown on the Proposed Tract Map. The final easement documents shall be signed and notarized by the Property Owner. Easement documents shall be submitted to the District during the plan review process for review and approval.
3. **Agreement and Water and Sewer Easements Approval:** District staff will present the Agreement and Easement Documents to Board of Directors for review and approval. If approved, Agreement will be signed by Board President and Secretary with a copy returned to the Applicant and two (2) remaining copies will be kept on file at District’s office.

District will forward any original grant of easement documents to the County of Orange Recorder’s office for recording. District will pay all recording costs and will provide a recorded copy to the Applicant.

PLAN REVIEW AND IMPROVEMENT BONDS (Step 5)

1. **Plan Review:** Applicant to submit two (2) copies of the On-site and Off-site Water and Sewer Improvement Plans for review and approval **after** the Development Agreement has been approved by the Board and signed by the Applicant.

First Plan Submittal shall include the following:

- a. Tract Map – Tentative Tract Map and all reference Tract Maps.
 - b. Easement Documents – Proposed easements and any existing water and sewer easements.
 - c. Street Improvement Plans – Proposed and Existing
 - d. Grading Plans
 - e. Landscaping and Irrigation Plans
 - f. OCFA Fuel Modification Plans
 - g. Other Water Demand Features (i.e., livestock, fountains, etc.)
2. **Cost of Construction Statement:** Applicant to submit a “Cost of Construction Statement” for the proposed domestic and nondomestic water and sewer facilities including engineering services (See Appendices A-5 through A-7) to calculate Plan Review Fees.
 3. **Required Plan Check Fees, Inspection Fees, Or Other Fees:** The District will prepare a letter requesting payment for the plan check fee , inspection fee and/or other fees for the Development. These fees shall be paid prior to the second Plan Review submittal. Plan check fee , inspection fee and/or other fees shall be as determined by the Board of Directors.
 - a. **Plan Check Fees:** The plan check fee will be a fee deposit based on 3.3% of the Cost of Construction Statement for water and sewer facilities. A minimum deposit of \$1,000 will be required on all projects. The required amount of deposit may be changed periodically without prior notice to applicants.

- b. **Inspection Fees:** The inspection fee will be based on the cost for the District to retaining a consultant to provide construction inspection service. District will request an Inspection Fee deposit based on consultant providing inspection services before, during and after construction of the project.
- 4. **Improvement Bonds:** Applicant shall submit a Cost of Construction Statement for the proposed domestic and nondomestic water and sewer facilities including engineering services (See Appendices A-5 through A-7) to calculate the appropriate Improvement Bond costs needed for the Applicant to provide a “Faithful Performance Bond” (Improvement Bond) to guarantee that funding will be available for the District to complete the proposed improvements. The Improvement Bond shall include the following:
 - a. The Bond Certificates shall be submitted to the District prior to signing of Improvement Plans, per the Agreement.
 - b. District will notify the appropriate agency of the water and sewer bond amounts and provide a copy of the bond certificates to each agency.
 - c. If the Bonds are to be held by the District, the necessary agreement and bond forms will be supplied by the District for the Applicant’s execution.
 - d. The agreement and bonds must be approved by the District’s Board of Directors before the Improvements plans are signed.

APPLICANT FINAL SUBMISSION & PLAN SIGNATURE (Step 6)

- 6. **Developers Final Submission/Signing of Plans:** Developer to submit final Improvement Plans and Tract Map for approval and signature by District (One (1) original/reproducible).
- 7. **District Approval of Plans:** District Engineer to sign and approve Improvement Plans and Board Secretary to sign and approve Tract Map after the completion of all of the following items:
 - a. Payment for preparing SAMP and any additional final District costs.
 - b. Approved & Signed Will Serve Letter
 - c. Payment of Capacity Charges as shown above.
 - d. Approved & Signed Development Agreement
 - e. Grant of Easements: Signed and Approved Easements
 - f. Payment of Plan Review and Inspection Fees including
 - i) Coordination with connection to existing water and sewer facilities.
 - ii) Excludes the following to be performed by the Developer’s contractors: geotechnical testing, survey, pressure testing, gravity main test, disinfection, and testing.
 - g. Executed Improvement Bond (water and sewer bonds).
 - h. Approval of Improvement Plans and Tract Map by the Board of Directors, as recommended by the District Engineer and Board Secretary.
 - i) In the event that easements are dedicated by Tract or Parcel Map, the map must be signed by the owner(s) and notarized prior to the District signing Tract or Parcel Map.
 - ii) Approval of the Improvement Plans can occur prior to the recording of the map, **but** not before signature of the record map (Tract or Parcel Map) by the District.

CONSTRUCTION PHASE (Step 7)

1. **Construction Phase:** After approval of improvement plans, the Applicant shall select a Contractor for the project and provide the contractor information to the District.
2. **Pre-Construction Meeting:** The Applicant shall set up and attend a pre-construction meeting. The pre-construction meeting shall be set at least 48 hours prior to beginning construction and shall include the following:
 - a. Applicant (Owner/Developer)
 - b. Contractor and Foreman
 - c. TCWD Water & Sewer Staff and Inspector
 - d. County of Orange or other Agency Inspector
 - e. Southern California Edison
 - f. Southern California Gas
 - g. Cox Communication
 - h. Orange County Fire Authority
3. **Contractor Submittal to District:** The contractor shall submit the following documents to the District per the Agreement prior to beginning construction:
 - a. Contractor's License
 - b. Insurance Certificate including indemnification and naming the District as Additional Insured.
 - c. Deposit for hydrant meter and construction water per District's Rules & Regulations.
4. **Construction of Project:** The contractor shall coordinate work with the District.
 - a. The contractor shall confirm completion of street curb/gutter prior to construction of water and sewer facilities.
 - b. Contractor and Applicant shall notify the District 48 hours prior to beginning construction of water and sewer facilities.
5. **Inspection:** Applicant and Contractor shall work with TCWD's Inspector on compliance with the project plans and specifications.
6. **Final Construction:** The following tasks shall coordinate prior to the end of Construction.
 - a. Contractor and Applicant shall work with District on final punch list items and final inspection.
 - b. Applicant and Contractor shall agree (in writing) on completion of final punch list items and inspection.
 - c. Contractor and Applicant shall submit the following reports:
 - i) Geotechnical
 - ii) Hydraulic Pressure Testing
 - iii) Gravity Sewer Main Air Testing
 - iv) Disinfection results for Water Main.
 - v) Approved Shop Drawings.
 - vi) Any manufacturer's manuals and warranties.
 - d. Contractor and Applicant shall submit two (2) sets of the As-Built Improvement Plans and electronic version of plans in AutoCAD and PDF.
 - e. Applicant shall submit two (2) copies of the Final Signed Tract Map.
 - f. Applicant shall submit two (2) copies of the As-Built and/or New Easements and provide copies of revised easements that are signed and notarized.
7. **Return of Hydrant Meter for Construction Water:** Contractor shall return the Hydrant Meter in good working order and pay any additional water use charges. If the Hydrant Meter is returned in non-working order, the Contractor shall pay the cost to replace the Hydrant Meter prior final acceptance.

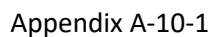
8. **Bill of Sale**: Applicant shall submit the Bill of Sale information on TCWD forms (See Appendices A-2 through A-4) based on actual cost of construction of water and sewer facilities installed to the District.
9. **Request for Formal Acceptance and Release of Bonds**: Applicant shall request in writing for acceptance and release of bonds with the District in accordance with Section A-9 of Procedures and Design Criteria Manual.
 - a. When the work is acceptable to the District, the work will submit to the Board for acceptance and release of bonds. Request must be made at least 30 days prior to a regularly scheduled Board of Directors Meeting
 - b. District to prepare Resolution for Board of Directors including project acceptance, beginning of 365 day (1 Year) warranty period and any new grant of easements in agenda, followed by recording of easements with the County of Orange.
10. **Certificate of Acceptance**: District's General Manager to sign Certificate of Acceptance (included in the Bill of Sale) after formal acceptance.
11. **Notice of Completion**: District shall file a Notice of Completion with County of Orange after formal acceptance.
12. **Release of Improvement Bonds**: District to release improvement bonds (water and sewer) one-year after date of recorded Notice of Completion for any warrantee work and if no claims are received.

FINAL PROJECT COST OUT (Step 8)

1. **Request for Water Meter**: Applicant can request a new water meter for each new service connection as shown on the Improvement Plans, after completion of construction and acceptance of facilities by the District.
 - a. Each request must be accompanied by a letter request for the water meter as shown on the Improvement Plans and confirm the meter size, box and cover type, location, and quantity.
2. **Release of Water Meters and Meter Boxes**: The District will invoice the Applicant for the cost of new water meters and water meter boxes that will be installed by the Applicant. The District will release the water meters after payment of the invoice. Allow up to 4 weeks for meter delivery after receipt of payment.
3. **Water Meter Application**: Applicant shall submit a meter service application for each lot or property that will require water service. New customers can coordinate directly with TCWD's customer service for new account setup and billing.

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Appendix B

TRABUCO CANYON WATER DISTRICT RULES AND REGULATIONS FOR NONDOMESTIC WATER

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Appendix B

TRABUCO CANYON WATER DISTRICT RULES AND REGULATIONS FOR NONDOMESTIC WATER

A. GENERAL

A-1 INTRODUCTION

Trabuco Canyon Water District ("District") serves nondomestic water throughout the District's Reclaimed Water Distribution System.

The nondomestic water system is served from the District's offsite nondomestic water facilities, including but not limited to, a combination of treated wastewater, recycled water, intercepted surface, and subsurface stream flow, supplemented by other waters, including domestic (potable) water for irrigation purposes only and in accordance with the California Water Code (Water Code) Section 13050(n). Also, referred to as "Recycled Water," "Reclaimed Water" or "Non-potable Reuse." Nondomestic water is not intended for human consumption.

The District is a contract agency of and under the jurisdiction of the South Orange County Wastewater Authority (SOCWA), that was formed in 2001. SOCWA was formed, with the support of the San Diego Regional Water Quality Control Board (RWQCB), in order to promote the beneficial use of treated wastewater through reclamation in South Orange County. In addition to pursuing comprehensive basin plan amendments to accommodate reclamation, SOCWA's goals and objectives, as stated in San Diego RWQCB Resolution No.97-52, include the following:

1. Collect, treat, beneficially reuse, and dispose of wastewater in a manner that protects and respects the environment, maintains the public's health, and meets local, state, and federal regulations.
2. Develop a structure between the San Diego RWQCB (Region 9) and SOCWA that provides for the eventual participation of all reclaimed water purveyors in the Orange County portion of Region 9.
3. Develop standard water reclamation requirements between SOCWA, its member agencies, and users incorporating minimum standard regulations for the delivery and use of reclaimed water, reclaimed water quality specifications, plan review and construction inspection procedures, Use Permit requirements, operational certification requirements. and distribution agreements.
4. Provide for monitoring and periodic inspections for the activities of SOCWA, its member/contract agencies, and users with reports to the San Diego RWQCB on the status of compliance with State Water Resources Control Board mandated requirements.
5. Encourage the regional planning and design of reclamation facilities so as to maximize cost economies and the availability of reclaimed water supply to users at all times during the year.

The use of water reclaimed from domestic sewage within Trabuco Canyon Water District is regulated by SOCWA and the San Diego RWQCB. The California Water Code Section 13551 establishes a state-wide policy to encourage the use of reclaimed (nondomestic) water.

Permission to use reclaimed water is based on the ability to adequately treat domestic wastewater to the point that the reclaimed water (effluent) meets the most current requirements of Title 22, Division 4, Chapter 3 Wastewater Reclamation Criteria, of the California Code of Regulations. Title 22 was promulgated by the State Water Resources Control Board, Division of Drinking Water (DDW) to ensure proper health protection and specify the treatment degree to match the intended applications.

In accordance with waste discharge requirements (San Diego RWQCB Order No. 97-52) for SOCWA water reclamation projects, the San Diego RWQCB requires that regulations for facilities using reclaimed water be established.

A-2 Purpose

The purpose of these regulations is to establish standard procedures, specifications, and limitations for the safe and orderly development and operation of reclaimed water facilities and systems in the District's jurisdictional area. These "Rules and Regulations for the Users of Reclaimed Water," cover the administrative, design, construction, and operational requirements, for obtaining reclaimed water service and the use of reclaimed water in onsite facilities, and aspects of the relationship between users and the District.

A-3 Scope: These regulations are adopted to:

A-3.1 Promote Conservation

Achieve conservation of potable water supplies by using reclaimed water to the maximum extent possible for current and future demands. Reclaimed water uses shall be for the maximum public benefit and may include:

1. Agricultural irrigation.
2. Commercial uses (including flushing toilets and urinals).
3. Construction use.
4. Groundwater recharge.
5. Industrial processes.
6. Landscape irrigation.
7. Landscape and/or recreational impoundments.
8. Wildlife habitat.

and others as may be approved by the District, State Water Resources Control Board, Division of Drinking Water, and the San Diego RWQCB.

A-3.2 Prevent Human Consumption: Prevent direct human consumption of reclaimed water through:

1. Adherence to all applicable rules and regulations
2. Posting of identification signs by the user
3. Cross-connection/backflow prevention and testing programs in accordance with Title 17
4. Tagging and color-coding reclaimed water equipment

A-3.3 Provide Control and Enforcement: Provide controls over the use of the reclaimed water system which would cause a nuisance or pollution as defined in the California Water Code and provide provisions for enforcement.

A-3.4 Supplement Standard Specifications: Supplement the District's Standard Specifications for Construction of Domestic and Nondomestic Water and Sewer Facilities.

A-4 Policy: Use of potable water for reclaimed uses is contrary to the District policy, which shall not be considered the most beneficial use of a natural resource and shall be avoided to the maximum extent possible. The District's Mandatory Use Resolution No. 99-886 requires the use of reclaimed water where available, in conformance with Sections 13550 and 13551 of the Water Code of the State of California.

A-5 Specific Authority: These Rules and Regulations for Users of Reclaimed Water are required by as part of the SOCWA Discharge Permit.

A-6 General Authority: The District, a contract agency of SOCWA, which is acting as an agent of the San Diego RWQCB, is authorized to review, approve, or disapprove, and initiate enforcement or mitigation requirements for all actions or proposed actions relating to the production, distribution, or use of reclaimed water within the District's jurisdictional area.

A-7 Inspection Authority: The User shall allow the District, the San Diego RWQCB, or an authorized representative of these parties, or any representative of the United States Environmental Protection Agency, DDW, or the OCHCA, upon presentation of proper credentials, to inspect the facilities and approved use area reclaimed water user to ascertain whether the user is complying with these regulations. The user, the operator, and any operations personnel are obligated to cooperate with those making the inspection and to assist in the performance of operational tests as requested.

A-8 Severability: If any section, subsection, sentence, clause, or phrase of these regulations is for any reason found to be invalid or unconstitutional, such decision shall not affect the remaining portions of these regulations. The District declares that it would have approved these regulations by section, subsection, sentence, clause, or phrase irrespective of the fact that any one or more of the sections subsections, sentences, clauses, or phrases be declared invalid or unconstitutional.

A-9 Service Area: These regulations pertain to reclaimed water service to lands and/or improvements lying within the legal boundaries of the District, unless otherwise stated.

A-10 Amendments: These regulations may be amended by District resolution at any regular or special meeting by a simple majority vote of the Board of Directors and without the approval of any user, operator, or owner. Moreover, any amendments so made shall be deemed incorporated into these regulations immediately upon adoption and will be administered as such. In so far these regulations carry out certain provisions of the California Code of Regulations, Title 17, and Title 22, and said State regulations, including any amendments, or new related State legislation that affects reclaimed water quality or use shall be deemed immediately incorporated into these regulations.

A-11 Precedence: These regulations shall take precedence when they require higher quality material, equipment, design, and/or construction methods than are required by the local governing codes.

