

ENGINEERING
*Design
Criteria*

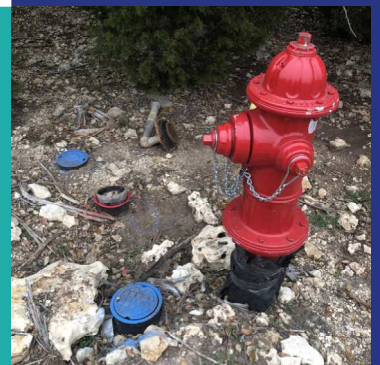


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General

Section 1 – Introduction

Items not specifically referred to herein or with the latest version of the TWC Standard Construction Notes for Plans shall comply with the latest edition of the Standards of the American Water Works Association and shall be subject to approval by TWC. Information contained in this document is subject to change without notice. Design Engineers are required to submit plans for review prior to issuing any plans for bidding purposes. See Water Section 1 of the TWC Standard Construction Notes for Plans.

The information herein is intended to assist engineers with water (and wastewater) design within the TWC CCN. The Engineer of Record will be responsible for ensuring the plans are in compliance with all local, state, and federal requirements.

Sections of the TWC Engineering Design Criteria and TWC Standard Construction Notes for Plans have been written concurrently. Information that applies to Contractor and work performed on-site is listed in the TWC Standard Construction Notes for Plans. During design, both documents should be checked for clarity.

Section 2 – Plan Preparation

All water distribution systems, water main extensions, and all appurtenant items shall be designed in accordance with these standards, TWC Standard Details and TCEQ Title 30 Chapter 290 Standards, whichever is most stringent. Consult TWC for clarification of specific items.

TWC shall own and maintain all portions of the water system up to and including the water meter. The water distribution system or water main extension or any portion thereof, which is to become the property and sole responsibility of TWC, shall be designed by a Registered Professional Engineer and constructed within a public right-of-way and/or easement.

Please consult the TWC website for specific plan preparation guideline, standard notes that must be included in all sets of plans, and standard details. Plan and profiles are required for water lines 12” and larger.

2a. Plan Review

For subdivision or site development, the Developer or Customer shall submit an electronic copy of plans in .pdf format to the Engineering Manager, including on-site and off-site improvements, and irrigation plans for review, and approval by the TWC Engineering Department. TWC will only review plans related to water lines and associated appurtenances. Once plans have been reviewed and approved by TWC, the plans shall be stamped by TWC as “Approved for Construction.” An electronic copy (.pdf) of the approved plans shall be returned to the design engineer.

After plans are approved and construction is complete, the Developer’s Engineer of Record will stamp the plans as “Record Drawings” for submission to TWC. One full size paper copy of the As-built drawings shall be submitted along with one copy in .pdf format file submitted to the

Engineering Manager. Compliance with this submittal requirement is not complete until final review and approval by TWC.

Section 3 – Mandatory Pre-Construction Meeting

See General Section 3 of TWC Standard Construction Notes for Plans.

Section 4 – Project Cleanliness

See General Section 4 of TWC Standard Construction Notes for Plans.

Section 5 – Project Layout Control and Surface Repair

See General Section 5 of TWC Standard Construction Notes for Plans.

Section 6 – Contract Close-Out

6a. Final Inspection

After bacteriological test samples meet standards listed in the TWC Standard Construction Notes for Plans and in accordance with TCEQ, Inspector will then provide three acceptance forms to be signed by the Engineer, Contractor and TWC inspector. Each party shall receive a dated copy of the form. See Section 6 of TWC General.

6b. Record Drawings

Acceptance of facilities by TWC will not be authorized until receipt of an approved set of record drawings. See General Section 6 of TWC Standard Construction Notes for Plans for approval of Record Drawings.

6c. Warranty Period

See General Section 6 of TWC Standard Construction Notes for Plans.

Section 7 – Line Separation

7a. Horizontal Separation

Water mains shall be installed to provide a minimum horizontal separation of 9 feet (per TCEQ regulations) from any existing or proposed wastewater line (gravity or force main). The distance shall be measured from outside of pipe to outside of pipe. Separation to all other facilities including gas, telephone, storm and electric shall be a minimum of 5 feet.

7b. Vertical Separation

Water mains crossing other pipelines shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the storm water, reclaimed water, wastewater line, conduit or other facility.

Water main crossings below other pipelines or conduits should be avoided whenever possible. All water lines crossing wastewater lines shall follow 30 TAC Chapter 290 Subchapter D.

