CAMROSA WATER DISTRICT

WATER

DESIGN AND CONSTRUCTION

STANDARDS

CAMROSA
WATER DISTRICT

BUILDING WATER
SELF-RELIANCE

CAMROSA WATER DISTRICT
ENGINEERING DEPARTMENT
7385 SANTA ROSA ROAD
CAMARILLO, CA 93012

WATER STANDARDS

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SECTION I

INTRODUCTION AND GENERAL POLICIES

1.1 INTRODUCTION

A. SOURCES OF WATER

A water supply system delivers water from its sources to the customer for home, business, public, or industrial water use purposes. The source of water supply may be groundwater, surface waters, or a combination of both.

Groundwater is a water source below the ground surface that is pumped to ground level, sometimes treated, and then put into the distribution system.

Surface waters may be natural lakes, streams, rivers or reservoirs behind dams. In general, surface water is characterized by turbidity, suspended solids, some color, and microbiological contamination. Surface water must be clarified, where suspended materials are removed, and disinfected to eliminate potential disease-causing organisms to ensure that it is potable, pleasing to the senses, and safe.

Surface Water is usually transported from its source through a transmission system consisting of either open channels (canals) or large-diameter pipes (called raw water conduits) to treatment plants. After treatment, the water is usually pumped into transmission lines that are connected to Camrosa's distribution system. From the distribution system the water is delivered to individual service lines that serve private homes, businesses, and, commercial and industrial facilities.

B. DEFINITION OF WATER TYPES

a. Potable Water

Water that does not contain objectionable pollution, contamination, minerals, or infective agents and is considered satisfactory for drinking.

b. Non-potable Water

Water that may contain objectionable pollution, contamination, minerals, or infective agents and considered unsafe and/or unpalatable for drinking.

c. Safe Water

Water that does not contain harmful bacteria, or toxic materials, or chemicals. Water may have tastes and slight odor problems, color and certain minerals, and still be considered safe for drinking.

1.2 SCOPE

The design and construction of potable water facilities intended to be connected to or become part of the potable distribution system of Camrosa Water District shall comply with these standards herein called, "Water Design and Construction Standards" and the permit requirements of various governing bodies. **All parts of these Standards and the accompanying Standard Plate Drawings have been examined by the General Manager and the District's Registered Engineer and approved as to content.** A Registered Civil Engineer shall sign all submitted plans and all work shall be in accordance with good engineering practices and these standards. This document sets forth the procedure for designing and preparing plans and specifications for potable water facilities built for the District. Wherever there are differences between these standards and other city, county, state or federal regulations, the most stringent or highest requirement shall govern.

1.3 DISTRICT AUTHORITY

The authority of the District is granted under the provisions of Division 12, Section 31100 of the Water Code of the State of California and regulations of the Camrosa Water District.

1.4 INTERPRETATION

The General Manager of Camrosa Water District shall decide all questions of the interpretation of "good engineering practice" being guided by the various standards and manuals to include those published by the American Waterworks Association (AWWA).

1.5 APPLICABLE CODES AND POLICIES

Ordinances, requirements, and applicable standards of governmental agencies having jurisdiction within the District's service area shall be observed in the design and construction of potable water systems. Such requirements include but are not limited to current revisions of the following:

1. The Uniform Building Code.

2. Road Encroachment regulations and standards of the Cities of Camarillo, Moorpark, Thousand Oaks, and the County of Ventura.
3. CAL Trans Standard Specifications

1.6 DEVELOPER'S ENGINEER'S RESPONSIBILITY

These standards establish uniform policies and procedures for the design and construction of the District's potable water system. They are not intended to be a substitute for engineering knowledge, judgment, or experience. These procedures shall be reviewed by the Developer's Engineer and shall be applied as necessary to the project. Proposed deviation to these standards shall be submitted, in writing, prior to tentative map and /or development project approval.

It is the Developer's Engineer's responsibility to be aware of the District's Master Plan for potable water systems improvements and to indicate any main line relocations, extensions, or over-sizing on the potable water plan.

All plans and specifications, reports or documents shall be prepared and signed by a registered Civil Engineer in the State of California, or by a subordinate employee under his direction, and shall be signed by him/her and stamped with his/her seal to indicate responsibility for them.

Plans approved and signed by the District's Engineer shall be revised or supplemented at any time it is determined that the District's requirements have not been met. However, generally, plans that are signed will not require revisions based upon subsequent revisions to these standards unless in the District's opinion, a change is necessary based upon a significant change in the standards or unless the developer does not proceed to construct within the time allowed in the agreement with the District.

1.7 DEFINITION OF TERMS

Whenever reference is made thereto of the following terms, abbreviations or definitions, the intent and meaning shall be interpreted as follows:

ABBREVIATIONS

AASHTO	**A**merican **A**ssociation of **S**tate **H**ighway and **T**ransportation **O**fficials
ACI	**A**merican **C**oncrete **I**nstitute
ANSI	**A**merican **N**ational **S**tandards **I**nstitute
ASCE	**A**merican **S**ociety of **C**ivil **E**ngineers

ASTM	**A**merican **S**ociety for **T**esting and **M**aterials
AWWA	**A**merican **W**aterworks **A**ssociation
BFV	**B**utterfly **V**alve
C/L	**C**enter **L**ine
D/R	**D**imension **R**atio
DUE or EDU	**D**welling **U**nit **E**quivalent/**E**quivalent **D**welling **U**nit
GV	**G**ate **V**alve
OS&Y	**O**utside **S**tem **and Y**oke
P/L	**P**roperty **L**ine
RSGV	**R**ising **S**tem **G**ate **V**alve
R/W	**R**ight of **W**ay
RWV	**R**esilient **W**edge **V**alve
UBC	**U**niform **B**uilding **C**ode
UPC	**U**niform **P**lumbing **C**ode
USCGS	**U**nited **S**tate **C**oast and **G**eodetic **S**urvey
WPCF	**W**ater **P**ollution **C**ontrol **F**ederation

<u>Pipe Types</u>:

ABS	**A**crylonitrile **B**utadiene **S**tyrene
ACP	**A**sbestos **C**ement **P**ipe (Transite Pipe; No longer allowed for use in the District)
CIP	**C**ast **I**ron **P**ipe
CMP	**C**orrugated **M**etal **P**ipe
DIP	**D**uctile **I**ron **P**ipe
CML&C	**C**ement **M**ortar **L**ined **and C**oated (**S**teel **P**ipe)
HDPE	High Density Polyethylene Pipe

PVC	**P**oly-**V**inyl **C**hloride Pipe
RCP	**R**einforced **C**oncrete **P**ipe
TP	**T**russ **P**ipe
VCP	**V**itrified **C**lay **P**ipe

DEFINITIONS

"Approved"	Unless specifically indicated, this shall mean the approval of the General Manager and/or District's Engineer of the Camrosa Water District.
"City"	The City of Camarillo, California, and the various agencies and departments thereof. In some cases "City" may mean Thousand Oaks or Moorpark.
"Contract"	The contract includes the Notice Inviting Bids, Proposals, Specifications, Agreements, Bonds and Plans.
"Contractor"	The individual, partnership, firm or corporation entering into an agreement with the District, or with a developer to perform or execute the contemplated work.
"County"	The County of Ventura, California, and the various agencies and departments thereof.
"Developer"	An individual or organized group, partnership, corporation, etc. proposing to subdivide or improve land requiring water service from the District.
"Developer's Engineer"	The Engineer licensed by the State of California as a Civil Engineer, employed by the developer, under whose direction, plans, profiles, and details and cost estimates for the work are prepared and submitted to the District for review and approval.
"District"	The Camrosa Water District or its authorized representatives.
"District's Engineer"	A registered civil engineer employed by the District and designated by the General Manager to act on the District's behalf.

"Easement" A recorded documents in that the landowner gives the District permanent or temporary rights to construct and maintain water mains and/or facilities across private property.

“Facility" Any conduit, structure, or feature used in the supply of water or collection and distribution of sewage.

"Field Acceptance" When the Inspector approved the physical installation of the water system.

"Final Acceptance" When the Board approves both physical improvements, as well as the administrative items associated with the development.

"Fire Department" Ventura County Fire Department

"Fire Service Line” A waterline dedicated to provide fire protection to a building or property.

"Fixture Unit Equivalent” The unit equivalent of plumbing fixtures as tabulated in the Uniform Plumbing Code.

"Horizontal Separation” The least horizontal distance between the centerlines of pipelines laid approximately parallel to one another at their closest point of approach and the least horizontal distance between the centerline of pipelines and the nearest edge of facilities.

"House Plumbing" Plumbing fixtures, devices, and drainage piping within a building or structure.

"Inspector" An employee or agent of the District engaged to observe and record field compliance with design criteria, plans, and construction standards.

"Incremental Cost" The difference in cost between the pipelines and appurtenances necessary to serve a particular development and the larger facility required by the District.

"Main Line Sewer" A sewer that has been constructed to accommodate more than one building sewer and that has been approved by the District.

"Manager"	Manager shall mean the General Manager of Camrosa Water District, or the person engaged by the District and authorized to perform the duties assigned to the Manager, and shall include his/her Directors and representatives.
"Offsite or Off-Tract Line"	A water line beyond tract boundaries connecting the tract water or sewer system with the District's.
"Or Approved Equal"	The item referred to may be substituted for another item, if this item is approved by the District for the particular use intended.
"Oversizing Cost"	The incremental cost of oversizing water or sewer pipelines required by the District to suit its master plan needs..
"Permit"	Any written authorization required pursuant to any regulation of the District.
"Plans"	The official drawings, profiles, or reproductions thereof, approved by the District that shows the locations, characters, dimensions, and details of work to be done.
"Plate No."	When not specified to the contrary, this refers to plates (Specification Drawings) attached to these Standards.
"Pressure Zone"	The zone within the District as defined by its elevations.
"Required"	Unless otherwise indicated, this shall mean a requirement of the District.
"Required Fire Flow"	A requirement established for each project, as determined by the Ventura Fire Department or the District using Insurance Services Office Guidelines.
"Service Line"	Shall mean that portion of the horizontal piping beginning at the water main and extending to its connection with the water meter.
"Sewer Line"	Any conduit carrying "sewage" or "industrial waste" as defined in Health and Safety Code Sections 5410(a) and 5410(b); any conduit carrying the effluent of treated sewage or industrial waste; or any conduit carrying agricultural waste or effluent of any treated agricultural waste including, but not limited to, interceptors, outfalls, and force mains.

"Tract Water Lines" The system of street water lines and service lines and other appurtenances constructed by a developer within an approved tract.

"Vertical Separation" The difference in elevation between the outside bottom of the higher pipe and the outside top of the lower pipe.

"Water Line or Main" Any conduit carrying water that is 6" or larger that supplies water to service lines, fire hydrants and other appurtenances.

"Water Purveyor" Agency or Company supplying and selling water to the customers.

"Water Well" Any hole or excavation used to obtain water from under the surface of the ground.

"Work" All of the work for the project contemplated and called for or shown

1.8 GENERAL METER POLICY

Unless otherwise approved by the General Manager, a separate water meter shall be installed for each single owner, single tenant residential property, such as detached single family homes, townhouses, or condominiums. Single ownership, multiple tenant multi-family dwellings such as apartment buildings, apartment complexes, and commercial developments shall be master metered. In some cases, multiple master meters at multiple points of connections (P.O.C.) to the District's system may be required to provide redundancy and necessary fire flow.

1.9 DISTRICT JURISDICTION

The District is responsible for the approval of plans and inspection of all public main water lines and service lines within the public right-of-way and easements of the District's water service area. The Building and Safety Division of the City or County or corresponding fire department of where the work is performed is responsible for all systems beyond the water meter or backflow prevention device.

Where repairs or replacement of a service line on the District's side of the meter is required subsequent to initial construction, it shall be the responsibility of the District unless it is an upgrade situation in which case the owner or customer shall post a cash bond for the work prior to start of construction. Conversely,

repairs or replacement on the customer side of the meter shall be the responsibility of the property owner.

1.10 OCCUPANCY/WATER SERVICE

As a part of the clearance procedure for individual house/building occupancy, the District must “clear” the facility. Occupancy cannot be given until the public water system is field accepted by the District inspector working with the District’s Operation & Maintenance personnel. For tract construction where numerous units are involved, clearances will be granted on a street by street basis only; individual clearances on a piecemeal basis will not be allowed.

1.11 BOARD OF DIRECTORS ACCEPTANCE

The District will not recommend that a water system be accepted until all applicable requirements of these standards are met.

SECTION 2.0

DESIGN CRITERIA

2.1 CAMROSA WATER DISTRICT SYSTEM

A. GENERAL

Camrosa Water District is one of the five water purveyors serving water within portions of the City of Camarillo. The other four are the City of Camarillo, Pleasant Valley Mutual Water Company, Pleasant Valley County Water District, and Crestview Mutual Water Company. Camrosa Water District's service area generally includes the region east of Calleguas Creek, including the University of California, Channel Islands campus and portions of the Cities of Simi Valley, Moorpark and Thousand Oaks and unincorporated areas of Ventura County. The District should be consulted concerning the exact boundaries of its specific service area.

The District receives imported water from the California State Water Project through Calleguas Municipal Water District, a wholesale contracting member of the Metropolitan Water District. The District also operates wells, extracting ground water from the Santa Rosa Basin and the Fox Canyon Groundwater Basin, blending this with the purchased imported water in order to provide service at the most economical cost to the customers.

A detailed description of the District water system is contained in the District's Water Master Plan.

B. SYSTEM DESCRIPTION

The following sub-section presents a brief description of the District's Water System as of the Summer 2016. It is given for information and does not relieve the Developer/Engineer from having a thorough knowledge of the current Water Master Plan and subsequent studies performed for various zones.

Tables 2-1A, presents a description of various zones, reservoir capacities, pumping stations, and turnouts.

TABLE 2-1A
RESERVOIR INFORMATION

RESERVOIR	ZONE	BOTTOM ELEVATION	CAPACITY (MG)	LOCATION
1B	1	410”	3.00	101 Freeway
2A	2	610’	0.75	Easement N/O Barranca Road
2B	2	610’	1.25	Easement N/O Calle Dia
3A	3	810’	2.50	Tierra Rejada Road
3B	3	810	1.00	Easement S/O Moorpark Road
3C	3	810’	1.00	East End of Presilla Road
3D	3-D	744’	1.25	W/O Escollera Road
4A	4-A	1050’	2.00	Easement N/O Olsen Road
4B	4-B	1050’	0.55	Easement N/O YMCA
4C	4-C	1043’	1.00	Presilla Road

(10) RESERVOIRS TOTAL CAPACITY = 14.30MG

2.2 **WATER MAIN PRESSURES, CAPACITY AND SIZES**

A. QUANTITY OF FLOW

Flow rates shall be determined from the maximum potential population or land use of the area served. Unless otherwise approved, the following criteria shall be used:

If the number of housing units is known:

3.38 persons/single family unit (detached) **	220 gallons/capita/day (gpcd)
2.1 persons/multiple family dwelling	220 gallons/capita/day (gpcd)

** 1.75 persons/mobile home unit

For a residential project, the quantity of flow should be derived from the above values and either the known number of units or an estimated number of units based upon the particular zoning for the area. All storage and distribution facilities should be based on these values. In this regard the City or County Planning Department who has jurisdiction over the area should be consulted. In general, estimates based upon rough approximation using ground slope are not approved because they can be misleading. For other projects involving commercial, industrial, greenbelt areas or school, etc., the preferable method is to estimate the flow requirements for each building or area and then combine the results. AWWA Manual No.M22 and the Uniform Plumbing Code can be useful tools for this work. In the absence of such definition, the following may be used with prior approval:

TABLE 2.5

TYPE OF ZONING	COMPUTED AVERAGE USAGE (FLOW)
Heavy Commercial Light Industrial	3,000 gal/acre/day (28,000 liters/hectare/day)
Light Commercial	2,000 gal/acre/day (19,000 liters/hectare/day
Parks, Green belt	1, 500 gal/acre/day (14,000 liters/hectare/day)
Schools, Hospitals	Specific flow requirements should be calculated

After calculating the average daily flow, the following peaking factors shall be used to determine the system demands during conditions other than the average daily flow:

TABLE 2.6

Multiply Average Daily Flow By Factor Shown

Maximum Month Demand	1.60
Maximum Day Demand	2.15
Peak Hour Demand	4.50

If and when special studies of a particular area are conducted that demonstrate that different water use or peaking factors are appropriate, then those values may be used if approved by the District.

B. FIRE FLOW REQUIREMENTS:

The District generally follows the requirements of the Insurance Service Office (ISO) as might be modified upwards by the Ventura Fire Department, that provides fire protection service within the City. The information presented below is excerpted from the current ISO standards and is not intended to be all-inclusive. Some of it has been simplified for easier understanding of what can be a complex numerical calculation. It may, however, be used as a guideline recognizing that specific requirements are set by the Fire Department and possibly the District.

The basic formula for determining fire flow is:

NFFi = (Ci) (Oi) (X + P) (i) where

Ci	=	Construction Factor
Oi	=	Occupancy Factor
Xi and Pi	=	Exposure and Communication Factor
Subscript "i"=		Allows averaging buildings where a different factor is assigned to different portions

The factors are determined as follows:

a. Ci = 18F (Ai)05 where

Ci	=	Fire Flow attributed to building size and construction type
F	=	Coefficient related to the class of construction: F = 1.5 for Construction Class 1 (Frame) = 1.0 for Construction Class 2 (Joisted Masonry) = 0.8 for Construction Class 3 (Non-Combustible) and Construction Class 4 (Masonry Non-Combustible) = 0.6 for Construction Class 5 (Modified Fire-Resistive) and Construction Class 6 (Fire Resistive)
Ai	=	Effective Area

b. Oi = A factor between 0.75 and 1.25 with the higher values for rapid burning occupancy materials.

c. Xi and Pi = Factors that reflect the influence of exposed and communicating buildings. It relates to the possibility of spreading fires and term

(X +P)(i) can vary between 1.0 and 1.75.

Also to be considered is the impact of installing sprinklers in the building(s). It can greatly reduce the needed fire flow. Consult the Fire Department for details.

As a general note for single family residences not exceeding 2 stories in height, the fire flow requirement shall be 1,500 gpm (63 L/S). The determination of the required fire flow shall be in accordance with the ISO standards and shall not be diminished by consideration of practices outside the District's water service area.

The fire flow duration is 2 hours for needed fire flows (NFF) up to 2,500 gpm and three (3) hours for the needed fire flows of 3,000 and 3,500 gpm. Above 3,500 gpm, the requirement is as set by the Fire Department.

Table 2.7 below lists the fire flow requirements that the District has adopted and set forth in the District's Facilities Master Plan.

TABLE 2.7

Land Use Category	Fire Flow (gpm)	Duration (hrs)
RESIDENTIAL		
Residential Estate, Very Low, Low Density (0-3 D.U./Acre)	1500	2
Medium, Mobile Home, Mobile Home Subdivision Density (3.1 – 10 D.U./Acre)	1500	2
High, Very High Density (10.1 – 18.1+ D.U/Acre)	2000	2
COMMERCIAL		
Recreational, Commercial, Office,	2500	2
INDUSTRIAL		
Light Industrial, Business Park, Industrial	3000	2

Reserve, Airport		
PUBLIC & SEMI-PUBIC Community Services (churches, shools, library, etc..), Parks, Hospitals, Schools	3000	2

It is the Developer's Engineer responsibility to demonstrate through calculations that the required fire flow can be met while the District's water system is under maximum day demand. The calculations shall be assumed that the fire flow is achieved from storage not relying on pumping stations. Under fire flow conditions including the maximum daily requirement, the residual pressure in the system shall be no less than 20 psi. The only exception is for a fire hydrant located adjacent to or near a reservoir when there are no domestic water services between the fire hydrant and the reservoir or where it can be determined that the residual pressures less than 20 psi will not adversely impact domestic customers. In making the calculation, the District mains must be considered with respect to their headloss. In instances of high fire flows, computer analyses may be necessary.

C. PRESSURE

Water mains shall be designed to provide for service pressures between 45psi and 150psi with the following provisions:

- Service pressure shall mean the pressure at the house or building and shall be interpreted to be the static pressure available with the service reservoir at no more than half full.
- There is a strong desire to keep pressures between 45 and 80 psi since above that value, the Uniform Plumbing Code requires individual pressure regulators at the house or building on the customer side of the meter.
- Where pressure would exceed 150 psi, special approval is required and the Developer most likely will have to install separate Pressure Regulators ahead of the meters or a Pressure Regulating Station on the main line.

D. VELOCITY

Water mains shall be designed to provide mean velocity of not more than five (5) feet per second (1.5 m/sec) under maximum daily flow conditions

E. HYDRAULICS

Pipe analysis shall be performed with the understanding of both the existing and future developments. Hydraulic calculations shall be assume a Hazen-Williams coefficient "C"= 120. For reference, the following can be used:

TABLE 2-7

Pipe Size	Head Loss in Ft/Ft **
6"	0.0194
8"	0.00483
10"	0.00163
12"	0.000670
14"	0.000317
16"	0.000165
18"	0.0000932

** using hl = (2.31Q) 1.85 where Q is in cfs and d is in feet (Ch d 2.63)

F. SIZING OF MAINS

In general, water mains shall be 8" in diameter as a minimum. To be included in this category are fire hydrant runs servicing more than one fire hydrant. Exceptions are as follows:

- Dead end mains past the last fire hydrant may be 6" in diameter. A dead end line is one that cannot and will not be extended in the future.
- Larger size mains may be required, particularly for backbone pipelines.

G. PIPE NETWORKS

The District encourages and in most cases requires the use of "looped" pipe systems while recognizing that not all lines can or should be looped. Most often this occurs on cul-de-sac streets where it is not feasible or practical to tie the main to another pipeline. Nevertheless, the Developer's Engineer shall strive to provide multiple sources of water for any subdivisions or major commercial/industrial project.

2.3 **SELECTION AND TYPES OF PIPE**

A. GENERAL

These standards cover main lines up to and including 24 inches in diameter.

B. MAIN PIPELINES

In general, main lines shall be Polyvinyl Chloride (PVC, AWWA C-900 or C-905), Steel Cylinder or Ductile Iron Pipe in accordance with Sections 3 and 7 of these standards. A.C. (Asbestos-Cement or Transite) and cast iron pipe are no longer allowed for pipeline use in the District.

Where PVC pipe is selected, the following head classes shall be used:

Static Pressure	Class of PVC*
0-125 psi	150
126-175 psi	200

*Of course, where pipes are laid in deep trenches, then the class size should be determined using AWWA C-900.

Where Class 200 pipe is used for a portion of a project, the separation between Class 200 and Class 150 shall be a valve; all fire hydrants runs shall be Class 200.

Steel pipe thickness shall be sufficient for the static pressure in accordance with Section 3.3, although the minimum thickness specified in that Section are for welding and corrosion purpose and in all normal cases govern the thickness selected.

Ductile Iron pipe shall be selected with the thickness, that will be suitable for the pressure and laying condition in accordance with Tables 12 and 13 AWWA C150 as approved, by the District. Ductile Iron pipe with restrained joints shall be used within all District easements or private roadways.

C. SERVICE LINES

These shall be 1-inch or larger except as described below. In the 1-inch size, type K copper is approved as described in Sections 3.5 and 7.10. The next larger size service shall be 1½ & 2 inch that shall also be type K copper. Four inch or larger service lines shall be PVC, Ductile Iron or as approved by the District.

Service lines shall be capable of taking pressure up to the same level as the main line.

2.4 LOCATIONS OF LINES AND FIRE HYDRANTS

A. WATER MAINS

The water centerline, wherever possible, shall be located in public streets parallel to and 5 feet north or west of the centerline. See **Plate W-55** for separation requirements between any waste water line and the water lines.

However, where storm drains or other facilities are in the center of the street, the water lines shall be located to provide a minimum of 4 feet clearance between the outside of the pipe (measured on a horizontal plane). This pertains as well to any case of paralleling lines.

Special care is required where storm drains or other pipes cross above flexible pipes to avoid deflection problems when the other lines are installed. A minimum of 1' separation is required. In some instances, the District may require the installation of ductile iron pipe at crossings.