A-12 Other Authority: All onsite facilities shall be designed to meet the standards of the local City, County and State governing codes, rules, and regulations, and AWWA standards.

A-13 Liability: The District assumes no responsibility for the maintenance and operation of any onsite reclaimed water system beyond the water meter with respect to violations of the regulatory agency requirements. The user can expect a range in the quality of reclaimed water delivered to the use site due to the varied quality of source water. The user should recognize the limitations of using reclaimed water with certain plants. The user assumes all liability and responsibility of every other kind to the end that the District shall be kept whole and blameless from any claim, damage or liability resulting from quantities, quality, time of delivery, or any other matter related to the maintenance, operation, and service of the user's onsite facilities.

A-14 Enforcement: TCWD shall enforce these regulations in all matters concerning the use of any reclaimed water. Each and every condition and requirement with respect to the use, connection, disconnection, reconnection, and/or discontinuance of reclaimed water and/or reclaimed water service provided by and set forth in these regulations shall apply with equal force and effect to any person(s) or firm, public or private. There shall be no deviation from these regulations except upon written authorization by the District's General Manager, who will act at all times within applicable regulatory agency constraints. An appeal procedure shall be provided, and action of the Trabuco Canyon Water District's Board of Directors shall be final.

A-15 Protection of Public Health: TCWD reserves the right to take any action with respect to the operation of the reclaimed water system and at such time as it deems proper to safeguard public health. All production, distribution, and use of reclaimed water shall conform to the requirements of Title 22, Division 4, Chapter 3, Wastewater Reclamation Criteria, of the California Code of Regulations. Where not covered more specifically herein, all uses shall conform to the State Water Resources Control Board.

A-16 Authorized Uses: These regulations limit the application of reclaimed water to irrigation, commercial use, habitat development and maintenance, recreational use, groundwater recharge, impoundments, and construction use for which Title 22, Division 4, Chapter 3, Wastewater Reclamation Criteria, of the California Code of Regulations, or other specific State legislation provides requirements.

Any of the aforementioned uses or other uses for which explicit specifications are not provided in these regulations can be considered but must be approved on a case-by-case basis by the District after other appropriate regulatory agencies have granted such approvals, as may be required.

A-17 Comprehensive Water Quality Control Plan Report (Basin Plan): The Basin Plan for the area of South Orange County with the San Diego Region 9 jurisdiction provides the guidelines for use of reclaimed water within the service area. The SOCWA Waste Discharge Permit and these regulations governing the Trabuco Canyon Water District water reclamation program are based upon the current water reclamation criteria.

A-18 AWWA Guidelines For Distribution Of Nonpotable Water: The AWWA Guidelines for Distribution of Nonpotable Water, latest edition, published by the California-Nevada Section of AWWA is hereby incorporated into these regulations by reference.

B. USER GENERAL PROVISIONS

B-1 Approved Uses and Use Areas: Reclaimed water may only be used for approved uses in areas approved by the District. Approval may be obtained only through the service application procedure contained in these regulations. In all cases, approval of a use and use area by the District will be contingent upon satisfaction of the requirements of the District and other applicable regulatory agencies. The user shall obtain approval from the District for any proposed change in the character of the use of reclaimed water.

B-2 Design Approval: Prior to the construction of the onsite facilities that will use or receive reclaimed water, the design of such facilities must be approved by the District. Approval shall be obtained only through the procedure contained in these regulations. Approval shall be contingent upon the apparent satisfaction of applicable design requirements, including those contained within these regulations.

B-3 System Responsibility: All offsite distribution facilities are the property of the District and shall be under the management and control of the District. Only authorized employees of the District shall have any right to operate said system and/or property in any manner. The offsite supervisor, designated by the District, shall be responsible for the operation of the offsite distribution systems and for the assessment of water quality as it relates to compliance with requirements of regulatory agencies. The District's Representative will be responsible for the onsite monitoring, inspection, and surveillance of all users.

B-4 Request for Information: Reclaimed water users shall provide upon request, written responses to the District, SOCWA, the San Diego RWQCB, DDW, and the OCHCA, requests for information to ascertain whether the reclaimed water user is complying with these regulations. The District shall upon request make available to the User a report which shows the typical or average quality of reclaimed water which the user can expect to be delivered to his use site.

B-5 Liability: The District assumes no responsibility for the maintenance and operation of any onsite reclaimed water system beyond the water meter with respect to violations of the regulatory agency requirements. The user can expect a range in the quality of reclaimed water delivered to the use site due to the varied quality of source water.

The user should recognize the limitations of using reclaimed water with certain plants. The user assumes all liability and responsibility of every other kind to the end that District shall be kept whole and blameless at all times from any claim, damage or liability resulting from quantities, quality, time or occasion of delivery, or any other matter related to the maintenance, operation, and service of user's onsite facilities.

B-6 Enforcement: TCWD shall enforce these regulations in all matter concerning the use of any reclaimed water. Each and every condition and requirement with respect to the use, connection, disconnection, reconnection, and/or discontinuance of reclaimed water and/or reclaimed water service provided by and set forth in these regulations shall apply with equal force and effect to any person(s) or firm, public or private.

There shall be no deviation from these regulations except upon written authorization by District's General Manager, who will act at all times within applicable regulatory agency constraints. An appeal procedure shall be provided, and action of Trabuco Canyon Water District's Board of Directors shall be final.

B-7 Conditions of Service: Trabuco Canyon Water District reserves the right to revoke a Use Permit if any of the service conditions contained herein are **not** satisfied at all times.

B-7.1 Regulatory Conditions: Service to a User may be terminated at any time if the quality of the reclaimed water does not comply with the requirements of regulatory agencies or at any time the user's operations do not conform to these regulations.

B-7.2 Operational Conditions: All reclaimed water will be provided to the user in the Use Permit for reclaimed water service. Reclaimed water use may or may not be subject to the same restrictions as potable water. TCWD reserves the right to schedule and control the use of reclaimed water. If in the opinion of the District or designated representative, control and scheduling are necessary.

B-7.3 Other Conditions: The user shall retain a copy of these regulations. These regulations shall be made available at all times for reference by the operations personnel.

B-8 Contingency Reservations: If at any time during the construction or operation of facilities designed to use reclaimed water real or potential hazards are evidenced, Trabuco Canyon Water District reserves the right and has the authority to terminate water service in the interest of protecting the public health, safety and welfare or other elements of the reclaimed system.

In the event that reclaimed water service is terminated; District may supply water to the affected onsite facilities either temporarily or permanently from the potable water system. The use of potable water would be subject to potable water availability from the District as well as special conditions set by the DDW, OCHCA, and Trabuco Canyon Water District.

B-9 Fees: The plan checking, and inspection (PCI) fee will be determined by the District prior to second plan review. The District will compute the PCI fee based on these regulations and will advise the applicant of the amount of the PCI fee. The PCI fee may be revised from time to time by the Board of Directors, and all amounts shall be deemed incorporated herein upon adoption.

C. USER ADMINISTRATIVE REQUIREMENTS: The following details for user administration that are User specific, such as for irrigation, are intended as examples of current use practice and are not intended to preclude other approved uses, which may require case-by-case administration by the District.

C-1 Use Permit Application Process: A completed application for nondomestic water service must be submitted to the District by the user. Approval for service shall be indicated by the District issuing a Use Permit for nondomestic water service.

A Use Permit for nondomestic water service issued by the District may replace any previous requirement by the San Diego RWQCB for submittal of a Waste Discharge Report, or some equivalent information/application package, and issuance of water reclamation requirements for individual projects or reclaimed water use sites.

The steps for obtaining nondomestic water service are listed in Appendix B-2. District shall furnish the application form upon request by prospective users. District shall provide information regarding User account and meter numbers, hydrologic subarea, and Title 22 water quality information.

An application form is included as Appendix B-3 of this document. The applicant shall agree to comply with these regulations by signing the application form. Appendix B-3A becomes the "Use Permit", once signed by the Applicant and District.

The following items are to be included in an application package:

1. Completed application form.
2. Required drawing(s)
3. Required fees and deposits, which are due prior to approval.

District shall review the material and respond after receipt of a completed application package. District may request additional information it deems necessary.

District shall determine if the property to be served is in a suitable area for reclaimed water use, and if the necessary quantity and quality of reclaimed water can be made available to the applicant.

For conversion projects only, after review and approval of the application package, District will send the application to the OCHCA for approval. Applications for new construction may be approved by the District and the Use Permit issued without further approval by OCHCA.

C-2 Use Permit: A Use Permit must be obtained by the User, to receive reclaimed water on any property within the District. The completed and fully executed application as shown in Appendix B-3 will become the Use Permit (Appendix 3A). The Use site number and User account number shall be the Use Permit Numbers for general reference purposes. Use permits to receive reclaimed water service made by the Applicant and as provided under these regulations pursuant to receipt of an application for such service shall be subject to the following conditions:

C-2.1 Requirements: The applicant shall adhere to requirements prescribed by these regulations and to all future requirements prescribed by all governing agencies pertaining to reclaimed water service.

C-2.2 Permit Approval: The Use Permit shall come into full-force after the project has been constructed, tested, issued a final release, and been approved by the involved agencies.

Trabuco Canyon Water District will initiate a reclaimed water service in accordance with the Use Permit upon completion of the steps listed in Appendix B-2. The Use permit and its conditions shall be the binding agreement between Trabuco Canyon Water District and the User.

C-2.3 Permit Availability: A copy of the current Use permit must be on file at the User's office and available for review at all times.

C-2.4 Permit Life: The Use Permit shall stay in effect indefinitely but may be cancelled or suspended if a change of User occurs, **and** the User has not notified the District via the forms in Appendix B-3 and Appendix B-3A of the impending change at least 30 calendar days prior to change based on the following.

1. A change of operator occurs, and the User has not notified the District via the form in Appendix B-4 (Certification form) of the pending change 30 calendar days prior to the change.
2. A change of reclaimed water use occurs that is inconsistent with the limits of the Use Permit
3. A violation occurs and results in the Nondomestic Water system being turned off.
4. A new completed Appendix B-3A and Appendix B-4 application must be submitted to reinstate a Use Permit that has been previously cancelled.

C-3 Submittals and Records

C-3.1 Onsite Irrigation Systems:

Preliminary Investigation: The applicant shall meet with the District at the earliest possible date to determine whether the property to be irrigated is within the District's service area. At this time, the availability of existing reclaimed water distribution lines and District reclaimed water requirements can also be reviewed. Feasibility acceptance must be obtained prior to making formal application for reclaimed water service.

The applicant shall provide two (2) copies of a pre-construction report, signed by a design engineering consultant, describing the scope of the project, including the proposed use area, volume of use, gpm per acre, hours of operation during peak use, and preliminary layout and design of the onsite facilities, including any potable water uses and use areas with backflow protection.

System Design Documents: The following information shall be submitted to and approved by the District prior to commencing any construction:

Plans and Specifications:

1. Two (2) copies of the construction plan with details, and specifications signed by the design engineer or landscape architect, for the construction of the onsite irrigation system, shall be submitted to the District for review and approval.
2. All drinking fountains, permanent tables, potable water lines, water meters, backflow prevention assemblies, play areas, hardscape, ball field layouts, etc. shall be shown on the plans.
3. Plans shall include a vicinity index map and shall include major street crossings and point of connection street names.

Title Sheet: Title sheet shall show Tract and Lot number. Plans shall include irrigation system design, notes, appurtenance details and legends without separate attachments.

Meter Criteria: The following irrigation meter criteria information should be included in each set of plans adjacent to each meter.

Tract and Lot Numbers _____
Use Site Number _____
Meter _____ Size _____
Elevation _____
Zone/HGL _____
POC Static Pressure _____ psi
Required Dynamic Pressure Onsite _____
Average Application Rate _____ gpm/ac
Maximum Application Rate _____ gpm/ac
Area Served _____ AC
Annual Water Use _____ ac-ft/yr.

Irrigation Criteria: A legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes and type of construction materials, and all related appurtenances including their size, model number and description.

Provide a detail for the installation of all proposed appurtenances and controller timing charts showing maximum hours of operation.

Callouts: Backflow prevention assemblies, meters, vaults, quick couplers, hose bibbs, all potable water lines, exterior drinking fountains and other facilities shall be shown and called out on the plans.

If no backflow prevention assemblies, potable water lines, exterior drinking fountains or other facilities are present in the design area, it shall be specifically stated on the plans that none exist.

Standard Notes: As a minimum standard note that is to be listed on the plans are as follows.

Additional notes may be added, as appropriate.

1. The design, installation, identification and use of all onsite potable water systems, fire protection systems, potable water used for irrigation systems and reclaimed water irrigation systems shall conform to all State of California, County of Orange, DDW, AVWA and District Rules, Regulations, Guidelines, Articles and Codes regarding the design, installation, identification, use and maintenance of onsite systems and protection of the public's health.
2. The Contractor shall always have a copy of these Construction Plans and Specifications on job.
3. No construction shall take place without all required approvals and signatures on the plans.
4. The District shall be furnished with two (2) copies of the approved construction plans prior to starting construction.
5. A pre-construction meeting shall be held on the jobsite at least 24 hours prior to the start of construction.
6. The District's inspector shall be notified two days (48 hours) prior to construction, or any inspection.
7. All water meters and related appurtenances shall be installed and inspected per District specifications before any water use can take place.
8. Onsite Separation Requirements:

Horizontal Separation: The pressurized reclaimed water piping shall maintain a ten (10) foot horizontal separation at all times from all potable water piping and/or a parallel sanitary sewer system. If a 10-foot horizontal separation is not possible, special construction requirements shall be considered, refer to District Standard Detail. Common trench construction is prohibited.

Vertical Separation: The pressurized reclaimed water piping shall always maintain a minimum one-foot vertical separation from all pressurized potable water piping and/or a sanitary sewer system.

The pressurized reclaimed water piping shall be installed one foot below all pressurized potable water piping and one foot above all sanitary sewer systems. If a one-foot vertical separation is not possible, special construction requirements shall be considered. Refer to District Standard Drawing.

9. Quick coupling valves on reclaimed water irrigation mainlines shall be removed at the end of the maintenance period unless specifically approved by the District to remain in place. If the quick coupling valves are required to be removed, the manner of removal shall be determined by the District.
10. Adjust all sprinklers, impact, and rotor heads to eliminate direct overspray, windblown spray, ponding, and runoff, onto non-irrigated areas.
11. Any deviations from the signed and approved set of plans must be approved in writing prior to installation by the design consultant and the District. Any revision must be submitted to the design consultant and the District for approval. Failure to comply will result in a "STOP WORK NOTICE."
12. Final coverage tests must be performed and passed before a final release will be issued. Direct overspray, windblown spray, ponding, and runoff onto non-irrigated areas are prohibited.
13. Cross connection tests shall be performed on all water systems, including reclaimed or future reclaimed irrigation systems, and all potable water systems, as determined by the District prior to the use of reclaimed water. All cross-connection tests must be performed and passed before a final release will be issued.
14. The entire irrigation system and its appurtenances, as well as all onsite facilities and appurtenances shall be inspected and reviews by the District. Final inspection site reviews must be performed and passed by the District before a final release will be issued.
15. The reclaimed water system hours of operation are 9:00pm to 6:00am unless directed otherwise by the District.
16. The following information must be submitted to Trabuco Canyon Water District before a final release will be issued:
 - a. One complete set of District Approved Bond Record Plans. All record drawing information must be reviewed and approved in writing by the design consultant and the District before producing as-built plans for submittal to District. Final record plans shall be professionally drafted.
 - b. Completed District backflow investigation and test reports for all backflow prevention assemblies on site. All backflow test reports shall be submitted to the District.
 - c. Certificates of substantial compliance, calibration, acceptance and/or proper installation/operation of the irrigation system and appurtenances as deemed necessary by the District.
 - d. Completed District reclaimed water certification form for each reclaimed water point of connection.
17. Failure to comply with any of the prior provisions and/or any other of these regulations will place the system in violation of these regulations and will result in a stop work notice and/or termination of service until appropriate corrective steps have been taken.
18. Install internal, external, or in-line anti-drain valves as necessary to prevent low-head drainage.
19. Final Record Drawings and Documents: Final Record drawings shall be approved by the District before a request for regular service start-up is made. The following shall apply:

Recording Changes: All changes in the work constituting departures from the original design drawings, including changes in both pressure and non-pressure lines, number or location of spray heads, bubbler, or drip systems, shall be accurately recorded on one set of drawings. At the end of each working day, the contractor shall record all work accomplished for that day on the set of drawings in red ink. The final set of record drawings shall be professionally drafted and provide a bond copy and DWG file to the District. The red line copy shall be available to District upon request.

