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ENGINEERING STANDARDS

CITRUS HEIGHTS WATER DISTRICT

REVISIONS

Users of Citrus Heights Water District's Engineering Standards shall be responsible to confirm they are using the most recent versions. To confirm the most recent versions of the Engineering Standards and Approved Materials List, see www.chwd.org, or contact the CHWD Engineering Department at (916) 725-6873.

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SECTION 1. PURPOSE AND DEFINITIONS

1.1 Scope and Purpose

The scope and purpose of these Engineering Standards ("Standards") are to define party responsibilities and establish minimum requirements for the design, construction materials, installation, and testing of facilities within the Citrus Heights Water District's ("District") water system located on both public and private properties. The water system includes mains, service assemblies, hydrants, valves, and all other necessary appurtenances.

These Standards implement the District's policies. If a conflict arises between these Standards and District Policies, District Policies shall prevail. These Standards apply to Applicants proposing to install and connect water facilities to the District's water system, as well as to those proposing to replace, relocate, or repair District water facilities, and privately owned backflow prevention devices.

1.2 Organization

The Standards are organized as listed below:

- Section 1 – Purpose and Definitions: Identifies the purpose of these Standards and lists definitions for terms used throughout the Standards
- Section 2 – Application and Administration: Identifies responsibilities of all parties related to planning, review, approval, and construction requirements and administrative processes
- Section 3 – Design Standards and Criteria: Establishes minimum design standards and criteria for planning and design of public water facilities
- Section 4 – Construction Standards: Identifies requirements for construction, including installation and testing requirements and allowable materials
- Appendix A – Standard Detail Drawings
- Appendix B – Project Checklist
- Appendix C – Project Acceptance Summary/Value of Facilities Form
- Appendix D – District Cross-Connection and Backflow Prevention Regulation
- Appendix E – CHWD Disinfection/Sampling Procedure

1.3 Definitions

Whenever the following terms, or pronouns used in their place, occur in these documents or in any documents that these Design Criteria and Standards govern, the intent and meaning shall be interpreted as defined below:

Authority Having Jurisdiction	The federal, state, or local agency that has jurisdiction over a project or portion of the project.
Applicant	Any person(s), firm, partnership, corporation, agency, or combination thereof, financially responsible for the water system improvements.
Appurtenance	A general term used to describe components such as valves, fire hydrants, and meters.
Board	The Board of Directors of the Citrus Heights Water District.
Contract	The agreement covering the performance of the Work and the furnishing of labor, materials, tools, and equipment in the construction of the Work.
Contractor	The person or persons, firm, partnership, corporation, or combination thereof, that has entered into a contract with the District or the Applicant, and who is duly licensed under the laws of the State of California to do or perform such tasks as said contract may define.
County	Either the County of Sacramento or County of Placer, California, whichever applies.
Customer	Any property owner, tenant, or other water user who receives water from or pays a water bill to the District.
Day	A calendar day of 24 hours.
Development	The act or process of constructing on properties, including subdivision improvement.
Distribution Main	A water main less than 14 inches in diameter.
District	The Citrus Heights Water District.
District Engineer	The District Engineer of the Citrus Heights Water District, or his/her duly appointed representative.
District Facilities	Water facilities owned by the District, located upstream of and including the water meter.
Engineering Standards	The standard procedures, specifications, and drawings established by the District in this document.
Fire Authority	Organization or agency responsible for overseeing fire protection, prevention, and emergency response services within its specific jurisdictional area.
General Manager	The General Manager of the Citrus Heights Water District, or his/her duly appointed representative.
Hydrant Valve	A valve that is installed in a water line between a fire hydrant and the main, which can be closed to isolate the hydrant.
Improvement Plans	Drawings showing all Work necessary to provide water to a proposed project, including all water services, mains, and appurtenances.
Inspector	An employee or agent of the District, duly authorized by the District Engineer and engaged to observe and record field compliance with these Standards, design criteria, plans, and construction standards.
Isolation Valve	A valve that is used to stop flow or isolate a portion of the water system.
Main	A water pipeline dedicated for public use in the District's system, excluding services and laterals.

Water Service	A metered connection from the District's water system to a customer's facilities.
Service Assembly	Service assemblies are the complete set of components that connect a water main to a customer's plumbing system. They typically include the service saddle, corporation stop, service line, curb or angle stop, meter, meter box or vault, backflow device (if required), and related fittings. Configurations vary by service type and size and must meet the requirements of these Standards and Detail Drawings.
Service Line	The pipe and fittings between the District's main and the meter.
Standards	The specifications and drawings contained herein and approved addenda, plus any other standard specifications incorporated by reference. In general, the referenced standards or specifications shall be understood as being the latest edition.
Transmission Main	A water main 14 inches in diameter or larger.
Water	Potable water that is safe for drinking and complies with the latest edition the California Safe Drinking Water Act, the United States Environmental Protection Agency (EPA) National Primary Drinking Water Regulations, and/or other applicable standards.
Water Facilities	Infrastructure and systems used for sourcing, treating, storing, distributing, and otherwise managing water as part of the District's water system.
Water System	The potable water supply system of the District approved by or under the public health supervision of the Division of Drinking Water of the California State Water Resources Control Board.
Work	All obligations, duties, and responsibilities necessary to the successful completion of the project assigned to or undertaken by a Contractor including all labor, materials, equipment, and other incidentals, and the furnishing thereof.

1.4 Abbreviations

Whenever the following abbreviations occur in these documents or in any documents that these Design Criteria and Standards govern, the intent and meaning shall be interpreted as defined below:

AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
ADU	Accessory Dwelling Unit
ANSI	American National Standards Institute
ARV	Air and Vacuum Relief Valve
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BOV	Blow-off valve
Cal/OSHA	California Division of Occupational Safety and Health
Caltrans	California Department of Transportation
CCCPH	Cross Connection Control Policy Handbook
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CHWD	Citrus Heights Water District

DDW	Division of Drinking Water
DIP	Ductile Iron Pipe
DIPRA	Ductile Iron Pipe Research Association
DOT	Department of Transportation
DR	Dimension Ratio
DWG	Drawing
e.g.	For example
EPA	Environmental Protection Agency
fps	feet per second
gpm	gallons per minute
HDD	Horizontal Directional Drilling
ISO	Insurance Services Office
MGD	Million Gallons per Day
NAD	North American Datum
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPT	National Pipe Thread
NSF	National Sanitation Foundation
OD	Outside diameter
OSHA	Occupational Safety and Health Administration
ppm	parts per million
psi	pounds per square inch
psig	pounds per square inch gauge
PUE	Public utility easement
PVC	Polyvinyl Chloride
ROW	Right-of-way
SDR	Standard Dimension Ratio
SJWD	San Juan Water District
SWPPP	Storm Water Pollution Prevention Plan
USA	Underground Services Alert
UWMP	Urban Water Management Plan
WEF	Water Environment Federation

SECTION 2. APPLICATION AND ADMINISTRATION

This section applies to applicant-initiated projects and outlines the responsibilities of all parties involved. It also describes the planning, review, and construction-related requirements and processes.

2.1 Roles and Responsibilities

The responsibilities of the District, Applicant, Applicant's Engineer, and Applicant's Contractor with respect to administrative implementation of an applicant-initiated project are defined in the following subsections.

2.1.1 District Responsibilities

The District shall be responsible for the review and approval of Improvement Plans and the inspection of all water facilities to be dedicated to the District. This may include facilities within public rights-of-way, private property, public utility easements and dedicated water easements.

2.1.2 Applicant Responsibilities

The Applicant shall have ultimate responsibility for compliance with all requirements specified in these Standards and any other standards, codes, regulations, and requirements as they may apply. The Applicant is solely responsible for all administrative requirements including application, submittal of all required Improvement Plans and payment of fees. The Applicant shall reference and adhere to the Project Checklist and Application for Water Service provided on the District website (www.chwd.org). The Applicant is also responsible for ensuring that the Applicant's Engineer meets all design requirements and that the Applicant's Contractor meets all construction-related requirements. The Applicant shall obtain approval of improvement plans, construct the project per approved plans, and successfully pass inspections and testing prior to connection to existing District facilities.

Upon Applicant's request, the District may install a single water service for the residential parcel.

2.1.3 Applicant's Engineer Responsibilities

These Standards establish requirements for the design and construction for the District's water system and are not a substitute for engineering knowledge, judgment, or experience. The Standards presented herein shall be reviewed by the Applicant's Engineer and shall be applied as necessary to the project. Proposed deviations from these Standards shall be submitted, in writing, to the District Engineer, for review and approval.

All development project plans, specifications, reports, or other documents shall be prepared by a civil engineer registered in the State of California or by a subordinate employee under the direction of a civil engineer registered in the State of California. All documents shall be signed by a civil engineer registered in the State of California and stamped with the registered seal to indicate responsibility for them. District plan approval does not in any way relieve the Applicant's Engineer of the responsibility to: adhere generally to accepted engineering standards and exercise the same level of care, skill, and diligence in the performance of the services as is ordinarily provided by a professional engineer under similar circumstances; and meet all District requirements. The Improvement Plans shall be revised or supplemented at any time it is determined that the District's requirements have not been met. Any design changes made after plan approval shall be submitted to the District for review and approval.

The Applicant's Engineer shall be responsible for compliance with all governing federal, state, and local laws, ordinances, codes, orders, and regulations.

In conformance with the California Environmental Quality Act (CEQA), all actions by the District in reviewing and approving Improvement Plans and inspecting construction for applicant-initiated projects shall be deemed ministerial. It shall be the Applicant's responsibility to conform to the requirements of CEQA and the requirements of the lead agency, which has approved a development project or entitlement, including all mitigation measures that may relate to public improvements under District approval and inspection. The District shall be held harmless from any suit or action arising out of noncompliance by the Applicant with CEQA, or performance or lack of performance by the Applicant of any mitigation measures adopted or required by any local government.

2.1.4 Applicant's Contractor Responsibilities

The Contractor shall hold a valid State of California Class "A" General Engineering Contractor license throughout construction. The Contractor shall provide the District with valid Contractor's license information including license number, name of license holder, classification, and expiration date. The Contractor shall be skilled and regularly engaged in constructing public water systems.

The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures of construction not otherwise specified in these Standards or the Improvement Plans. At all times, the Contractor shall be responsible for compliance with all governing federal, state, and local laws, ordinances, codes, orders, and regulations that in any manner affect those engaged or employed on the job site, the materials used in the Work, and the safe conduct of the Work. The Contractor shall also be solely responsible for ensuring all finished work complies with these Standards and the approved Improvement Plans.

Inspection or approval by the District Engineer or Inspector of the work does not relieve the Contractor of the responsibility to: adhere to the standards generally prevailing for the construction; exercise the same degree of care, skill, and diligence in the performance of the work as is ordinarily provided by a licensed Contractor under similar circumstances; and adhere to the approved plans and these Standards. Any defective work discovered by the District before the expiration of the period prescribed for latent deficiencies in Section 337.15 of the Code of Civil Procedure shall be removed and replaced, at the applicant's expense, by work that fully conforms to the provisions of the approved plans and these Standards.

2.2 Plan Submittal

The first step an Applicant shall take for project review is to submit an Application for Water Service to the District, as provided on the District's website. The District will perform a cursory review of the project to determine if a formal fee-based plan review is required. The District Engineer will review proposed Work in accordance with the District Standards to identify the best plan for delivery of water for a development project. The District Engineer will determine if a Will Serve Letter is required for the proposed work, which will list the anticipated water system improvements.

2.3 Planning and Review Services

To identify the most effective plan for water delivery to a development project, the District Engineer will review proposed Work in accordance with District planning documents, including its Water Master Plan as amended from time to time. The District Engineer shall determine if the proposed Work will require a plan of services.

A plan of services may include any water planning documents needed to evaluate water service for a proposed project while maintaining service to existing customers. This may include, but is not limited to,

water supply assessments, water supply verifications, and water system capacity analyses. Any and all costs associated with preparation of a plan of services, if required, shall be the Applicant's responsibility.

The District's standard plan review includes review by District staff of any required engineering documentation such as Improvement Plans or calculations prepared by the Applicant or Applicant's Engineer. Standard plan review includes up to two (2) hours of consultation time with District staff. Consultation time includes any in person, phone, and virtual meetings. Additional time may be necessary depending on the project's size and scope (e.g., number of connections).

The District operates and maintains a water system model. Upon request, the District may conduct a fire flow evaluation for the Applicant's project. Applicant is responsible for costs associated with the evaluation.

The District will collect a Base Plan Check fee associated with its standard plan review process. In the event that District time for plan review services exceeds three (3) review iterations and two (2) hours of consultation time, the Applicant may be charged for further planning consultation services based on District staff time, equipment, and labor costs.

2.4 Plan Approval Process – Improvement Plans

District approval of Improvement Plans is required prior to construction of water facilities.

The plan approval process shall typically consist of, but not be limited to:

1. Submittal of Improvement Plans and Final Map or Parcel Map for District review.
2. Submittal of the Application for Water Service and payment of the plan check deposit.
3. Submittal of Engineer's Cost Estimate for water facilities.
4. Payment of District Total Plan Check Fee.
5. Submittal (if applicable) of all required easement offers, legal descriptions, and plat plans. The fee title owner shall sign the easement offer. See other sections of these Standards for requirements about water easement dedication.
6. For projects with potentially unstable soils (e.g., on steep slopes, near a creek), submittal of a report prepared by a licensed geotechnical engineer that documents existing conditions and provides recommendations for construction.
7. Submittal of any project-specific documents as required by the District Engineer.

Once all plan review requirements have been satisfied and plan check fees have been paid, final plans will be approved by the District Engineer and will remain valid for construction for one (1) year from date of signature on the design documents. Note: Plans must be approved by the Fire Authority prior to the District's approval.

2.4.1 Improvement Plan Requirements

The Improvement Plans shall show all Work necessary to provide water to the Project, including Work necessary for the installation of mains, services, and appurtenances. The Improvement Plans shall be prepared under the direction of, and signed by, a currently registered professional civil engineer in the State of California.

Improvement Plans showing the proposed Work shall be submitted to the District for review and approval. Included with this submittal shall be all calculations requested by the District Engineer to verify the design of any portion of the water system. Calculations shall be based on methods generally accepted by the

engineering profession and shall be neatly and legibly done in such form as to enable them to be readily checked. Calculations shall be signed and stamped by a State of California registered civil engineer. In addition, literature and technical data concerning any of the materials and equipment to be used shall be furnished to the District Engineer upon request.

Improvement Plans shall comply with the following requirements. Exceptions for projects that do not require water main extensions may be granted subject to the discretion of the District Engineer.

1. A full-size PDF file along with two (2) sets of full-size Improvement Plans, with a minimum drawing size of 22 inches by 34 inches, shall be submitted. Refer to the District website for directions on electronic plan submittal.
2. All proposed water facilities, including pipe sizes, types, and classes, shall be shown on the plans. All proposed mains and valves, including fire hydrants, shall be shown in plan and profile views. The profile shall also include other existing and proposed utilities with crossing details. An enlarged detail(s) may be required for clarity.
3. All points of connection and tie-ins shall be shown in detail.
4. All existing water facilities shall be shown.
5. All private water facilities (existing or proposed) shall be shown on the plans and identified as private.
6. All existing water pipelines and facilities to be abandoned shall be shown. The plans shall indicate how active water facilities on or adjacent to the construction area are to be protected and shall show that the abandonment of lines does not adversely affect the water system.
7. All existing and proposed buildings and other structures, including light standards and accessory structures, which may affect maintenance, operations, or replacement of water facilities, shall be shown.
8. All existing and proposed easements shall be shown.
9. Plan and profile drawing scale shall be 1-inch equals 20 feet or 1-inch equals 40 feet with scale bar shown.
10. If necessary, an overall plan view of the entire proposed water system shall be provided and shown on one sheet with a drawing key for subsequent plan and profile sheets. A smaller drawing scale can be used for this purpose.
11. A location map showing the area to be served relative to established public roads shall be shown.
12. A note that states: “Work shall conform to the most current edition of the Engineering Standards and Detail Drawings of Citrus Heights Water District” shall be shown.
13. All existing and proposed dry and wet utilities in the vicinity of any proposed water facilities shall be shown. “Water Only” plans shall not be approved by the District Engineer.
14. All items on the District’s Project Checklist shall be addressed. The Applicant shall reference the Project Checklist provided on the District website (www.chwd.org). A sample of the Project Checklist is provided in Appendix B.
15. Any other project-specific requirements as determined by the District Engineer shall be included.