When an area outside the tract or development can be logically served by extending the water main in future streets or easements, the pipeline shall be extended to the tract or project boundary or to the end of a paved street in a manner facilitating future extensions.

B. FIRE HYDRANTS

The Ventura Fire Department generally approves the location of fire hydrants. The District recommends that where possible a fire hydrant location correspond to that required for a blow-off structure. That is because a fire hydrant will serve as and actually perform better than a blow-off assembly.

Fire hydrants are generally located by the Ventura County Fire Department using the following criteria:

Type of Construction	Fire Hydrant Spacing
Residential Single Family	500 feet
Dwelling, duplex	
Commercial and Apartments	300 feet

Note: Fire hydrant to be no further than 150 feet from farthest corner of any building site. Plans are to be reviewed by the Fire Department to determine fire hydrant placements.

Fire hydrants shall be located a minimum of 2 feet behind the face of the curb as shown on **Plate W-28**, and in residential installations, shall straddle a property line where possible.

C. SEPARATION OF WATER AND SEWER MAINS

1. General:

Proper separation of wastewater and water systems is necessary to reduce the potential for outbreaks of waterborne diseases. Sanitary sewers may leak and saturate the surrounding soil with sewage. This is caused primarily by structural failure of the sewer line, improperly encasing conduit. A serious public health hazard exists when the water mains are depressurized and no pressure or negative pressures occur. The hazard is further compounded when, in the course of installing or repairing a water main, existing sewer enters into the water main. Additionally, if a water main fails in close proximity to a sewer line, the resultant failure may disturb the bedding of the sewer line and cause it to fail. In the event of an earthquake or man-made disaster, simultaneous failure of both conduits often occurs. The discussion below is excerpted from the criteria established by the Department of Public Health , State of California, Health and Welfare Agency.

2. Basic Separation Standards:

- Parallel Construction

  The Horizontal distance between pressure water mains and sewer lines shall be at least 10 feet.

- Perpendicular Construction (Crossing)

  Pressure water mains shall be at least one foot above sanitary sewer lines where these lines must cross.

- Common Trench

  Water mains and wastewater lines must not be installed in the same trench. When water mains and sanitary sewers are not adequately separated, the potential for contamination of the water supply increases. Therefore, when adequate physical

separation cannot be attained, increasing the structural integrity of both the pipe materials and joints should provide an increase in the factor of safety.

3. Exceptions to Basic Separation Standards:

Local conditions such as available space, limited slope, existing structure, etc., may create a situation where there is no alternative but to install water mains or sewer lines at a distance less than required by the Basic Separation Standards. In such cases, alternative construction criteria as specified in **Plate W-55** should be followed, subject to the special provisions outlined below. **Plate W-56** contains a thorough discussion of various cases where less than 10 feet separation would be allowed.

4. Special Provisions:

- Basic Separation Standards are applicable under normal conditions for wastewater (sewage) collection lines and water distribution mains.

- More stringent requirements may be determined by the Engineer and/or the District.

- Wastewater lines shall not be installed within 25 feet horizontally of a low head (5psi or less pressure) water main.

- In the installation of water mains or sewer lines, measures should be taken to prevent or minimize disturbances of the existing line. Disturbance of the supporting base of this line could eventually result in failure of this existing pipeline.

- If a water line must go under an existing sewer line, the new water line shall be installed to allow a 10' section to straddle the sewer line.

- Pipelines located within easements shall begin and end with a valve and shall be constructed of ductile iron pipe with restrained joints.

- Wastewater Force Mains

    a. Wastewater force mains shall not be installed within 10 feet (horizontally) of a water main.

b. When a wastewater force mains must cross a water line, the crossing should be as close as practical to the perpendicular. The wastewater force main should at least be one foot below the water line.

c. When a new wastewater force main crosses under an existing water main, all portions of the wastewater force mains within ten feet (horizontally) of the water main shall be enclosed in a continuous sleeve.

d. When a new water main crosses over an existing wastewater force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating and shall straddle the force main, 10' on either side of its joint.

2.5 LOCATION OF LINES in EASEMENTS

Easements should be avoided where a reasonable alternate solution exists. Unless there are either physical limitations or extreme economic penalties, water lines should be installed within streets. Another instance would be where a looped system of benefit to a particular zone can be gained through the use of an easement. When easements are required, there shall be careful consideration of how the line is to be maintained and/or replaced, if necessary. Where easements are necessary and where the slope (perpendicular to the pipe) exceeds 25 percent (1 vertical to 4 horizontal) then the plans shall clearly indicate appropriate contours within the easement.

In general, the line within the easement shall be accessible by conventional maintenance vehicles traveling over paved roads or driveways unless otherwise approved.

Service lines should be connected to a main line within an easement unless specifically approved.

A. Width:

Water easements for pipes up to 18 inches in diameter should normally be a minimum of 20 feet wide. However, additional easement width shall be required where the depths of pipe are excessive or where deemed necessary. The plans should clearly indicate any known block walls, pavements, trees or other obstructions within a proposed easement. Such items are contrary to the Districts policy and require special approval. Included with such approval may be monetary obligation towards the operation and maintenance of the

water line within the easement; also, the “As-Built” drawings shall indicate such approval and such installations.

B. Pipeline Location:

Pipelines shall generally be placed in the center of easements; only in unusual circumstances will a line be approved that is closer than 5 feet from the easement edge. Unless specifically otherwise approved, the line shall be straight without horizontal bends or deflections.

C. Easement Location:

The full easement width shall be on one lot or property in such a manner that walls, trees or permanent improvements will not obstruct access to the pipeline. Where this requirement cannot be met without interfering with the existing buildings, easements may straddle lot lines providing special approval is received and the water pipeline is not located on the lot lines

D. Deeds

Deeds for easements shall provide for restrictions of permanent construction with easement to provide ingress and egress for maintenance.

E. Easement Provisions:

Easements shall be provided as follows:

1. For Subdivision Tracts:

   The Owner of the land included within the subdivision shall offer to dedicate, for public use, the water easements so designated on the final map. Standard language is included in **Section 4.10**.

2. For Other Than Subdivision Tracts:

   Dedication of water rights-of -way shall occur by means of deeds of conveyance to the District for all dedications other than those dedications created by subdivision tract maps on a form and as approved.

2.6 DEPTH AND COVER OF WATER MAINS

The standard minimum depth of cover to the top of the pipe shall be 4 42 inches.

In achieving the above depths, it must be recognized that numerous grade changes to achieve r 42-inch depths of cover may not be desirable and the designer shall adjust the cover for a reasonable straight pipeline with a relatively uniform depth.

Increases in depth may be required where future road improvements could potentially remove some of the existing cover or where there are other conflicting utilities. Pipelines placed in open, unpaved terrain shall generally have a minimum cover of 42-inches.

2.7 LOCATION AND SIZE OF VALVES

The standard minimum depth of cover to the top of the pipe shall be 42 inches.

Valves shall be located at locations allowing for the isolation of particular pipe segments in the event repairs or replacements are needed. In general, all branches at major intersections shall be valved unless otherwise approved. Further, branches at minor intersections shall be valved when necessary to facilitate future repairs without causing multiple streets without water.

Longer reaches of pipelines shall require an in-line valve at intervals of no more than 1,000 feet except for lines 12” or larger, where valves shall be at intervals no greater than 750 feet. All valves shall be the same size as the pipeline.

Any valve deeper than 5 feet to the top of the nut, shall have extensions installed as shown on Plate W-27**.**

2.8 AIR AND VACUUM ASSEMBLIES

A. TYPES OF VALVES

1. Air release valves allow the discharge of air that accumulates at high points along the pipeline. The air is entrained in the water and when it accumulates at the high points, it creates throttling effect, as would a partially closed valve.

2. Air and vacuum valves allow large quantities of air to be expelled during filling and allow air to re-enter the pipeline during draining of the pipeline whether planned or due to rupture. These valves are located at high points along the line.

3. "Combination Air Release Valves" combine both the air release and air & vacuum valves described above and it is this type of valve that is generally specified in the District system.

B. LOCATION:

Combination air release valves shall be located at all significant high points along the pipeline as approved or required by the District.

C. SIZING:

In order to somewhat simplify the selection of the combination of air release valves, the following is provided as guidelines for determining the size:

1. Determine the maximum rate of flow that can occur in the line:

Rate in CFS = GPM under filling conditions
7 x 60

Rate in CFS = 0.087 (SD5) ½ under draining conditions

S = Slope or gradient (ft. per second)

D = Diameter of pipe in inches

2. Using the value in "1" above, the size should be:

CFS Rate	Valve Size
0-5	1"
5-15	2"

3. For most installation involving 8-inch pipelines, the valve will be 1" size. **Plates W-33 and W-34** illustrates typical installations.

4. For steel pipelines a further consideration is the collapsing pressure and the designer should investigate this in accordance with manufacturer's instructions.

2.9 BLOW-OFF ASSEMBLIES

A. GENERAL:

Blow-off assemblies are placed at low spots in the line to facilitate line draining and to allow the removal of sediment that accumulate in low areas of the pipeline.

Plates W-30, W-31, and W-32 shows 2- inch and 4-inch assemblies respectively. Also, fire hydrants perform the same functions as a blow off and therefore are an approved substitute, providing a bottom outlet tee is used to connect to the mainline (see Section 3.11). Design Engineers are encouraged to utilize fire hydrants as blow-offs when appropriate.

B. SIZING:

Blow-offs should be sized according to the following criteria:

1. In general, particular section of pipeline should be capable of being drained within 2-4 hours.

2. The Blow-off should be capable of creating a velocity of not less than 2.5 fps in the pipeline for the removal of sediments. For typical pressures between 45 and 100 psi, this velocity can be created by the following:

TABLE 2-8

Pipe Size	Blow-off size
6”	2”
8”	2” or 4’ **
10”	4”
12”	4”
Above 12”	By special design

** Two- inch (2”) blow-offs can be used unless the reach being drained is extensive where a 4” blow-off is desirable.

2.10 DESIGN FOR PROPER FLUSHING

Proper flushing of water mains and the prevention of sediment buildup are important aspects of the District’s maintenance program:

A. Unnecessary intermediate low points in the lines should be eliminated whenever possible to prevent spots for sediment accumulation.

B. The flushing techniques mentioned in **Sections 9.3 and 9.4** should be followed.

C. Fire hydrants are encouraged as an alternative for blow-offs.

D. When appropriate, looped systems are preferable to dead end systems providing unacceptable easements are not required for the looping.

2.11 HORIZONTAL AND VERTICAL CURVES

A. GENERAL:

In curved streets, the water line shall generally follow the street curvature, while not crossing the centerline. Allowable joint deflections shall be the more stringent of those set forth below and the manufacturer's recommendations. Where there is grade break exceeding the allowable deflections in a coupling or joint, then appropriate fittings will be required or a vertical curve should be use in lieu of the grade break.

B. PVC (AWWA C900)

The standard laying lengths for PVC pipe are 20 feet. The pipe must not be bent to a lesser (tighter) radius than the minimum shown below:

TABLE 2-10

Nominal Pipe Size in Inches	Minimum Radius of Curve
6"	175'
8"	225'
10"	275'
12"	325'

C. STEEL PIPE:

With bell and spigot type steel pipe, the maximum allowable deflection per joint shall be limited to 2-1/2 degrees. Using that value and standard lengths as follows, the minimum radius of curvature would be:

TABLE 2-11

Normal Pipe Size	Minimum Radius of Curvature	
	For 40’ Length	For 20’ Length
8” - 18”	920’	460’

Obviously, for a tighter radius either shorter lengths must be used or fittings must be installed.

D. DUCTILE IRON PIPE:

The maximum allowable deflection shall be:

TABLE 2-12

Pipe Size	Total Deflection
6” - 12”	4 degrees
14” - 18”	3 degrees

And when using standard laying lengths of 18 feet, the minimum radius of curvature would be 260 feet and 345 feet for 6” to 12” pipe and 14” to 18” pipe, respectively. If fewer radiuses is needed or if the degree of curvature is tighter than can be achieved with standard length pipe and the coupling limitations as outlined above, then shorter lengths may be used as illustrated below:

TABLE 2-13

Nominal Pipe Size in Inches	Max. Allowable Deflection	Minimum Radius of Curvature in Feet Without Using Deflection Couplings For Pipe Length		
		3.25’	6.25’	13’
6 to 12	4 degrees	45	90	180
14 to 18	3 degrees	67.5	135	270

If changes in grade or alignment cannot be accomplished with the use of couplings, then standard fittings are available with bends of 90, 45, 22 ½ or 11-¼ degrees.

2.12 **PROPER SIZING OF WATER METERS AND SERVICE LINES**

A. GENERAL:

Two excellent references for discussion of water meter sizing published by the American Water Works Association (AWWA) as follows:

AWWA Manual M6 "Water Meters- Selection, Installation, Testing and Maintenance".

AWWA Manual M22 " Sizing Water Service Lines and Meters".

As a guide, the information below has been excerpted from those publications.

B. METER TYPES:

The positive–displacement, piston or disc-type meter, is the most widely used meter because it is adaptable to residential and other customers who experience long periods when no water is used. Current and propeller meters are suitable only when the water usage is without low flow periods in which the flow will not register; as such, they require special approval. Compound meters are a combination of the positive-displacement and the current type meters and have lower head and maintenance requirement and must be carefully selected to provide economical service.

TABLE 2-12

SUGGESTED USES FOR EACH TYPE OF METER CLASSIFICATION (AWWA)

Meter Type	Suggested Use
Positive-displacement meters ¾" to 2"	Customer with normal demands Residential, small to medium apartments, small businesses, filling stations, restaurants, barber shops
Propeller–meters (strainer required) (usually turbine) 2" – 12"	Large hotels and motels, customers requiring high demands, or continuous flow. Some manufacturing, refineries, petrol-chemicals
Compound Meters 2" to 10"	Most commercial and industrial, medium hotels and motels, special customers having high demand and low demands, schools, Public buildings, laundries,

C. Meter Sizing:

Water meters are designed to deliver a maximum flow for short periods of time with a lower flow capacity for sustained usage without damage or above normal wear occurring to the meter. The selection of the type and

size of the meter should be based only on the flow requirement and the type of use- not on the pressure loss through the meter.

If there is a known expansion program or increased meter usage can be anticipated in the future, then provision should be made for larger facilities in the future. When this occurs, the meter should be installed for the needs at the time but also with a meter box and connections that are adequate for future requirements.

It should be remembered that the District would select the meter type; however, as a guide in determining the meter size, Table 2-13 can be used. Notes for that Table include:

1. AWWA recommends that the continuous flow service in the meter not exceed 30% of the maximum capacity.

2. AWWA further recommended that for design purposes the maximum capacity be valued at 80% of the rated capacity.

TABLE 2-13

Service Line	Application	Meter Size	Meter Description	Low Flow GPM*	Normal Flow Range GPM	Maximum Rating GPM
1”	Residential	¾”	Positive Displacement	0.25	1-10	20
1”	Residential	¾”	Positive Displacement	0.5	2-15	30
1”	Residential	1”	Positive Displacement	0.75	3-25	50
1”	Residential	1-1/2”	Positive Displacement	1.5	5-50	100
2”	Irrigation	1-1/2”	Positive Displacement	1.5	5-50	100
2”	Irrigation	2”	Positive Displacement	2	8-80	160
2”	Irrigation	2”	Turbo (or propeller)	3	4-160	200
4”	Irrigation	3”	Turbo (or propeller)	4	5-350	450
4”	Irrigation	4”	Turbo (or propeller)	10	15-1,000	1,250
2”	Commercial & Institutional	2”	Compound	¼	2-80	160

	(no fire)					
4”	Commercial & Institutional (no fire)	3”	Compound	½	4-160	320
4”	Commercial & Institutional (no fire)	4”	Compound	¾	6-250	500
6”	Commercial & Institutional (no fire)	6”	Compound	1.5	10-500	1,000
6”	Commercial & Institutional (Private Line)	6 x 3”	Double Detector Check	½	16-1,600	1,600
6”	Commercial & Institutional (Private Line)	6”	Double Detector check w/ 3-2” compounds in tandem	½	12-480	2,560

Notes:

1. B/F = Backflow Device
2. In high-pressure areas for residential use, a ¾” service may be used.
3. * At 95% accuracy

Pressure losses through the meters may be illustrated as follows:

TABLE 2-14

METER TYPE	PRESSURE LOSS (PSI) @ DESIGNATED FLOW	
	30% OF MAX. CAPACITY	80 % OF MAX. CAPACITY

Displacement	0.5 - 1.1	6.3 – 8.6
Compound	2.5 – 4.2	5.8 – 8.9
Turbo or propeller	0.7 – 1.2	2.0 – 3.0

The sizing of the meter is dependent upon the correct establishment of a maximum flow rate. In this regard, Chapter 4 of AWWA Manual No.22 can be consulted. In general, the meter should not be oversized and for all but residential or small commercial structures, the Developer's Engineer should check such items as fixture units and landscape irrigation in arriving at the proper meter size.

D. SERVICE LINE SIZING

Proper service line sizing is a function of the maximum anticipated flow rates and the allowable pressure loss for adequate pressure. If pressure to the structure is questionable or if flows are anticipated to increase in the future, it is better to oversize the service line than to oversize the meter. As a guideline for the smaller installations the following service lines should be used with the respective meters:

TABLE 2-15

METER SIZE IN INCHES	SERVICE LINE SIZE IN INCHES*
¾	1" copper
1"	1" copper
1-1/2"	2" copper
2"	2" copper

1. Of course, larger sized than that shown could be used if justified hydraulically.

E. FIRE METERS

Traditionally, in most commercial and multi-family residential developments, two complete water systems are installed. One system handles indoor and outdoor domestic water demands, while the second system connect to fire sprinklers and/or private fire hydrants. Becoming more popular is the installation of a single system that serves both purposes. These systems are approved by the District on a case-by-case basis and are up to the District's discretion. If a single system is approved, the developer shall install a fire meter assembly that includes a Factory Mutual (FM) and Underwriter Laboratory (UL) approved fire meter of the appropriate size along with the appropriate size domestic meter for normal

and low flow conditions. The meter shall be equipped with the appropriate strainer. The size and location must be approved by the District.

In order to judge the pressure loss through the service line, the following Table can be used:

TABLE 2-16

SERVICE LINE SIZE IN INCHES	FLOW RATE (GPM) 5	10	20	50
1" copper	1.12	4.04	14.51	79.0*
2" copper	0.04	0.15	0.54	2.93

- *Obviously excessive but shown for illustration
- In using the table above, remember that the losses are for 100 feet of pipe and most service lines will be shorter.

2.13 **LOCATION OF METER BOXES, FIRE HYDRANTS AND AIR RELEASES**

A. METER BOXES:

These shall be located as shown on **Plate W-42**. Meter boxes shall not be located in driveways, equestrian trails, etc.,unless authorized by the District's Engineer.

B. FIRE HYDRANTS:

These shall be located at least 2' behind curb per **Plates W-28 and W-29**.

C. COMBINATION AIR RELEASE ASSEMBLIES:

Locate these per **Plates W-33, W-34**, and similar to Meter Box locations per **Plate W-42**. Strive to minimize the visual impact by locating them near property lines rather than in the middle of the front yard area.

D. POLICY ON IRRIGATION METERS:

Where the parkways or side landscaping strips along the streets are to be irrigated, a separate meter must be installed on each side of the street. In such cases, running an irrigation line from the meter to the other side of the street is not allowed.

Where a center median strip must be irrigated, the meter shall be located in the side parkway.. The District reserves the right to select all meter locations.

2.14 **STRUCTURAL REQUIREMENTS**

A. UNDER ROADS:

All structures and pipe placed under public roads shall be of sufficient strength to support with an adequate factor of safety for the backfill, road surfacing and H-20 loading per AASHTO Standard Specifications (truck loading with impact). The City or County who has jurisdiction over the project area may specify higher loading.

B. OTHER PIPES AND STRUCTURES:

Water lines designed to cross under or over other pipes or structures shall be protected from damage and shall be constructed to prevent endangering the other pipe or structure. In this regard, particular attention should be given to the possibility and prevention of settlement-cause damage. Also, where future replacement of any line may be extremely difficult due to the pipe or structure, special design consideration may be required. Any of the plates, that detail various encasements or other protection, may be required in such instances.

C. FLEXIBLE JOINTS:

Flexible joints that will allow for different settlements or other movement of water pipe lines or structures, adjacent pipe and adjacent structures shall be provided where water lines enter encasements or other structures. Flexible joints shall be within a minimum of 24” of such structures unless otherwise approved.

D. THRUST BLOCKS:

These are required in the following locations:

1. At abrupt changes in grade or alignment requiring tees or elbows.

2. At changes in pipe size

3. At dead ends of lines

4. At locations subject to sudden thrust, such as valves.

Plates W-1 through W-6 present dimensions and details for thrust blocks

E. STEEP GRADES:

Water lines laid on grades steeper than 10 %, that are not under, nor intended to be under pavement should be examined for possible erosion protection. Where the slope exceeds 35% (1.43 horizontal to 1 vertical) a redwood check dam **Plate W-9** shall be installed across the trench line at an interval of 20 feet to reduce erosion.

Slopes above 35% (1.43 to 1 vertical) shall require concrete slope protection to be placed along the trench line at intervals specified in **Plate W-8** to reduce the flow of water within the pipe trench.

Where steep grades are present, ML&C steel pipe with welded joints may be preferable because of thrust considerations. Pipe without welded joints would require substantial anchorage to prevent separation.

F. DESIGN FOR EARTH LOADS:

Generally, because of the pipe materials specified and the relatively shallow depths of cover, specific design for earth loads is not necessary. Therefore, the subject will not be covered in any detail in these standards. However, the Engineer should be aware of the following sources of information:

- AWWA Manual No, M-11 covering steel pipe in all size ranges.
- AWWA Standard C900 covering PVC pipe in sizes 4" to 12"
- AWWA Standard C905 covering PVC pipe above 12"

2.15 SPECIAL CONSIDERATIONS FOR WELDED STEEL PIPE

Where joints are welded, it is possible to eliminate or reduce thrust blocks providing that the steel pipe is not over stressed or the shear resistance by the soil to pipe movement is less than the thrust it is trying to resist. The subject matter is rather complex and will not be discussed in detail.

As a special note, with steel pipe, the deflection must not exceed 2% of the diameter as a result of both live and dead loads. This is to prevent the mortar lining and coating from cracking.

2.16 FIRE SERVICE LINES

Fire service lines are those lines from the main to the building intended solely for fire protection such as fire sprinklers. The District has the jurisdiction for the

design and inspection up to the double-detector check backflow prevention assembly that must be placed on the fire service line. The materials for these lines should be either PVC or ductile iron pipe underground and ductile iron pipe above ground. The most commonly used sizes are 4", 6" or 8". Section 12 covers the requirements for the backflow prevention devices (detector check).

SECTION 3.0

MATERIALS

3.1 GENERAL REQUIREMENTS

This section discusses the materials involved in water pipeline systems and associated construction activities. The materials selected have been chosen for their strength, durability, and ease of maintenance. All materials, unless specifically approved otherwise, shall be new and unused.

Where applicable, American Water Works Association (AWWA) or other standards have been referenced and it shall be the responsibility of the Developer/Engineer/Contractor to be familiar with those standards to ensure compliance. Titles corresponding to the specific numbers are given in the reference section of the standards.

In some instances, particular manufacturers and product names have been mentioned as being approved for the benefit of providing some degree of standardization. Other products may also meet the requirements, but must first be approved in writing by the District
If at any time the District believes that the use of a specific product must either be halted or changed, the District has the authority to make the change providing the decision is based upon an engineering, performance, or maintenance evaluation.

3.2 TESTING AND FINAL ACCEPTABILITY OF MATERIAL

The District shall require such tests and certifications as deemed necessary to show that the specified materials have been employed. Notwithstanding prior to factory or yard inspections, the District shall have the right to reject any damaged or defective materials found on the job that will affect the durability or performance of the installation and order its removal from site.