Dimensioning: All dimensions shall be taken from two permanent points of reference such as buildings, monuments, sidewalks, curbs, or pavements.

Specific Cal-Outs: The locations of the following items shall be shown:

1. Points of Connection
2. Routing of irrigation supply lines
3. Gate valves
4. Sprinkler control valves
5. Quick coupling valves
6. Routing of control wires
7. Irrigation controllers
8. Remote control valves
9. Irrigation-related appurtenances

Record Drawings: For the purpose of reference, record drawings shall always be available.

Control Charts: Shall be prepared and submitted with the record drawings and approved by the District before formal request for service start-up is made. The control chart submittal shall include the following:

1. Chart Requirement: Three (3) 11" x 16" controller charts shall be provided for each point of connection supplied showing the system area covered by the controller.
2. Chart Scale: Each chart shall be a reduced record drawing of the system. The final controller sequence shall be clearly legible at the reduction chosen.
3. Chart Coloring: Each chart shall show the area of coverage for each station.

Establishing a Temporary Service Connection:

1. Prior to regular service, a temporary service connection may be used to supply water to onsite facilities to permit the testing of all or a portion of the facilities during installation. The temporary service connection is valid for 90 calendar days. The inspector shall be notified at least 24 hours in advance of such intended use of reclaimed water.
2. No reclaimed water connections from offsite to onsite facilities are allowed for sites being served potable water until cross connection testing is completed and satisfactorily completed and all backflow prevention assemblies have been installed, tested, and inspected. Test results are to be submitted to the District inspector.

Final Onsite Facilities Inspection:

Before final acceptance, the District and the Contractor's superintendent or foreman, will make a final inspection of all work to check the following items:

1. Final site review.
2. Final coverage test has been performed.
3. Cross connection testing has been performed and passed.
4. The information requested in the Standard Notes has been submitted to the District.

The District will issue a completed reclaimed water certification form and Use Permit upon successful completion of final inspection. The Use Permit must be obtained within 90 calendar days following the service connection establishment, otherwise service will be discontinued.

C-3.2 Construction Water Facilities:

Preliminary Investigation: The applicant shall meet with the District at the earliest possible date to determine whether the property to be served is within the District's Service area.

At this time, the availability of existing reclaimed water distribution lines can also be reviewed. This determination shall be made prior to the date on which feasibility acceptance is desired. Feasibility acceptance must be obtained prior to making formal application for reclaimed water service.

System Layout Documents: A location drawing shall be submitted by the user to the District and approved by the District prior to commencing any installation of facilities.

This drawing shall indicate the exact boundaries of the site of the proposed reclaimed water use at a scale that includes the site and the nearest paved surface street containing a reclaimed water distribution main. A materials list shall be submitted by the operator to the District and approved by the District prior to commencing any installation of facilities. This list shall include the following:

Transmission Facilities: The diameter, approximate length, and construction material of all onsite reclaimed water lines, whether flexible hose or rigid pipe.

Storage Facilities: The estimated number of fixed storage tanks or ponds and the approximate volume of each.

C-4 Reporting

Certain reporting or notification between the parties involved with the use of reclaimed water may be conducted in person, by email or by telephone.

C-4.1 District: The following information shall be submitted in writing by the District to the user upon request and relates to ongoing reclaimed water service:

1. The quantity of reclaimed water consumed by the user.
2. The quality of reclaimed water delivered to the user.
3. A reclaimed water monitoring report for the site.

C-4.2 User: The user shall report any noncompliance which may endanger health or the environment. Any such information shall be provided to Trabuco Canyon Water District immediately after the user becomes aware of the circumstances.

A written submission shall also be provided within five (5) calendar days of the time the user becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected; the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

The District, or an authorized representative, may waive the written report on a case-by-case basis if the oral report has been received within 24 hours. The following occurrences(s) must be reported to the District within 24 hours:

1. Any unplanned or uncontrolled discharge of reclaimed water resulting from water line breaks, malfunctioning control system, or any other circumstances.
2. Discharge of reclaimed water outside of the approved use area due to runoff, direct spray, overspray, or windblown spray
3. Discharge of reclaimed water at a construction site in an unapproved manner or in an unapproved area

Due to the potential threat to the public water supply, discovery of a cross connection of a reclaimed water system with a potable water system must be reported **immediately** to the District.

C-5 Upgrades and Alterations to Onsite Irrigation Systems: Upgrades or alterations to reclaimed water irrigation systems, and potable water systems, must be approved and inspected by the District. Prior to commencement of work, record drawings must be revised and submitted to the District.

Any upgrades or alterations made to a reclaimed water irrigation system, which are not inspected or follow stated notification procedures, places the owner and the irrigation system in violation of Trabuco Canyon Water District's reclaimed water rules and regulations. Penalties may apply, including, but not limited to, discontinuation of service.

C-6 Repairs to Onsite Irrigation Systems: Repairs to buried pipes for irrigation systems and potable water systems on reclaimed water use sites must be inspected by the District. The District must be notified immediately when a repair is made. Any repairs performed and backfilled without District inspection shall be exposed at the owner's expense for inspection and compliance.

Any repairs that are not inspected or follow stated notification procedures, place the owner and the irrigation system in violation of the District's reclaimed water rules and regulations. Penalties may apply, including, but not limited to, discontinuation of service.

D. USER TECHNICAL REQUIREMENTS

D-1 Onsite Irrigation Systems

D-1.1 Design Responsibility: The design of an onsite irrigation system that will use reclaimed water, including the preparation of plans and construction specifications, shall be under the responsibility of a design consultant registered with the State of California.

D-1.2 Provisions For Reclaimed Water: In those areas where reclaimed water is not immediately available for use when the area is ready for construction, an approved backflow prevention assembly shall be required for any potable water use.

This assembly shall be provided, installed, and tested at least annually by the user. All maintenance of the onsite backflow prevention assembly shall be the responsibility of the user.

In those cases where the District uses a master backflow prevention assembly at the intertie between the reclaimed water distribution system and the potable water system, District may waive the requirement for the user to install an onsite approved backflow prevention assembly.

Only the District, or the user in accordance with District's requirements and under the inspection of the District, shall remove said backflow prevention assembly and make the connection to the reclaimed water distribution system when reclaimed water becomes available. At such time, if the District removed the assembly, District shall return the assembly to the user. All points of connection to District's offsite facilities shall be determined by the District.

Backflow prevention assemblies are not required on reclaimed water irrigation systems after service has begun with reclaimed water.

However, backflow prevention assemblies may be required on irrigation systems using reclaimed water, on a case-by-case basis as determined by the District.

Backflow prevention assemblies required by the District on reclaimed water systems shall be clearly identified and/or installed in protective enclosures. The District shall test these reclaimed water backflow prevention assemblies with the appropriate equipment, used only for reclaimed water backflow prevention assemblies.

Notification of all action taken with backflow prevention assemblies shall be made by the District to the OCHCA.

D-1.3 Service Line: District reserves the right to specify the size and location and/or type of all offsite facilities. The reclaimed water service lines shall be extended to a location in compliance with District's standard drawings or a curb line of the customer's property abutting upon a public street, highway, road, or utility easement in which reclaimed water mains are installed.

D-1.4 Service Pressure: Static service pressure shall be as provided by the District. The design consultant must prepare and submit a hydraulic worksheet indicating hydraulic constraints.

When a reasonable service pressure would not be available to onsite facilities previously served from the potable water system, correcting this situation upon conversion to the reclaimed system shall be handled as follows:

1. If a booster pump or pressure regulation is required for onsite facilities when service was provided from the potable system, then any booster pump or pressure regulation required for reclaimed water service shall be provided by the user.
2. If reasonable service pressure was available for the onsite facilities when service was provided from the potable system, then any action needed to provide reclaimed water service shall be considered on a case--by-case basis in conjunction with the Use Permit application review.

D-1.5 Design Capacity: The onsite irrigation system shall be designed to meet the peak-demand requirements for all plant materials used within the design area. Peak demand must be determined utilizing performance evapotranspiration rates (ET_0), crop coefficients (K_c), distribution of uniformity (D.U.), irrigation efficiency (I.E.), and a 9-hour irrigation period per day.

D-1.6 Design Application Rates: The onsite irrigation system shall be designed to apply irrigation water in a manner compatible with the infiltration rates of the soil types within the approved use area.

Evidence that infiltration rates have been assessed shall be included with the design. Where varying soil types are present to the extent that they cannot be adequately addressed by separate zones (hydrozone), the design of the irrigation system shall be compatible with the lowest infiltration rate present.

Average and maximum application rates: All irrigation systems **must not exceed** the following application rates:

Flat area:	Average Application Rate	15 gpm/acre
	Maximum Application Rate	20 gpm/acre
Slope area:	Average Application Rate	10 gpm/acre
	Maximum Application Rate	15 gpm/acre

D-1.7 System Layout: The irrigation system shall be designed based on peak-application rate requirements to prevent discharge onto areas that are not approved for use. Adjustable arc, adjustable radius sprinklers with anti-drain/check valves shall be used adjacent to roadways, boundary lines, and hardscape to confine the discharge from the irrigation system to the design area. No reclaimed water shall leave the planting areas, whether by direct overspray, ponding, runoff, or sprinkler break.

A drainage device under control of owner shall be installed at toe of slope draining to single family residential lots. The onsite irrigation system shall be required to automatically shut off in the event of a line break.

The irrigation system design shall avoid spray patterns that include obstructions that tend to concentrate reclaimed water to produce ponding and/or runoff, such as direct or indirect spraying against structures.

The District reserves the right to limit the area of land under one ownership or homeowner's association to be supplied by one reclaimed water service connection and corresponding meter. A reclaimed water service connection and its corresponding meter shall not be used to supply adjoining property of a different owner.

Irrigation systems where landscaping around homes and in common areas served with one meter and owned by the same user, e.g., a homeowner's association, may be allowed to crossroads, streets, or other public rights-of-way within the user's property.

When a property provided with a reclaimed water connection and corresponding meter is subdivided, such connection and meter shall be considered as serving the lot or parcel of land on which the meter is located.

Additional reclaimed water mains and/or reclaimed water service lines will be required for all subdivided areas in accordance with these regulations.

For properties of the same user, irrigation systems shall be allowed to crossroads, streets, or other public rights-of-way to serve medians and slopes along streets.

All reclaimed water used on any property must pass through the meter. Users shall be held responsible and charged for all reclaimed water passing through their meters.

Onsite separation requirements:

Horizontal Separation: The pressurized reclaimed water piping shall always maintain a ten (10) foot horizontal separation from all potable water piping and/or a parallel sanitary sewer system. If a 10-foot horizontal separation is not possible, special construction requirements shall be considered, refer to District Standard Drawing. Common trench construction is prohibited.

Vertical Separation: The pressurized reclaimed water piping shall always maintain a minimum one-foot vertical separation from all pressurized potable water piping and/or a sanitary sewer system. The pressurized reclaimed water piping shall be installed one foot below all pressurized potable water piping and one foot above all sanitary sewer systems. If a one-foot vertical separation is not possible, special construction requirements shall be considered, refer to District Standard Drawing.

D-1.8 System Control Devices: Every reclaimed water service line shall be equipped with an angle stop on the inlet side of the meter and ball valve on the discharge side of the meter. The angle stop is to be used only by District personnel to control the reclaimed water supply through the water service line. If the angle stop is damaged by the user or his use of reclaimed water to an extent requiring replacement, then the user shall bear full financial responsibility.

The onsite irrigation system shall be required to automatically shut off in the event of a line break. A master valve connected to a flow sensor should be used to provide automatic system shut down in the event of a pipeline break.

D-1.9 Identification Requirements: Refer to Technical Specification Section 17110 Identification.

D-2 Construction Water Facilities

D-2.1 Service Connections: Service connections for the construction use of reclaimed water may be provided by the District at locations as convenient as practicable to the user, but at the discretion of the District.

The service shall include a valved connection to a reclaimed water distribution main and water meter whose capacity shall be determined by the District from information supplied by the user in his Use Permit application. The user shall make the connection to the main in accordance with the District's requirements or contract with the District to do so. The meter shall be supplied by the District and installed by the user in accordance with District's requirements. Refer to the TCWD Standard Specifications for Construction of Domestic and Nondomestic Water and Sewer Facilities incorporated herein.

D-2.2 Onsite Distribution Facilities: Transmission lines for conveying reclaimed water from the metered service connection to a storage container or water distribution vehicle shall be of adequate size and structural integrity to ensure that leaks or ruptures will not occur in the course of normal construction activity. These lines shall be provided by the user. Lines crossing construction roadways or other areas receiving regular vehicular traffic must be buried to a depth of at least 18 inches for pipes less than 2-inch diameter or greater than 24 inches deep if pipe diameter is 2 inches or greater.

Rigid pipes able to withstand the planned vehicular loads shall be employed for such installations.

D-2.3 Storage Facilities: Reclaimed water storage tanks and distribution vehicles (i.e., Water Trucks) shall be of adequate design and structural integrity to ensure that leaks or ruptures will not occur in the course of normal use. These tanks or ponds shall be provided by the user.

All storage ponds and any storage tanks not supported more than six feet above ground-level shall be contained within a fence or other enclosure that will restrict access by the general public to these facilities at all times when operations personnel are not present. Outlet control with positive shut-off shall be provided at each storage facility.

All reclaimed water storage facilities owned and/or operated by the user shall be protected against erosion, overland runoff, and other impacts resulting from a 100-year frequency 24-hour storm and protected against 100-year frequency peak stream flows as defined by the County of Orange Flood Control District.

D-2.4 Distribution Vehicles: Vehicles used for distributing reclaimed water for soil compaction and dust control shall be provided with adequate tanks and plumbing systems to ensure that leaks and ruptures will not occur in the course of normal use.

Control valves shall be provided such that the reclaimed water can be applied in a controlled fashion on the approved use area and completely retained during transit in all other areas. Spray heads or nozzles shall be provided and configured such that the discharge is uniformly distributed, and runoff, ponding or windblown overspray conditions are prevented.

D-3 Protective Measures: The following provisions are to protect the potable water supplies against actual undiscovered, unauthorized, or potential cross-connections to the user's reclaimed water system.

These provisions are in addition to, not in lieu of, the controls and requirements of other regulatory agencies. These provisions are in accordance with the DDW Cross Connection Control Manual, dated July 2024, and Title 17 (Public Health) of the California Code of Regulations. These regulations are intended to protect potable water supplies and are not intended to provide regulatory measures for protection of users from the hazards of cross-connections within their own property.

Approved backflow prevention methods on the potable water services to the property, as required in these provisions, shall be provided, installed, tested, and maintained by the user at user expense. These methods shall be located on the property served immediately downstream of the meter and shall not be on District facilities.

All devices used shall be readily accessible for testing and maintenance and no device shall be submerged or exposed to reclaimed water, direct overspray, or runoff at any time.

When water service is initiated, the applicant must provide sufficient information, including plumbing and building plans, to enable the District to determine the level of backflow protection required. The proper backflow protection, as determined by the District and approved by DDW and other appropriate regulatory agencies, shall then be installed, inspected, and tested before reclaimed water service is provided.

The user shall notify the District, not less than 30 calendar days prior to a change of use, user, onsite supervisor, owner, tenant, or operator. District will then reassess the level of protection required. Any and all proposed alterations to existing onsite facilities that may affect required protection level must be reported to and approved by the District prior to the proposed change.

