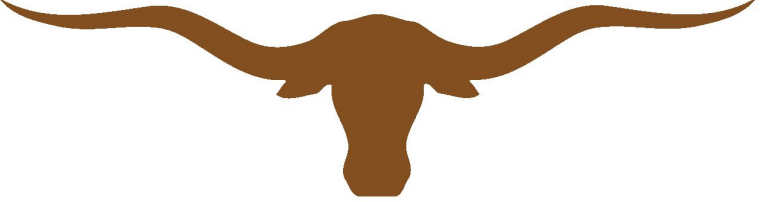


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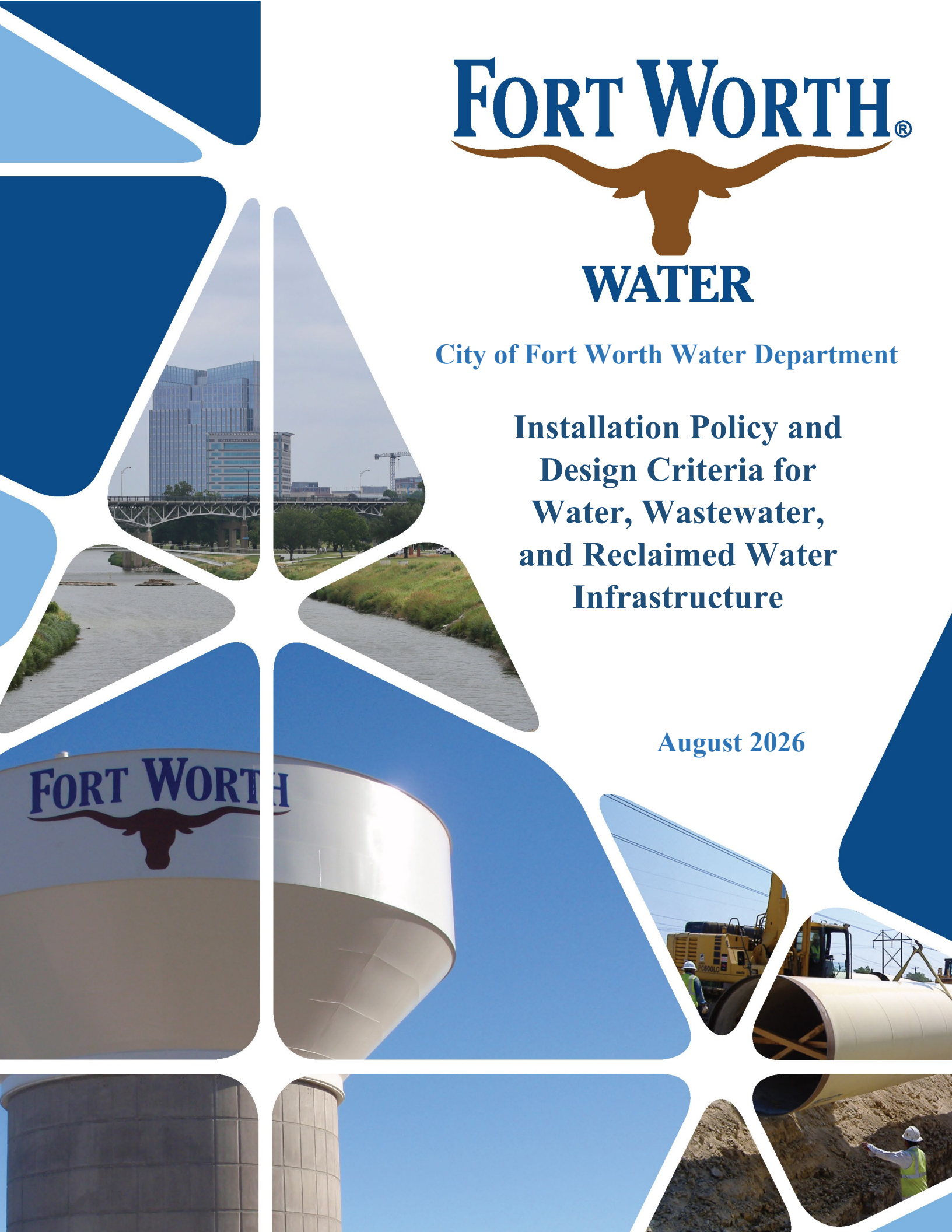


WATER

City of Fort Worth Water Department

Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water Infrastructure

August 2026





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SECTION 1 – INTRODUCTION

1.1 PURPOSE

- 1.1.1 The purpose of this Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water Infrastructure (“Policy” or “Manual”) is to establish the policies and procedures governing facilities as well as design criteria for water, wastewater, and reclaimed water systems to assist engineers in preparing designs for the construction of these facilities. These policies, procedures, and criteria are applicable to engineering planning and design work performed by the Fort Worth Water Department, engineering firms engaged by the City, or by other public or private interests. Deviations from these policies and procedures will not be acceptable without an approved waiver in accordance with **Section 9** (Waiver Process).
- 1.1.2 *Clarification* - The terms water, wastewater, and reclaimed water are used throughout this manual to differentiate between the three types of water uses. The City Code uses the term “sewer” throughout. The term “wastewater” used in this manual is synonymous with the term “sewer” used in the City Code.



SECTION 2 – DEFINITIONS

Approach Main

The Off-Site Main required to connect a Development to a source of ample supply. The limits of the Approach Main are from the Point of Connection to the existing main to the Point of Connection to the Frontage Main.

Area Plan

A strategic plan that allows for growth and/or redevelopment within a particular area or district with the City while maintaining a safe, reliable, and manageable system through the identification of both planned improvements for the water, wastewater, or reclaimed water system.

Certificate of Compliance

Official documentation issued by the City confirming that a Property has been platted.

Certificate of Convenience and Necessity (CCN)

Certification issued for Water or Wastewater utility service issued by the Public Utility Commission (PUC) to a public or private organization to provide exclusive water or wastewater service to a defined area.

City

Refers to the City of Fort Worth, Texas.

City Code

The Code of the City of Fort Worth (2015), as amended.

City Council

The governing body of the City of Fort Worth.

City Participation

The City's financial participation in a Community Facilities Agreement for the construction of public infrastructure.

Community Facilities

Streets, sidewalks, storm drains, water and sanitary sewer facilities, bridges, culverts, and other public infrastructure constructed pursuant to a Community Facilities Agreement or other agreement between the City and a Developer.

Community Facilities Agreement (CFA)

A contract between a Developer and the City for the construction of Community Facilities, on Property in which the City has or will have an ownership or other legal interest, that the City requires to be constructed as a condition of plat or plan approval, or the issuance of a building permit.



Critical Facilities

Any medically oriented building such as, but not limited to, hospitals, skilled nursing/rehabilitation facilities, assisted living centers, dialysis centers, outpatient surgery centers. These facilities also include other buildings where a disruption to water service impacts public health, welfare, or safety such as incarceration facilities or other critical care facilities.

Cross Connection

An actual, or potential, unprotected connection between a potable water system and a recycled or other non-potable water system that would allow non-potable water to pass into the potable water supply.

Customer

Any individual or Developer eligible for utility service in accordance with these regulations.

Dead-End Main

A main in the water distribution system that is only fed from one end at the time of installation.

Department

The Department having jurisdiction over work being performed, including the Water Department, Department of Transportation and Public Works, or other Department of the City.

Developer

The owner, or the agent of an owner, of a tract of land that has been subdivided, is being subdivided, or requires the construction of public infrastructure as a condition of the approval of a plat, building permit, or other plans.

Development/Developing Property

Property on or to which a Developer is extending or constructing public infrastructure to provide service to one or more existing or proposed lots, regardless of whether the Property is located in an area that was previously developed, or the act of making improvements to Property.

Development Services – Water Section Staff

An employee of the City of Fort Worth assigned to the Development Services Department Water Section.

Director

The director of the Water Department, or their designee.



Encroachment Agreement

A contract between the City and a person or entity authorizing the placement or intrusion of private infrastructure, private personal Property, or another public entity's infrastructure or Property, within the City's real Property.

Engineer

See "Engineer of Record."

Engineer of Record

The Professional Engineer (P.E.) licensed in the State of Texas through the Texas Board of Professional Engineers (TBPE) who is responsible for the signing and sealing of construction drawings, studies, calculations, and/or any other engineering documents in accordance with TBPE's requirements for professional practice. Also known as Engineer.

Existing, Occupied Parcel

A parcel of land containing an existing occupied residence or an existing commercial building not presently connected to the City's water and/or wastewater systems.

Extraterritorial Jurisdiction (ETJ)

Unincorporated area extending generally five miles from the city limit in which the City has the authority to regulate subdivision and platting of Property.

Facility

Any structure, excluding mains, pertaining to a water, wastewater, or reclaimed water system for the production, treatment, distribution, or collection of water and wastewater, including, without limitation, wells, reservoirs, elevated tanks and hydro-pneumatic tanks, pumping stations, master pressure reducing valves, water, water and wastewater treatment facilities, wastewater lift stations, inverted siphons, and force mains.

Fire Line

A private line for fire protection purposes connected to the City's water system that connects to a fire extinguishing system with an automatic sprinkler system, a standpipe system, a combined system, basement pipe inlet, and/or private fire hydrants.

Frontage

The full length of the boundary across a Property that is adjacent to Right-of-Way or an easement.

Frontage Main

The Off-Site Main required to connect a Development to a source of ample supply. The limits of the Frontage Main are from the Point of Connection to Approach Main across one full Frontage of the Property.

Front Foot Charges (FFC)

The charge made for a connection to a water, wastewater, or reclaimed water main, in addition to the regular tap or service connection fee, based on the Front Footage measurement of the Property to be served. The amount of the front foot charge shall be established by Ordinance.

Front Footage

The number of linear feet in that portion of a Property boundary abutting a street, alley, or easement containing a water, wastewater, or reclaimed water main for which Front Foot Charges are collected for connection.

Impact Fee

A charge or assessment levied on new Development in order to generate revenue to fund the costs of general benefit facilities necessitated by and attributable to that new Development as specified in the Capital Improvements Plan (CIP) for Water, Water Supply and Wastewater Improvements.

Landowner

The holder of the legal title to a Property, including the owner's agents, successors and assigns.

Loading Analysis

A water, wastewater, or reclaimed water engineering capacity analysis as described in the Fort Worth Water Department's Water and Sewer Study Guidelines.

Master Plan

A comprehensive, strategic plan that allows for growth while maintaining a safe, reliable, and manageable system through the identification of both short-term and long-term planned improvements for the water, wastewater, or reclaimed water system.

Mechanic's Lien and Note

A legal document that requires a homeowner or homebuyer to pay any debts due to the construction or improvement of a Property.

New Development

See Development.

Off-Site Mains

An Off-Site Main consist of a water, wastewater, or reclaimed water main that is not contained within a Developing Property but is constructed to provide service to the Property. Approach Mains and Frontage Mains are Off-Site Mains.

On-Site Mains

An On-Site Main is a main that provides service within a Development.

On-Site Sewage Facilities

Wastewater systems designed to treat and dispose of effluent on the same Property that produces the wastewater in accordance with 30 Texas Administrative Code, Chapter 285.

Ordinance

A law, statute, or regulation enacted by the City.

Oversizing

When City Participation in a CFA is used to make the Public Improvements larger, longer or more enhanced than the Developer is required to construct.

Point of Connection

The location where an existing main connects to an Approach Main and/or the location where an Approach Main connects to a Frontage Main.

Private Facilities or Improvements

Any improvements on private Property where a public entity (i.e. the City) is not considered the Owner.

Property

An undivided tract or parcel of land having Frontage on a public street, or upon an approved access easement have direct public street access, and which is, or in the future may be, offered for sale, conveyance, transfer or improvement.

Public Facilities or Improvements

Public facilities and/or improvements include water mains, wastewater mains, or other similar improvements constructed within public Right-of-Way or easements.

Professional Engineer

A person duly authorized under the provisions of the Texas Engineering Practice Act, as heretofore and hereafter amended, to practice the profession of engineering.

Redevelopment

See Development.

Right-of-Way (ROW)

A strip of land dedicated for use of public streets, alleys, and/or related facilities. Other facilities include, but are not limited to, utilities, drainage systems, and other transportation uses.

Service Area

The area within the boundaries defined by a Certificate of Convenience and Necessity.

Service Line

The branch of pipe extending from the water, wastewater, or reclaimed water main to the approximate location of the Property or easement boundary intended to provide direct retail service to a Property.

Shared Access Development

A type of Development where one or more of the lots within the Development do not front on a public or private street, where access to the lots within the Development is provided via a shared access easement that meets all of the requirements of satisfying the City's requirements for a Shared Access Easement consisting of, but not limited to, a maximum length of privately maintained access for lots not exceeding 150 feet in length.

Shared Utility Easement

An area designated for use as access to individual lots and placement of City and franchise utilities for a Shared Access Development.

Study

A water, wastewater, or reclaimed water engineering capacity analysis and report as described in the Fort Worth Water Department's Water and Sewer Study Guidelines.

Subdivision Ordinance

The City's Ordinance, and all subsequent revisions, regulating Development with the City of Fort Worth.

Sub-Meters

Privately owned meters that can be used to encourage effective conservation and efficient use of water by fairly allocating its cost among the ultimate users within a master metered apartment unit, office building, or shopping center. The Sub-Meters are not to be read and billed by the City as they are considered private meters.

TAC

Texas Administrative Code

TLGC

Texas Local Government Code

TCEQ

Texas Commission on Environmental Quality.

TxDOT

Texas Department of Transportation.

Urban Infill

Areas designated within the City where there is Development of vacant parcels within previously built areas. These areas are already served by public infrastructure, such as transportation, water, wastewater, and other utilities.



Wastewater Per Acre Charge

A charge based upon the demand required for the Development with its basin area in accordance with Division 3 – Sewer Per Acre Charges of *City Code Chapter 35*.

Water Department Director

The duly appointed director of the Water Department, or their designee.

Water Department Staff

An employee of the City of Fort Worth Water Department.

Water Main Capacity Charge (WMCC)

A charge based on 1.0 million gallons per day (MGD) of maximum day demand generated by a Development in accordance with Division 4 – Water Capacity Charges of *City Code Chapter 35*.

Water/Wastewater Facilities

See “Facilities.”

Wastewater Capacity Charge (WWCC)

A pro rata charge based on 1.0 million gallons per day (MGD) of sewer capacity in accordance with Division 5 – Sewer Capacity Charges of *City Code Chapter 35*.

Zone of Influence

The notional envelope within which an external vertical load would exert stress on the pipe. The stressed zone beneath a foundation which is responsible for the settlement of a structure.



SECTION 3 – POLICY

3.1 GENERAL

- 3.1.1 All platted Property within the corporate limits of the City of Fort Worth (City) shall have a connection to the City’s public water system, as defined by *30 Texas Administrative Code (TAC) Chapter 290*, to supply drinking water in adequate quantities and to furnish fire protection. Likewise, all platted Property within the corporate limits of the City connecting to the City’s wastewater collection system shall connect in accordance with *30 TAC Chapter 217* to transport wastewater to a wastewater treatment facility. Connections to the City’s reclaimed water system shall be in accordance with *30 TAC Chapter 210* to provide reclaimed water service. This policy shall govern the installation of all water, wastewater, and reclaimed water facilities within the corporate limits of the City of Fort Worth, Texas, or other areas approved by the City.
- 3.1.2 Extension Policy Outline – **Sections 3.2 – 3.5** are used to describe the City’s requirements for main extensions, Oversizing, cost participation, and cost recovery, as well as removal of existing services. A brief description of each section is outlined below:
- 3.1.2.1 **Section 3.2 Requirements for Service and Removal of Existing Services** – This section includes references to City Code and statutory requirements for connecting to the City’s water, wastewater, or reclaimed water system, and the requirements associated with removing existing water, wastewater, or reclaimed water services.
- 3.1.2.2 **Section 3.3 Extension of Service** – This section describes situations that require main extensions or construction of water, wastewater, or reclaimed water facilities. It also describes the City’s right to oversize mains or facilities followed by various figures depicting potential main extension examples.
- 3.1.2.3 **Section 3.4 Cost Participation** – This section includes the following components:
- 3.1.2.3.1 Development cost responsibilities;
- 3.1.2.3.2 Situations that allow for request of City Participation in cost of improvements; and
- 3.1.2.3.3 City cost participation calculations.
- 3.1.2.4 **Section 3.5 Cost Recovery** – This section includes cost recovery provisions for Developers and the City through Front Foot Charges, Water Main Capacity Charges, Wastewater Per Acres Charges, or Wastewater Capacity Charges.

3.2 REQUIREMENTS FOR REQUESTING NEW SERVICE AND REMOVAL OF EXISTING SERVICES

- 3.2.1 Landowners who request a Property be connected to the City's water, wastewater, or reclaimed water system must:
- 3.2.1.1 Possess a Certificate of Compliance issued by the City stating the Property has been platted, unless the Property was served prior to September 1, 1987, and request to reestablish service in accordance with *TLGC 212.0115* and *City Code Chapter 31*.
 - 3.2.1.2 Be located within the limits of the City, or the Landowner must petition the City for water and sanitary sewer services for annexation into the City or enter into a pre-annexation agreement with the City in accordance with the City's *Annexation Policy and Program*, comply with *TLGC 212.012*, and comply with the City's *Subdivision Ordinance*. Water, wastewater, or reclaimed water service will not be available to land not contiguous to the City limits and unable to be annexed in accordance with State Law until such time annexation can occur, unless a pre-annexation agreement is executed.
 - 3.2.1.3 Be located within the City's current Certificates of Convenience and Necessity (CCN) for water and wastewater . If the Property is located outside the City's existing water CCN and is within another CCN holder's jurisdiction, the Landowner must decertify from the existing water CCN holder through the Public Utility Commission of Texas before annexation. If the Property is located outside the City's existing water CCN and not located within another CCN, the Landowner must consent to the City's petition to the Public Utility Commission to include the Property in the City's CCN in accordance with provisions set forth in the agreement for service.
- 3.2.2 Existing water or wastewater services that are not proposed to be used on a site shall be removed at the owner's expense in accordance with *Sections 35-57.4* and *35-57.5* of the *City Code*.
- 3.2.2.1 The owner shall submit a signed, written request to the Water Department to remove an existing tap to the City's water, wastewater, or reclaimed water system. The written request shall contain an exhibit showing the existing service taps to be removed.
 - 3.2.2.2 Landowners that choose to keep unused service taps are subject to monthly fees based on *Section 35-56* of the *City Code*.

3.3 EXTENSION OF SERVICE

- 3.3.1 *General* – This section describes when a water, wastewater, or reclaimed water main extension is required to provide service to a Property. Payment for the main extension is not included in this section and is described in **Section 3.4** (Cost Participation).
- 3.3.2 *Main Extension Terminology* – Main extensions are required from the existing main to a point across the full Frontage of the Developing Property. An Approach Main consists of that portion of the main from the Point of Connection to the existing main to the nearest Property corner of the Developing Property. A Frontage Main includes the portion of the main located within the Frontage of the Developing Property.
- 3.3.3 Frontage Mains shall be extended across the full Frontage of the Developing Property to allow for service to future Development. However, there may be situations that may not require a full Frontage Main extension such as topography, dead-ends, or Service Area limitations as discussed in this Manual.
- 3.3.4 Elevations and grades for all wastewater approach and Frontage Main extensions shall be designed to account for service to surrounding properties.
- 3.3.5 *Main Extension Requirements for New Development Areas* – A water, wastewater, reclaimed water main extension, or parallel main is required to connect to a Developing Property in any of the situations outlined below. See **Section 3.4** (Cost Participation) for the City’s participation policy.
 - 3.3.5.1 Connecting a Property to a water, wastewater, and/or reclaimed water main located beyond the Property boundary.
 - 3.3.5.2 Connecting a Property to a water main and/or wastewater main through a Shared Utility Easement.
 - 3.3.5.3 Connecting a Property to a water main 16-inches or larger, in diameter or to a wastewater main larger than 15-inches in diameter located along the Frontage of Property or within the boundary of the Property. Wastewater mains larger than 15-inches in diameter shall not be allowed in any new residential street Right-of-Way.
 - 3.3.5.4 Connecting a Property to a water, wastewater, and/or reclaimed water main that requires a Service Line to:
 - 3.3.5.4.1 Cross an Interstate Highway, a United States or State of Texas Highway, or a State of Texas Farm to Market Road or other State-maintained road;
 - 3.3.5.4.2 Cross a Property line;
 - 3.3.5.4.3 Cross a river, creek, or other water feature; or

- 3.3.5.4.4 Exceed 55 feet from the water/reclaimed water main to the meter or from the wastewater main to the Property line.
 - 3.3.5.4.4.1 Water/Reclaimed water Service Lines for residential properties may only be granted a waiver if their Service Lines are no larger than 1 inch in diameter and the Service Line is not spliced.
- 3.3.5.5 Connecting a Property to water main and/or wastewater main at a depth greater than 15 feet deep from the proposed surface to the top of the main.
- 3.3.5.6 Relocating an existing water, wastewater, or reclaimed water main in conflict with some element of the Development.
- 3.3.5.7 *Looping* – Connecting a Property to a water or reclaimed water main from the Point of Connection across the full Frontage of the Property to a second Point of Connection when required to meet the capacity requirements of the *Water and Sewer Study Guidelines* in accordance with **Section 5.4** (Sizing Water Mains) or **Section 7.2** (Sizing Reclaimed Water Mains).
- 3.3.6 *Main Extension Requirements for Redeveloped Areas* – A water, wastewater, or reclaimed water main extension is required to connect to a Developing Property located within an area containing existing water, wastewater, or reclaimed water infrastructure if any of the following situations apply. See **Section 3.4** (Cost Participation) for the City’s participation policy.
 - 3.3.6.1 Connecting a Property to a water, wastewater, and/or reclaimed water main identified to have insufficient capacity to serve the Property according to the *Water and Sewer Study Guidelines* performed in accordance with **Section 5.4** (Sizing Water Mains) or **Section 6.3** (Sizing Wastewater Mains).
 - 3.3.6.2 Connecting a Property to a water and/or wastewater main which has been identified for replacement by the City’s Risk Assessment Programs.
 - 3.3.6.2.1 Risk Assessment is generally based upon main condition and criticality factors, such as, but not limited to:
 - 3.3.6.2.1.1 Age;
 - 3.3.6.2.1.2 Material;
 - 3.3.6.2.1.3 Maintenance/Work Order History;
 - 3.3.6.2.1.4 Pressure Impacts (water/reclaimed water);
 - 3.3.6.2.1.5 Actual Field Condition Data;
 - 3.3.6.2.1.6 Access Issues;

- 3.3.6.2.1.7 Critical Facilities;
- 3.3.6.2.1.8 Resiliency;
- 3.3.6.2.1.9 Customers Served;
- 3.3.6.2.1.10 Diameter; and/or,
- 3.3.6.2.1.11 Sensitive Areas/Crossings.

3.3.7 *Water, Wastewater, or Reclaimed Water Facility Requirements* – A water, wastewater, or reclaimed water facility is required to:

3.3.7.1 Connect a Property to a water, wastewater, or reclaimed water main in accordance with the Design Criteria and an approved Loading Analysis or Study requires:

- 3.3.7.1.1 A water or reclaimed water pump station to meet pressure or capacity requirements;
- 3.3.7.1.2 A water or reclaimed water elevated or ground storage tank;
- 3.3.7.1.3 A wastewater lift station, force main, or low-pressure sewer system; or
- 3.3.7.1.4 A wholesale Customer water, wastewater, or reclaimed water meter station.

3.3.8 *Oversize Requirements for Water, Wastewater, or Reclaimed Water Main Extension or Facilities*

3.3.8.1 The City may elect to require a water, wastewater reclaimed water main extension, or a water or wastewater facility to be sized beyond the capacity required by the *Water and Sewer Study Guidelines* and require the main or facility to be sized in accordance with:

- 3.3.8.1.1 The City’s Water, Wastewater, or Reclaimed Water Master Plans;
- 3.3.8.1.2 A City Area Plan; or,
- 3.3.8.1.3 To meet general growth requirements, as determined by the City.

3.3.9 The cost for capacity exceeding the minimum size of the water, wastewater, or reclaimed water main extension, or the requirements of the *Water and Sewer Study Guidelines* shall be the City’s responsibility as determined and set forth in **Section 3.4** (Cost Participation).

3.3.10 Water, Wastewater, and Reclaimed Main Extension Examples

3.3.10.1 *General* – Water, wastewater, and reclaimed water mains shall be sized to provide the capacity required by the Development in accordance with the *Water and Sewer Study Guidelines* as required in accordance with **Section 5.4** (Sizing Water Mains), **Section 6.3** (Sizing Wastewater Mains), or **Section 7.2** (Sizing Reclaimed Water Mains). In no case shall the main size be less than the minimum main size required, even if the capacity requirement is less than the minimum size.

3.3.10.2 The examples in this section provide schematic configurations for situations requiring a main extension, but examples may not address all possible scenarios requiring extension.

3.3.10.3 *Full Frontage* – Frontage Mains shall be extended across the entire Frontage of the Developing Property’s lot to allow for service to future Development. Depending upon the location of water, wastewater, or reclaimed water infrastructure, the full Frontage may be along the side or rear of a Developing Property’s lot and not along the street Frontage. In these circumstances, the City’s Development Services Department – Water Section will determine which side of the lot is considered Frontage. The following examples outline several common scenarios:

3.3.10.3.1 An existing wastewater main Point of Connection may be located near the rear of a Property, due to topography. In this case, the wastewater main Frontage would be the rear of the Property, and the wastewater extension would be required across the entire Property’s rear Frontage.

3.3.10.3.2 If existing water, wastewater, or reclaimed water infrastructure is adjacent to a Property’s side Frontage, the Development Services Department – Water Section may consider the side of the Property to serve as the Frontage for the infrastructure extension.

3.3.10.3.3 Service area limitations may preclude extension across a Property’s full Frontage. Depending upon the location of the existing infrastructure’s Point of Connection, the Development Services Department – Water Section may require the side or rear of the Property to serve as the water, wastewater, or reclaimed water’s Frontage.

3.3.10.3.4 The foregoing situations are not all-inclusive but are included to outline situations where the infrastructure Frontage may not be warranted along a Property’s street Frontage.

- 3.3.10.4 Elevations and grades for all wastewater approach and Frontage Main extensions shall be designed to account for service to surrounding properties.
- 3.3.10.5 *Parallel Main Concept* – A parallel main extension shall be required for Service Lines exceeding 55 feet (i.e., long service lines), crossings at non-City Rights-of-Way, a main size larger than 15 inches, or a main depth 15 feet or deeper will require an extension of a parallel main. The City will review proposed locations for Point of Connections to existing mains to ensure that the connection benefits the overall water/wastewater/reclaimed water system and does not adversely impact its existing Customers.
- 3.3.10.6 *Single Frontage Developments* – Developments with Frontage along only one City Right-of-Way will require a main extension from the Point of Connection across the Property’s full Frontage. See **Figures 3-1 to 3-13** for extension examples for Developments with single Frontage.
- 3.3.10.7 *Multiple Frontage Developments* – Developments with street Frontage along more than one City Right-of-Way, or water, wastewater, or reclaimed water infrastructure Frontage along more than one side of the lot, will require a main extension from the Point of Connection across the Property’s full Frontage(s) that is proposed to have a Service Line or a connection for an On-Site Main extension. No extension is required for Frontage(s) where a Service Line or main connection is not proposed, unless a second Point of Connection is required to meet the capacity requirements of the *Water and Sewer Guidelines*. See **Figures 3-14 and 3-15** for extension examples for Developments with multiple Frontage.
- 3.3.10.8 *Wastewater Mains Along Creeks, Rivers, Water Features* – Developments containing an existing wastewater main located along a creek, river, water feature, or other topographic low, require a wastewater main extension to adequately provide service to upstream properties. See **Figures 3-16 to 3-18** for extension examples for these Developments.
- 3.3.10.9 *Shared Access Development* – When connecting a Property to a water or wastewater main in accordance with a Shared Utility Easement and agreement, the Developer shall extend a water or wastewater main in accordance with **Section 3.11** (Shared Utility Easements).
- 3.3.10.10 Extension Examples with Figures:

- 3.3.10.10.1 *Developments with Single Frontage*– If an existing main is located beyond a Property’s boundary, a main extension is required to and across a Property’s full Frontage from an offsite Point of Connection to a water, wastewater, or reclaimed water main along each Frontage where service is required. See **Figure 3-1**. For other situations requiring main extensions due to Service Line length, crossing non-City Right-of-Way, main size, main depth, or On-Site Main extensions, see **Figures 3-2 to 3-13**.