3.3 MAIN LINE PIPE MATERIALS

Generally accepted main line pipe materials consists of either polyvinyl chloride (PVC), steel (ML &C) or ductile iron pipe (DIP) as described in this section. While the District has many miles of Transite (A/C, Asbestos-Cement) pipelines within its distribution system, this product is no longer acceptable for use in new construction anywhere in the District for the purpose of transporting water. It is not hazardous when used in this manner, however, the cutting and milling involved in its installation releases fibers into the surrounding atmosphere creating an unsafe working environment.

A. PVC PIPE:

1. PVC pipe shall conform to the quality and strength requirements of AWWA C900, which covers PVC pipe in sizes 4" –12" and C905 for sizes greater than 12". Each standard or random length of pipe shall be clearly marked with the following:
    - Nominal size and O.D. base , i.e. 6" cast iron pipe size
    - Material code "PVC 1120"
    - AWWA pressure class i.e. PC150
    - AWWA designation "AWWA C900 or C905"
    - Manufacturer's trade name and production record code.
    - Seal (mark) of testing agency

    The standard laying length shall be 20 feet (plus/minus) 1 inch in all classes and sizes. A maximum, of 15 percent may be furnished in random lengths of not less than 10 feet each.

    AWWA C900 & C905 pipe has the same outside (O.D.) as that of a ductile iron pipe (D.I.P.) in the sizes furnished.

    One gasket shall be furnished with each length of elastomeric-gasket bell-end pipe and two gaskets shall be furnished with each coupling where couplings are used.

    Pipe surfaces shall be free from nicks, scratches, fading, and other blemishes. The joining surfaces of pipe spigots and of integral bell and sleeve reinforced bell sockets shall be free from gouges or other imperfections that might cause leakage.

    Approved manufacturers include Certainteed, JM Eagle, and Vinyltech.

2. Joint Mechanisms:

    The joints shall be either of the following:

    - Integral wall-thickened bell end (bell and spigot with rubber gasket).
    - Integral sleeve reinforced bell end.
    - Elastomeric gasket couplings.

    PVC solvent cement joints are **not** approved for use within this District.

3. Couplings and Fittings:

Where couplings are used, they shall meet the requirements of AWWA C900 and C905. Couplings shall be as furnished by the manufacturers. Couplings shall be marked with the same information as the pipe.

Ductile Iron fittings can be used with PVC pipe and these are discussed in Section 3-4.

4. Physical Test Requirements.

   Hydrostatic, burst, and sustained pressure and crushing tests shall be conducted at the factory in accordance with AWWA C400. All testing shall be done by a recognized testing laboratory with such testing available for inspection by the District. If required, the manufacturer shall supply a letter of certification attesting to their pipe meeting these specifications.

5. Because PVC is non-conductive and subject to more damage if struck by excavating equipment, a detectable ribbon at least 3" in width, 5 mil, blue in color, with the legend "Waterline Buried Below", or similar, shall be installed a minimum of 12" but no greater than 24" above the pipeline.. Approved Manufacturers are Northtown, Christy's, Mutual Industries, Pro-Line, Empire Magnatec, Terra Tape, or other approved equal.

   The hydrostatic proof test for every piece of pipe shall be as follows:

CLASS	SUSTAINED PSI
DR 18 or Class 235	800
DR 25 or Class 165	600

6. PVC pipe delivered to a job site that appears to be faded or "sun-burned" shall be rejected.

B. <u>STEEL PIPE:</u>

1. Pipe.

   Steel pipe shall conform to the quality and strength requirements of AWWA C200 or as specified below. That standard pertains to electrically butt-welded straight-seam or spiral–seam pipe and to seamless pipe 6" in diameter or larger.

   The steel shall conform to one of the following:

TABLE 3-2

Specification	Grade	Minimum Yield Point (psi)
ASTM A238	C	30,000
	D	33,000
ASTM A570	30	30,000
	36	36,000
	40	40,000
	45	45,000

The stress in the steel pipe shall not exceed the higher of 15,000psi or one-half the designated working pressure except that the following minimum thickness shall be used:

TABLE 3-3

Normal Inside Diameter Inches	Minimum Thickness Inches	Maximum Pressure* For Thickness Specified PSI
8”	0.105	394
10”	0.135	405
12”	0.135	338
14”	0.135	389
16”	0.135	253
18”	0.179	298

*Assuming 15,000psi stress and the formula below:

$P = \frac{2st}{D}$ where

P = Pressure (maximum working)
S = Allowable stress (15,000psi or one-half yield)
T = Pipe wall thickness (inches)
D = Outside diameter (inches)

The gages specified above consider the thickness required for welding as well as that required for external loads and a corrosion allowance.

Another factor for consideration in some steel lines is earth loads, AWWA Manual M-11 and Section 2.14 of these standards should be consulted in this regard.

The pipe shall be essentially round. The outside circumference shall not vary more than 1.0 percent from the nominal outside circumference based

upon the diameter specified (except for the ends which are discussed below)

The pipe shall not deviate by more than 1/8 inch from a 10 ft long straight edge held against the pipe.

The pipe lengths, generally 40 feet long, shall be furnished with a tolerance of (plus/minus) 2 inches. Random lengths shall be furnished in lengths averaging 29 feet or more, with a minimum of 20 feet.

2. Pipe Ends:

   Various end treatments can be supplied as discussed in AWWA C400 and briefly listed below:

   - Ends for mechanical coupled field joints. These are the plain, grooved or banded.
   - Ends for lap joints for field welding. These shall have a bell end pressed or rolled without hammering. The surfaces shall be ground smooth. Joints shall permit a lap when the joint is assembled of at least 1-1/2 inches.
   - Plain end pipe. These shall have a plain end right angle cut.
   - Beveled ends for field butt-welding. These, where specified, shall have a bevel, which is 30 degree (+5 degree – 0 degree) when measured from the pipe axis.
   - Ends fitted with butt straps for field welding. The butt straps may be made in halves or as complete cylinders.
   - Bell and spigot ends with rubber gaskets. These shall have bell ends that are made without hammering. Spigot ends shall be formed or fabricated to the required shape to retain the gasket. The gasket shall be designed and fitted as the sole element dependent upon to make the joint water-tight. The gasket shall meet the requirements of AWWA C400.
   - Plain ends fitted with flanges.

The allowable tolerance at pipe ends is discussed in AWWA C400 and summarized below:

- For bell and spigot: clearance between O.D. of spigot and I.D. of bell shall be between 0.2 – 0.06 inches.
- For lap joint: I.D. of bell shall be 1/32 - 3/16 inches greater than O.D. of spigot.
- For plain ends (incl. beveled or butt straps or flanges): O.D. within 4 inches of end shall be –1/16 inch or + 1/8 inch from specified O.D.

3. Hydrostatic Tests:

Each pipe shall be tested by the manufacturer to a pressure not less than that determined by:

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

Where S = 0.75 times the minimum yield strength of the steel and other items are as discussed earlier.

4. Mortar Lining and Coating (ML &C):

Unless otherwise approved or as revised below, all steel pipes shall be mortar lined and coated in accordance with AWWA C205, which covers shop applied lining, and the lining holdback shall be as specified for the particular type of joint.

TABLE 3-4

CEMENT MORTAR LINING THICKNESSES

NORMAL PIPE SIZES INCHES	LINING THICKNESS INCHES	TOLERANCE INCHES
6”-10”	5/16	-1/16 + 1/8
12”- 16”	3/8	-1/16 + 1/8
18”+	½	-1/16 + 1/8

It should be noted that the District requirements for thickness exceed those of the AWWA standard. Also, it should be noted that no wire fabric reinforcement is required for any lining of specials less than 24-inches in diameter.

Mortar Lining:

Cement mortar lining shall be uniform in thickness except at joints or other discontinuities. Ends of lining shall be left square and uniform and the lining holdback shall be as specified for the particular type of joint.

TABLE 3-5

CEMENT MORTAR COATING THICKNESS

Normal Pipe Size Inches	Coating Thickness Inches	Tolerance Inches
6” – 10”	½	-0 + 1/8
12” – 16”	¾	-0 + 1/8
18”	1	-0 + 1/8

It should be noted that the District’s requirements exceed those of the AWWA standard.

Reinforcement for the coating of pipe section shall be one of the following as specified by the supplier:

- Spiral wire - 15 gage @ max. 1-1/4 in. spacing with wire meeting ASTM A82
- Wire fabric - 2 x 4 steel wire mesh, 13 gage each way meeting ASTM A185
- Ribbon mesh - 1 x 1 mesh of 18 gage wire or 1- ½ x 1- ½ mesh of 17 gage wire, all meeting ASTM A82

5. Field Joints:

   The materials and construction methods for field joints shall be as discussed in Section 7.

6. Electrically Bonded Connections.

   Two metal jumper rods are required to form an electrically boned connection between all steel pipe joints that are not welded, except at insulating coupling called for on the plans.

   The jumper rods shall be either 3/8” diameter rods or ¼ “ x ½” bars. They shall be at least 7 inches long with an offset of ¼ inch in the middle 3 inches. No welding shall take place in the middle 3 inch section.

7. Factory Tests and Inspection:

   All materials shall be inspected and tested in a normal air-dry condition by the manufacturer prior to shipment for conformance to the stated requirements. The District shall at all times have the right to inspect the work and materials in the course of manufacture and make or witness such tests are required in these specifications, or as deemed advisable. In lieu of the preceding, the manufacturer shall upon request submit a certificate certifying that the materials meet the requirements of this Specification. All testing will be done in recognized testing laboratories within the State of California.

8. Welded Joints:

One of each section shall be swaged out to form a female or bell that shall permit the male or spigot end to enter approximately one-inch with a clearance of approximately 1/32-inch. The spigot end shall be "sized" to permit it to enter the bell end of the adjacent section and the weld bead shall be ground flush for the distance it is to enter the bell-end.

9. Butt Strap Closures:

The butt straps shall be the same thickness as the pipe wall but not less than 10 gage, at least 10 inches wide and rolled to fit the outside cylinder diameter, and shall be centered over the ends of the pipe sections they are to join. A standard 5-inch pipe half coupling handhole shall be shop welded to the top section of the butt strap to permit access for mortar lining the inside of the joint. The coupling shall be sealed with a standard 5-inch plug field welded to the coupling. The butt strap shall then be covered in wire mesh and mortar coated.

C. Ductile Iron Pipe

1. Pipe:

The pipe shall conform to AWWA C151 for both quality and strength. Each pipe shall include the letters "DI" or word "DUCTILE" to indicate the pipe material.

2. Joints:

These shall be of the rubber gasket push-on joint type conforming to the requirements of AWWA C111 and being the "TYTON" type. Where restrained joints are required, Field Lok gaskets are an approved product.

3. Fittings:

All fittings shall conform to AWWA C110.

4. Lining and Coating:

Unless otherwise approved, the internal surfaces shall be lined with a uniform thickness of cement mortar and then sealed with a bituminous coating in accordance with AWWA C104.

5. Encasement:

The outside surface shall be protected with polyethylene encasement furnished and installed in accordance with AWWA C105.

3.4 MAIN LINE FITTINGS

A. Ductile Iron Fittings:

These fittings shall meet the requirements of AWWA C110. All fittings shall be rated for 250 PSI. This standard covers all, but is not limited to fittings with combination of ends including mechanical joints, plain end, flange, push joint. The fitting types are as follows: 90º ell, 45º ell, 22½º ell, 11¼º ell.Tees and crosses, reducers, caps and plugs, connecting pieces, flanged bends, flanged tees and crosses, flanged reducers.

Ductile–iron compact fittings, per AWWA C153, are not allowed.

It should be understood that care must be exercised to not mix mechanical and flange joint ends since they will not mate. Section B discusses flange requirements. Fitting manufacturers must own their own facilities.

B. Flanges, Bolts, Nuts, and Gaskets:

They shall be flat-faced and meet the requirements of AWWA C207 and should be AWWA standard steel hub flanges, Class E (275 psi) (these flanges meet ANSI B-16.5). The flanges shall be marked with the size, name or trademark of manufacturer and with the AWWA class, i.e. “E”

Bolts and nuts shall be stainless steel type 316 or better and shall be coated with an anti-seize lubricant during installation.

Gaskets shall be of the drop-in gasket type, 1/8” thick.

TABLE 3-5

PIPE SIZE	BOLT HOLE DIA.	BOLT DIA.& LENGTH	NO.OF BOLTS
6”	7/8”	¾” x 3-1/2”	8
8”	7/8”	¾” x 3-1/2”	8
10”	1”	7/8” x 4	12
12”	1”	7/8” x 4	12
14”	1-1/8”	1 x 4-1/2”	12
16”	1-1/8”	1 x 4-1/2”	16

18”	1-1/4”	1-1/8 x 5	16

The inherent problem with flanges is that they are rigid and do not provide flexibility. Two keys to their installation are:

- Uniform tightening of bolts
- Prevention of bending or tensional strains

Proper anchorage is important to meet the latter objective.

C. Mechanical Joint Fittings:

This is a bolted joint of the stuffing box type. Each joint has a bell provided with an exterior flange having bolt-holes or slots, and a socket with gaskets to receive the plain end of the pipe or fitting. The joint also has a sealing gasket, follower gland with bolt-holes and fitted with tee-head bolts with hexagonal nuts.

The mechanical joints shall meet AWWA C111. That standard covers the joint as well as gaskets and bolts.

TABLE 3-6

Pipe Size Inches	No. of Bolts	Bolt Diameter & Length Inches
6	6	¾ x 3-1/2
8	6	¾ x 4
10	8	¾ x 4
12	8	¾ x 4
14	10	¾ x 4-1/2
16	12	¾ x 4-1/2
18	12	¾ x 4-1/2

D. Flexible Couplings:

These are designed to connect plain end pipes with a mechanical compression joint to provide a stress relieving, flexible, leak proof joint. They can be ordered in steel or ductile iron pipe sizes (note: C900 PVC pipe has the same O. D. as ductile iron). The couplings shall either be Smith Blair Series 411 or Romac 501 and fitted with 316 stainless steel bolts. The center barrel length for pipe sizes greater than 8” shall be minimum 14”. All couplings shall be lined and coated with fusion bonded epoxy in accordance with AWWA C213.

E. Transition Couplings:

These are used to connect pipes of the same nominal size but different materials. AC, Steel and PVC pipes can be connected to one another. Approved are Smith Blair 442 Omni Long Sleeve transition couplings and fitted with 316 stainless steel bolts. All couplings shall be lined and coated with fusion bonded epoxy in accordance with AWWA C213.

F. Flanged Coupling Adapters:

These are used to connect plain end pipe to flanged valves, pumps, meters, etc. They eliminate the need for both a flanged spool and coupling. Generally, they are available in sizes through 12 inches. Approved are Smith Blair 912 Omni ductile iron coupling adapters and fitted with 316 stainless steel bolts. All couplings shall be lined and coated with fusion bonded epoxy in accordance with AWWA C213.

G. Insulating Couplings:

These are used to stop the flow of electric current across the joint by means of an insulating boot. Approved are Rockwell Series 438 and Dresser Style 39 insulating couplings and fitted with stainless steel bolts.

H. Special Steel Pipe Fittings:

AWWA C208 covers special fittings such as elbows, tees, crosses, reducers, etc., and should be consulted for a specific application.

3.5 BOLTS and NUTS

ALL bolts and nuts that will be installed and buried underground shall be 316 stainless steel or better. The only exception is for fittings where stainless steel bolts and/or nuts are not an option. This may include but is not limited to: Meter flange bolts, flanged fittings, transition and flexible couplings, tapping sleeves, gate valve bonnet bolts, and any other situation where required. Refer to the first sentence of this section (3.5).

3.6 SERVICE LINE MATERIALS AND FITTINGS

The materials covered in this section include the service line pipe, corporation stop and saddles as well as the valves inside the meter box. Where specific manufacturers' products are listed, it should be understood that other products, that are equivalent, might be used if approved in writing. Also, see **Plates W-36 through W-50** for typical installations and Section 2.12 and 7.10 of these standards for design and construction considerations. This section is written as the minimum service line size is 1". Service line fittings shall comply with California Law AB 1953 limiting the amount of lead.

Bolts and Nuts used in all meter installations shall be 316 Stainless Steel or better.

Meter Gaskets shall be constructed of 1/8" thick neoprene rubber and shall be the full-face type for all meters 1½" and larger.

A. COPPER PIPE:

Copper pipe material is the only material approved for all service lines from 1" through 2". The pipe shall be Type "K" soft copper tubing. Type "K" rigid may be used if the situation warrants (eg. pushing through an under pavement bore-hole). Soldered fittings shall be joined with solder containing no lead; instead, it shall be a blend of silver, copper, and phosphorous.

B. SERVICE SADDLES:

These shall be of the double or single strap type made of bronze with bronze nuts or stainless steel strap with stainless steel lugs. The thread shall be corporation (tapered thread) except in the case of a new tap on a steel pipe where an armored extra-strong half-coupling shall be used and a corp. with I.P. threads. Service saddles for 1" through 2" service lines connecting to C900 PVC pipe shall be James Jones J-969, Ford 202BS, or Mueller BR2S. Service saddles connecting to AC or ductile iron pipe shall be James Jones J-979, Ford 202B, or Mueller BR2B .

C. CORPORATION STOP:

These shall be bronze with a corporation thread on the inlet side (see exception in section B above) and flared fitting on the outlet. One-inch through 2" stops shall be ball type corporation stops. The outlet for the pipe sizes shown below shall be as follows:

TABLE 3-9

Service Pipe	Corp Stop Outlet	Corp Stop
1" copper	Compression	James Jones – J-1937SG Ford - FB1000-4-NL
1-1/2" copper	Compression	James Jones –J-1930 Ford – FB1000-X-NL
2"	Compression	James Jones – J-1930 Ford – FB1000-X-NL

D. ANGLE METER STOP:

These shall be bronze and in the 1-inch size they shall be standard 90-degree angle meter stop. In 1½" and 2" size they shall be a flanged 90-degree angle meter stop. Refer to the following table:

Note Change below table to BFA Ball Versions

TABLE 3-10

Service Line	Angle Meter Stop	Inlet	Outlet	Type
1" copper	Standard	Compression	Meter Coupling Nut	James Jones J-1963SG Ford KV43-444W-Q-NL
I½" copper	Flanged Angle	Compression	Flanged	Jones J197SG Ford FV43-666W-G-NL
2"	Flanged Angle	Compression	Flanged	Jones J-1975SG Ford FV43-777W-G-NL

E. CUSTOMER HAND VALVE:

These are to be bronze ball valves with a customer handle. The outlets are always female iron pipe threads. Refer to the table below.

TABLE 3-11

Meter Size	Inlet	Outlet Size (Customer Side)	Type
¾" & 1"	1" meter coupling nut	1"	Jones-J1908 Ford- B13-444W HB34
1-1/2"	Flanged	1-1/2"	Jones-J1913W Ford- BF13-666W HB67S
2"	Flanged	2"	Jones-J1913W Ford BF13777W HB67s

F. POLYETHYLENE SLEEVE

Due to the corrosive nature of local soils, a protective polyethylene sleeve, as manufactured by the Northtown Company as Polywrap-C or an approved equal, shall be installed over the copper service line on all sizes from 1" to 2". It may be clear or blue in color and shall encase the service line from the corp stop to the angle meter stop in one continuous piece. It shall be attached to both the corp and the angle meter stop by using PVC Tape Wrap, Duct Tape or other suitable adhesive tape.

3.7 METER BOXES

The meter boxes for ¾", 1", 1½" and 2" meters shall be constructed of a synthetic material such as the Polyethylene and Polymer Concrete composite manufactured by the Armorcast Products Company, or an approved equal, with a composite cover. The cover shall be one-piece for the ¾" and 1" meter box, and a two-piece cover for the larger box with a rectangular reading lid. A **1¾" hole bored through** the cover near a corner of the solid lid for the smaller meter box and the cover, not the reading lid, of the larger box. This hole is for the installation of an automated meter reading interface module. For installation of meter box see 7.14(B). The dimensions for each acceptable meter box are as follows:

TABLE 3-12

Meter Size	Box Inside Dimensions	Model Numbers
¾" or 1"	Synthetic Composite 12" x 20" x 12"	**Armorcast Rotocast #P6000485** w/ A6000848 one-piece cover, or approved equal.
1½"	Synthetic Composite 17" x 30" x 12"	**Armorcast Rotocast #P6001534X12** w/ A6001643DZ-H1 two-piece cover and lid, or approved equal.
2"	Synthetic Composite 17" x 30" x 12"	Same as for 1½" Meter

Traffic lids are not generally approved since the meter boxes should be placed outside the traveled right-of-way, including driveways. Where no other alternative is available and the meter box will be in the traveled right-of-way, then an approved traffic rated lid and a traffic rated meter box shall be used. Contact the District for approved alternates. The angle meter stops and customer hand valves that are placed inside the meter box are discussed in the previous section of service lines.

The District crews will install the meter. A temporary PVC jumper shall be installed pending installation of the meter.

3.8 WATER METERS

Water meter type and manufacturers shall be selected and installed by the District. Section 2.12 discusses general meter types.

3.9 MAIN LINE VALVES

A. BUTTERFLY VALVES:

1. General:

   Butterfly valves shall be tightly closing, rubber seated valves conforming to AWWA C504. Valves must be Class 200-B designed for tight shut-off up to 200psi. Valve disc shall rotate 90 degrees from fully open to tightly closed position and may be used on any sized application of 4" and larger.

2. Valve Body:

   Shall be ductile iron with integrally cast mechanical joint ends, pipe flanged ends or push-joint ends. The disc shall be constructed of ductile iron ASTM A536, Grade 65-45-12.

   The valve shall have a rubber seat made of EPDM which is an integral part of the valve body. The valve shaft shall consist of one-piece units extending through the discs of 18-8 stainless Type 303 or 304. Shaft diameter shall be in accordance with AWWA C504. Shaft seals shall be designed for the use of standard split V type packing or for standard O-ring seals. Disc seating edges shall be either 316 stainless steel or ni-chrome. Valve disc fasteners shall be 18-8 stainless steel type 304.

3. Valve Operators:

   Shall be of a manual traveling nut type. Operators shall be equipped with a 2" AWWA square operating nut unless otherwise specified. They shall be sealed, gasketed and lubricated for underground service. The operator shall be capable of withstanding an input torque of 450 ft. lbs at extreme operator position without damage. Valve shaft shall be 304 stainless steel.

4. Painting:

See section 3.17

5. Marking:

   The manufacturer shall show on the valve the valve size, manufacturer, class and year of manufacture.

6. Approved Valves:

   Shall be either Pratt Groundhog or M & H 450

7. Number of Turns:

   The number of turns to open or close is as follows:

TABLE 3-13

Valve Size	Pratt Groundhog No. of Turns	H & H 450 No. of Turns
6”	27	16-1/2
8”	27	24
10” & 12”	32	36
14” & 16”	30	48
18” & 20”	40	72

8. End Types Available:

   Information of typical cases is as follows:

TABLE 3-14
ENDS AVAILABLE BY VALVE SIZE

Type	Pratt Groundhog	M &H 450
Flange x Flange	6” – 20”	6” – 20”
Flange x PJ	6”, 8”, 10”, 12”	6”, 8”,12”
PJ x PJ	6” – 16”	6”-12” + 16”
MJ	6” – 20”	6” – 20”

B. <u>RESILIENT-SEATED GATE VALVES:</u>

This specification pertains to resilient-seated gate valves for underground service 4” to 12” in size where design working pressures are less than 200 psig. Resilient-seated gate valves shall meet the requirements of AWWA C509 specifications and shall generally be of the same size as the main in which they are installed. All such valves shall be of the non-rising stem type, stainless steel stem and bolts, fully encapsulated wedge with EPDM, with O-ring seal, equipped with a 2-inch square operating nut that shall turn to the left in a counter-clockwise direction to open the valve. Valve bodies and gates

shall be manufactured of ductile iron with internal working parts machined from the grades of low zinc bronze or stainless steel. Trim shall be 316 stainless steel. Interior & Exterior coating shall be in accordance with AWWA C550-electrostatically applied fusion bonded epoxy coating

Currently approved manufacturers are: AVK Series 45, , Mueller A2362, E381, , or an approved equal.