At their discretion, representatives of TCWD, and any regulatory agency having jurisdiction may conduct surveys of property where water service is provided by the TCWD. These surveys are to determine if any actual or potential cross-connections exist.

The user shall provide full cooperation in facilitating these surveys. Where protection is required, backflow protection in accordance with DDW Cross-Connection Control Manual, latest edition and Title 17 and approved by DDW for potable water supplies shall be provided as follows:

Each District water service connection that supplies potable water to a parcel having a reclaimed water supply shall be protected against backflow from the parcel into the potable water system.

Backflow protection may be required at parcels where there has been a history of cross-connections to reclaimed water supply being re-established.

Water meters used for reclaimed water service shall be tagged or color-coded "Purple" or otherwise distinguished as such in accordance with AWWA Guidelines. These meters shall not be interchanged or used for potable water service after repairs and/or meter testing have been performed.

District will inspect and test at least annually, each site using reclaimed water for compliance with all District, State and County regulations regarding the use of reclaimed water onsite. The testing and inspections will include, but not be limited to the following:

1. Operational test
2. Cross-connection tests on all onsite systems
3. Review of reclaimed, potable, fire protection, and potable water used for irrigation systems.

4. Identification tags and labels
5. Painted surfaces.
6. Covers, caps, signs.
7. Other items that indicate reclaimed water are being used.
8. Irrigation controller time schedule
9. Backflow protection
10. All reclaimed and potable water related appurtenances.

E. USER CONSTRUCTION SPECIFICATIONS: The following details for user construction specifications that are use specific, such as for irrigation, are intended as examples of current use practice and are not intended to preclude other approved uses, which may require case-by-case specifications.

E-1 General Conditions: All construction work for onsite reclaimed water facilities shall be in conformance with the TCWD Rules and Regulations for Users of Reclaimed Water, and addendums thereto.

Work is to begin only after the contractor, installer, or user has obtained approval for reclaimed water use from the District (issued a use permit) and OCHCA.

E-1.1 Trade Names or Approved Equivalents: The contractor shall be permitted to supply any of the specified materials or to offer for approval by the design consultant and the District equivalent materials in accordance with the appropriate section of these TCWD Rules and Regulations for Users of Reclaimed Water.

E-1.2 Permits and Licenses: Except as otherwise provided, the contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work.

E-1.3 Connections to Existing District Facilities: Refer to Section C, herein.

E-1.4 Liability: Neither the District nor any other officer, member of the Board of Directors of the District, employee or authorized agent of the said agencies shall be personally responsible for any liability arising out of the work performed.

The user shall procure and maintain for the duration of the construction period certificates of general liability insurance and workmanship insurance in forms and amendments approved by the District and naming the District and its member agencies and all the prior individuals as additional insured.

E-1.5 Loss and Damage: Neither TCWD, the San Diego RWQCB, nor authorized representatives thereof shall be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof; or for any material or equipment used in performing the work ;or for injury or damage to any person(s), either workmen or the public; or for damage to adjoining property from any cause whatsoever during the progress of the work or at any time before final acceptance.

E-1.6 Legal Responsibility: The Contractor shall keep fully informed of all laws, ordinances, and regulations that in any manner affect those engaged or employed in the work or the materials used in the work, or that in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the plans, drawings, specifications, or other documents in relation to any such law, ordinance, regulations, order or decree, the contractor shall forthwith report the same to the design consultant and the District in writing.

The contractor shall observe and comply with and shall cause all of the contractor's agents and employees to observe and comply with all such existing and future laws, ordinances, resolutions, regulations, orders and decrees, and shall protect and indemnify the District, the San Diego RWQCB, and all their officers and agents against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by the contractor or contractor's employees.

The contractor shall also indemnify and save the District, its officers, its employees, or authorized agents harmless from all costs, losses, expenses, damages, attorneys' fees, and other costs of defense that the District may incur with respect to or on account of the work, and with respect to the failure, neglect, or refusal of contractor to faithfully perform the work and all of contractor's obligations under the contract.

Such costs, expenses and damages shall include all costs incurred by the District to defend against any claims, stop notices or lawsuits based thereon in which the District is had a party of.

The contractor shall observe the rules and regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety and, in particular, rules and regulations relating to shoring of trenches and excavations.

All work shall be done in accordance with all directives, provisions and requirements pertaining to the method and manner of performing the work, in accordance with CAL-OSHA latest amendment or revision.

The contractor shall provide a job foreman present during working hours that can communicate effectively with District personnel both orally and in writing.

E-1.7 Inspection Authority: District shall at all times have access to all onsite work during construction and shall be furnished with such information as it may desire regarding location of facilities, the progress, workmanship, and character of materials used in the work.

TCWD shall have the authority to notify the user of an apparent failure on the part of the contractor to carry out orders given or to fulfil any provisions of the plans or specifications.

Upon confirmation of the apparent failure, the user shall be obligated to require the contractor to suspend the work wholly or in part. The contractor shall immediately comply with the written order of the District to suspend the work wholly or in part.

Dependent on the nature of non-compliance, it may require immediate action by the contractor via verbal order with a written order following. The work shall be resumed when methods or defective work are corrected as ordered and approved in writing by the District. Failure to comply with requests of the District will prevent further work and the final release of the entire project.

E-1.8 Potable Water System Identification: Where potable water service is provided to sites with reclaimed water service, the potable water system must be identified; refer to Section C, herein.

E-2 Materials Specifications

E-2.1 Facilities and Equipment Identification: Colors and materials used for the identification of all reclaimed water pipes, appurtenances, equipment, storage facilities, and approved use areas shall be in accordance with the latest edition of the AWWA Guidelines. The AWWA Guidelines describe the wording required for identification signs for approved use areas, storage facilities, and construction equipment. All reclaimed water distribution equipment, storage facilities, and approved use areas shall be identified as such.

Identification requirements are shown in the attached Reclaimed Water Standard Detail Drawings. The standards pertain to all reclaimed water facilities and potable water facilities (including those used for irrigation) that are used on the same site or adjacent to sites using reclaimed water.

Identification requirements for piping (including hoses) are shown in standard detail. Identification requirements for control valves are shown in Section 15151. All other reclaimed water facilities shall have tags or labels attached as directed by the District.

For site identification, a minimum of two reclaimed water caution signs (shall be installed on each site as directed by the District. The tag and label requirements are shown in standard detail drawing TCWD RW-20.

E-2.2 Onsite Irrigation Systems

E-2.2.1 Piping: Piping and piping materials shall conform in all respects to the requirements in these policies and procedures, and as a minimum shall conform to the AWWA Standards for the type, size, and class of pipe being used.

E-2.2.2 Pressure Supply Line: All onsite reclaimed water piping shall be installed in accordance with the UPC and all other local governing codes, rules, and regulations. All piping shall be continuously and permanently marked with the manufacturer's name or trademark, nominal size, and schedule or class indicating the pressure rating. Supply lines up to the first control valve(s) shall be brass.

E-2.2.3 Minimum Requirements of Piping and Fittings: The minimum class or schedule of piping and fittings shall be as follows:

1. <u>Hard Drawn Copper Type K:</u>	ANSI H-26.1 and ASTM B 88.
2. <u>Wrought Copper or Bronze Solder Fittings:</u>	ANSI B.16.22.
3. <u>PVC pressure main line piping 4 inches and larger:</u>	Ring Tite, PVC Class 315RT.
4. <u>PVC pressure main line piping 2 and 3 inches:</u>	Solvent weld joint, PVC Class 315.
5. <u>PVC pressure main line piping 1-½ inches and smaller:</u>	Solvent weld joint, PVC SCH 40.
6. <u>PVC intermittent pressure lateral line piping:</u>	Solvent weld joint, PVC Class 200, PVC Class 315, or Schedule 40.
7. <u>PVC sleeving:</u>	Solvent weld joint, Class 200, 200 psi rated pipe or greater.
8. <u>PVC fittings:</u>	PVC Schedule 40 or 80 solvent weld and factory manufactured.
9. <u>Tubing for drip irrigation systems:</u>	Manufactured from virgin polyethylene conforming to ASTM D 1248, Type II, Class C, or approved equals, such as Elastane and Polybutylene.
10. <u>Brass pipe and fittings:</u>	Schedule 40.

E-2.2.4. PVC Plastic Pipe: Piping and fittings shall conform to the following:

1. PVC plastic pipe and fittings shall be installed below grade, except ultraviolet protected pipe and fittings.
2. All PVC pipes shall be made from Grade I compound conforming to ASTM D 1784.
3. All PVC Schedule 40 and Schedule 80 pipes shall be manufactured conforming to ASTM D 1785 and D 2466.
4. All PVC, Class 200, and Class 315 solvent weld and Ring Tite pipe shall be manufactured conforming to ASTM D 2241 and meet requirements set forth in Federal Specification PS-22, with Standard Dimension Ratio (SDR) for pressure rated pipe. Pipe shall be extruded from approved Class 12454-PVC with resin specifications conforming to ASTM D 1784 and rubber rings conforming to ASTM D 169.
5. All pipe shall be homogeneous throughout, free from visible cracks, holes, or foreign materials. The pipe shall be free from blisters, dents, wrinkles, or ripples, die, and heat marks.
6. All PVC plastic pipe fittings shall be rigid PVC virgin Type I, minimum Schedule 40, with working pressure no lower than that of the pipe. Sockets shall be tapered to conform to the outside diameter of the pipe, as recommended by the pipe manufacturer. All Schedule 40 fittings shall conform to ASTM D 2466. Schedule 80 fittings shall conform to ASTM D 2464 and D 2467.

7. All fittings shall be injection molded of an improved PVC fitting compound featuring high tensile strength, high chemical resistance, and high strength. The compound must meet the requirements described in ASTM D 1784 and D 2466, cell classification 13454B. Where threads are required for plastic fittings, they shall also be injected molded. All tees and ells shall be side gated.
8. PVC solvent cement shall conform to ASTM D 2564.
9. Brass and galvanized Schedule 40 piping, wrap piping with plumbers' tape when buried per UPC.
10. Drip systems per manufacturer's specifications.

E-2.2.5 Quick Coupling Valve: Quick coupling valves shall be permitted for use only during the initial landscape germination period and shall be removed at the end of that period unless approved by the District to remain in the system. The manner of removal shall be subject to approval by the District. Quick coupling valves shall conform to the following:

E-2.2.6 Rating: Quick coupling valves shall be 3/4-inch or one-inch nominal size with brass construction, acme thread body and key, and a normal working pressure of 150 psi. All quick coupler valves used for reclaimed water shall be of a design that prevents the quick coupler key (spike) from being used in potable water quick couplers.

E-2.2.7 Cover: The cover shall be permanently attached to the quick coupling valve. It shall be purple in color and made of rubber or vinyl with the following information stamped or molded on the cover:

1. "Reclaimed Water" in English and Spanish
2. "Do Not Drink" in English and Spanish; or
3. The international "Do Not Drink" symbol: A glass of water in a circle with slash through it.
4. Locking cover.

E-2.2.8 Mainline Valves: Valves shall be of the type and manufacture shown on the plans or approved equal. All underground gate and ball valves three inches and smaller shall be threaded bronze bodies furnished with handwheels.

All gate and ball valves larger than three inches shall be flanged with cast iron bodies and two-inch square operating nuts.

Ball valves required directly behind meter box shall be Jones #1913 or approved equal. Bolt valve to meter flange. For 1-inch meter, thread valve to discharge side of meter.

E-2.2.9 Valve Boxes: All remote-control valves, gate valves, quick coupling, drip valve assemblies, flush valve assemblies, manual drain valves, and pressure relief valves shall be installed in suitable valve boxes, complete with locking and hinged cover, or other approved secure enclosure. Reclaimed water valve boxes must be colored purple and have reclaimed water identification imprinted.

E-2.2.10 Wye Strainer/Basket Strainer: - Strainers shall have cast bronze body. Screen shall be 80 mesh minimum, stainless-steel screens. Automatic flushing is prohibited.

E-2.2.11 Irrigation Heads: Reclaimed water irrigation heads and snap on reclaimed water identification caps shall be used whenever possible. All onsite irrigation (sprinkler) heads shall conform to the following:

1. Rating: Sprinkler heads shall be the types and sizes with the radius of throw, pressure, discharge, and any other designations, as indicated on the plans. The irrigation heads shall have internal check valves.
2. Manufacture: All heads of a particular type of function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification in such a position that they can be identified without being removed from the system.

3. Adjustable-arc, adjustable-radius heads/nozzles: To be used at site perimeters, walks, play areas, along non-vegetated areas and near picnic tables and drinking fountains.
4. Risers: All sprinkler risers shall be as shown on the plans. All risers shall be considered an above-ground new pipe. This includes existing risers on systems to be converted to reclaimed water use.
5. Substitutions: Any substitutions by the contractor for items specified on the Plans must be submitted to the user and District for approval.

E-2.2.12 Sprinkler Head Stabilizer: Sprinkler heads shall be securely installed to minimize breakage.

E-2.2.13 External Check Valves: Install external check valves at all heads or bubblers that exceed manufacturer's internal check valve requirements.

E-2.2.14 System Control Devices: All onsite irrigation controllers and appurtenances shall conform to the following:

1. Type: Automatic controllers shall be UL listed of the type and manufacture shown on the plans or approved equal.
2. Each controller shall be capable of eight repeats daily with 16-day variable cycles minimum.
3. The controller shall have a water budget feature. It shall have remote start capability. It must be compatible with the master valve and flow sensor. It must have power outage time keeping capability.

E-2.2.15 Inline Pressure Regulator: Reclaimed water inline pressure regulators smaller than 3 inches shall have a cast bronze body. The screens shall be stainless steel.

E-2.2.16 Master Valve: Reclaimed water master valve shall be a pressure regulating (manually and electrically), normally closed position valve.

E-2.2.17 Flow Sensor: The reclaimed water flow sensor must be compatible with the controller and master valve. The flow sensor must have high flow shut off capability.

E-2.2.18 Remote Control Valves: Reclaimed water remote control valves shall have purple plastic bodies or brass bodies and bonnets. They shall be contamination proof, self-flushing & cleaning style valves. It shall be pressure regulating (manually and electrically), normally closed positioned valve.

E-2.2.19 Booster Pumps: Booster pumps are to be approved on an individual basis by the District.

E-2.3 Construction Water Facilities

1. Piping: All piping employed for the transmission of reclaimed water for construction purposes shall be in serviceable condition and free from leaks and structural faults. All joints shall be structurally sound and free from leaks.
2. Valves: All valves employed with facilities using reclaimed water for construction purposes shall be in serviceable condition, provide positive shutoff, and be free from leaks.
3. Storage Tanks: All storage tanks used for reclaimed water, whether fixed or mounted on distribution vehicles, shall be structurally sound and free from leaks.

E-3 Methods of Construction

E-3.1 Onsite Irrigation Systems

E-3.1.1 Valve and System Control Device Installations: All onsite valves, valve boxes, valve markers and power supplies shall be installed in accord with the requirements in these TCWD's Rules and Regulations.

E-3.1.2 Separation from Other Utilities: Separation between onsite reclaimed water lines and sanitary sewers and potable water lines shall be established in accordance with the latest requirements set forth by the DDW and OCHCA, but not less than the separations described in the AWWA Guidelines.

E-3.1.3 Laying Pipe:

1. Reclaimed water lines 1½-inches and less in diameter below grade shall be buried with a cover of at least 18 inches.
2. Reclaimed water pipelines 2-inches and greater shall be buried with a cover of at least 24 inches.
3. Pipe trenches shall be backfilled with clean material containing no rocks and debris that can damage the pipe.
4. Reclaimed water lines laid above grade shall be protected from thrust motion if such protection is determined to be required by the District. To achieve such protection, metal stakes with wire lashes shall be installed at all bends in the pipeline of 45 degrees or greater. Alternative methods of protection from thrust motion may be approved by the District.