Once a development project plan set has been signed by the District Engineer and all other agencies, two (2) full-size sets, and one (1) full-size PDF file shall be submitted to the District. All submitted map drawings shall use the Global Coordinate System of USA, California, NAD 83 California State Planes, Zone III, and U. S. foot unless approved by the District Engineer.

No changes shall be made to the signed plan set unless approved by the District Engineer. In the case of an approved change, all submitted sheets affected by the change shall be replaced.

During construction, one (1) complete set of signed plans shall be kept on site at all times.

2.4.2 Standard Notes and Details

Improvement Plans shall include applicable District Water System Notes and Detail Drawings as provided in Appendix A.

2.4.3 Interpretation of Standards

These Standards are intended to serve as one document. This means that the written standards and the drawings are complementary, and requirements stated in either the written standards or the drawings shall be equally binding. In the case of conflict between the written standards and drawings, the written standards shall govern. In case of conflict between the Improvement Plans and Detail Drawings, the Detail Drawings will govern unless the District Engineer has approved a specific variance.

In the event of discrepancies, errors, or omissions found in these Standards, or should it appear there is not sufficient detail to perform the Work, then the Applicant shall promptly submit in writing to the District Engineer a request for clarification or interpretation. The request shall identify the exact requirement(s) at issue and indicate the proposed interpretation. The District Engineer will act upon such a request within ten (10) working days.

2.4.4 Variances

A request for a variance from any requirements contained in these Standards must be submitted in writing to the District Engineer by the Applicant. The request must clearly identify the specific requirement and the proposed variance with supporting factual information. The District Engineer will begin review of such requests within ten (10) working days. The District may assess fees for District cost and efforts associated with the variance request review.

Any appeal for a decision by the District Engineer must be submitted in writing to the General Manager within ten (10) working days of the District Engineer's action.

2.4.5 Payment of Fees

All remaining Plan Check Fees shall be paid before final approval and signature by the District. The District reserves the right to charge additional fees if the plan review process exceeds typical review times described in Section 2.3.

Water facilities construction (including any preconstruction meeting and material submittal review) shall not commence until plans and supporting documents (e.g., easements) are approved by the District and all required fees are paid (including one-time San Juan Water District (SJWD) wholesale capital facility fees). These wholesale fees are applicable to new services, based on the new service size, and are subject to annual updates by SJWD.

Detailed information regarding fees is provided on the District website.

2.5 Plan Approval Process – Tenant Improvements

District approval of Tenant Improvement Plans is required prior to construction.

The plan approval process shall typically consist of, but not be limited to:

1. Submittal of Tenant Improvement Plans for District review.
2. Submittal of the Plan Submittal Form.
3. Payment of District plan check fees.
4. Submittal of any project-specific documents as required by the District Engineer.

Once all plan review requirements have been satisfied and plan check fees have been paid, final plans will be approved by the District Engineer and will remain valid for construction for one (1) year from date of signature on the design documents.

2.6 Easements

All public water facilities must be installed within public right-of-way (ROW), public utility easement (PUE), or dedicated water easement.

When conditions require that District water facilities be located in private property, including water services located outside the property they serve, an easement for the area must be prepared and granted by the property owner to the District, at no cost to the District. The easement shall grant the District the permanent right to construct, operate, and maintain public water facilities on private property. Section 3 of these Standards provides detailed easement requirements. In circumstances where an easement is required across an adjacent property not owned by the Applicant, the Applicant shall be responsible for negotiating and acquiring easements for water facilities that may be required.

The easement documents must be received and approved by the District prior to improvement plan approval by the District.

2.6.1 Grant of Easement

Applicant shall complete the following and provide them to the District for review.

1. Grant of easement form, to be provided by the District
2. Easement legal description
3. Plat map

After the District review and tentative approval of the easement documents, original documents with notarized wet signature(s) shall be provided to the District for acceptance. The District will record the document with the appropriate County. Easements will not be recorded until construction is complete and it is determined that no modifications to the easement are required. Any revisions to the easement documents shall be prepared by the property owner and resubmitted to the District for approval.

2.7 Inspection and Testing

The Contractor shall coordinate all Work with the District Construction Inspector.

All materials furnished and all Work performed as indicated on the approved plans shall be subject to inspection by the District Engineer. The Contractor shall be held strictly accountable to the true intent of the Standards with respect to material quality, workmanship, and diligent execution of the Work. Such inspection may include mill, plant, shop, or field inspection as required. The District Engineer shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated; and shall be furnished with such materials, information, and assistance by the Contractor and subcontractors and suppliers as is required to make a complete and detailed inspection. The District shall have unrestricted access to all premises on which any District facilities have

been constructed. The District shall also have unrestricted access at reasonable hours to all premises to which the District provides water, including private water facilities that are connected or may potentially be connected to District facilities, to inspect and to see that the rules and regulations of the District regarding installation of facilities and use of water are being observed.

2.7.1 The Inspector

District Inspectors are authorized to inspect, on behalf of the District Engineer, all Work done and all materials furnished. Such inspection may extend to all or any part of the Work. The Inspector is authorized to call attention of the Contractor to any failure of the Work or materials to conform to the Standards. The Inspector has the authority to reject materials or suspend the Work until any questions at issue can be referred to and decided by the District Engineer or a duly appointed representative. The Inspector shall in no case act as a supervisor or perform other duties for the Contractor, nor interfere with the management of the Work by the Contractor. Any advice the Inspector provides shall in no way be construed as binding to the District in any way or releasing the Contractor from fulfilling all the Contractor's responsibilities.

If the Contractor refuses to suspend operations on verbal order from the Inspector, the District Engineer shall then issue a written order stopping all Work. After delivery of the order to the Contractor or person in charge, the Inspector will immediately leave the job, and all Work done in the absence of the Inspector shall not be accepted.

2.7.2 Work Done in the Absence of Inspection

Work done in the absence of District inspection will require removal and replacement. The entire cost of removal and replacement shall be borne by the Contractor, regardless of whether the Work removed is found to be defective or not.

2.7.3 Testing

All required testing, as outlined in Section 4 of these Standards, and any other testing as determined by the District Engineer, shall be completed and passed prior to Project approval. The Contractor shall furnish all materials and labor necessary to complete all required testing. The Contractor shall be responsible for any retests and any corrective measures deemed necessary by the District Engineer.

2.7.4 Cost of Inspection and Testing

The cost of initial inspection and testing is developed on a per project basis, based on the District's development fees, and collected prior to any water related construction activities. If District expenses exceed the initial calculated inspection fees due to any reason (e.g., non-compliance or failed testing, or estimated less than the actual cost), the Applicant shall pay the difference.

Overtime/off hour construction work, whether required by the District or requested by the Contractor, shall be at the expense of the Applicant. These fees will be determined on a case-by-case basis based on District staff time, equipment, and labor costs. The District's normal business hours are four (4) 10-hour days, Monday through Thursday. Overtime charges shall apply beyond the District 40-hour work week and for any time on Friday, Saturday, Sunday, or District holidays. The Applicant or Contractor shall submit a written request for any overtime or off-hours work two (2) weeks in advance of the planned work and coordinate with the Inspector.

2.8 Use and Service

2.8.1 Beneficial Use

The District may, prior to acceptance of the Work, use any completed part or parts of the Work, providing these areas have been approved for use by the District. Only the District shall operate and maintain parts of the Work in use to ensure continued service to its customers. The exercise of this right shall in no way constitute an acceptance of such parts, or any part of the Work.

District use of part(s) of the Work does not relieve the Applicant or Contractor from completing the remaining Work associated with those part(s) of the Work in use. During the beneficial use period, the Applicant and/or Contractor shall perform maintenance and/or repairs on those part(s) of the Work in use associated with faulty or insufficient materials, workmanship, and/or installation, and any damages associated with the construction of the Project. During construction activities, the Applicant and the Contractor shall protect those part(s) of the Work in use and shall be responsible for responding to any Underground Services Alert (USA) requests for information.

Operation of facilities during the beneficial use period shall be performed by District personnel, or under the District inspector's supervision and with prior District approval. The Applicant and the Contractor shall be responsible for fines and District costs incurred to correct issues caused by unauthorized operation of facilities during beneficial use.

The warranty period for these part(s) of the Work in use shall commence upon District acceptance of all of the Work.

2.8.2 Service

The following conditions shall be met before water is supplied to a property and/or water meters are set:

1. All mains, services, and major appurtenances such as fire hydrants and valves for water systems have been installed to the satisfaction of the Inspector.
2. A meter box for each service has been installed by the Applicant's Contractor.
3. All connections to existing District systems and facilities have been completed.
4. All testing and certification as required in these Standards have been successfully completed.
5. No further construction Work, such as roadwork, will jeopardize the integrity or quality of water facilities already installed.
6. District has access to all operating facilities such as vaults and valves.

The District reserves the right to withhold a portion of project water meters or deny water service until all Work is completed.

2.9 Acceptance and Warranty

Acceptance of the Applicant's Development Project shall occur only after the following conditions are satisfied:

1. All applicable District fees and charges pertaining to the project shall be paid in full.
2. Facilities to be accepted must be adequately protected from on-going construction. Where facilities are installed in paved areas, the final lift of pavement must be in place.
3. All Work, including punch list, shall be completed in accordance with these Standards and the approved Improvement Plans.
4. All required testing has been conducted and successfully completed.

5. The project Record Drawings shall be submitted to the District in accordance with Section 2.10 of these Standards.
6. The Project Acceptance Summary/Value of Facilities Form shall be submitted to the District. A copy of this form is included as Appendix C.
7. Property dedication requirements for water facilities to be dedicated shall be complete.
8. A satisfactory final inspection has been completed.
9. Necessary easement(s) have been accepted by the District.

Once all conditions are satisfied, the District Engineer shall issue a Letter of Acceptance.

Immediately upon issuance of a Letter of Acceptance by the District, the warranty period on all Work shall be in effect. The standard warranty period shall be one (1) year unless the District Engineer requires a longer period.

Any faulty workmanship and/or defective materials, which are discovered within the warranty period, shall be corrected and/or replaced by the Contractor at no expense to the District. The Contractor shall also correct and/or replace any damage to surrounding areas caused by the faulty workmanship and/or defective materials. Such warranty period on the repaired work may be extended for one (1) year after the repair unless the District Engineer requires a longer period.

All repair work (except emergency work) required during the warranty period shall be performed within five (5) working days of issuance of written notification to the Contractor. Emergency work, as deemed necessary by the District, shall be addressed immediately. Emergency work performed by the District on Work of the Contractor; and work performed by the District due to non-performance of the Contractor shall be reimbursed by the District within thirty (30) days of invoice.

At the conclusion of the warranty period, an inspection of the Work will be performed by the District. A letter will be sent to the Applicant releasing the warranty or requesting repair of any deficiencies.

2.10 Record Drawings

The Applicant or the Applicant's Contractor shall maintain one (1) set of full-size prints as Record Drawings and accurately mark thereon the actual work, including any deviations from plan dimensions, elevations, or orientations. Upon completion of the job, the Record Drawings shall be prepared under the supervision of the Applicant's Engineer and submitted in a condition acceptable to the District as a condition of acceptance of the Project. Marked prints shall be updated on a regular basis by the Contractor and shall be available for District review.

At the completion of all Work, Applicant shall submit Record Drawings as follows:

- One (1) full-size copy in PDF form
- One (1) full-size hardcopy set
- One (1) electronic set in the latest AutoCAD format, NAD 83

Record Drawings submitted for approval shall include the following information:

1. Water Facilities Depth: Record drawings shall indicate the depth, clearance, and location of each water facility at a crossing with existing or proposed utilities and where the facilities depth differs by six (6) inches or more from the plans. If possible, the actual depth shall be marked on the profile.
2. Inverts: Any deviation from the invert elevations proposed on the plan shall be recorded.

3. Horizontal Main Alignment: Any change in horizontal main alignment greater than twenty-four (24) inches shall be recorded.
4. Unexpected obstruction and difficulties: All unexpected obstructions or difficulties found during construction shall be recorded, noting the type of obstruction, station and/or location, and dimensions at the point of crossing with water facilities.

All submitted map drawings shall use the Global Coordinate System of USA, California, NAD 83 California State Planes, Zone III, and U. S. feet, unless approved by the District Engineer.

2.11 (RESERVED)

2.12 (RESERVED)

SECTION 3. DESIGN STANDARDS AND CRITERIA

This Section outlines general design information and criteria for water distribution systems that serve District customers. It establishes the District's minimum standards for planning and designing of public water systems. These Standards are not a substitute for the engineering knowledge, judgment, or experience of the design engineer. The standards presented herein shall be reviewed by the Applicant's Engineer and shall be applied as necessary to the Applicant's project.

Proposed variances from these Standards or special designs not addressed in these Standards shall be submitted in writing to the District Engineer. All variances and special designs shall be reviewed and approved by the District prior to District review of the affected portion of the project plans.

3.1 Pipe Sizing Design Criteria

Each water main segment shall be sized to provide sufficient flow and pressure to meet domestic, commercial, and fire flow demands at all times. Water mains designed to serve future development shall also include capacity for future demands. Capacity for future demands shall be as determined by the District Engineer in accordance with the Water System Master Plan and applicable planning documents.

Water mains shall be sized using the Hazen-Williams formula. The design criteria to be used to determine the sizes of the mains in the distribution system shall be the values which are given in the following sections.

3.1.1 Water Supply

Water mains shall be designed to deliver water at a rate sufficient to meet the combined demand of all the service connections served by the system or facilities as described in Table 3-1.

Table 3-1. Design Flow Criteria

Development Type	Design Combined Flow[(a)]
Residential Area	100 percent of maximum daily demand plus fire flow from two (2) nearest fire hydrants within the existing and proposed water system.
Commercial/Industrial Area	100 percent of maximum daily demand plus fire flow from three (3) nearest fire hydrants within the existing and proposed water system.
Transmission Main	100 percent of maximum day transmission main flows plus highest fire flow in the system, as determined by District Engineer by using the District's Water Model and District planning documents, including its Water Master Plan as amended from time to time.

(a) Fire flow shall be as required by the local Fire Authority.

3.1.2 Design Water Demand

Average daily demand shall be calculated based on the water use factors in Table 3-2.

Table 3-2. Water Use Factors	
User Type	Average Daily Demand Water Use Factor, gallons per minute/service connection[(a)]
Single Family Residential	0.31
Multi-Family Residential	0.62
Commercial/Institutional	0.78
Industrial	3.81
Landscape	1.51
(a) Average Daily Demand water use factors are based on the CHWD 2020 UWMP and include the projected 4.8% of non-revenue water.	

Design water demand shall be based on the maximum daily demand. Maximum daily water demand shall be 2.09 times the average daily demand.

3.1.3 Required Fire Flows

Fire flow requirements shall be established by the Fire Authority. For preliminary designs, fire flows shall be in accordance with the criteria in Table 3-3.

Table 3-3. Fire Flow Rates and Duration[(a)]		
Use Type	Flow, gpm	Duration, hour
Single Family Residential	1,500	2
Multi-Family Residential	2,500	2
Commercial/Institutional[(b)]	2,500	3
Industrial[(b)]	4,000	4
(a) Applicant shall contact the fire authority who has jurisdiction about the fire flow requirements. Required fire flow shall be provided on the improvement plans. (b) Fire flow requirements for commercial, institutional, and industrial uses assume the structures will have approved automatic sprinkler systems installed.		