7c. Typical Section Showing All Utilities

A typical section shall be provided in the engineering design plans showing the location and depth of all utilities located inside the right of way and in easement area adjacent to the right of way. The section shall show all utilities running parallel to the roadway, as well as show any service crossings running perpendicular to the roadway. When crossing the roadway with a service, all other utilities shall pass below the water main. It is the responsibility of the design engineer to ensure there are no utility conflicts. The design engineer shall coordinate with all utility providers on locations prior to receiving approval of the plans.

Section 8 – Pipe Laying Requirements

See General Section 8 of TWC Standard Construction Notes for Plans.

Section 9 – Trench Excavation

See General Section 9 of TWC Standard Construction Notes for Plans.

Section 10 – Bedding, Backfill, Compaction, and Final Grading

See General Section 10 of TWC Standard Construction Notes for Plans.

Water

Section 1 – System Design and Flow Criteria

1a. Capacity Criteria

The following is the system design capacity criteria for water systems:

Single-Family Requirements:

3 people per household

Average Day Demand: 100 gallons per day/person

Max Day Demand: 1.96 x Average Day Demand

Peak Hour Demand: 1.85 x Max Day Demand

Contact TWC for design capacity criteria for multifamily, commercial, and industrial land use.

1b. Line Sizing Criteria

The pipe sizing design criteria for water distribution systems shall as a minimum provide for at least 100% of the combined maximum day demand rate plus fire flow and Peak Hour demand, whichever is greater. The allowable minimum service pressure under said design condition in a transmission or distribution line shall not be less than:

- 20 psi (Max Day + Fire Flow conditions)
- 45 psi at the highest elevation served within the scope of the Project (Peak Hour).

Line sizing shall be reviewed and approved by TWC staff.

Oversizing may be required in certain areas based on the TWC planning efforts. Oversizing determination shall be made by TWC. Compensation for any oversizing completed by the developer will be determined as part of the Developer Water Service Agreement.

1c. Minimum Line Size

The minimum pipe size for distribution mains shall be 4 inches, unless otherwise authorized by TWC. The minimum size for distribution mains serving fire hydrants and fire hydrant branches shall be 6 inches in diameter.

1d. Water Line Routing and Looping

With TWC approval, water lines should be routed 3' – 5' within the edge of a public right-of-way. Multiple points of connection may be required in order to minimize service outage during, repairs, etc., and to improve fire protection and water quality.

Mains shall be looped whenever possible to avoid dead end mains. When looping is not feasible, auto flush hydrants must be installed at all dead-ends.

1e. Water Line Easements

Water Lines outside road rights-of-way shall be located within a utility easement that is dedicated to TWC (exclusive or non-exclusive) unless otherwise approved. Easement should be 20' minimum width or 3x the bury depth, whichever is more stringent. Easement width should increase based on the depth of bury as approved by TWC. A 10' temporary construction easement may be required if

requested by TWC. Easement documents and the metes and bounds shall be submitted to TWC for review and approval prior to recordation in the real property records of the appropriate county.

1f. Depth of Cover

See Water Section 1 of TWC Standard Construction Notes for Plans.

Section 2 – Connection to Existing Water Mains

See Water Section 2 of TWC Standard Construction Notes for Plans.

2a. Tapping Valves and Sleeves

See Water Section 2 of TWC Standard Construction Notes for Plans .

Section 3 – Cross-Connection Control and Backflow Prevention

TWC shall own and maintain all portions of the water system up to and including the water meter.

Backflow prevention devices shall be installed on all lines where the possibility exists for water from any other source to enter the public water supply system or on standby service lines (fire lines).

Double check valves, double check detector assemblies, reduced pressure principle backflow preventers, and other appurtenances if installed underground must be installed in a vault. All installations must be reviewed and approved by TWC.

Annual inspection, maintenance, and repair of any back flow prevention device shall be the responsibility of the customer. The requirements for backflow prevention devices can be found in 30 TAC 290.47. Some of the more common applications and required devices are listed below:

- i. Lots with existing water wells: A lot owner may continue to use his/her water well after requesting water service from TWC so long as proper back flow prevention measures are taken. This can be accomplished using one of the following methods:
 - If the well is connected directly to a line sharing service with water provided by TWC, a reduced pressure principle back flow preventer (rppz) must be installed on the customer service line just beyond the meter to meet proper backflow prevention criteria.
 - If TWC water and well water are pumped into a common holding tank, the potable water source (TWC) line must have an “air gap” flowing into the tank. An air gap means that water is discharged into the tank from the top of the tank with line that is at least 1 foot above the overflow level of the tank.
- ii. For situations not covered above, contact the TWC engineering department for further guidance on backflow requirements.