E-3.2 Onsite Construction - Water Facilities

E-3.2.1 Valve Installations: All valves installed along the reclaimed water transmission pipeline and not attached to a rigid structure shall be protected from thrust motion if such protection is determined to be required by the engineer or inspector. To achieve such protection, metal stakes with wire lashes shall be installed at all such valves.

E-3.2.2 Alternative Methods: Alternative methods of protection from thrust motion may be approved by the engineer or inspector.

E-3.2.2 Laying Pipe: Refer to Section 5.3.1.

E-3.2.3 Water Trucks: Trucks must be identified as carrying reclaimed water and not suitable for drinking. The feed pipe to the truck must be permanently attached and have an air gap to the tank.

E-3.2.4 Storage Tank Installations: All reclaimed water storage tanks shall be erected only on level ground. Provisions shall be made to prevent differential settling of the tank supporting structure.

E-4 Inspection: The inspection of the work shall not relieve the contractor of any of his obligations to complete the work as prescribed by the applicable specifications. Defective work shall be made good and unsuitable materials may be rejected notwithstanding the fact that such defective work and unsuitable materials have been previously overlooked by the inspector and accepted. The installation and inspection of unsuitable materials shall not be construed as acceptance, and modification to these specifications shall only be made by the District in writing.

E-4.1 Onsite Irrigation Systems

Construction Schedule: If required by the District, the contractor shall submit a schedule to the District outlining his proposed construction operation. The contractor shall conform to the rules and regulations of the District regarding prior notification for inspection and deviations from the approved schedule.

Notification and Approvals: All work, onsite and offsite, shall be subject to inspection, as required by the District in the TCWD's Standard Specifications for Construction of Domestic Water, Sewer, and Reclaimed Water Facilities and these rules and regulations.

The contractor shall schedule the District, OCHCA, DDW, and all other regulating agencies for inspection on all onsite irrigation systems involving conversions (See Section 5.6).

The contractor should give due notice to the inspector in advance of backfilling so that proper inspection may be provided. Unless the District expressly states otherwise, 48-hour notice shall be given by the contractor in advance of all inspection requirements, whether for materials or construction work.

Inspection Intervals: All work shall be subject to inspection by the District and shall be left open and uncovered until approved by the District. The Contractor shall not proceed with any subsequent phase of work until the previous phase has been inspected and approved by the District Inspector. The following items shall be included in the inspection process:

1. Plans (approved and signed by all regulatory agencies)
2. Materials
3. Trenching
4. Mainlines (including sleeving where applicable)

5. Identification tape (reclaimed and domestic)
6. Meter and box setting
7. Mainline record drawing
8. Pressure test (Section 5.5.1, see installed piping systems)
9. All valves (master valves, control valves, quick couplers, gate valves, ball valves, etc.)
10. Lateral lines
11. All sprinkler heads and emitters
12. Drip lines and emitters
13. Backflows, all strainers
14. Irrigation pumps
15. Fertilizer injector
16. Coverage test (preliminary and final)
17. Complete review of site and irrigation system installation, for final release

Final Inspection: Following the completion of all construction work and the submittal and approval of recorded documents, the Contractor shall request a final inspection of the work. This request shall include the scheduling of the operational testing.

Before final acceptance, the District, accompanied by the Contractor's superintendent or foreman, will make a final inspection of all work to check the following items:

1. That all phases of the work are completed and installed in accord with plans & specifications.
2. Controller installation, operation, and hours of operation.
3. Moisture sensor/automatic rain shutoff calibration and operation.
4. System identification tags, signs, and labels.
5. Valve box identification and cover bolted down with stainless steel bolts and washers.
6. Booster pump operation.
7. Fertilizer injector operation.
8. Pressure regulator setting.
9. Backflow prevention assemblies' installation and test report.
10. Flow sensor calibration and report.
11. Wye or basket strainer.
12. Quick coupling valve locations and installation.
13. Gate valve/ball valve locations and installation.
14. Remote control valve pressure setting installation, if required.
15. Wiring expansion coils; identification color; installation at controller.
16. Piping required identification.
17. Pipe anchors secure proper spacing.
18. Sprinkler heads required identification.
19. Sprinkler risers required identification.
20. External check valves as necessary to prevent drainage after valve is closed.
21. Coverage tests.
22. Cross connection and backflowing testing.

E-4.2 Construction Water Facilities

Construction Schedule: The Contractor shall give the District a construction schedule prior to initiation of construction work.

Notification and Approvals: Unless the District expressly states otherwise, 48-hour notice shall be given by the Contractor in advance of any and all inspection requirements, whether for materials or installation work.

Final Inspection: The Contractor shall request final inspection of the work. Prior to use of reclaimed water, District approval must be obtained. Signage, labels, and air gap on truck tank must be installed. The Use Permit must be onsite and in vehicle.

E-5 Review and Testing

E-5.1 Onsite Irrigation Systems

Materials: The contractor shall furnish the District with such information as it may desire regarding the character and quality of materials used. When requested by District, the contractor shall submit a certification that the product meets the requirements of these specifications.

All pipe and accessories shall be carefully inspected by the District and contractor for damage in transit. Any damaged pipe or fittings delivered and unloaded at trench-site shall be rejected and removed by the contractor from the site of the work at no additional cost to the District.

Installed Piping Systems: New piping systems shall be subjected to a 4-hour hydrostatic pressure test at 120 percent of maximum rated operating pressure of the pipe or 150 psi, whichever is greater. The testing shall be conducted by the contractor in the presence of a District representative.

The District may require the tests be performed by a State-certified testing company who will provide certified testing results to the District if the systems fail more than two tests. Before testing, the pipe shall be center loaded to hold the pipe in place while testing. The water necessary to maintain this pressure shall be measured through a meter or other means satisfactory to the inspector. The leakage shall be considered as the amount of water entering the pipe during the test, less the measured leakage through valves and bulkheads. Any noticeable leaks shall be stopped, and any defective pipe shall be replaced with new sections.

For systems with 4-inch diameter or greater pressure main lines, a State-certified testing company must provide certified testing results for all hydrostatic testing.

The test shall be taken prior to connecting the new piping system with existing systems or a service connection. The test shall be conducted with gate valves, master valves and ball valves open and the open ends of pipes, valves and fittings suitably plugged. Valves shall be open during the test period.

All concrete thrust blocks shall be allowed to cure to develop design strength prior to testing. All labor, materials, tools, and equipment for the testing shall be furnished by the contractor.

Operational Testing: Prior to final acceptance by the District, all onsite reclaimed and potable water systems shall pass an operational test.

The test shall be conducted by the contractor in the presence of the District Inspector. The scheduling of these tests shall be the responsibility of the contractor.

The following items shall be examined:

1. Operation of the automatic controllers.
2. General operation and coverage of the irrigation system.
3. Required protection of the onsite potable water system.

The District shall note all required corrections in the form of a punch list. Regular service startup shall not be authorized until all corrections are made to the satisfaction of the District. Punch list is valid for 30 days only.

Identification:-Site shall be reviewed by the District Inspector and contractor to verify that all required identification is in place.

E-5.2 Construction Water Facilities

Materials: The contractor shall furnish the District such information as it may desire regarding the character or quality of materials used.

Installed Piping Systems: Installed piping systems shall be subjected to a leak test administered by the inspector with the cooperation of the contractor, using a California State certified tester. Before testing, the pipe and valves shall be staked if such protection from thrust motion has been determined to be required by the engineer or inspector. Any noticeable leaks shall be stopped, and defective materials shall be replaced. Valves shall be operated during the test period.

Operational Testing: Prior to final acceptance by the District, all construction facilities shall be required to successfully pass an operational test as administered by the design consultant in the presence of the District Inspector. The leak test for installed piping systems in conjunction with a leak test of all storage tank installations shall constitute the operational test.

Any required corrections shall be noted in the form of a punch list and submitted to the contractor by the District for correction. Service startup shall not be authorized until all corrections are made to the satisfaction of the District.

E-6 Conversions

E-6.1 Conversion to Reclaimed Water Use: Where it is planned that an existing potable water system will be converted to a reclaimed water facility, the facilities to be converted to reclaimed water shall be investigated in detail by the District and at the user's expense.

On a case-by-case basis, District shall review the record drawings and determine the measures necessary to bring the system into acceptable compliance with these regulations. After District approval, the OCHCA shall also review and approved per these regulations.

No existing onsite potable water facilities shall be connected to or incorporated into the reclaimed water system without Trabuco Canyon Water District and other regulatory agency testing and approval. TCWD guidelines for converting services to reclaimed water service are available through TCWD staff.

At a minimum, conversion of a potable water system to a reclaimed water system shall require the following:

1. Identification of all existing onsite pressure pipelines (meter to controlled valves), valves, and appurtenances in accordance with requirements of these Regulations for new construction of reclaimed water systems.
2. Installation of an approved air gap or backflow prevention assembly device in accordance with requirements of these Regulations and subject to cross connection control tests required in order to prevent cross connection or contamination of a potable water system at any location where it is proposed to retain a connection to a potable system
3. Performance of dye test or pressure test to determine existence of cross connection with potable water system.

District recommends installation of a master valve and flow sensor to automatically shut off system in the event of a pipeline break.

E-6.2 Conversion from Reclaimed Water Use: If, due to onsite failure of the reclaimed water system, or use violations, District determines it necessary to convert onsite facilities from a reclaimed water supply to a potable, or other water supply, it shall be the responsibility of the user to perform conversion, unless determined otherwise by the District.

Prior to District approval, the OCHCA shall review and approve all conversions. As part of the conversion effort, the user shall perform the following:

3. Isolate the reclaimed water supply. Service shall be removed and plugged at the reclaimed water main or abandoned in a manner approved by District or designated representative.
4. Install approved backflow prevention assemblies. The user shall install approved backflow prevention assemblies on all potable or other water meter connections.
5. Remove any/all special reclaimed water quick couplers. The user shall be responsible for replacement with quick couplers approved for potable water systems.
6. Notify all onsite personnel involved.
7. Remove all reclaimed water identification labels/signs, tags, and tapes where possible. Change out branded valve box lids.
8. Provide required disinfection as mandated by appropriate regulatory agencies.

F. USER OPERATIONAL REQUIREMENTS

The following details for user operational requirements that are use specific, such as for irrigation, are intended as examples of current use practice and are not intended to preclude other approved uses, which may require case-by-case specifications and approval from the District.

F-1 Specific Prohibitions

F-1.1 Runoff Conditions: Conditions that directly or indirectly cause runoff outside of the approved use area, whether by design, construction practice, or system operation, are prohibited.

F-1.2 Ponding Conditions: Conditions that directly or indirectly cause ponding outside of or within the approved use area, whether by design, construction practice, or system operation, are prohibited. Temporary ponding caused by draining of system is allowed with prior District approval.

F-1.3 Direct Overspray Conditions: Any discharge of water directly onto areas other than that within the approved use area is prohibited.

F-1.4 Windblown Overspray Conditions: Conditions that directly or indirectly permit windblown spray to pass outside of the approved use area, whether by design, construction practice, or system operation, are prohibited.

F-1.5 Unapproved Uses: Use of reclaimed water for any purposes other than those explicitly approved in the currently effective Use Permit issued by Trabuco Canyon Water District and without the prior knowledge and approval of the District is prohibited.

F-1.6 Disposal In Unapproved Areas: Disposal of reclaimed water for any purposes, including approved uses, in areas other than those explicitly approved in the currently effective Use Permit issued by the District and without the prior knowledge and approval of the District, is strictly prohibited. Discharge of water from flushing or draining of the reclaimed system shall be done either at the approved use site and in a manner that does not create ponding or runoff conditions, or to a sanitary sewer manhole, with the approval of the agency responsible for operation of the sanitary sewer. In no case shall the discharge of reclaimed water to a sanitary sewer cause the sewer to overflow or otherwise create a public health hazard or nuisance.

F-1.7 Cross Connections: Cross connections, as defined by the Cross Connection Policy Manual dated July 2024 and the California Administrative Code Title 17, resulting from the use of reclaimed water or from the physical presence of a reclaimed water service, whether by design, construction practice, or system operation, are strictly prohibited.

F-1.8 Unprotected Drinking Fountains: Any and all drinking fountains located within the approved use area designated by the Use Permit shall be protected by siting and/or a structure from contact with reclaimed water, whether by direct overspray, windblown overspray or by direct application through irrigation or other approved use. Lack of such protection, whether by design, construction practice, or system operation, is strictly prohibited.

F-1.9 Unprotected Public Facilities: Facilities that may be used by the public, including but not limited to eating areas, eating surfaces, pools, spas, hardscape, and playground equipment, and located within the approved use area designated by the Use Permit, shall be protected by siting and/or a structure from contact with reclaimed water, whether by windblown overspray or by direct application through irrigation or other approved use.

Lack of such protection is prohibited until review and concurrence by Trabuco Canyon Water District, DDW and OCHCA on a case-by-case basis.

F-1.10 Hose Bibbs: Permanent installation of hose bibbs on any onsite system that presently operates or is designed to operate with reclaimed water, regardless of the hose bibb construction or identification, is strictly prohibited.

F-1.11 Fire Hydrants: Use or installation of fire hydrants on any onsite system that presently operates or is designed to operate with reclaimed water, regardless of the fire hydrant construction or identification, is subject to specific prior approval by the District on a case-by-case basis.

F-1.12 Hours of Operation: Irrigation with reclaimed water is restricted to the hours between 9:00 p.m. and 6:00 a.m., unless otherwise directed by the District.

F-1.13 Hose and Hose Appurtenances: Under no circumstances shall hoses or hose appurtenances that have used reclaimed water be used in any way for other purposes.

F-2 Onsite Irrigation Systems

F-2.1 Supervision: Onsite irrigation systems at each use area under the user's control shall be under the management of the onsite supervisor designated by the user or the operator and approved by Trabuco Canyon Water District.

Onsite supervisors shall be responsible for the installation, operation, and maintenance of the irrigation system, enforcement of these Regulations, prevention of potential hazards, cross connections and maintenance of the reclaimed water system plans in record drawing form. The onsite supervisor, in the event of contamination to the public potable water supply, shall be responsible for immediate notification of District.

The onsite supervisor or his representative shall check all appurtenances on the onsite irrigation system to ensure proper operation and perform a coverage test of the system at least monthly.

Owner shall keep records of the monthly onsite testing (refer to Appendix 4, Onsite Testing Form) for District review.

Monthly Report: For sites with both domestic water and reclaimed water, a copy of the report showing the results of the checks shall be submitted to the District by the 10th day of the following month. Failure to comply may result in termination of service. A reconnection fee will be required to reinstate service after the appropriate reports have been submitted.

The onsite supervisor or his representative shall be available during normal working hours at an address listed with the District for the purpose of hosting an inspection tour or for discussing operational aspects of the system.

The onsite supervisor shall be able to effectively communicate with District personnel orally and in writing. The onsite supervisor or his representative shall be available via telephone at a number listed with the District for emergency off-hours contact (see Appendix 3, certification form). Where necessary, keys and/or lock combinations shall be issued to the District to provide access upon request.

F-2.2 Certification Submittal: Once the operator of an onsite reclaimed water system has been selected by the user, the certification of reclaimed water service operation must be initiated.

District shall evaluate this submittal and advise the operator of the need for any additional information or action. Operators must attend a training session coordinated by TCWD prior to receiving operation certification.

Following receipt of operation certification and after granting final inspection approval of the onsite facilities, District shall complete design and construction certification. Within 60 days of completion of the certification form, the District shall retain a copy of the form for its records. A sample of the certification form is included as Appendix 3.

New Operator: If the user selects a new operator during the course of service, a new operation certification form shall be submitted by the new operator to TCWD. Annually, the District shall update all operation certifications to confirm information accuracy.

F-2.3 Temporary Service Connection: A temporary service connection may be provided for onsite construction testing purposes only. The temporary service connection consists of permanent service connections and meter plus any backflow prevention assemblies. A temporary service connection is valid for only 90 days.