Industrial, institutional, and medium to large commercial developments shall be evaluated on a case-by-case basis by the Fire Authority using procedures as outlined in the Insurance Services Office publication, "Fire Suppression Rating Schedule," latest edition.

In accordance with Section 2.3, the District may conduct a fire flow evaluation for a project upon request.

3.1.4 Pressure Requirements

3.1.4.A System Minimum Pressure

Under normal operating conditions and during maximum day demand scenario, a minimum of forty (40) pounds per square inch (psi) system pressure shall be maintained at all times except under fire flow conditions. Under fire flow conditions with the required fire flow rate plus maximum daily demand, the system residual pressure at the hydrant outlet or the customer's meter outlet shall not fall below twenty (20) psi.

3.1.4.B Typical System Pressure

Static pressure in the District ranges from 75 to 115 psi.

3.1.5 Velocity Requirements

Pipeline stresses shall be minimized and kept within the design limits of the pipe. Water velocity in the main shall account for variable flow conditions, cyclic surging, and water hammer effects. Water velocity shall not exceed seven (7) feet per second (fps) under peak-hour demand.

Under fire flow conditions, velocities up to a maximum of ten (10) fps may be allowed by the District Engineer, provided that consideration is given to the design and operation of control valves, relief valves, and pumps when included in the water system. All requested variances from the maximum flow velocity of seven (7) fps shall require an independent hydraulic analysis conducted by the District or its consultant. Costs for such analysis will be borne entirely by the Applicant.

3.1.6 Allowable Water Main Pipe Materials

Water mains shall comply with AWWA standards and NSF/ANSI Standard 61. Mains 10 inches in diameter and smaller shall be polyvinyl chloride (PVC) pipe C900, DR 14, Pressure Class 305, or ductile iron pipe (DIP), Pressure Class 350.

Ductile iron pipe (DIP), Pressure Class 350 will be required in the following situations:

1. Mains 12-inches and larger.
2. Where separation from structures as stated in this Standard cannot be maintained.
3. Where burial depth of pipe exceeds 6 feet.
4. Where pipeline is located in an unpaved area outside the public ROW.
5. Mains within any arterial roadway.
6. At utility crossings requiring Detail Drawing UC_001.
7. Where thirty-six (36) inches of cover cannot be maintained.
8. In other special circumstances, as determined by the District Engineer.

The Applicant's Engineer shall be responsible for designing the proposed water system in compliance with these requirements. Pipe size, type, and class shall be clearly indicated on the improvement plans.

3.1.7 Pipe Friction Factor

For design consistency, the District requires the use of pipe friction factors shown in Table 3-4 are used in calculations.

Table 3-4. Pipe Friction Factors

Pipe Type	Hazen Williams C Factor
Ductile Iron Pipe (DIP), Cement-Lined	120
Polyvinyl Chloride (PVC) Pipe	130

3.2 Minimum Water Main Size

Water mains shall be a minimum of eight (8) inches in diameter. Upon review and approval, the District Engineer may allow the use of a 6-inch main in small cul-de-sacs or dead-ends without fire flow requirements or hydrants.

3.3 Placement of Water Mains

Mains shall be located within public rights-of-way, public utility easements, or dedicated water easements. Water facilities shall be placed in a separate trench from all other utilities. Water mains shall be located with the required horizontal and vertical separations from all utilities in conformance with Section 3.3.3.

3.3.1 Street

Water mains shall be placed a minimum of three (3) feet from the lip of gutter, in the street, unless otherwise specified by the Plans or Detail Drawings. In any case, mains shall be located so that excavation and repair of the main or its appurtenances will not encroach on private property without a public utility easement or dedicated water easement.

Pipelines shall not be installed under pavers, decorative pavement, or concrete. Furthermore, pipelines shall not be installed within building courtyards or alleyways.

3.3.2 Building and Other Above-ground Structure Set Back from Mains

Water mains shall be placed no closer than seven and one-half (7.5) feet clear from any building or structure foundation.

The installation of mains less than seven and one half (7.5) feet from the building or above-ground structure shall be subject to the approval of the District Engineer. In such cases, DIP shall be used.

Water facilities must maintain a minimum horizontal clearance of twenty-four (24) inches from concrete street light foundations.

3.3.3 Separation of Water Mains from Other Pipelines

All horizontal and vertical separations between water mains and sanitary sewer and storm drainage lines shall meet the minimum installation requirements provided in this section pursuant to Title 22 of the California Code of Regulations. If a conflict arises between these criteria and Title 22 separation criteria, whichever is more stringent shall prevail. Wherever separation criteria cannot be maintained, all special construction criteria must be proposed to and approved by the Division of Drinking Water (DDW) as an alternative. Parallel and crossing requirements are as follows:

1. New water mains shall be installed with a minimum separation of ten (10) feet horizontally and one (1) foot vertically above any parallel pipeline that is conveying sanitary sewer.
2. New water mains shall be installed with a minimum separation of four (4) feet horizontally and one (1) foot vertically above any parallel pipeline conveying storm drainage.
3. All water facilities shall be installed with a minimum separation of four (4) feet horizontally and (1) one foot vertically from any utility other than listed above.
4. All new water mains and services crossing other utilities shall include a minimum separation of one (1) foot above the top of the utility. No connection joints shall be made in the water main within ten (10) feet horizontally from sanitary sewer mains or four (4) feet horizontally from storm drain.

3.3.4 Minimum Cover

Minimum cover shall be measured from the top of pipe to finished grade.

3.3.4.A Water Mains

Minimum cover for water mains shall be thirty-six (36) inches below finished grade and in conformance with the detail drawings in the TREN series.

In cases where minimum cover cannot be maintained, such as at the crossing of a water main with a sanitary sewer main or any other utility line, then either an under-crossing or over-crossing shall be chosen based upon an evaluation by the Applicant's Engineer and approval by the District Engineer. Evaluation shall include the need for higher class pipe or protection of the pipe, ability to meet the DDW criteria for the separation of water mains and non-potable pipelines and the resulting need for either blow off or air and vacuum relief valves. All detailed drawings and calculations involved in this evaluation shall be submitted to the District Engineer for review and acceptance. DIP shall be used wherever cover becomes less than the minimum subject to prior approval. Under no circumstances shall a water main be installed with less than twenty-four (24) inches of cover from finished grade.

3.3.4.B Water Services and Air Relief Service Lines

A minimum of twenty-four (24) inches of cover is required from finish grade.

3.3.4.C Fire Hydrant Lateral Lines

A minimum of thirty-six (36) inches of cover is required from finish grade.

3.4 Connections to Existing Mains

3.4.1 New Main Connections

Existing mains and appurtenances that would otherwise remain in good working condition without disturbance due to new main connection shall be replaced and brought up to current District standards. The extent of facilities to be replaced shall be as determined by the District Engineer.

3.4.2 Water Line Taps

Connection of water service lines to an empty water main shall be by dry tap.

The connection of water service lines two (2) inches or smaller in diameter to pressurized mains shall be made by wet tap or hot tap using a tapping sleeve with a tapping valve. Hot taps greater than two (2) inches in diameter will be reviewed on a case-by-case basis.

Hot taps of the same size as the main (size-on-size) are not permitted.

Hot taps are not allowed for water main extensions six (6) inches and greater in diameter. Connection of water mains shall be by dry tap, connecting to an empty water main. A gate valve shall be installed at the connection for water mains up to twelve (12) inches in diameter, and a butterfly valve for new water mains fourteen (14) inches and greater.

3.5 Easement Requirements and Locations

3.5.1 General Requirements

Easements granted to the District shall allow for the installation, maintenance, operations, and repair of public water facilities, allow for the perpetual right of ingress and egress, and must comply with the following:

1. No other utilities, private or public, shall be constructed within the easement unless they are approved by the District.
2. No buildings, facilities, walls, fences, or other structures shall be situated within the easement.
3. Planting of trees is not allowed within the easement.
4. Easements shall be prepared and granted to the District as outlined in Section 2.6.

3.5.2 Easement Location and Access

The full easement width shall be located on a single parcel or lot. Access to District facilities shall not be obstructed by walls, trees, or other permanent improvements. Where this requirement cannot be met without interfering with existing buildings, easements may straddle lot lines providing approval is received from the District Engineer.

3.5.3 Easement Size

Facility location within the easement will be determined by the District and in general shall meet the following size requirements:

1. Easement for Transmission Mains shall be a minimum of twenty (20) feet wide. Where additional public water facilities (e.g., air and vacuum relief valve [ARV], blow off valve [BOV], or hydrant) are to be installed or are already existing on the transmission main, the easement shall encompass all facilities with a minimum of five (5) feet buffer on all sides.
2. Easement for Distribution Mains shall be a minimum of fifteen (15) feet wide (five [5] feet and ten [10] feet from the pipe center line). Additional easement width may be required where the depths of bury exceed ten (10) feet, or as deemed necessary by the District Engineer.
3. Easement for Hydrants, ARVs, and BOVs shall be a minimum of ten (10) feet wide, centered over the facility, and shall provide a minimum of five (5) feet buffer on all sides.
4. Easement for Water Services, when required based on Section 2.6, shall be a minimum of ten (10) feet wide, centered over the service line, and shall provide a minimum of five (5) feet buffer on all sides.
5. Easement for Water Wells or Other Facilities shall be determined by the District.
6. Easement for water mains shall have a minimum of twenty (20) feet vertical unobstructed access.

3.6 Layout of Mains

3.6.1 Water Main Looping

All water mains shall be designed in a looped system. At looped connections, tee or cross fittings shall be used and valves installed at the main or branches. Cross fittings shall have up to four (4) valves; tee fittings

shall have up to three (3) valves as determined by the District. The District may require the Applicant to construct additional water mains outside of the project boundary to provide a looped system for the area.

Maximum unconnected water main reaches shall be determined on a case-by-case basis and verified by analysis by the District's water model to meet District service criteria.

3.6.2 Dead End Mains

All mains shall have a minimum of two points of connection, except dead-end mains, which may be allowed for cul-de-sacs and dead-end streets. Dead-end mains shall be provided with a blow-off valve or other means of flushing acceptable to the District. The maximum length for dead-end mains shall be 500 feet, unless approved by the District Engineer. Dead-end mains intended for future extension shall include a blow-off valve and be sized by the District.

3.6.3 Main Extension

Per District Policy 8300, water mains shall be constructed in the public rights-of-way adjacent to the entire frontage of the parcel and/or in an approved easement. The minimum pipe size required in the frontage and within the easement shall be in accordance with Section 3.1, or as required by the District.

At the discretion of the District Engineer, if the main extension along the entire frontage (and or side street for corner lots) is not necessary, the main shall be extended to the location identified by the District. The Applicant shall then install a service line at their own expense from the water meter to the property and shall be responsible for obtaining appropriate property rights required for installation of the water service line.

3.6.4 Dual Mains

Dual mains (one main on each side of the street) shall be installed on streets constructed with either:

1. A raised center median separating opposing lanes of traffic, or
2. A public right-of-way width of 80 feet or greater.

The minimum size of the main shall be as required in Section 3.2. Larger sized mains may be required to serve multi-family residential, commercial, or industrial projects or areas, as determined by an analytical evaluation of the anticipated requirements.

The District Engineer may waive this requirement based on review of local water system reliability and determination of minimal interruption of water service to customers.

Dual mains shall be interconnected ("cross-tied") as required by the District Engineer.

3.6.5 Horizontal and Vertical Curves

In curved streets, the main shall follow the street curvature, and the alignment shall be planned to minimize crossing the street centerline. In general, horizontal and vertical curves shall be formed by deflecting the joints or by use of fittings. The amount of deflection in a joint shall not exceed fifty (50) percent of the value recommended by the pipe manufacturer or in accordance with AWWA standards, whichever is more stringent. Individual lengths of PVC pipe shall not be bent.

3.7 Distribution System Appurtenances

Materials for all distribution system appurtenances shall be as listed in Section 4 of these Standards.

3.7.1 Valves

3.7.1.A Gate Valves

Gate valves shall be resilient wedge gate valves (AWWA C509) and shall be installed on all distribution mains twelve (12) inches in diameter and smaller such that:

1. No more than four valves need to be closed to shut down and isolate any section of water main.
2. Cross fittings shall have up to four (4) valves at the cross and tee fittings shall have up to three (3) valves at the tee, as determined by the District.
3. A minimum of one valve, located on the fire hydrant lead, is required at any tee installed for a fire hydrant.
4. Valves are no more than 800 feet apart on distribution mains, unless otherwise approved by the District.
5. No distribution main shutdown shall result in shutting down a transmission main.
6. No more than two (2) fire hydrants shall be out of service from any single shutdown.
7. Valves are placed on both sides of all casings and crossings of bridges, drainage channels, irrigation canals, railroads, and arterial roads.
8. Valves shall not be located in gutters or in driveways, if possible.
9. If an inline valve is required, it shall be located on a property line.

3.7.1.B Butterfly Valves and Gear Actuated Gate Valves

Butterfly valves shall be resilient seat valves (AWWA C504) and shall be placed to isolate transmission mains fourteen (14) inches in diameter and larger such that valves are no more than 2,000 feet apart on the transmission main, unless otherwise required by the District.

Gear actuated gate valves (AWWA C515) may be required by the District in place of a butterfly valve at specific locations identified by the District.

A minimum of one blow-off valve or hydrant, and one air and vacuum relief valve, shall be installed between isolation valves on mains 14 inches or larger.

Valve symbols shall indicate on which side of the pipe to install valve operator (valve box). No more than one valve operator shall be located in a single quadrant of a tee or cross.

3.7.1.C Combination Air and Vacuum Relief Valves

The water distribution system shall be designed to minimize high points where air can accumulate. All high points in the distribution system shall be provided with combination ARVs (AWWA C512). ARVs shall be provided in accordance with Table 3-5.

Table 3-5. Combination Air and Vacuum Relief Valve Sizing

Pipe Diameter	ARV Size
6 to 12 inches	1 inch
14 to 24 inches	2 inches

Any pipe larger than 24 inches in diameter shall have an ARV designed by an engineer to allow for proper release of air and prevent vacuums during operation and maintenance.

ARVs shall be installed in accordance with Detail Drawings in the AV series. When possible, ARVs shall be located behind sidewalks, outside traffic areas, or within public rights-of-way or easements. ARVs shall be accessible to District personnel at all times.

3.7.1.D Blow off Valves

Blow off valves (BOVs) shall be installed at all low points and dead ends. BOVs shall be designed to allow dewatering sections of main for maintenance and repair or for water quality flushing. The District may require the installation of a fire hydrant in lieu of a BOV at dead ends.

BOV sizing shall be as identified in Table 3-6.

Table 3-6. Blowoff Assembly Sizing

Pipe Size / Blow off Valve Type	BOV Size / Detail Drawing No.
Up to 12-inch pipe / dead end	2-inch Blowoff / BO_511
Up to 12-inch pipe / low point	2-inch Blowoff / BO_512

Any pipe larger than twelve (12) inches in diameter shall have a BOV designed by an engineer to allow for proper flushing velocity and flow.

BOVs shall be installed in accordance with Detail Drawings in the BO series. When possible, BOVs shall be located outside of traffic areas. BOVs shall be accessible to District personnel at all times.

3.7.1.E Tapping Valves

All taps into existing mains shall include tapping valves.

3.7.2 Fire Hydrants

Hydrants (AWWA C502 and C503) shall be located to provide adequate water for fire protection needs.

Hydrants shall be located with a maximum separation, as measured along the street curb, as follows:

1. Single Family Residential Areas: Five hundred (500) feet
2. Commercial and Multi-Family Residential Areas: Three hundred (300) feet

The local Fire Authority has ultimate authority for the location of hydrant placement. If feasible, within residential areas, hydrants shall be located on property lines between lots.

Hydrants shall be located within public rights-of-way, public utility easements, or dedicated water easements. Hydrants shall be located no less than three (3) feet from above ground surface features to provide unobstructed access in conformance with Detail Drawings in the FH series. Bollards shall be installed around fire hydrants (e.g., parking lots) as required by the District.