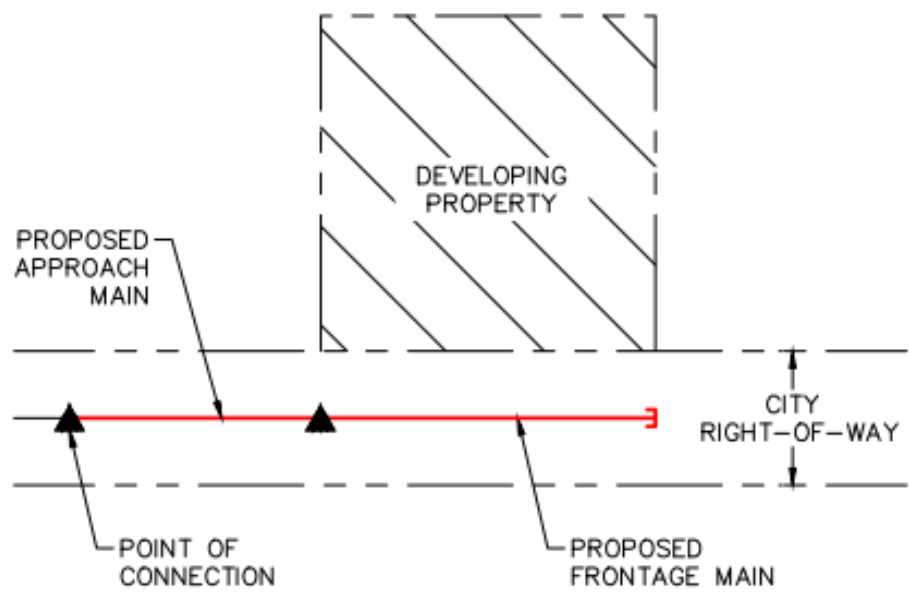


Figure 3-1. SINGLE FRONTAGE

Crossing Property Frontage in the Off-site Connection to a Water, Reclaimed Water, or Wastewater Main

Note: Wastewater mains shall end in a manhole in accordance with the Design Criteria. Main shown in this figure intended to represent required limits of main installation.

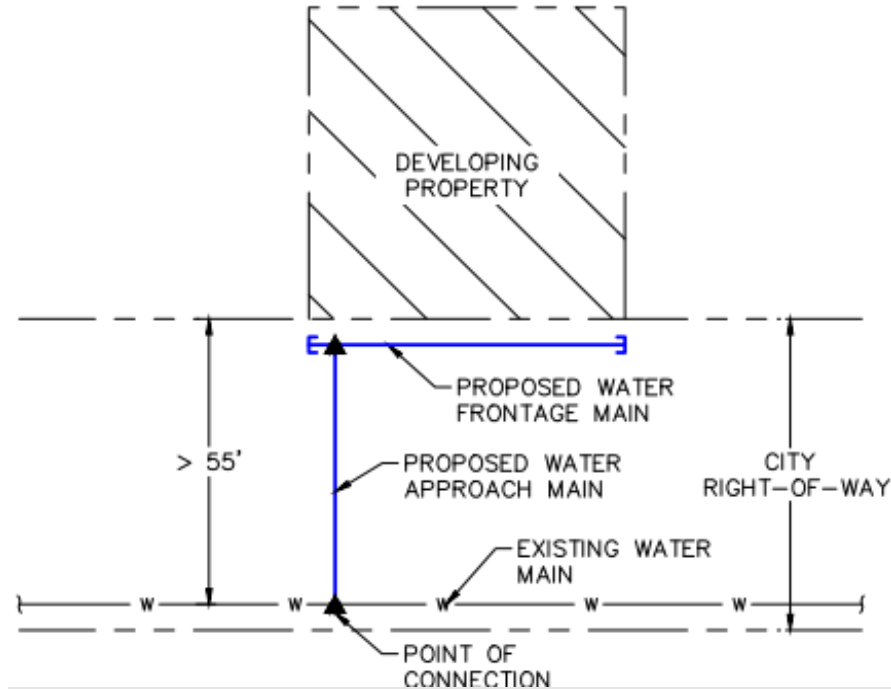


Figure 3-2. SINGLE FRONTAGE – Water Service > 55 feet

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main where the Water or Reclaimed Water Service Line exceeds a length of 55 feet from Main to Meter

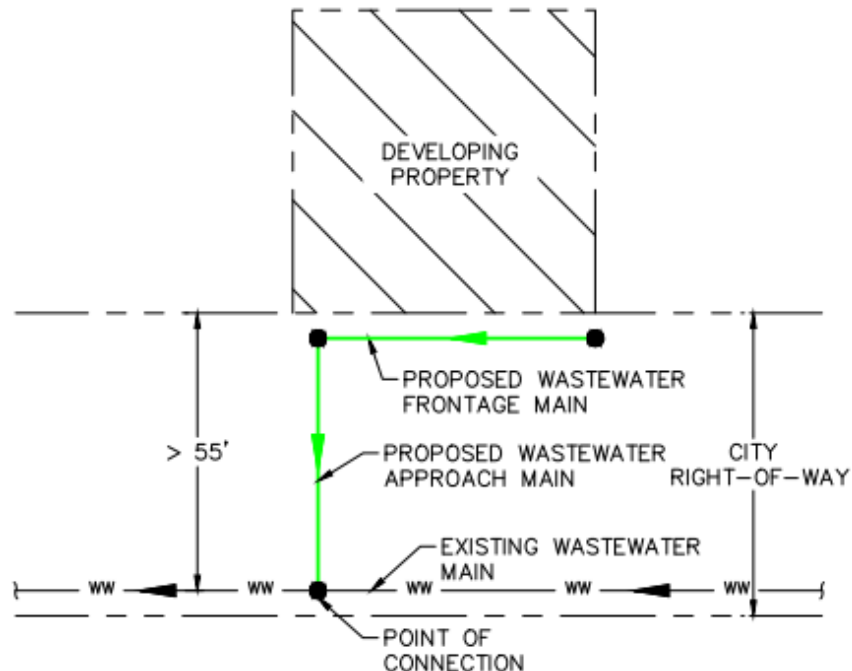


Figure 3-3. SINGLE FRONTAGE – Wastewater Service > 55 feet

Crossing Property Frontage from a Point of Connection to a Wastewater Main where the Wastewater Service Line exceeds a length of 55 feet from Main to Meter

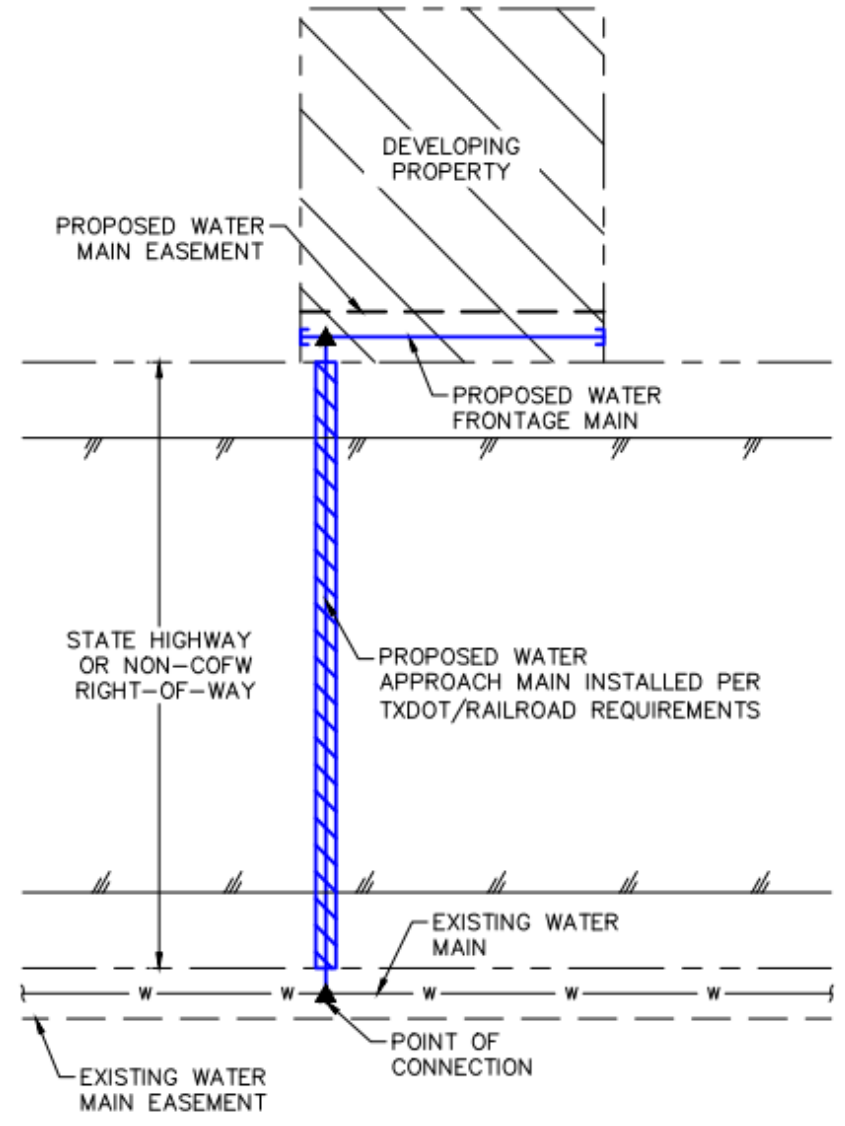


Figure 3-4. SINGLE FRONTAGE – Water Crossing Non-City ROW

Property Frontage from a Point of Connection to a Water or Reclaimed Water Main where the Water or Reclaimed Water Service Line Crosses a State Highway or Railroad

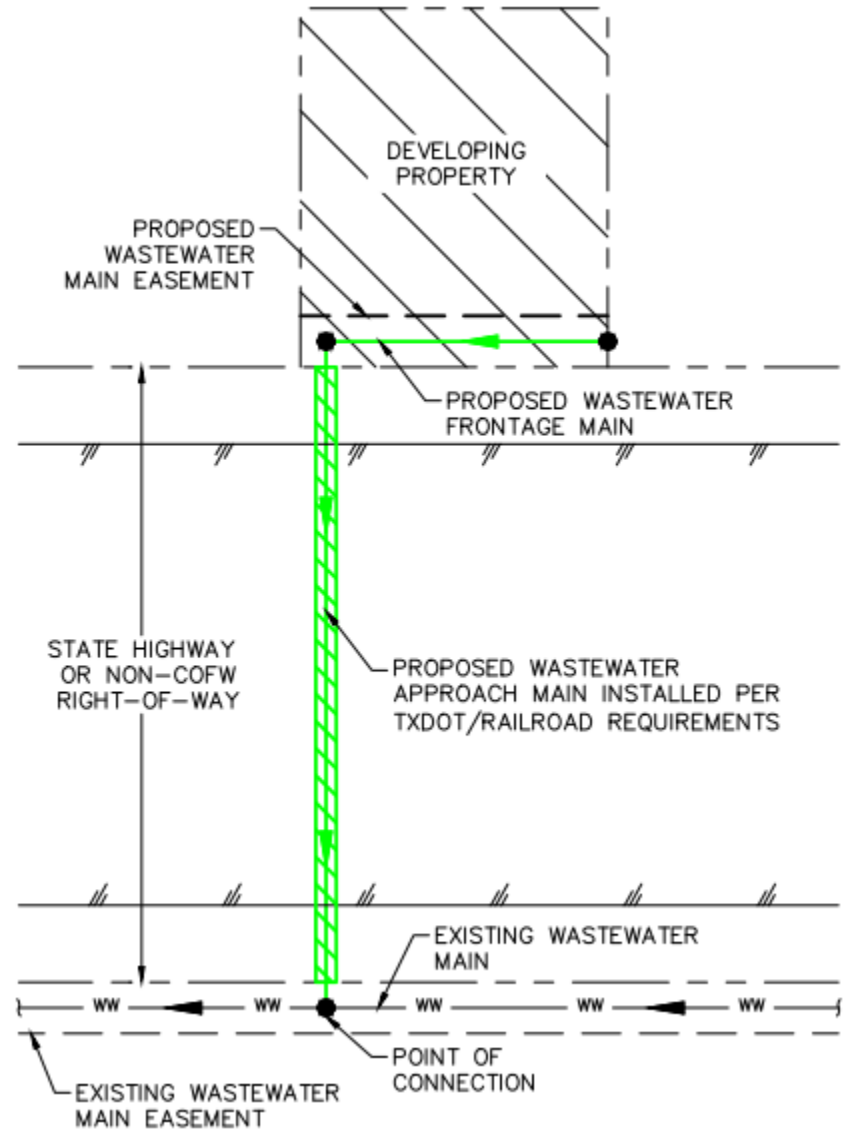


Figure 3-5. SINGLE FRONTAGE – Wastewater Crossing Non-City ROW

Crossing Property Frontage from a Point of Connection to a Wastewater Main where the Wastewater Service Line Crosses a State Highway or Railroad

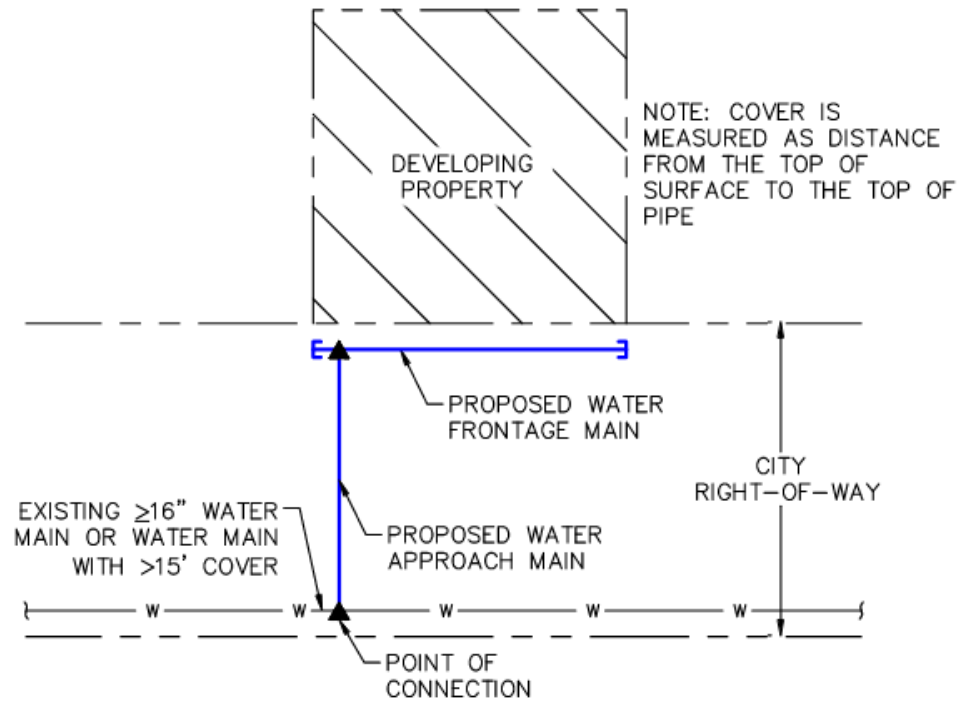


Figure 3-6. SINGLE FRONTAGE – Water Main Size/Depth

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main 16 inches, or Larger, or Exceeding 15 feet of cover

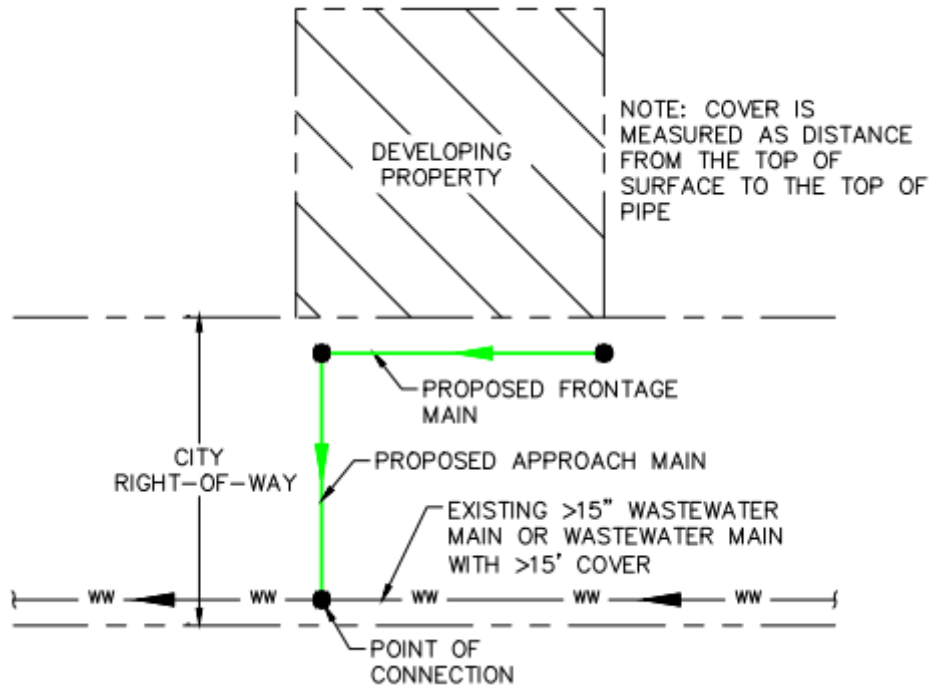


Figure 3-7. SINGLE FRONTAGE – Wastewater Main Size/Depth

**Crossing Property Frontage from a Point of Connection to a Wastewater Main
Larger than 15 inches or Exceeding 15 feet of cover**

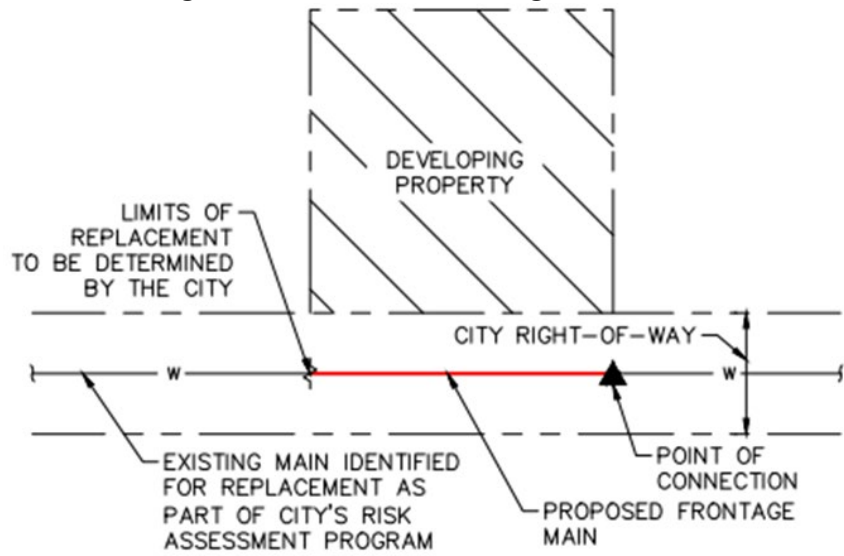


Figure 3-8. SINGLE FRONTAGE – Condition/Criticality

**Crossing Property Frontage from a Point of Connection Replacing a Main Identified for
Replacement as Part of the City's Risk Assessment Program.**

Note: Wastewater mains shall end in a manhole in accordance with the Design Criteria. Main shown in this figure intended to represent required limits of main installation.

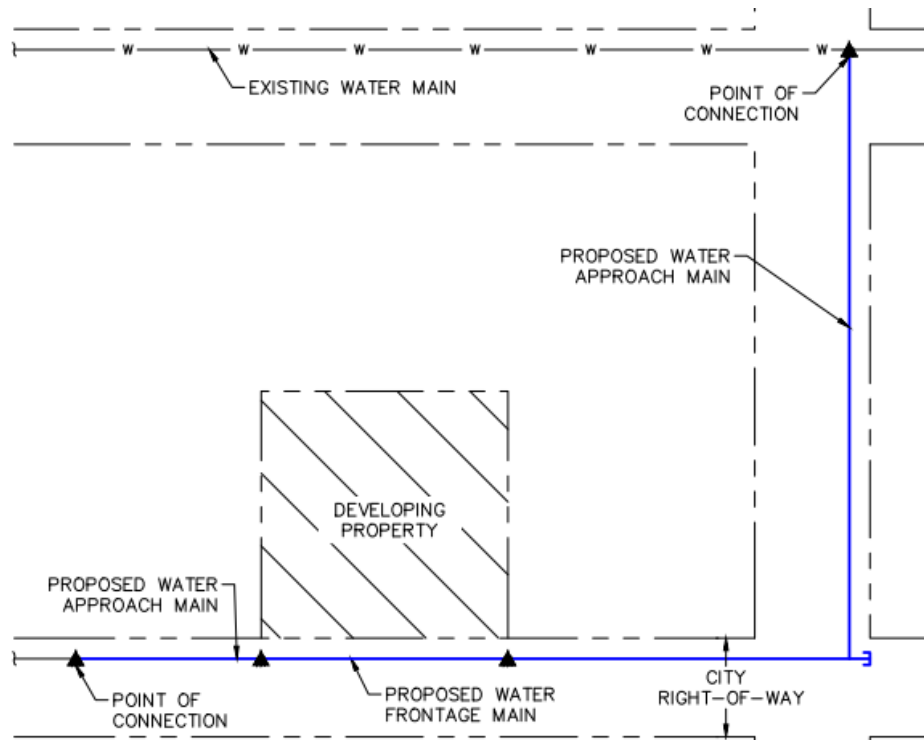


Figure 3-9. SINGLE FRONTAGE – Water Looping

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main to a Second Point of Connection (when required to meet the capacity and/or redundancy requirements of the *Water and Sewer Study Guidelines*.)

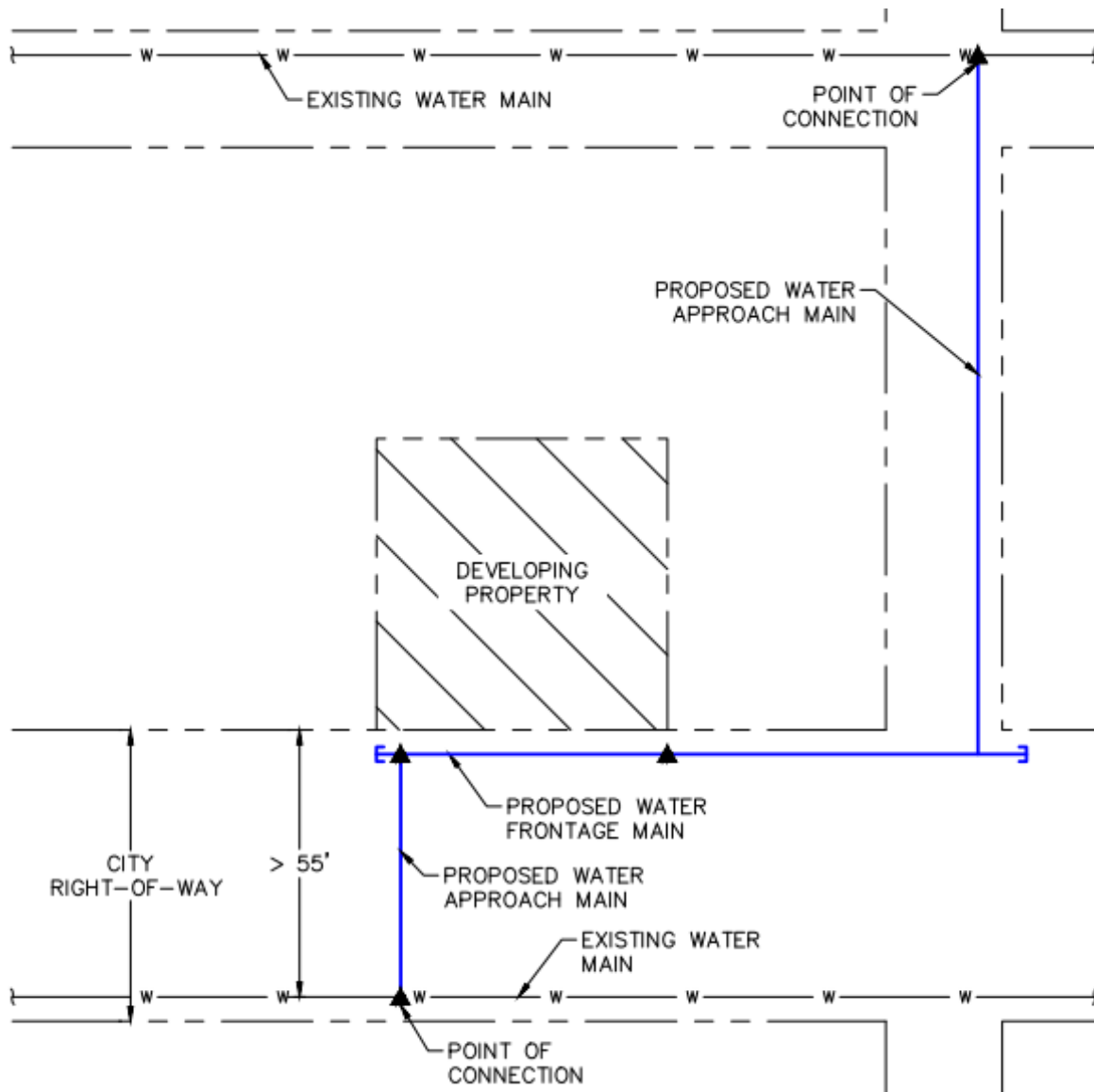


Figure 3-10. SINGLE FRONTAGE – Looping and Water Service Line Length

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main to a Second Point of Connection (when required to meet the capacity and/or redundancy requirements of the *Water and Sewer Study Guidelines*) and where Service Line exceeds a length of 55 feet from Main to Meter.