C. TAPPING SLEEVES AND VALVES:

1. Tapping Sleeves:

Tapping sleeves shall be of stainless steel with fusion epoxy coated steel flanges, specifically designed to withstand the strains and vibrations of the tapping machine. All connection bolts shall be 316 stainless steel or better. Smith Blair 662

The mechanical tapping sleeve for tapping existing Transite pipelines must have gaskets at each end of the sleeve. Sleeves with only the O-ring around the tapped hole are not approved for use with transite pipelines.

Approved tapping sleeves for Transite are as follows:

- Mueller H-615 sizes 6" – 12" Class 200
- Clow F-5207 sizes 6" – 12" Class 200

In selecting the class of the tapping sleeve, a class 200 should be used wherever the main line is Class 200 or if the operating pressure exceeds 125psi.

.

2. Tapping Valve:

These shall meet all of the requirements under "gate valves" in the preceding section with the exception of items such as oversized seat rings to allow entry of the tapping machine cutter.

3. Painting and Coating:

   See Section 3.17 for painting and coating requirements.

D. VALVE STACKS AND COVERS:

The valve stack shall be 8" in diameter, Schedule 40 PVC or DR 35 Sewer pipe, see **Plates W-20 through W-29.**

The valve box cap shall be of the heavy duty, long body type. Approved cap is the Christy G3 Traffic valve box 10" x 12". Lid shall be stamped "Water."

3.10 COMBINATION AIR RELEASE ASSEMBLIES

A. MECHANICAL ASSEMBLY:

As discussed in Section 2.8, the combination air release assembly has both the features of an air release valve and an air and vacuum valve. Both units shall be housed in a cast iron body and all internal parts such as the float, bushings, level pins, seat and baffle shall be either stainless steel or brass as furnished by the manufacturer. All assemblies shall be rated at 300psi maximum operating pressure.

Approved assemblies are as follows:

Size	APCO Valve No.	Height	Clow Model Design	Crispin Model Design
1"	143C	10"	A	UL10
2"	145C	12"	B	UL20
3"	147C	15"	C	UL30
4"	149C	17"	D	UL40
6"	150C	19"	E	UL50

- Used only where the working pressure is under 125psi for 1" and 165psi for the larger sizes.

- The inlet threads shall be iron pipe threads of the same size as the valve.

- For low pressure application, low head seats are required to ensure a proper seal with no leakage.

B. AIR-VAC HOUSING OR "CAN": Shall be Armorcast P6002002 Low Linear Density Polyethylene, Sandstone Finish. Enclosures for 4" and 6" Air-Vacs are illustrated on **Plate W-35.**

C. SERVICE LINES: Type K soft copper per Section 3.5. There shall be a corporation stop at the main per Section 3.5. See Section 3.6-F for poly sleeve requirement

D. BALL VALVES: James Jones 1900 or Ford B11-333 with a female iron pipe thread on each end and tee head.

E. GUARD POSTS: See Section 3.19 and **Plate W-10.**

3.11 BLOW-OFF ASSEMBLIES

A. TWO-INCH (2") BLOW-OFF.

Reference **Plates W-31 and W-32**. Materials shall be as follows:

1. Service Line: Type K copper per Section 3.5 with a corporation stop and a saddle at the main per Section 3.5. See Section 3.6-F for poly sleeve requirement.

2. 2" Ball Valve: James Jones 1900 or Ford B11-777 with female iron pipe thread on each end and tee head.

3. Vault: The same as for a 2" meter installation. See Section 3.5.

4. Plastic Plug: This shall protect the top of ball valve.

B. Four Inch (4") and six inch (6") Blow –Off:

Reference **Plate W-32**. Materials shall be as follows:

1. Service Line: 4" or 6" ML&C Steel or DIP per Section 3.8. There shall be a bottom outlet tee on the main per Section 3.4 that also discusses other miscellaneous fittings.

2. Valve: Resilient Wedge or Butterfly valve per Section 3.8

3. Groove-type fitting: Victaulic or equal.

4. Tapped Victaulic Cap: Vic. Cap with ¾" bleed valve.

5. Vault: 24" Manhole Grade rings set in concrete with Cast Iron Ring and Cover or size 66 meter box set on 6" of gravel base with standard or traffic cover depending on location.

6. Guard Posts: Required where an above ground blow-off is located in undeveloped areas. **Plate W-10**.

3.12 FIRE HYDRANT ASSEMBLIES

A. HYDRANT TYPE:

Fire hydrants for single family detached **residential areas** shall be wet barrel type meeting AWWA C503, and have a 6-inch flanged inlet with **one 2-1/2 inch and one 4 inch outlet** with National Standard fire hoses threads. Fire hydrants for **commercial and industrial projects** and multiple dwelling areas shall have **one 4" and two 2-1/2" outlets**. Where the required flow exceeds 3,000 gpm, there shall be two 4" and one 2-1/2" outlets. The outlets shall be protected with caps attached to the hydrant with a chain. Other specific requirements are:

- The hydrant upper portion (above ground) may consist of either one or two sections.
- Hydrant materials are listed in AWWA C503.
- Hydrants shall be designed for a minimum working pressure of 150 psi (per AWWA C503).
- Hydrant flanges shall contain six equally spaced bolt-holes of 7/8 inch diameter on a 9-3/8 inch diameter pattern.
- All hydrants shall be permanently marked with the manufacturer's name and the year of manufacture.
- Caps shall be bronze or stainless steel.

Approved fire hydrants include the AVK 2442, 2452, and Jones J-3700 Series (bronze body), hydrants, unless the Ventura County Fire Department requires a three-way fire hydrant, that requires special approval. Fire hydrant type and location are to be approved by the Fire Department. Other manufacturer's hydrants will be considered on a case-by-case basis but the District has the final say as to approval as-equal.

B. HYDRANT LATERAL:

Either 6" PVC or DIP shall be used. Hydrant laterals shall be a minimum class 200. See Section 3.3 for material specifications. Also, see Section 3.4 for fittings description. Thrust block sizes are covered in **Plates W-28 and W-29**. Where the fire hydrant also serves as a blow-off, the tee in the line shall be a "bottom outlet tee" specially made so that the flow will scour the bottom of the main line.

C. HYDRANT VALVE:

Shall be a 6” valve (see section 3.8) with flange x ring-tite ends for PVC pipe. The valve shall be stacked to the surface using materials discussed in Section 3.8.

D. PAINTING:

See Section 3.17

E. SPOOLS AND BURY:

As shown on Plate No.11, a 6 x 6 flanged extension break-off spool shall be used between the bury and fire hydrant. The spool shall be made of cast or ductile iron. It shall also be painted in accordance with that section.

Hydrant buries shall be a 6-inch inside diameter and made of cast iron conforming to ASTM A-126. The buries shall be one piece with the top having a flanged drilled with 6 holes to receive the extension spool or hydrant. In the event the hydrant lateral is PVC then the bury end shall be a push joint or mechanical joint fitting. Buries are generally available in 30”, 36”, 42” and 48” lengths. An approved product is “Rich Fire Hydrant Buries”.

F. BOLTS:

Alloy steel break-off bolts shall be used to attach the fire hydrant to the break-off extension spool. The bolt cavities shall be filled with an approved product to prevent the accumulation of water.

G. BOTTOM OUTLET TEE:

Where fire hydrants are at low spots in the pipeline and essentially are also performing as a blow-off, a bottom outlet tee shall be substituted for a regular tee to facilitate flushing.

H. WATER MAINS SERVING MORE THAN ONE FIRE HYDRANT:

Waterlines used serve more than one fire hydrant shall be a minimum of 8” in diameter regardless of any other potable uses on that waterline. Actual size will be determined by the District.

3.13 PIPE TRENCH MATERIALS

Refer to **Plates W-10 and W-11** for trench cross-section terminology.

A. WITHIN PIPE ZONE:

The pipe zone extends from the bottom of the trench to 12” above the top of the pipe. The material within this zone shall be a clean, well graded imported sand with sizes within the following ranges:

Sieve Sizes	Percent Passing
No.4	100
No.8	80-95
No.200	0-10

B. ABOVE PIPE ZONE:

The material shall conform to the requirements of the City or County or CalTrans, entity who has jurisdiction in the area. In the absence of stricter requirements, the material above the pipe zone shall be native material that does not contain rocks larger than 6” and shall be made so graded that at least 40 percent of the material passes the No.4 sieve.

C. SPECIAL SLURRY BACKFILL:

For pipelines, that are laid in an already paved street, the entity that has jurisdiction in the area may require the backfill above the pipe zone to be two sack slurry mix in lieu of compacted soil backfill.

3.14 ROADWAY MATERIALS

Pavement materials for resurfacing of trenches out in existing pavement shall comply with the requirements of the entity that has jurisdiction over the area. Asphalt, aggregate base and aggregate sub-base specifications are those set at by the latest published edition of California, Department of Transportation, Standard Specifications.

3.15 CONCRETE MATERIALS

Approved concrete material shall be based on the 28 day compressive strength and shall be chosen according to the following chart showing its intended use:

Class	Application	28 Day Compressive Strength, Minimum PSI	Maximum Aggregate Size, Inches	Slump Minimum Inches	Slump Maximum Inches
A	Walls, structures and reinforced encasements	3,500	1-1/2”	3	6
	Thrust blocks, non-reinforced				

B	pipe encasement, non-structural use	3,000	1-1/2”	2	6
C	Pump mix for abandoning lines	1,000	3/8”	Adequate for pumping	Adequate for pumping

3.16 REINFORCING STEEL

A. RE-BAR REINFORCEMENT:

Shall be Grade 40 minimum deformed bars conforming to ASTM A615, accurately placed securely in position. Where bars are spliced, they shall be lapped at least twenty (20) times diameter or butt-welded, except where otherwise shown on the plans.

B. MESH REINFORCEMENT:

Mesh reinforcement shall conform to the requirements of ASTM A185, wire gauge and mesh dimensions will be as shown on the plans.

3.17 PAINTING

A. GENERAL:

This section will only cover the paint materials. “Painting” as it relates to construction is discussed in Section 7.20.

All paint colors shall be as specified or as selected by the District. Paints shall be delivered to the job site in original, unopened cans or packages bearing the brand name and manufacturer’s name. Paints specified shall be used unless specific written approval is obtained in advance to use other products.

B. SPECIFIC MATERIAL REQUIREMENTS:

1. Fire Hydrants:

   Use Dunn Edwards Ultra Grip (W715) acrylic multi-purpose primer.. Finish coat shall be Dunn Edwards Endurogloss Silicone Alkyd Gloss Enamel 42-53V. Two finish coats are required.

2. Combination Air Release Cans and enclosures:

   Painting of the Armorcast enclosure is not required.

3. Ductile Iron Valves, Fittings and Miscellaneous Metal (Except Bronze):

   Exterior surfaces shall receive 2 coats of No-Oxyd (15 mil each).

   In addition to the No-Oxyd coating, encapsulate all exterior surfaces including nuts and bolts with a 10-mil layer of plastic film wrap described in 3.18 below.

   The interior of valves with the exception of bronze and working parts (see exception below) shall be coated with 100 percent solids, catalytically setting epoxy which is manufactured for use in the interior of potable water systems. The fusions method of coating 100 percent solid epoxy is acceptable. The two components shall be of different colors to aid in complete mixing. The epoxy lining shall be factory applied and field applications will not be allowed. Exceptions to the above policy for interior coating require written approval in advance of delivery to the job site. Fittings shall all be cement mortar lined or epoxy lined.

4. Steel Surfaces:

   Use one shop coat of rust penetrating Rustoleum Damp-proof Red Primer #5A60 or Koppers #622 and one coat of PUG primer. Finish coats for inside locations to be 2 coats Rustoleum High Performance Industrial Enamel or Koppers Glamortex #501 enamel (alkyd). Finish coats for outside locations shall be two coats of Rustoleum Industrial Enamel DTM Epoxy or Koppers Ponkote 300 (epoxy ester).

5. Concrete and Masonry:

   Exterior surfaces shall receive one coat of Koppers Block sealer, or Dutch Boy block coater No. 30W01; one coat of Dutch Boy Nalprep No.019; and one coat of Dutch Boy Nalcrete, or two coats Koppers #600 exterior (acrylic emulsion).

   Exterior surfaces below ground shall receive two coats of Koppers Bitusmastic Super Service Black, 12 mils/coat, or approved equal.

   Interior above ground surfaces shall receive one coat of Dutch Boy Masonry Vinyl Speed Primer No.30W10 or Koppers Surfacers, and one coat of Dutch Boy Masonry Vinyl No.32W11, or Koppers 601 Interior.

   Interior below ground surfaces such as in Pressure Reducing Stations and Lift Stations, shall receive a cementitious seal coat of Koppers

Inertol Patching Compound. After at least three days, two coats of Koppers #600 Exterior (acrylic emulsion) shall be applied.

6. Wood:

Exterior locations shall receive one primer coat and two finish coats. Primer shall be one coat of Koppers Glamortex #501 Enamel (alkyd) thinned 20%. Finish shall be two coats of Koppers Glamortex #501 Enamel (alkyd)

Interior wood surfaces shall receive one primer coat and two finish coats. Primer shall be one coat of Koppers #625 Undercoater. Finish coat shall be two coats of Koppers Glamortex #501 Enamel (alkyd)

3.18 PLASTIC FILM WRAP:

This wrap shall be used around all buried valves, bolted flanges and other fittings. The polyethylene film shall be of virgin polyethylene as produced from Dupont Alathon resin and shall meet the requirements of ASTM Designation D 1248 for Type I, Class A, Grade E-1, and shall have a flow rate or nominal melt index of 0.4 g/min./maximum.

The polyethylene film shall be 6 mils in thickness. The length shall be sufficient to firmly attach the film to the pipe on either side of the valve, flange, or fitting. The following minimum flat sheet widths shall be used for the specified valve sizes:

Nominal Valve or Flange Size	Minimum Flat Sheet Width
4”	24”
6”	24”
8”	24”
10”	30”
12”	36”
16”	48”
18”	48”

At the Contractor’s option, tubular materials may be purchased and cut with one side to fold out to the required width.

Tape for securing the polyethylene wrap shall be two (2) inch wide adhesive tape such as Polyken No. 900 (Polyethylene), Scotchrap No.5 (Polyvinyl), or

approved equal. The tape shall be such that the adhesive will bond securely to both metal surfaces and polyethylene film.

3.19 MARKER POSTS

In easements or where required on the plans, marker or guard posts shall be installed per the requirements of the District. Where no vehicular traffic could be anticipated, the posts shall be 4" x 4" x 5'6" dense structural grade redwood surfaced on all four sides and chamfered on top. They shall be set into the ground 2'-6" deep.

Where vehicular traffic could disturb the post or where its primary function is as a guard post, the material shall be 4" diameter, standard weight galvanized steel pipe, 5'-6" in length. Set the post 2'-6" below ground in a concrete base of not less than 18" in diameter.
Unless otherwise approved, the marker posts shall be painted Safety Yellow per Section 3.17.

SECTION 4.0

PLAN PREPARATION

4.1 GENERAL

The District has established procedures that must be followed in the preparation of plans. Deviations from these requirements, unless specifically authorized will be cause for rejection by the District. All Engineers preparing plans should have in their possession a complete set of these Standards. All work shall be in ink on Mylar sheets.

The plan design and preparation shall be performed by or under the direct supervision of a professional engineer with a current registration in the State of California. The Engineer has a distinct responsibility to follow the progress of the work and to submit change orders or to incorporate "As-Built" information on the drawings.

It should be understood that the responsibility for accuracy and completeness of the drawing rests with the Developer's Engineer. By signing the drawings, the District Manager attests to the fact that the plans have been reviewed and that the District has authorized construction provided that all fees and required documents have been submitted.

4.2 SHEET SIZE AND MARGINS

Overall dimensions are 24" x 36". Margins shall be 1-1/2" on the left; all others are one-half inches.

4.3 SIGNATURE BLOCK

All sheets of the plan shall have an approved title block, see Plate W-57. The approval blocks shall be signed before any construction can occur. Any changes to the plans after initial approval shall be shown as revisions and shall be approved by the District.

4.4 COVER SHEET

This shall be the first sheet in the set and shall contain:

A. AN INDEX MAP:

A map with an overall plan at a scale of 1" = 100' showing the general layout of waterlines, sizes, valve and fire hydrant locations, named streets, tract boundaries, lot boundaries and numbers, a sheet index and other pertinent information. This sheet shall include a note as to the pressure zone by

number and elevation. Care must be exercised to make sure scale and orientation are correct since these index maps are used to produce a water atlas and incorrectly drawn maps will be have to be redrawn.

B. A VICINITY MAP:

A Vicinity Map shall be drawn in a scale of 1" = 1,000' showing tract boundaries, streets, adjacent tracts, major streets outside the tract boundaries and the location of benchmark.

C. BENCH MARK:

All Bench Mark used in the project shall be graphically shown on this sheet and the elevations, description, locations, etc., spelled out as illustrated below:

B.M. _____ Elev. _____ F.B. _____ Page _____

Type of Marker _____

Location _____

All elevations used in preparation of Standard Plans shall be based on United States Coast Guard and Geodetic Survey (U.S.C & G.S.) mean sea level datum adjusted to 1961.

D. THE GENERAL NOTES

Shall be shown on the Key Map Sheet and need not be shown on the other sheets. The General Notes shall include a note requiring compliance with these Standards and a five- day notice prior to beginning construction (see Section 4.11)

E. WATER SERVICE CERTIFICATION:

Water Service Certification is required and shall be worded as follows:

CERTIFICATION

I hereby certify that the water system as shown on Drawing Number _____,

Sheets _____ through _____ has been designed to adequately provide each and

every lot (or facilities) of this tract (project) with proper pressure and fire flow.

_____

Registered Civil Engineer RCE No. Date

If the project does not involve specific lots, then substitute the words "…
Designed to adequately provide for the development said system is intended to serve".

Further, the Engineer's California Registration stamp including license expiration date shall be placed on the cover sheet.

F. "AS-BUILT" INFORMATION:

On the cover sheet there shall be a block to be used for "As-Built" information. It shall be as follows:

MATERIAL LIST

ITEM	SUPPLIER AND/OR MANUFACTURER	MODEL/TYPE NO.	NO.
Pipe			
Services/Sizes			
Fire Hydrants			
Valves			
Brass Products			

Prior to submittal of As-Built drawings, the pertinent information shall be completed by the Developer's Engineer.

G. "AS-BUILT CERTIFICATION":

"As-Built" certification is also required. The wording shall be as follows:

"AS-BUILT" CERTIFICATE

I hereby certify that the work shown on Drawing No. _____ Sheet _____ through _____ inclusive, marked "As-Built" has been constructed in conformance with the lines and grades as shown on said Plans and referred Specifications.

Registered Civil Engineer RCE No. Date

4.5 PLAN OF WATER SYSTEM

Plan drawings shall show location of water mains, service line locations and other structures in relation to survey lines and stations. Included shall be blow-offs, combination air release valves, main line valves, fire hydrants, thrust blocks, etc. Provide all data for horizontal deflections or curves and indicate limits of any easements. Any known pad locations that are adjacent to an easement should be shown as well as fences, walls, trees, etc, that are within the easement. Show and label, on the plans, the size and ownership of all existing and/ proposed underground utilities that cross or parallel the waterline. Facilities of other water companies shall be included on the plans where they exist.

4.6 PROFILE OF WATER SYSTEM

Profiles shall show the grade, including any vertical curve data, size, and type of pipe and the distances involved with pipe types or sizes. Any special encasement required to carry loads on the pipe shall also be shown. Items such as valves and other structures or appurtenant features listed for the plan shall also be shown on the profile. Any pipe line two inches (2") or more in diameter that crosses the waterline and especially wastewater, gas, telephone, power, storm drains, television, and oil lines, shall be shown and labeled on the profile. The grade of major paralleling lines within 5 feet of the waterline shall be shown as dashed.

The District is not responsible for the accuracy of the location of these underground lines, and approval of water plans by the District does not constitute a representation as to the accuracy of the location of, or the existence or non-existence of any underground utility, pipe or structure within the limits of the project.

4.7 GRAPHIC SCALES AND NORTH ARROW

All plan and profile sheets shall contain:

A. A GRAPHIC SCALE:

A Graphic Scale, horizontal as well as vertical, illustrated as such that a true representation is produced when the plans are reduced in size, and they shall be as follows:

HORIZONTAL	1" = 40 feet
VERTICAL	1" = 4 feet

* Double scale drawings (i.e. 1" = 8 feet) may only be submitted where the predominant slope of the existing ground surface or any one sheet exceeds 15%. In such cases, the word "Double Scale" shall be boldly shown.

B. A NORTH ARROW:

A North Arrow oriented toward the top or to the right only, or as approved. Generally, North shall be oriented towards the top or right hand side of the sheet.

4.8 PROCEDURE FOR APPROVAL:

Approval for improvement plans consists of two phases. Each phase consists of a series of requirements that must be met before final acceptance.

A. REQUIREMENTS FOR AUTHORIZATION OF CONSTRUCTION

(SEE SECTION 5 OF THESE STANDARDS)

B. REQUIREMENTS FOR FINAL ACCEPTANCE

(SEE SECTION 11 OF THESE STANDARDS)

4.9 PLAN CHECKING LIST

The following list is intended as a guide to assist the preparer; it is not represented to be a complete list of requirements:

CHECK LIST
PLAN CHECKING AND PROJECT REQUIREMENTS
WATER

A. COVER SHEET:

- Standard size, title block, signature block
- Revision and Engineer's block
- Key and Vicinity Map
- Include lot numbers and lot lines
- Sheet index
- Pressure Zone and elevation
- Adjacent tracts and street layout
- Bench mark
- Design and as-built certificates
- Pressure in project and fire flow requirement
- General Notes

- Underground Service Alert note
- Engineer's stamp and expiration date

B. GENERAL DESIGN:

1. Conform to master plan
2. Check for over sizing requirements
3. Check for pressure and fire flow
4. Selection of pipe materials
5. For any tie-ins to the District's existing system, provide instructions relative to the sequencing, timing and thrust blocks.

C. PLAN AND PROFILE SHEETS:

- Graphic Scales
- North Arrows
- Water line stationing left to right
- Proper cover
- Curve data if there are curves
- Pipe sizes and type (s)
- Street, curb dimensions, street names
- Lot boundaries
- Easements including line bearings
- Angle points- show deflection angle right or left moving up station
- Show valves, fire hydrants, and comb. Air releases and blow-offs
- Fire Department approval of fire hydrant type and location
- Where meter boxes are located
- Lot numbers and pad elevations
- Size of all services, meters and indicate for irrigation where appropriate
- Minimum separation between parallel pipes (Outside to outside)
- Thrust blocks

D. ADMINISTRATIVE BEFORE CONSTRUCTION CAN BEGIN:

- Cost estimate
- Inspection and plan check fees
- Bonds or Letter of Credits
- Easements
- Calleguas Release and Receipt
- Will-Serve Letter
- Water Wells and Water Rights Dedication Documents
- Agreements
- Fire Flow Calculations
- Facilities Dedication Document

4.10 STANDARD LANGUAGE FOR DEDICATION OF FACILITIES TO THE DISTRICT

The following language is intended as an example of standard language for the dedication of facilities to the District. It shall be modified as necessary to fit a particular set of circumstances.

A. GRANT DEED, QUITCLAIM DEED, BILL OF SALE OR OTHER:

All of its rights, title, and interests in and to the water system, pipelines, manholes, and appurtenances thereto as located in, on, over, under and across streets, easements and rights-of-way shown on Tract _____ as per map thereof recorded in Book____, Page _____, and shown on the easement(s) as per Document No. _____, recorded on _____ of Official Records, in the Office of the County Recorder, County of Ventura, State of California.

B. EASEMENT DEED:

An easement and right-of-way to lay, construct, repair, maintain, operate, renew and replace pipeline and appurtenances incidental thereto for the transportation of water with the rights to ingress and egress to and from same, in, over, under and across the following described real property in the County of Ventura, State of California, and rights to disturb the surface of the easement area or surface improvements constructed by the servient tenement wherein the responsibility for replacement or restoration shall belong to the servient tenement unless otherwise specified herein.

The District as required may add additional language.