Hydrant runs shall not cross curb returns. The hydrant lateral line shall be a minimum of six (6) inches DIP. The District may require a larger diameter service line if the length exceeds fifty (50) feet.

Blue reflective hydrant markers shall be installed in accordance with the requirements of the Fire Authority, immediately upon being placed into service.

3.7.3 Metered Water Services

All water services shall be metered per District Policy 8000 series. The number of service connections and water service sizes, and water meter sizes shall be in accordance with District Policy 8000 series. Common spaces (e.g., pools and community buildings) shall be served by dedicated meters with a minimum size of three-quarters (3/4) inch.

3.7.3.A Single Family Residential

A separate water service shall be installed for each residential parcel. The water service and meter size shall be as summarized below. The water service line size shall be equivalent to the proposed meter size, except for three-quarters (¾) inch meters as described below.

Single Dwelling – Detached: Single parcel with one (1) detached dwelling unit; minimum one (1) inch service line and meter.

Single Dwellings – Detached: Single parcel with two (2) detached dwelling units, one of which is an accessory dwelling unit (ADU); minimum one (1) inch service and meter. An additional one (1) inch service line and minimum three-quarters (3/4) inch meter may be allowed for the ADU.

Halfplex Dwelling – Attached: Common wall halfplex designed for occupancy by two households, each side being its own parcel; minimum one (1) inch service line and minimum three-quarters (3/4) inch meter per parcel.

Duplex Dwelling – One side: Common wall duplex designed for occupancy by two households living independently of each other, on a single parcel; one (1) service line supplying each side, minimum one (1) inch service lines and minimum three-quarters (3/4) inch meters.

Condominium/Townhome: Multiple (3 or more) attached dwellings, where each unit has its own front access on the ground floor, each having its own service; minimum one (1) inch service line and minimum three-quarters (3/4) inch meter.

Residential Parcels: Requests for water service lines and meter sizes exceeding the minimum will be evaluated on a case-by-case basis.

When possible, residential services and meters shall be installed within three (3) feet of adjacent property lines. Services for adjacent lots shall be located on the shared property line with a minimum of three (3) feet of separation.

3.7.3.B Multi-Family Residential

Multi-family residential communities, consisting of one or more residential buildings, each divided to accommodate three (3) or more households living independently of each other in separate dwelling units, and mobile home communities, consisting of any site on which two or more residential mobile home lots are located, may be served by either of the following methods, as determined by the District Engineer in accordance with District Policy 8000 series:

- For communities with no existing District-owned mains through the property, metered service(s) shall be installed adjacent to the public ROW. All water facilities after the meter(s) are private.

- For communities with existing District-owned mains through the property, metered services shall be installed at each multi-unit building or mobile home space. Services shall be connected to District-owned mains internal to the community, all located in dedicated water easements or PUEs.

Service and meter size shall be determined by the Applicant's engineer based on maximum continuous demand.

3.7.3.C Non-Residential

Service and meter size shall be determined by the Applicant's engineer based on the maximum continuous demand and shall be a minimum of one (1) inch in diameter.

Non-residential properties requiring internal mains and service lines may be designed for private ownership or District ownership within an easement, as determined by the District Engineer based on offsite impacts to the water system.

3.7.3.D Dedicated Irrigation Meters – Residential and Non-Residential

A parcel shall have a separate irrigation meter when the parcel includes more than the prescribed square footage of irrigable landscape area per the authority having jurisdiction, in accordance with Policy Series 8000. The irrigation meter shall be either part of a dedicated metered irrigation service from the District or a privately owned submeter.

3.7.3.E Meter Locations

Water meters shall generally be located outside of traffic areas and shall conform to the District's Detail Drawings in the WS Series. Water meters and services shall be located in areas accessible to District personnel or agents at all times. Water meters and services not located on the property being served will require an easement, as determined by the District Engineer.

3.7.4 Meter Banks

In areas where water services and meters are installed in a bank of (3) three or more, the Applicant's Improvement Plans shall include the alignment of each private service line from meter to structure. Design and construction of these "meter banks" shall be developed in coordination with the District Engineer. Each meter shall be installed with permanent identification tags clearly indicating the address of the unit served.

3.7.5 Fire Service Lines

Fire lines shall be provided as required by the local Fire Authority and as specified below.

1. Fire Service for Single Family Residential Dwellings: The metered domestic water service to single family residential dwellings may be used for fire protection purposes. The Applicant's engineer shall size the water service to provide adequate flow for both domestic use and fire protection.
2. Fire Service for Non-residential Facilities and Multi-family Dwellings: A dedicated fire service(s) is required for commercial/industrial and institutional facilities and multi-family dwellings when protection is required by the Fire Authority.
3. Fire service shall be sized by the Applicant's engineer.

4. Fire service design and construction shall conform to the District's Detail Drawings in the FP series.
5. A backflow prevention device shall be installed on the fire service in accordance with Section 3.7.6.

3.7.6 Backflow Prevention Devices

Backflow prevention devices shall be installed in the branch or service line supplying water to residential, commercial, or institutional customers where a potential exists for back siphonage of water into the distribution main, in accordance with the California State Water Resources Control Board Cross Connection Control Policy Handbook (CCCPH) and District cross-connection and backflow prevention regulation (included as Appendix F). In general, backflow prevention devices shall be installed on services to the following:

1. Single family residential services with auxiliary water supply, such as groundwater wells or water storage tanks
2. Irrigation water services
3. Multi-family residential, commercial/industrial, institutional, and governmental water services
4. Fire service lines

Backflow devices shall be listed on the most current List of Approved Backflow Prevention Assemblies published by the Foundation for Cross-Connection Control and Hydraulic Research, a Division of the University of Southern California, and as approved by the District. Backflow devices must also be on the District's list of approved products in Section 4.3.10 of these Standards.

All backflow devices shall be installed outside of building structures, and a minimum of thirty (30) inches and a maximum of sixty (60) inches downstream of the water meter. Backflow prevention devices for fire lines shall be located as close to the water main connection as feasible, at or near the property boundary and out of traffic areas.

3.7.6.A New Services

Backflow prevention devices shall be installed on all new services connected to the District water system, except for single-family residential users without auxiliary water supply.

3.7.6.B Existing Services

The District shall review existing water services for tenant improvement projects for conformance with current State and/or District standards and regulations. If the District determines that protection from backflow is needed, the existing water facilities shall be upgraded to comply with the current standards, in accordance with District Policy 8400.

3.7.7 Thrust Blocks and Restrained Joints

3.7.7.A Mechanical Joints

All mechanical joints shall be restrained.

3.7.7.B Thrust Blocks

Thrust blocks shall be provided for all horizontal bends of 11-1/4 degrees and greater, tees, crosses, reducers, dead ends, and as required by the District Engineer. Thrust blocks for fittings

up to twelve (12) inches shall comply with District standard drawing TB_001. Thrust blocks for fittings larger than twelve (12) inches shall be sized by the applicant's engineer. Thrust blocks shall be designed for test pressures of 150 psi with a minimum safety factor of 1.25.

3.7.7.C Restrained Joints

For all vertical bends of 11-1/4 degrees and greater, and in instances where thrust blocks are not feasible, restrained joints, tie rods, or other methods of anchoring the pipes and fittings shall be provided. Such alternate methods shall be designed by the applicant's engineer and subject to approval by the District Engineer.

Pipe joints shall be mechanically restrained for pipe installed on slopes exceeding thirty (30) percent.

3.7.8 Sampling Stations

Sampling stations shall be installed at locations where required by the District Engineer in accordance with Detail Drawing WS_079. Sampling stations shall be located behind curbs or sidewalks, outside traffic areas, and within public ROW, PUE, or dedicated water easement, where it is accessible to District personnel or its agents at all times.

3.8 Special Conditions

3.8.1 Separation from Structures

Proposed water facilities shall be located to protect all existing and proposed structures. The minimum clear separation from any structure shall be seven and one-half (7.5) feet horizontally and one (1) foot vertically. If this minimum cannot be maintained, the following modifications may be required:

- Upgraded pipe material
- Pipe encasement

In such cases, the Applicant's engineer shall be responsible for the design and submission of the modification to the District for review and approval.

3.8.2 Flexible Joints

Flexible joints shall be installed when water mains transition from below ground to above ground, where water mains enter a bridge or encasement, or in any other situation where differential settlement may be a concern, as determined by the District Engineer. The Applicant's engineer shall be responsible for the design and submission to the District for review and approval.

3.8.3 Steep Grades

Water mains proposed on grades steeper than thirty (30) percent and not under nor intended to be under pavement shall be provided with special erosion protection over the pipe trench. As a minimum requirement, ground cover shall be planted. Trench dams to control water and sediment flow, diversion structures, and other surface improvements shall be required for slopes steeper than 10 percent.

The Applicant's engineer shall be responsible for the design of special erosion protection of the pipe and submission to the District for review and approval.

3.8.4 Water Mains Mounted on a Structure

Water mains mounted on a structure may be required in special situations and will require District approval. A structural engineer shall prepare the design plans and calculations for review and approval by the District. The design shall include the following:

1. Pipe shall be DIP with internal restrained joints and external restrained fittings.
2. Flexible joints, as required.
3. Pipe support system.
4. ARV with cover at high point.
5. Valves, as required.
6. Pipe protection measures to prevent vandalism or unauthorized access, as required.

3.8.5 Trenchless Construction

Boring and jacking, or horizontal directional drilling (HDD), may be required in specific situations and shall require prior approval by the District. A geotechnical evaluation shall be completed to verify soil conditions and viability of design. The design shall include the following:

1. Bore and jack shall be designed in accordance with Detail Drawings in the BORE series.
2. The design shall be shown in plan and profile with clear horizontal and vertical distances from existing structures.
3. Pipe installed within casings shall be supported by polyethylene runners.
4. The casing pipe shall be sized to provide adequate space to allow for the installation of pipe centralizers/runners and no less than eight (8) inches greater in diameter than the water pipe to be installed.
5. Pipe shall be ductile iron with restrained joints.
6. End seals shall be provided.
7. An in-line blow off valve or fire hydrant shall be provided at the low point in accordance with Detail Drawing BO_512 or FH_621.
8. ARVs may be required on one or both sides of the trenchless installation.
9. Valves on either side of the trenchless installation may be required.

3.9 Corrosion Protection

Cathodic protection systems, if required by the District, shall be designed by a licensed Corrosion Engineer and approved by the District. The cathodic protection system shall include test stations on all reaches of the pipeline.

3.10 Abandonment of Water Facilities

When existing water facilities are to be abandoned, they shall be physically disconnected from the active water system and rendered inoperable. All water mains designated for abandonment shall be abandoned in place and capped and sealed to the satisfaction of the District. If the abandonment of facilities in place is not feasible, the facilities shall be completely removed. The extent of removal shall be determined at the discretion of the District Engineer. Water mains twelve (12) inches and smaller shall be cut and capped, or plugged and completely encased in concrete, at each end. Water mains larger than twelve (12) inches shall be completely filled with sand or cement slurry mixture and capped, or plugged and completely encased in

concrete, at each end. Where an existing main is to remain in service, the tee or cross shall be blind flanged and restrained with a thrust block.

The meter, meter box, setter, and wood supports, for water service lines connected to water mains to be abandoned shall be removed.

When a water service line is to be abandoned on a main that will remain in service, the water service line and service saddle shall be removed. A minimum twelve (12) wide full circle stainless steel repair band shall be installed around the water main.

Abandonment of any water facilities or structures not listed in this section shall be as directed by the District.

SECTION 4. CONSTRUCTION STANDARDS

This Section outlines the materials, installation, testing, and general construction requirements for the water system intended to deliver water to District customers. It establishes the District's minimum standards for constructing all water facilities.

These standards do not replace all construction requirements. If a specific construction requirement is not addressed in these Standards or the approved Project Plans, the appropriate requirements from the authority having jurisdiction shall apply. The Applicant's Engineer and the Applicant's Contractor must review and apply these standards to the Applicant's projects, as necessary.

4.1 General Requirements

4.1.1 Approved Plans Required

No work shall commence on any water facilities which are intended to be attached to the District's system unless the Contractor is in possession of complete, fully approved plans and specifications bearing the signature of the District Engineer or duly authorized representative and covering all phases of the proposed construction. At the District Engineer's discretion, smaller projects, such as a single water service, may be allowed to submit simplified plans.

4.1.2 Reference to Standards

References to standards in these specifications shall always pertain to the most recent officially adopted revision, including but not limited to AWWA, ASTM, manufacturer standards, and other relevant guidelines.

4.1.3 Construction Safety

The Contractor shall be responsible for initiating, maintaining, supervising, and enforcing all safety precautions and programs related to the Work, as required by Labor Code Section 6401.7. The Contractor must take all necessary measures to ensure the safety of all workers on site and other individuals who may be affected by the Work.

The Contractor shall adhere to all applicable laws, ordinances, rules, regulations, and orders of any authority having jurisdiction for the safety of persons or property to protect them from damage, injury, or loss. This includes compliance with Cal/OSHA standards and the Construction Safety Orders and rules of the Division of Industrial Safety, State of California, as contained in the California Administrative Code, Title 8, Chapter 4, and any subsequent amendments.

4.1.4 Asbestos Cement Pipe Handling

The District requires a current certificate of completion for training that qualifies individuals to perform asbestos construction work with asbestos cement pipe. Training must meet all applicable local, state, and federal regulations, as well as the District's Asbestos Cement Pipe Safety Plan.

4.1.5 Traffic Control

The Contractor shall comply with all local ordinances and regulations established by the authority having jurisdiction for traffic control. A traffic control plan shall be prepared and submitted with the application for an encroachment permit. The Contractor must obtain approval from the authority having jurisdiction prior to starting construction. A copy of the approved encroachment permit, including the traffic control plan, shall be provided to the District before construction begins.

4.1.6 Utilities and Existing Facilities Coordination

The Contractor is responsible for locating and protecting all existing utilities within the project limits. The Contractor must notify Underground Service Alert (USA) at least forty-eight (48) hours before any underground construction. Existing underground utilities must be exposed and their locations and elevations verified prior to constructing new improvements. Fire hydrants on or near the work site must always remain accessible to firefighting equipment.

Any damage to existing pipelines, services, utilities, fences, buildings, landscaping, or other improvements shall be repaired or replaced by the Contractor at their expense.

Where construction impacts existing water facilities, the Contractor shall replace the affected facilities in accordance with the District's Standards and District Engineer requirements.

If an unexpected water facility not shown on the Improvement Plans is encountered, the Contractor must immediately notify the District. The District Engineer will decide whether to modify the Improvement Plans, relocate the utility, or have the contractor work around it.

4.1.7 Permits, Licenses, and Fees

The Contractor shall obtain all required permits and licenses, and pay any applicable fees required for construction of the Work. All Contractors performing work must hold a valid license under California law and in accordance with Section 2.1.4 to undertake such work. The Contractor shall acquire all permits necessary for construction, including any required encroachment permits for work within city, county, or state rights-of-way or easements. The Contractor shall comply with all requirements imposed by the authority having jurisdiction as specified in the encroachment permit.

4.1.8 Security

The Contractor shall be responsible for the security and protection of the job site, including all work, materials, equipment, and existing facilities, until final acceptance of the work measures must be taken to prevent vandalism and unauthorized access.

4.1.9 Pre-Construction Meeting

An on-site pre-construction meeting shall be held at least two (2) days before construction. The meeting will include the District Inspector, Applicant’s Engineer, representatives of any authorities having jurisdiction, and the Applicant’s Contractor to review materials, schedule inspections, discuss the approved water system construction plans, and arrange any necessary tie-in connections. The Contractor must possess the approved improvement plans before the pre-construction meeting and throughout the construction process. Pre-construction meetings shall only be scheduled after all water related fees are paid.

The Contractor shall contact the District five (5) working days prior to the requested pre-construction meeting.