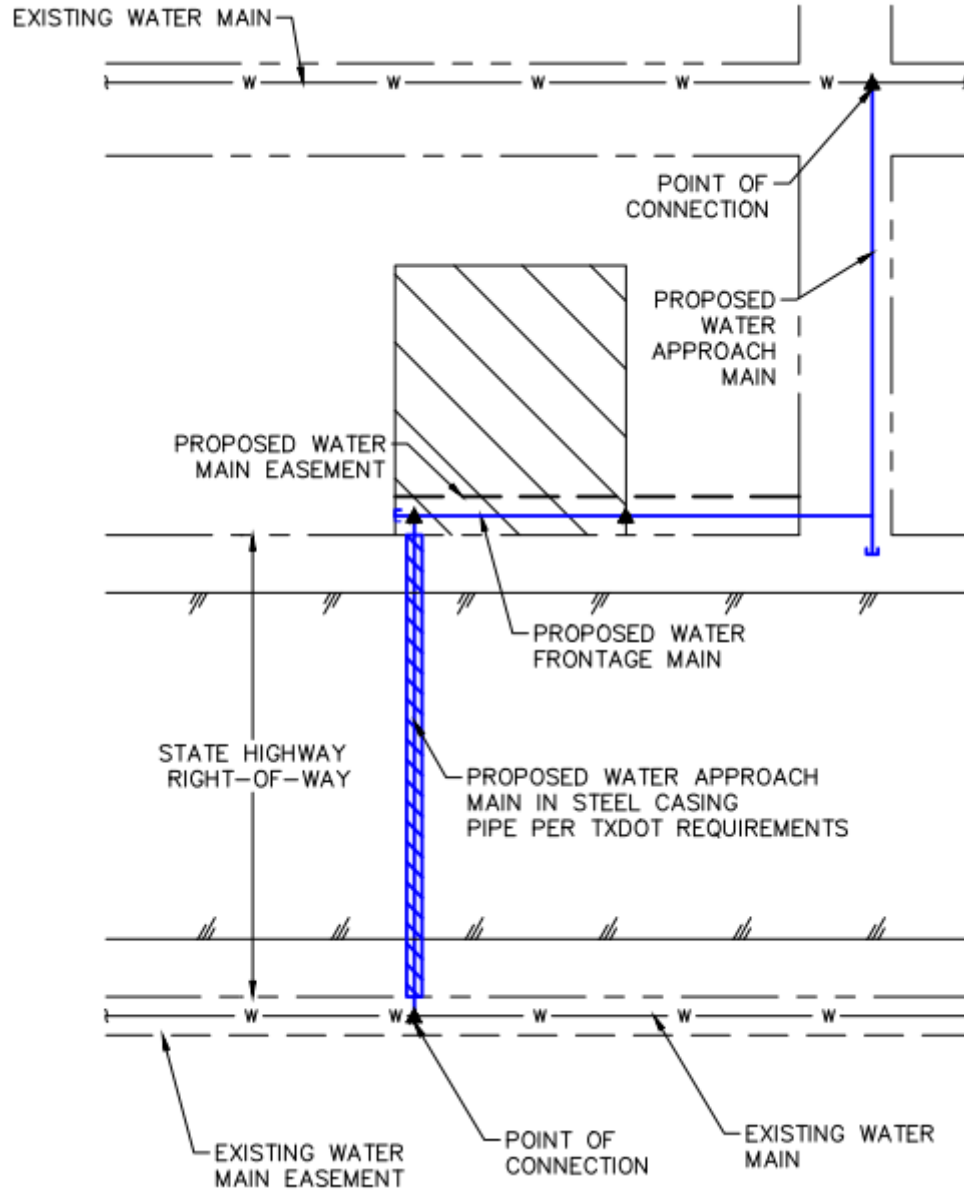


Figure 3-11. SINGLE FRONTAGE – Looping and Non-City ROW

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main to a Second Point of Connection (when required to meet the capacity and/or redundancy requirements of the *Water and Sewer Study Guidelines*) where the Water or Reclaimed Water Service Line Crosses a State Highway

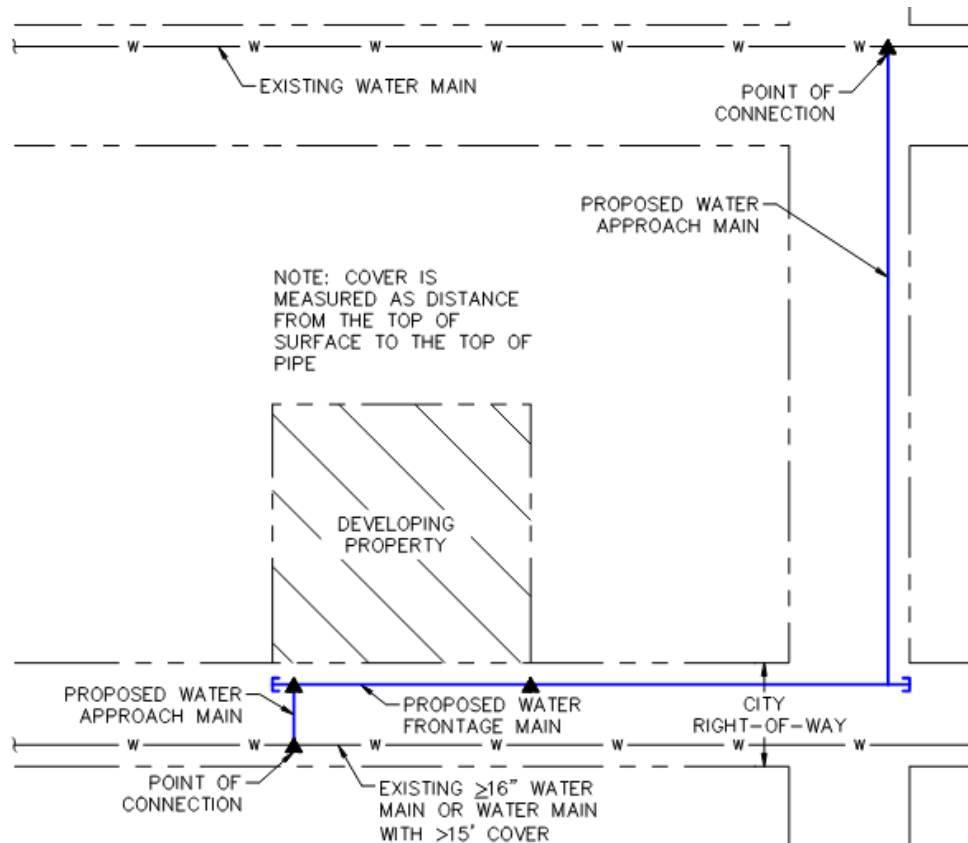


Figure 3-12. SINGLE FRONTAGE – Looping and Water Size/Depth

Crossing Property Frontage from a Point of Connection to a Water Main 16 inches, or Larger, Exceeding 15 feet of Cover to a Second Point of Connection (when required to meet the capacity and/or redundancy requirements of the *Water and Sewer Study Guidelines*)

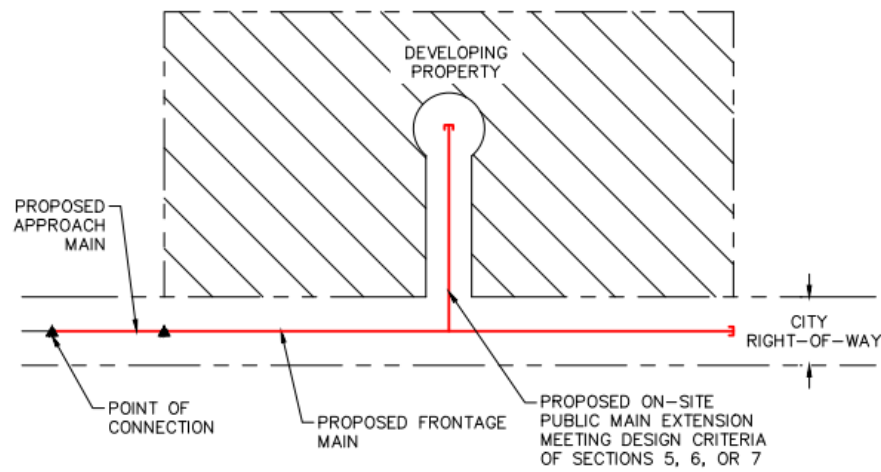


Figure 3-13. SINGLE FRONTAGE/Single Entrance Development

With Public On-Site Water, Reclaimed Water, or Wastewater Mains.

Note: Wastewater mains shall end in a manhole in accordance with the Design Criteria. Mains shown in this figure intended to represent required limits of main installation.

- 3.3.10.10.2 *Developments with Multiple Frontages:* If an existing main is located beyond a Property's boundary, a main extension is required to and across a Property's full Frontage from an offsite Point of Connection to a water, wastewater, or reclaimed water main along each Frontage where service is required. Main extensions are not required along each Frontage if service or main connections are not proposed along the other Frontage(s). See **Figure 3-14**.

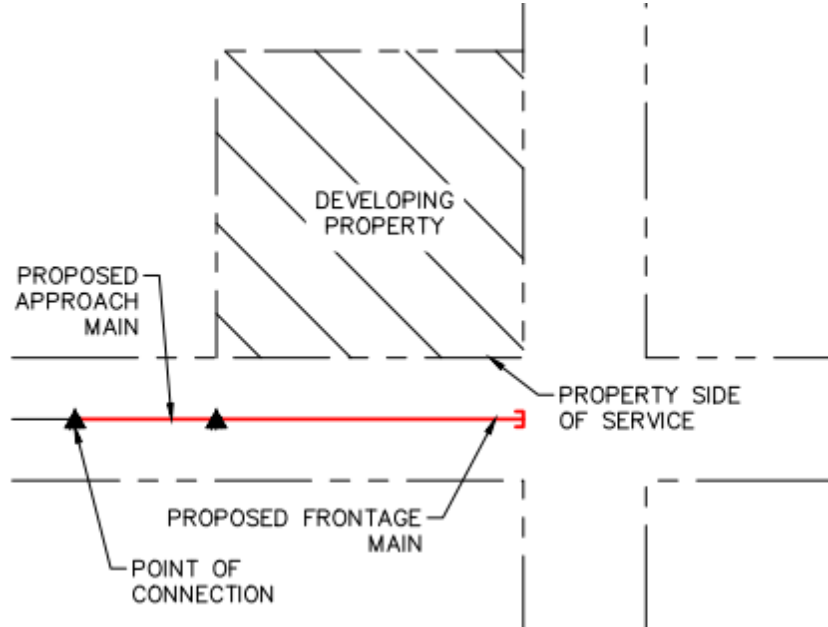


Figure 3-14. MULTIPLE FRONTAGE DEVELOPMENT

Crossing Property Frontage in the Off-Site Connection to a Water, Wastewater, or Reclaimed Water Main

- 3.3.10.10.2.1 *Multiple Frontage with Long Services:* A main extension is required to and across a Property's full Frontage connecting to a water or wastewater main where the Service Line would exceed a distance of 55 feet from main to meter, see **Figure 3-2** or **Figure 3-3**.
- 3.3.10.10.2.2 *Multiple Frontage Crossing Non-City ROW:* A main extension is required to and across a Property's full Frontage connecting to a water or wastewater main where the Service Line would cross a State Highway, or other non-City Right-of-Way, see **Figure 3-4** or **Figure 3-5**.

- 3.3.10.10.2.3 *Multiple Frontage with Large/Deep Mains:* A main extension is required to and across a Property's full Frontage connecting to a water main 16 inches, or larger, a wastewater main larger than 15 inches, or any main exceeding 15 feet from the top of the main to the surface, see **Figure 3-6** or **Figure 3-7**.
- 3.3.10.10.2.4 *Multiple Frontage with Condition/Criticality Factors:* A main extension is required to and across a Property's full Frontage replacing a main identified for replacement as part of the City's Risk Assessment Programs, see **Figure 3-8**.
- 3.3.10.10.3 *Developments with Multiple Frontages Requiring Looping –* When required to meet the capacity needed in accordance with the Water and Sewer Study Guidelines, a water or reclaimed water main extension is required from a Point of Connection across the full Frontage of the Property to a second Point of Connection.
- 3.3.10.10.3.1 If an existing main is located beyond a Property's boundary, a main extension is required to and across a Property's full Frontage from an offsite Point of Connection to a water/reclaimed water main, see **Figure 3-9**.
- 3.3.10.10.3.2 A main extension is required to and across a Property's full Frontage connecting to a water/reclaimed water main where the Service Line exceeds 55 feet of pavement, see **Figure 3-10**.
- 3.3.10.10.3.3 A main extension is required to and across a Property's full Frontage connecting to a water/reclaimed water main where the Service Line would cross a State Highway, see **Figure 3-11**.
- 3.3.10.10.3.4 A main extension is required to and across a Property's full Frontage connecting to a water/reclaimed main 16 inches, or larger, or exceeding 15 feet from the top of the main to the surface, see **Figure 3-12**.

- 3.3.10.10.4 *Developments with Multiple Frontages and On-Site Extensions* - If an existing main is located beyond a Property's boundary, a water, wastewater, or reclaimed water main extension is required from the Point of Connection across the Property's full Frontage to terminate at the far Property line when the Development is proposing to have a water, wastewater, or reclaimed water connection for an on-site water, wastewater, or reclaimed water main extension. See **Figure 3-15**. If looping is also required to meet the capacity needed in accordance with the Water and Sewer Study Guidelines, a water or reclaimed water main extension is required from a Point of Connection across the full Frontage of the Property to a second Point of Connection.

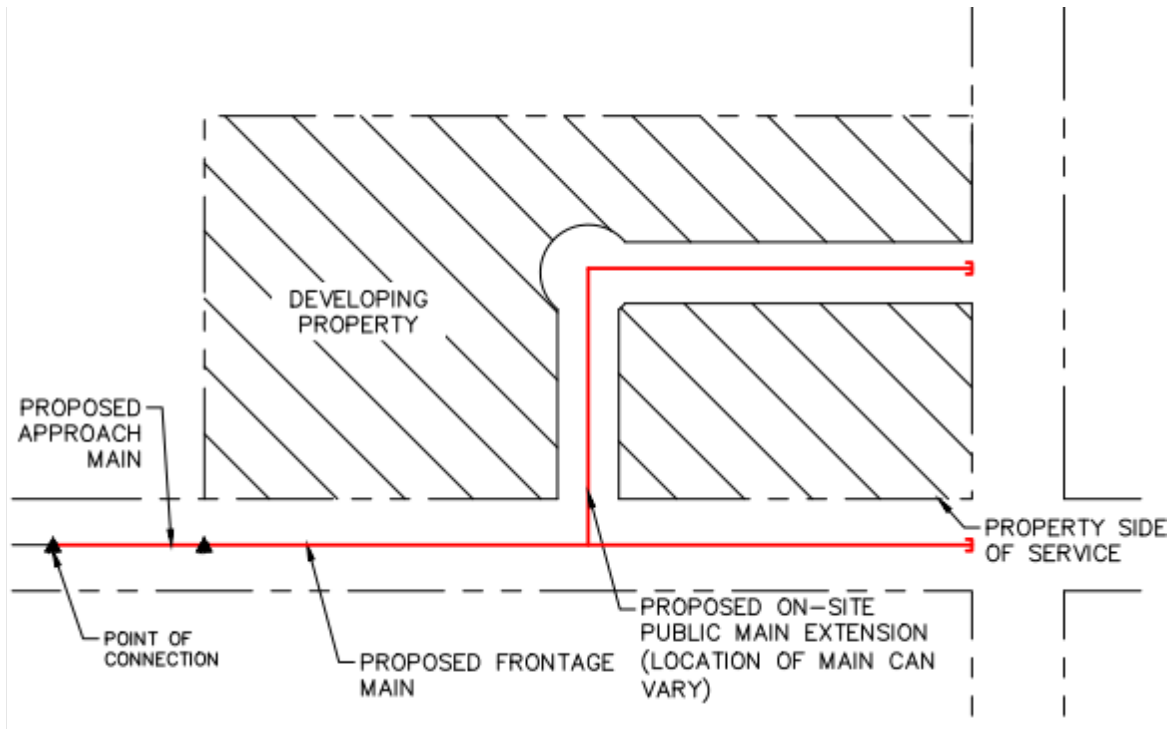


Figure 3-15. MULTIPLE FRONTAGE DEVELOPMENT - On-Site Mains

Crossing Property Frontage in the Off-site Connection to a Water, Reclaimed Water, or Wastewater Main for Developments Proposing an On-site Extension

Note: Wastewater mains shall end in a manhole in accordance with the Design Criteria. Mains shown in this figure intended to represent required limits of main installation.

- 3.3.10.10.5 *Wastewater Mains along a Creek/River/Water Feature* – When connecting a Property to a wastewater main located within an easement paralleling a creek, river, water feature, or a topographic low, and not located within City Right-of-Way, a wastewater main extension is required from the Point of Connection along the creek or the topographic low (outside the floodway and top of bank) by extending through the Property to the far Property line. See **Figure 3-16**. Depth of wastewater main must allow for Service Lines to sufficiently cross beneath water feature.

- 3.3.10.10.5.1 If no wastewater Service Line connection, or no Point of Connection to an on-site wastewater main, is required to serve the Development, then dedication of an easement and wastewater main extension is required where the proposed extension would occur to serve any or all upstream properties.

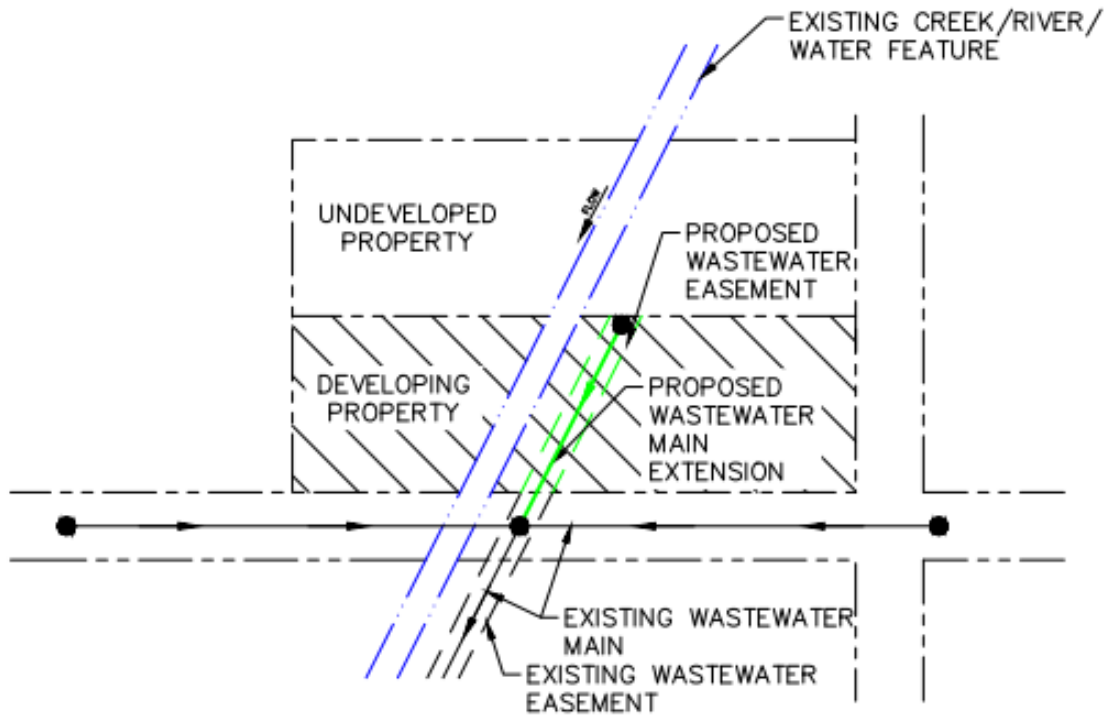


Figure 3-16. Wastewater Mains Along a Creek
Crossing Property Following a Creek/River/Water Feature

- 3.3.10.10.6 *Wastewater Mains Across and Along a Creek/River/Water Feature* – When connecting a Property to a wastewater main located within an easement paralleling a creek, river, water feature, or a topographic low, and not located within City Right-of-Way, a wastewater main extension is required from the Point of Connection across and along the creek or the topographic low (outside the floodway and top of bank) by extending across the Frontage and/or through the Property to the far Property line. See **Figure 3-17** and **Figure 3-18**. Depth of wastewater main must allow for Service Lines to sufficiently cross beneath water feature.

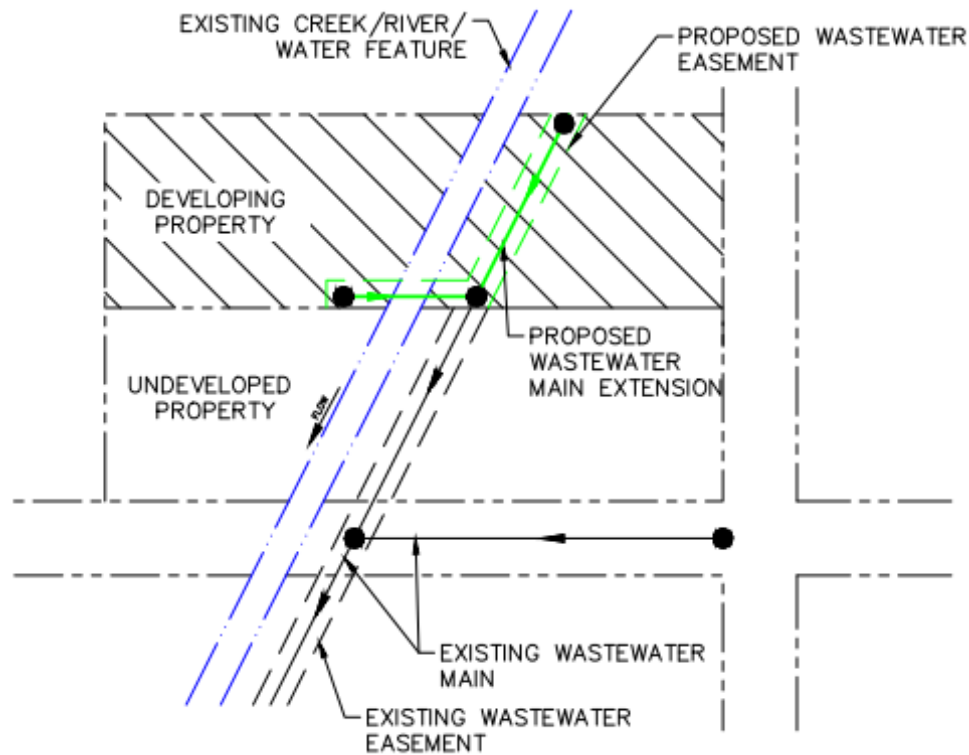


Figure 3-17. Wastewater Mains Along and Across a Creek

Crossing Property Following a Creek/River/Water Feature and Extending across Frontage

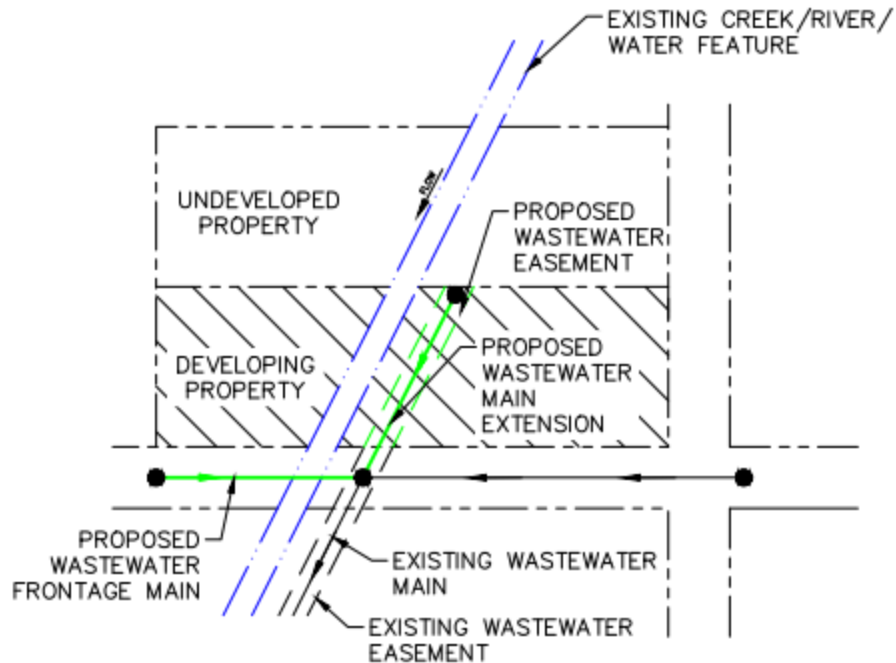


Figure 3-18. Wastewater Mains Along and Across a Creek

Crossing a Property's Full Length Within an Easement Following a Creek/River/Water Feature and/or Crossing the Creek/River/Water Feature to Serve the Property

3.4 COST PARTICIPATION

3.4.1 The Developer shall construct a water, wastewater, or reclaimed water main, or a water, wastewater, or reclaimed water facility, in accordance with the Design Criteria and the City's *Standard Construction Specifications and Details* that upon acceptance will become part of the City's water, wastewater, or reclaimed water system. The Developer shall incur all cost associated with providing water, wastewater, or reclaimed water main or water, wastewater, or reclaimed water facilities as determined by City in accordance with the *Water and Sewer Study Guidelines*. Cost includes, but is not limited to, design, easements, Property acquisition, permitting, fees, charges, and construction associated with completing the improvements.

3.4.1.1 Examples of improvements to serve the Development at 100% Developer cost may include:

- 3.4.1.1.1 Capacity improvements to serve the Development;
- 3.4.1.1.2 Relocation of mains due to a conflict created by the Development, regardless of the condition of the main; and/or,
- 3.4.1.1.3 Replacement of mains with insufficient capacity to serve the Development.

3.4.1.1.4 Extension of mains across one full Frontage of the Development.

3.4.2 The Developer may request cost participation if one, or more, of the following conditions exist:

3.4.2.1 City Main Oversizing –

3.4.2.1.1 *Water or Wastewater* – The City’s minimum main size is 8-inch diameter for water and wastewater mains per **Sections 5 and 6** (Design Criteria for Water System Facilities and Design Criteria for Wastewater System Facilities). The Developer’s minimum required size per the approved Water Study may be larger than an 8-inch. When the City requests Oversizing above the Developer’s minimum required size per the approved Water Study, the Developer may request cost participation for the main if the improvement is a water or wastewater main that has a diameter of greater than the main required to serve the Development as shown in the Water and Sewer Study Guidelines.

3.4.2.1.2 *Reclaimed Water* – The City’s minimum reclaimed water main size is per **Section 7** (Design Criteria for Reclaimed Water Mains). The Developer’s minimum required size per the approved Water Study may be larger than the minimum size in **Section 7**. When the City requests Oversizing above the Developer’s minimum required size per the approved Water Study, the Developer may request cost participation if the improvement is a reclaimed water main with a diameter greater than required to serve the Development as shown in the Water and Sewer Study Guidelines.

3.4.2.2 *City Facility Oversize*– When the City requests Oversizing, the Developer may request cost participation if the improvement is a facility, (pump station, lift station, storage tank, or force main) not already included in the City’s Impact Fee, with greater capacity than required to serve the Development as shown in the approved *Water and Sewer Study Guidelines*.

3.4.2.3 *Risk-Based Assessment* – When the City requests replacement, the Developer may request 100% cost participation from the City if an existing water, wastewater, or reclaimed water main size has been identified for replacement by the City’s Risk Assessment Programs and additional capacity is NOT required to serve the Development as shown in the *Water and Sewer Study Guidelines*.

3.4.2.4 *Tapping Oversize* – When the Landowner requests the service tap size to be increased from the size of the existing tap that is proposed to be replaced as part of an active CIP project, a Landowner shall pay for the increased cost for a larger service tap and meter. Additional Impact Fees will apply based on the increased size of meter.

3.4.2.5 *Certain Existing, Occupied Parcels* – Landowners may request cost participation when a single, or multiple, Existing, Occupied (by persons) Parcel, currently served by alternative systems, is serviceable by an extension of an existing water or wastewater main. The Landowner will be eligible for 200 LF credit per each (water well or septic tank) alternative system serving existing occupied structure(s).

3.4.2.6 *Redundancy* – In scenarios where the Development does not require an offsite extension as a second Point of Connection, the City may require a second Point of Connection for redundancy purposes at 100% City cost.

3.4.3 City Cost Participation Calculations

3.4.3.1 Calculations for City Participation for main Oversizing, facility Oversizing, and risk-based assessment will be in accordance with the City's *Unit Price Ordinance*.

3.4.3.2 *Tapping Oversize* – When the City is proposing to replace an existing service tap as part of a CIP project, and a Landowner requests to increase the size of the existing tap, the City will be responsible for costs associated with the existing service tap size. The Landowner will be responsible for the cost difference between the two service taps. Developer's cost for the Oversizing may include, as appropriate, design, easements, permitting, Water Department fees and charges, and construction cost. The size of the proposed oversized tap shall be in accordance with the water and wastewater studies approved by the City. The construction cost of Oversizing will be based on the public bid price, City's tap fee, or the City's *Unit Price Ordinance*, as applicable at the time of the request for Oversizing. Where the City requests to oversize a tap for service included in a Community Facilities Agreement, City Participation will be in accordance with the City's *Unit Price Ordinance*.

3.4.3.3 *Certain Existing, Occupied Parcels* – As an incentive to connect to the City’s water, wastewater, or reclaimed water system, the City may pay the cost for an extension up to 200 linear feet for parcels located within the Fort Worth City Limits. No more than one extension credit of 200 feet will be allowed for each separate single, Existing, Occupied proposed Parcel to be served, regardless of the number of buildings, occupied or otherwise, which might be located on said lot or tract. To be eligible for 200 feet credit, all parcels must be platted and contain an existing water well (for water credit) or On-Site Sewage Facility (for wastewater credit). Proof that an on-site sewage facility is permitted by the City, as TCEQ’s authorized agent for permitting, is required prior to the City agreeing to provide the 200 linear foot credit when connecting the Property to the City’s sewage system. The following sections describe other eligible City Participation scenarios:

3.4.3.3.1 *Single, Existing, Occupied Parcel within 200 Linear Feet* – City Participation of water, wastewater, or reclaimed water main extension for a single, Existing, Occupied Parcel where the total extension of the main does not exceed 200 linear feet up to and across the Property Frontage.