4.11 STANDARD NOTES:

The Standard Notes shown on the following page(s) should be included on the cover sheet as applicable. They are subject to change to suit the needs of the District:

WATER NOTES

1. Contractor shall notify the District at (805) 482-9625 five (5) days prior to commencing construction.

2. All construction shall conform to the District's Water Design and Construction Standards.

3. Pipe shall be PVC Class 200 AWWA C900 or C905 unless otherwise specified.

4. Connections to the existing waterline shall be done only in the presence of the District's Inspector or authorized District's Representative.

5. Only the District Personnel shall operate any valves on the existing water system unless authorized and in the presence of a District Representative.

6. Separation between water and wastewater lines shall be in accordance with **Plate W-55**.

7. Utility locations and depths shown hereon have been plotted in accordance with the data furnished by the respective Utility Companies. The Engineer assumes no responsibility for the accuracy of the information received from each company. It is the Contractor's responsibility to protect all public and private property in so far as it may be endangered by the Contractor's operation. The Contractor in his bid shall absorb all costs for protecting, removing, and restoring existing improvements.

8. All trench backfill and compaction in public right-of-way above the pipe zone will be under the supervision of the City's or County Inspector.

9. Fire hydrants to be wet barrel only, AVK 2442 or 2452 and/or Jones J-3700 or J-4000 series. Color shall be Rustoleum "Safety Yellow" #6H383. They shall be a minimum 2 feet behind curb (Note- revise for multiple dwelling or commercial/industrial projects. See Section 3.11).

10. Contractor shall mark the location of all water services with the letter "W" at least 2" high and ¼" deep engraved into the curb. Service lines to be (specify size) _____ copper pipe to be adapted to proposed meter. All meter boxes shall be located within the street utilities easements.

11. The total site required fire flow is _____ gpm at 20 psig residual and _____ gpm at _____ psig residual for individual hydrants.

12. Based upon static conditions, the maximum and minimum pressures for the _____ ft. zone are calculated to be _____ psi (lots #_____) and _____ psi (lot # _____), respectively.

13. Water lines shall be hydrostatically tested and disinfected after installation, backfilling and compaction.

14. All construction shall conform to the approved plans unless change order request is submitted and approved by the District.

15. The District does not warrant or guarantee the accuracy of locations and grades of main line, service lines and laterals as shown on these plans.

16. Under Service Alert: Call USA-SC for underground locating two (2) working days prior to any excavation (1-800-422-4133).

17 Prior to construction, Owner/Developer shall provide to the Inspector a current copy of approved insurance certificate.

18. Twelve Gauge insulated copper wire taped at 10’ intervals to be used over pipe for location and identification purposes.

19. In all instances of Commercial development and in Residential developments where non-potable water is available and provided, a Backflow Prevention Device (Reduced Pressure Principle) shall be installed on the customer side of the meter prior to the District’s acceptance of the water system (see Plate #CC-2). Size to be determined by the District.

20. Prior to field acceptance and before connecting a pipeline or pipelines to the District’s system, the lines shall be disinfected, thoroughly flushed and a Bacteriological (Bac-T) sample taken by the District. Until the sample satisfactorily passes the test, the development lines will not be connected to or accepted by the District.

SECTION 5.0

FEES, CHARGES AND REQUIREMENTS FOR AUTHORIZATION OF CONSTRUCTION

5.1 GENERAL:

The authority to institute Fees and Charges is generally established in the District Code. Resolution(s) by the Board of Directors authorize specific amounts of Fees and Charges. The Board, as required by law, only adopts changes in the Fees and Charges after conducting a public hearing. Copies of the current documents are available.

5.2 PLAN CHECK FEE

When water plans are first submitted, the Developer shall pay a plan check fee to the District. This fee shall be at the current rates using the Developer's Engineer's estimate of the cost of improvements. The District shall approve this estimate. The minimum plans check Board Resolution shall establish fee and minimum change order fee. Under no circumstances shall refunds of the plan check fee be made. However, the plan check fee required may be increased if actual or subsequent estimated costs exceed that used for initial fee calculation.

5.3 SUBMITTAL OF BLUELINE PRINTS (FOR PLAN CHECK)

Two sets of the blue line prints of the proposed water improvements, one copy of the final tract map (where appropriate), one complete set of street improvement plans, and three copies of the cost estimates shall be submitted together with the plan check fee for the first plan check. Plans illustrating an incomplete design and drafting detail may not meet minimum standards and may be just cause for rejection of the first plan check. The Developer or Developer's Engineer shall submit preliminary plans completed in accordance with these Standards. The Developer and Engineer should be aware that most projects involve several plan checks/submittals before the drawings are deemed to be satisfactory. Also required will be fire flow calculations including criteria used in determining the size of the water lines and adequacy of backbone facilities including reservoirs (see Section 2.2 for details)

5.4 SPECIAL PROVISIONS

If there are unusual conditions that would require substantial deviation from the District's Standards, particularly with respect to service pressures, such deviations should be submitted in writing prior to tentative map and/or development project approval, or in any case prior to submittal of the first plan check.

5.5 INSPECTION FEES

The District staff analyzes the plans and materials as submitted and prepares and sends comments to the Developer's Engineer. Upon receipt of revised plans, the Developer's Engineer prepares a final cost estimate for the proposed improvements. The inspection fee amounts using the most current cost rates (percentage figures) and unit prices applicable at the time the project goes to the Board for authorization to construct shall be determined and paid. In addition, the following is applicable:

A. MINIMUM INSPECTION FEE:

A minimum inspection fee shall be per Board resolutions. Development inspection fees are based upon the cost of improvements and in general are based upon the following formula:

For inspection, post in cash an amount equal to 3½% of the first $25,000 in construction cost, 2½% of the next $75,000, and 1¾% for all estimated costs exceeding $100,000.

B. SPECIAL SITUATION INSPECTION FEE:

Construction inspection fees for special situations, as determined by the District, such as inspections on Saturdays, Sundays, or District holidays or beyond the normal working hours, shall be charged as follows:

1. For inspection of special situations during the normal working hours, the current inspector rate per hour worked, plus an allowance for fringe benefits (currently 40 percent), plus 30 percent for overhead.

2. For inspection during overtime periods, the current inspector rate per hour worked multiplied by a factor of 1-1/2, plus 40% fringe benefits, plus 30 % for overhead.

3. For inspection during Sundays and Holidays, the current inspector rate per hour worked, multiplied by a factor of 2, plus 40% fringe benefits, plus 30% for overhead.

5.6 EASEMENTS

Any easements necessary must have deeds submitted for checking at this time or must be shown on the tract map before recordation. Also see Section 2.5 and 4.0 of these Standards for easement requirements.

5.7 AGREEMENTS, BONDS, AND INSURANCE CERTIFICATES

Staff will provide the Developer with proper forms and the Developer shall submit the following:

A. AGREEMENT

The Developer shall submit an Agreement for Construction of Water Facilities (in triplicate with notarized signatures).

B. INSURANCE

Insurance policy with limits as stated in " Agreement" Attention is particularly called to the District's requirements concerning submittal of an "Accord" form. The insurance certificate shall include general liability, auto liability and workers compensation insurance in amounts as required by the District. The District, its officers, employees and agents, shall be named as additional insured. The notice of cancellation period must be no less than 30 days. Any reference in the cancellation period must be no less than 30 days. Any reference in the cancellation clause to "endeavor to" or "but failure to mail such notice shall impose no obligation or liability of any kind upon the company" must be deleted. Also, the words " This certificate is issued as a matter of information only and confers no rights on the certificate holder " must be deleted. If disclaimer cannot be deleted from the Accord form, then a signed warranty letter must be attached to the certificate.

C. FAITHFUL PERFORMANCE BOND

The District reserves the right to request the District Accord form utilized. The Developer shall submit a Faithful Performance Bond (in triplicate and signatures notarized) equivalent to 100% of the estimated cost including contingencies of construction.

Note: Certificates of Deposits and Letters of Credit may be substituted.

D. LABOR AND MATERIALS BOND

The Developer shall submit a Labor and Materials Bond (in triplicate and signatures notarized) equivalent to 100 % of the estimated cost.

Note: Certificate of Deposit or Letter of Credit may be substituted.

SECTION 6.0

CONSTRUCTION STAKING

6.1 GENERAL REQUIREMENTS

Construction staking is the responsibility of the Developer; its Engineer or Contractor.

When the term is used, it should be remembered that it encompasses construction pipeline markings that may not involve any staking, such as marking on pavement. Stakes or marks will be set parallel to the pipeline alignment at an offset distance and direction agreed upon with the contractor, but in no case shall construction stakes be offset more than 10 feet. Stakes or marks will be set at no greater interval than 50 feet on straight alignments when the pipeline slope is 0.6 percent or more. For horizontally curved pipelines at less than 0.6 percent slope, the stake or mark interval shall be 10 feet and for curved pipelines above 0.6% slope and for straight pipelines below 0.6 % slope the stake or mark interval shall be 25 feet.

For tank and pump station sites, after construction is completed, the developer shall have established and installed, permanent markers at all property corners.

6.2 PRESERVATION OF STAKES

Construction stakes or construction markings shall be carefully preserved by the Contractor until after the completed worked is accepted by the District. If two or more consecutive stakes are knocked out during construction, new stakes shall be set at the Contractor's expense.

6.3 SERVICE LINES

For each service line, a stake shall be placed near the property line, referenced to show its location. If the meter box installation is not anticipated prior to field acceptance, then the stake shall be a minimum 2" x 4" redwood post 2 feet in length with 18" buried.

6.4 "AS-BUILT"

The stationing for each service line is required on the "As-Built" drawings.

E. CALLEGUAS RECEIPT AND RELEASE

` The Developer shall have made arrangements with the Calleguas Municipal Water District (CMWD) to satisfy the requirements of their Ordinance No. 14, which assesses fees for capital projects. The District requires a copy of the CMWD "release and receipt" for the project.

5.8 WILL-SERVE LETTER

Prior to or concurrent with any District authorization to construct facilities or prior to any parcel receiving water service (one or both may be applicable), the District shall issue a Will-Serve Letter indicating that the subject property lies within the District's service area and that the District will provide water service subject to certain terms, conditions and limitations as outlined in the Will- Serve Letter, as required by the these Standards. For tracts, issuance of a Will- Serve Letter by the District shall normally precede recordation and construction.

5.9 APPROVAL FOR CONSTRUCTION

Upon receipt of all documents, bonds, fees and checking for all the documents, bonds and fees, the staff shall prepare a resolution for the District's action, which is accompanied by or refers to the following material:

- Original water plans.
- Agreement for construction of water facilities.
- Faithful Performance Bond.
- Labor and Materials Bond.

The District will sign the original plans only after the approval by the Board, and will notify the Developer's Engineer that the plans are signed and available. The Developer's Engineer will then provide the District with two sets of blue line prints, and the original drawings will be returned to the Developer's Engineer until they are "As-Built", at which time the originals become the District l's property.

No construction should occur before the plans are signed and before the proper five days District notification has been given. This notification will allow time for a pre-construction meeting of all interested parties.

The District and the Developer have a direct relationship via the documents outlined above. Therefore, to the extent possible, correspondence and verbal communication should be between these parties rather than District/ Contractor or Subcontractor communications excluding the Developer.

5.10 WATER CAPITAL FEE

Generally, no parcel or property shall be connected, or building permit issued, to the District's water system until the Water Capital Improvement Fee has been paid. The charge is based upon the size of the meter required for the building or project, location of project, or upon intended use, i.e. apartment or condominium units.

5.11 SPECIAL FACILITIES SURCHARGE & FIRE FLOW SURCHARGE

Selected water service zones may be subject to the special facilities surcharge fees that are due and payable along with the plant investment fee. Likewise, projects having required fire flows exceeding 1,500 gpm are subject to fire flow surcharge fees.

5.12 SERVICE LINE, FIRE HYDRANT OR METER INSTALLATION

In general, the Developer will install the required service lines and fire hydrants as part of the development project. The District will then install the meter.

5.13 SPECIAL CHARGES

If there are items requiring special approval, the District may require deposition of funds or agreements for funds in the future to provide for operation and maintenance of substandard system.

5.14 MAIN LINE EXTENSION AND OVERSIZING AGREEMENTS AND LOCAL SHARE

In general, if any Developer desires to enter into a reimbursement agreement with the District, such arrangement shall be made prior to the time authorization to construct the waterlines (or system) is given to the District. The reimbursement agreements for main line extensions involve future payments to the Developer installing the improvements if and when the District receives funds from other benefiting properties. In the case of the District contribution for over-sizing a line, no District contribution can be considered unless the line is 10" or greater in diameter.

SECTION 7.0

CONSTRUCTION

7.1 GENERAL REQUIREMENTS

This Section describes the use of materials and workmanship to be employed in construction of the water system. The Developer/Engineer shall prepare such general and special specifications as are necessary to define the nature and location of the work, contractual arrangements, payment for work and any other matters concerning the owner or his Contractor; these items are not discussed within the Standards presented here.

A. USE OF THIS SECTION:

The construction Section is intended to highlight the features of construction that are deemed to be most significant. In any construction activity, the recommendations of the manufacturer of a product, especially where more stringent, should apply. Also, the omission of a particular practice, that is not considered to be a good construction technique common to the construction industry, should not be construed to mean that it is not required.

There are a number of construction activities that pertain to all pipe types and these will be presented first. Specialized activities unique to a particular pipe type will be covered separately.

Specific references which are incorporated into this Section include:

- AWWA C206 “Field Welding of Steel Pipes”
- AWWA C900” Polyvinyl Chloride (PVC) Pressure Pipe, 4” to 12”,
- AWWA C905 Polyvinyl Chloride (PVC) Pressure Pipe, 16” – Up,
- AWWA Manual M11 “Steel Pipe-Design and Installation”
- AWWA Manual M16 “ Work Practices for Asbestos-Cement Pipe”.
- AWWA Manual M17 “Installation, Operation and Maintenance for Fire Hydrants.
- AWWA Manual M23 “PVC Pipe- Design and Installation”

Finally, Section 3 of these Standards contains material descriptions and the Developer/ Contractor should use that Section along with this Section and their respective plates as a reference. Section 9 describes testing and disinfections procedures and requirements.

B. PROTECTION/ OPERATION OF EXISTING WATER SYSTEM.

A primary concern of the District is the protection and operation of the existing water system. No Developer or Contractor will be allowed to operate any existing water valves or to cause a shutdown of any portion of the District's water system without prior approval from a District's representative. In general, the District personnel will do any operation of valves in a planned shutdown. Any planned shutdown should be discussed at the pre-construction meeting or at least 3 working days in advance. Shutdowns will only be allowed if no other reasonable alternative exists, such as the use of hot-tap connection in lieu of cut-in. When shutdowns are required in a part of the District's system, the District will expect evaluation of whether the shutdown should be done during the day or during the night. Contractor/ Developer economics shall weigh less heavily in the decision than in the interruption and inconvenience to existing customers. Any shutdown shall involve a thorough notification plan for existing customers as well as the provision of bottled water, water tanks, etc, where appropriate.

C. QUALITY OF MATERIALS

Materials and equipment to be incorporated into the work shall be new and unused unless otherwise approved. In a case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used. When construction bids are received directly from the District, such bids shall show the proposed pipe material and the manufacturer's name, if more than one type is allowed.

Contractor shall have at the job site or be able to supply upon request, certified copies of factory or laboratory test reports showing the strength and characteristics of the material used in the work. For all reinforced concrete work he shall furnish in advance of pouring concrete, and if requested, the mix design and calculated concrete strength as prepared by the concrete supplier.

D. SUBSTITUTION

Where articles or materials are specified by brand or trade name, alternative materials or articles equal to those specified may be approved provided the request for approval is in writing accompanied by supporting data, in ample time to permit investigation without delaying the work. Unless substitutions have been received prior approval, no deviation from the Standards will be allowed.

E. QUALITY OF WORKMANSHIP:

Persons experienced in the specific work, under competent supervision and a first class manner to the District's satisfaction will do all work. When work is being done directly for the District, the Contractor in the proposal shall name each sub-contractor and no substitution will be permitted without prior approval.

F. DEFECTIVE WORK:

Any defective materials or workmanship, that shall become evident within one year after field acceptance of completed work shall be replaced or repaired without cost to the District. Refusal of the Contractor to correct defective work that is clearly his responsibility will be considered just cause for exclusion from performing future work to be connected to the District's water system. Such exclusion does not impair the District's right to bring legal action to correct the deficiencies as well as to withhold exoneration of performance and payment bonds.

G. DISTRICT INSPECTION, FIELD ACCEPTANCE AND GUARANTEE PERIOD:

The District is responsible for inspection of all excavation, pipe laying including appurtenant structures, trench backfill within the pipe zone, and testing. All such work shall be available for inspection at all times. It will be the Contractor's responsibility to provide a five (5) working day notice to the District prior to the start of any work. Such notification will allow for scheduling a pre-construction meeting between interested parties. Failure to provide proper notification may delay the starting date since the District may not be able to inspect the work and cannot accept any work for which the inspection has not been arranged. It must be emphasized that the primary responsibility for compliance with all the District's requirements and standards rests with the Developer and/or the Contractor of this basic responsibility.

Field acceptance is made by the Inspector and will not coincide with the date of District's acceptance of the work. However, the one-year guarantee period for all work shall begin after District's Board acceptance. As mentioned in Section 7.1E, any defective work discovered during this period shall be repaired or replaced and a new one-year period will begin for the corrected work.

All holiday or weekend inspection will be subject to additional charges as discussed in Section 5.4.

H. PUBLIC RELATIONS:

The Contractor shall conduct its affairs in a manner that will lessen the disturbance to residents in the vicinity of the work. In this regard, standard working hours as specified in the City or County encroachment permits shall be observed unless prior approval is received. The job site shall be maintained in a condition, that will not bring discredit to the District or its personnel, and all affected private improvements shall be restored to at least their original condition.

7.2 PERMITS

The following may be required of the Contractor:

A. ENCROACHMENT:

Where construction will encroach into the public-right-of way, the Contractor shall obtain all necessary encroachment permits. Within the Cities of Camarillo, Thousand Oaks, Moorpark and Simi Valley, the permit is secured from the Public Works Department. Within the unincorporated area, the County requires a similar permit. Particular attention is called to Section 7.15 and the appropriate Plates.

B. EXPLOSIVES:

Where the Contractor anticipates the use of explosives in conjunction with the water construction, a blasting permit shall be first obtained from the Ventura County Sheriff's Department, and all nearby property owners shall be notified. These permits are discretionary and may not be given for a particular circumstance.

7.3 SHIPMENT AND DELIVERY

All pipes shall be braced and stulled to prevent damage during shipment. Any damaged pipe or fittings delivered and unloaded at trench side shall be removed by the Contractor from the work site.

With steel ML& C (mortar lined and coated), the off loading of the pipe as well as placement in the trench shall be done with straps at each end. Chains shall not be allowed to come into contact with the pipe.

PVC pipe that appears faded, "sunburned" or without markings shall be rejected.

7.4 CLEARING AND GRUBBING

A. GENERAL:

Clearing and grubbing, that consists of removal of objectionable material from the right-of-way, shall be done with caution such that existing water or wastewater improvements, adjacent property and trees and shrubbery that are not to be removed shall be protected from injury or damage.

Within water easements or right-of–way, trees, shrubs, fences and all other improvements that have to be removed to permit construction and that are intended for replacement, shall be replaced in kind or size (excluding native trees under 2-inch diameter or native brush) or with approved substitutes unless permission to exclude such replacement is obtained from the owner/agency or granted by the District.

B. REMOVAL AND DISPOSAL OF MATERIAL:

The Contractor shall be responsible for leaving the site in a neat and finished appearance, free from debris or inflammable material,

7.5 UTILITIES, EXISTING FACILITIES AND CONCRETE REMOVAL

A. ABANDONMENT:

Refer to Section 8 regarding abandonment of existing water lines an/or structures.

B. UTILITIES AND EXISTING FACILITIES:

The existing utilities and/or facilities shown on the drawings or the location of which is made known to the Contractor prior to excavation shall be protected from damage during the excavation and backfilling of trenches and, if damaged, shall be repaired by and at the contractor's expense. Any existing utility or facility not shown on the drawings or the location of which is not shown to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor; and adjustment in payment, if any, is subject to negotiation between the Contractor and the Developer without any District liability, unless it is a District sponsored project.

Whether expressly indicated on the drawings or not, all Contractors shall call the Underground Service Alert prior to any construction of pipelines.

Failure to do so shall not relieve the Contractor of any liability associated with disturbance/breakage of existing utilities.

In case it shall be necessary to remove any such utilities, facilities or any portion thereof, the Contractor shall notify the District and the owner of the structure. The Contractor shall not interfere with said utility and./or facility structures until disposition of the obstruction to the work has been determined and/or notice to relocate or remove has been given by the District or authorized agent of the Owner of the utility and/or facility so affected.

The fact that any underground utility and/or facility is not shown on the plans shall not relieve the Contractor of his responsibility to comply with these standards. It shall be the Contractor's responsibility to ascertain prior to commencing work the existence of any underground utilities or facilities that may be subject to damage by reason of these operations.

The District will provide service line location services of existing facilities upon request and with satisfactory notification in advance.

C. CONCRETE, MASONRY OR MORTARED CONSTRUCTION REMOVAL:

At locations shown on the plans, portions of existing concrete pavements, curbs, gutters, sidewalks, foundations and other concrete or mortared structures shall be removed to the lines and elevations specified. Concrete structure or objects not shown or noted on the plans shall be removed where necessary and disposed of by the Contractor.

Concrete removal operations in connection with the reconstruction of existing structures shall be performed without damage to any portions of the structure that is to remain in place. If damage occurs, the contractor shall repair any such damage at his own expense, to the satisfaction of the District. Repair/replacement of any sidewalks, curb and/or gutters shall be to the satisfaction of the City or County Public Works Department, as appropriate. Where existing reinforcement is to be incorporated in new work, such reinforcement shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in a new concrete.

7.6 EXCAVATION AND TRENCHING

A. GENERAL:

Trench excavation shall consist of all excavation involved in the grading and construction of the water line as shown on plans. The Contractor shall perform all excavation of every description and of whatever

substances encountered, to depths indicated on the drawings or otherwise specified or required. During excavation, material suitable for backfilling shall be piled in an ordinary manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. The material piles shall also not obstruct existing sidewalks or driveways unless it cannot be avoided. All excavated materials not required or unsuitable for backfill shall be removed. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water from any source accumulating therein shall be removed by pumping or by other approved methods. Such sheeting and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel.

Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the District, the pipe or duct can be safely and properly installed and backfill can be properly tamped in such a tunnel sections.

If blasting is necessary, the Contractor shall notify the City or County of his blasting schedule and procedures and obtain a blasting permit, and shall observe all reasonable precautions in protecting life and property.

B. EXCAVATION:

Excavation for water lines shall be made only after pipe and other necessary materials are delivered on the work site. After such delivery, trench excavation shall proceed as rapidly as possible, and the pipe installed and the trench backfilled without undue delay.

Where rock excavation is required, the rock shall be excavated to a minimum over depth of 6” below the trench depths indicated on the drawings or specified. Over depths in the rock excavation and unauthorized over depths shall be backfilled with the same material as the bedding zone. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe as determined by the District is encountered in the bottom the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with an appropriate material between a course sand and a crushed rock to provide a stable foundation.

C. SHORING:

All shoring for open excavations shall conforms to the State of California, Department of Industrial Relations, and Division of Industrial Safety “Construction Safety Orders”

The Contractor shall be responsible for adequately shored and braced excavation so that the earth will not slide, move or settle, and so that all existing improvements of any kind will be fully protected from damage.
No shoring once installed shall be removed until the trench has been approved for backfill operations and in such a manner as to prevent any movement of the ground or damage to the pipe or other structure.

The Contractor shall obtain and pay for all permits for any excavations over five (5) feet in depth into which a person is required to descent or any excavation less than five (5) feet in depth in solids where hazardous ground movement may be expected and into which a person is required to descent.