4.1.10 Required Notice

The Contractor shall notify the District at least three (3) days before commencing construction. The Contractor must also provide the District with at least two (2) days’ notice when inspections are required, as outlined in Section 4.2.1.

4.1.11 Water System Shutdown

Only District personnel are authorized to perform water system shutdowns. Under no circumstances shall anyone other than a District representative open or close any valve in the District's system.

The Contractor must notify the District Engineer in writing at least seven (7) calendar days before a required shutdown to allow the District to provide advance notice to affected customers and the local Fire Authority. The written notice shall specify the expected duration and extent of the shutdown. Shutdowns shall not begin until the District Inspector verifies that the Contractor is present on-site and prepared with the necessary personnel, materials, and equipment as specified on approved plans.

Generally, shutdowns shall be scheduled to minimize interference with water usage by any District customer. If the shutdown period exceeds normal working hours, the Contractor will be responsible for the District's costs associated with providing overtime inspections.

4.2 Control of Work and Materials

4.2.1 Inspection Requirements

All construction inspection and testing are subject to provisions outlined in Section 2.7, Inspection and Testing, of these Standards. District Inspectors, acting on behalf of the District Engineer, are authorized to inspect any portion of the Work and all materials provided. Inspections may extend to all, or any part of the construction process as needed.

Typically, District construction inspection is required at the following stages:

1. Upon material delivery, prior to installation
2. During the installation of any facilities, before initial backfill
3. After initial backfill has been placed
4. During hydrostatic and bacteriological testing

The Contractor must keep the District construction inspector informed of the general progress of water system construction. Work performed without District inspection may require removal and replacement at the Contractor's expense.

If the Inspector identifies any failure of the Work or materials to meet the Standards, approved plans, or safety requirements, they may verbally notify the Contractor. The Inspector has the authority to reject materials or halt Work until the issue is resolved by the District Engineer or a duly appointed representative.

If the Contractor refuses to suspend operations on verbal order from the Inspector, the District Engineer shall then issue a written order stopping all Work. After delivery of the order to the Contractor or person in charge, the Inspector will immediately leave the job, and all Work done in the absence of the Inspector shall not be accepted.

4.2.1.A Final Inspection

Within ten (10) days after receiving a request for a final inspection, the District will inspect the completed work. The District will provide written notification to the Contractor, Applicant's Engineer, and the Applicant regarding any defects or deficiencies that must be addressed. The Contractor shall promptly correct any identified issues. Once corrective actions are completed,

the District will conduct a follow-up inspection to ensure compliance with the plans. The District will not accept the work or project until all deficiencies have been resolved to its satisfaction.

4.2.2 Lines and Grades

All Work shall be performed in accordance with the lines, grades, and elevations shown on the District approved Improvement Plans.

Basic horizontal and vertical control points will be established or designated by Applicant's Engineer. These points serve as the datum for the work. As a part of the construction, the Applicant's Engineer or Contractor shall perform all necessary surveys, layouts, and measurement tasks.

The Applicant's Engineer or Contractor shall provide skilled personnel, appropriate instruments, tools, stakes, and materials required for survey and layout tasks. Additionally, they must furnish competent staff and necessary equipment to establish control points, set construction easement boundaries, and verify the accuracy of survey work. Survey cut sheets showing stations, grade elevations, and cut and fill amount shall be submitted to the District Inspector prior to starting any work.

4.2.3 Materials Approval

At least ten (10) days before the pre-construction meeting, the Contractor shall submit a list of all materials proposed for use in the water system construction to the District for approval. The list must include the manufacturer, location of manufacture, and model number for each item. Construction work involving water system components shall not commence until all material submittals are approved by the District.

4.2.4 Quality of Material

All materials incorporated into the work shall be new and of a quality equal to or better than specified in these Standards. If the specified grade of a material is not clear, the highest quality available shall be used.

The Contractor shall, upon request, provide the District Engineer with authenticated documents or other proof demonstrating compliance with the specifications. This may include factory or laboratory test reports that verify the strength and quality of materials used. For all reinforced concrete work, the Contractor shall submit the mix design and calculated concrete strength prepared by the concrete supplier before pouring, if requested.

4.2.5 Substitutions

Where specific brands or trade names are listed in the Standards, the Contractor may propose alternative materials if they demonstrate equivalent design, quality, and efficiency. Any proposed substitution must be submitted in writing to the District Engineer, accompanied by supporting data. The District Engineer will review the proposal and provide a response within ten (10) business days.

No deviations from the Standards will be allowed unless the District Engineer approves substitutions. Any schedule delays resulting from submittals or use of "or equal" materials will be the sole responsibility of the Contractor.

4.2.6 Defective Material and Work

Any materials that do not conform to the specified requirements will be considered defective. Such materials, whether installed or not, shall be rejected and removed from the project site at the Contractor's expense.

4.2.7 Quality of Workmanship

All construction work shall be performed by experienced personnel under competent supervision, using best practices to meet the District's standards. The District reserves the right to reject any work that does not meet the required quality.

4.3 Materials

This section specifies the materials required for water mains, fittings, and other components in the distribution system. All materials must be certified for potable water systems, comply with AWWA standards, and meet NSF 61 potable water certification. Additionally, they must adhere to California Assembly Bill (AB) 1953, which mandates a lead content of less than 0.25 percent lead by average weight.

4.3.1 Materials and Brand Names

All materials supplied under these specifications shall be new and exhibit the functional quality and efficiency specified. Where a brand or trade name is specified, it indicates a product known to meet the operational requirements. The Contractor must provide adequate documentation if proposing alternative materials, as outlined in Section 4.2.5.

All material proposed to be used shall carry the AWWA stamp of approval with test results to verify the material satisfies AWWA Standards and shall be subject to approval by the District Engineer.

4.3.2 Water Pipe and Fittings

Pipe used in constructing the water distribution system shall be one of the types specified below unless a particular type is explicitly required or shown on the approved plans.

All Water main materials must comply with Section 3 of these Standards. Pipes shall be free of defects and discoloration.

4.3.2.A Ductile Iron Pipe

DIP shall meet the requirements specified in AWWA C151. Pipes shall be lined and coated as specified herein.

The minimum pressure class for DIP shall be 350.

4.3.2.A.1 Joints for DIP

Joints for DIP shall be selected to suit the installation conditions. Gaskets for push-on joints, mechanical joints, and flanged joints shall consist of standard styrene- butadiene rubber in accordance with AWWA C111 and AWWA C115. Joints shall be in accordance with the AWWA C111 for push-on and mechanical joints, and AWWA C115 for flanged joints. Minimum rating of all joints shall be 250 psi. Flange gaskets shall be one-eighth (1/8) inch, either ring type or full face, in accordance with AWWA C115.

Push-on restrained joint pipe and fittings for ductile iron shall be boltless and capable of deflection after assembly. Restrained joints shall be rated for 350 psi working pressure for sizes four (4) inch through twenty-four (24) inch and 250 psi working pressure for sizes thirty (30) inch and thirty-six (36) inch. Restrained joint pipe and fittings shall be of the same manufacturer.

Manufactured restraint systems for mechanical joints shall be wedge type or wedge collar and rod type. Wedge type restraint systems shall use twist off bolts to ensure proper gripping pressure. Systems that rely on set screws only will not be acceptable.

4.3.2.A.2 Fittings for DIP

All fittings used with DIP shall be ductile iron and conform to AWWA C110 and AWWA C153 with flanged and/or mechanical joints as required.

Flange gaskets shall be one-eighth (1/8) inch thick, either ring type or full face, conforming to AWWA C115.

4.3.2.A.3 Lining and Coating for DIP and Fittings

DIP shall have a cement lining in accordance with AWWA C104 and have an asphaltic coating in conformance with AWWA C151.

4.3.2.A.4 Approved Manufacturers and Products

1. Piping
    a. American Cast Iron Pipe Company
    b. McWane Ductile
    c. US Pipe
2. Mechanical Joint Restraints
    a. EBAA Iron Series 1100 Megalug
    b. Star Pipe Products Stargrip Series 3000
    c. Tyler Union TUFGRIP Series 1000
3. Push-On Joint Restraints
    a. FIELD LOK350®
    b. TR FLEX® with TR FLEX Gripper Ring®
4. Fittings
    a. Tyler Union
    b. Star Pipe Products
    c. SIGMA

4.3.2.B Polyvinyl Chloride Pressure Pipe

All PVC water pipes shall conform to the requirements as specified in AWWA C900. PVC pipe shall be DR 14, Pressure Class 305and manufactured within eighteen (18) months prior to installation.

The standard length of PVC pipe shall be twenty (20) feet with cast iron outside diameters.

4.3.2.B.1 Joints for PVC Pipe

PVC pipe joints shall be made with elastomeric gasket bell ends, which shall be integral and thickened, conforming to AWWA C900 standards. Gaskets shall conform to the requirements of ASTM F477.

Manufactured restraint systems for mechanical joints shall be wedge type or wedge collar and rod type. Wedge type restraint systems shall use twist-off bolts to ensure proper

gripping pressure. Systems that rely solely on set screws are not acceptable. Mechanical restrained joints used on PVC pipe shall be specifically designed and rated for PVC use.

4.3.2.B.2 Fittings for PVC Pipe

All fittings for PVC pipe shall be in accordance with Section 4.3.2.A.2 of these Standards.

4.3.2.B.3 Lining and Coating for PVC

No lining or coating is required for PVC pipe.

4.3.2.B.4 Approved Manufacturers and Products

1. Piping
    a. Diamond Plastics
    b. JM Eagle
    c. North American Pipe Corporation
    d. Northern Pipe Products
    e. Vinyltech
2. Mechanical Joint Restraints
    a. EBAA Iron Series 2000PV Megalug
    b. Star Pipe Products Stargrip Series 4000
    c. Tyler Union TUFGRIP Series 2000
3. Fittings
    a. Tyler Union
    b. Star Pipe Products
    c. SIGMA

4.3.3 Valves and Valve Boxes

All main valves and fire hydrant valves shall be provided with traffic-rated valve boxes and cast iron lid, marked with the word “WATER.”

All AWWA key-operated valves, twelve (12) inch and smaller, shall be resilient wedge gate valves unless otherwise specified.

Valves fourteen (14) inch and larger shall be butterfly valves unless otherwise specified.

All valves shall be flanged to fittings unless otherwise noted.

4.3.3.A Gate Valves

Gate valves shall be ductile iron with fusion-bonded epoxy coating and conform to AWWA C509. These valves shall be resilient wedge type valves with non-rising stems and have “O” ring stuffing boxes. Stuffing boxes shall be bolted and designed for easy repair. Valves shall open counterclockwise and have a two (2) inch square operating nut. Valves twelve (12) inches and smaller shall be hydrostatically tested and drop-tight at a pressure of not less than 500 psi and rated for 250 psi working pressure.

4.3.3.A.1 Approved Manufacturers and Products

1. Clow, Model 2639
2. Kennedy Valve, Model KS-RW
3. Mueller, 2360 Series

4. American, Series 2500

4.3.3.B Butterfly Valves

Butterfly valves, fourteen (14) inches and larger, shall be rubber-seated conforming to AWWA C504 Class 250B. Valves shall open counterclockwise and have a two (2) inch square operating nut. Each butterfly valve shall be provided with a manual gear actuator, with stops in the full open and full closed positions, designed for buried service.

4.3.3.B.1 Approved Manufacturers and Products

1. Mueller / Pratt HP250™
2. Clow, Style 4500 (14”–24”) and Style 1450 (30”–54”)

4.3.3.C Air Release and Vacuum Relief Valves

Air release and vacuum relief valves shall be single-body, combination air release valves conforming to AWWA C512. The valves shall be sized according to the line size and pipe length they are designed to protect.

The valve body shall be rated for a working pressure of at least 200 psi, coated with fusion-bonded epoxy, and constructed with stainless steel floats corrosion-resistant components, such as brass, bronze, or stainless steel. Air release and vacuum relief valves shall be assembled and installed in accordance with Detail Drawings in the Air/Vacuum Valves (AV) series, as required.

4.3.3.C.1.Approved Manufacturers and Products

1. Crispin, UL Series

4.3.3.D Tapping Sleeves and Tapping Valves

Tapping sleeves conforming to this specification and conforming to AWWA C223 shall be used for all wet tapped connections larger than two (2) inches onto an existing water main. The tapping sleeve for wet tapping of PVC, ductile iron, or ACP water mains shall be a stainless steel (Type 304) tapping sleeve assembly, complete with gaskets and bolts. Each tapping sleeve shall include a tapping valve of the same size as the branch tallowing attachment of a drilling machine for tapping the main. The tapping sleeve and valve shall have a minimum rating of 250 psi working pressure. Tapping valves shall have a two (2) inch square nut operating nut.

Tapping sleeves shall be fully constructed of stainless steel. Tapping valves shall comply with gate valve requirements as outlined in Section 4.3.3.A.

4.3.3.D.1 Approved Manufacturers and Products

1. Tapping Sleeves
    a. JCM, 432 All Stainless Steel Tapping Sleeves

4.3.3.E Blowoffs

Blowoffs shall be installed in accordance with Detail Drawings in the Blow-off Valves (BO_500) series, as required. The installation shall ensure adequate drainage and accessibility for maintenance.

4.3.3.E.1 Approved Manufacturers and Products

1. Nibco, T-113-LF

4.3.3.F Corporation and Curb Stops

All corporation stops and curb stops shall be ball valves made of lead-free brass.

4.3.3.F.1 Approved Manufacturers and Products

1. Corporation Stops
    a. Mueller 300 Series Ball Type
    b. Ford FB Series with MNPT Inlet
2. Straight Curb Stops
    a. Mueller 300 Series
    b. Ford
    c. Jones

4.3.3.G Valve Boxes, Risers, and Enclosures

Valve boxes and risers shall be installed for all main line valves and fire hydrant valves and shall be traffic rated. Enclosures for air/vacuum valves shall be appropriately selected based on their location.

Valve risers shall consist of a single section of 8-inch SDR 35 PVC pipe.

4.3.3.G.1 Approved Manufacturers and Products

1. Blow Off Valves
    a. Carson 1220-12 with Carson 1220-4B lid (Landscape Area)
    b. Christy FL30TBOX12 with Christy FL30T lid (Sidewalk/Driveway)
    c. Christy B1324BOX with Christy B1324-61JH lid (Street)
2. Main line Valves and Fire Hydrant Valves
    a. Oldcastle Precast No. G04 Box with Oldcastle Precast G04C Lid
    b. B & T Mark VII CUL12RHVYF Box and GRE12LHVYWLS Lid (Arterial Streets)
3. Air/Vacuum Valve Enclosure, Above Ground
    a. Placer Waterworks Model PW/SJARV2 Insulated (1-inch)
    b. Placer Waterworks Model PW/SJARV-3 Insulated (2-inch)
4. Air/Vacuum Valve Enclosure, Below Ground
    a. Quazite B30 (1-inch)
    b. Quazite B36 (2-inch)
5. Air/Vacuum Valve Lid and Housing, Below Ground
    a. Placer Waterworks Model PW/AE3018-M (1-inch)
    b. JTS Manufacturing JS30-ARVT-N (1-inch)
    c. Placer Waterworks Model PW/AE3618-MC (2-inch)
    d. JTS Manufacturing JS36-ARV10T-N (2-inch)

4.3.4 Fire Hydrants

Fire hydrants shall be installed in accordance with the requirements of the Fire Authority having jurisdiction and in conformance with the appropriate Detail Drawing from the Fire Hydrants & Protection Barricades (FH_600) series. Prior to installation, Contractor shall confirm requirements with the Fire

Authority. The Fire Authority requirements, where more stringent, supersede the general requirements provided in this section or in the Detail Drawings.

All fire hydrants shall conform to the requirements of AWWA C502 or C503. Hydrant buries shall have mechanical or flanged joints.