3.4.3.3.1.1 City will pay for and install the main extension.
Landowner shall pay for the tap and Impact Fees.

3.4.3.3.2 *Single, Existing, Occupied Parcel greater than 200 Linear Feet* – City Participation of water, wastewater, or reclaimed water main extension for a single, Existing, Occupied Parcel where the extension is greater than 200 linear feet up to and across the Property Frontage.

3.4.3.3.2.1 City will pay for the cost of extending the main a distance of 200 linear feet.

3.4.3.3.2.2 The Landowner will be responsible for paying the City the actual cost of the main extension in excess of 200 feet, together with such other costs required by *City Code*.

3.4.3.3.2.2.1 Payment shall be made before construction begins. In the event payment cannot be in full, the Property owner may execute a Mechanic’s Lien and Note to guarantee payments of the extension cost.

- 3.4.3.3.2.2.2 In the event the Water Department Director agrees to the execution of the Mechanic's Lien and Note, the note shall be for a term not to exceed 5 years and shall bear interest at the highest rate permitted by law.
- 3.4.3.3.2.2.3 All cost of filing of the Mechanic's Lien shall be the responsibility of the Property owner.
- 3.4.3.3.2.2.4 Any refund of Front Foot Charges which may become due to a single Customer Property owner making payments on such a Mechanic's Lien will be credited against the lien until such lien is satisfied.
- 3.4.3.3.3 *Multiple, Existing, Occupied Parcels greater than 200 Linear Feet* – City Participation of water, wastewater, or reclaimed water main extension for multiple, Existing, Occupied Parcel where the extension is greater than 200 linear feet up to and across the Property Frontage.
 - 3.4.3.3.3.1 Additional Credits for Multiple, Existing, Occupied Parcels
 - 3.4.3.3.3.1.1 City will credit cost of extending the main a distance of 200 linear feet for each Existing, Occupied Parcel to be connected to the main.
 - 3.4.3.3.3.1.2 Any main length in excess of 200 linear feet will be paid for at the actual cost of the total excess length.
 - 3.4.3.3.3.1.3 The actual number of Existing, Occupied Parcels connected to such extension at the time of construction shall be responsible pro rata for payment to the City for such excess length.
 - 3.4.3.3.3.1.4 Properties connecting to such extension after completion of construction shall be subject to front-foot charges, such charges to be reimbursed as described in this section.

- 3.4.3.3.2 *Existing Platted, Occupied Customer Parcels Exceeding 5 Parcels* – In the case of an existing platted Development, or any Development exceeding 5 parcels, where Existing, Occupied Parcels without existing water, wastewater, or reclaimed water mains to provide service:
- 3.4.3.3.2.1 City will credit cost of extending the main a distance of 200 linear feet for each Existing, Occupied Parcel to be connected to the main.
 - 3.4.3.3.2.2 To receive this credit, a petition must be submitted to the Water Department Director with the names signed and printed, addresses, legal description of the Property, telephone numbers, and appointing a committee of not more than 5 Property owners of the area to be served. All Property owners included in the area must authorize the committee to act in their behalf in negotiating with the City on all matters pertaining to the water and/or wastewater installation. A committee representative shall be designated in writing as the contact person to coordinate with Water Department staff.
 - 3.4.3.3.3 Water Department, at its cost, will furnish the necessary maps and plans and perform the engineering design connected with the water, wastewater, or reclaimed water main extensions.
 - 3.4.3.3.4 The committee shall be responsible for all contact with the other Property owners in the area to be served and for collecting and depositing with the Water Department all required funds to be paid by the existing, occupied, single Customer Property owners.
 - 3.4.3.3.5 The City, at its expense, shall extend water, wastewater, or reclaimed water main up to 200 linear feet for each existing single Customer Property that has met the requirements of this section.

- 3.4.3.3.3.5.1 Construction will be released once all service installation fees have been paid by 100% of the proposed Customers. The Director of the Water Department may allow a project to be released to construction prior to 100% of the installation fees being paid.
- 3.4.3.3.3.5.2 Owners of parcels who did not participate in the petition, submit required fees, or who choose not to connect for service will be subject to Front Foot Charges for future connection requests, as well as tapping, impact, or other fees, in accordance with *City Code Chapter 35-58*.
- 3.4.3.3.3.6 The actual number of Existing, Occupied, single Customer Parcels connected to the extension shall be responsible pro rata for payment to the City for any excess length, fees to be divided among petitioners.
 - 3.4.3.3.3.6.1 Payment for the extension, and such other costs as may be required by the *City Code*, will be made in advance of the construction, unless other arrangements are made in advance, including the execution of a Mechanic's Lien and Note.
- 3.4.3.3.3.7 The City will not extend the water, wastewater, or reclaimed water main beyond the point of extension to serve the last existing single Customer Property represented by the committee.

3.5 COST RECOVERY

3.5.1 Developer Cost Recovery

3.5.1.1 General

- 3.5.1.1.1 In accordance with *City Code Chapter 35*, a Developer may be eligible for reimbursement for a portion of cost incurred for improvements through Front Foot Charges, Water Main Capacity Charges, Wastewater Per Acre Charges, or Wastewater Capacity Charges.
- 3.5.1.1.1 Reimbursement may not exceed the cost of the improvements as described in the following sections.



3.5.1.2 Front Foot Charges

3.5.1.2.1 *Eligibility* – A Developer is eligible for reimbursement of Front Foot Charges when cost is incurred for a water or wastewater Approach Main beyond the Development Property’s Frontage(s), and/or costs are incurred for a Frontage Main.

3.5.1.2.1.1 Frontage Main eligibility may only occur when the Property’s Frontage Main is shared with another Property on the opposing side of the street Right-of-Way from the Developer’s Property. This Property must be owned by a separate Landowner not affiliated with the Developer.

3.5.1.2.2 *Application* – Once the improvements required to serve the Development, as approved in the Water and Sewer Study Guidelines, are determined, the Developer and Water Department will document the limits of main eligible for reimbursement of Front Foot Charges. Documentation can be provided in a letter or email summary and will be logged in the Water Department’s Front Foot Charge database.

3.5.1.2.3 Reimbursement of Front Foot Charges

3.5.1.2.3.1 Front Foot Charges will be collected by the City per provisions set forth in *City Code Chapter 35-38*.

3.5.1.3 Developer Cost Recovery – Water Main Capacity/Wastewater Per Acre/Wastewater Capacity

3.5.1.3.1 *Eligibility* – If reimbursement of Front Foot Charges is impractical due to the inability to directly connect a main for service, or if the Developer elects to increase extend a main beyond what is required to service the Development, the Developer may request reimbursement of Wastewater Per Acre Charges, Wastewater Capacity Charges and/or Water Main Capacity Charges.

3.5.1.3.2 *Application* – Once the improvements required to serve the Development, as approved in the Water and Sewer Study Guidelines, are determined, the Developer and Water Department will document the amount eligible for reimbursement in accordance with Division 3 of *City Code Chapter 35* (Sewer per Acre Charges) and/or Division 4 of *City Code Chapter 35* (Water Main Capacity Charges). Cost recovery to be documented by City Ordinance approved by City Council.

3.5.1.3.3 *Reimbursement* – Upon City Council approval, the Developer will be reimbursed in accordance with the provisions set forth in Division 3 of *City Code Chapter 35* (Sewer per Acre Charges), Division 4 of *City Code Chapter 35* (Water Main Capacity Charges), and/or Division 5 of *City Code Chapter 35* (Sewer Capacity Charges).

3.5.2 City Cost Recovery

3.5.2.1 Front Foot Charges

3.5.2.1.1 *Eligibility* – The City is eligible for reimbursement of Front Foot Charges when the City constructs a water or wastewater main extension at its sole cost and the water/wastewater main contains Frontage across unserved properties.

3.5.2.1.2 *Reimbursement* – Front Foot Charges will be collected by City and shall be subject to the following conditions:

3.5.2.1.2.1 The City will collect Front Foot Charges per the provisions set forth in *City Code Chapter 35-58*.

3.5.2.1.2.2 Reimbursement shall be made solely from Front Foot Charges collected by the City during the period that Front Foot Charges are assessed for the water or wastewater Service Line connections and Point of Connections to the water or wastewater main extension.

3.5.2.2 City Cost Recovery – Wastewater Per Acre/Wastewater Capacity/Water Main Capacity Charge

3.5.2.2.1 *Eligibility* – The City is eligible for reimbursement of Wastewater Per Acre, Wastewater Capacity, and/or Water Main Capacity Charges when the City constructs a water or wastewater main extension at its sole cost as a City-initiated CIP project or through City Participation in Oversizing improvements.

3.5.2.2.2 *Reimbursement* – Upon City Council approval, City reimbursement shall be in accordance with provisions set forth in Division 3 of *City Code Chapter 35* (Sewer per Acre Charges), Division 4 of *City Code Chapter 35* (Water Main Capacity Charges), and/or Division 5 of *City Code Chapter 35* (Sewer Capacity Charges).

3.5.3 Shared Cost Recovery

3.5.3.1 Should the City elect to oversize a water or wastewater main that is eligible for cost recovery, both the City and Developer may be reimbursed for Front Foot, Water Main Capacity, Wastewater Capacity, and/or Wastewater per Acre Charges. The allocation of reimbursement eligibility between the City and Developer will be determined based upon the City Cost Participation Calculation percentages established in **Section 3.4** (Cost Participation). All other reimbursement provisions will follow the provisions set forth above in this section. Upon City Council approval, the Developer will be reimbursed for the Developer's allocation in accordance with **Section 3.5.1**.

3.5.4 Payment of City Participation to Developer for Design Procurement Agreements (DPA)

3.5.4.1 *Reimbursement* – City shall pay City Participation to the Developer in accordance with the executed Design Procurement Agreement.

3.5.5 Payment of City Participation to Developer for Community Facilities Agreements (CFA) or Infrastructure Construction Agreements (ICA)

3.5.5.1 *Reimbursement* – City shall pay City Participation in accordance with the executed Community Facilities Agreement (CFA) or Infrastructure Construction Agreement (ICA).

3.6 EXISTING ON-SITE SYSTEMS

- 3.6.1 *Property within City Limits* - Any existing Property served by an On-Site Sewage Facility system experiencing failures, in need of a repair permit, or replacement with the same size system, that is located within 100 feet of an existing City wastewater main, is required to connect to the City wastewater main unless the Property owner provides the City with approved permits showing that the On-Site Sewage Facility system will be replaced with the same size system, or repaired. Any existing Property served by an On-Site Sewage Facility system that needs to be expanded, replaced with a larger size system, or that needs an additional system, must connect to the City wastewater main, regardless of the distance from the Property to the City wastewater main.
- 3.6.2 *Property within City's ETJ* - Any existing Property served by an On-Site Sewage Facility system experiencing failures or in need of a repair permit, and within 100 feet of an existing City wastewater main, may connect to the City wastewater main if the Landowner petitions the City for annexation into the City or enters into a pre-annexation agreement with the City in accordance with the City's *Annexation Policy and Program*.
- 3.6.2.1 Property cannot be provided wastewater service from the City if the Property is located within another provider's water CCN boundary.
- 3.6.3 For existing properties containing a water well that obtains water service from the City, the water well may continue to be used on the Property for irrigation service only provided that a reduced pressure zone (RPZ) assembly, in accordance with City requirements, is installed on the new water service to prevent potential Cross Connections. Should the Property be located outside of the City limits, the service can be approved upon a Landowner petition to the City for annexation into the City or if the Landowner enters into a pre-annexation agreement with the City in accordance with the City's *Annexation Policy and Program*.

3.7 PROPOSED ON-SITE SYSTEMS

- 3.7.1 *Property within City Limits or Water CCN and within 2,000 linear feet of a surface water body* – Proposed Developments within the City limits that are within 2,000 linear feet of a surface water body will not be approved to be served with individual on-site systems. Developments will be required to connect to the City’s water and wastewater system. Main extensions will be required if existing water and wastewater mains do not front the Property.
- 3.7.2 *Property within the City’s ETJ Limits and within 2,000 linear feet of a surface water body* – Proposed Developments within the City’s ETJ limits that are within 2,000 linear feet of a surface water body are under the permitting authority for On-Site Sewage Facilities of Tarrant Regional Water District. To prevent water quality issues, connection to the City’s water and wastewater systems is encouraged and will be assessed by the City. Landowners shall coordinate with Water Department Staff to evaluate connection alternatives prior to installation of individual on-site systems.
- 3.7.3 *Property within the City’s ETJ Limits, but outside 2,000 linear feet of a surface water body* – Proposed Developments within the City’s ETJ limits that are outside 2,000 linear feet of a surface water body are under the On-Site Sewage Facility permitting authority of their respective County and/or Groundwater Conservation District for groundwater well spacing and installation requirements. Single family Developments designed to meet minimum lot acreage and spacing regulations for On-Site Sewage Facilities and individual water wells may consider installation of a proposed on-site system.
 - 3.7.3.1 Dense commercial or industrial Developments shall coordinate with Water Department Staff for assessment of proposed connections to the City’s water and wastewater system.
 - 3.7.3.1.1 Connections will require Landowners to petition the City for annexation into the City or enter into a pre-annexation agreement with the City in accordance with the City’s Annexation Policy and Program.
 - 3.7.3.1.2 Temporary Holding Tanks - Use of holding tanks for temporary sewage disposal is not allowed.
- 3.7.4 *Single Family lots served by On-Site Sewage Facility within City’s ETJ* - Developments within the City’s ETJ to be served by the City’s wastewater system, but having individual water wells, are subject to paying fees when a future connection to the City water system is requested in accordance with *City Code Chapter 35-58*. Water main and Service Line installation shall conform to the requirements of **Section 5** (Design Criteria for Water Systems) and the City’s *Standard Construction Specifications and Details*.



3.8 OWNERSHIP AND MAINTENANCE

3.8.1 *Water, Wastewater, and Reclaimed Water Mains* - Title to all water, wastewater, and reclaimed water mains constructed under this policy that have been completed and accepted by the Water Department Director, except title to wastewater service connections, shall be vested in the City.

3.8.2 Title to all Water and Wastewater Service Connections

3.8.2.1 Water Service Connections

3.8.2.1.1 Domestic/Irrigation Service Connection

3.8.2.1.1.1 Upon completion and acceptance by the Water Department Director, title to all water service connections for domestic/irrigation service from the water main to the meter, including the meter and meter box or vault, shall be vested in the City.

3.8.2.1.1.2 Installation of landscape irrigation system shall be in accordance with *City Code Chapter 35, Article VII*.

3.8.2.1.1.3 Installation of a private backflow shall be placed at the point of delivery in accordance with *City Code Chapter 12.5*.

3.8.2.1.2 Fire Line Connection

3.8.2.1.2.1 Upon completion and acceptance by the Water Department Director, title to all Fire Line connections from the water main to the gate valve on the City side of the double detector check shall be vested in the City.

3.8.2.1.2.2 Installation of the double detector check shall be in accordance with the Water Department's *Backflow Prevention Policy*.

3.8.2.1.2.2.1 If the gate valve is located in the street, title to the Fire Line connection will be from the water main (downstream of the gate valve) to the curb line adjacent to the Property served.

3.8.2.1.2.2.2 If the gate valve is located at the Property line of the Property being served, title to the Fire Line connection will be from the water main to the gate valve.

3.8.2.2 Wastewater Service Connections

- 3.8.2.2.1 The Developer or Existing, Occupied Parcel Landowner shall be responsible for the operation and maintenance of the service connection within private Property. City is responsible for operation and maintenance from the main to the cleanout/Property line.

3.8.2.3 Reclaimed Water Service Connections

- 3.8.2.3.1 Upon completion and acceptance by the Water Department Director, title to all reclaimed water service connections from the water main to the meter, to include the meter and meter box or vault, shall be vested in the City.

3.8.3 City Responsibility for Water, Wastewater, and Reclaimed Water Mains and Facilities

- 3.8.3.1 The City shall operate and maintain only those water, wastewater, and reclaimed water mains facilities, whose titles are vested in the City. All mains and facilities to be maintained by the City shall be located within City Right-of-Way, approved permit areas, or within a water, wastewater, or reclaimed water easement.

3.9 STANDARD EASEMENTS

- 3.9.1 The following requirements apply to water, wastewater, reclaimed water, and force mains that are not installed within street Right-of-Way. All required easements must be exclusive, fully executed, and submitted to the City before commencing construction activity within the easement.

- 3.9.1.1 If a water, wastewater, or reclaimed main is proposed to be within, or cross, an existing dedicated City Park, a park conversion may be necessary in accordance with the City's Parks and Recreation Department's requirements and state law.

- 3.9.2 Public water, wastewater, and reclaimed water mains located on Property owned by a Homeowners Association (HOA) shall be dedicated within exclusive water, wastewater, or reclaimed water easements.

- 3.9.2.1 All easements shall be exclusive for public water, wastewater, and reclaimed water facilities, with allowances for approved crossings.

- 3.9.2.1.1 Exclusive easements for public water, wastewater, and reclaimed water mains shall not share other public or private utility easements or storm drain easements, except when necessary to cross non-city owned easements or Right-of-Way, as approved by the City.

- 3.9.2.1.2 Mains shall be placed in the center of the easement. Refer to **Section 5.5.1.1** and **Section 6.4.1.1** for main locations.
- 3.9.2.1.3 Side slopes of an embankment or drainage feature shall not be located in an easement.

3.9.3 Standard Plat Provisions

3.9.3.1 Fort Worth Water Department easements are in accordance with Standard Plat Provisions as follows:

- 3.9.3.1.1 Any public utility, including the City of Fort Worth, shall have the right to move and keep moved all or part of any building, fence, shrubs, other growth or improvement which in any way endangers or interferes with the construction, maintenance or efficiency of its respective system on any of the easements shown on the plat; and they shall have the right at all times to ingress and egress upon said easements for the purpose of construction, reconstruction, inspection, patrolling, maintaining, and adding to or removing all or part of its respective systems without the necessity at any time of procuring the permission of anyone.
- 3.9.3.1.2 No permanent buildings or structures shall be constructed over any existing or platted water, sanitary sewer, drainage, gas, electric, cable or other utility easement of any type.

3.9.4 *Format* – All easement instruments shall be in a standard City format with standard City language.

3.9.4.1 For each easement submitted, a minimum of 2 easement instruments with original signature(s) of the Property owner(s) and notary signature/seal is required.

3.9.4.2 If the easement is to be acquired by the City, a minimum of 2 easement instruments in a standard City format is required. All easement instruments shall be in a form acceptable to the City.

3.9.5 *Filling* – Excessive filling of material on top of any easement is prohibited. If filling is proposed, calculations, sealed by a Licensed Professional Engineer, must be submitted to evaluate the impact of the additional fill material with respect to the main.

3.9.6 *Minimum Vertical Clearance* – The minimum vertical clearance above any easement is 25 feet for items such as, but not limited to, structures, awnings aerial walkways, etc. This allows a typical backhoe to maneuver in the case where a repair is necessary and minimizes the risk to the City and the grantor of the easement.

- 3.9.6.1 Overhead utilities may be allowed to cross with a clearance of less than 25 feet but shall be avoided when possible.
- 3.9.6.2 Vertical clearance requirements for Shared Access Developments are outlined in **Section 3.12** (Shared Utility Easements).
- 3.9.7 *Minimum Horizontal Clearance* – The minimum horizontal clearance between proposed lines and existing/proposed foundations, piers, or other vertical structures shall be 10 feet, as measured from outside edge to outside edge.
 - 3.9.7.1 For horizontal clearance requirements for Certain Urban Infill Areas and Shared Utility Easements, see **Sections 3.11** and **3.12**, respectively.
 - 3.9.7.2 Any building, fence, retaining walls, monument signs, trees, shrubs, other growth or improvement which in any way endangers or interferes with the construction, maintenance or efficiency of its respective system may be moved by the City of Fort Worth.
- 3.9.8 *Proximity of Lot Lines* – Easements parallel to lot lines shall be wholly contained on one lot and shall not cross lot lines.
 - 3.9.8.1 Public mains shall not be along the side or rear Property lot lines, or encroach into natural areas, protected areas (including but not limited to cemeteries, historical sites, or archaeological areas), or wetlands.
 - 3.9.8.1.1 The foregoing rule shall not apply to water transmission mains and wastewater interceptor mains.
- 3.9.9 Minimum Easement Widths
 - 3.9.9.1 *General* – The easement widths provided in this section are necessary to meet the minimum requirements for proper maintenance of mains, facilities, and appurtenances. However, certain circumstances, such as, but not limited to, topography, accessibility, or additional fill material over the easement, may dictate the necessity for the City to acquire additional easement width.
 - 3.9.9.2 *10 feet Depth or less* - For water mains, wastewater mains, reclaimed water mains, and force mains installed at a maximum depth of **10 feet** (measured from the ground level to the pipe flowline) outside of the public Right-of-Way, the main shall be installed within an easement with a minimum width in accordance with **Table 3-1**. Single mains shall be centered within the permanent easement, unless adjacent to City Right-of-Way.

Table 3-1. Minimum Easement Widths for Mains

Main Type	Main Size	Easement Width (feet)
Water/Reclaimed Water Mains	12-inch or less (adjacent to City Right-of-Way)	10
	12-inch or less	15
	16-inch	20
	24-inch to 30-inch	25
	36-inch or larger	30
Wastewater/Force Mains	15-inch or less (adjacent to City Right-of-Way)	10
	15-inch or less	15
	18-inch to 24-inch	20
	27-inch to 48-inch	25
	54-inch or larger	30
Combined Mains	Water mains (12-inch or less) and wastewater or force mains (15-inch or less)	25
	Water and Reclaimed Water mains (12-inch or less) and wastewater mains (15-inch or less)	30
	Two Water mains (12-inch or less)	25
	Other combined mains	Per approval of Water Department Director

3.9.9.3 When an easement is adjacent to City Right-of-Way, all water and wastewater mains shall be a minimum of 2.5 feet from the Right-of-Way line.

3.9.9.4 *Greater than 10 feet Depth* - For water mains, wastewater mains, reclaimed water mains, and force mains with depths **greater than 10 feet** (measured from ground level to flowline of pipe), the following equation will apply:

$$\text{Easement Width}^1 = [(\text{Depth of Pipe}) \times 2] + (\text{O.D.}^2 \text{ of Pipe}) + (2 \text{ feet})$$

Note: 1 – Width is rounded up to nearest 5 feet.

2 – O.D. shall mean the outside diameter of pipe (in feet).

3.9.9.5 Easement shall not exceed 50 feet in width, unless required by special circumstances.

3.9.9.6 If depths of mains vary across the easement, the largest resulting easement width shall apply.

3.9.9.6.1 Easement widths shall not vary within the same parcel/lot.

3.9.10 Facility/Appurtenance Easement Requirements

- 3.9.10.1 Water, Wastewater, and Reclaimed Water facilities and appurtenances located outside of the street Right-of-Way shall be placed in a facility easement, as required by **Table 3-2**.
- 3.9.10.2 Finished or proposed grades across dedicated water, wastewater, and reclaimed water facility easements shall not have a cross slope greater than 10%.

Table 3-2. Easement Widths for Facilities and Appurtenances

Facility/Appurtenance	Easement Width (feet)
2" Water Meters and smaller	5 x 5
3" and 4" Water Meters	10 x 10
6" and 8" Water Meters	15 x 15
Fire Hydrant	10 x 10
Sampling Station	10 x 10
Air Valve Assembly	10 x 10
Blow-off Valve Assembly	10 x 10
Grinder Pump	10 x 10
Wastewater Access Chamber	10 x 10
Manhole	10 x 10
Cleanout	5 x 5

3.9.11 Easements for Off-Site Facilities

- 3.9.11.1 The Developer shall be responsible for 100% of the cost to acquire easements for all off-site facilities sized solely to properly serve the proposed Development (no over-sizing required).
- 3.9.11.2 Where facilities are over-sized by the City (greater than that which the Developer needs to properly serve the proposed Development) and where the City desires to acquire a larger easement for future facilities, the City has the option to acquire additional easements for Approach Mains through negotiation and/or condemnation. The Developer shall be responsible for the cost of the portion of the easement required to properly serve the proposed Development, and the City shall be responsible for that portion of the easement required for over-sizing, or for future facilities.
- 3.9.11.3 The City shall not be responsible to the Developer for any delays, costs, expenses, or damages of any kind or nature caused to the Developer during the time that the City is in the process of acquiring any easements through negotiation and/or condemnation.

3.9.11.4 In the event the Developer desires to acquire the required easements, the Developer shall notify the City, in writing. In such case, the Developer shall be responsible for 100% of the cost of the entire easement except for those projects with executed Design Procurement Agreements or Community Facilities Agreements that include City Participation for the easement cost.

3.9.12 *Easements Required for Relocation/Replacement* – The Developer shall dedicate such easements or Right-of-Way within the Development as may be required to permit construction of the relocation/replacement. Responsibility for the acquisition of easements outside of the Development shall be as provided for easements for approach facilities.

3.9.13 *Notice of City Facilities* – The City will file a Notice of City Facilities in the county deed records for public infrastructure located on City-owned properties in order to establish a maintenance area and document the need to reserve an easement if the Property is sold.

3.9.14 *Encroachment Agreements* - Except as otherwise provided by City Code, any proposed crossing through an exclusive water, wastewater, or reclaimed water easement requires execution of an Encroachment Agreement in accordance with Water Department requirements and the City Code.

3.10 TEMPORARY CONSTRUCTION EASEMENTS

3.10.1 Off-site water, wastewater, or reclaimed water lines, force mains, or other facilities to be constructed outside the Developer's Property may require additional temporary construction easements. These easements are in addition to the above listed permanent easements.

3.11 EASEMENTS FOR EXISTING WASTEWATER MAINS IN URBAN INFILL AREAS

3.11.1 Certain areas designated by the City as Urban Infill may have existing alleys, or existing easements, containing existing wastewater mains. If Standard Alley width, or Standard Easement width requirements per **Section 3.9** (Standard Easements), cannot be accommodated due to existing physical conflicts, a waiver request for a minimum wastewater easement width of 10 feet or use of a substandard alley will not be approved unless all of the following conditions are satisfied:

3.11.1.1 Franchise utilities are located outside of the wastewater easement;

3.11.1.2 The existing wastewater main does not exceed 8-inches in diameter with a maximum depth of cover of 6.5 feet;

3.11.1.3 No water mains or storm drains exist within the alley;

3.11.1.4 No physical encroachments exist with the easement or alley;

- 3.11.1.5 Existing buildings are verified to be constructed with pier, or other deep-type foundations, or the foundations can be verified by a Licensed Professional Engineer to be outside of the Zone of Influence of any construction associated with maintaining the existing main; and
- 3.11.1.6 A minimum vertical clearance of 18 feet is provided above the wastewater main.

3.12 SHARED UTILITY EASEMENTS

3.12.1 Shared Utility Easements are allowed for utility services in small, infill-type Developments where the maximum length of the Development, and its associated infrastructure, does not exceed 150 feet in length. Developments exceeding the infrastructure size and length requirements do not qualify for a Shared Utility Easement and must adhere to Standard Easement requirements, **Section 3.9**. In the event that a Standard Easement cannot be provided per **Section 3.9** (Standard Easements), a waiver request to allow a Shared Utility Easement will not be approved unless the following requirements are met:

3.12.1.1 *Easement Width* – For shared access Developments including public water and wastewater mains, the following easement widths apply:

Table 3-3. Minimum Width Requirements

Shared Utility Easement	Water and Wastewater Easement
22 feet*	12 feet
20 feet**	18 feet

* includes 10' Public Utility Easement containing gas, electric, and communication on one side, or a 5' Public Utility Easement on each side, of the Water and Wastewater Easement.

** assumes no Public Utility Easement with 5.5 feet horizontal clearance for wastewater main and 8 feet for water main from edge of easement.

3.12.1.2 General Requirements

- 3.12.1.2.1 Water or wastewater mains located in a Shared Utility Easement may only provide service to lots directly adjacent to the Shared Utility Easement.
- 3.12.1.2.2 The minimum vertical clearance above the water and wastewater easement shall be 18 feet.
- 3.12.1.2.3 Traffic rated water meter lids and wastewater cleanout covers are required.
- 3.12.1.2.4 No parking is allowed over the water and wastewater easement. In addition, “No Parking” signs shall be installed and existing/proposed curbs shall be painted in red to prevent any vehicles parking over the water and wastewater easement.