F-2.4 Service Startup: Following final District inspection and certification (Appendix 3) of the project, the user shall request in writing regular service startup. District shall begin regular service within five working days of approval of service startup.

F-2.5 Irrigation Application Rates: Reclaimed water shall be applied at a rate that does not exceed the application rate limits designated in Section 4. 1.6.

F-2.6 Periods of Operation: The operation of the irrigation system shall be during periods of minimal use of the approved use area by the general public. Refer to Section 6.1.12, Hours of Operations.

Scheduling Reclaim Water Use: In order to maintain acceptable working conditions (i.e., pressure and flow) throughout the reclaimed water system, District may schedule a period of time during a given day or week or month that of reclaimed water will be available. Such scheduling may involve programming reclaimed water deliveries from the District to different users and/or to various portions of a single user's onsite system. Any scheduling of reclaimed water use shall consider applicable constraints of all involved regulatory agencies, these Regulations, and the operating constraints of the affected users.

Terminate Reclaimed Water Service: District may temporarily terminate reclaimed water service at any time when the reclaimed water at the terminal point of the supply source does not meet the requirements of the regulatory agencies. Reclaimed water service would, in such case, be restored when the reclaimed water meets the governing requirements at the terminal point of the supply source.

District may provide reclaimed water service from other approved sources. In addition, approved air gap separations may be used to provide potable water to the reclaimed water system to ensure water service. The District, OCHCA and DDW shall review and approve the air gap installation. All associated costs are the responsibility of the user.

F-2.7 Confinement of Irrigation: The user shall be responsible for maintaining and controlling the system to minimize human contact and prevent consumption of reclaimed water and to control and spray, overspray, ponding, and runoff. The user shall be responsible for eliminate direct any and all subsequent uses of the reclaimed water at no additional cost to the District.

F-2.8 Dye Testing/Pressure Testing: In order to determine the existence of any cross connections or backflow conditions into the potable water system, acceptable tracer dyes may periodically be introduced into the reclaimed water system by the District, where feasible. The user may also perform a pressure test where the reclaimed system is isolated for a period of 24 hours.

F-2.9 Contamination: In the event of contamination or pollution of a potable water system due to a cross connection or other failure, OCHCA and the District shall be immediately notified. The user will provide appropriate measures to be taken to correct the problem per DDW requirements. Onsite supervisor shall submit a written report explaining the contamination within five (5) working days.

F-2.10 Maintenance: A "Preventive Maintenance Program" designed and implemented by the user to ensure the continued operation of all system elements within the requirements of these Regulations. The Preventive Maintenance Program shall be submitted to the District for review by the User and shall be available to the District. See Section 6.2.1 for reporting requirements. See Appendix 4 for testing report form.

F-3 Construction Water Facilities

F-3.1 Supervision: The operation and surveillance of the construction water facility at each use area under the user's control shall be under the management of an onsite supervisor designated by the user or the operator and approved by the District. Onsite supervisors shall be responsible for the installation, operation, and maintenance of the onsite facility, equipment, enforcement of these regulations, and prevention of cross connections and potential hazards. The onsite supervisor or his representative shall be available at phone numbers listed with the District for contact during working hours and after hours.

F-3.2 Application Control: Reclaimed water used for the purpose of soil compaction and dust control shall not be stored or applied in a manner which causes runoff, ponding, or windblown overspray conditions. If such conditions occur, the method of application shall be altered to correct them and prevent any and all further ponding and runoff.

Control valves on the water distribution vehicles and other controlling devices shall be properly employed to prevent the application of reclaimed water outside the approved use area onto surfaces including, but not limited to, street pavements, sidewalks, and drainage courses.

F-3.3 Periods of Operation: The periods of operation of the construction water facilities, as they are dependent on the supply of reclaimed water from the offsite system, shall be subject to regulation by the District and in accordance with the needs of TCWD's reclaimed water distribution system.

F-3.4 Maintenance: A "Preventive Maintenance Program" designed to ensure the continued operation of all system elements within the requirements of these Regulations shall be prepared and utilized by the user and open to inspection by Trabuco Canyon Water District.

F-3.5 Reuse of Equipment: Any equipment, such as tanks, water trucks, temporary piping or valves and portable pumps, which has been used with reclaimed water shall be cleaned and disinfected before removal from the approved use area to another job site. This disinfection and cleaning shall ensure the protection of the public health in the event of any reuse of such equipment with higher quality water.

Methods of disinfection shall be approved by the District and the disinfection process shall be performed in the District's presence. When storage tanks or distribution vehicle tanks are provided with an inlet air gap whose configuration is approved by the OCHCA, such onsite disinfection shall not be required.

F-4 Cross Connection Testing Procedures: Prior to start of any reclaimed water service, cross-connection testing is required as shown below:

1. Case I: Applies to cases where reclaimed water is only supplied to the site.
2. Case II: Applies to cases where reclaimed water and potable water are supplied to the site.

The following are the steps required to perform the cross-connection test:

F-4.1 Case I- Reclaimed Water - No Other Water Sources On Site

The Site User shall provide the following information:

Verify Record	Meter Number
Owner Address	Meter Size
Site Address	Meter Location

List of all personnel in attendance of test

Procedure for Cross Connection Control Testing:

1. Water Pressure: Verify and record full water pressure at all remote-control valves, manual valves, quick coupling valves, and other system valves.
2. Deactivate System: Turn off and lock service, turn off automatic irrigation controller, and open master valve manually (if any).
3. Drain System: Reduce pressure to an acceptable level (approved by District).
4. Verify and record that the water pressure within the system does not exceed acceptable level at remote control valves, manual valves, quick coupling valves, and other system valves. Also, check low points for water pressure.
5. Perform a 24-hour cross connection test. Record date and time and testing results.
6. Notify On-site personnel and District that the reclaimed water system is to remain off during the duration of the cross connection test.
7. Return to site at least 24 hours after start of cross-connection test. Record date and time and testing results.

8. Verify and record the following reclaimed water system conditions:
 - a. Reclaimed Water Service is off and locked.
 - b. Master valve is open.
 - c. There is low ("acceptable level") water pressure at remote control valves, manual valves, quick-coupling valves, and other system valves.
9. Complete section of cross-connection report stating whether the reclaimed water irrigation system has passed or failed the cross-connection test.

If reclaimed water system passed: District unlocks and turns on angle stop, the user pressurizes the irrigation system, turns on controller, and places master valve back in the normal operating position.

If reclaimed water system fails: Service shall remain off and locked. The Site User shall notify OCHCA and DDW of cross connection. The Site User shall locate source of cross connection and correct any cross connection situation. The Site User shall retest the reclaimed water system at the Site User expense. The Site User shall complete the cross-connection report form for reporting. Other requirements may be necessary on a case-by-case basis.

The Site User shall file the cross-connection test form with the District and send a copy to OCHCA and DDW.

F-4.2 Case II - Reclaimed Water/Potable Water Systems

The Site User shall provide the following information:

Verify Record	Meter Number
Owner Address	Meter Size
Site Address	Meter Location
Backflow Device	List of all personnel in attendance of test

The Site User shall test all systems in the following order:

1. Reclaimed water used for irrigation systems.
2. Reclaimed water systems used for other purposes
3. Potable water used for irrigation systems
4. Potable water fire protection systems
5. Potable on-site water system

A. Procedure for Cross Connection Control Testing:

1. Verify and record full water pressure for all reclaimed water irrigation facilities such as remote-control valves, manual valves, quick-coupling valves, and other system valves. Manually open master valve, if any.
2. Verify and record full water pressure at all reclaimed water system outlets.
3. Verify and record full water pressure at all potable water irrigation facilities such as remote-control valves, manual valves, quick-coupling valves, hose bibbs, and other system valves. Manually open master valve, if any.
4. Verify and record full water pressure at potable water fire protection systems, as necessary.
5. Verify and record full water pressure at all potable water system outlets, i.e., buildings, restrooms, drinking fountains, sinks, hose bibbs, and other facilities.
6. Deactivate reclaimed water irrigation system.
 - a. Turn off and lock service
 - b. Verify master valve is manually open if any.
7. Drain reclaimed water irrigation system. Verify and record that the water pressure does not exceed acceptable level at low points of system.
8. Verify and record that the water pressure does not exceed acceptable level at all reclaimed water irrigation system, i.e., remote control valves, manual valves, quick-coupling valves, and other system valves. Check low points for water pressure again.

9. Verify and record full water pressure on the following systems:
 - a. Reclaimed water systems not a part of irrigation system
 - b. Potable water is used for irrigation system only.
 - c. Potable water fire protection systems only
 - d. Potable water outlets
10. Start reclaimed water irrigation system cross-connection test. Record date and time and testing results.
11. Return to site at least 24 hours after start of cross-connection test. Record date and time and testing results.
12. Verify and record that the reclaimed water irrigation system after 24 hours:
 - a. The angle stop is off and locked.
 - b. Master valve is manually open.
 - c. There is low ("acceptable level") water pressure at all, remote control valves, manual valves, quick-coupling valves, and other system valves.
13. Verify and record full water pressure at:
 - a. Reclaimed water systems not a part of irrigation system
 - b. Potable water is used for irrigation system only.
 - c. Potable water fire protection systems only
 - d. Potable water outlets
14. Complete section of cross-connection report stating whether the reclaimed water irrigation system has passed or failed the cross-connection test.

If reclaimed water system passed: District unlocks and turns on reclaim water service. User pressurizes the reclaimed water irrigation system, turns on controller, places reclaimed water master valve back in normal operating position, and returns the potable water irrigation master valve back to normal operating position.

If reclaimed water system fails: Angle stop shall remain off and locked. Turn off and lock the potable water angle stops. Discontinue use of all systems until further notice. The Site User shall notify the District, OCHCA, DDW of cross connection test. The Site User shall locate source of cross connection and correct any cross connection situation. The Site User shall retest the reclaimed water system at the Site User expense. The Site User shall complete the cross-connection report form for reporting. Other requirements may be necessary on a case-by-case basis.

B. Reclaimed Water System (Not Used For Irrigation) Cross-Connection Test

1. Verify and record the full water pressure at all reclaimed water system outlets.
2. Verify and record the full water pressure at all reclaimed water irrigation facilities, such as remote control valves, manual valves, quick-coupling valves, and other system valves. Manually open master valve, if any.
3. Verify and record the full water pressure at all potable water irrigation facilities, such as remote control valves, manual valves, quick-coupling valves, hose bibbs, and other system valves. Manually open master valve, if any.
4. Verify and record the full water pressure at all potable water fire protection systems, as necessary.
5. Verify and record the full water pressure at all potable water system outlets, i.e., buildings, restrooms, drinking fountains, sinks, hose bibbs, and other facilities.
6. Deactivate the reclaimed water system that is not being used for irrigation.
 - a. Turn off and lock service.
7. Drain reclaimed water system (not being used for irrigation) to a water pressure of an acceptable low level as approved by the District.

8. Verify and record that the water pressure does not exceed "acceptable level" at all reclaimed water system outlets.
9. Verify and record the full water pressure on the following systems:
 - a. Reclaimed water irrigation system only.
 - b. Potable water used for irrigation system only.
 - c. Potable water used for fire protection system.
 - d. Potable water outlets.
10. Start reclaimed water system (not used for irrigation) cross-connection test. Verify and record date and time and testing information.
11. Return to site within 24 hours after start of cross-connection test. Verify and record date and time and testing information.
12. Verify and record that the reclaimed water system (not used for irrigation) water pressure does not exceed "acceptable level" at all reclaimed water system outlets.
13. Verify and record the full water pressure at:
 - a. Reclaimed water irrigation system only.
 - b. Potable water used for irrigation system only.
 - c. Potable water used for fire protection system.
 - d. Potable water outlets.
14. Complete section of report stating whether the reclaimed water system (not used for irrigation) has passed or failed the cross-connection test.

If reclaimed water system passed: District unlocks and turns on reclaim water service. User pressurizes the reclaimed water (not used for irrigation) system, turns on controller, places reclaimed water master valve back in normal operating position.

If reclaimed water system fails: Service remains off and locked. The User shall turn off and lock all reclaimed water and potable water services. The User shall discontinue use of all systems until further notice. The User shall notify the District, OCHCA, DDW of cross connection failure. The User shall locate source of cross connection, correct cross connection, retest all systems, complete cross-connection report forms. Other requirements may be necessary on a case-by-case basis.

C. Potable Water Used for Irrigation Cross-Connection Test

1. Verify and record the full water pressure at all potable water irrigation facilities including remote control valves, manual valves, quick coupling valves, and other system valves. Manually open master valve, if any.
2. Verify and record the full water pressure at all reclaimed water irrigation facilities including remote control valves, manual valves, quick coupling valves, and other system valves. Manually open master valve, if any.
3. Verify and record the full water pressure at all reclaimed water system outlets.
4. Verify and record the full water pressure at all potable water used for fire protection systems, as necessary.
5. Verify and record the full water pressure at all potable water system outlets including building, restrooms, drinking fountains, sinks, hose bibbs, and other facilities.
6. The User shall deactivate the potable water irrigation system.
 - a. Turn off backflow at isolation valves
 - b. Verify master valve is manually open if any
7. The User shall drain potable water irrigation system. Verify and record that the water pressure is at an acceptable low level at low point of system.
8. The User shall verify and record that the water pressure does not exceed "acceptable level" at all potable water irrigation facilities.
 - a. Remote control valves, manual valves, quick- coupling valves, and other system valves.
 - b. Check low points for water pressure again.

9. The User shall verify and record that full water pressure on the following systems:
 - a. Reclaimed water irrigation systems
 - b. Reclaimed water systems
 - c. Potable water fire protection systems
 - d. Potable water outlets
10. The User shall start potable water irrigation system cross-connection test. Record date and time and testing results.
11. The User shall return to site within 24 hours after start of cross-connection test. Record date and time and testing results.
12. The User shall verify that the potable water irrigation system:
 - a. Backflow isolation valves are off
 - b. Master Valve is manually open if any
 - c. The water pressure does not exceed "acceptable level" at remote control valves, manual valves, quick-coupling valves, or other system valves.
13. Verify and record the full water pressure at:
 - a. Reclaimed water irrigation systems
 - b. Reclaimed water systems
 - c. Potable water fire protection systems
 - d. Potable water outlets
14. Complete section of report stating whether the potable water irrigation has passed or failed the cross-connection test.

If potable water system passed: The User shall open the backflow isolation valves, pressurize the potable water irrigation system, and place the master valve back in the normal operating position, returns the reclaimed water irrigation master valve back to normal operating position.

If potable water system fails: Angle stop shall remain off and locked. The User shall turn off and lock all potable water and reclaimed water angle stops. The User shall discontinue use of all systems until further notice. The User shall notify the District, OCHCA, DDW of cross connection. The User shall locate source of cross connection, correct cross connection, retest all systems, complete cross-connection report form. Other requirements may be necessary on a case-by-case basis.

D. Potable Water Fire Protection Systems Cross-Connection Test, As Necessary

1. The User shall notify OCFA that the fire protection system will be out of service. Provide the start time and duration of the test.
2. Verify and record the full water pressure at all potable water fire protection system outlets, as necessary.
3. Verify and record the full water pressure at all reclaimed water irrigation facilities including remote control valves, manual valves, quick coupling valves, and other system valves. Manually open master valve, if any.
4. Verify and record the full water pressure at all reclaimed water system outlets.
5. Verify and record the full water pressure at all potable water irrigation facilities including remote control valves, manual valves, quick coupling valves, hose bibbs, and other system valves. Manually open master valve, if any.
6. Verify and record the full water pressure at all potable water system outlets including buildings, restrooms, drinking fountains, sinks, hose bibbs, and other facilities.
7. The User shall deactivate potable water fire protection system.
 - a. Turn off backflow at isolation valves.
 - b. Notify fire department system is off-line.