D. TRENCH WIDTH AND GRADE:

The width of the trench within the pipe zone shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed the amount detailed in the Standard Plates. In general, the following shall be adhered to:

TABLE 7-1

Nominal Pipe Diameter	Trench	
	Minimum	Maximum
6” – 12”	O.D. + 12 “	O.D. + 18”
14” – 18”	O.D. + 18”	O.D. + 24”

Trench widths in excess of those shown may be as wide as necessary if for the explicit purpose of installing sheeting and bracing the performance of the work.

E. PIPE SUB-GRADE:

The trench bottom shall have a flat or semi-circular cross section. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of each joint except for required “bell holes” at the joints. A coupling hole shall be excavated as necessary with sufficient length, width and depth to permit assembly and provide a minimum clearance of 3 inches below the coupling for a length of 6 inches beyond the coupling.

See Section 7-7 for specific requirements with respect to bedding.

7.7 PIPE BEDDING AND LAYING

A. GENERAL:

This portion of the work includes the furnishing of all materials and their proper assembly to result in a first class waterline installation true to line and grade and free from leaks, cracks and obstruction.

Where choices are allowed, the Contractor shall select such materials and construction methods that will result in a completed project in full conformance with these Standards. In that regard, refer to Section 3 (Materials) and the Plates for additional details.

The Contractor is warned that the approved water pipeline design is based upon a proper combination of pipe strength and pipe support. No acceptance will be given unless the work of trenching, bedding, laying, backfilling and compacting is conscientiously done in accordance with the procedures outlined in these Standards.

Except as otherwise approved or included in permits, the maximum length of open trench at any one time shall be 500 feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater.

Experienced workmen, using not less than three consecutive grade points in common, shall transfer grades from ground surface to the bottom of the trench so that variations from a straight grade may be readily detected. Each length of pipe shall be laid on firm, approved bedding material as specified and shall have full bearing for its entire length between bell holes excavated in said bedding material to allow for undistracted assembly of all joints. Adjustments of pipe to line and grade shall be made by scraping away or filling in and tamping approved material under the body of pipe. No wedging or blocking with wood or soil to support the pipe will be permitted. Under no circumstances will a contractor be allowed to dump backfill materials on top of a pipe that is not continuously supported in its final grade position.

Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe, following manufacturer's instructions for the specific jointing method being used. Pipe shall not be laid when the Engineer or Inspector determines that the condition of the trench or weather is unstable. As the work progresses, the interior of the water line shall be cleared of all dirt and superfluous

materials of every description. If the maximum width of the trench at the top of the pipe is exceeded, the Contractor shall install such concrete cradling, pipe encasement or other bedding as may be required to support the added load of the backfill. Trenches shall be kept free from water until sufficient backfill has been applied to keep the pipe in place. At times when work is not in progress, open ends of pipe and fittings shall be securely closed to the satisfaction of the Inspector so that no trench water, earth or other substance will enter the pipe or fittings. Pipe or fittings damage during assembly shall be removed and replaced.

B. PIPE LAID ON BEDDING VS. EARTH MOUNDS:

The key elements to the pipe bedding are that the pipe ultimately be continuous supported and that the full 4 inches of bedding material (imported sand or better) be placed under the pipe. Where pipe is to be laid where considerable amounts of rock or cobblestone or groundwater are present, then the continuous bedding method shall be used. Earth mounds may be used, if specifically approved by the District Inspector, in areas exhibiting ideal pipe laying conditions where there is clear demonstration that the 4" bedding material will be placed after the pipe is laid in the trench.

For the continuous bedding method, the trench bottom shall be over-excavated a minimum of 4" and brought back to grade with imported bedding material. Prior to lowering the pipe into the trench, coupling holes shall be excavated in the bedding with sufficient length, width and depth to permit assembly and provide a minimum of 2" below the coupling.

For the earth mound method, the mounds shall be compacted firmly and of a size adequate to suspend the pipe 4" above the trench bottom while maintaining the pipe true to grade. Each length of pipe shall be laid on two mounds with the center of each placed at approximately one-fifth the distance from each end. Coupling holes shall provide a minimum clearance of 2". After assembly, the trench zone shall be properly backfilled with imported bedding material. The bedding material shall then be compacted utilizing appropriate methods to provide a firm and uniform bedding throughout the entire length of pipe.

C. PIPE LAYING FOR STEEL PIPE:

1. As mentioned in Section 7.3, CML & C steel pipe shall be handled with straps. Chains or bare cinch or choker type cables shall not be used. The sling shall be of sufficient width to prevent damage to the lining or coating.

2. No welded joint shall be backfilled until the District has inspected it. Sufficient trench space shall be left open in the vicinity of each joint to permit visual inspection around entire periphery of the joint.

3. Rubber Ring Joints

   Joining the pipe is similar to that for PVC pipe with the exceptions noted under field joints and electrically bonded connections.

4. Inside Joints

   Mortar lining of the interior joints shall be done with a mortar composed of one part cement to not more than 2 parts sand, dry mixed and moistened with sufficient water to permit caulking and toweling without crumbling. Sand shall be graded within the limits for plaster sand. Water shall be potable. Workability of the mortar may be improved by replacing not more than 7 percent, by weight, of the cement with hydrated lime, or by replacing not more than 30 % by weight of the cement with an approved pozzolan, an agent that slows the curing of concrete making it stronger.

   When the pipe is smaller than 22", the joint shall be finished by placing a sufficient amount of the joint mortar in the bell end of the section against the shoulder of the lining, just prior to installing it in the line. When the section has been laid in place, the joint shall be finished by pulling a rubber ball or the equivalent through the joint to finish it off smooth with the inside surface of the lining (swabbing).

   The meter jumper rods will then be welded in place to form an electrical bond.

   No pipe shall be placed into service or filled with water until at least 24 hours after the joints are mortared.

5. Outside Joints

   Mortar coating of the holdback section shall be as described below:

   Grout composed of one part cement to not more than two parts sand, thoroughly mixed with water to a consistency of thick cream. Sand gradation shall conform to the requirements of ASTM C33 except that 100% shall pass the No.16 sieve. The joints shall be coated with cement-mortar, retained by suitable bands or diapers so as to bridge the joint and retain the grout without leakage. The diaper shall be made of heavy-duty sailcloth of sufficiently close

weave to prevent cement loss from the mortar. The diapers shall be Mar-Mac fabric diapers or approved equal. The fabric shall be hemmed on each edge and shall contain a metal strap within each hem sufficiently longer than the circumference of the pipe to allow a secure attachment of the diaper to the pipe. The diaper width will depend on the pipe size and design and shall the manufacturer recommend the width. The grout space, prior to filling, shall be flushed with water so that the surface of the joint to be in contact with the grout will be thoroughly moistened when the grout is poured. The joint shall be filled with grout by pouring form one side only, and shall be rodded with a wire or other flexible rod or vibrated so that the grout completely fills the joint recess by moving down one side of the pipe, around the bottom of the pipe, and up the opposite side. Pouring and rodding the grout shall be continued to allow completion of the filling of the entire joint recess in one operation. Care shall be taken to leave no unfilled space. The exposed portion of the grout at the top of the pipe shall be coated with sealing compound or covered with burlap or moist earth.

6. Welded Joints:

Field welding of joints shall be in accordance with AWWA C206. This Specification pertains to automatic field welding by the metal arc-welding process and covers lap joints, butt joints and butt strap joints.

Experienced welders qualified in accordance with the Standards of the American Welding Society shall do all welding. Welding electrodes shall comply with the requirements of ASTM Specification A233. Welding procedures shall meet the qualifications of AWS Standard D10.9 “Qualification of Welding Procedures and Welders for Piping and Tubing”.

Welds shall be applied by means of continuous stringer beads. Each bead shall be thoroughly cleaned and de-scaled before the succeeding bead is applied. The metal shall be deposited in successive layers and the minimum number of passes or beads in the completed weld shall be as follows:

Steel Cylinder Thickness Inches	Fillet Weld Minimum Number of Passes
Smaller than 3/16”	1
3/16” and ¼”	2
5/16”	3
3/8”	3

When welded joints are designated on the plans, the pipe may be joined with rubber gasket as specified in the above provision for rubber ring joints in lieu of slip (lap) joints. The outside recess between the bell and spigot shall then be caulked with a rod to facilitate the welding. The weld shall be continuous for the full circumference of the pipe. In all welding, undercutting of the base metal in pipe adjoining the weld is a defect and shall be repaired. Overlapping or burning back the inside or outside corner during the application of a fillet weld will not be permitted. The finished fillet weld must be free of grooves, deep valleys or ridges and contain no abrupt changes in section at the toe. Lap or fillet welds shall have legs of equal size except when specified otherwise, and they shall have a throat profile that is straight to slightly convex. In no case will a throat with a concave surface be acceptable. Small erection tack welds used in the assembly of joints need not be removed provided they are sound and do not exceed in size the subsequent applied root pass.

After the joints have been welded, each joint shall be grouted with cement mortar in the same manner as specified for rubber ring joints.

Butt strap closure joints shall be completed in the trench after the pipe has been laid to the alignment and grade shown on the plans. They shall be field welded to the outside of the pipe along both edges by full circumferential fillet welds or one of the edges may be shop welded and the other field welded. A half of a standard five inch (5”) pipe coupling shall be shop welded to the top section of the butt strap to permit access for mortaring the inside of the joint. Butt joints shall be accurately aligned and retained in position during the welding operations so that in the finished joint the abutting pipe sections shall not be misaligned by more than 20% of the pipe thickness, or a maximum of 1/8”.

After welding and mortaring, this coupling shall be closed with a standard threaded pipe plug welded in place for sealing.

The interior of butt strap joints shall be finished in the same manner as bell and spigot joints.

The exterior of butt strap joints shall be finished as describe below:

Wire mesh, 2”x4” x No.13 gauge, clean and free from rust, shall be applied to the exterior of the butt strap joints so that the wires on the 2” spacing run circumferentially around the pipe. The wires on the 4” spacing shall be crimped in such a manner that the mesh will be held 3/8” from the metal joint surface. The mesh shall be lapped in the minimum of 8” and shall be securely wired in position. The joint exterior shall then be coated with cement mortar to a minimum thickness of 1½”. Immediately prior to applying mortar to the interior or exterior of the joints, a cement wash shall be applied to the metal surfaces to be coated.

7. Flanged Joints

Flange faces shall be wire brushed and gasket shall be thorough cleaned just prior to joining. Following the tightening of the bolts, all exposed metal surfaces including bolts and nuts shall be cleaned by wire brushing and then primed with Koppers Jet Set, or approved equal. Following application of the primer, the flanged joints shall be covered with fabric diapers as specified for rubber ring joints except that the diapers shall contain a metal insert within the fabric to provide sufficient clearance between the flanges and diapers to insure a minimum thickness of ½” coal tar coating covering all flanges, nuts and bolts. The former diapers shall then be filled from the top with Koppers hot bitumastic coupling compound. The joints shall be poured from one side only until the compound shows on the other side. All metal surfaces shall be coated with compound to minimum thickness of ½”. See Section 3.4 for fitting materials.

8. Flexible Coupling Joints

Shall be completed in the trench after the pipe has been laid to the alignment and grade as shown on the plans. Each pipe end for a distance of 6” to 8” back from the end shall be thoroughly cleaned to remove oil, dirt, loose scale, rust and other foreign matter. Flanges, gaskets and sleeves shall be assembled on the pipe ends in accordance with the manufacturer’s recommendations. Gaskets, pipe ends and coupling sleeve flares shall be lubricated with a non-toxic vegetable soap compound to facilitate the joining. Coupling sleeves shall be accurately centered over the pipe ends and one pipe end shall touch the coupling sleeve centering stop if the coupling sleeve is so equipped.

Bolts shall be tightened to the torque recommended by the manufacturer with a torque wrench in the presence of the Inspector.

All exposed coupling and pipe metal surfaces shall be cleaned, primed, diapered and encased with hot coal tar compound as specified for flanged joints.

D. PIPE LAYING FOR PVC PIPE:

Pipe laying of PVC C900 & C905 pipe is very similar to that for AC pipe with the following exceptions:

1. Because it is a plastic product, the pipe should be covered with an opaque material if it is be stored outside for a prolonged period of time (45 days).

2. In obtaining a square end cut, a PVC pipe cutter is recommended, but conventional fine-tooth hand or power saws may be used.

3. Field beveling of pipe ends after cutting can be done with special beveling tools or with such items as rasps.

4. In making the pipe conform to a curve, the pipe lengths should first be assembled in a straight line and then bent as they are lowered into the trench.

5. Because PVC is non-conductive and subject to more damage if struck with excavating equipment, a detectable ribbon at least 3" in width, blue in color, with the legend "Waterline Buried Below" shall be installed a minimum of 12", but no greater than 24", above the pipeline.

E. PIPE LAYING FOR DUCTILE IRON PIPE:

Where approved for use, ductile iron pipe shall be laid in accordance with manufacturer's instructions and in general compliance with the applicable procedures as listed for PVC pipe. Where specified, the District may request a specification for such installation practices. Specific attention shall be given to the placement of the polyethylene encasement wrap and any tapping of the pipeline for services and/or other main connections.

7.8 THRUST BLOCKS, SUPPORTING OF VALVES, ETC.

A. SUPPORTING OF VALVES:

Valves and fittings shall be supported by the trench bottom and shall be independent of the pipe. When pouring thrust blocks around a fitting, the concrete should be around the fitting and not the joint.

B. THRUST BLOCKS:

These shall be placed as shown on the plans or as required by **Plates W-24 and W-25.** The concrete shall meet the requirements of Section 3.14. Care shall be taken to insure that the concrete is poured against undisturbed ground and the fitting to be anchored.

7.9 HOT TAPPING

Hot tapping shall only be done in the presence of the District Inspector or Representative. Section 3.8 discusses the tapping sleeve and valve requirements. The tapping mechanism shall be of the self purging type so that cutting chips are removed from the tapping machine and do not enter the pipeline.

7.10 SERVICE CONNECTIONS AND SERVICE LINES

Generally, service saddles and dry tapping are approved.

Service connections on the opposite sides of the pipe are not allowed. There shall be a minimum of one-foot (1') separation between the services.

As shown on **Plates W-37 and W-38**, service connections (copper only is authorized) to the main shall be made at a minimum of 15º to a maximum of 45º above horizontal (spring line). 1½" and 2" services shall not exceed the 15º limit.

In all metal-to-metal threaded connections, the tap shall be oversized and a nylon bushings installed.

Service lines shall be one continuous length "snaked" within the trench to allow for expansion and contraction.

Due to the corrosive nature of local soils, a protective polyethylene sleeve, manufactured by The Northtown Company as Polywrap-C or an approved equal, shall be installed over the copper service line on all sizes from 1" to 2". It may be clear or blue in color and shall encase the service line from the corp stop to the angle meter stop in one continuous piece. It shall be attached to both the corp and the angle meter stop by using duct tape or other suitable adhesive tape.

7.11 INSTALLATION OF VALVES AND FITTINGS

Valves and fittings shall be installed at the locations and grades shown on the plans. The following items comprise a checklist:

- The weight of the valve or fitting is to be taken by firm ground or blocking not the pipe.

- All materials are covered in Sections 3.4, 3.9, and 3.18.

- Valves and all bolted connections shall receive a plastic film wrap (see Section 3.18 for material) installed as follows:

  Passing the flat sheet of film under the valve bottom and bringing the ends up around the body to the stem and securing it in place with 2" strips of the plastic adhesive tape shall wrap the valves. The polyethylene shall be secured around the valve stem in such a manner as to leave the stem free to operate. The film shall be brought completely around the flanges and secured to the pipe with a plastic adhesive tape on either side of the valve, flange or fitting.

The tightening of all bolted connections shall be performed in an even manner by a series of tightening steps so that no portion of the bolted connection is overstressed. All stainless steel bolts shall be coated with an anti-seize lubricant.

7.12 INSTALLATION OF AIR RELEASE AND BLOW-OFF ASSEMBLIES

Combination air release and blow-off assemblies shall be installed as shown on **Plates W-30 through W-35**. The Developer/Contractor shall locate the combination air release cans and blow-off vaults in a suitable location with respect to the adjacent properties. This shall include locating them closer to the property lines rather than in the middle of a property where there could be future objections from the property owner. The service line to the assembly shall have a positive grade to prevent accumulations of air.

All copper tubing connections shall be made with approved corporation stops (see Section 3.5). The service line shall be one continuous length without fittings between the corp. stop to the air release valve riser. See Section 7.10 or 3.6-F for poly sleeve requirement.

Dielectric connections with PVC tape wrap shall be provided at all connections between steel and brass or copper. **See Plate W-36**

7.13 INSTALLATION OF FIRE HYDRANT ASSEMBLIES

Fire hydrant assemblies are to be installed in accordance with the general instructions contained in AWWA C600 and AWWA Manual No.M17. Materials are covered in Section 3.11 and the installation is shown on **Plate W-28**. Special attention is called to the following:

1. The 2-foot (2') setback from the curb face must be adhered to regardless of whether the curb is next to a private street or within a private street parking lot. The two feet dimension is from the curb face to the nearest portion of the fire hydrant and is not the fire hydrant centerline.

2. The elbow in the fire hydrant bury must be anchored on concrete thrust block.

3. The fire hydrant shall be positioned so that the bolts between the extension piece and the hydrant are accessible, both top and bottom within the limits shown on Plate No.11. If the hydrant is either too low or too high, it shall be corrected.

4. Painting shall be per Section 3.16 with all metal surfaces above ground being painted including any extensions. It is suggested that the extension piece be painted before pouring the sidewalk.

5. All underground flanges shall be coated and wrapped with a plastic film per Sections 3.18 and 7.11.

7.14 INSTALLATION OF METER BOXES, PRESSURE REGULATORS

A. GENERAL:

Specific installation details are shown on the following plates:

Plate No.	Type
W-37, W-40, W-41	¾" and 1" meter
W-38, W-41	1-1/2" and 2" meter
W-39, W-40	2" compound meter
W-48	4" and larger compound meter

Information concerning the sizing of meters is presented in Section 2.12. In all cases, the District will select the meter type and install the meter after proper arrangements (see Section 5) have been made.

B. METER BOXES:

These shall be set with the longitudinal axis perpendicular with the street and located as shown in **Plate W-42** with respect to the curb. Only in special circumstances shall they be located within driveways. In instances where meter boxes must be within the traveled right-of-way, special written approval is required and the cover must be suitable for traffic load.

Angle meter stop, jumper, and customer ball valve shall be centered and parallel to the sides of the meter box and the flow-line of these fittings shall be set 3" higher than the floor or base for 1", 1½", and 2" services and meters .

Spacers (jumpers) are to be placed in the meter box until the District installs the meter. The Contractor may utilize spacers provided by the District on an "as available " basis. Care must be taken to avoid placing a strain on the spacer through misalignment of the house or service line.

C. JURISDICTION:

All pipes on the main line side (before the meter and including the meter; also the street side) of the meter box are under the jurisdiction of the District.

D. PRESSURE REGULATORS:

Wherever the normal operating pressure at the house or building exceeds 80psi, a pressure regulator is required. For convenience, the houses or buildings requiring regulators are shown on the plans, but this does not relieve the Developer/Contractor's responsibility to check the pressure of each house or building. The type of regulators and their installation are as required by the respective Building & Safety Department.

7.15 BACKFILL AND COMPACTION

A. GENERAL:

There are several distinct zones to be considered in the backfilling procedure as follows, refer to **Plate W-11**.

- Pipe Zone

  This area is from the trench bottom to 12" above the pipe. This zone is to be backfilled under the strict jurisdiction of the District.

- Above Pipe Zone but Below Pavement Sub-grade Plus the Zone Including the Sub-grade and Pavement

  Backfill and compaction in existing streets and in the area above the pipe zone shall be in full compliance with the City or County encroachment permit issued for the specific work, and with the City or County land development specifications. In both cases, the filling of trenches shall be subject to the approval of their Inspectors, who shall

have full authority to order compaction tests to demonstrate the actual density.

Section 3.12 of these Standards contains the material designations for both the pipe zone above pipe zone regions.

B. BACKFILLING PIPE ZONE:

Sand as specified in Section 3.12 must be used and shall be placed in the pipe zone with particular attention to getting material to the underside of the pipe and fittings to provide a firm support along the full length of the pipe. Care shall be exercised in backfilling to prevent damage to the pipe or coating, as applicable. Backfill in the pipe zone may be either compacted by hand tamping methods or flooded into place in a single lift without hand working. In no case shall sufficient water be applied to float the pipe. See further discussion of flooding or jetting below in Section E. Acceptability of compaction in the pipe zone will be determined primarily by visual inspection and probing by the Inspector to determine that no voids exist in the backfill. The backfill within the pipe zone shall meet the requirements of 90% relative compaction.

C. BACKFILLING ABOVE PIPE ZONE:

The sequence of backfilling and compaction above the pipe zone (in public right-of-way i.e., streets) shall be as directed by the City or County Inspector, but in the absence of such instructions, the following procedure shall govern:

- Testing for pipe and joint leakage will be done after consolidation of the backfill to the top of the sub-grade zone and after service lines have been installed to the property lines.
- Backfill, compaction and resurfacing shall be scheduled so that existing public streets may be opened to normal traffic in accordance with the City or County encroachment permit, and so that the backfill operations closely follow the pipe laying avoiding open trenches overnight.
- The trenches or excavations shall not be backfilled without prior inspection by the District. Such inspection does not relieve the Contractor from compliance with the testing of the waterline, which should be conducted after final assembly of main, and service lines in consolidation of backfill as described above. Contractor shall assume the cost of removal and replacement of backfill necessary for correction of defective conditions revealed by testing.

- If no pavement is to be placed, the backfill zone between the top of the pipe zone and the bottom of the sub-grade zone or ground surface may be filled with approved native material. It shall be placed in lifts not exceeding 3 feet in un-compacted thickness, and compacted by water or mechanical means so as to obtain 90% relative density, except for the sub-grade zone, consisting of the space under pavement and/or shoulder to at least 2.5 feet below finished road grade which shall be filled and compacted to the prevailing City or County requirements, without flooding or jetting.

- If the work is in private property and not subject to public agency requirements, excavations shall be final, backfilled, compacted and finished to match original conditions as interpreted by the District as further described in Section 10- Final Clean-up.

- In traffic areas within public right-of-way where pavement is to be replaced, the City or County requirements may call for a cement sand slurry mixture to be used for trench backfill. This requirement will generally apply to repair trenches that are 2 feet or less in width. For trenches wider than 2 feet, the aforementioned procedures may be approved by the entity's Public Works Departments. It must be emphasized that the specific requirements above the pipe zone are within the jurisdiction of the Public Works Departments and Developers and Contractors shall have a responsibility to investigate and comply with the applicable requirements.

D. BACKFILL BY TAMPING METHOD:

Backfill material shall be placed in uniform layers of the thickness specified above. The moisture content of the backfill material shall be near or at the optimum required for compaction and each layer shall be tamped until compacted to the required minimum relative compaction. Heavy-duty compacting equipment having an overall weight in excess of 125 pounds shall not be used until backfill has been completed to a depth of 2 feet over the top of the pipe.

If hydro-hammer is used for compaction of overlying materials, at least 4 feet of backfill must be placed over top of pipe prior to its use. This is required to insure that the pipe is not damaged.

E. BACKFILLING BY FLOODING OR WATER SETTLING METHOD OR JETTING

This method should only be attempted where the trench drains naturally and in a fairly rapid manner. Also, the backfill material must be sufficiently

granular to consolidate properly by this method and must not cause damage to surrounding structures or soils.

If flooding is used, sufficient time shall be allowed for the puddle or flooded mass in each layer to solidify until it will support the weight of a man before any overburden is placed on the pipe. Apply only enough water to give complete saturation of the backfill material. Drain off excess water as it will retard the drying and consolidation of the materials. Flooding, if used, shall be applied after pipe zone material placed. However, to prevent floating the pipe at a minimum, some material should be placed adjacent to and over the pipe to add weight.

In the pipe zone, the backfill material shall be placed in uniform layers of the thickness specified above. At the top of each layer, the trench shall be diked at suitable intervals depending on the slope, and the trench between dikes shall be filled with sufficient water to inundate the backfill materials. Visual inspection of the backfill must indicate settlement prior to placing the next layer of fill. Care shall be exercised to prevent floating the pipe.