- 3.12.1.2.5 No public or private storm drainage is allowed within the water and wastewater easement.
- 3.12.1.2.6 Water and Wastewater horizontal separation must be 4 feet as measured from the outside edge of the water and wastewater mains.
- 3.12.1.2.7 The maximum length of the street, water improvements, and wastewater improvements is 150 feet each.
- 3.12.1.2.8 Water meters and wastewater cleanouts must be located a minimum distance of 3 feet from any structure.
- 3.12.1.2.9 The location of franchise utilities must be approved by each franchise utility prior to Shared Utility Easement waiver approval by the City. Depending upon type of service required, franchise utility may not be able to accommodate either of the options described in **Table 3-3**.

3.12.1.3 Water Main Requirements

3.12.1.3.1 *Size* – 4-inch

- 3.12.1.3.1.1 Developments requiring larger than 4-inch water mains, must meet standard easement width requirements.

3.12.1.3.2 *Location* – Water main must be a minimum distance of 2.0 feet from the edge of water and wastewater easement to the centerline of the water main (opposite side of the wastewater main) and adjacent to a minimum 10-foot wide public utility easement. See Appendix.

- 3.12.1.3.2.1 The minimum horizontal clearance between the water main and the franchise gas main must be 5.5 feet as measured from the centerlines of each main.

- 3.12.1.3.2.2 An alternative layout includes 5-foot public utility easements on each side of the Water and Wastewater Easement and is shown in the Appendix.

3.12.1.3.3 *Cover* – 4 feet maximum cover, 3 feet minimum cover

- 3.12.1.3.4 A 6-inch isolation gate valve shall be provided at the boundary line of the shared access Development and the public Right-of-Way.

- 3.12.1.3.5 No Fire Line connections or fire hydrants can be located within the shared access Development.
- 3.12.1.3.6 Meter locations shall meet the 3-foot clear radius requirement outlined in **Section 5.5** for meter signal reading.
- 3.12.1.3.7 A bullhead water meter configuration is required for lots with less than 40 feet of Frontage.
- 3.12.1.3.8 Dead-End Mains cannot exceed 150 feet in length.
 - 3.12.1.3.8.1 Any main terminating as a dead-end shall be required to install an automatic flushing device. A water meter must be installed with the device. Device must be located within the water and wastewater easement and discharge directly to a wastewater manhole with an appropriate backflow device to prevent Cross Connections.

3.12.2 Wastewater Main Requirements

- 3.12.2.1.1 *Material* – Wastewater main material shall be ductile iron pipe (lined with Protecto 401) or SDR 26, ASTM D2241, PR 160 PVC pipe with pressure rated joints, as defined in the City's *Standard Construction Specifications and Details*.
 - 3.12.2.1.1.1 Pipe of the same material must be installed from manhole to manhole.
 - 3.12.2.1.1.2 PVC pipe must be green in color.
- 3.12.2.1.2 *Size* – 8-inch
 - 3.12.2.1.2.1 Developments requiring larger than 8-inch wastewater mains, must meet standard easement width requirements.
- 3.12.2.1.3 *Location* – Wastewater main must be a minimum distance of 5.5 feet from the edge of water and wastewater easement to the centerline of the wastewater main (opposite side of the water main). See Appendix.
 - 3.12.2.1.3.1 An alternative layout includes 5-foot public utility easements on each side of the Water and Wastewater Easement and is shown in the Appendix.

3.12.2.1.4 *Cover* – 6.5 feet maximum cover

3.12.2.1.4.1 Depth of cover cannot be less than 6.5 feet unless it can be demonstrated that all service mains (including franchise) can meet the separation requirements in Chapters 5 and 6 of this Policy.

3.12.2.1.5 The use of wastewater access chambers on wastewater mains shall only be allowed if included in a waiver request and approved as part of the waiver approval.

3.12.2.1.6 The minimum slope of the wastewater main shall be 0.75% due to anticipated low flow condition.

3.12.3 The City has no obligation to maintain the Shared Utility Easement, including its surface. If the Shared Utility Easement area is not maintained in compliance with the requirements set forth in the executed easement, the City shall have the right, but not the obligation, to take those actions necessary to repair the surface. Any cost, including costs borne by the City, associated with surface repairs will be the Development's responsibility in accordance with the easement.

3.13 OTHER STANDARD PLAT COMMENTS

3.13.1 An Impact Fee Statement is required for every plat in accordance with *City Code Chapter 35-70.4*. The statement shall read as follows: "The City of Fort Worth has an Ordinance implementing the assessment and collection of water and wastewater Impact Fees. The total amount assessed is established on the recordation date of this plat, based upon Schedule I of the current Impact Fee Ordinance. The amount to be collected is determined under Schedule II then in effect on the date a building permit is issued, or the connection date to the municipal water and/or wastewater system."

3.13.2 A Private Water and Sewer Statement is required on plats for properties without access to water or sewer and located outside the City Limits. The statement shall read as follows: "Water to be served by private well water. Sewer to be served by private individual disposal system."

3.13.3 A CCN Holder statement is required on plats for properties within the ETJ with no connection to the City of Fort Worth water and/or wastewater system. The statement shall read as follows: "(Provide Name and Number of CCN Holder): Water and/or Sewer to be provided by CCN No. (insert number) and (Name of Holder)."

3.13.4 A PRV (Pressure Reducing Valve) statement is required for plats with properties being served by a higher pressure plane in accordance with **Section 5.4.5.6**. The statement shall read as follows: "PRVs will be required: water pressure exceeds 80 P.S.I."

3.14 PRIVATIZATION OR ABANDONMENT OF EXISTING WATER AND WASTEWATER MAINS INFRASTRUCTURE

3.14.1 Privatization of Existing Water Infrastructure

3.14.1.1 Water mains shall be privatized upon written request from Landowner. An executed Privatization Agreement shall be required to transfer ownership of and responsibility for the subject infrastructure to the Landowner. To be privatized, the infrastructure must meet the following criteria:

- 3.14.1.1.1 The public water infrastructure to be privatized shall exclusively serve the lot within which it is located;
- 3.14.1.1.2 The subject infrastructure cannot have been constructed using funds from a debt program unless that debt obligation has been fully satisfied;
- 3.14.1.1.3 The subject infrastructure must have met its useful life in years as determined by the City's *Capital Asset Policy*, which is maintained by the Financial Management Services Department;
- 3.14.1.1.4 The subject infrastructure is not included in any planned or future Water Capital Improvement Program project and will not compromise long-term service delivery or future utility access.
- 3.14.1.1.5 A delineation point between private plumbing and public infrastructure is installed at either the existing Property line, the existing public Right-of-Way line, or other point as set forth in the Privatization Agreement.
 - 3.14.1.1.5.1 The delineation point may be a private water backflow prevention device for water lines.

3.14.1.2 Valuation and Payment for Privatization or Abandonment of Existing Water Infrastructure

- 3.14.1.2.1 Development Services– Water Section Staff will evaluate the final cost charged to the Developer for privatization or abandonment of existing water infrastructure. The final cost will include reimbursement to the City for the Net Book Value (NBV) of the asset recorded in the City's financial records.
- 3.14.1.2.2 The cost shall not apply if the request is from the same Developer/entity who originally installed the public asset.

- 3.14.1.2.3 If the Developer installs alternative public infrastructure, at their own cost, to reroute the existing public infrastructure, payment of the NBV of the asset is waived.
 - 3.14.1.3 A Privatization Agreement including the following must be executed:
 - 3.14.1.3.1 The Landowner is willingly assuming ownership of the subject infrastructure in “as-is” condition and assuming all responsibility for maintaining the subject infrastructure;
 - 3.14.1.3.2 An exhibit identifying the limits of the privatization, including stationing.
 - 3.14.1.4 Any exclusive easement for the subject infrastructure may be vacated by separate instrument following the procedures of the Property Management Department’s Real Property Division, after execution of the Privatization Agreement and installation of the delineation point between the public infrastructure and private plumbing.
 - 3.14.2 Privatization of Existing Wastewater Infrastructure
 - 3.14.2.1 Wastewater Mains shall be privatized upon written request from Landowner. An executed Privatization Agreement shall be required to transfer ownership of and responsibility for the subject infrastructure to the Landowner. To be privatized, the infrastructure must meet the following criteria:
 - 3.14.2.1.1 The public wastewater infrastructure to be privatized shall exclusively serve the lot within which it is located;
 - 3.14.2.1.2 The subject infrastructure cannot have been constructed using funds from a debt program unless that debt obligation has been fully satisfied;
 - 3.14.2.1.3 The subject infrastructure must have met its useful life in years as determined by the City’s *Capital Asset Policy*, which is maintained by the Financial Management Services Department; and
 - 3.14.2.1.4 The subject infrastructure is not included in any planned or future Wastewater Capital Improvement Program project and will not compromise long-term service delivery or future utility access.
 - 3.14.2.1.5 A delineation point between private plumbing and public infrastructure has been installed at either the existing Property line, the existing public ROW line, or other point as set forth in the Privatization Agreement.



- 3.14.2.1.5.1 Such delineation point could be a public manhole for wastewater lines.
 - 3.14.2.2 Valuation and Payment for Privatization or Abandonment of Existing Wastewater Infrastructure
 - 3.14.2.2.1 Development Services – Water Section Staff will evaluate the final cost charged to the Developer for privatization or abandonment of existing wastewater infrastructure. The final cost will include reimbursement to the City for the Net Book Value (NBV) of the asset recorded in the City’s financial records.
 - 3.14.2.2.2 The cost shall not apply if the request is from the same Developer/entity who originally installed the public asset.
 - 3.14.2.2.3 If the Developer installs alternative public infrastructure, at their own cost, to reroute the existing public infrastructure, payment of the NBV of the asset is waived.
 - 3.14.2.3 A Privatization Agreement which includes the following must be executed:
 - 3.14.2.3.1 A provision that the Landowner is willingly assuming ownership of the subject infrastructure in “as-is” conditions and assuming all responsibility for maintaining the subject infrastructure;
 - 3.14.2.3.2 An exhibit identifying the limits of privatization, including stationing; and.
 - 3.14.2.3.3 That the Landowner obtains and pays for a CCTV inspection and delivers a report to the City documenting the condition of the line being privatized.
 - 3.14.2.4 Any exclusive easement for the subject infrastructure shall be vacated by separate instrument following the procedures of the Property Management Department’s Real Property Division.

SECTION 4 – PROCEDURE

4.1 GENERAL

- 4.1.1 These procedures for the planning and design of water, wastewater, and reclaimed water facilities are furnished to prevent delays, improve uniformity, and secure adequate drawings so that these facilities will be designed and constructed as economically as feasible to meet present and future requirements. These procedures are provided to supplement the City of Fort Worth’s overall Development/redevelopment procedures and do not replace requirements set forth in other City documents such as, but not limited to, the City’s *Community Facilities Agreements Ordinance*.

4.2 PROJECT PROCESS

4.2.1 Water/Wastewater Loading/Study Determination

- 4.2.1.1 Prior to formal submission of a Preliminary Plat, Infrastructure Plan Review Center (IPRC) process, Community Facilities Agreement (CFA), redevelopment, or new building permit process, the Developer is recommended to contact Water Department Staff to determine Loading Analysis or Study Requirements. The Developer shall be prepared to discuss the following:

- 4.2.1.1.1 General overview and location of the Development project;
- 4.2.1.1.2 Summary of proposed water, wastewater, and/or reclaimed water demands; and,
- 4.2.1.1.3 Demonstration of how the proposed system will connect to the City’s existing system.

- 4.2.1.2 Water Department Staff shall have the final decision in determining whether a Loading Analysis or Study will be required to be submitted for review. In general, a Water Loading Analysis will be sufficient for smaller Developments that do not contain a fire Service Line. A Wastewater Loading Analysis will be sufficient for most Developments as long as the capacity of the existing main will not be exceeded with the additional load, or the existing main is not already identified to be constructed in the Department’s *Master Plan*. A Study will be required for all other Developments. The following contains requirements and references for Loading Analysis and Studies:

4.2.1.2.1 Loading Analysis

4.2.1.2.1.1 The Developer shall submit the Loading Analysis in accordance with the Department's requirements. *Water and Sewer Study Guidelines* are attached in the Appendix.

4.2.1.2.1.2 Upon submission to the Water Department and subsequent review, comments will be provided, if necessary. Once the submittal is determined to meet the Water Department's requirements, the Development shall proceed to Cost Participation Determination, if necessary.

4.2.1.2.2 Study

4.2.1.2.2.1 The Developer shall submit the Study in accordance with the Department's requirements. In general, the Study shall be prepared in report format and be sealed by a Licensed Professional Engineer in the State of Texas. In general, the Study should address the following sections: Purpose and Scope, Design Criteria, Hydraulic Analysis, and Recommendations. Refer to the *Water and Sewer Study Guidelines*, attached in the Appendix, for more specific requirements.

4.2.1.2.2.2 Upon submission to the Water Department and subsequent review, comments will be provided, if necessary. Once the submitted study is determined to meet the Water Department's requirements, the Development shall proceed to Cost Participation Determination, if necessary.

4.2.1.2.3 Developments containing Loading Analysis and Study Requirements

4.2.1.2.3.1 It is possible for a proposed Development to be required to submit a Loading Analysis for one type of service (i.e. wastewater) and a Study for another type of service (i.e. water). In this event, comments must be addressed and meet the Water Department's requirements for all types of service (water/wastewater/reclaimed water) before proceeding to Cost Participation Determination, if necessary.

4.2.2 Cost Participation Determination

- 4.2.2.1 Once the Loading Analysis and/or Study meets the requirements of the Water Department, the Water Department Staff will review and recommend approval of the proposed improvements. In accordance with *Texas Local Government Code 212.904*, the Developer's portion of the cost of improvements must be determined by a Licensed Professional Engineer retained by the City and may not exceed the amount required that is roughly proportionate to the improvements required to serve the Development. Cost Participation, if any, will be determined in accordance with **Section 3** (Policy).
- 4.2.2.2 *Community Facilities Agreement (CFA)* – A common cost participation process is through the approval of a CFA. If it is determined City Participation will be provided, the Developer shall be required to apply for a CFA in accordance with the City's *Community Facilities Agreements Ordinance*. In general, the CFA process requires bonding and a public bidding process, with bid openings held at the City. Community Facility Agreements often require City Council approval depending upon their contract amounts.
- 4.2.2.2.1 IPRC Process – Upon determination of City Participation, the Development shall begin the IPRC process for preparation and review of construction drawings and specifications in accordance with the City's Community Facilities Agreements Ordinance.
- 4.2.2.2.2 Pre-Qualification Requirements – Once the required facility improvements have been determined by the Water Department Staff, any Public Improvements must be constructed by a Water Department approved pre-qualified contractor. Pre-qualification requirements are outlined in **Section 4.4** (Pre-Qualification Requirements for Contractors).
- 4.2.2.2.3 Any project requiring permit approval from TxDOT is required to utilize the CFA process.
- 4.2.2.2.4 If a project initiates a CFA, the entire project shall be completed within the CFA process. Miscellaneous Contracts are not allowed to supplement CFA projects, nor are CFA projects allowed to supplement Miscellaneous Contracts.

4.2.2.3 *Miscellaneous Contracts* – The Department’s Miscellaneous Contract process is an in-house option for design and construction of water or wastewater infrastructure. Construction schedules for Miscellaneous Contracts are often more streamlined than the CFA process, but can be impacted by current construction workload and available contract funding.

4.2.2.3.1 Miscellaneous Contracts are intended for the following types of infrastructure:

- 4.2.2.3.1.1 Fire line taps
- 4.2.2.3.1.2 Fire Hydrants
- 4.2.2.3.1.3 Water Service Lines 2-inches or smaller when other services on this list are included
- 4.2.2.3.1.4 Water service taps greater than 2-inches
- 4.2.2.3.1.5 All water service taps on concrete, steel-cylinder type mains.
- 4.2.2.3.1.6 Water or wastewater main extensions for pipes with a diameter of 16 inches or smaller, and extending less than 400 linear feet.
- 4.2.2.3.1.7 Sewer taps on lines with a depth greater than 8 feet but less than 15 feet.

4.2.2.3.2 Any and all public water or public sewer easements by separate instrument necessary for the proposed infrastructure must be accepted by In-House Design Staff before a Miscellaneous Contract project’s pricing will be released. The City will not prepare or obtain easements for a Miscellaneous contract project. It is the Developer or Property owner’s responsibility to obtain all on-site or off-site easements required for the project prior to construction.

4.2.2.3.3 Miscellaneous Contracts are not allowed for the following:

- 4.2.2.3.3.1 Any facilities, services or tap removals that require full pavement repair, wider than standard trench repair or on streets less than 2 years old, pursuant to the *City of Fort Worth Utility Construction Policy (2019)* based upon the street’s Pavement Condition Index (PCI),
- 4.2.2.3.3.2 Any projects within TxDOT ROW;
- 4.2.2.3.3.3 Any project within railroad ROW;

- 4.2.2.3.3.4 Any project requiring consent from another governmental or other third-party agency; or
- 4.2.2.3.3.5 Projects requiring a waiver from this Manual or the Subdivision Ordinance.
- 4.2.2.3.4 At the discretion of Water Department Staff:
 - 4.2.2.3.4.1 Water or wastewater infrastructure that does not qualify for the Miscellaneous Contract process, may be approved if combined with infrastructure that does qualify for a Miscellaneous Contract process;
 - 4.2.2.3.4.2 Any Facilities or services that require temporary shutdown of water service to an active Customer may not be approved by the Water Department for a Miscellaneous Project; and
 - 4.2.2.3.4.3 If special, or unique, challenges prohibit the Department from accepting a Miscellaneous Project, a Community Facilities Agreement will be necessary.
- 4.2.2.3.5 *Downtown Developments* – Development improvements within the City’s Downtown Central Business District are not eligible for the Miscellaneous Contract process unless granted prior approval from the Water Department Director.
- 4.2.2.3.6 If a Development application requires the extension of public water or wastewater and the project is eligible and accepted for the Water Department’s Miscellaneous Contracts process, all required fees must be paid to the City before any related holds may be released.
 - 4.2.2.3.6.1 Miscellaneous Contract projects will be reconciled upon completion, and the Developer must pay the City any outstanding fees more than \$200. In the case of overpayment, the difference shall be refunded by the City to the Developer.
 - 4.2.2.3.6.2 The Miscellaneous Contracts cost is subject to change. Developer initiated changes during construction, including necessary design changes, may result in a revision to the original estimate. The Developer is responsible for payment of any changes from the original estimate.

- 4.2.2.3.6.3 A Development shall not have a Community Facilities Agreement and use the Miscellaneous Contracts process.

4.2.2.4 *Water Department Tap Installation* – In accordance with the City’s Tapping Fee Ordinance, a landowner can contract with the Water Department for installation of water service taps 2-inches and smaller and wastewater service taps 8-inches and smaller (not exceeding 8 feet in depth). Additional fees may be required in accordance with the City’s Utility Construction Policy.

4.2.2.5 *Water Department Coordination* – Coordination with the Water Department Staff for the various items above may be completed via telephone conversations, mail, email correspondence, or scheduled meetings. Meetings are encouraged for Developments containing unique circumstances.

4.3 FEES AND CHARGES

4.3.1 Service Installation Fees

4.3.1.1 The Water Department has separate service installation fees that may apply to Developments depending upon various elements of the Development. Some of the more common fees include Impact Fees, Tapping Fees, and Meter Deposits and are described in more detail below. Additional fees associated with service installations may apply. Contact the Water Department to determine if other fees may need to be planned for the improvements.

4.3.1.1.1 *Impact Fees* – Water and Wastewater Impact Fees are one-time fees assessed at the time that the final plat is recorded and are based on the size of the water meter installed. Impact fees apply to domestic and irrigation meters, but not Fire Line meters, and are calculated in accordance with the requirements set forth in *Texas Local Government Code Chapter 395* and codified in *City Code Chapter 35*. Impact fees shall be paid before the City will issue a building permit. More specific information about Impact Fees and the amount to be paid for Impact Fees can be found on the City’s Website.

4.3.1.1.2 *Tap Fees* – A tap fee is a service fee that is charged for the Water Department to install the Service Line from the public water or wastewater main to the private plumbing. Tap fees only apply to connections to existing mains. However, all new connections incur both a tap and an Impact Fee. More specific information about tap fees and the amount required to be paid for tap fees can be found on the City’s Website.

4.3.1.1.2.1 Tap fees are not required for service connections to new mains constructed as part of the Development.

4.3.1.1.3 *Meter Deposits* – New domestic and irrigation water taps also require a meter deposit to be paid for billing purposes. Deposits amounts are based upon meter size and Customer class. More specific information about meter deposits and the amount required to be paid for meter deposits can be found on the City’s Website.

4.3.1.1.4 *Water Testing Lab Fee* – Before placing a newly constructed water main in service, the City requires water sample testing. Water sample testing is conducted at a City laboratory. The Developer must pay any applicable Water Testing Lab Fees in accordance with the City’s Community Facilities Agreements Ordinance. Water Testing Lab Fees only apply to water sample testing of water samples at a City laboratory and does not include collection of the water sample.

4.3.1.2 Water and Wastewater Main Charges

4.3.1.2.1 Wastewater per Acre Charges

4.3.1.2.1.1 Wastewater (sewer) per acre charges allow Developers and the City to recover some of the costs incurred associated with the construction of wastewater main extensions. Charges are based upon the demand required for the Development with its basin area in accordance with Division 3 – Sewer Per Acre Charges of *City Code Chapter 35*.

4.3.1.2.2 Water Main Capacity Charges

- 4.3.1.2.2.1 Water main capacity charges allow Developers and the City to recover a portion of the cost incurred that are associated with the construction of water mains. Charges are based on 1.0 million gallons per day (MGD) of maximum day demand generated by a Development in accordance with Division 4 – Water Capacity Charges of *City Code Chapter 35*.

4.3.1.2.3 Wastewater Capacity Charge

- 4.3.1.2.3.1 Wastewater (sewer) capacity charges allow Developers and the City to recover a portion of the costs incurred that are associated with the construction of wastewater main extensions. Charges are based on 1.0 million gallons per day (MGD) of wastewater capacity generated by a Development in accordance with Division 5 – Wastewater Capacity Charges of *City Code Chapter 35*.

4.3.2 Front Foot Charges

- 4.3.2.1 Connections to an existing water, wastewater, or reclaimed water main shall be assessed a front foot charge in accordance with *City Code Chapter 35-58*. Front foot charge amounts are subject to change on an annual basis by City Ordinance. Front foot charges shall be paid in the following cases:
- 4.3.2.1.1 Service connections made to a main constructed by a Developer or single Customer Property owner before December 31, 1983;
 - 4.3.2.1.2 Service connections or extensions made to serve adjacent Property from a main constructed by a Developer or single Customer Property owner after December 31, 1983;
 - 4.3.2.1.3 Service connections or extensions made to vacant lots from a water main that has been replaced at Developer or single Customer Property owner cost; or,
 - 4.3.2.1.4 Service connections or extensions made to vacant lots from a main installed by multiple single Customer Property owners.

- 4.3.3 *Assessment Taps* – In cases where the City has paved a street that contains water or wastewater mains and provided service taps to one or more unserved lots, in order to prevent future pavement cuts, the City shall charge an additional fee for providing service to this lot in accordance with *City Code Chapter 35-57.7*.

4.4 PRE-QUALIFICATION REQUIREMENTS FOR CONTRACTORS

- 4.4.1 Any project containing public infrastructure must be performed by a pre-qualified contractor/sub-contractor in accordance the City requirements. A list of Water Department pre-qualified contractors is continually updated and available from the Water Department.

4.4.1.1 If a contractor or sub-contractor is pre-qualified with the Water Department, the General Conditions of the Project Manual must include the City’s *Standard Construction Specification Documents, General Conditions* (or Developer Awarded Projects *General Conditions*, as applicable) *Section 00 45 12*. This form includes listing the applicable work type categories, name of the contractor/sub-contractor, and the expiration date for their pre-qualification approval.

4.4.1.2 If a contractor or sub-contractor is not pre-qualified with the Water Department, the contractor shall submit an application to be reviewed for approval. Upon receipt of the pre-qualification application, the Water Department Staff shall review the application for conformance with the requirements and issue an approval or denial letter within 7 days. Pre-qualification work type categories and specific information on the requirements to obtain pre-qualification are included in the City’s *Standard Construction Specification Documents, General Conditions* (or Developer Awarded Projects *General Conditions*, as applicable) *Sections 00 45 11* and *00 45 13*.

4.4.1.2.1 General requirements for pre-qualification, further described in City’s *Standard Construction Specification Documents, General Conditions* (or Developer Awarded Projects *General Conditions*, as applicable) *Sections 00 45 11* and *00 45 13*, include:

- 4.4.1.2.1.1 Financial Statement;
- 4.4.1.2.1.2 General Scope of Project Containing Public Water and/or Wastewater Infrastructure;
- 4.4.1.2.1.3 Work References;
- 4.4.1.2.1.4 Equipment Schedule; and,
- 4.4.1.2.1.5 Relevant Water and/or Wastewater Construction Experience.

4.5 OTHER WATER/WASTEWATER FACILITIES

- 4.5.1 It is the intent of the Water Department to provide service by main extensions. The installation of metering stations, booster pump stations, pressure regulating valves, lift stations, and/or storage facilities are only allowed through an approved waiver. If a waiver is granted, the City and Developer must execute an agreement relating to the design of the facility. Any cost participation for these improvements by the Water Department will be in accordance with **Section 3** (Policy) and coordinated with the Developer on a case-by-case basis.

4.6 REGIONAL WATER, WASTEWATER, AND RECLAIMED WATER LINES

- 4.6.1 Regional water, wastewater or reclaimed water lines are those 24-inches in diameter, or larger, with the intent to serve multiple Development areas. Before beginning any design efforts on a regional line, the design and installation concept must obtain approval, in writing, by the Water Department Director. Upon approval by the Director, a waiver shall be submitted for approval that includes contract terms for executing an agreement with the City for design of the lines. The terms must address cost sharing with the City (in accordance with **Section 3** (Policy)), the selection of the engineer in accordance with *Chapter 2254, Subchapter A* of the *Texas Local Government Code*, and the City approved level of effort for design.

4.7 ON-SITE SYSTEMS

- 4.7.1 If allowed in accordance with **Section 3.7**, alternative systems, such as individual on-site water wells and on-site sewerage facilities, shall be designed and operated in strict compliance with all applicable permits, Ordinances, regulatory guidance and regulations including the Environmental Protection Agency (EPA), TCEQ, Texas Department of State Health Services, County, and City.

4.7.1.1 All On-Site Sewage Facilities shall be designed in accordance with *30 TAC Chapter 285* and approved by the appropriate permitting authority. Use of holding tanks for temporary sewage disposal is not allowed.

4.7.1.2 Water wells must be drilled by a licensed well driller in accordance with the *Texas Occupations Code Chapter 1901*.

4.8 PRE-TREATMENT

- 4.8.1 Commercial and industrial Developments are subject to certain specific requirements related to discharges into the wastewater system. These requirements are set forth in *City Code Chapter 12.5 – Environmental Protection and Compliance*.

4.8.1.1 Data Center Developments must obtain a Non-Significant Industrial User (NSIU) Permit.



4.9

BACKFLOW AND CROSS CONNECTION

Pursuant to 30 Texas Administrative Code (TAC), Section 290.44, it is the responsibility of the City of Fort Worth to protect its drinking water supply by instituting and enforcing a Cross Connection program. These requirements are set forth in City Code Chapter 12.5 – Environmental Protection and Compliance and Section 5.21 (Backflow Protection).

SECTION 5 – DESIGN CRITERIA FOR WATER SYSTEMS

5.1 GENERAL

- 5.1.1 The following are the minimum Standard Design Criteria that must be met for all water improvements to meet the requirements of *30 Texas Administrative Code (TAC) Chapter 290, Sections 290.38 through 290.47*, the current edition of the City of Fort Worth *Subdivision Ordinance*, and the City of Fort Worth *Community Facilities Agreements Ordinance* for incorporation into the Fort Worth Water System.