4.3.4.A Approved Manufacturers and Products

1. City of Roseville
    a. Clow, 2060 Series
    b. James Jones, Model J3762-Z13
2. Sacramento Metropolitan Fire District
    a. American Darling, Model B84B
    b. Mueller, Model A-423
3. South Placer Fire Protection District
    a. Clow 960

4.3.5 Service Lines and Fittings

Water service line shall be sized per Section 3.7.3 of these Standards and the Detail Drawings in the Water Services (WS) Series, unless otherwise specified in the approved project plans.

Embedment material for service lines shall be installed in conformance with requirements in Section 4.4.5 of these Standards and Detail Drawings in the Trenches (TREN) series.

4.3.5.A Service Line Material and Installation

Service lines up to and including two (2) inches in diameter shall be polyethylene tubing in conformance with AWWA C901 and shall conform with Detail Drawings in the WS Series (3/4 inch to 2 inch). Service lines larger than two (2) inches in diameter shall be DIP in accordance with the Detail Drawings in the WS Series (3-inch and larger).

#10 insulated copper locator wire shall be placed on the polyethylene line and extend into the meter box.

4.3.5.A.1 Approved Manufacturers and Products

1. CTS, EndoPure PE 4710 SODR 9
2. ADS, Polyflex Series

4.3.5.B Service Taps and Connections

Service saddles shall be used for all pipe connections up to two (2) inches on water mains. Service valves and fittings shall conform to AWWA C800. Saddles shall be designed and rated for the specific pipe diameter and material being tapped. Saddles shall be shaped to accurately fit the contour of the main.

Saddles for ductile iron pipe and asbestos cement pipe shall be silicon bronze double straps and constructed from bronze or brass. Straps shall have a flattened design to provide large bearing surfaces for a secure installation. Saddles for PVC pipes shall be made of bronze with neoprene gaskets wedged in place at the tapping boss to provide a tight seal at the main. “Eared” saddles are not permitted.

All service valves shall be full-port ball valves with stainless steel inserts.

Connections for fire sprinkler systems shall be approved by the Fire Authority and the District Engineer.

Service connections shall be as shown in Detail Drawings in the WS series.

4.3.5.B.1 Approved Manufacturers and Products

1. Mueller
2. McDonald
3. Ford
4. Jones

4.3.6 Meters and Meter Boxes

4.3.6.A Meters and Meter Equipment

All water services shall be equipped with meters, consistent with the required meter sizes in Section 3.7.3 of these Standards. The District will provide and install new meters for sizes up to two (2) inches. Meters larger than two (2) inches shall be supplied and installed by the Contractor, with the meter type and model obtained from the District.

4.3.6.A.1 Approved Manufacturers and Products

1. Combined Fire Service Meter
    a. Neptune Protectus III
    b. Neptune Mach 10
2. Detector Check RadioRead Monitor for Fire Lines
    a. Neptune Mach 10 with ProCoder R900I Register
3. AMR Meter Interface Units for Fire Lines
    a. Datamatic Innov8 Smart Reader Register

4.3.6.B Meter Boxes

Meter boxes shall be provided for all service meters up to six (6) inches and installed as indicated on Detail Drawings in the WS series. Unless otherwise specified by the District Engineer, meter boxes shall be selected according to the Meter Box Schedule provided in Table 4-1.

Table 4-1. Meter Box Schedule			
Meter Box Location	Meter Size, inches		
	¾ – 1	1 ½ – 2	3 – 6 (compound)
Street			
Model No.	Christy BXB1324-H/20 Lid 1324-61JH	Christy BXB1730-61JH	Christy B3048BOX with B3048-63JH Lid
Inside Width, inches	14	17-7/8	30-1/4
Inside Length, inches	24-5/8	30-5/8	48-1/4
Sidewalk or Driveway			
Model No.	Quazite B30 Box PD1324B5507 with Quazite B30 Lid PG1324W54150 or Christy FL30T Series with Christy FL30P Lid	Quazite B36 Box PD1730B510 with Quazite Lid PG1730W4250 or Christy FL36TBOX12 with FL36P Lid	N/A
Inside Width, inches	13-1/4	17-1/8	-
Inside Length, inches	24-1/4	30-1/4	-
Landscape			
Model No.	Carson 1220-12 with 1220-4B Lid	Carson 1730-15 with 1730-4B Lid	Christy B48 BOX with B48-62J Lid
Inside Width, inches	17-3/8	17	30-1/4
Inside Length, inches	23-7/8	30	48-1/4

Meter boxes and lids in traffic areas shall be H-20 load rated reinforced concrete boxes with steel or cast iron lids. Meter boxes in all other areas shall be concrete or polymer composite boxes with lids of matching material. Each meter box lid shall have a recessed hole for a meter reading probe.

4.3.6.C Meter Vaults

Meters greater than six (6) inches in size shall be housed in meter vaults and shall be installed as indicated on Detail Drawings in the WS series.

4.3.6.C.1 Approved Manufacturers and Products

1. Meter Vaults: Teichert Precast 510 Series

4.3.6.D Meter Accessories

Meter accessories shall conform to the requirements specified in these Standards and Detail Drawings. Approved products for meter accessories are listed in Table 4-2.

Table 4-2. Approved Manufacturers and Products for Meter Accessories	
Item Description	Approved Materials/Manufacturers
Strainer for Meters 3” and Larger	Neptune 53107-000
Meter (3” and Larger) to Customer Pipe Connection Flange Adaptor	Romac RFCA Star Pipe Products StarFlange RAFC
Bronze Flanges for Meters 2” and Smaller	Ford #7F Ford #6F

4.3.7 Flexible and Transition Couplings and Mechanical Joint Sleeves

Flexible couplings shall be bolted, sleeve-type steel or ductile iron couplings conforming to AWWA C219. These couplings shall be designed and rated for use on the intended pipe materials and sizes. Insulating couplings shall be used for insulated connections. The minimum body length for transition couplings shall be twelve (12) inches. Any new style transition coupling must be approved by the District prior to installation.

4.3.7.A Approved Manufacturers and Products

1. Ford, Model FC2W-L12
2. ROMAC Industries, Inc., Model XR501

4.3.8 Flange Gaskets

Gaskets shall be one-sixteenth (1/16) inch thick or greater, full-faced type, made of styrene butadiene rubber.

Where required to connect two different pipe metals, a pipe joint insulation kit shall be installed, including isolating Type ‘E’ full-face gasket, bolt sleeves and double washers. The insulation kit shall be NSF61 compliant.

4.3.8.A Approved Manufacturers and Products

1. Ford, Rubber Gasket Model GT141

4.3.9 Bolts and Hardware

All bolts, including T-Bolts, nuts, All-Thread rod, etc., shall be hot-dip galvanized after fabrication. Substituting stainless steel fasteners for galvanized fasteners is not permitted. Bolts for flanged curb stops and flanged meters shall be fifteen sixteenths (15/16) inch. Anti-seize lubricant shall be applied on bolt threads. All bolts shall be torqued to manufacturer’s specifications.

Approved products for additional hardware are provided in Table 4-3.

Table 4-3. Approved Manufacturers and Products for Hardware	
Item Description	Approved Materials/Manufacturers
Valve Extension	Placer Waterworks Model PW/ACWD STD
Pipe Joint Isolation Kit	Advance Product Systems (APS) Voltacept™ G-10 Type 'E' Gasket Kit with Trojan Gasket GPT Linebacker® 61™ G-10 Type 'E' Flange Isolation Kit
Threaded Air Vent Cap with Stainless Steel Screen	T Christy's Air Vent Cap, Model VC1 or VCM1 (1") T Christy's Air Vent Cap, Model VC2 or VCM2 (2")

4.3.10 Backflow Prevention Devices

Backflow prevention devices shall be of the type approved on the plans and consistent with Section 3.7.6 for the appropriate service and situation. All backflow devices shall comply with California Department of Health Services Title 22 requirements and the standards established in the most recent edition of the State Water Resources Control Board Cross-Connection Control Policy Handbook. In accordance with Appendix D, backflow devices shall be approved by the DDW and be on the most recent List of Approved Backflow Prevention Assemblies published by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research. Devices must be protected by an insulated enclosure as specified in Detail Drawings in the Reduced Pressure Backflow Prevention Assemblies (RP) series.

4.3.10.A Approved Manufacturers and Products

1. Backflow Prevention Devices
    a. Zurn/Wilkins
    b. Febco
    c. Watts
2. Backflow enclosure:
    a. Placer Waterworks Models PW/E1A-W(S) or PW/E1A-W(M)
    b. Weather freeze bag (Green)

4.3.11 Locator Wire and Warning Tape

Locator wire shall be copper wire, Type TW, size AWG No. 10 with a minimum insulation thickness of 0.045mm.

Warning tape shall be acid and alkali resistant polyethylene or polyolefin film, with a width of three (3) inches and a thickness of four (4) mils. The tape shall be blue for potable water, continuously printed with the words "Warning Water Line Below" or equivalent.

4.3.12 Pipe Embedment

Pipe embedment material shall be No. 2 washed sand, free from organic materials, recycled materials, including recycled aggregate base, and other deleterious substances. Pipe embedment material shall be compacted to form a firm, stable base. Embedment material shall be installed in conformance with requirements outlined in Section 4.4.5 of these Standards and Detail Drawings in the TREN series.

4.3.13 Thrust Blocks

Thrust blocks shall be constructed using Class B Type II six-sack Portland cement. The dimensions of the thrust blocks shall be in accordance with Detail Drawing TB_001A.

4.3.14 Restrained Joints

Pipes shall be restrained to the length specified in the approved Project plans.

4.3.15 Concrete

Concrete for thrust blocks, encasements, filling, blocking, piers, and other applications shall be transit-mixed from a supervised batch plant. Each load must include a certified delivery ticket showing the mix proportions, mixing time, true departure time and water added. Certified tickets shall be presented to the Inspector at the time of delivery. Ready-mixed concrete shall be batched and handled in accordance with ASTM C94, while job-mixed concrete is limited to minor non-structural uses requiring one sack or less of cement. In such cases, materials and workmanship shall meet the same standards as transit-mixed concrete.

Approved concrete material shall be Portland Cement concrete as specified in Section 90 of the California Department of Transportation (Caltrans) Standard Specifications and shall be chosen according to Table 4-4.

Table 4-4. Concrete Material

Class	Application	Min. Weight of Portland Cement, lbs/cy	Maximum Aggregate Size, Inches	Slump Inches Min	Slump Inches Max
A	Walls, drop structures, slabs, and reinforced structural encasement	564 (6 sack)	1-1/2	3	6
B	Thrust blocks, drop pipe encasement, pipe bedding, nonstructural use	470 (5 sack)	1-1/2	2	6
C	Pump mix for abandoning lines	376 (4 sack)	3/8	--	--

The 28-day compressive design strength of concrete shall be chosen according to its intended use as outlined above.

4.3.16 Mortar

Mortar used for construction shall be a commercial-grade non-shrink grout.

4.3.17 Reinforcing Steel

Reinforcing bars shall be Grade 40 minimum, deformed, and conform to ASTM A615.

Wire mesh reinforcement shall conform to the requirements of ASTM A185, with wire gauge and mesh dimensions as shown on the Improvement Plans.

4.4 Installation and Construction

The location of water facilities shall be established and staked by a licensed civil engineer or land surveyor. Finished grade locations shall be staked for fire hydrants, main valves, tees, crosses, angle points, water services, and related appurtenances. The Contractor shall remove and reconstruct any work that is improperly located.

All pipe, fittings, and appurtenances shall be loaded for delivery and unloaded in such a manner as to avoid damage to the pipe or appurtenance. All fittings, hardware, and installation methods shall be appropriate for the type of material being installed.

Delivery of pipe and appurtenances to the site of the Work shall not take place until immediately prior to the installation thereof.

All pipe and appurtenances shall be handled with care to avoid damage. Whether moved by hand, skidways, or hoists, the pipe shall not be dropped or bumped against other pipe, accessories, or other projects.

4.4.1 Control of Site Conditions

Contractor shall be responsible for controlling all site conditions including noise, dust, drainage, erosion, and pollution, in accordance with all local ordinances and regulations involving the control of site conditions. The requirements that follow are intended to supplement those governing local ordinances and regulations. Where a conflict arises, the local ordinances and regulations shall prevail.

4.4.1.A Control of Water

The Contractor shall provide and maintain temporary drainage of groundwater from all excavations related to construction of water facilities. The Contractor shall remove all water that may accumulate in the excavation during the progress of the Work so that all Work can be done under dry conditions. Trenches and other excavations shall be kept free from water while the pipe or structures are installed, while concrete is setting, and until backfill has progressed to a sufficient height to anchor the Work against possible flotation or leakage. The laying of pipe or the placing of concrete will not be allowed under circumstances where there is standing water in the excavation. Failure by the Contractor to dewater the excavation area may result in an order to halt progress of the Work until compliance has been achieved.

4.4.2 Water Used in Construction

If water use is needed at the construction site, the Applicant or Contractor shall complete a Hydrant Meter Permit and obtain a construction water meter from the District. An appropriate billing address for water use during construction must also be provided. No construction water shall be taken from an unmetered source unless specifically approved by the District Engineer.

Construction water for residential development projects shall be available in accordance with the fees and conditions in the District Policies. Water meter idlers may be installed in place of water meters for lots in single-family developments in accordance with Detail Drawings in the WS series after payment of fees and at District inspection. The water meter idler may be used to reserve space for the water meter while installing the domestic water line to the home . No water use is permitted through the idler.

Water services may be shut down if any District personnel observe unauthorized water use.

The Applicant and Contractor are jointly and severally responsible for paying for water consumption during construction, including, but not limited to, water used for grading, pipeline flushing, and testing. The project will not be accepted until the account is paid in full.

4.4.3 Coordination of Work with Street Development

Street development activities, such as grading and laying of base rock and asphalt, must be coordinated with water facilities installation to ensure the integrity of installed pipes and connecting joints. If, in the Inspector's opinion, street development work compromises the water installation after a passing test, the

Contractor may be required to conduct additional pressure tests. Any damage identified must be repaired at the Contractor's expense, including reimbursing the District for the cost of extra tests.

4.4.4 Existing Pavement Removal

Existing pavement removal shall be removed according to the standards set by the authority having jurisdiction. The pavement must be cut on straight, neat lines prior to excavation, parallel and equidistant from the trench centerline. The width of the removed pavement shall conform to the specifications of the authority having jurisdiction or the Detail Drawings from the TREN series, whichever is more stringent. Pavement between these lines shall be broken and removed just ahead of trenching operations. Any pavement damaged outside these lines shall be restored at the Contractor's expense.

4.4.5 Trench Excavation and Backfilling

Prior to excavation, the Contractor shall verify requirements with the authority having jurisdiction. Excavation and trenching in public streets and highways shall comply with the standards of the authority having jurisdiction. In the pipe zone, from the trench bottom up to twelve (12) inches above the pipe, District requirements shall take precedence. In all other cases, the following standards apply.

Trench excavation involves all digging necessary for grading and constructing the water line as shown on the Improvement Plans and in accordance with the Detail Drawings in the TREN series. The Contractor shall excavate to the specified depths indicated on the Improvement Plans, regardless of the materials encountered, unless otherwise specified or required. Excavation shall be by open cut unless short trench sections can be safely tunneled and properly compacted.

Excavation should only occur after the necessary pipes and materials are delivered to the site.

Holes for bells or couplings shall be excavated after the trench bottom has been graded and embedment material placed. These holes should be only as large as necessary to properly make the joint. Any over-excavation areas shall be backfilled with the same bedding material.

The trench bottom shall be evenly graded to ensure uniform bearing and support for each pipe section, free of clods, rocks, and excess spoil material. Grades must be transferred from the ground surface to the trench bottom by experienced workers using lesson fewer than three (3) consecutive grade points to ensure accurate alignment.

4.4.5.A Trench Width

The width of unsheathed trenches shall be sufficient to provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Trenches shall be constructed following the applicable Detail Drawings in the TREN series.

The area above the pipe zone must meet the requirements of the authority having jurisdiction. In cases of conflict between the TREN series details and the requirements of the authority having jurisdiction, the latter shall prevail.