Section 4 – Fire Protection Standards

In cases where the County Fire Marshal or municipal requirements contradict the guidelines listed below, the more stringent of the requirements shall apply. The County Fire Marshal is responsible for implementing current fire code requirements within the county. Municipal codes may also apply

for developments within the city limits of a municipality. All plans for new commercial developments as well as remodeling of existing developments for commercial use shall require a review and approval by the county fire marshal and/or municipal code enforcement officials. This review is separate from any review completed by TWC.

In areas where existing TWC waterlines were not designed for and do not meet pressure and flow requirements as specified by the County Fire Marshal or municipal code, the developer shall be responsible for infrastructure improvements needed to meet the demands created by the developer’s project.

4a. Fire Flow

Fire flow shall be calculated in accordance with the fire flow requirements specified by the City, County, and/or Fire Marshal, whichever is most stringent. See **Section 1b** of this document for line sizing requirements.

Minimum requirements for 1 and 2 family dwellings not exceeding 2 stories in height shall be as follows:

Distance Between Buildings	Min. Fire Flow
More than 100'	500 gpm
31' - 100'	750 gpm
11' - 30'	1,000 gpm
10' or Less	1,500 gpm

For all other structures and uses, the minimum fire flow shall be 1,500 gpm unless otherwise determined by TWC. Sites storing large quantities of combustible materials may have much higher requirements, up to 3,500 gpm.

In areas where local municipal codes are enforced for development, and conflict with this information, the more stringent requirement shall apply.

4b. Fire Hydrant Spacing

See Water Section 4 of TWC Standard Construction Notes for Plans.

4c. Fire Hydrant Location

See Water Section 4 of TWC Standard Construction Notes for Plans.

4d. Fire Hydrant Requirements

See Water Section 4 of TWC Standard Construction Notes for Plans.

4e. Standby Service Lines (Fire Lines)

Any commercial building required by the County Fire Marshal to have a Standby Service Line (Fire Line) installed shall have the line designed in accordance with these specifications. In addition to receiving plan review approval from TWC, It shall be the responsibility of the commercial developer to have all fire line plans reviewed and approved by the County Fire Marshal to ensure they meet current County Fire Code Requirements.

Standby Service Lines (Fire Lines) shall be designed with adequate cross-connection and backflow prevention measures as well as a method for determining water flow. See Water Section 4 of TWC Standard Construction Notes for Plans.

Section 5 – Vaults

See Water Section 5 of TWC Standard Construction Notes for Plans.

Section 6 – Water Main Materials

The following table lists the allowable pipe materials for various sizes of potable water main pipe unless otherwise approved:

Water Main Pipe		
Diameter	Material	General Specifications
4"	PVC	SDR-21 ASTM D-2241 Class 200
6" to 8"	PVCO	AWWA C909 PVCO PC235
12" and larger	DICL	ANSI/AWWA A21.51/C151 Class 350

6a. Ductile Iron Pipe, Fittings, and Gaskets

All pipe, regardless of size, that will ultimately be covered by an asphaltic or concrete surface shall be DICL unless installed within a casing. These areas include but are not limited to: private driveways, county roads, parking lots, or service roads. Unless more stringent requirements apply, all pipes on under bodies of water, under railroad tracks, in or crossing state roadways shall be DICL or steel within either a steel casing or a HDPE casing. The casing must be at least 12 inches larger in diameter than the carrier pipe with appropriate spacers and seals sized for water main and casing, see Casing Detail. All lines requiring casing shall be constructed in accordance with the TWC Standard Detail for casing. Any deviation from this standard shall be subject to review and approval by TWC Engineering staff.

All ductile fittings installed below ground shall be restrained mechanical joint with a minimum pressure rating of 350 psi, and shall conform to the requirements of ANSI/AWWA A21.10/C110 or A21.53/C153. Mechanical joints consisting of bell, socket, gland, gasket, bolt and nuts shall conform to ANSI A21.11.

6b. PVC and PVCO Pipe

All fittings should be manufactured domestically in the United States.

Restrained joint calculations are required for all water mains. Lengths and locations of restrained pipe should be shown on the plans. See Water Section 6 of TWC Standard Construction Notes for Plans.

All PVC and PVCO pipe (4" and larger) shall have the same O.D. as ductile iron pipe and be compatible for use with ductile iron fittings.