5.2 PRESSURE PLANE AREAS

- 5.2.1 The City of Fort Worth distribution system is divided into several water pressure planes to ensure even water pressure gradients throughout the City. Before designing connection points between a proposed main and any existing main, the Engineer shall investigate and determine if the proposed water main crosses the boundary between any pressure planes. Even though there are physical continuations of water pipes between pressure planes, they are designed with valves that are closed at the boundary points to isolate each pressure plane is isolated.
- 5.2.1.1 In addition, many pressure planes contain special Service Areas. These areas could be susceptible to higher or lower pressures and are often controlled through the use of pressure regulating valves. Understanding the operation of these specialized Service Areas is critical to ensuring proper water service to the area.
- 5.2.2 In certain conditions, pressure plane elevations may fluctuate depending upon where Development occurs within the pressure plane. The list below identifies standard pressure planes within the City. These pressure plane elevations shall be used for planning purposes. The Engineer can review more specific information related to the pressure plane locations and boundaries by contacting the Water Department Staff.
- 5.2.2.1 *Holly Plane* – The central area of the City, which is served from the Holly Water Treatment Plants directly, without re-pumping, which lies below ground elevation 640 feet. The water storage tank(s) overflow elevation is 760 feet. The bottom of the water storage tank(s) bowl elevation is 728 feet.
- 5.2.2.2 *South Side II Plane* – The area south and south west of the Holly Plane between the ground elevations of 640 feet and 720 feet. The water storage tank(s) overflow elevation is 850 feet. The bottom of the water storage tank(s) bowl elevation is 815 feet.

- 5.2.2.3 *South Side III Plane* – The area south and south west of the Southside II Plane between the ground elevations of 720 feet and 860 feet. The water storage tank(s) overflow elevation is 990 feet. The bottom of the water storage tank(s) bowl elevation is 955 feet.
- 5.2.2.4 *South Side IV Plane* – The projected area south of the Southside III plane between the ground elevations 860 feet of 920 feet. The water storage tank(s) overflow elevation is projected to be 1075 feet. Currently, there is no bowl for this pressure plane.
- 5.2.2.5 *West Side II Plane* – The area west of the Holly Plane between ground elevation 640 feet and 720 feet. The water storage tank(s) overflow is 857 feet. The bottom of the water storage tank(s) bowl elevation is 825 feet.
- 5.2.2.6 *West Side III Plane* – The area west of the West Side II Plane between the ground elevations of 720 feet and 830 feet. The water storage tank(s) overflow elevation is 974 feet. The bottom of the water storage tank(s) bowl elevation is 924 feet.
- 5.2.2.7 *West Side IV Plane* – The area west of the West Side III Plane between the ground elevations of 830 feet and 930 feet. The water storage tank(s) overflow elevation is 1065 feet. The bottom of the water storage tank(s) bowl elevation is 1022 feet.
- 5.2.2.8 *West Side V Plane* – The area west of the West Side IV Plane between the ground elevations of 930 feet and 1060 feet. The water storage tank(s) overflow elevation is 1190 feet. The bottom of the water storage tank bowl elevation is 1155 feet.
- 5.2.2.9 *Northside II Plane* – The area north, northwest, and northeast of the Holly Plane between ground elevations of 640 feet and 720 feet. The water storage tank(s) overflow elevation is 853 feet. The bottom of the water storage tank(s) bowl elevation is 797 feet.
- 5.2.2.10 *Northside III Plane* – The area north and northwest of the North Side II Plane between the ground elevations of 720 feet and 820 feet. The water storage tank(s) overflow elevation is 950 feet. The bottom of the water storage tank(s) bowl elevation is 910 feet.
- 5.2.2.11 *Northside IV Plane* – The area north and northwest of the North Side III Plane between the ground elevations of 820 feet and 920 feet. The water storage tank(s) overflow elevation is 1030 feet. The bottom of the water storage tank(s) bowl elevation is 990 feet.

- 5.2.2.12 *East Side II Plane* – The area east of the Holly Plane area between ground elevation 640 feet and 680 feet. The water storage tank(s) overflow elevation is 805 feet. This plane also includes the area east of IH-35 and north of Holly Plane. The bottom of the water storage tank(s) bowl elevation is 770 feet.

5.3 MINIMUM WATER MAIN SIZE

- 5.3.1 *Residential & Commercial Water Mains* – The minimum water main size for a residential (defined as single-family detached or two-family/duplex housing) area or a commercial (defined as Development not composed of single-family detached or two-family/duplex housing and industrial Developments) area is 8-inch inside diameter (I.D.), or such larger size as may be necessary to properly serve the proposed and existing Development.
- 5.3.1.1 Smaller residential Developments, such as cul-de-sacs, with Dead-End Mains less than 150 feet in length will be allowed to contain water mains less than 8-inch (I.D.) to help prevent water quality issues. The minimum size allowed for these special circumstances will be 4-inch water mains (with minimum 6-inch gate valves).
- 5.3.2 *Industrial Water Mains* – The minimum water main size for an industrial zoned area shall be 12-inch (I.D.).

5.4 SIZING WATER MAINS

- 5.4.1 *Standard Sizes* – New water mains shall consist of the following diameters (in inches): 8, 12, 16, 24, 30, 36, and multiples of 6-inch thereon.
- 5.4.2 *Standard Tap Sizes*
- 5.4.2.1 Domestic services consist of the following diameters (in inches): 1, 1.5, 2, 4, and multiples of 2-inch thereon up to 12 inches. Refer to **Section 4** (Procedure) for installation alternatives.
- 5.4.3 A Loading Analysis or Water Study shall be performed to determine the demand/loads created by proposed Development and if any necessary improvements to the existing system to support the Development are needed. *Water and Sewer Study Guidelines* are included in the Appendix.
- 5.4.4 An alignment walk shall be required if the water main is outside of the existing public Right-of-Way.
- 5.4.4.1 All water mains 16-inch, and larger, in diameter will require an alignment walk. Alignment walks are valid for one year after the issuance of the alignment approval letter.

5.4.4.2 An alignment walk shall be required for 12-inch water mains and smaller that are within the Right-of-Way if there are existing or proposed bar ditches or the water main is not located under the pavement.

5.4.4.3 The alignment walk must show that the water main:

- 5.4.4.3.1 Has access that is maneuverable by construction equipment, is free of obstructions and has no obstacles to future maintenance;
- 5.4.4.3.2 Is located outside heavily wooded areas containing protected trees;
- 5.4.4.3.3 Is not located in historically preserved areas;
- 5.4.4.3.4 Is not located on gas well pads or fee simple properties owned by a utility company;
- 5.4.4.3.5 Is not in TxDOT and/or railroad rights-of-way;
- 5.4.4.3.6 Is not less than 10 feet from the top of a creek bank;
- 5.4.4.3.7 Easement does not contain side slopes of an embankment or drainage feature;
- 5.4.4.3.8 Is not located in areas with ground slopes steeper than 4:1;
- 5.4.4.3.9 Is perpendicular to ground slopes;
- 5.4.4.3.10 Is not located inside a designated Floodplain, except for water transmission mains; and
- 5.4.4.3.11 Is not located within a Floodway, or Cemetery Burial Site.

5.4.5 Water Demand Calculations and Modeling Criteria

5.4.5.1 Demand – The following demand criteria is in accordance with the Water Master Plan and Water and Sewer Study Guidelines:

- 5.4.5.1.1 Average Day Water Use – Refer to **Table 5-1** for average day water demands for different land use types.

Table 5-1 Water Demands per Capita

Land Use Type	Residential Average Day per Capita (gpcd)	Non-Residential Average Day per Employee/Person/Student/Bed (gpcd)
High Density Residential	180	-
Medium Density Residential	180	-
Low Density Residential	180	-
Manufactured Housing	125	-
Single Family	200	-
Mixed Use Growth Center	180	50
Commercial/Office	-	50
Heavy Industrial*	-	75
Light Industrial*	-	50
Hospitals	-	350
Institutional/Schools (with showers)	-	50
Institutional/Schools without Showers	-	35
Restaurant/Fast Food	-	15 gallons / meal
Restaurant (with Bar or Cocktail Lounge)	-	18 gallons / meal
Car Wash & Automotive Services	-	50 gallons / car
Hotel/Motel	-	125
Theatre	-	5 gallons/seat

*Additional processes and maximum operating rate of water usage will need to be added to the Water Study for proper pipe sizing calculations. Some Industrial Developments (Processing Facility, etc.) need to be evaluated case by case.

- 5.4.5.1.2 Maximum Day Water Use – For maximum day unrestricted use, multiply the annual Average day by 2.25.
- 5.4.5.1.3 Maximum Hour Water Use – For maximum hour unrestricted use, multiply the maximum day by 2.00.
- 5.4.5.1.4 Population Density for Study Purposes –When actual values are unknown, use the following densities:
 - 5.4.5.1.4.1 *Single Family* – 14 persons per gross acre (based on previous density assessment)

5.4.5.1.4.2 *Commercial/Warehouse/Industrial** – Assume 5% of the total square footage as an office area with a population density of 1 person per 400 square feet, and 95% of the total square footage with a population density of 1 person per 2,000 square feet. *Population density for the industrial Development is highly dependent on the type of industrial Development.

5.4.5.1.4.2.1 Data centers are considered light industrial and must use a closed loop cooling system.

5.4.5.1.4.3 *Hotel* – A minimum of 2 persons per guest room

5.4.5.1.4.4 *Multifamily* – Assume 60 persons per acre.

5.4.5.1.4.5 For mixed use land types, population density shall be calculated for residential and non-residential buildings separately.

5.4.5.1.5 Persons per Residential Connection

5.4.5.1.5.1 3.5 people per connection for single-family residential buildings

5.4.5.1.5.2 2.5 people per connection for multi-family buildings

5.4.5.1.6 Computations

5.4.5.1.6.1 Maximum Day/Connection = $\frac{(2.25)(200 \text{ GPCD})(3.5 \text{ p/c})}{1,000,000}$

Maximum Day/Connection = 0.001575 MGD

5.4.5.1.6.2 Maximum Hour/Connection = $(2.00)(0.001575 \text{ MGD})$

Maximum Day/Connection = 0.001575MGD

5.4.5.2 Velocity and Head Loss

5.4.5.2.1 For maximum hour demand condition, 12-inch and smaller water mains shall be designed for a maximum velocity of 5 fps or a maximum friction loss of 5 feet per 1,000 feet (ft/1,000-ft) during a 24-hour extended period simulation, whichever is more restrictive.

- 5.4.5.2.2 For maximum hour demand condition, 16-inch, and larger water mains, shall be designed for a maximum velocity of 7 fps or a maximum friction loss of 7 feet per 1,000 feet during a 24-hour extended period simulation, whichever is more restrictive. For maximum day plus fire flow demand condition, water mains shall be designed for a maximum velocity of 10 fps.
- 5.4.5.2.3 For Standard Size water mains, listed in **Section 5.4.1**, with no minor losses, a Hazen-Williams coefficient of 130 shall be used.
- 5.4.5.2.4 *Looping* – Looping is required for commercial Developments where water mains are not extended within a public street for redundancy and to meet velocity requirements of **Section 5.4.5.2** (Velocity and Head Loss).
- 5.4.5.3 *Fire Flow* – Fire flow shall be defined as the amount of water that should be available for providing fire protection at selected locations throughout a community. Fire flow rates vary depending on the land use types per current Fire Code requirements as included in *City Code Chapter 13*. Texas Commission on Environmental Quality (TCEQ) requires a minimum residual pressure of 20 pounds per square inch (psi) be maintained while delivering fire flow under maximum day demand conditions. Minimum fire flow requirements are as follows:
 - 5.4.5.3.1 One and two-family dwellings:
 - 5.4.5.3.1.1 1,000 gallons per minute (gpm) for proposed dwellings smaller than 3,600 square feet
 - 5.4.5.3.1.2 1,500 gpm if the dwelling's square footage is greater than 3,600 square feet
 - 5.4.5.3.1.3 The minimum fire flow duration is 1 hour.
 - 5.4.5.3.2 Other than one and two-family dwellings:
 - 5.4.5.3.2.1 1,500 gpm is required
 - 5.4.5.3.2.2 The minimum fire flow duration is 2 hours.
- 5.4.5.4 *Supply Storage versus Pumping* – The “Maximum Hour” demand must be supplied with not less than 60% from pumping capacity and not more than 40% from available elevated storage.
- 5.4.5.5 *Elevated Storage Tank Depletion* – Elevated water storage must be maintained not less than 5 feet above the storage tank’s bottom capacity level.

5.4.5.6 Minimum Working Pressure

5.4.5.6.1 A minimum of 40 psi must be maintained at all times under normal conditions.

5.4.5.6.2 Plumbing Code allows a maximum pressure of 80 psi and a pressure reducing valve (PRV) is required at connections where the pressure exceeds 80 psi during any season.

5.4.5.7 *Design* – Water mains must be sized to meet “Maximum Hour” or “Maximum Day” plus Fire Flow, whichever is greater. Fire flow requirements as superimposed upon the maximum day conditions, elevation, and the type of Development proposed, shall be used in arriving at the final water main capacity.

5.4.5.8 *Main Extensions for Wide Paved Streets* – Wide paved streets resulting in a copper service length of greater than 55 linear feet will require a water main extension in accordance with **Section 3** (Policy).

5.4.5.8.1 The capacity of the two parallel water mains shall not be less than the required capacity of a single line designed to serve the area.

5.5 LAYOUT OF WATER MAINS, SERVICE LINES, AND APPURTENANCES WITHIN RIGHT-OF-WAY

5.5.1 *Locations* – The following design criteria shall be the locations where water mains, Service Lines, and appurtenances are allowed in the Right-of-Way in the Fort Worth Water distribution system:

5.5.1.1 *Water Main Location* – The location of water mains shall be in the north or east ¼ of the street.

5.5.1.1.1 Other Street Types – Layouts where water mains within cul-de-sacs and roundabouts are allowed are included in the Appendix.

5.5.1.2 *Residential Water Service Lines* – residential water Service Lines shall be located in the parkway in front of the Property and 1-foot offset from the Property line.

5.5.1.3 *Non-Residential Water Service Lines* – When non-residential Service Lines connect to a water main requiring a crossing of the main or tee, the Service Line shall not be connected to the section of the main that is lowered to accommodate the crossing.

5.5.1.3.1 Public or private Service Lines are not allowed to cross Property lines in accordance with Plumbing Code.

5.5.1.4 *Meters* –Domestic and irrigation water meter boxes containing meters shall be located 2 feet behind the back of curb and outside of driveways.

5.5.1.4.1 The water meter box containing the meter shall not be located outside of the public Right-of-Way or water easement.

5.5.1.4.2 All meters shall have a 3-foot radius buffer clearance for AMI signal meter readings and staff accessibility. No objects, including trees, mailboxes, or any structure that overshadows the meter which could impede signal transmission shall be allowed within the 15-foot radius buffer.

5.5.1.4.3 Meters and meter boxes within parking lots must be placed in a parking lot island.

5.5.1.4.4 Meters and meter boxes shall not be located less than 5 feet from any fire hydrant as measured from center of the hydrant to the edge of the meter box.

5.5.1.4.5 No meters or meter boxes shall be located in driveways, or sidewalks.

5.5.1.4.6 Meter boxes and lids shall withstand H-20 loading and be located in non-deliberate or incidental traffic areas.

5.5.1.5 Valves

5.5.1.5.1 Valves shall be located at all water main intersections and within the street intersection at water main crosses or tees.

5.5.1.5.1.1 Ring connections must be provided for water mains 16-inch, and larger, instead of crosses in accordance with the *City's Standard Construction Details*.

5.5.1.5.2 Valve locations shall align with projected Property line.

5.5.1.5.2.1 To provide proper valve restraint, large water mains containing flanged connections require valves to be flanged to the tee, or outlet fitting.

5.5.1.5.2.2 Valves shall not be located within curb ramps, or driveways.

5.5.1.5.3 In-line valves, not located at intersections but required due to spacing, must be placed before a fire hydrant lead line.

5.5.1.5.4 For sizing and spacing of valves, refer to **Section 5.13** (Gate Valve and Butterfly Valve Requirements).

5.5.1.5.5 The location of any proposed or relocated pressure plane valve requires approval from Water Department Staff.

5.5.1.6 Fire Hydrants

5.5.1.6.1 Fire hydrants at intersections must be at least 2.5 feet, but less than 9 feet, from the back of the curb of the paved street or edge of a designated approved fire lane.

5.5.1.6.2 Fire hydrants that are not located in intersections shall be located 3 feet behind the back of curb. Fire hydrants shall not be placed within sidewalks, driveways, loading areas, etc. Fire hydrants must be placed to have the shortest possible lead under street pavement.

5.5.1.6.3 The distance from a fire hydrant to the water main directly connected to the fire hydrant shall not exceed 55 feet, in accordance with **Section 3** (Policy).

5.5.1.6.4 For spacing and separations requirements, refer to **Section 5.11** (Fire Hydrants).

5.5.1.6.5 A standard blue raised reflective pavement marker shall be placed on a highway, street, or road to mark fire hydrant locations. These makers must be placed on the side nearest the fire hydrant 0.5 foot from the centerline stripe, or at the approximate center of the pavement if there is no centerline stripe. Markers must be installed in accordance with the Federal Highway Administration Manual of Uniform Traffic Control Devices Chapter 3A requirements.

5.5.1.7 *Layouts* – Layouts for water and wastewater mains and appurtenances that are approved by the City are included in the Appendix.

5.6 HORIZONTAL/VERTICAL ALIGNMENT AND CLEARANCE REQUIREMENTS

5.6.1 *Radius of Curvature/Joint Deflection* – Minimum radius of curve and maximum deflection angle of pipe joints are restricted to 50% of manufacturer's recommendation, after which the use of horizontal or vertical bends are required. No bending of pipe is allowed.

5.6.2 *Bends* – All bends shall be 45° or less. Two 45° bends in a series must be used in lieu of 90° bends. Tee fittings must be used in lieu of a 90° bend to allow for proper restraint for future maintenance or connections.

- 5.6.3 *Restrained Joints* – All vertical and horizontal fittings and valves shall be designed with restrained joints in addition to concrete thrust blocking. Anchor tees or anchor couplings must be used to secure all branch valves to fittings. **Table 5-2** includes the minimum lengths of pipe to be restrained for 8-inch and 12-inch PVC water mains.

Table 5-2. PVC Pipe Joint Restraint

Pipe Size (inches)	Plugs, Tees, and Valves	Bends*			
		90°	45°	22.5°	11.25°
8	88 ft	33 ft	14 ft	7 ft	4 ft
12	126 ft	45 ft	19 ft	9 ft	5 ft

*Length to be restrained on each side of the bend.

Assumptions: 250 psi test pressure, 1.5 safety factor, SP soil type, Type 4 trench

5.6.4 Depth of Cover Requirements

5.6.4.1 12-inch and smaller water mains shall be designed for a minimum cover of 48 inches, measured from the top of surface (existing and future) to the top of pipe.

5.6.4.2 16-inch, and larger, water mains shall be designed for a minimum cover of 60 inches, measured from the top of surface (existing and future) to the top of pipe.

5.6.4.2.1 To accommodate water main appurtenances requiring vaults, depths exceeding 60 inches may be necessary.

5.6.5 *Existing Appurtenances* - If grade changes or pavement improvements are proposed, all existing water appurtenances shall be adjusted to the proposed final grade.

5.6.6 Clearance Requirements

5.6.6.1 Other Water Mains within City Right-of-Way

5.6.6.1.1 If a 12-inch, or smaller, water main is proposed to be laid parallel to an existing 12-inch, or smaller, water main, a horizontal clearance of 10 feet is required between the two water mains as measured from the outside diameter of each main. In no case shall the excavation of either main impact the bedding or embedment of the other main.

5.6.6.1.2 If a 16-inch, or larger, water main is proposed to be laid parallel to an existing 16-inch, or larger, water main, a horizontal clearance of 20 feet is required between the two water mains, as measured from the outside diameter of each main. In no case shall the excavation of either main impact the bedding or embedment of the other main.

5.6.6.2 Storm Drain

- 5.6.6.2.1 When water mains are parallel to storm drains, the minimum horizontal clearance shall be 5 feet as measured from the outside diameters of each main.
 - 5.6.6.2.2 When water mains cross storm drains, the water main must cross over the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.
 - 5.6.6.2.2.1 If crossing over the storm drain cannot be achieved due to limited cover over the water main, the water main must cross under the storm drain in accordance with the City's *Standard Construction Specifications and Details*.
 - 5.6.6.2.2.2 Cement Stabilized Sand (CSS) or Controlled Low Strength Material (CLSM) backfill is required for any storm drain crossings over water mains.
 - 5.6.6.2.2.3 Crossings beneath storm drains larger than 24" and all box culverts shall require steel casing.
 - 5.6.6.2.3 *Storm Drain Junction Structure Separation* – Storm drain junction structures must have 5 feet of separation from the water main.
 - 5.6.6.2.4 *Streets Containing Large Storm Drains* – For streets containing greater than 36-inch storm drains, collaborative approval from the Transportation/Public Works Department and Water Department must be obtained for the water main to remain within the pavement. If the water main cannot be located in the north or east $\frac{1}{4}$ of the street, this cannot be achieved, the water main shall be placed within the parkway 5 feet from the north or east Property line.
 - 5.6.6.2.5 If a water main is proposed to be laid parallel to an existing or proposed drainage channel or feature, a horizontal clearance of 10 feet is required between the water main and the top of drainage channel or feature as measured from the outside diameter of the water main to the top of bank of the drainage channel or top of the drainage feature.
- 5.6.6.3 *Franchise Utilities* – A minimum clearance of 3 feet horizontally and vertically shall be maintained from all franchise utilities such as gas, electric, fiber optic, and cable within City Right-of-Way or easements. Proposed franchise utilities shall cross beneath water mains.

- 5.6.6.3.1 A franchise utility may require a greater minimum clearance distance. Where the City's minimum clearance requirement and the franchise utility's minimum clearance requirement differ, the greatest minimum clearance requirement shall be used. .

5.6.6.4 *Non-Franchise Utilities* – Water mains proposed to parallel or cross existing non-franchise utility lines, such as gas or energy pipelines, shall adhere to all clearance and other requirements of the non-franchise utility. Privately owned water, sewer, storm drain, or other lines crossing a public water main shall meet the requirements of this section. At a minimum, water mains shall maintain a horizontal clearance of 3 feet and vertical clearance of 3 feet, as measured from the outside diameters of each main. If the non-franchise utility contains an impressed current cathodic protection system, a minimum horizontal clearance of 5 feet and vertical clearance of 3 feet is required as measured from the outside diameters of each main to minimize the impacts of stray current to the main, fittings, and appurtenances. Where the City's minimum clearance requirement and the non-franchise utility's minimum clearance requirement differ, the greatest minimum clearance requirement shall be used.

5.6.6.5 *Drilled Shafts* – Water mains adjacent to drilled shafts shall be designed with a minimum horizontal clearance of 10 feet as measured from the outside diameter (OD) of the main to the outside edge of the drilled shaft.

5.6.6.5.1 *Streetlights and Traffic Signal Foundations* – For 12-inch, or smaller, water mains within residential streets, the minimum horizontal clearance shall be 7 feet as measured from the outside diameter (OD) of the main to the outside edge of the streetlight or traffic signal foundation.

5.6.6.6 *Drainage Headwalls and Inlets*

- 5.6.6.6.1 Water mains and Service Lines shall not cross under headwalls and inlets.
- 5.6.6.6.2 Water mains and Service Lines adjacent to headwalls and inlets shall be designed with a minimum horizontal clearance of 10 feet to headwall and 5 feet to inlets as measured from the outside diameter of the main to the outside edge of the headwall or inlet.

- 5.6.6.6.3 Water mains perpendicular to headwalls and inlets shall be designed with a minimum clearance of 10 feet to headwall and 5 feet to inlets, as measured from the outside diameter of the main to the outside edge of the headwall or inlet.

5.6.6.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

- 5.6.6.7.1 Water mains adjacent to MSE or other retaining walls shall be designed to be placed outside of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.

- 5.6.6.7.2 Water mains crossing MSE or other retaining walls shall be designed with steel casing through the entirety of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.

- 5.6.6.8 *Other Bridge Features* – Unless required otherwise by the bridge owner, a minimum clearance of 5 feet horizontally and vertically shall be maintained from all other bridge features.

- 5.6.6.9 *Coordination with Other Entities* – In situations where water mains are required to be placed adjacent, within, or crossing easements or Right-of-Way of highway or railroad entities, the Engineer is responsible for coordinating with such entity to confirm that future expansions from the entity will not impact the proposed water main. Documentation of such correspondence must be provided for review. Water mains shall not be placed within, or crossing, easements or right-way of a highway or railroad in an area that is designated for future expansion.

5.7 WATER MAIN SEPARATION FROM WASTEWATER MAINS

- 5.7.1 In accordance with TCEQ requirements, the purpose of maintaining minimal spacing between water and wastewater mains is to protect the public water distribution system from contamination from wastewater. Contamination may occur when a vacuum develops within a water main due to breakage or malfunction of relief valve. The minimum horizontal space between a new wastewater main and a water main shall be 9 feet as measured from the outside diameter of the water and wastewater mains or facilities. The wastewater main that is parallel to a water main shall be installed in a separate trench. When the 9-foot horizontal separation distance cannot be achieved, or if a water main is crossing a wastewater main, the mains must meet the separation requirements set forth in 30 TAC Chapter 290.44.

5.8 WATER MAIN MATERIALS AND EMBEDMENT

- 5.8.1 Material and embedment requirements for water mains shall be as defined in the City's *Standard Construction Specifications and Details*.

5.8.1.1 *Material Type* – Material for water taps shall be as defined in the City’s *Standard Construction Specifications and Details*.

5.8.2 Trench Water Stops

5.8.2.1 If encountered during construction, or if groundwater is known to be present, trench water stops must be installed at 500-foot intervals to prevent migration of water within the water main trench.

5.8.2.2 If a project is within the jurisdiction of the current *City Code Appendix A, Zoning Regulations, Chapter 6 Section 6.302 (Tree Ordinance)*, all onsite underground utilities with backfill other than onsite material shall have a trench water stop every 200 feet for the entire length of the utility placement.

5.9 CONNECTIONS TO EXISTING WATER MAINS

5.9.1 *Cut-in Tees* – Connections shall be made in locations where existing valves can be closed to isolate the connection point while keeping as much of the surrounding system in service as possible. Cut-in tees shall be used to connect a new water line to an existing water main.

5.9.1.1 Cut-in connections shall require an additional valve on the existing main to reduce the number of service disruptions.

5.9.1.2 If a waiver is granted to allow a tapping sleeve, the tap can only be connected to water mains when the tap is at least one standard size smaller than the existing main size. For example: 12-inch existing water main size and 8-inch tap and tapping valve size.

5.9.2 *Provision for Future Extensions* – Connections must be designed to facilitate future replacements and improvements. To accommodate future 12-inch or smaller extensions and minimize future outages, the water main must terminate with a gate valve and one joint of 18-20 feet of water main. Water mains 16-inch, and larger, will require a minimum of 40 feet of water main for future stub-out or anchoring restraint.

5.9.3 *Shut-Down Periods for Large Mains* – If a shut-down is required for a connection or relocation to an existing main that is 16-inches in diameter, or larger, the Engineer shall place provisions within the construction Contract Documents, including drawings, to notify the contractor that connections to mains will only be allowed from December 1- March 1. Before final plans are submitted, the Engineer shall coordinate with Water Department Staff to discuss the shut-down procedure and to determine if any additional requirements need to be incorporated into the Contract Documents. Drawings shall also contain the following notices for the contractor to adhere to during construction:

- 5.9.3.1 Contractor shall coordinate with Water Department Field Operations at least 2 weeks before shut-down to discuss the plan.
- 5.9.3.2 Contractor shall coordinate with Water Department Field Operations at least 48 hours in advance of planned connection to discuss details and sequencing procedure of the connection.
- 5.9.3.3 No shut-down will occur unless all required material and equipment are on site.
- 5.9.4 For any proposed extensions, the proposed extension must connect to an existing line that is the same size or larger than the proposed extension.