8. The User shall drain the potable water fire protection system. Confirm the water pressure does not exceed "acceptable level" at low point of system.
9. The User shall verify and record that the water pressure does not exceed "acceptable level" at all potable water fire protection system outlets.
10. The User shall verify full water pressure on the following systems:
 - a. Reclaimed water irrigation system only
 - b. Reclaimed water systems
 - c. Potable water irrigation system only
 - d. Potable water outlets
10. The User shall start potable water fire protection system cross-connection test. Record date and time and testing results.
11. The User shall return to site within 24 hours after start of cross-connection test. Record date and time and testing results.
12. The User shall verify that the potable water fire protection system water pressure does not exceed "acceptable level" at all outlets, as necessary.
13. The User shall Verify full water pressure at
 - a. Reclaimed water irrigation systems
 - b. Reclaimed water systems
 - c. Potable water irrigation systems
 - d. Potable water outlets
14. Complete section of report stating whether the potable water fire protection system has passed or failed the cross-connection test.

If fire protection system passed: The User shall open the backflow isolation valves, pressurizes system, notifies fire department system is back on-line. Returns both reclaimed water irrigation and potable water irrigation master valves back to normal operating position.

If fire protection system fails: Fire Protection Service remains off and isolated. The User shall turn off and lock all reclaimed water and potable water services. The User shall discontinue use of all systems until further notice.

The User shall notify the District, OCHCA, DDW of cross connection. The User shall locate source of cross connection, correct cross connection, retest all systems, complete cross-connection report forms. Other requirements may be necessary on a case-by-case basis.

E. Potable Water Cross-Connection Test

1. Verify and record the full water pressure at all potable water outlets including buildings, restrooms, drinking fountains, sinks, hose bibbs, and other facilities.
2. Verify and record the full water pressure at all reclaimed water irrigation systems, remote control valves, manual valves, quick-coupling valves, and other system valves. Manually open master valve, if any.
3. Verify and record the full water pressure at all reclaimed water system outlets.
4. Verify and record the full water pressure at all potable water irrigation system including remote control valves, manual valves, quick-coupling valves, and other system valves. Manually open master valve, if any.
5. Verify and record the full water pressure at potable water fire protection systems, as necessary.
6. The User shall deactivate potable water system. Turn off backflow at isolation valves
7. Drain potable water system. Verify the water pressure is at an acceptable low level at low point of system.
8. Verify and record that the water pressure does not exceed "acceptable level" at all potable water outlets.

9. Verify and record the full water pressure on the following systems:
 - a. Reclaimed water irrigation systems
 - b. Reclaimed water systems
 - c. Potable water irrigation systems
 - d. Potable water fire protection systems, as necessary
10. The User shall start potable water cross-connection test. Record date and time and testing results.
11. The User shall return to site within 24 hours after start of cross connection test. Record date and time and testing results.
12. The User shall verify potable water system water pressure does not exceed "acceptable level" at any outlets.
13. Verify and record the full water pressure at:
 - a. Reclaimed water irrigation systems
 - b. Reclaimed water systems
 - c. Potable water irrigation systems
 - d. Potable water fire protection systems, as necessary
14. Complete section of report stating whether the potable water system has passed or failed the cross-connection test.

If potable water system passed: The User shall open the backflow isolation valves, pressurizes system, returns both reclaimed water irrigation and potable water irrigation master valves back to normal operating position.

If potable water system fails: Service remains off and isolated. The User shall turn off and lock all reclaimed water and potable water services, discontinue use of all systems until further notice.

The User shall notify the District, OCHCA, DDW of cross connection. The User shall locate source of cross connection, correct cross connection, retest all systems, complete cross-connection report forms. Other requirements may be necessary on a case-by-case basis.

NOTE: All testing shall be done in conjunction with TCWD cross-connection specialist, OCHCA and DDW.

G. USER VIOLATIONS, ENFORCEMENT AND PENALTIES

G-1 General: Any person, firm, corporation, association, or agency found to be violating any provision of the District's Nondomestic Rules and Regulations or the terms and conditions of the applicant's, owner's, or customer's service agreement, permit, or any and all applicable Federal, State, or local statutes, regulations, ordinances, or other requirements shall be served by the District with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof.

The offender shall, within the period of time as stated in such notice, permanently cease all violations.

This provision herein is in addition to and not by way of derogation of any other remedies or procedures available to the District by law, regulation, or pursuant to any of the provisions of the Rules and Regulations.

Pursuant to Section 35424 of the Water Code of the State of California, any violation of the District's Rules and Regulations is a misdemeanor, the violation of which shall, upon conviction thereof, be subject to a fine of not less than \$50.00 nor more than \$200.00.

Failure to permanently cease all violations within the time stated shall result in revocation of the permit by the District and termination of water, sewer, and/or reclaimed water service.

Violations regarding any one service may result, at the sole discretion of the Board of Directors or the General Manager, in termination of any combination of or all water, sewer, and reclaimed water service in the following manner:

G-2 Interim Revocation: In cases where the serious nature of the violations described above require immediate action, Board of Directors or the General Manager may, in the sole discretion of the Board of Directors or the General Manager, immediately revoke the permit on an interim basis and thereupon cease water, sewer, and/or reclaimed water service, subject to a timely decision on permanent revocation of permit pursuant to a public hearing as provided herein. In cases of sewer service termination, there shall be no discharge of any type by an applicant, owner, or customer into the District's sewer facilities.

G-3 Permanent Revocation: Permanent revocation of a permit shall occur only subsequent to a public hearing held in the manner hereinafter provided.

The applicant, owner, or customer shall be given written notice ten (10) consecutive calendar days prior to a hearing on the possible permanent revocation of any permit by the District. The notice shall specify the grounds of the proposed revocation of any such permit in reasonable detail. It may but need not describe suggestive corrective action acceptable to the District.

Notice may be delivered personally to the applicant, owner, or customer or it may be given by depositing such in the United States mail with postage prepaid, addressed to the applicant, owner, or customer either at the address for the applicant, owner, or customer as reflected on the last equalized assessment roll of the County of Orange as defined in the Revenue and Taxation Code of the State of California.

Any such action to permanently revoke the permit shall be effective ten (10) consecutive calendar days after notice of the Board's decision and shall be either personally delivered to the applicant, owner, or customer or placed in the United States mail, postage prepaid, addressed to the applicant, owner, or customer in the manner hereinabove specified.

In the alternative to such action, the District may establish a surcharge on the continuation of water, sewer, and/or reclaimed water service by the District until such time as the applicant, owner, or customer has taken action to comply with all of the hereinabove described requirements for obtaining service from the District in its reasonable discretion.

Any request to reestablish service subsequent to the revocation of a permit and the termination of water, sewer, and/or reclaimed water service shall be in the manner prescribed for initially obtaining service from the District, which may include the collection of a security deposit.

However, in addition, the District may, in its discretion, require that an agreement and financial security conditioned upon compliance with the District's Rules and Regulations be provided in an amount, manner, and for a period of time as determined by the Board.

The foregoing provisions of these Rules and Regulations are a requirement of any permit, and any application for service and permit therefore shall be subject to such provisions. The Board, if it deems such to be in the best interest of the District, may on an interim basis or otherwise waive or modify any of the foregoing.

G-4 Determination

District reserves the right to determine whether a violation of the Regulations has resulted from any action or occurrence that is the responsibility of the user. Insofar as the violation of these Regulations constitutes a violation of any regulatory agency requirement, the District makes its determination on behalf of the concerned agency.

G-5 Specific Violations

Specific violations shall include those that directly cause noncompliance with any one of the specific prohibitions as listed in these Regulations, hours of operation, such as runoff conditions, ponding conditions, direct and windblown overspray conditions, unapproved uses, disposal in unapproved areas, cross connections, unprotected drinking fountains, unprotected public facilities, hose bibbs and fire hydrants. Refer to Section 3.4.2 for reporting requirements in the event of a violation.

G-6 Appeal

The user may appeal the determination of the District to the District's Board of Directors. Such appeal must be presented in writing to the General Manager for presentation to the Board at its regular meeting. The appeal shall state the conditions that have been determined by the Board.

TRABUCO CANYON WATER DISTRICT

APPENDIX B-2

CHECKLIST/ACTION REQUEST FORM FOR OBTAINING RECLAIMED WATER SERVICE

Owner/User: _____ Use Site #: _____ Account #: _____

Project Name: _____ Tract No. _____ Lot No. _____ Date _____

Location/Cross Streets: _____ New Construction: _____ Conversion: _____

Specific Action Requested: _____

**Date
Completed**

_____	1. Applicant submits a pre-construction report/preliminary package and plan to the District.
_____	2. District reviews for approval of the application package and preliminary plan.
_____	3. For onsite potable, District requests DDW "in lieu of" approval for meter protection.
_____	4. DDW "in lieu of" approval granted.
_____	5. Preliminary approval granted, owner/user proceeds with project submittals
_____	6. The applicant submits application to the District including the following:
	• Completed irrigation plans for construction or conversion.
	• Work schedule for construction or conversion.
	• Required fees.
_____	7. District reviews plans.
_____	8. District approves and signs plans.
_____	9. District issues a Reclaimed Water Use Permit (Appendix B-2A).
_____	10. Applicant has operator (installation contractor/maintenance contractor) complete operation certification (Appendix B-3).
_____	11. Meter installed and placed in service. Potable water backflow prevention devices installed and tested (if applicable).
_____	12. Applicant has final set of record drawings prepared and submits one (1) set to District.
_____	13. Applicant requests final inspection by District.
_____	14. The District performs final inspection, operational testing, and cross-connection testing.
_____	15. District completes design/construction certification and sends a copy of certification form to applicant, SOCWA, OCHCA and DDW.
_____	16. District initiates reclaimed water services.

HOW TO USE THIS FORM:

1. This form is to be used by the applicant, District, DDW, and SOCWA to request specific action or Items needed to complete the process for obtaining reclaimed water service.
2. Complete each step in the sequence as shown.
3. Make sure the form is dated and signed by Applicant.
4. This checklist keeps all entities informed of the application process and the steps remaining to provide reclaimed water service.

TRABUCO CANYON WATER DISTRICT
APPENDIX B-3
APPLICATION FOR RECLAIMED WATER SERVICE

(Please Type)

(*To be Completed by District)

Location: _____ *Node#: _____ *Use Site # _____

Project/site name: _____ *Account 1# _____

Project/site address: _____ *Account 2# _____

_____ *Account 3# _____

*Hydrologic subarea: _____ *Meter 1# _____

_____ *Meter 2# _____

_____ *Meter 3# _____

Owner/User: _____ Contact: _____

Mailing Address: _____ Title: _____

_____ Phone: _____

Contractor: _____ Phone: _____

Title: _____ Email: _____

Onsite Supervisor: _____ Phone: _____

Mailing address: _____ Email: _____

*Community Facilities Districts and Assessment Districts or Planning Area. No. (If applicable): _____

Legal land description: _____ Tract No: _____

Nearest arterial streets: _____ Lot No: _____

1. Type of use: _____ Landscape irrigation _____ Agricultural use _____ Recreational use _____ Other
(check each use) _____ Commercial use _____ Groundwater recharge _____ Impoundments
_____ Construction use _____ Industrial Use _____ Wildlife habitat.

2. Brief description of use(s): _____

3. Total irrigated area: _____ acres _____ Type of plant material: _____

4. Estimated application rate: Total quantity: _____ acre-feet/year

Max. at POC: _____ gpm (total) Min. pressure: _____ psi

5. # of Service Connections: _____ # of meters requested: _____ Size of meters (in.): _____

6. This will be a: _____ NEW or _____ CONVERTED system.

7. If a new system, how are pipes to be identified: _____ Color-coded & stenciled _____ Tape wrap _____ Other

8. Are there special construction requirements? _____ Yes _____ No If yes, explain:

9. Date desired to initiate construction/conversion: _____

10. Date desired to initiate reclaim water service: _____

11. Duration of service (permanent, temporary, interim, construction use): _____

12. Additional information: (Include special conditions affecting Service): _____

Please include the following items:

13. Drawing of the project area include/show the following:

- Location and size of service connections
- Potable and reclaimed water main line locations
- Specific reclaimed water use areas
- Specific potable water use areas
- Location of all wells
- Location of all streams and water bodies
- Location of all septic tank systems

14. Location map

Also see page 3-3 plans and specifications for additional call outs.

I, the applicant, have read and understand TCWD's Rules and Regulations for Users of Reclaimed Water and agree to restrict reclaimed water use for the purposes described in this application.

I agree to use reclaimed water in accordance with these Regulations and all other applicable documents.

I understand that reclaimed water may not be compatible with certain types of vegetation because of its composition.

I agree that TCWD will not be liable for damages that may occur to vegetation or for damages which may occur due to uses of reclaimed water.

I hereby acknowledge and consent to TCWD's use as it opts out of reclaimed water in lieu of potable water for the purposes herein mentioned in accordance with the Regulations of TCWD and as may be required by Chapter 894 of the Statutes of 1978, the Water Code of the State of California, and Section 2 of Article X of the California Constitution.

Applicant's Name: _____ Title: _____

Applicant's Signature _____ Date: _____

Owner's Name: _____

Owner's Signature _____ Date: _____

Comments: _____

*Service Connection(s) size approved? _____ Yes, _____ No Service location approved? _____ Yes _____ No

*Use(s) approved? _____ Yes, _____ No Comments: _____

*Can TCWD provide requested reclaimed water service with existing facilities? _____ Yes _____ No

If not, what are the constraints? _____

*Is a reclaimed water service required? _____ Yes _____ No

Comments: _____

*Will this system be initially connected to the potable water system? _____ Yes _____ No, or District's intertie system _____

*Is backflow protection required? _____ Yes No. _____ Describe level and method required:

*Billing Rate: _____

REVIEWED BY: _____ Date: _____

Title: _____

TRABUCO CANYON WATER DISTRICT

APPENDIX 3A

RECLAIMED WATER USE PERMIT

(PLEASE TYPE)

(*COMPLETED BY DISTRICT)

*User Site No: _____ *Node#: _____ *Use Site # _____

Project/site name: _____ *Account 1# _____

Project/site address: _____ *Account 2# _____

*Account 3# _____

*Hydrologic subarea: _____ *Meter 1# _____

*Meter 2# _____

*Meter 3# _____

*Community Facilities Districts and Assessment Districts or Planning Area. No. (If applicable): _____

Legal land description: _____ Tract No: _____

Nearest arterial streets: _____ Lot No: _____

Owner/User: _____ Contact: _____

Mailing Address: _____ Title: _____

Phone: _____

Maintenance Contractor: _____ Phone: _____

Onsite Supervisor: _____ Title: _____

Mailing address: _____ Emer#: _____

Phone: _____

Type of use: _____ Landscape irrigation _____ Agricultural use _____ Recreational use _____ Other
(check each use) _____ Commercial use _____ Groundwater recharge _____ Impoundments
_____ Construction use _____ Industrial Use _____ Wildlife habitat.

2. Brief description of use(s): _____

3. Total irrigated area: _____ acres _____ Type of plant material: _____

4. # of Service connections: _____ # of meters requested _____ Size of meters (in): _____

5. This will be a: _____ NEW or _____ CONVERTED system.

6. Duration of service (permanent, temporary, interim, construction use): _____ Service Start up made on _____

7. Potable water uses on-site: Buildings _____ Restrooms _____ Drinking Fountains _____

Hose Bibbs _____ Fire Protection _____ Irrigation _____ Quick Coupling Valves _____

8. State approved backflow prevention assemblies Required _____ Yes _____ No

9. Serial # and date backflow prevention assemblies were last tested:

Serial # _____ Date _____

10. Have any upgrades, alterations, or repairs to the use site and/or appurtenances taken place in the past 12 months? Yes _____ No _____ If yes, please explain.

11. Additional information: *(Include special conditions affecting Service)*

I, the applicant, have read and understand TCWD's Rules and Regulations for Users of Reclaimed Water and agree to restrict reclaimed water use for the purposes described in this application.

I agree to use reclaimed water in accordance with these Regulations and all other applicable documents.