Following the backfilling of the pipe zone, the trench shall be filled in uniform layers not to exceed 18" in thickness. Each layer of fill will be diked at suitable intervals depending upon the slope, and the area between the dikes flooded with water at repeated time intervals until the backfill is completely saturated. Visual inspection of the backfill must indicate settlement prior to placing the next layer of fill. The final layer shall also be saturated and after settlement occurs the surface will be prepared for final dressing or paving.
Jetting with water to saturate the trench backfill layers is an acceptable alternate to flooding. Jet holes shall be a maximum of 10 feet apart and sufficient water should be applied to consolidate the backfill materials. Also, care must be taken not to push the jetting pipe down below the spring line of the pipe, causing disturbance to the pipe grade. Also, the materials should be jetted from the bottom upwards.

F. COMPACTION TESTS:

These tests shall be taken as determined by the District. The Developer/Contractor shall make all necessary excavation for the tests at locations selected by the District, and shall refill and re-compact these excavations to the specified densities.

7.16 RESURFACING AND RESTORATION

If the water work shall occur in the streets where no paving exists, the Contractor shall, in accordance with the City and County requirements, leave the completed

trenches in a suitably compacted condition for finish grading, placement of base material and paving by others.

If the work is within existing City or County streets, any required surfacing shall be in accordance with the City or County encroachment permit. **Plate W-11** is included as information.

If the work has disturbed or damaged existing private streets, alleys, driveways or other improved surfaces, the damaged portions shall be removed and restored, including the provision of adequate sub-grade where these operations have disturbed the original material…

Substructures removed or damaged on public or private property shall be restored or replaced unless such structures are designated on plans "to be abandoned". Such structures include but are not limited to trees, bushes, plantings, ground cover, mailboxes, fences and sprinkler systems.

Any temporary paving, the Contractor as required shall furnish barricades or special provisions required by public agencies.

7.17 BORING AND JACKING OPERATIONS

A. GENERAL:

Placement of pipe by boring, directional drilling, or jacking methods requires special District approval for each instance. However, as a general guideline, the following shall pertain:

1. Except for the use of air or water, the methods and equipment used in boring and jacking operations shall be optional to the Contractor provided that the District reviews them prior to work.

2. The placement of pipe shall be to the lines and grades shown on the plans.

3. Voids remaining outside the pipe (or carrier pipe if applicable) shall be backfilled with concrete.

4. Where a casing is used, it shall be no less than 8" greater in diameter than the pipe to be installed.

5. The placement of pipe in casing shall be supported with plastic and stainless steel spacers to the lines and grades as shown on the plans. Zippered end caps shall be installed on the ends of the casing.

B. BORES:

The boring machine shall cut a true circular bore to the required line and grade. The bored tunnel shall be no more than 2" larger in diameter than the maximum outside diameter of the casing or water pipe to be installed.

C. JACKED STEEL CASING:

In addition to applicable sections above, the following shall pertain:

1. Where casings are used, the size and wall thickness of the casing shall be at the Contractor's option except that the minimum casing thickness shall be not less than 3/8".

2. Field joints of steel casings shall be welded with a continuous circumference weld.

3. The placement of pipe in casings shall be supported with redwood skids, shims or wedges to the lines and grades shown on the plans.

4. Prior to backfilling the annular space between the pipe and casing, the pipeline shall be tested in accordance with Section 9, Testing.

5. The annular space shall be backfilled with washed concrete sand blown or rammed into place until the entire cavity is filled. Concrete bulkheads shall be placed at each end of the cased section to retain the backfill material.

7.18 CONCRETE AND MORTAR WORK

A. CONCRETE:

1. Material:

Concrete used for encasements, filling, blocking, piers and other typical water construction applications shall be transit-mixed concrete from a supervised batch plant that issues certified delivery tickets with each load, showing the mix proportions, mixing time, truck departure time and water added. Such certified tickets will be handed to the Inspector at the time of delivery. Ready-mixed concrete shall be batched and handled in accordance with ASTM C94. Job mixed concrete shall be limited to that needed for patching and minor non-structural uses requiring one sack of cement or less. In these cases,

the materials and workmanship shall be the same as if transit-mixed concrete had been used.

Sand:

Sand shall be fine granular material resulting from the natural disintegration of rock and shall be free from injurious amounts of oil, mica, clay, or other deleterious substance. Sand when tested in accordance with ASTM C117-49 shall not exceed 3% by weight of clay and silt.

Class	Application	28 Day Compressive Strength, Minimum PSI	Maximum Aggregate Size, Inches	Slump Minimum Inches	Slump Maximum Inches
A	Walls, structures, piers and reinforced encasements	3,500	1-1/2”	3	6
B	Thrust blocks, non-reinforced pipe encasement, non-structural use	3,000	1-1/2”	2	6
C	Pump mix for abandoning lines	1,000	3/8”	Adequate for pumping	Adequate for pumping

Rock and Gravel:

All rock and gravel used in concrete shall be mechanically worked. It shall consist of gravel or a combination or gravel and sound crushed rock. It hall be clean, hard, and durable and shall have no thin, elongated, laminated pieces alkali, oil, organic, or other deleterious substances.

Water:

All water used for cement mortar, grout, or concrete shall be clean and free from oil or vegetable matter. The Contractor shall at his expense proportion the concrete mix to produce compressive strengths at the 28-day test equal or better than for the above Classes and applications.

7.19 PAVEMENT

a. Untreated Rock Base- Untreated rock base shall conform to the provisions of the State Standard Specifications. Thickness shall match existing but shall not be less than 4”. Rock shall conform to ¾“ maximum size.

b. Asphaltic Concrete- Asphaltic Concrete shall be Type B-1 and shall conform to the State of California, Division of Highways Standard Specifications and these special provisions.

c. Aggregate- Aggregate for asphaltic concrete shall be a ¾" maximum, medium grade combined mineral aggregate and the bituminous binder shall be steam refined paving asphalt penetration grade 85-100.

d. Prime Coat- The Prime Coat shall be liquid asphalt or tack oil SC-250 applied of ¼ (.25) gallon per square yard over the area to be paved.

e. Fog Seal Coat- The fog seal coat shall be asphaltic emulsion containing not over 50% water. The fog seal coat shall be applied at a rate of 1/10th of a gallon per square yard.

f. Uniform Compacted Asphaltic Concrete- The uniform compacted asphaltic concrete shall weigh not less than 11.25 pounds per inch of thickness per square foot of paving.

7.20 PAINTING

Paint shall be applied in such a manner as to assure an even, smooth, uniformed adhering coat free from dirt, runs, brush marks and laps, and shall be applied as recommended by the manufacturer. Painting will not be permitted when freshly painted surfaces may become damage by rain, fog or condensation or when inclement weather can be anticipated. The Contractor at his expense shall replace fresh paint damaged by the elements. Drop cloths shall be used to protect floors, equipment, piping and other exposed surfaces from spattering and spillage. Paint shall be allowed to dry thoroughly between applications of successive coats. The manufacturer's recommended time between coats will be used as a guide by the Inspector as to when the next coat of paint may be applied. The District must give approval before successive coats are applied, unless otherwise approved.

The Contractor shall notify the District after surface preparation and after the application of each successive coat of paint. Spray painting will not be permitted unless specifically authorized by the District.

7.21 SAFETY

Wherever the Contractor is aware of unsafe operations, such operation should be discontinued immediately. Also, if the Inspector is aware of such conditions and informs the Contractor of same, it will be the Contractor's responsibility to comply. In such instances, the advice shall not be construed as implying any District liability. Essential to proper safety is adherence to all traffic control requirements.

Contractor is to submit to the District a copy of their annual CAL-OSHA permit and the letter notifying CAL-OSHA of their work on the District project.

SECTION 8.0

ABANDONMENT

8.1 GENERAL

The Developer's Engineer shall indicate all existing waterlines or structures that are to be abandoned, on the drawings. In general, abandoned lines, which are in service, will be replaced with a parallel line of equal or larger size, and the Engineer shall demonstrate in any case that the abandonment does not adversely affect the water system.

All abandonment and construction techniques shall be discussed with the District Inspector and approved prior to any such work.

8.2 WATER LINES

Water lines to be abandoned shall be entirely filled by pumping concrete into them. The pump mix shall be a mixture sufficiently workable for the purposes intended and shall be a concrete mix of 2,000psi minimum. The Engineer shall show on the drawings the approximate number of cubic yards of concrete that will be required for any particular reach. All buried valves and valve cans shall be removed.

8.3 STRUCTURES

Structures associated with lines to be abandoned shall be removed by the Contractor/Developer and given to the District if salvageable. This includes valves and valve boxes.

SECTION 9.0

TESTING AND DISINFECTING WATERMAINS

9.1 GENERAL

All completed water lines, as well as the service lines and appurtenant structures, will be tested by and at the expense of the Contractor in the Inspector's presence prior to field acceptance of the work. The Contractor must correct all defects in workmanship or materials that become evident by Inspection or testing at any time during the work. Testing will be done after the completed installation and compaction of all underground utilities, except as modified below.

9.2 HYDROSTATIC TESTING

A. GENERAL REQUIREMENTS:

The purpose of the hydrostatic test is both to test for the ability of the pipeline to withstand pressure and to test for an acceptable leakage.

After the pipe and all appurtenances have been laid and backfilled and compacted sufficiently for the required restraint, they shall be subjected to a three (3) hour hydrostatic pressure of 50psi greater than the operating pressure as shown on the plans. This value for the test pressure shall be used for most installations. However, where the operating pressure exceeds 125psi as called out on the cover sheet of the drawing then the test pressure shall not be less than 225psi for Class 150 pipe or 250psi for Class 200 pipe. This test pressure shall be at the low point in the section being tested and shall be corrected to the elevation of the test gauge. The District shall designate tests locations. The pressure test or retest shall be conducted any time after trench backfill compactive effort with heavy-duty compacting equipment having an overall weight in excess of 125 pounds.

The maximum length of pipe to be included in any one test shall be not more than 2,500 Lf or the distance between valves, whichever is less. The contractor shall provide suitable tests bulkheads, blocking and fittings to permit such sectionalizing.

B. PREPARATION:

The lines shall be filled with water at least 24 hours prior to testing; this allows the pipe lining material to become saturated. During this period no pressure need be maintained on the line although some pressure, say 50psi, will help to saturate the line and remove the air. While filling and immediately prior to testing, all air shall be expelled from the pipeline and whenever practical, water should be introduced from the low end of new

system to facilitate the elimination of air in the pipeline and whenever practical, water should be introduced from the low end of new system to facilitate the elimination of air in the pipeline prior to testing. Where air valves or other suitable outlets are not available for releasing air for applying the test, approved taps and fittings shall be installed and later securely plugged.

C. PROCEDURE:

The pipeline pressure shall be pumped up to the specified test pressure. Then the pumping shall be discontinued until the pressure in the line has dropped 10-15psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until 3 hours have elapsed from the time the specified test pressure was first applied. At the end of this period, the pressure shall be pumped up to the test pressure for the last time.

D. LEAKAGE:

Shall be considered as the total amount of water pumped into the pipeline during the three (3) hour period, including the amount required in reaching the test pressure for the final time. Leakage shall not exceed the rates given in the Table below. If leakage exceeds this rate, the weak points shall be located and stopped, and all defective pipe, fittings, valves and other accessories discovered shall be removed and replaced with sound material and test shall be repeated until the leakage test is passed. All perceptible leaks shall be similarly repaired.

E. STEEL PIPE:

Steel pipe with mortar lining has the same requirement for a minimum soaking period. However, assuming 40 standard lengths, the leakage allowance is lower as seen in the Table below:

TABLE 9-1
ALLOWABLE LEAKAGE FOR 3 HOURS PER 1,000 LF OF PIPE**

Pipe Size	Test @200 PSI	Test @250 PSI
8”	0.5 gal	0.7 gal
10”	0.9 gal	1.2 gal
12”	1.3 gal	1.6 gal
14”	1.7 gal	2.0 gal
16”	2.1 gal	2.4 gal
18”	2.5 gal	2.9 gal

** Based upon L= N x P divided by 7400 where L= leakage in gal/hr; N= # of joints; P= test pressure in psi

Of course, where the joints are welded, there should be no leakage allowance.

F. DIFFERENCE FOR PVC PIPE:

The soaking period requirement is not critical for PVC pipe since the walls do not absorb water and become saturated. Although AWWA Manual M23 recognizes a two (2) hour leakage and pressure test, the District requires the same three (3) hour tests for PVC and steel. The leakage allowance is the same given in Table 9-2.

G. DIFFERENCE FOR DUCTILE IRON PIPE:

As with PVC pipe, the soaking period is not critical unless the pipe is mortar lined. Then the minimum 24 period is required. A three (3) hour pressure test shall be used and the limits will be 2.2 times the values in Table 9-2 assuming lengths of pipe are 18 feet instead of the 40 feet the Table was set up for. If using 20-foot lengths of pipe, the allowance is the same as Table 9-2.

H. POSSIBLE CAUSES FOR TEST FAILURES:

For information, the following is provided:

1. A hydrant valve held open by a piece of rag, wood or some other foreign matter. When a valve is held slightly open, line pressure will be relieved through hydrant drain.

2. Dirt of foreign material under the coupling gasket.

3. Pipe not sufficiently covered in trench.

4. Fittings and valves in test section not sufficiently blocked.

5. Corporation cocks not tightly closed.

6. Air in line (no air-vac)

7. Leakage through valve at end of test section.

8. Valve bonnet plug leaking.

9. Packing on valves and wet-barrel hydrants leaking.

10. Test pump leaking. Check valve as well as gate valve.

11. Curves not sufficiently thrust blocked.

12. Testing too lengthy a section of pipeline.

13. Insufficient saturation time (24 hours)

14. Ruptured pipe-cracked, blown out.

15. Broken couplings

16. Faulty accessory equipment – valves, fittings, hydrants, saddles, corps and air-vacs.

17. Faulty test gauge.

18. Test pump suction line drawing air.

19. Fish- mouthed gasket.

9.3 ROLE OF FLUSHING

All mains shall be flushed with potable water after completion of construction and prior to disinfection. The primary purpose of this function is to remove the sediments and miscellaneous products of construction. After lines are chlorinated, they are to be flushed again per Section 9.5.

9.4 DISINFECTING WATER MAINS

A. PURPOSE:

1. Preventing contaminating materials from entering the water mains during Construction or repair and removing by flushing materials that may have entered the main.

2. Disinfecting any residual contamination that remains.

3. Determining the bacteriologic quality by laboratory test after disinfection.

B. PROCEDURE:

All mains shall be flushed with potable water after completion of construction and prior to disinfection. Included shall be service lines, fire hydrants, valves and all other accessories. The Contractor shall provide a sufficient number of suitable outlets at the end(s) of the line(s) being sterilized in addition to those required by the plans, to permit the main to be flushed with water at a velocity of at least 2.5 feet per second over the

F. PROCEDURE AFTER CUTTING INTO OR REPAIRING MAINS:

Two procedures are recommended as follows:

1. Swabbing with hypochlorite - where all pipe and fittings are swabbed on the interior with 5 percent hypochlorite solution before they are installed. Flushing, preferably from both directions should follow this.

2. Slug method - whereby a section of line is isolated and then fed a slug dosage of chlorine up to 500 mg/l for a minimum of ½ hour. Then the line is flushed.

9.5 TESTING FOR FIRE FLOW OR PRESSURE

In selected areas, the District may require a check of the fire flow or pressure following construction. In such instances, the Developer/Contractor shall assists either the District or the Fire Department, as appropriate.

CHLORINE REQUIRED TO PRODUCE 50 MG/L CONCENTRATION IN 100 FEET OF PIPE

Pipe Size	100 % Chlorine	1 % Chlorine Solution
6”	Use 0.61 lb	0.73 gal
8”	0.108 lb	1.30 gal
10”	0.170 lb	2.04 gal
12”	0.240 lb	2.88 gal

2. Slug Method:

   This method is generally not approved. It involves dosing the line with a moving slug of no less than 300 mg/l of chlorine and maintaining that concentration in any one section for at least 3 hours.

3. Tablet Method

   This method is generally only used in instances such as fire line where the continuous feed method may be impractical. The tablets shall be placed in the ceiling of the pipe and care must be taken to fill the line at no more than 1 foot/second. AWWA C601 lists the number of tablets per section of pipe required to achieve a dose of 50 mg/l. For example, an 8-inch pipe 13 feet long requires 2 tablets per section; whereas, a 12-inch pipe requires 5 per section.

C. FINAL FLUSHING:

After the applicable retention period, the heavily chlorinated water shall be flushed until the remaining chlorine residual is less than 1mg/l. Water containing chlorine shall be de-chlorinated.

D. BACTERIOLOGICAL TESTS:

After final flushing and before the main is placed in service, the District will sample the water and test for bacteriological quality. These tests are an indicator of adequate disinfection. Sample(s) shall be collected from the main ends except for mains over 2,500 feet in length where additional samples at intermediate points as determined by the District.

E. REPETITION OF PROCEDURE:

If the disinfection fails, then the procedure is repeated.

entire length. The outlet provided shall meet the requirements for fittings as specified for the type main constructed. Drainage Facilities shall be constructed such that the water lines cannot be contaminated through the flushing outlet. It should also be noted that certain contaminants, such as caked deposits, resist flushing at any velocity. Therefore, 2.5 fps should be considered a minimum.

TABLE 9-3
MINIMUM FLUSHING FLOW

Pipe Size	Flow Rate to Produce 2.5 fps
6”	220 gpm
8”	390 gpm
10”	610 gpm
12”	880 gpm
14”	1,200 gpm
16”	1,565 gpm
18”	1,980 gpm

After flushing, the water mains shall be disinfected with one of the following:

- Liquid chlorine (gas at atmospheric pressure)
- Calcium hypochlorite- it is either granular or tabular in form and chlorinated water solution is prepared by dissolving the granules in water (not allowed).
- Sodium hypochlorite- Packaged in liquid form. A chlorine water solution is made by adding water.

Three different applications methods are discussed in AWWA C601.

1. Continuous Feed Method

   This is the standard method in the District and should be used unless one of the other two methods is approved because this method is not practical. In the continuous feed method, water dosed with chlorine is fed continuously into line at a constant rate such that the chlorine concentration in the water in the pipe is maintained at a minimum 50 mg/l available chlorine. The chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall then be retained in the main for a minimum of 24-hour period during which time all valves and hydrants shall be operated in order to disinfect the appurtenances. At the end of the 24-hour period, the chlorine residual shall be no less than 24 mg/l throughout the main. The following Table should be useful in determining the amount of chlorine:

TABLE 9-4

SECTION 10.0

WATER SYSTEM AND WORK AREA CLEAN-UP

10.1 FINAL PROJECT CLEAN-UP

Once all pipeline systems have been installed, pressure tested, chlorinated and flushed, the system can be field accepted providing the necessary cleanup has occurred. All structures including fire hydrants shall be properly painted, where required, and free from dirt, concrete or other spattered materials. Also, the Contractor will clean the work site of construction debris. All private improvements damaged during construction shall be restored to at least the original condition of said improvements including but not limited to trees, shrubs, gutters, sidewalks, fences, grass, etc. Filled excavations in private property shall be neatly finished in a manner to facilitate natural drainage and eliminate hazards to persons or property. Also, all requirements of the District, the City and/or County Public Works Department, as appropriate, shall have been met.

SECTION 11.0

REQUIREMENTS FOR FINAL ACCEPTANCE

11.1 GENERAL

"Acceptance" of a project by the District really occurs in several stages. In this regard, there are several appropriate terms associated with acceptance:

A. PARTIAL FIELD ACCEPTANCE FOR OCCUPANCY CLEARANCE PURPOSES:

This may be given when occupancy is requested for certain units with a development project where the entire water system is not to a state of completion where it could be termed field accepted. In no event can occupancy clearances be given where satisfactory service cannot be assured. Also, clearance for occupancy does not imply that the District has waived any right to insist on repairs or corrections of punch list items subsequently identified in a final inspection or the entire water system.

B. FIELD ACCEPTANCE:

This is the term used when the District Inspector inspect the project and agree that all requirements as shown on the approved drawings and as specified in these Standards have been met.

C. FINAL ACCEPTANCE:

This is the term used when the Board formally accepts the water system by resolution.

11.2 FIELD ACCEPTANCE

After satisfactory completion of the improvements, the District Inspector will provide a field acceptance letter to the Engineering Manager. However, it shall be the Developer's responsibility to initiate action and to supply the required administrative items prior to official District Board acceptance of improvements.

11.3 "AS-BUILT" ORIGINALS

Original "As-Built" drawings and two (2) sets of blue-line prints shall be submitted to the District. The "As-Built" shall reflect the actual improvements made and give the accurate location of all new/or relocated facilities. The following certificates shall be signed and shall be signed and shall appear on the cover sheet of the water plans.

AS-BUILT CERTIFICATE

I hereby certify that the work shown on Drawing No. _____, Sheets No. _____through _____ marked 'As-Built" has been constructed in conformance with lines and grades and requirements as shown on said plans, drawings and referred specifications.

_____	_____	_____
Registered Civil Engineer	Number	Date

It should be emphasized that the responsibility for accurate "As-Built" drawings must involve active participation by the Developer's Engineer during the project construction. All changes, whether done through the formal change order or revision process or whether done, as field adjustment should be reflected on the "As-Built" drawings.

11.4 NOTICE OF COMPLETION

The Developer shall submit a copy of the recorded notice of the completion of the water system to the District.

11.5 GRANT DEED

The Developer shall submit the original unrecorded "Grant Deed" executed by the Developer conveying the system to the District; this includes notarization of all signatures. Language to be used on Grant Deed is as follows:

" An Easement and Right-of –Way to lay, construct, repair, maintain, operate, renew, replace pipeline and appurtenances incidental hereto for the transportation of water with the right of Ingress and Egress to and from same in, over, under and across the easement and with the right to disturb the surface of the easement area. Replacement or repair of improvements, including landscaping, that are disturbed, damaged or destroyed by the District in exercising the above described rights, will be the responsibility of the servient tenement, who shall bear the full cost, unless otherwise stated herein".

11.6 ITEMIZED COST/ADDITIONAL FEES

A certified and itemized copy of the cost of the facilities offered for dedication shall be submitted. Such certification shall consist of copies of the signed contractual agreement with any change orders. If the final cost is found to be more than the originally approved Engineer/s cost estimate, Developer shall pay the District an additional amount of Plan Check and Inspection Fees.

11.7 OTHER ADMINISTRATIVE ITEMS INCLUDING EASEMENTS

Depending upon the project, there can be other Administrative items required before final Acceptance. Examples are unpaid invoices, contractual requirements involving easements, etc.

11.8 APPROVAL FOR ACCEPTANCE

When all requirements (field and administrative) have been met, staff will prepare a resolution recommending Board acceptance of the improvements and exoneration of the Performance Bonds and Labor and Materials Bonds (10% of the bonds remain in force until it is fully exonerated; generally this is for the one-year maintenance and guarantee period).

Whereas, the normal maintenance and guarantee period is one year and the bond retention is 10% of the final cost of construction; both of these may be increased if in the Opinion of the District, the normal period and amount are not sufficient.

11.9 STATUS DURING MAINTENANCE AND GUARANTEE PERIOD

The Developer/Contractor is responsible during the guarantee period for the proper maintenance of the water system. Should the District's crew have to perform any of this work, the costs for it may be invoiced to the Developer /Contractor.

11.10 EXONERATION OF SURETY

Ninety Percent (90%) of the final cost of the development will normally be exonerated upon acceptance by the District. Ten percent (10 %) will be retained for the one-year guarantee period and then released.

SECTION 12.0

CROSS CONNECTION AND BACKFLOW DEVICES

12.1 GENERAL

According to AWWA definition, “Cross Connection means any connection or structural arrangement between a public or a consumer’s potable water system and any non-potable source or system through which backflow can occur. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices and other temporary or permanent devices through which, or because of which, backflow can occur are considered cross-connections”.

Cross-connections may be regarded as direct or indirect:

1. A direct connection is an arrangement whereby a safe water system is physically joined to a system containing unsafe water, wastewater or other waste.