5.10 DEAD-END WATER MAINS

- 5.10.1 In order to meet the minimum allowable velocity per **Section 5.4.5.2** (Velocity and Head Loss) Dead-End Mains should be avoided, and are only allowed when a looped or interconnected water main system is not available. The design of all water distribution systems must include the opportunity for future looping or interconnect of any approved or proposed dead-end line.
- 5.10.2 Residential cul-de-sac dead-end lines shall be allowed to be reduced down to 4-inch diameter if the following criteria are satisfied:
 - 5.10.2.1 The fire hydrant lead shall be installed prior to the reduction of the main size;
 - 5.10.2.2 The maximum length of a Dead-End Main in a cul-de-sac without a fire hydrant is 250 feet;
 - 5.10.2.3 Future extensions from a 4-inch or 6-inch Dead-End Main will not be allowed; and
 - 5.10.2.4 The minimum allowable velocity per **Section 5.4.5.2** (Velocity and Head Loss) is met.
- 5.10.3 Where Dead-End Mains are approved, the design shall allow for periodic flushing of stagnant water through a flushing device in accordance with **Table 5-3**.

Table 5-3. Flushing Requirements

Dead-End Length (feet)	Flushing Requirement
Less than 100	Flush Point
100– 300	Flush Point or Fire Hydrant
More than 300	Fire Hydrant and Automatic Flushing Device with water meter (permanent and temporary flushing devices)

- 5.10.3.1 Permanent flushing devices shall require a 2-inch water Service Line and fire hydrant water meter, and have a wastewater service connection to the existing or proposed wastewater main. Connection to the wastewater main shall contain an air gap in accordance with TCEQ requirements to prevent cross-contamination.
- 5.10.3.2 Temporary flushing devices, proposed to be installed for a period less than 2 years, shall contain a de-chlorination basket, which will treat stagnant water before it is discharged to surrounding areas.
- 5.10.4 Pressure Plane boundaries shall be determined by the Water Department Staff to meet operational requirements. Proposed mains that approach pressure plane boundaries must be designed to loop within their designated pressure plane.
- 5.10.5 To provide improved fire protection, water mains serving more than two fire hydrants must be a looped system. Looped water mains through the site must be connected to two different existing water mains to provide system redundancy.

5.11 FIRE HYDRANTS

- 5.11.1 *Fire Hydrant Spacing and Separation* – Fire hydrants in the Fort Worth distribution system shall comply with the requirements in **Section 5.11** (Fire Hydrants). Fire Hydrant locations shall be in accordance with *City Code Chapter 13, Section 507.5.1* and reviewed by the Bureau of Fire Prevention of the Fort Worth Fire Department.
 - 5.11.1.1 *One and Two-Family Residences* – For all one and two-family residences, fire hydrants must be installed within (or along) a 500-foot radius along a direct horizontal line from the residence and must be within 600-feet of hose lay using the most direct route of access between fire hydrant and building.
 - 5.11.1.2 *Other Land Uses* – For all other land uses, fire hydrants must be installed within (or along) a 300-foot radius along a direct horizontal line from building and must be within 500 feet of hose lay using the most direct route of access between fire hydrant and building.
 - 5.11.1.3 *Cul-de-Sacs* – Streets longer than 300 feet, which end in a cul-de-sac, must have a fire hydrant in the cul-de-sac. When the cul-de-sac is less than 300 feet from the center of the connecting street intersection, a fire hydrant is required at the connecting street intersection.

- 5.11.1.4 *Ground Elevation* – The ground line on the fire hydrant shall be set even with the elevation of the top of the adjacent existing or proposed curb. When parkways are to be developed with a rolling or irregular slope, the ground line index on the fire hydrant shall be set to the proposed ground elevation at the point of installation. Elevations shall be in accordance with the City’s Standard Details.
- 5.11.2 *Private Fire Hydrants* – Where a fire hydrant is on a metered line, the fire hydrant must be maintained by the owner of the Property and the fire hydrant may not be obstructed. Private fire hydrants shall be painted red to differentiate them from public fire hydrants, which are colored aluminum.
- 5.11.3 *Fire Department Connection* – Fire Department Connection shall be within 150 feet of a fire hydrant.
- 5.11.4 *Fire Flow* – Fire flow requirements shall comply with *City Code Chapter 13, Section B104*, unless otherwise required or approved by the Fire Marshal.
- 5.11.4.1 Water supply, or fire hydrant flow, testing shall comply with *City Code Chapter 13, Section 507.4*.
- 5.11.5 *Fire Hydrant Installation* – All fire hydrants shall be installed in accordance with the City’s Standard Construction Specifications and Details.

5.12 FIRE LINES

- 5.12.1 *Main Connection Size* – Fire lines can only be connected to water mains that are one size larger or more than the Fire Line size.
- 5.12.2 There shall be no extensions or connections from dedicated Fire Lines for domestic or irrigation Service Lines.
- 5.12.3 *Double Check Detector Assembly*– All un-metered Fire Lines shall have, at a minimum, a double check detector backflow prevention assembly. The detector assembly and vault, or above ground assembly, shall be located on private Property in accordance with the requirements set forth in **Section 5.21** (Backflow Protection).
- 5.12.4 *Fire Department Connection* – When a Fire Department Connection is required, it must be located on the discharge (Customer) side of the backflow preventer.
- 5.12.5 *Fire Line Testing* – The Bureau of Fire Prevention of the Fort Worth Fire Department is responsible for inspection and testing of all Fire Lines on a Property owner’s side of the meter, gate valve, or backflow preventer.
- 5.12.6 *Backflow Prevention Vault Location* –If the backflow preventer is located within a vault, or an above ground assembly, the vault and assembly shall be located adjacent to the Right-of-Way or easement

5.12.7 *Design and Construction Requirements for the Reconnection of Fire Lines* – The following procedure must be utilized for the reconnection of Fire Lines during design and construction of water mains:

- 5.12.7.1 All Fire Lines on existing water mains to be replaced shall be clearly identified on the drawings. When construction interrupts water service to existing Customers, a detailed sequence of construction must be provided for the reconnection to ensure that affected properties have adequate fire protection during and after construction. The Fort Worth Fire Department shall be notified of any water supply impairments to a Property's fire protection system(s). A construction permit shall be obtained from the Fort Worth Fire Department when required by the Fire Department.
- 5.12.7.2 The Engineer shall meet with affected Property owners to obtain fire flow and pressure requirements and incorporate the data into the fire service reconstruction design.
- 5.12.7.3 The Engineer must coordinate with Water Department Field Operations before submitting plans to the City to coordinate water shutdown limits. If the water main is removed and replaced in the same trench adequate fire protection must be maintained. The transfer time of the Fire Line to the new water main must be approved by the Fire Marshal.. Written approval of the Fire Marshal shall be submitted to IPRC when the construction plans are filed for review.
- 5.12.7.4 If temporary water service is necessary to supply Fire Lines during construction, temporary water service must be included in the design and corresponding pay items included in the contract book. If there is any question about the adequacy of the temporary service to the Fire Line, then the inspector or project manager shall request that field operations perform a pressure test at the nearest fire hydrant or outlet to determine the adequacy of the temporary connection. If the temporary connection is inadequate to provide fire protection until the permanent feed is in place, the Developer or contractor shall follow the instructions provided by the City's project manager and obtain approval from Fire Marshal.. Written approval of the Fire Marshal shall be submitted to IPRC when the construction plans are filed for review.
- 5.12.7.5 The Engineer shall locate and identify fire services to buildings. The construction drawings must notify contractors that it is the contractor's responsibility to maintain fire service to buildings. The proposed sequence of reconnection for Fire Lines must be discussed at the pre-construction meeting and adhered to during construction.

- 5.12.7.6 The construction drawings must require the contractor to notify the inspector, the Bureau of Fire Prevention, and Property owners as early as possible during construction of the time frame that the Fire Line will be impaired or shut down. All notifications that Fire Lines will be impaired or shut down must be in writing from the contractor, on the contractor's company letter head. No Fire Line shut outs will be allowed until the letter has been delivered to the City Inspector, the Bureau of Fire Prevention and the affected Property owners.
- 5.12.7.7 *Fire Department Connection* – When an immediate water source is required for a fire protection system, after approval by the Fire Department, the contractor shall provide enough water pressure and flow to the system through an alternate means approved by the Fire Department, such as the Fire Department Connection. At the Fire Department's request, calculations shall be submitted to show that fire flow requirements for the specific hazard class are met.
- 5.12.7.8 *Standpipe* – When it is required that a standpipe be kept operational from the Fire Department Connection, the contractor shall submit documents to the Bureau of Fire Protection showing that valves are in place and configured to allow the system to be pumped at the Fire Department Connection without flowing back into the areas being repaired. A visual inspection by a Fire Inspector is required.
- 5.12.7.9 *Fire Watch Requirements* – When a fire watch must be provided, the Engineer must obtain approval of the fire watch from the Fire Marshal. The Engineer shall place notes on the construction drawings notifying the contractor that the contractor must perform continuous and systematic surveillance of the building by one or more qualified individuals for the purposes of identifying and controlling fire hazards, detecting early signs of unwanted fire, raising an alarm of fire and notifying the Fire Department. The individuals assigned to fire watch duties shall have no other duty except as described above. Each assigned person shall be an adult, be capable of communicating verbally in English, and be provided with a method to communicate with the Fire Department in the case of fire. There shall be enough persons assigned to fire watch so that all portions of the building shall be observed in a systematic manner at least once every 30 minutes, or as required by the Fire Marshal. Any Fire Watch requires approval of the Fire Marshal.

5.13 GATE VALVE AND BUTTERFLY VALVE REQUIREMENTS

5.13.1 Valve Spacing

- 5.13.1.1 Spacing between gate valves on a 16-inch, or smaller, water main within a residential area shall be at least every 800 feet.

- 5.13.1.2 Spacing between valves for water mains 16-inch, and larger, shall be at least every 2,000 feet.
- 5.13.2 All valves shall be placed on a flat horizontal grade.
- 5.13.3 *Valves on Fire Hydrants* – All fire hydrants lead lines shall have a gate valve (minimum 6-inch) and anchor tee.
- 5.13.4 *Mains* – All new water main connections (such as new water services or mains, etc.) shall have an isolation valve at connections to an existing or proposed water main.
 - 5.13.4.1 A gate valve must be placed after the last service installed on the water main.
- 5.13.5 *Gate Valves* – Gate valves shall be used for water mains 24-inch and smaller.
 - 5.13.5.1 *Vaults for 16-inch Valves & Larger* – All valves that are 16-inch, or larger, shall be installed in a valve vault in accordance with the City's *Standard Construction Specifications and Details*.
 - 5.13.5.2 *Minimum Gate Valve Size* – The minimum size of gate valve allowed is 6 inches. Any valves needed for 4-inch or smaller connections must be increased with a 6-inch reducer fitting and 6-inch gate valve.
- 5.13.6 *Gate Valve Orientation* – All gate valves shall be installed in the vertical direction. No horizontal orientations will be allowed. Gate valves must be placed perpendicular to the existing/proposed ground elevation and shall open in the clockwise direction.
- 5.13.7 *Butterfly Valves* – All valves installed on water mains 30-inch or larger in diameter shall be butterfly valves contained within a vault in accordance with the City's *Standard Construction Specifications and Details*.
- 5.13.8 *Existing Isolation Valves for Connections and Sequencing* – Existing or, if necessary, additional gate valves shall be located on the construction drawings in a manner that allows isolation of a specific section of the distribution system to prevent shutting off more than one service to Customers who are served by water lines outside.
- 5.13.9 Special Requirements for Valves
 - 5.13.9.1 Plans shall contain a note that contractors shall not operate existing valves in the field. Only Water Department Staff are authorized to operate valves.
 - 5.13.9.2 Pressure plane valves and other pressure maintenance valves require approval by Water Department Staff to be added or relocated.
- 5.13.10 Gate valves shall not be placed on the lowered section of a water line.

5.14 CLEANING PIGS AND WYES

5.14.1 In strategic locations along water mains, cleaning wyes shall be provided for passing cleaning pigs through the water line to sweep trash, dirt and debris from the pipe. Cleaning wyes shall be supplemented with chlorination and sampling points, as required for disinfecting of the water main. All water mains 24-inch and smaller shall be cleaned using cleaning pigs.

5.14.1.1 Locations for insertion of cleaning pigs and clean-out wyes shall be located on the overall water layout of the construction drawings and in accordance with the City's *Standard Construction Specifications and Details*.

5.14.1.2 Water mains containing butterfly valves will require alternate methods for cleaning such as closed-circuit television video (CCTV) or physical inspection.

5.15 COMBINATION AIR VALVE ASSEMBLIES

5.15.1 In accordance with American Water Works Association (AWWA) standards and manuals of practice, combination air release/vacuum valves shall be installed in such locations to exhaust trapped air from the water distribution system. These locations include, but are not limited to, high points, the downstream side of mainline valves, increased downslopes or decreased upslopes, long ascents or descents, and the beginning and end of horizontal runs. Refer to *AWWA M51* for locations for combination air release/vacuum valves. **Table 5-4** includes general sizes of combination air valve assemblies but shall be verified by the Engineer.

Table 5-4. Combination Air Valve Assemblies

Water Main Size	Size of Relief Valve	Type of Relief Valve
16-inch and smaller	2-inch	Combination
24-inch to 30-inch	4-inch	Combination
36-inch	6-inch	Combination
42-inch	6-inch	Combination
48-inch	8-inch	Combination
54-inch and larger	8-inch	Combination

5.15.1.1 A smaller size release/vacuum valve may be used if calculations sealed by an Engineer are provided to demonstrate that the smaller valve size is sufficient.

5.15.1.2 Combination release/vacuum valves shall be installed in vaults in accordance with the City's *Standard Construction Specifications and Details*.

5.16 BLOW-OFF ASSEMBLIES

- 5.16.1 Blow-off valves and vaults are required in the system to drain the mains and shall be placed at low points along transmission mains (16-inch and larger). Blow-off assembly valve sizes are shown in **Table 5-5**.

Table 5-5. Blow-off Valve Size

Water Main Size	Size of Blow-off Valve
16-inch	6-inch
24-inch and larger	8-inch

5.17 PRIVATE PRESSURE REDUCING VALVES

- 5.17.1 In low areas where pressures exceed 80 psi, construction drawings must require individual pressure reducing devices to be installed in accordance with the current *Plumbing Code* adopted by the City of Fort Worth.

5.18 SERVICE LINE AND WATER METER REQUIREMENTS

5.18.1 Service Lines

- 5.18.1.1 No horizontal bending or splicing of Service Lines is allowed.
- 5.18.1.2 Service lines shall be aligned straight and perpendicular to the main.
- 5.18.1.3 Service lines shall not be placed within driveways.
- 5.18.1.4 Service lines shall meet the clearance requirements in **Section 5.6.6** (Clearance Requirements) with existing and/or proposed utilities, including street lighting.
- 5.18.1.5 Service lines shall not be installed on pipe lowering sections.
- 5.18.1.6 Public and private Service Lines are not allowed to cross any existing, proposed, or future lot lines.
- 5.18.1.7 When in the opinion of the Water Department Staff or Development Department-Water Section Staff, the integrity of the water Service Lines may be jeopardized due to proximity of other utilities, structures, etc., the Service Line less than 3 feet depth shall be required to be placed within steel casing or sleeve.
- 5.18.1.8 *Location within cul-de-sacs* – Services within cul-de-sacs shall be placed perpendicular to the main. Approved layouts for water mains and Service Lines within cul-de-sacs are included in the Appendix.

- 5.18.1.9 *Location within roundabouts or traffic circles* – Services within roundabouts or traffic circles shall not have meters placed within the interior median of the roundabout or traffic circle. Any private plumbing inside the Right-of-Way of a roundabout or traffic circle requires an Encroachment Agreement when required by City Code.
- 5.18.1.10 *Staggering of Services* – When providing service to both sides of the street, Service Lines shall be staggered a minimum of 12 inches.
- 5.18.1.11 *Service Lines for Wide Paved Streets* – Wide paved streets resulting in a service length of greater than 55 linear feet require a parallel main system (water main extension) in accordance with **Section 3** (Policy).
- 5.18.1.12 *Service Lines for Fire Lines* – When a structure requires a Fire Line for service, a separate Service Line is required from the main with separate backflow devices. A 2-inch or smaller domestic Service Line and meter shall not be combined with a private Fire Line service.
- 5.18.2 *Residential Water Meters and Service Lines* – The minimum size residential water Service Line for new residential Development shall be 1-inch. A residential meter shall be either 5/8-, 3/4-, or 1-inch. Meters shall be installed in a meter box in accordance with *City of Fort Worth Standard Construction Specifications and Details*.
 - 5.18.2.1 A 1-inch water service with two 3/4-inch meters (commonly called a bullhead connection) can be installed for residential duplex lots or for contiguous single-family residential lots having a Front Footage of 40 feet or less. The meter boxes must be installed in non-paved areas.
 - 5.18.2.1.1 Irrigation meters are not allowed for bullhead installations. A separate Service Line and meter box is required.
- 5.18.3 *Meters Larger than 2-inches in Size* – Water meters that are larger than 2-inches in size shall comply with the following criteria:
 - 5.18.3.1 *Meter Vault* – Meters shall be installed in a vault in accordance with *City of Fort Worth Standard Construction Specifications and Details*.
 - 5.18.3.1.1 Pre-cast meter vaults for 3" and larger meters will not be accepted. Meter vaults for 3" and larger meters must be cast in place to accommodate existing site conditions and maintain minimum clearances from walls, mains, and bypass water lines.
 - 5.18.3.2 *Bypass* – All meters larger than 2 inches shall have a bypass in accordance with *City of Fort Worth Standard Construction Specifications and Details*.

5.18.3.3 *Type of Meter* – All meters larger than 2-inch shall comply with the following:

- 5.18.3.3.1 For Normal Commercial Domestic Use – a Compound Meter must be used.
- 5.18.3.3.2 For Irrigation Use – a Turbine Meter must be used.
- 5.18.3.3.3 For Combined Domestic and Fire Use – a Fire Domestic Rated Meter meeting the Underwriters Laboratories (UL) ratings must be used.
- 5.18.3.3.4 For Industrial Use for Beverages or Food Preparation – a Turbine Meter must be used.
- 5.18.3.3.5 For Light Industrial Use where Water is not Used for Manufacturing Products – a Compound Meter must be used.
- 5.18.3.3.6 For Heavy Industrial Use where Water is Used for Production – a Turbine Meter must be used.
- 5.18.3.3.7 All meter installations shall comply with the City of Fort Worth *Standard Construction Specifications and Details*.

5.18.3.3.7.1 Meters shall be installed in a horizontal line in such a position that the register is readily accessible for reading. Meters shall be installed with the flow directional arrow pointed toward downstream. If fittings such as reducers or valves are installed, a minimum of ten diameters of straight pipe shall be immediately upstream of the meter and a minimum of five diameters of straight pipe shall be immediately downstream to obtain valid meter registration.

5.18.3.4 *Purchase* – All meters larger than 2 inches shall be purchased from the Water Department.

5.18.3.5 *Service Line Size* – 3-inch and 4-inch meters shall contain a minimum Service Line size of 4-inches.

5.18.4 Service Connections from Existing Lines

5.18.4.1 Domestic water service taps shall be off a looped water main, when available.

5.18.4.2 Domestic water service taps less than 1-inch shall not be shared, split or bullheaded with any service.

5.18.5 Sub-metering Requirements

5.18.5.1 Owners shall comply with private sub-metering requirements established by the Fort Worth *Plumbing Code* and TCEQ Requirements.

5.18.5.1.1 Sub-metering is a private measurement of water beyond the City's master meter and considered private plumbing. Sub-metering shall be at the cost of the Landowner and managed and billed by the Landowner. The City shall only bill the City's main master meter in the City's Right-of-Way.

5.18.5.2 Water service to multi-unit facilities; including condominiums, apartments, manufactured home rental communities and multiple use facilities, will be provided through a master meter, if construction is on one lot.

5.18.5.2.1 Sub-meters and plumbing after the master meter will be installed and maintained at the Customers' expense.

5.18.5.2.2 Sub-meters must conform to current AWWA Standards C700.

5.18.5.2.3 Master meters will be furnished by the Water Department and paid for by the Customer.

5.18.5.2.4 Maximum Number of Meters per Lot – The number of domestic meters allowed on one lot shall not exceed 4.

5.19 WATER SAMPLE STATIONS AND SAMPLING LOCATIONS

5.19.1 Water sample stations are used for microbiological analysis as required by *Texas Administrative Code- Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46 (b)*. Water sample stations shall be installed within the public Right-of-Way at locations such as major intersections, water transmission main tees/crosses, large water meters, public schools, medical facilities, fire stations, or other locations to be designated by the Water Department.

5.19.2 Water sampling locations are required water sample points during the construction of water mains and shall be incorporated into the water main design in accordance with **Section 8** (Requirements for Drawings).

Water Sampling Quantity Calculations			
	<u>Water Main and Appurtenances</u> *Provide 1 location per item listed below	<u>Number of Samples</u>	
1)	1LF-1000 LF		EA
2)	Dead-End Main		EA
3)	Branched off the main (stubs longer than 20 LF)		EA
4)	Fire Line		EA
5)	Hydrant		EA
6)	Contingency 20%		
	Subtotal		EA
	Total Sample Tested (2 consecutive passing) =		EA

Figure 5-1. Water Sampling Quantity Calculations

5.20 CATHODIC PROTECTION

- 5.20.1 If materials other than PVC are proposed for City water mains, a corrosion specialist must perform a Cathodic Protection Study. Construction Drawings and Specifications must include Cathodic Protection in accordance with the Cathodic Protection Study and the *City of Fort Worth Standard Construction Specifications and Details*

5.21 BACKFLOW PROTECTION

- 5.21.1 As a condition of water service, all Customers shall install, maintain, and operate their piping and plumbing systems in accordance with the current City adopted *Plumbing Code* and *City Code Chapter 12.5* (Environmental Protection and Compliance). Service connections shall have a back-flow prevention device to protect the public water system from cross contamination in accordance with the most restrictive requirements set forth by City Code and the City's *Backflow Guidelines, Installation Standards & Specifications*. All back-flow prevention devices shall be installed in accordance with the City's Backflow Protection Construction Details. These supersede any prior-dated information obtained from the City's website, or other means.
- 5.21.2 *Circumstances Requiring Use of Backflow* – At a minimum, a backflow prevention assembly is required in accordance with *City Code Chapter 12.5*.
- 5.21.3 *Location Requirements* – Backflow preventer location approval must be obtained from the City of Fort Worth Water Department, Cross Connection Section, before installation.

5.21.3.1 For unmetered, dedicated Fire Lines, the assembly shall be installed in an approved vault, or above ground (type of assembly) at Property line. Install to meet City testing procedures. Locate the assembly on private Property, not in an easement or right of way.

5.21.3.2 All RPZ installations shall be horizontal. For a waiver to be granted to allow installation in the vertical position, the assembly must meet the following criteria:

5.21.3.2.1 Be approved by University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCCHR) for vertical installation;

5.21.3.2.2 Contain spring loaded checks;

5.21.3.2.3 Be installed in the up-flow position; and

5.21.3.2.4 Be approved by the appropriate authority within the City.

5.21.3.2.4.1 Fire Line backflow approval is through Water Department's Backflow Division.

5.21.3.2.4.2 All other backflow approvals are through the City's building permit process.

5.21.4 Backflow Prevention for Fire Lines

5.21.4.1 Backflow prevention for Fire Lines shall be in accordance with **Table 5-6**.

Table 5-6. Backflow Prevention for Fire Lines

Fire Line Type	Backflow Protection
Fire line with no chemical additive and no additional water supply	Double Check Detector Assembly
Fire line with fire hydrant with no chemical additive and no additional water supply	Double Check Detector Assembly
Fire line with chemical additive	Air Gap Separation or Reduced Pressure Principle Assembly
Fire protection system with access to an auxiliary water supply	Air Gap Separation or Reduce Pressure Principle Assembly
Fire line connected to metered domestic lines	Double Check Valve Assembly

- 5.21.4.2 Systems with only a single chemical loop, e.g., anti-freeze loop, foam, etc., may install the backflow protection on the loop, however, an expansion chamber must be installed to compensate for thermal expansion.
- 5.21.4.3 Systems containing more than one loop must provide backflow protection for each connection into the system.
- 5.21.4.4 Existing chemical loops and systems with access to an auxiliary water supply shall be retrofitted with approved backflow protection.
- 5.21.4.5 Existing Fire Lines
 - 5.21.4.5.1 Retrofitting existing Fire Lines is required if there is a chemical additive used, or if there is alternate water tied into system. This is a HIGH HAZARD RETROFIT.
 - 5.21.4.5.2 Retrofitting low hazard existing Fire Line is not required unless the size of main is changed or the main is replaced to accommodate pressure loss for additional sprinkler heads.
- 5.21.4.6 Testing Requirements for Fire Lines
 - 5.21.4.6.1 Backflow prevention for Fire Lines is permitted and tested through the Water Department.
 - 5.21.4.6.2 New Fire Lines – Coordinate with Water Department Backflow Division for specific testing requirements.
 - 5.21.4.6.3 Existing Fire Lines – Coordinate with Water Department Field Operations to schedule valve crew and associated testing.
 - 5.21.4.6.4 Backflow assemblies shall meet testing specifications for distance from wall to floor in accordance with the City Standard Construction Specifications and Details for backflow prevention.
 - 5.21.4.6.5 Backflow assemblies inside buildings, more than 5 feet above floor level, shall have an approved permanent platform for testing and maintenance
- 5.21.5 *Backflow Preventive Approval* – Backflow preventer approval must be obtained from the Water Department, Cross Connection Division, before installation. The installation shall conform to the *Backflow Guidelines, Installation Standards & Specifications*.

- 5.21.6 *Installation Requirements* – Backflow prevention assemblies and their installation and application shall be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research, and installed in accordance with the City’s *Plumbing Code* and *City Code Chapter 12.5*. The assembly installer shall obtain the required plumbing permits before installation and shall have the assembly inspected by a certified Cross Connection inspector and as required by the *Plumbing Code*.

- 5.21.6.1 Vaults must have BILCO type J, JD or equivalent. Vaults in high traffic areas must have BILCO type HLC, or equivalent.

5.22 ABANDONMENT OF WATER MAINS AND APPURTENANCES

- 5.22.1 Water mains shall be abandoned by removal if the proposed main is within the same trench as the existing main.

- 5.22.1.1 All other water mains shall be abandoned by draining the existing main, cutting and filling the existing main with grout, and plugging in accordance with the *City of Fort Worth Standard Construction Specifications and Details*

- 5.22.2 Water main appurtenances shall be removed and salvaged in accordance the City of Fort Worth Standard Construction Specifications and Details.

- 5.22.3 Service taps and Service Lines shall be removed at the Point of Connection to the main in accordance with the *City Code Chapter 35-57.4*

- 5.22.4 Concrete Water Vaults

- 5.22.4.1 In accordance with City of Fort Worth *Standard Construction Specifications and Details*, abandonment for concrete vaults shall be as follows:

- 5.22.4.1.1 Remove and salvage vault lid, valves, and meters;
- 5.22.4.1.2 Remove and dispose of piping and other appurtenances; and/or,
- 5.22.4.1.3 Demolish and remove entire concrete vault and backfill.

- 5.22.5 If a waiver is granted to not require vault demolition and removal, the vault shall be abandoned by removing the top 3 feet of vault and filling the vault with acceptable material in accordance with *City of Fort Worth Standard Construction Specifications and Details*.

5.23 SPECIAL REQUIREMENTS FOR CRITICAL FACILITIES

- 5.23.1 Critical Facilities require the following additional provisions:

- 5.23.1.1 Meters and Services

5.23.1.1.1 A minimum of 2 domestic and fire services shall be provided for redundant operation of the entire facility.

5.23.1.1.1.1 Each domestic/fire service shall be located on separate water mains.

5.23.1.1.2 Domestic and fire services line shall be a separate service with separate taps from the water main.

5.23.1.1.2.1 Combined Service Lines are not allowed.

5.23.1.1.3 Meters must be located at perimeter locations of the Development and must not be located within private Property or vacated streets.

5.23.1.1.3.1 Meters cannot be located within a street or within a building with limited access such as a basement, tunnel, garage, etc.

5.23.1.1.4 Meter vaults and meters shall be free of obstruction to allow for emergency repairs, maintenance, and access.

5.23.1.1.5 Meter vaults and meters shall be easily accessible. Meters shall not be confined to fenced or secured areas.

5.23.1.1.6 Meter vault bypass valves shall be the same size as the main Service Line to support the facility's operations.