I understand that reclaimed water may not be compatible with certain types of vegetation because of its composition.

I agree that TCWD will not be liable for damages that may occur to vegetation or for damages which may occur due to uses of reclaimed water.

I hereby acknowledge and consent to TCWD's use as it opts out of reclaimed water in lieu of potable water for the purposes herein mentioned in accordance with the Regulations of TCWD and as may be required by Chapter 894 of the Statutes of 1978, the Water Code of the State of California, and Section 2 of Article X of the California Constitution.

Applicant's Name: _____ Title: _____

Applicant's Signature _____ Date: _____

Owner's Name: _____

Owner's Signature _____ Date: _____

DISTRICT USE ONLY

Offsite Supervisor _____ Title _____

Business Address: _____

Business Telephone _____ Off-hours Telephone _____

I certify the reclaimed water system is in accordance with all applicable requirements contained in the TCWD Rules and Regulations

For Users of Reclaimed Water.

Signature _____ Date: _____

Name _____ Title: _____

Date copy of permit sent to OCHCA, and DDW

TRABUCO CANYON WATER DISTRICT

APPENDIX 4

CERTIFICATION FORM FOR RECLAIMED WATER SERVICE

(Please type)

USE SITE # _____

ACCOUNT # _____

METER # _____

Type of use: ☐ Landscape irrigation ☐ Agricultural use ☐ Recreational use ☐ Other
(check each use) ☐ Commercial use ☐ Groundwater recharge ☐ Impoundments
 ☐ Construction use ☐ Industrial Use ☐ Wildlife habitat.

Operation Certification

Operator of Onsite Reclaimed Water System (*Company Name*) _____

Relationship to Property Owner _____

Onsite Supervisor _____ Relationship to Operator _____

Business Address _____

Business Telephone _____ Cell Telephone _____ Fax: _____

I have reviewed the TCWD Rules and Regulations for Users of Reclaimed Water and certify that the operation of this reclaimed water system will be in accordance with all applicable requirements contained therein, including certification of the onsite supervisor, and providing for the required training and supervision of all personnel under my control who will be involved with the use of reclaimed water.

Onsite Supervisor's Name: _____ Title: _____

Onsite Supervisor's Signature _____ Date: _____

Design and Construction Certification (Completed By TCWD)

Offsite Supervisor _____ Title: _____

Final inspection made on _____ Service start up made on _____

Business Address: _____

Business Telephone _____ Mobile Telephone _____

Final inspection made on _____ Service start up made on _____

I certify that the design and construction of the reclaimed water system is in accordance with all applicable requirements contained in the TCWD and SOCWA Rules and Regulations for Users of Reclaimed Water.

Signature _____ Date: _____

Name: _____ Title: _____

Date copy of permit sent to SOCWA, OCHCA, and DDW _____

TRABUCO CANYON WATER DISTRICT
APPENDIX B-5
 RECLAIMED WATER
 ONSITE TESTING AND MAINTENANCE REPORT

Owner:		Office Phone#:	Cell Phone#:
Address:		Fax#:	Email:
Date of Test:	Time of Test:		
Association:		Office Phone#:	Cell Phone#:
Address:		Fax#:	Email:
Account #:	Meter #:	Identification Letter:	
Maintenance Contractor		Office Phone#:	Cell Phone#:
Onsite Supervisor		Fax#:	Email:
Address:			
Site Location:			
Two Major Cross Streets:			
1. Controller Operational		12. Moisture Sensors Operational	
2. Hours of Operation		13. RW Identification Tags Attached	
3. Strainer Operational		14. All Valve Box Lids Branded:	
4. Master Valve Operational		15. All Valve Box Lids Bolted Down	
5. Flow Sensor Operational		16. RW Identification Sign On Site	
6. Booster Pump Operational		17. Backflows Operational	
7. Pressure Regulator Operational		18. Drinking Fountains Protected	
8. PSI Static/Dynamic		19. Potable Identification Tags Attached	
9. Fertilizer Injector Operational		20. Any Cross Connections	
10. Quick Couplers Operational		21. Approximate Temperature	
11. QC Identification Tags Attached		22. Approximate Wind Speed	
Repairs or Adjustments Performed:			
Print name of person performing test			
Signature of person performing test			

TRABUCO CANYON WATER DISTRICT
APPENDIX B-5A
RECLAIMED WATER
COVERAGE TEST

Controller Identification Letter: _____

Place a YES or NO in each box as needed: _____

Control Valve	Over spray	Corrected	Run Off	Corrected	Ponding	Corrected	Check valves at Base of Heads	(Anti Drain Valves) Operational	Minutes of Run Time	Cycles Per day
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										

(COVERAGE TEST on reverse side)

TRABUCO CANYON WATER DISTRICT

APPENDIX B-6

FINAL RELEASE CHECKLIST

Account #: _____ Meter #: _____ Node #: _____

Use Site #: _____ Tract No: _____ Lot #: _____

Location: _____

Owner: _____

Address: _____

Office Phone #: _____ Cell Phone #: _____ Email: _____

Contractor: _____

Address: _____

Office Phone #: _____ Cell Phone #: _____ Email: _____

Architect/Engineer: _____

Address: _____

Office Phone #: _____ Cell Phone #: _____ Email: _____

Final Coverage Test Completion Date: _____

Cross Connection Testing, Performed and Passed, Date: _____

Site Inspection Completion Date: _____

Certification/Calibration Reports Received Date: _____

Meter Releases Issued to Customer Service, Date: _____

Backflow Test Reports Issued to Customer Service Date: _____

Record Drawings:

Contractors redline set of construction drawings; Date Reviewed: _____

Final record drawings, Date Reviewed: _____

Approval Date:

(3) 11" x 16" Cibachrome Control Charts, Date Received: _____

(1) Set Bluelines, Date Received: _____

(1) Set Mylars, Date Received: _____

Application Form, Date Received: _____

Certification Form, Date Received: _____

Final Release Letter, Date Issued: _____

Main Office Engineering Notified of Service Start-Up, Date: _____

TRABUCO CANYON WATER DISTRICT

APPENDIX B-7

AGENCY CONTACTS

Agency:

State Water Resources Control Board, Division of Drinking Water (DDW)
District 8 – Santa Ana
2 MacArthur Place, Suite 150
Santa Ana, California 92707
(714) 558-4410

San Diego Regional Water Quality Control Board (RWQCB)
2375 Northside Drive, Suite 100
San Diego, CA 92108-2700
(619) 516-1990

County of Orange Health Care Agency (OCHCA)
Environmental Health Division
1241 E. Dyer Rd., Suite 120
Santa Ana, California 92705
(714) 433-6000

South Orange County Wastewater Authority (SOCWA)
34156 Del Obispo Street
Dana Point, California 92629
(949) 234-5400

Trabuco Canyon Water District (TCWD)
32003 Dove Canyon Dr.
Trabuco Canyon, California 92679
(949) 858-0277

TRABUCO CANYON WATER DISTRICT

APPENDIX B-8

GUIDELINES

ONSITE RECLAIMED WATER CONVERSION PROCEDURES

The following are conversion procedure requirements that must be adhered to by the Owner of Record prior to any conversion to reclaimed water. Trabuco Canyon Water District will provide coordination assistance in converting these irrigation systems.

1. Preliminary coverage tests are intended to ensure compliance with District regulations regarding direct spray, windblown spray, overspray, ponding, and runoff.
2. Preliminary cross-connection tests are required to ensure that no cross connections exist between the irrigation systems and any potable water sources prior to any conversion to reclaimed water.
3. Remove existing quick-coupling valves per District regulations or change out to brass ACME thread reclaimed water style quick-coupling valves. The locking cover shall be purple rubber or vinyl with the following information stamped or molded into the cover:
 - a. "Reclaimed Water" in English and Spanish
 - b. "Do Not Drink" in English and Spanish
 - c. The International "Do Not Drink" symbol: A glass of water in a circle with a slash.
4. Remove existing hose bibbs to the satisfaction of TCWD. Hose bibbs are prohibited on reclaimed water systems.
5. Heat brand all plastic valve box lids per District regulations to identify them as reclaimed water and type of appurtenance enclosed. Other valve boxes or enclosures shall be identified as directed by TCWD. Bolt down all valve box covers with stainless steel bolts.
6. Attach purple reclaimed water identification tags in English and Spanish to all reclaimed water appurtenances.
7. Identify all above ground pressure and non-pressure reclaimed water piping, as reclaimed water by attaching purple reclaimed water identification labels to the piping at five-foot intervals.
8. Identify all "Rainbird" 1800 sprinkler heads with "Rainbird" 1800 purple reclaimed water snap caps. Identify "Toro" heads in kind. Other heads may require identification as determined by District.
9. Identify all sprinkler, bubbler, or drip system risers with purple reclaimed water identification labels in English and Spanish if potable water used on site. Otherwise, identify only the risers on the perimeter of the use site.
10. Install check valves below any sprinkler head or bubbler head where run-off occurs after the control valve has been shut down.

Note: The Owner has the option to replace affected sprinkler heads with reclaimed water style heads which have built in check valves and purple reclaimed water identification caps.

11. All on site pressurized reclaimed water mainlines are required to maintain minimum horizontal and vertical separations from all pressurized potable water piping, and sanitary sewer systems as specified in Section 3.3.1, Onsite Irrigation Systems Standard Notes.

Suspect piping shall be required to be exposed for verification of separation requirements. All exposed piping shall have appropriate identification tapes attached to them.

12. All potable water service points of connection must have appropriate backflow prevention assemblies. Backflow device must be tested before reclaimed water is used on site.
13. Heat brand all plastic valve box lids per District regulations to identify them as potable water or potable water irrigation and type of appurtenance enclosed. Other valve boxes or enclosures shall be identified as "Potable Water" or "Potable Water Used for Irrigation," as directed by TCWD.
14. Attach blue "Potable Water" or lime-green "Potable Water Used for Irrigation" identification tags, in English and Spanish, to all potable water exterior appurtenances and potable water irrigation appurtenances.
15. Identify all above ground potable water irrigation pressure piping, and potable water irrigation non-pressure piping, as "Potable Water Used for Irrigation" by attaching lime-green identification labels stating "Potable Water Used for Irrigation" in English and Spanish, at five-foot intervals.
16. Protect drinking fountains from reclaimed water by placing drinking fountains away from reclaimed water areas or protecting the drinking fountains to the satisfaction of Trabuco Canyon Water District and State Water Resources Control Board and Orange County Department of Health Services.
17. Drinking fountains, buildings and other potable water appurtenances shall be protected from potable water quick-coupling valves, if any, when they use the same main line by an approved reduced pressure, principle backflow assembly placed between the quick-couplers and drinking fountain or buildings. Backflow prevention assembly location to be determined by TCWD.
18. All onsite potable water hose bibbs shall have brass hose bibb vacuum breaker devices attached to them. Potable water identification tags shall also be attached to the hose bibbs per District regulations.
19. Any connections between potable water systems, potable water irrigation systems and the reclaimed water systems are prohibited.
20. Disconnect the irrigation system from the potable water meter and remove the backflow prevention assembly from the irrigation system prior to connecting the system to reclaimed water.
21. Existing potable water irrigation meters will be moved and tied into the new reclaimed water points of connection (POC) by Trabuco Canyon Water District. The owner of record is responsible for purchasing and installing new reclaimed water meters and meter boxes or meter vaults, following District specifications and procedures at use sites where the existing potable water meters, meter boxes, or meter vaults will need to remain in place for onsite use.
22. Make the connection to the reclaimed water meter, using Class 315, purple PVC reclaimed water piping. For piping with diameters of four inches or greater, use piping as approved by Trabuco Canyon Water District on a case-by-case basis.
23. Install a resilient-seat ball valve and a line size 80 mesh wye strainer or basket strainer immediately after the reclaimed water meter.
24. Attach reclaimed water identification labels to controller door face and controller enclosure face (supplied by TCWD).
25. Place a minimum of two (2) reclaimed water identification signs (1/16" aluminum, 18" x 24") in locations designated by TCWD. These are supplied by the Trabuco Canyon Water District. Additional signs may be necessary due to site considerations.
26. The irrigation controller shall operate reclaimed water systems only. (Example: a single controller cannot operate a potable water irrigation system and a reclaimed water irrigation system). All systems must remain separate.

27. Submit to the District record irrigation drawings and record drawing information for all irrigation systems receiving reclaimed water as well as any potable water systems and/or potable water irrigation systems within the same use site on a reproducible record drawing which shall include:
 - a. cover sheets, record irrigation sheets, irrigation legend detail sheets and any other sheets pertaining to the irrigation system or other onsite systems and their specifications.
 - b. Submit one copy of the final record drawings and information described previously,
 - c. Three (3) 11" x 16" Cibachrome matte finish photo process control charts in final record form for each point of connection, controller, and/or sheets of irrigation drawings.
28. Prior to activating service, the District will perform final inspection and final coverage tests to assure compliance with District regulations. Included in the final inspection are cross connection tests to assure that no cross connections exist between the reclaimed water irrigation system and any potable water sources.
29. Operate and maintain the irrigation system in the same condition as it was when TCWD issued its final release. Comply with TCWD rules and regulations regarding the use of reclaimed water.
30. TCWD regulations require monthly onsite testing and maintenance reports to be completed and available to TCWD. These must be sent to TCWD in cases where both potable water and reclaimed water are delivered to a service site.
31. Onsite reclaimed, potable water systems and potable water irrigation systems at each use site under the user's control shall be under the management of the onsite supervisor designated by the user or the operator and approved by TCWD.
 - a. Onsite supervisors shall be responsible for the installation, operation and maintenance of the irrigation system, enforcement of TCWD's rules and regulations, prevention of cross connections, potential hazards, and maintenance of the reclaimed water system and other onsite system facilities as depicted in final record drawings.
 - b. In the event of contamination of the potable water supply, the onsite supervisor shall be responsible for immediate notification of TCWD.
 - c. The onsite supervisor shall check all onsite irrigation system appurtenances to ensure proper operation and perform a coverage test of the systems at least monthly.
 - d. A copy of the report showing the results of the checks shall be available to TCWD.
 - e. The onsite supervisor or his representative shall be available during normal working hours at an address listed with TCWD for the purpose of hosting an inspection tour or for discussing operational considerations.
 - f. The onsite supervisor or his representative shall be available via telephone at a number listed with TCWD for emergency after-hours contact.
 - g. Where necessary, keys and/or lock combinations shall be issued to Trabuco Canyon Water District to provide such access upon request during normal business hours of operation.
32. Notify TCWD when any revision, upgrade, alteration, or repair is anticipated or performed to the irrigation systems, onsite potable water systems, or their related components.
 - a. TCWD must approve all plans concerning changes to onsite reclaimed water systems, potable water irrigation systems, and all potable water systems.
 - b. Inspections for all the above are mandatory.

33. Certain precautions should be taken when reclaimed water is used. Please see TCWD information titled: "Guidelines for Worker Protection Where Reclaimed Water is Used Onsite."
34. The hours of operation for reclaimed water irrigation systems are 9:00 p.m.to 6:00 a.m., seven days a week.
35. TCWD is required to monitor all reclaimed water use sites for compliance with District regulations.
 - a. A reclaimed water monitoring report will be issued to the owner of record and the onsite supervisor, who is responsible for the particular use site. If a violation occurs, the District must be notified orally or in writing of the steps taken to correct the violation 48 hours within receipt of the report.
 - b. Noncompliance with this regulation will result in termination of service and a re-connection fee will be charged to reestablish service.
 - c. Onsite conditions that endanger the public's health will require immediate termination of service until corrections have been made to the satisfaction of TCWD and appropriate regulatory agencies.
36. The Association should notify its members advising them of the fact that reclaimed water is being used for irrigation in the area and to ask the members for their assistance in notifying the Association of any main line breaks, broken heads, direct spray, windblown, or overspray onto private property, ponding, run off, or any damage to the irrigation systems.
37. Any questions regarding onsite conversion requirements should be addressed to Trabuco Canyon Water District's General Manager.