2. An indirect connection is an arrangement whereby unsafe water in a system may be blown, pulled by vacuum, or otherwise diverted into a safe water system.

To understand cross-connection and backflow prevention, several other terms need definition. Backflow is generally defined as the flow of any foreign liquids, gases or other substances into the distribution pipelines or a potable supply of water from any other source or sources than the intended one. For backflow to occur, two conditions must be present:

1. A link must exist between the potable and the non-potable systems.

2. The resultant flow produced by the differential pressure must be toward the potable system.

If both systems are at pressures greater than atmospheric (positive pressure), backflow due to “back-pressure” occurs. A pump, elevated tank or boiler can create a backpressure that is greater than the pressure in the potable system.

If the potable system is at a pressure less than atmospheric (negative pressure), the atmospheric pressure on the foreign liquid will force it toward the partial vacuum and “back–siphonage” occurs. A more explicit term for backflow when sub-atmospheric pressure exists is back-siphonage. Back-siphonage is the backing up, or siphoning, of a foreign liquid into the potable water system.

12.2 JURISDICTION, AUTHORITY AND REFERENCES

The District has adopted the regulations of the Department of Public Health of the State, Title 17 of the California Administrative Code. The Developer/Contractor should be familiar with the applicable sections of this code. The District is responsible for ensuring that the devices are properly installed, maintained and tested. The various protective devices are to be installed maintained and tested by and the expense of the property owner.

A source of general information is a booklet titled “Cross-Connection and Backflow Prevention” as published by AWWA.

12.3 TYPES OF BACKFLOW PREVENTION DEVICES

As described below, there are several different types of protective devices. The “Reduced Pressure Principle Device” and “Double Check Valve” are used to prevent backflow and the former also prevents back-siphonage. The “Air-Gap” and “Pressure or Atmospheric Vacuum Breakers” are used for prevention of back-siphonage. Description of each devices is as follows:

A. REDUCED PRESSURE PRINCIPLE DEVICE (RP):

Commonly referred to as an RP, or RPP, this device consists of two independently acting Check Valves, together with an automatically operating pressure differential relief valve located between the two Check Valves. The first Check Valve reduces the supply pressure at a predetermined amount so that during normal flow, and at cessation of normal flow, the pressure between the two Check Valves shall be lower than the supply pressure. If either Check Valves leaks, the relief valve will discharge to the atmosphere. This will maintain the pressure in the zone between the two check valves lower than the supply pressure. The unit also has two shutoff valves (one upstream and one downstream of the checks) and properly located test cocks for field-testing. **This is the preferred device for all circumstances.**

B. DOUBLE CHECK VALVES:

The Double Check Valve assembly is composed of two single, independent acting check valves. The unit also has two tightly closing shut–off valves located at each end of the device and four test cocks for the testing of the check valves. It protects the District System by preventing the return of “degraded fire system waters” into the street supply mains that could happen when a Fire Department “pumper” connects to the system

The Double Check Detector Meter is specifically designed for use on fire protection system pipeline installations. The device detects leakage or unauthorized use of water from fire system lines. That usage is immediately registered on the low flow meter on the unit.

C. AIR GAP:

An air gap is a physical separation between the free flowing discharge end of a potable pipeline and an open or non-pressure receiving vessel. To have an acceptable air gap, the end of the discharge pipe has to be at least twice the diameter of the pipe above the topmost rim of the receiving vessel, but in no case can this distance be less than one inch (1”).

This may be the simplest, the most effective and least expensive type of protection. However, the chance for future cross connections, the cost of additional pumps to pressurize the system often makes this an expensive protection system. The most common use of the Air Gap is at the fill pipe on a water truck.

D. PRESSURE VACUUM BREAKER:

The Pressure Vacuum Breaker (or PVB for short) is a device that contains within a single body, a single loaded check valve and a loaded air-opening valve, that opens to admit air whenever the pressure within the body of the device approaches atmospheric. The body of the device has two tight closing shutoff valves and it is fitted with test cocks, appropriately placed, for testing the device. This device may be used internally on privately owned systems but is not approved for the protection of the District Water System from Commercial or Agricultural facilities. (See 12.3, sub-Section A)

E. ATMOSPHERIC VACUUM BREAKER:

An Atmospheric Vacuum Breaker has a moving element inside, which during low flow prevents water from spilling from the device and during cessation of flow, drops down to provide a vent opening. This device should not remain under pressure for long durations and it cannot have any shutoff valve downstream from it. This device may be used internally on privately owned systems but is not approved for the protection of the District Water System from Commercial or Agricultural facilities (See 12.3, sub-Section A)

12.4 REQUIREMENTS

The following lists requirements indicating locations where the various devices are to be installed. In addition, the following is provided:

A. REDUCED PRESSURE PRINCIPLE DEVICE (RP):

1. General:

   Use where cross-connections are known to or probably will exist that cannot be eliminated and where the degree of severity is judged by the District to warrant more than a double check valve.

2. Specific Examples:

   - Water service to all industrial or commercial facilities.
   - Water service to all Agricultural parcels using potable water as its water source.
   - Water service to hospitals, doctors, and dental offices for humans and animals.
   - Irrigation systems such as median or park strips along streets or landscape areas within projects that are subject to backpressure.
   - Fire sprinkler systems using chemical additives.
   - Water service to mortuaries.
   - Service to mobile home parks.
   - Food processing plants.
   - Community swimming pools and private swimming pools within a development
   - Any parcel that has an auxiliary source of water.

B. DOUBLE CHECK DETECTOR CHECK VALVE:

1. General:

   Use where there is no other meter between the water source and the building such as a fire service line for a building utilizing fire suppression sprinklers.

2. Specific Examples:

   - Fire service line for buildings with fire sprinklers.

C. AIR GAP:

1. General:

Use where there is a connection to any premise using a dangerous or toxic substance in toxic concentrations. The air gap shall be located as close as practicable to the service cock and all piping between the service cock and receiving tank shall be entirely visible. If these conditions can't be met, then an RP device will be required.

2. Specific Examples:

- A commercial or agricultural installation where an air gap is the only approved cross connection method allowed due to hazardous chemicals used on the site.
- The fill pipe on a water truck.

D. PRESSURE VACUUM BREAKER (PVB)

1. General:

This unit can only be used where there can be no backpressure and only where there can be no back-siphonage. The unit can have shutoff valves downstream of the device. The PVB must be installed at least 12" above the highest outlet or tank. This device may be used internally on privately owned systems but is not approved for the protection of the District Water System from Commercial or Agricultural facilities. (See 12.4, A-2)

2. Specific Example:

- Lawn irrigation system where outlets are situated well below the device and where there may be a shut-off valve downstream (or past) the device such as a hose bib.

E. ATMOSPHERIC VACUUM BREAKER:

1. General:

As with the pressure type, there should be no possibility of backpressure. This device cannot have any shut-off valves downstream of the device. It must be installed at least 6" above the highest outlet or tank. This device may be used internally on privately owned systems but is not approved for the protection of the District Water System from Commercial or Agricultural facilities (See 12.4, A-2)

2. Specific Example:

- Typical residential sprinkler system.

12.5 INSTALLATION

A. GENERAL:

In terms of installation, there is an essential difference between “service” and “internal” protection. Service protection is a backflow device installed outside of the building, but on the customer’s side of the meter. These devices are specifically intended to protect the District Water System regardless of other protective devices inside the building.

Internal protection devices are installed within the building or facility.

B. SERVICE PROTECTION DEVICES:

The Owner/Developer submits drawings of the building to the City’s Building and Safety Department, which may require an outside or service protection device. Also, the District may require service protection after a survey of the facility once under construction or occupied unless internal cross connections are abated to the satisfaction of the District. In any case, the Owner/Developer should make arrangements with the District for inspection.

C. INTERNAL PROTECTION:

The installation of these devices falls under the jurisdiction of the Building and Safety Department and as approved to the satisfaction of the District.

12.6 APPROVED DEVICES

Current approved list issued by Ventura County’s Environmental Resource Agency.

http://www.ventura.org/envhealth/programs/x_connection/index.htm

12.7 TESTING AND MAINTENANCE

All backflow prevention devices are to be tested annually, at the owner’s expense, by a certified tester with repairs or maintenance as needed.

1. METER AND SERVICE CONNECTION, SIZE AND LOCATION:

The District reserves the right to determine the location and size of service connections and the water meter size.

A. **Service Size and Meter Size:**

1. Size of service connection and meter shall be based upon the peak customer demand per AWWA Manual M2, the total demand based upon the equivalent fixture unit value per the Uniform Plumbing Code, or the Districts previous experience and data. The basis shall be in accordance with sound engineering principles, equitable, fair, and in the best interest of all District customers.

2. The District must exercise caution in reducing the meter size since sustained periods of high flows that are greater than the meter capacity, will produce low customer pressures, registration errors, and high maintenance costs.

3. If the equivalent fixture unit count, per the uniform plumbing code, is not available, e.g. lot sales, the size of the service and meter shall be determined by the size of the lot. In no case will the service line be smaller than one-inch or the meter size smaller than ¾-inch.

4. The following table shall serve as a guide for determining the size of service and meter if the equivalent fixture values and other engineering data are not available during the planning stages.

Lot size	size of service*	size of meter*
¼ acre or less	1" minimum	¾"
¼ to ½ acre	1"	1"
½ to 1 acre	1 ½"	1"
1 ½ or more acres	2"	1 ½ "

* Recommended

Notes:

1. These are the recommended minimum sizes of services and meters. Developers and property owners can request a larger service line or meter if there is an anticipated demand greater than normal. Provisions shall be made for larger appurtenances if there is a possibility of an expansion program in the future. The size of the corporation stop, the service line, the angle meter stop, the customer valve and the meter box shall be the optimum size. The size of the meter shall be dictated by the needs at that time.

2. Owners of parcels containing one and a half acres and larger, can request to modify the connection to provide a separate line for agricultural uses provided there is at least one acre of land available for the production of a commercial crop. No capital fees will be charged for a separate meter that meets the criteria for agricultural use.

B. Meter Location:

1. Residential Meters:

- Shall be located 2' from the property line and 1' behind the curb if there is no sidewalk or 1' behind the sidewalk of each lot on tract houses. The District may approve variance from this condition if warranted.

- Shall be located on the property it serves.

- There shall be one meter for each lot; each unit in a condo complex and townhouse; and each building in an apartment complex.

- The meter shall be located within the Public Utility Easement otherwise an easement in favor of CWD will be required.

- Meter boxes shall not be located in the driveways for safety and maintenance reasons.

- In tracts served by both the Potable and Non-potable water, the Domestic meter shall be located to the right of the Non-potable (irrigation), with at least 4 feet of separation, when facing the house.

- In tracts where equestrian easements overlap, abut, or adjoin the utility easements, the meter shall be located as close to the curb as possible, or completely outside of the equestrian easement. If the meter must be installed within an equestrian easement it shall be protected with a traffic rated lid.

2. **Commercial meters:**

- Shall be located behind or beside buildings and/or other less conspicuous areas around the building to facilitate meter reading and maintenance tasks.

- There shall be one meter for each unit in a shopping center.

- There shall be one meter for each building other than a shopping center.

- Fixture unit counts and a copy of the plumbing plan must be submitted to the District to calculate the dwelling unit equivalent for fees and monthly charges.

3. **Industrial meters:**

- There shall be one meter for each building unless one individual or corporation owns the entire complex e.g. Siemens Solar Inc. In this case a master meter serving several buildings may be approved. Sub-leasing or selling a part of the complex may require the installation of a new meter for the leased or sold portion.

- Industrial and commercial customers south of the 101 freeway are advised to consider the installation of a separate irrigation meter. The City of Camarillo provides sewer service in this area and the city's sewer charges are based upon the water usage. Water used for irrigation purposes is not factored into the sewer bill provided there is a separate meter for irrigation use.

4. **Irrigation meters:**

Safety, accessibility, and maintenance considerations shall dictate the location of irrigation meters.

- Where the parkways along main thoroughfares e.g. Santa Rosa Rd., Adolfo Rd., Mission Oaks Blvd., Upland Rd., Highway 101, Pleasant Valley Rd., Moorpark Rd., Highway 23, Tierra Rejada Rd., are to be irrigated, the meter shall be located as close to a side street as possible to provide parking for the meter reader.

- Where a median strip is to be irrigated, the meter shall be located in the side parkway.

- Irrigation meters shall not be located in the sidewalks, driveways, and roadways, behind catch basins, culverts; box structures etc. especially electrical structures.

- Irrigation meters for agriculture shall be located in the mainline easement and shall be made accessible via an all weather road.

- Backflow devices shall be located as close as possible to the meter.

- Where meters are to be located in an unstable soil or a slope, a retaining wall shall be constructed.

C. **Water Service and Meter Installations In General:**

- The request for a meter installation carries with it an implied consent that District employees can access the property being served by the meter at any time, day or night, for meter reading, routine maintenance and during an emergency. Access to the properties of District customers residing in gated or guarded communities must be provided by whatever method residents utilize, e.g. passkeys, padlock keys or combinations, or numerical entry codes. The District will provide it's master padlock for use in multiple user locking devises.

- Meters serving firelines, irrigation lines, medical facilities, swimming pools, car washes, sewer facilities, RV dumping stations, Laundromats, and other facilities which have a potential for cross contamination of the domestic water shall have a backflow prevention device approved by the County of Ventura Environmental Health Dept. This device shall be periodically inspected to assure that it continues to operate properly and serve the purpose for which it was installed. The County Environmental Health Dept. administers the inspection program.

GENERAL NOTES - WATER

1. WATER FACILITIES CONSTRUCTION SHALL BE IN ACCORDANCE WITH CAMROSA WATER DISTRICT'S WATER DESIGN AND CONSTRUCTION STANDARDS.

2. BEFORE STARTING ANY WORK WITHIN A PUBLIC RIGHT-OF-WAY, THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM THE AGENCY HAVING JURISDICTION. THE CONTRACTOR SHALL PAY ALL PERMIT COSTS INCLUDING PLAN CHECKING AND INSPECTION FEES.

3. ELEVATIONS ARE IN FEET ABOVE U.S. C. & G. S. MEAN SEA LEVEL DATUM ADJUSTED TO 1961.

4. THESE DRAWINGS AND THE DATA HEREON ARE HEREBY MADE A PART OF THE STANDARD SPECIFICATIONS. WORK SHALL BE CONSTRUCTED ACCORDING TO THE STANDARD SPECIFICATIONS ON FILE IN CAMROSA WATER DISTRICT'S OFFICE.

5. NO REVISIONS SHALL BE MADE IN THESE PLANS WITHOUT THE APPROVAL OF THE GENERAL MANAGER OR DISTRICT'S ENGINEERING REPRESENTATIVE.

6. NO REPRESENTATIVE OF THE DISTRICT WILL SURVEY OR LAY OUT ANY PORTION OF THE WORK.

7. FIVE (5) DAYS PRIOR TO START OF ANY WORK, THE CONTRACTOR SHALL NOTIFY THE DISTRICT TO SCHEDULE A PRE-CONSTRUCTION MEETING AND PROVIDE 24 HOURS ADVANCE NOTICE FOR INSPECTION SERVICES.

8. THE CONTRACTOR IS REQUIRED TO SUBMIT SHOP DRAWINGS & CATALOG CUT SHEETS FOR ALL MATERIALS FOR APPROVAL BY THE DISTRICT. FAILURE TO SUBMIT THIS INFORMATION OF NON-COMPLYING MATERIALS MAY REQUIRE REMOVAL AND REPLACEMENT WITH ACCEPTABLE COMPONENTS AT NO COST TO THE DISTRICT.

9. ALL KNOWN INTERFERENCES IN EXISTING STREETS HAVE BEEN SHOWN ON THE PLANS. THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT A MINIMUM OF 48-HOURS PRIOR TO ANY EXCAVATION AND ASSUME RESPONSIBILITY FOR ANY DAMAGE DONE TO EXISTING FACILITIES.

10. VERTICAL SHORING SHALL CONFORM TO THE ORDERS OF THE STATE OF CALIFORNIA DIVISION OF INDUSTRIAL SAFETY AND/OR CAL/OSHA.

11. BACKFILLING AND RESURFACING OF ALL TRENCHES WITHIN PAVED AREA SHALL MEET THE REQUIREMENTS OF THE AGENCY HAVING JURISDICTION. JURISDICTION GENERALLY APPLIES FROM THE TOP OF THE PIPE ZONE, WHICH IS NORMALLY 12" FROM THE TOP OF THE PIPE, TO THE FINISHED SURFACE.

12. IF WORK IS TO BE DONE WITHIN A STATE HIGHWAY AND/OR RIGHT-OF-WAY, A PERMIT MUST BE OBTAINED BY THE CONTRACTOR FROM THE STATE OF CALIFORNIA, DIVISION OF HIGHWAYS OR CALTRANS.

13. LOCATION OF EXISTING UTILITIES SHOWN, HAVE BEEN DETERMINED FROM AVAILABLE "RECORD DRAWINGS" AND "AS-BUILT" INFORMATION. HOWEVER, IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE EXISTING UTILITIES AND TO EXERCISE PROPER PRECAUTION TO AVOID INJURY DURING CONSTRUCTION.

14. CONNECTIONS TO EXISTING DISTRICT FACILITIES SHALL BE MADE WITH AUTHORIZATION AND IN THE PRESENCE OF A DISTRICT REPRESENTATIVE.

15. DEVELOPER SHALL PROVIDE A CERTIFIED COST ESTIMATE OF THE WATER AND/OR SEWER FACILITY IMPROVEMENTS PRIOR TO ACCEPTANCE.

16. CONTRACTOR SHALL BE RESPONSIBLE FOR METERING AND PAYING FOR ALL WATER USED DURING CONSTRUCTION. PRIOR TO START OF CONSTRUCTION, PAYMENT CORRESPONDING TO THREE TIMES THE CALCULATED VOLUME OF WATER CONTAINED WITHIN THE NEWLY-INSTALLED WATER MAINS SHALL BE PAID TO ACCOUNT FOR TESTING, CHLORINATING, AND FLUSHING. THE CALCULATED VOLUME OF THE NEWLY INSTALLED WATER MAINS IS _____.

17. THE ENGINEER OF RECORD SHALL FURNISH TO THE DISTRICT A MYLAR AS-BUILT PRIOR TO FINAL ACCEPTANCE OF THE PROJECT.

18. THE DEVELOPER SHALL FURNISH THE DISTRICT A BILL OF SALE OR DEDICATION AND ACCEPTANCE OF IMPROVEMENTS AGREEMENT, OFFERING THE FACILITIES CONSTRUCTED UNDER THIS PROJECT FOR DEDICATION TO THE DISTRICT, ON THE FORMS FURNISHED BY THE DISTRICT.

19. ACCEPTANCE OF THE FACILITIES SHALL BE IN ACCORDANCE WITH THE CURRENT TERMS AND CONDITIONS SET FORTH IN THE “WATER AND SEWER RULES AND REGULATIONS” OF THE CAMROSA WATER DISTRICT.

20. ALL DISINFECTION WORK SHALL BE PERFORMED BY PERSONNEL CERTIFIED BY THE CALIFORNIA DEPARTMENT OF PUBLIC HEALTH IN ACCORDANCE WITH CHAPTER 9, DIVISION 5 OF THE HEALTH AND SAFETY CODE AND DISTRICT STANDARDS. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE COTNRACTOR SHALL PROVIDE A DISINFECTION PLAN TO THE DISTRICT FOR REVIEW AND APPROVAL BY THE DISTRICT ENGINEER.

POTABLE WATER NOTES

1. WATER SYSTEM SPECIFICATIONS OF THE CAMROSA WATER DISTRICT SHALL GOVERN THE MATERIALS AND INSTALLATION OF THE PROJECT AND ANY VARIATION THEREFROM SHALL BE APPROVED BY THE DISTRICT'S ENGINEERING SERVICES MANAGER.

2. ALL PIPES SHALL BE MINIMUM CLASS 200 PRESSURE PIPE PROVIDED, HOWEVER, THAT CLASS 150 MAY BE APPROVED FOR DIAMETERS 14" AND LARGER WHEN THE STATIC PRESSURE IS LESS THAN 150 P.S.I.

3. DUCTILE IRON PIPE SHALL BE CEMENT-MORTAR LINED AND ENCASED IN POLYETHELENE CONFORMING TO AWWA C100.

4. PVC PIPE SHALL BE CLASS 200, DR 14 AND SHALL CONFORM TO AWWA C-900.

5. STEEL WATER PIPES SHALL BE 10 GAUGE AND CEMENT-MORTAR LINED AND MORTAR COATED AND SHALL CONFORM TO AWWA C200; FITTINGS SHALL CONFORM TO AWWA SPEC. #208.59.

6. FIRE HYDRANTS SHALL BE WET BARREL VAN DEVENTER TYPE WITH 1- 2 ½ "OUTLET AND 1-4" OUTLET FOR RESIDENTIAL AREAS AND 2- 2 ½ " OUTLETS AND 1- 4" OUTLET FOR COMMERCIAL AREAS.

7. SERVICE LATERALS SHALL BE TYPE "K" SOFT COPPER AND SHALL BE A MINIMUM OF 1" (ONE) INCH IN SIZE UNLESS OTHERWISE NOTED.

8. THE WATER MAIN (S) SHALL BE INSTALLED AFTER THE STREET HAS BEEN BROUGHT TO SUBGRADE.

9. SEPARATE SERVICE LATERALS SHALL BE PROVIDED FOR EACH LOT. SEPARATE LATERALS FOR POTABLE AND NON-POTABLE WATER SHALL BE INSTALLED A MINIMUM OF 4 FEET APART AND PREFERABLY AT OPPOSITE SIDES OF THE LOT.

10. ALL DOMESTIC WATER SERVICES WILL REQUIRE AN R.P. TYPE BACKFLOW DEVICE, FEBCO 825Y OR EQUAL, WHEN NON-POTABLE WATER FACILITIES ARE INSTALLED.

11. CONTRACTOR SHALL MARK THE LOCATION OF ALL WATER SERVICES ON THE FACE OF THE CURB BY CHISELING THE LETTER "W" 2" HIGH AND 1/8" DEEP ON THE CONCRETE FOR THE POTABLE SERVICE AND SIMILARLY WITH AN "N" FOR THE NON-POTABLE SERVICE.

12. METER (S) SHALL BE FURNISHED AND INSTALLED BY THE DISTRICT AT THE EXPENSE OF THE SUBDIVIDER.

13. ALL OUTSIDE IRRIGATION SYSTEMS SHALL BE CONNECTED TO THE NON-POTABLE METER EVEN THOUGH NON-POTABLE SERVICE MAY NOT BE AVILABLE AT THE TIME. INTERCONNECTION OF THE NON-POTABLE WATER AND DOMESTIC WATER WILL BE REQUIRED TO FACILITATE THE ACTIVATION AND USE OF NON-POTABLE WATER WITH MINIMUM OR NO EXPENSE OR SERVICE INTERRUPTION TO THE NEW CUSTOMERS.

14. THE FOLLOWING CAMROSA WATER DISTRICT STANDARD DRAWINGS ARE APPLICABLE: W-1 THROUGH W-56 INCLUSIVE.

15. THE THRUST BLOCKS SHALL BE SELECTED TO WITHSTAND AN IMPOSED HYDRAULIC GRADIENT OF _____.

16. ALL ELEVATIONS SHOWN ON THE PLANS ARE FROM THE INVERT OF THE PIPE.

17. WATER PRESSURE IS ANTICIPATED TO BE IN EXCESS OF 100 PSI, PRESSURE REGULATORS AT THE HOUSE ARE RECOMMENDED.

18. ALL WATER MAIN AND FIRE HYDRANT RUN-OUT PIPE SHALL HAVE A MINIMUM COVE OF 36” UNLESS OTHERWISE SHOWN.

19. THE MINIMUM RADIUS OF CURVATURE OF PIPE SHALL NOT EXCEED THE RECOMMENDED MAXIMUM DEFLECTION AT COUPLINGS PER THE PIPE MANUFACTURER; FITTINGS MAY BE REQUIRED IN LIEU OF SHORT JOINTS.