Fittings for PVC and PVCO pipe (4 inches through 8 inches) shall be restrained ductile iron mechanical joint with a minimum pressure rating of 250 psi and shall conform to the requirements of ANSI/AWWA A21.10/C110 or A21.53/C153.

PVC and PVCO pipe shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push-on makeup connection. A push-on joint may be an elastomeric gasket ball end coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross-section.

6d. HDPE Pipe

HDPE pipe may be approved on a case-by-case basis for directional drill applications such as “slick boring” under and around existing trees. Engineer is responsible for selecting pipe pressure requirements based on system pressures. Engineer is responsible for matching consistent inside pipe diameters or selecting one pipe diameter larger than the diameter required, whichever is greater.

HDPE pipe should be fully restrained along the entire alignment. Mechanical Joint/Telescoping adapters and proper transition couplings should be used at all change in pipe size and/or pipe materials for fittings, valves, etc. When transitioning from Ductile Iron or PVC pipe to HDPE, Mechanical Joint adapters and restrained connections are required along the Ductile Iron or PVC pipe 60’ upstream of the material transition.

See Water Section 6 of TWC Standard Construction Notes for Plans.

Section 7 – Water Main Pipe Restraints

7a. Thrust Blocking

See Water Section 7 of TWC Standard Construction Notes for Plans.

7b. Ductile Iron Pipe Joint and Fitting Restraints

Restrained joints shall be installed at all valve fittings and locations as required by TWC. In combination with thrust blocking, joint restraints may be used. The length of pipe to be restrained shall be calculated as required, and subject to review and approval by TWC staff. Where minimum restrained length is not met, thrust blocks shall be used.

7c. PVC and PVCO Pipe Joint and Fitting Restraints

See Water Section 7 of TWC Standard Construction Notes for Plans.

Section 8 – Water Main Valves

8a. Gate Valves

For distribution lines 16” and smaller, gate valves should be located every 500 feet or as directed by TWC. For transmission lines, gate valves should be located every 1000 feet and at each hydrant or fire service. See Water Section 8 of TWC Standard Construction Notes for Plans.

Whenever possible, valves shall be located in turfed areas. If it is not possible to attain this, valves shall be located within the roadway. As a last resort, valves may be located under sidewalks.

Where pipes interconnect at a tee, a three-way valve bank shall be installed unless otherwise approved by TWC staff.

8b. Valve Boxes

See Water Section 8 of TWC Standard Construction Notes for Plans.

8c. Air Release Valves

Air release valves shall be of the type that will release air from the line when pressurized and keep air from entering the line when not pressurized. Air release valves shall be located at high elevation points on the pipeline and operate automatically.

Engineer is responsible for selecting the appropriately-sized air release valve.

See Water Section 8 of TWC Standard Construction Notes for Plans.

8d. Pressure Reducing Valves (PRV)

Main line PRV's should be installed in a vault within a dedicated easement in a non-paved area. Oil filled pressure gauges should be installed on both sides of the PRV to record incoming flow and pressure, and outgoing flow and pressure. PRV is to be installed as a bypass of the main.

An additional PRV bypass for low flows may be required on main line PRV's. The bypass can be as much as 2 standard sizes smaller than the main line PRV. Gate valves must be installed directly upstream and downstream of the valve in order to isolate PRV on main line and PRV on the bypass, see TWC standard detail. PRV's shall be Singer Valve Company or equivalent subject to review and approval by TWC.

Section 9 - Pipe and Valve Locating

9a. Electronic Locator Tape

See Water Section 9 of TWC Standard Construction Notes for Plans.

9b. Tracer Wire

See Water Section 9 of TWC Standard Construction Notes for Plans.

9c. Valve and Line Markers

See Water Section 9 of TWC Standard Construction Notes for Plans.

Section 10 – Service Installation Requirements

10a. Water Meters and Meter Box Installation

Engineer and/or TWC should determine all required meter sizes. TWC has the authority to adjust the meter sizes regardless of sizing by engineer.

Pressure Regulators should be installed on all services that have pressures of 100 psi or higher.

See Water Section 10 of TWC Standard Construction Notes for Plans.

10b. Service Saddles

See Water Section 10 of TWC Standard Construction Notes for Plans.

Section 11 – Hydrostatic and Leakage Test Requirements

See Water Section 11 of TWC Standard Construction Notes for Plans.

Section 12 – Disinfection Requirements

See Water Section 12 of TWC Standard Construction Notes for Plans.