4.4.5.B Pipe Cover

Unless specifically authorized by the District Engineer, the minimum cover for water mains shall be thirty-six (36) inches below finished grade. If the cover is less than this minimum, DIP shall be used, subject to prior District Engineer approval. In such cases, the DIP must have a minimum cover of twenty-four (24) inches below finished grade and a slurry cap.

4.4.5.C Shoring

The Contractor shall provide, install, and maintain sheeting or shoring, and bracing as needed to support excavation sides and prevent any soil movement that could damage structures or utilities. All excavations must adhere to the rules, orders, and regulations set forth by the California Division of Occupational Safety and Health (Cal/OSHA). All shoring practices shall comply with Cal/OSHA standards.

The Contractor is responsible for any injury or damage resulting from inadequate sheeting, shoring, or their removal.

4.4.5.D Placement of Pipe Embedment

Embedment material shall be placed in conformance with these Standards and Detail Drawings in the TREN series. Prior to embedment placement, the trench shall be cleared of debris, leveled, and inspected for the specified cut. Bottom embedment material shall be compacted and leveled before pipe placement.

Once the pipe is properly laid and inspected, embedment material shall be hand-shoveled uniformly on both sides of the pipe to anchor it securely. Care must be taken not to drop embedment material directly onto the pipe. During backfilling, all shoring materials shall be removed carefully to minimize movement or collapse.

Soil compaction shall be conducted in conformance with Section 4.4.10.B of these Standards.

4.4.5.E Maximum Length of Open Trench

Unless otherwise specified by the District Engineer, the maximum open trench length shall be one block, 400 feet, or the distance necessary for one day's pipe installation, whichever is shorter. No trenches shall be left open overnight unless covered with steel plates capable of bearing expected wheel loads.

4.4.5.F Unsuitable Material on Bottom of Trench

The Contractor shall excavate at least six inches below the pipe's bottom grade. If the excavation bottom does not provide a firm and uniform bearing for the pipe due to rock, hardpan, shale, or other non-excavatable material, the Contractor shall overexcavate an additional six inches. The trench shall then be refilled with the specified pipe embedment material, consolidated, and reshaped to the required section and grade as specified in Section 4.3.12.

4.4.5.G Over Excavation or Inaccurate Trimming

If over excavation or inaccurate trimming occurs due to the Contractor's operations or other reasons, resulting in inadequate trench shaping, the Contractor shall refill the trench with the specified backfill material at their own expense. The trench bottom shall then be consolidated and reshaped to meet the required specifications.

4.4.6 Pipe and Fitting Installation

Pipe shall be laid and installed in accordance with this section. Alignment and elevation of piping runs shown on the Improvement Plans shall be followed as closely as possible, with minor adjustments made to avoid obstructions. Any major relocations due to unforeseen obstructions require approval from the District Engineer.

4.4.6.A General Pipe Installation

The Contractor shall properly assemble all pipe and ensure an installation that is true to line and grade, free from leaks, cracks, and obstructions.

Each pipe length shall be laid on compacted, approved bedding material as specified in Section 4.3.12 ensuring full bearing along its length. Adjustments to line and grade shall be made by scraping or filling and tamping the bedding material under the pipe body. Wedging or blocking with wood or soil to support the pipe is prohibited.

Pipe sections and fittings must be cleaned before installation. Pipes shall be installed with the manufacturer's markings on top and visible. All pipe, fittings, valves, and appurtenances shall be lowered carefully into the trench using suitable tools or equipment to prevent damage. Damaged linings or coatings shall be repaired before installation or backfilling.

Pipes shall be laid true to line, with no visible misalignment at any joint unless a curved alignment is specified on the Improvement Plans. The maximum joint deflection shall not exceed 50% of the value recommended by the pipe manufacturer or as per AWWA standards, whichever is more stringent.

Joints shall only be made with the couplings and rubber rings provided with the pipe. The use of techniques like "Stabbing," "swinging in," or "popping on" spigot ends of pipe into bell ends is not permitted.

Pipe shall not be laid when trench or weather conditions are deemed unsuitable by the District Engineer. The interior of the pipe shall be cleared of any dirt or debris during construction. At the end of each workday, or during breaks, the pipe ends shall be securely covered to prevent contamination.

4.4.6.B. Minimum Pipe Length Segment

Water main layouts shall be designed using full pipe segments. At valve or water service tie-ins, pipe segments shall be at least three feet in length.

4.4.6.C PVC Pipe

PVC pipe installation shall conform to AWWA C605 and AWWA Manual No. 23, PVC Pipe - Design and Installation. Proper tools and equipment must be used to place the pipe in the trench without causing damage. Fittings, valves, and other components must not be supported or carried by the PVC pipe itself. When soil conditions or excavations do not provide adequate support, concrete pads or drain rock shall be used for fittings, valves, and appurtenances.

Field-cut PVC pipe must have burrs removed, ends beveled, and marked for proper insertion depth. Horizontal and vertical curves shall be formed by joint deflection not exceeding 50% of the manufacturer's recommendation or AWWA standards, whichever is more stricter. PVC pipe shall not be bent. Pipe must be laid with bell ends facing the direction of installation unless reverse laying is specifically approved by the District Engineer.

4.4.6.D Ductile Iron Pipe

Ductile Iron Pipes (DIP) shall be installed in accordance with AWWA C600, Installation of Ductile Iron Water Mains and their Appurtenances.

Pipes shall be laid in alignment and grade as indicated in the Improvement Plans. For curve alignments, pipe joints may be deflected to accommodate the curve using either shorter pipe sections or fittings, as required. Joints shall be deflected after the joint is properly assembled. For mechanical joints, the joints shall be deflected before tightening of bolts.

Pipe cutting shall be done in a neat manner, without damage to the pipe, coating, or the lining. Cuts should be smooth, straight, and perpendicular to the pipe axis. After cutting, the pipe end should be dressed with a file or power grinder to eliminate all roughness or sharp edges. The cut ends of push-on joint pipe shall be suitably beveled.

Mechanical joints should be assembled with care, in accordance with the manufacturer's recommendations. Bolts must be uniformly tightened to the torque values specified in Appendix A of AWWA C111. Over-tightening of bolts as a compensation for improper installation practice is not allowed.

Push-on joints, where approved, must be assembled in accordance with the pipe manufacturer's instructions. To ensure proper jointing, all surfaces should be lubricated with a heavy vegetable soap solution immediately before joint completion. The lubricant used should be water-compatible, stored in closed containers, and kept clean. Each spigot end must be appropriately beveled to facilitate assembly.

If the joint fails to seal effectively, it should be repaired or replaced, as necessary.

Corrosion protection may be required depending on specific soil conditions.

4.4.6.E Thrust Blocks

Thrust blocks shall be constructed of Class B concrete as specified in Section 4.3.15 and constructed in accordance with Detail Drawings in the Concrete Thrust Blocks (TB) series. They shall be poured against undisturbed earth. If the District Engineer determines that the soil is unsuitable to support the imposed load, the Contractor must provide additional anchorages as designed by the Applicant's Engineer and approved by the District Engineer. Ground surfaces where concrete will be placed should be moistened prior to pouring to prevent excessive moisture absorption. If forms are needed, they must be smooth, mortar- tight, and strong enough to maintain shape during concrete placement. Placing methods should ensure that the concrete reaches its final position without segregation. All concrete should be placed and compacted to create smooth surfaces along form lines and eliminate air pockets. Thrust blocks should be positioned so that pipe and fitting joints remain accessible for repair. The concrete used for thrust blocks must contact fittings, not the pipe.

Thrust blocks must cure for at least twenty-four (24) hours before backfilling or pressurizing the main.

4.4.6.F Mechanical Restraints

Manufactured restraint devices, where approved for use by the District Engineer, shall be designed to secure the pipeline at fittings and transfer thrust forces to the adjacent soil through friction and soil bearing. To obtain approval for manufactured restraint devices, the following information must be submitted to the District Engineer:

1. Details of the restraint system.

2. Site-specific or assumed worst case soil characteristics relevant to thrust resistance, referencing "Thrust Restraint Design Equations and Tables for Ductile Iron and PVC Pipe" (PD-6 (5-95) published by EBAA Iron).
3. Pipe and encasement specifications that influence soil friction.
4. Trench, pipe bedding, and cover depth specifications.
5. Test pressure (per Section 4.6.1 of these Standards).
6. Safety Factor (1.50 minimum).
7. Calculated length of restrained pipe for each condition, using the Ductile Iron Pipe Research Association (DIPRA) method where applicable.

Manufactured restraint devices must be installed per manufacturer's recommendations.

4.4.6.G Trenchless Construction

Placement of pipe using boring and jacking methods requires District approval for each occurrence. The following general guidelines apply, along with Section 3.8.5 of these Standards and Detail Drawings in the BORE series:

1. The size and thickness of the casing shall be per the District standard detail, unless otherwise specified in the plans.
2. Except for using air or water, the methods and equipment used in boring and jacking shall be chosen by the Contractor, provided that the District reviews and approves them prior to any work.
3. Pipe placement within casings must be supported with HDPE, polyethylene, or acetal skids to the lines and grades shown on the Improvement Plans.
4. The boring machine must create a circular bore that maintains the required lines and grades indicated in the Improvement Plans. The bored tunnel should not exceed 0.1 ft greater than the casing's maximum outside diameter.
5. Steel casing field joints must be welded with a continuous circumferential weld.
6. End seals must be installed at both ends of the cased section.

4.4.6.H Service Line Installation

Service lines shall be installed in accordance with Detail Drawings in the WS series.

Service lines must be installed by open-cut method unless horizontal directional drilling (HDD) is pre-approved by the District Engineer.

Service lines shall be placed on undisturbed earth at the bottom of the trench, maintaining a minimum cover of twenty-four (24) inches between the service line and gutter flow line. Embedment material shall meet the requirements outlined in Section 4.3.12 of these standards and Detail Drawings in the TREN series.

Polyethylene lines shall be snaked within the trench as recommended by the material manufacturer, from the corporation stop to the angle curb stop. Polyethylene lines must be continuous from the corporation stop to the angle curb stop, without mechanical couplings. All plastic service piping shall include an insulated ten (10) gauge copper wire installed along the service line and extended into the meter box.

Polyethylene tubing shall be cut with a clean square cut, ensuring it is not crimped. The minimum bend radius for polyethylene tube must be thirty (30) times the nominal tube diameter. No bends shall be constructed within ten (10) times the nominal tube diameter from a fitting.

Compression fittings with insert stiffeners, when required by Detail Drawings in the WS series, shall not be installed with the insert stiffeners protruding beyond the opening of the waterworks brass coupling nut. Protruding stiffeners must be trimmed to ensure a flush fit.

Service connections that are improperly installed must be removed and replaced at the water main tap, ensuring compliance with District standards. Any adjustments to customer water services shall be coordinated with the District to minimize water supply interruptions.

4.4.6.I Water Meter Installation

Water meters shall be installed in accordance with Detail Drawings in the WS series. Meters up to two (2) inches in size will be provided and installed by the District.

For meters larger than two (2) inches, the Applicant or the Contractor is responsible for providing and installing the meter. The meter type and model must be obtained from the District to ensure compatibility.

For fire service lines, a backflow prevention device supplied by the manufacturer shall be installed with the meter. After the approved inspection of the backflow prevention device, the District will replace the manufacturer-supplied meter with the appropriate meter. The Applicant is responsible for all costs associated with acquiring and replacing meter.

Meter boxes, spuds or tail piece, and backflow prevention devices shall be supplied and installed by the Contractor at a location approved by the District prior to meter installation and service connection.

For customer connections to meters three (3) inches and larger, the Contractor shall provide a flange adaptor to ensure proper fitting.

4.4.6.J Meter Boxes

Meter boxes shall be securely supported and centered over the meter assembly. The box must be placed on a stable foundation, such as pea gravel or drain rock, to ensure proper drainage and to keep the meter dry. The meter box cover shall be installed flush with the finished curb, sidewalk, or grade, or as indicated on the Improvement Plans. Installation of meter boxes shall be in accordance with the applicable Detail Drawings in the WS Series. The installation must ensure that the box remains level and free from movement after final placement.

4.4.6.K Common Trench and Manifold

For commercial establishments, domestic, irrigation, and fire services shall be provided by separate service lines. Domestic and irrigation service lines under single ownership may be allowed in a common trench if approved by the District Engineer. The minimum separation between service lines within the trench shall be twelve (12) inches, and between taps at the main shall be eighteen (18) inches, unless otherwise approved by the District Engineer.

For commercial projects with existing service lines requesting increased water demand, additional metered service lines may be manifolded to the existing service, providing the existing service line can accommodate the increased demand. A maximum of three (3) separate meters may be

manifolded on a single existing service line. All manifolded installations must receive prior approval from the District Engineer.

Meter clusters require brass tags to indicate the address or unit number served by each meter.

4.4.6.L Threaded Joints

All threaded joints shall be assembled using an appropriate thread sealant to ensure a leak-free connection.

4.4.7 Appurtenances

All water facility appurtenances must be installed in accordance with this section. Each fixture or appurtenance shall be thoroughly cleaned before installation to remove any debris or contaminants.

4.4.7.A Valves, Valve Boxes, and Valve Box Risers

Valves shall be set plumb, supported against settlement, and securely fitted to adjacent main sections. A valve box and riser pipe shall be installed over each valve, ensuring that neither the box nor the riser pipe bears directly on the valve or main, to avoid transferring surface traffic loads to the water pipe. Riser pipe shall ideally be one continuous piece. If not feasible, they may be joined using a coupling or bell end piece of the same material.

Valves buried more than five (5) feet from finished grade shall include extension stems and stabilizers, if necessary, to position the valve operating nut within twenty-four (24) inches of the finished grade. The extension stem and stabilizers shall be housed in a valve box riser, which must extend into the valve box and be flush with the finished grade. The valve box shall include a cover, designed for traffic type when placed on street or roadways.

Valve boxes shall be securely supported, concrete encased, and aligned plumb over the valve wrench nut, with the box cover flush with the pavement or grade as indicated on the Improvement Plans. The valve riser interior must be kept clean and debris-, with the wrench nut readily accessible for operation.

The triangular lid of the valve box shall be oriented to point toward the water main isolation valve. The valve operating nut should remain fully accessible and centered in the riser. Main valves, service valves, and blow-off valve boxes shall be positioned to avoid conflicts with curbs, gutters, sidewalks, and driveways unless specifically approved by the District. They should be visible and accessible after yard grading or landscaping by the Applicant's Contractor.

Installation of air release and vacuum relief valves shall be in accordance with applicable Detail Drawings in the AV and BO series. Installation of valve boxes shall be in accordance with applicable Detail Drawings in the Valve Boxes (VB) series.

4.4.7.B Tapping Sleeves and Tapping Valves

Tapping sleeves and tapping valves shall be installed in accordance with the manufacturer's instructions. The section of the main where the tapping sleeve will be installed shall be thoroughly cleaned. The outside diameter of the main shall be measured to ensure the correct size tapping sleeve and tapping valve is installed on the main. These components shall be independently supported and must not be supported or carried by the main itself. The entire assembly shall be equipped with thrust blocking per Section 4.3.13, and bedding and backfilling per Section 4.4.10. Tapping sleeves shall be subject to testing and disinfection, as specified in Section 4.6.

4.4.7.C Hydrants

All fire hydrants shall be installed in accordance with Detail Drawings in the FH series and at the location indicated on the Improvement Plans. A minimum clearance of three (3) feet shall be maintained around the fire hydrant. In parking lots or low-speed areas, barricades may be required for hydrant protection as determined by the District Engineer.

Improperly installed hydrants must be removed and correctly reinstalled at no cost to the District. The installation process for hydrants shall conform to the following sections.

4.4.7.C.1 Position of Outlets

All hydrants shall be positioned upright (plumb) with the lowest outlet situated between eighteen (18) inches and twenty (20) inches above ground level, as specified in the FH Series Detail Drawings. The outlet must face the street or the point of access for the Fire Authority's engine, as determined by the Fire Authority.

4.4.7.C.2 Painting

Hydrants shall be painted from the top to ground level with a primer coat that meets AWWA C503 standards, following the manufacturer's recommendations. Surfaces shall be cleaned using soap, water, and an abrasive pad prior to painting. A minimum of two coats of rust-preventative gloss white enamel paint shall be applied for the final finish.

4.4.7.C.3 Approved Manufacturers and Products

1. Hydrant Paint and Rust Preventative Enamel: Rustoleum Gloss White Enamel

4.4.7.D Backflow Prevention Devices

Backflow prevention devices shall be installed above ground and protected against damage and vandalism. Devices measuring two (2) inches and smaller shall be enclosed in an insulated bag or an insulated metal enclosure, in accordance with Detail Drawings in the RP series. In areas subject to traffic, the devices shall be shielded using traffic posts or enclosed for added protection.

Backflow prevention devices shall be installed before requesting the installation of water meters. All installations shall be in accordance with Detail Drawings in the RP series as applicable.

4.4.7.E Sampling Stations

Where specified by the District, water quality sampling stations shall be installed in accordance with Detail Drawing WS_079.

4.4.8 Locator Wire and Markers

A No. 10 insulated copper locator wire shall be affixed to water mains, fire hydrants, main and hydrant valves, water services, and appurtenances. The wire shall be affixed to the top of pipe with ten (10) mil vinyl tape every five (5) feet. The Contractor shall perform a continuity test on all locator wire splices to ensure connectivity.

For pipes twelve (12) inches and smaller, a minimum of two (2) strands of blue locator tape shall be placed twelve (12) inches above main and service piping, near the trench edges. For pipes fourteen (14) inches

and larger, three (3) strands of blue locator tape shall be placed twelve (12) inches above the pipe in accordance with Detail Drawings in the TREN series.

In unpaved areas, water mains shall be marked every one hundred and fifty (150) feet with a blue composite utility marker having a decal labeled “Caution Water Pipeline.” Appurtenances (such as valves, test stations, and angle points) shall also be marked for visibility and maintenance.

4.4.9 Water Facilities Corrosion Protection

All tees, elbows, valves, and special fittings shall be wrapped in eight (8) mil minimum polyethylene wrap encasement before any concrete pouring or backfilling.

4.4.10 Backfill and Compaction

4.4.10.A Backfill

All water mains within the pipe zone shall be backfilled with No. 2 washed sand, compacted to a relative compaction of not less than ninety (90) percent. The compacted sand should extend at least six (6) inches below and twelve (12) inches above the pipe. Backfill material must be free from debris, concrete fragments, pavement, stones, or soil chunks exceeding three (3) inches in any dimension. For existing roadways and traffic areas, trench backfill above the sand layer shall consist of three-quarters (3/4) inch Class 2 aggregate base, compacted mechanically in six (6) inch lifts to a compaction level of ninety-five (95) percent.

Open-cut service line trenches shall be backfilled per the Detail Drawings in the WS series.

4.4.10.B Compaction

Compaction methods within the trench shall be as specified by the most current editions of the Standard Specifications for Public Works Construction (“Greenbook”) and the County of Sacramento Public Works Standard Construction Specifications. The Contractor shall perform compaction tests using a Nuclear Density Meter operated by a licensed geotechnical engineer, in accordance with ASTM standards for in-place soil density.

In the pipe zone, the Contractor shall select a compaction device capable of achieving a minimum of ninety (90) percent relative compaction as defined by AASHTO Test No. T180 (Standard Proctor). Compaction equipment may be manual, mechanical, or pneumatic, provided it does not cause displacement, instability, or damage to the pipe. If pipe damage occurs, the Contractor shall promptly perform necessary repairs.

Except for directly above the pipe, compaction lifts shall be limited to six (6) inches within the pipe zone. For embedment material placed directly above the pipe, the compaction lift shall be of sufficient depth to achieve required compaction and protect the pipe. All compaction layers shall be compacted as required before the next layer is deposited.

The Inspector shall verify uniform compaction of the embedment material to ensure the absence of voids. If the required compaction is not met, the trench shall be recompacted and retested at the Contractor’s expense.

4.4.10.C Bracing and Shoring

When bracing and shoring are used in an excavation (such as trench or bore pit), the backfill shall be placed to a height sufficient to prevent surrounding soil from cracking or caving into the

excavation. This backfill must be installed before removing the bracing or shoring to maintain stability. The Contractor may be required to submit bracing or shoring plans and obtain permits before construction.

4.4.10.D Public Streets and Highways

For trench backfill and compaction performed in public streets and highways, the Contractor shall adhere to all regulations specified by the authority having jurisdiction. The pipe embedment zone, up to one (1) foot above the pipe, must comply with the District's standards as provided in these standards.

4.4.10.E Unimproved Rights-of-way

Trench backfill above the pipe embedment zone within unimproved rights-of-way shall consist of selected material excavated from the site, as approved by the District Engineer. This material shall be free of organic debris and other unsuitable materials such as rocks, boulders, or soil masses larger than four (4) inches in diameter.

The trench backfill must be compacted to a relative density of ninety (90) percent using AASHTO Test No. T180 (Standard Proctor). If the required compaction cannot be achieved, imported backfill material meeting the specifications must be used.

4.4.11 Resurfacing and Restoration

4.4.11.A General

When an unimproved surface is disrupted, the trench must be restored to its original condition unless otherwise indicated on the Improvement Plans.

Damaged private streets, driveways, or other improved surfaces affected by the work must be removed and restored to the original condition, including the reconstruction of the subgrade when disturbed.

Temporary paving, barricades, or special provisions mandated by the authority having jurisdiction must be supplied by the Contractor.

4.4.11.B Other Governing Agency Requirements

If the work is within existing public roadways or city streets, the resurfacing process shall be in accordance with the requirements of the authority having jurisdiction.

If the trench is located in areas without existing paving, the Contractor shall ensure the trench is suitably compacted for future grading and surfacing.

4.4.11.C District Requirements

If no specific requirements are outlined by a city or governing agency, the District's standards shall apply. All resurfacing materials and methods shall adhere to the latest edition of the Caltrans Standard Specifications. Resurfacing roadways or gravel areas shall be done in accordance with Detail Drawings in the TREN series.

For asphalt concrete surfaces, temporary paving shall be provided before final resurfacing. The existing asphalt shall be neatly cut to a depth of two (2) inches, with an additional six (6) inch

width on either side of the trench for proper keying. The cut edges must be straight, vertical, and free from irregularities.

The base course for the final surface shall be Class 2 aggregate, compacted to match the existing pavement thickness, with a minimum depth of sixteen (16) inches. Asphalt concrete shall be Type B, as specified in Section 39 of the Caltrans Standard Specifications, with a minimum thickness of three (3) inches.

4.4.11.D Temporary Paving

Temporary paving must meet the requirements of the governing authority. In areas outside city or county jurisdiction, temporary surfacing shall consist of a minimum of one and one-half (1-1/2) inches of premixed asphaltic paving material. Temporary paving must be installed at the end of each workday to maintain safety and usability.

Before reopening the street to traffic, all debris, rocks, and loose materials must be removed, and the surface swept clean. Temporary paving shall be continuously maintained to prevent the formation of potholes or surface deformation, keeping the surface level with the existing pavement.

4.4.11.E Permanent Paving

Permanent paving shall not commence until the compaction requirements specified by the governing authority or District are fulfilled. Permanent paving shall follow the applicable guidelines, including cutting the existing pavement to a uniform depth of two (2) inches and extending the cuts six (6) inches on either side of the trench for a secure joint.

The final wearing surface shall be asphalt concrete with a minimum depth of three (3) inches, following the requirements for Type B Asphalt Concrete as outlined in Section 39 of the Caltrans Standard Specifications.

4.4.12 Location Marking

All valves, blow-offs, air valves, services, and similar components shall be permanently marked on the closest curb face or sidewalk. A “V” shall be inscribed or stamped on the top of the curb or sidewalk if a valve is located behind it. For water meters positioned behind a curb or sidewalk, a “W” shall be marked in the curb or walkway. The lettering size shall be at least two (2) inches high to ensure visibility.

4.4.13 Concrete

4.4.13.A Placement

Concrete shall be placed into clean, properly prepared forms before the initial set begins, using the minimum amount of mixing water required for adequate workability. The concrete shall be thoroughly compacted by rodding or vibrating to achieve a dense and uniform mass, free from voids and rock pockets. All concrete must be vibrated unless specifically directed otherwise by the Inspector.

4.4.13.B Reinforcement

Reinforcement bars shall be accurately positioned and securely fastened according to the improvement plans. When splicing bars, the overlap shall be a minimum of twenty (20) diameters or butt-welded, unless specified differently in the plans.

4.4.13.C Finish

Exposed concrete surfaces shall have a uniform comparable to that achieved with new plywood forms. Slabs, pads, and walkways shall be finished with a neat broom texture unless an alternative finish is specified in the plans. All corners and edges shall be beveled, and surface imperfections repaired to blend with the surrounding concrete.

4.4.13.D Accelerated Curing

When circumstances warrant, calcium chloride admixture (not exceeding two (2) percent volume) may be used to accelerate curing, subject to the District Engineer's approval. The use of calcium chloride may be restricted at the District's discretion.

4.5 Water Facility Abandonment

4.5.1 Abandonment of Water Mains

Water mains designated for abandonment shall be emptied and deactivated as follows:

1. Drain the water mains completely.
2. Close all valves in place.
3. Remove all above-ground appurtenances (e.g., valve boxes and risers, fire hydrants) to a minimum depth of three (3) feet below grade, backfill, compact, and restore the surface as required by the authority having jurisdiction.
4. For water mains twelve (12) inches and smaller, cut and cap or plug the ends, enclosing them entirely in concrete.
5. For water mains larger than twelve (12) inches, fill with sand or cement slurry mixture and cap the ends with concrete.
6. If a tee or cross remains in service, it shall be blind flanged and restrained with a thrust block.

4.5.2 Abandonment of Water Service Lines

4.5.2.A Water Main to be Abandoned

Abandonment of water service lines connected to water mains to be abandoned shall be in accordance with the requirements provided below.

1. Remove the meter, meter box, setter, wood supports, curb stop, and all brass piping and fittings.
2. Plug the water service and crimp the end a minimum of two (2) feet below grade. Close the valve at the main.
3. Backfill and compact the excavated area and restore the surface to match existing conditions and as required by the authority having jurisdiction.

4.5.2.B Water Main to Remain in Service

Existing water service lines to be abandoned on mains that will remain in service shall comply with the above. In addition, the service saddle shall be removed, and a minimum twelve (12) inch wide full circle stainless steel repair band shall be installed on the main. The water service at the main shall be also plugged or crimped.

4.6 Testing and Disinfection

All water mains and appurtenances to be dedicated to the District shall be subject to hydrostatic pressure testing, disinfection, and bacteriological testing. All labor, equipment, and material, including water necessary for the testing and disinfection of these facilities, shall be provided by the Contractor at no cost to the District. Testing shall include corrections, repairs, and retesting until all facilities pass the required test.

Prior to testing, the Contractor shall provide access to all main valves, curb stops, hydrants, and blow offs. All testing shall be conducted in the presence of an Inspector, who shall be responsible for determining when the facilities are protected from damage and ready to be tested.

Prior to District provision of water for testing, the Contractor shall submit a disinfection and flushing plan conforming to the latest revision of AWWA C651 and these Standards. The plan shall address the items listed in the procedure in Appendix E.

All facilities to be connected to the water system shall pass the required testing prior to connection to the existing system.

4.6.1 Hydrostatic Tests

New water mains and associated facilities shall be temporarily connected to the District's water system using a construction jumper that includes a meter and a District-approved reduced pressure backflow prevention assembly. The assembly size shall conform to Table 4-5 specifications. The backflow prevention assembly must be tested and certified in accordance with Section 4.6.5 prior to usage.

Table 4-5. Backflow Assembly Size for Testing

Pipeline Diameter	Assembly Size
Less than or equal to 12 inches	2 inches
14 inches and greater	6 inches

The system shall be slowly filled and purged of air, with all valves opened. Independent pressurization from the existing system must be performed according to the latest AWWA C600 (DIP) or C605 (PVC) standards.

The system shall be pressurized to a minimum of 150 psi for two (2) hours. Any pressure loss greater than 5 psi during testing will result in a failure. Additionally, any loss exceeding the allowable threshold calculated per AWWA C600 or C605 shall constitute a failure. Upon successful testing, the temporary connection shall be replaced by a permanent connection.

4.6.2 Tapping Sleeve Leakage and Pressure Test

After assembling the tapping sleeve and valve, but before drilling, the tapping sleeve shall be tested for leakage. Testing shall be conducted using pressurized air at 100 psi for thirty (30) minutes. Any pressure

loss during this period will result in a failure. Care must be taken to avoid damaging the main during testing, with any resulting damages repaired by the Contractor.

4.6.3 Disinfection and Flushing of Water Lines

Disinfection of water lines shall not commence until the hydrostatic pressure test has been satisfactorily completed. Disinfection shall be performed by a licensed Chlorination Specialist holding active C36 (Plumbing) and C55 (Water Conditioning) licenses, as issued by the California Contractors State License Board.

Disinfection and sampling shall be conducted according to the District's Disinfection/Sampling Procedure outlined in Appendix E. Water samples from disinfected pipelines shall be collected by District personnel, in coordination with the Contractor, and tested at the Contractor's expense. Should bacteriological samples fail to meet minimum standards, additional chlorination will be required at the Contractor's expense until satisfactory results are obtained.

Sample points shall be designated by the District. If there are insufficient sample points, the Contractor must provide temporary outlets for sampling at their own cost.

Newly installed and disinfected pipelines must pass two consecutive rounds of bacteriological testing before being connected to the District's active water distribution system.

4.6.3.A Method of Disinfection

Water mains and service lines shall be chlorinated following the Continuous Feed Method as specified in the latest AWWA C651. Chlorine concentration shall be maintained between 50 and 100 ppm for a minimum of twenty-four (24) hours. At the end of this period, the chlorine residual throughout the pipeline shall not be less than 25 ppm.

4.6.3.B Cleaning and Disinfection of Tie-ins

All materials used for tie-ins shall be thoroughly cleaned to remove dust, dirt, and other contaminants, including residues from cutting operations. The piping materials used for tie-ins shall be disinfected by swabbing or spraying with a one (1) percent chlorine solution.

Before assembling tapping sleeves, the main's exterior surface and the interior of the sleeve shall be disinfected by swabbing or spraying with chlorine to minimize contamination risks.

4.6.3.C Flushing

Upon completion of disinfection, the pipeline shall be thoroughly flushed with fresh water from the existing system to replace the chlorinated water. Flushing shall continue until chlorine residual levels at all outlets match those of the active system. Proper disposal of flush water shall comply with AWWA C655 and relevant local and state regulations. Dechlorination procedures must be followed to prevent environmental harm, and the Contractor shall provide verification of uniform dechlorination at ten-minute intervals during disposal.

4.6.4 Locator Wire Continuity Test

Before final paving, the Contractor shall perform continuity testing on all locator wires installed on water lines. Testing shall be carried out using a direct connection adjustable frequency utility locating

system. All testing must be conducted in the presence of a District Inspector to ensure accuracy and compliance.

4.6.5 Backflow Testing

All newly installed backflow prevention devices must undergo testing by the District prior to activating the protected water line. Testing shall be performed according to District standards, and any deficiencies identified during testing must be addressed before the device is placed into service.

4.6.6 Cathodic Protection

Cathodic protection test stations shall be evaluated by an independent testing service. The Contractor must submit the test results to the District for review and approval prior to final acceptance of the pipeline. These tests are essential to verify the effectiveness of corrosion protection measures.

Appendix A

Standard Detail Drawings

Appendix B

Project Checklist

Appendix C

Project Acceptance Summary/ Value of Facilities Form

Appendix D

District Cross-Connection and Backflow Prevention Regulation

Appendix E

CHWD Disinfection/Sampling Procedure