5.23.1.2 Isolation Valves

5.23.1.2.1 Isolation valves shall be added as necessary to allow for service from 2 directions.

5.23.1.2.2 Services proposed to be placed on existing water mains must include sufficient isolation at each intersection.

5.23.1.2.2.1 Cut-in valves are required to achieve proper service from 2 directions if valve spacing exceeds 1,000 feet.

5.23.1.3 Distribution Lines

5.23.1.3.1 Water lines must be looped to ensure water quality, reliability, and capacity. Service is not allowed from dead-end water mains.

- 5.23.1.3.2 Developments proposed adjacent to any existing cast iron water main shall replace the cast iron water main in accordance with **Section 3** (Policy). Cast iron water main replacement minimum limit shall be either existing valve to valve or one block

5.24 CROSSINGS

5.24.1 Texas Department of Transportation (TxDOT) Highway Crossings

- 5.24.1.1 The design of water mains within a state highway must be in compliance with all applicable TxDOT requirements, unless a variance is approved by TxDOT. The following reference applies: *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.
- 5.24.1.2 Water mains shall be located to avoid or minimize the impact to future highway projects and improvements, to allow other utilities in the Right-of-Way, and to permit access to water mains and other utility facilities for their maintenance with minimum interference to highway traffic.
- 5.24.1.3 New water mains crossing a highway shall be installed at 90° to the centerline of the highway.
- 5.24.1.4 New water mains located longitudinally along a highway shall be designed parallel to and outside of the Right-of-Way in a separate easement.
- 5.24.1.5 All water crossings shall be cased with steel casing pipe, in accordance with City of Fort Worth Standard Construction Specifications and Details. Limits of casing pipe shall be in accordance with *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.
- 5.24.1.6 Water valves and other appurtenances shall not be placed in the pavement or shoulder of a highway.
- 5.24.1.7 Water main crossings shall include a valve on each side of the highway crossing.
- 5.24.1.8 Individual service meters shall be placed outside the limits of the Right-of-Way within an easement.
- 5.24.1.9 The Engineer shall prepare draft permits with all required drawings and attachments and deliver the draft permits to the City. Drawings must be signed and sealed by Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permits to TxDOT.

5.24.2 Railroad Crossings

- 5.24.2.1 The design of water mains within railroad Right-of-Way must be in compliance with the requirements of the appropriate railroad authority. The engineer must determine which railroad company Right-of-Way is being crossed and obtain their utility accommodation policies prior to beginning the design. These include, but are not limited to, insurance and licensing agreement requirements.
- 5.24.2.2 *License Agreement* – Construction of mains cannot occur until a permit or license agreement has been executed.
- 5.24.2.3 *Transverse Crossing* – New mains crossing the railroad shall be installed at 90° to the centerline of the railroad, if possible.
- 5.24.2.4 *Longitudinal/Encroachment Alignment* - New water mains located longitudinally along railroad Right-of-Way shall be designed parallel to and outside of the Right-of-Way within a separate easement.
 - 5.24.2.4.1 Longitudinal installation, if allowed, shall be located on uniform alignments to and outside of the Right-of-Way line within an easement to provide space for future railroad construction and possible future utility installation.
 - 5.24.2.4.2 All new mains shall be located on top of back slope at the outer limits of railroad Property.
 - 5.24.2.4.3 If a main is located 40 feet or less from the centerline of a railroad track, the main shall be encased in a steel pipe in a manner approved by the railroad authority. No main shall be placed within 25 feet from the centerline of the track, or in violation of railroad distance requirements, whichever distance is greater.
- 5.24.2.5 All mains crossing under railway track shall be placed in a casing pipe, unless otherwise approved by railroad authority. Casing pipe crossing railroad tracks shall be designed to withstand E80 railroad loadings in accordance with *City Standard Construction Specifications and Details* and shall extend to the Right-of-Way lines.
- 5.24.2.6 Water valves, manholes, meters and other appurtenances shall be placed outside the limits of the Right-of-Way.
- 5.24.2.7 Water main crossings shall include a valve on each side of the railroad crossing.

5.24.2.8 The Engineer shall be responsible for preparing draft permits with all required drawings and attachments and deliver the draft permits to the City. Drawings must be signed and sealed by Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permit to the railroad. Any application costs/fees associated with the railroad permit will be the responsibility of the Engineer.

5.24.3 Creek, River, or other Water Feature Crossings

5.24.3.1 Creek, river, or other water feature crossings are required to meet jurisdictional determination and permitting requirements in accordance with the United States Army Corps of Engineers and other regulatory agencies.

5.24.3.2 Main crossings of existing, or proposed, detention or retention ponds are not allowed.

5.24.3.3 Pursuant to *30 TAC Chapter 290.44(f)(2)*, where water mains are laid under any flowing stream or semi-permanent body of water, such as a marsh or pond, the water main shall be installed in a separate watertight casing pipe and installed with valves on each side of the crossing to allow the isolation and testing of that portion of the water main to determine if there are any leaks.

5.24.3.4 A primary consideration in the design of creek, river, or other water feature crossings is the prevention of soil erosion at the areas of trench backfill. Slope protection for such crossing shall be designed by a Licensed Engineer in the State of Texas from top of bank to top of bank in accordance with the City's *Standard Construction Specifications and Details*. In lieu of design calculations for rock riprap, a rock filled gabion basket, or other approved stabilization method designed by the Engineer, from top of bank to top of bank is required. The Engineer shall provide the engineering details for a rock filled gabion basket, or other approved stabilization method designed by the Engineer. Additional permits, such as a floodplain Development permit, shall be obtained if required for a rock filled gabion basket, or other approved stabilization method designed by the Engineer.

5.24.3.4.1 If velocities of the flowing water exceed 10 fps, the cement stabilized backfill shall be covered with riprap and/or stone-filled caged baskets from top of bank to top of bank.

- 5.24.3.4.2 In areas where there is a planned channel improvement, the stabilized backfill shall be used up to the line of planned improvement. The area above this planned line of improvement shall be compacted fill.
- 5.24.3.4.3 All mains must be designed with a minimum clearance from the top of the pipe to the bottom of the channel of 5 feet, or 1.5 multiplied by the outside diameter of the pipe, whichever is greater.
- 5.24.3.4.4 Reference **Section 5.6.6** (Clearance Requirements) for storm drain crossings.

5.24.4 Trenchless Construction

- 5.24.4.1 Construction by methods other than open cut are used for water main installation under restrictive conditions when open cut construction is not allowed. Only straight pipe alignments for both horizontal and vertical alignment are allowed.
- 5.24.4.2 Auger Boring
 - 5.24.4.2.1 Engineers should consider the location, size and depth of boring and receiving pits when choosing the beginning and ending stations for boring. Bore pit width varies depending on the depth and size of pipe. The minimum length of a bore pit shall be 20 feet and the minimum width of a bore pit shall be 5 feet.
 - 5.24.4.2.2 Auger Boring shall be designed in accordance with the City's Standard Construction Specifications and Details. The anticipated size and location for all bore pits must be included in the design for the main and shown on the drawings. Launching pits shall be located at the lower elevation end of the tunnel.
- 5.24.4.3 *Other Trenchless Construction* – When traditional auger boring is not feasible for the construction of the improvements, other trenchless methods of construction shall be designed by the Engineer in accordance with City's *Standard Construction Specifications and Details*. Any requests for a waiver to allow an alternative, such as, but not limited to, micro-tunneling, open shield pipe jacking, and horizontal directional drilling, will require submittal of design and technical specifications with the waiver request.

5.24.5 Elevated Crossings

5.24.5.1 Except as provided below, elevated crossings for water mains are not allowed. Elevated crossings create special design problems in which no set of circumstances is duplicated from one design to another. The two methods of elevated crossings acceptable to the City are:

5.24.5.1.1 Hanging the water main on a roadway bridge; or

5.24.5.1.2 Designing a specific utility bridge for the support of the water main crossing.

5.24.5.2 All elevated crossings must satisfy all of the following:

5.24.5.2.1 Documentation approving the placement of the main on the bridge must be provided to the City;

5.24.5.2.2 Thrust restraints are required at the points of transition from a buried conduit to an elevated conduit and for all elevated changes of alignments and fittings;

5.24.5.2.3 The water main must be fully restrained at changes in alignment and at fittings;

5.24.5.2.4 The design must adequately address increased loading effects on the bridge created by a full main and its supports;

5.24.5.2.5 Access to main and appurtenances for maintenance purposes must be included in the design;

5.24.5.2.6 Coatings or methods of corrosion control for elevated pipe sections and pipe supports must be included in the design;

5.24.5.2.7 PVC pipe shall not be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight;

5.24.5.2.8 The freeze potential of small diameter or low flow mains must be evaluated and the design must ensure that small diameter or low flow mains will not freeze;

5.24.5.2.9 To ensure positive restraint in all directions, each joint of pipe must have 2 support straps. Spacing of pipe supports must be in accordance with the length of pipe joints specified and one of the supports must be placed near the bell end of the pipe;

5.24.5.2.10 Air relief is required where high points are created in the main;

- 5.24.5.2.11 A minimum of one expansion joint fitting is required for a water main crossing on a roadway bridge. Placement of the expansion joints must coincide with the expansion joints of the roadway bridge;
- 5.24.5.2.12 Water main crossings shall include a valve on each side of the elevated crossing; and
- 5.24.5.2.13 Proposed elevation of the main shall meet low chord bridge requirements and must be at least 2 feet above the 100-year water surface elevation to prevent damage to the main.

5.25 PAVEMENT REPAIR

- 5.25.1 Mains designed to be placed within existing pavement shall contain provisions for pavement repair in accordance with the *City of Fort Worth Utility Construction Policy (2019)* based upon the street's Pavement Condition Index (PCI), as well as the *Standard Construction Specifications and Details*.

SECTION 6 – DESIGN CRITERIA FOR WASTEWATER MAINS

6.1 GENERAL

- 6.1.1 The design, construction and incorporation of all wastewater main improvements into the Fort Worth Wastewater Collection System must comply with this section and meet the requirements of *30 Texas Administrative Code (TAC) Chapter 217*, the current edition of the City of Fort Worth Subdivision Ordinance, and the City of Fort Worth Community Facilities Agreements Ordinance.

6.2 MINIMUM WASTEWATER MAIN SIZE

- 6.2.1 The minimum size for any public gravity wastewater collection main shall be 8 inches.

6.3 SIZING WASTEWATER MAINS

- 6.3.1 *Standard Sizes* – New wastewater mains shall consist of the following diameters (in inches): 8, 10, 12, 15, 18, 21, 24, 27, 30 and multiples of 6 inches thereon.

6.3.1.1 A proposed upstream diameter pipe size shall not exceed the immediate downstream proposed diameter pipe size within a single designed plan set.

- 6.3.2 *Standard Tap Sizes* – Domestic services shall be the following diameters (in inches): 4, 6, 8 or 10.

- 6.3.3 Wastewater mains must obtain a minimum cleansing velocity of 2 feet per second (fps) with maximum design flows. Wastewater mains maximum velocity shall not exceed 10 fps.

- 6.3.4 In accordance with Texas Commission on Environmental Quality (TCEQ) requirements, the maximum design flow velocity shall be determined using the “Manning’s Equation” with an “n” value (Roughness Coefficient) of 0.013. The minimum and maximum slopes for wastewater mains shall be in accordance with **Table 6-1**.

6.3.4.1 In addition to minimum and maximum slopes, each proposed segment may not deviate more than 0.5% slope from the immediate downstream and upstream segments.

Table 6-1. Minimum and Maximum Slopes

Main Size (Inches)	Minimum Slope (%)	Maximum Slope (%)
8	0.40	8.40*
10	0.29	6.23*
12	0.22	4.88*
15	0.16	3.62*
18	0.12	2.83*
21	0.095*	2.30*
24	0.08*	1.93*
27	0.07*	1.65*
30	0.06*	1.43*
36	0.045*	1.12*
Larger than 36	See Section 6.3.5	

*Minimum/maximum requirements per 30 TAC Chapter 217

6.3.4.2 The “n” value must take into consideration the slime, grit, and grease layers that will affect hydraulics or hinder flow as a pipe ages.

6.3.5 For mains larger than 36 inches in diameter (I.D.), the slope shall be determined by the Manning’s equation to maintain a minimum of 2 fps when flowing full and maximum velocity less than 10 fps when flowing full.

$$V = \left(\frac{1.49}{n} \right) (R_h^{0.67}) (S^{0.5})$$

Where: V = velocity (feet/second)

n = Manning’s roughness coefficient (n = 0.013) for all pipe materials, per 30 TAC 217.53

R_h = hydraulic radius (feet)

S = slope (feet/feet)

6.3.6 *Determination of Wastewater Flows* – A Loading Analysis or Sewer Study shall be performed to determine the demand/loads created by proposed Development and if any necessary improvements to the existing system to support the Development are needed. *Water and Sewer Study Guidelines* are included in the Appendix.

6.3.7 An alignment walk with Development Services Department – Water Section Staff and shall be required if the wastewater main is outside of the public Right-of-Way. Wastewater mains 15 inches and larger in diameter and wastewater force mains transitioning to gravity mains shall require an alignment walk.

6.3.7.1 A conceptual layout shall be provided to Development Services Department – Water Section Staff for review prior to scheduling the alignment walk. Alignment walks are valid for one year after the issuance of the alignment approval letter.

6.3.7.2 The alignment walk must show that the sewer main:

- 6.3.7.2.1 Has access which construction equipment can, is unobstructed, and has no obstacles to future maintenance;
- 6.3.7.2.2 Is located outside heavily wooded areas containing protected trees;
- 6.3.7.2.3 Is not located in historically preserved areas;
- 6.3.7.2.4 Is not located on gas well pads or fee simple properties owned by a utility company;
- 6.3.7.2.5 Is not in TxDOT and/or railroad rights-of-way;
- 6.3.7.2.6 Is not less than 10 feet from the top of a creek bank;
- 6.3.7.2.7 Easement does not contain side slopes of an embankment or drainage feature.;
- 6.3.7.2.8 Is not located in areas with ground slopes steeper than 4:1;
- 6.3.7.2.9 Is perpendicular to ground slopes;
- 6.3.7.2.10 Is not located inside a designated Floodplain, except for wastewater interceptors; and
- 6.3.7.2.11 Is not located within a Floodway, or Cemetery Burial Site.

6.3.8 Wastewater Demand Calculations and Modeling Criteria

6.3.8.1 *Single-Family Residential Demand* – The information in **Table 6-2** shall be used for calculating average day wastewater loading. If the density is unknown, a population density of 14 persons per gross acre shall be used to calculate the cumulative population load at each point of load increment to determine the load on each section below that point using:

6.3.8.2 *Average Day Wastewater Flow for Other Land Uses* – The information in **Table 6-2** shall be used for calculating average day wastewater load for different land use types.

6.3.8.3 Computation Example:

6.3.8.3.1 Single-Family Residential Buildings

6.3.8.3.1.1 Average load per person in GPM = $100/1440 = 0.0694$ GPM

6.3.8.3.1.2 Average load of a given population in GPM = $(0.0694 \text{ GPM}) \times (\text{population}) = (\text{load in GPM})$

Table 6-2. Wastewater Load per Capita

Land Use Type	Residential Average Day per Capita (gpcd)	Non-Residential Average Day per Employee/Person/Student (gpcd)
High Density Residential	85	-
Medium Density Residential	85	-
Low Density Residential	85	-
Manufactured Housing	90	-
Single Family	100	-
Mixed Use Growth Center	85	35
Commercial	-	35
Heavy Industrial*	-	50
Light Industrial*	-	35
Institutional/Schools (with showers)	-	20
Industrial/Schools (without showers)	-	15
Restaurant/Fast Food	-	10 gallons/meal
Restaurant (with bar and cocktail lounge)	-	12 gallons/meal
Hospitals	-	275
Car Wash & Automotive Services		40 gallons/car
Hotel/Motel	-	75
Theatre		3 gallons/seat

* Some Industrial & other non-typical Developments (Data Center and Processing Facility, etc.) are evaluated on a case-by-case basis.

6.3.8.4 Peak Daily Flow (PF)

- 6.3.8.4.1 Each wastewater main shall be sized with a peaking factor to handle infiltration and inflow. The peaking factor shall be evaluated by the Engineer from known metering and flow data for the particular basin or area under design. In the absence of actual peaking flow information, **Table 6-3** can be used to determine the minimum peaking flow.

Table 6-3. Wastewater Peaking Factor

Pipe Size	Peaking Factor	Depth of Flow
30-inch or less	Harmon's Formula	Full
36-inch or larger	2.5 or Harmon's Formula; whichever is greater	Full

- 6.3.8.4.2 Harmon's Formula – Ratio of Design Load (peak daily flow) to Average Load (average daily flow) is expressed by:

$$PF = 1 + \frac{14}{4 + \sqrt{P}}$$

Where: PF = Ratio of Design Load to Average Load

P = Population in Thousand

- 6.3.8.4.3 *Procedure for Design Flow Calculation* – Using the cumulative population at each load point based on residential and employment density, the cumulative population load must be calculated at each point of load increment to determine the load on each section below that point using:

6.3.8.4.3.1 Step 1:

- 6.3.8.4.3.1.1 Average load per person per day shall be equal to 100 gallons for single-family buildings.
- 6.3.8.4.3.1.2 Average load per employee/person/student shall be 35 gallons per day for non-residential buildings.

6.3.8.4.3.2 Step 2:

- 6.3.8.4.3.2.1 Average load per person in GPM = $100/1440 = 0.0694$ GPM
- 6.3.8.4.3.2.2 Average load per employee/person/student in GPM = $35/1440 = 0.0243$ GPM

- 6.3.8.4.3.3 *Step 3: Average load of a given population (in GPM) = (0.0694 GPM x population) + (0.0243 GPM x employment) = (load in GPM)*
- 6.3.8.4.3.4 *Step 4: Total Design Load = Peaking factor (PF) x the average load generated by the ultimate population to be served by the main being designed*
- 6.3.8.4.3.5 *Special Considerations for Infiltration Load –An infiltration load shall be considered for use on projects serving large areas developed using clay pipes. An allowance of 1.5 times the total design load shall be used in order to provide for excess infiltration in such areas.*

6.4 LAYOUT OF WASTEWATER MAINS, SERVICE LINES, AND APPURTENANCES WITHIN RIGHT-OF-WAY

- 6.4.1 *Locations* – The following shall be the locations for wastewater mains, Service Lines, and appurtenances in the Fort Worth wastewater system:
 - 6.4.1.1 *Wastewater Main Location* – Wastewater mains shall be located in the south or west 1/4 of the street.
 - 6.4.1.1.1 Wastewater mains larger than 15-inches in diameter shall not be allowed in any new residential street Right-of-Way.
 - 6.4.1.2 *Wastewater Mains on Wide Paved Streets* – A proposed wastewater service main that requires crossing over more than 55 linear feet (perpendicular to street center line) of street pavement (either existing or proposed) is not permitted and will require a wastewater main extension in accordance with **Section 3** (Policy).
 - 6.4.1.3 *Residential Wastewater Service Lines* – Residential wastewater Service Lines shall be located at the center of the lot Frontage.
 - 6.4.1.3.1 Wastewater Service Lines must maintain a minimum horizontal separation of 9 feet from water Service Lines as measured from the outside diameters of each Service Line.
 - 6.4.1.3.2 Wastewater services or cleanouts shall be placed outside of driveways. If the location of the residential wastewater Service Line places the service in the driveway, the Service Line must be placed south or west of the proposed driveway location.

6.4.1.3.3 Where the grade of the wastewater main serving the lot is 3% or more, the wastewater Service Line shall be located 5 feet upstream from the lower lot front corner.

6.4.1.3.4 For wastewater mains serving each side of the street, Service Lines must be staggered such that a distance of 24 inches separates the centerlines of each service tap.

6.4.1.4 *Cul-De-Sac Layouts* - Lots without Frontage to a wastewater service main may connect a Service Line to a manhole. More than one connection to the manhole will require 12 inches in separation. Manholes with internal drops are prohibited. An external drop shall be provided in accordance with the City's *Standard Construction Specifications and Details*.

6.4.1.5 *Manholes* – Manholes shall be placed at all points of change in alignment, grade, size, material, or inside diameter of the wastewater main. In addition, manholes shall be placed at an intersection of 2 or more wastewater mains, at the end of the main in accordance with **Section 3** (Policy), and any locations required to provide accessibility for maintenance.

6.4.1.6 *Layouts* – Layouts for City-approved water and wastewater mains and appurtenances are included in the Appendix.

6.5 HORIZONTAL/VERTICAL ALIGNMENT AND CLEARANCE REQUIREMENTS

6.5.1 General Horizontal Requirements:

6.5.1.1 Wastewater mains shall be laid straight between manholes.

6.5.1.1.1 No horizontal or vertical bends or curved alignments are allowed between manholes.

6.5.1.2 Wastewater mains shall not be installed parallel within the floodway.

6.5.1.3 Wastewater mains shall not be installed within the side slopes of a creek, river, channel, or other water feature.

6.5.1.3.1 Wastewater alignments shall be a minimum of 10 feet from the top of the bank.

6.5.2 Depth of Cover Requirements

6.5.2.1 Wastewater mains must be laid with the top of the pipe a minimum of 42 inches below the surface of the ground, or future ground, whichever is greater. .

- 6.5.2.1.1 If a waiver is granted to allow a wastewater main to be installed with less than 42 inches of cover, the main shall be encased in 1,500 psi concrete and constructed of ductile iron pipe through the restricted area. Encasement requirements for wastewater mains shall be as defined in the City's Standard Construction Specifications and Details.
- 6.5.3 *Existing Appurtenances* - If grade changes or pavement improvements are proposed, all existing wastewater appurtenances shall be adjusted to the proposed final grade.
- 6.5.4 *Deep Mains* – Wastewater mains exceeding 15 feet of cover from the top of the main to the surface require specialized backfill and embedment requirements in accordance with the City's *Standard Construction Specifications and Details*. In addition, Water Department staff must approve the pipe material for wastewater mains exceeding 20 feet of cover from the top of the main to the surface. Mains exceeding depth of 30 feet shall be required to be placed within steel casing or sleeve.
 - 6.5.4.1 4-inch and 6-inch wastewater Service Line connections are not permitted for wastewater mains with cover exceeding 15 feet. Instead, an extension of a horizontally parallel wastewater main is required for the wastewater Service Line connections, in accordance with **Section 3** (Policy). Vertically stacked mains are not allowed.
- 6.5.5 Clearance Requirements
 - 6.5.5.1 Other Wastewater Mains
 - 6.5.5.1.1 If a wastewater main is required to be laid parallel to an existing wastewater main, a minimum horizontal clearance of 4 feet shall be maintained as measured from the outside diameter of each main and other assets. In no case shall the excavation of either main impact the bedding or embedment of the other main. The Engineer is responsible for determining proper clearance between mains based upon soil conditions. Trench boxes, hydraulic shoring, or other means may be necessary to achieve clearance of 4 feet or more.
 - 6.5.5.2 Storm Drain
 - 6.5.5.2.1 When wastewater mains are parallel to storm drains, the minimum horizontal clearance shall be 5 feet as measured from the outside diameter of each main and manhole.

- 6.5.5.2.1.1 Wastewater services shall cross over or under storm drains with a minimum clearance of 2 feet.
- 6.5.5.2.2 When wastewater mains cross storm drains, the wastewater main must cross the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.
 - 6.5.5.2.2.1 Concrete Stabilized Sand (CSS) or Controlled Low Strength Material (CLSM) backfill is required for any storm drain crossings.
- 6.5.5.2.3 Crossings beneath storm drains larger than 24" and all box culverts shall require steel casing.
 - 6.5.5.2.3.1 Wastewater mains shall not cross through storm drains or storm drain junction structures.
- 6.5.5.2.4 Storm Drain Junction Structure Separation – Storm drain junction structures must have 5 feet of separation from the wastewater main.
- 6.5.5.2.5 If a wastewater main is proposed to be laid parallel to an existing or proposed drainage channel or feature, a horizontal clearance of 10 feet is required between the wastewater main and the top of drainage channel or feature as measured from the outside diameter of the wastewater main to the top of bank of the drainage channel or top of the drainage feature.
- 6.5.5.3 *Franchise Utilities* – A minimum horizontal and vertical clearance of 3 feet, as measured from outside diameter of the main to the outside diameter of the franchise utility, shall be maintained from all franchise utilities such as gas, electric, fiber optic, and cable within the City Right-of-Way or easements. Proposed franchise utilities shall cross beneath wastewater mains.
 - 6.5.5.3.1 A franchise utility may require a greater minimum clearance distance. Where the City's minimum clearance requirement and the franchise utility's minimum clearance requirement differ, the greatest minimum clearance requirement shall be used.

- 6.5.5.4 *Non-Franchise Utilities* – Wastewater mains proposed to parallel or cross existing non-franchise utility lines, such as gas or energy pipelines, shall adhere to all clearance and other requirements of the non-franchise utility.. Privately owned water, sewer, storm drain, or other lines crossing a public wastewater main shall meet the requirements of this section. At a minimum, wastewater mains shall maintain a horizontal clearance of 3 feet and vertical clearance of 3 feet, as measured from the outside diameters of each main. If the non-franchise utility contains an impressed current cathodic protection system, a minimum horizontal clearance of 5 feet and vertical clearance of 3 feet is required as measured from the outside diameters of each main to minimize the impacts of stray current to the main, fittings, and appurtenances. Where the City’s minimum clearance requirement and the non-franchise utility’s minimum clearance requirement differ, the greatest minimum clearance requirement shall be used.
- 6.5.5.5 *Drilled Shafts* – Wastewater mains adjacent to drilled shafts shall be designed with a minimum horizontal clearance of 10 feet as measured from the outside diameter of the main to the outside edge of the drilled shaft.
- 6.5.5.5.1 *Streetlights and Traffic Signal Foundations* – For 15-inch, or smaller, wastewater mains within residential streets, the minimum horizontal clearance shall be 7 feet as measured from the outside diameter (OD) of the main to the outside edge of the streetlight or traffic signal foundation.
- 6.5.5.6 *Drainage Headwalls and Inlets*
- 6.5.5.6.1 Wastewater mains and Service Lines shall not cross under headwalls and inlets.
- 6.5.5.6.2 Wastewater mains and Service Lines adjacent to headwalls and inlets shall be designed with a minimum horizontal clearance of 10 feet to headwall and 5 feet to inlets as measured from the outside diameter of the main to the outside edge of the headwall or inlet.
- 6.5.5.6.3 Wastewater mains perpendicular to headwalls and inlets shall be designed with a minimum clearance of 10 feet to headwall and 5 feet to inlets as measured from the outside diameter of the main to the outside edge of the headwall or inlet.

6.5.5.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

6.5.5.7.1 Wastewater mains adjacent to MSE or other retaining walls shall be designed to be placed outside of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.

6.5.5.7.2 Wastewater mains crossing MSE or other retaining walls, shall be designed with steel casing through the entirety of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.

6.5.5.8 *Other Bridge Features* – A minimum clearance of 5 feet horizontally and vertically shall be maintained from all other bridge features, unless required to be greater as regulated by the bridge owner.

6.5.5.9 *Coordination with Other Entities* – In situations where wastewater mains are required to be placed adjacent, within, or crossing easements or Right-of-Way of highway or railroad entities, the Engineer is responsible for coordinating with such entity to confirm that future expansions from the entity will not impact the proposed wastewater main. Documentation of such correspondence must be provided to the City. Wastewater mains shall not be placed within or crossing easements or right-way of a highway or railroad in an area that is designated for future expansion.

6.6 WASTEWATER MAIN SEPARATION FROM WATER MAINS

6.6.1 In accordance with TCEQ requirements, the purpose of maintaining minimal spacing between water and wastewater mains is to protect the public water distribution system from contamination from wastewater. Contamination may occur when a vacuum develops within water main due to breakage or malfunction of a relief valve. The minimum horizontal space between a new wastewater main and a water main shall be 9 feet measured from the outside diameter of the water and wastewater mains or facilities. A wastewater collection system pipe must be located below a water supply pipe. In addition, any wastewater main that is parallel to a water main shall be installed in a separate trench. When the 9-foot horizontal separation distance cannot be achieved, or if a wastewater main is crossing a water main, the mains must meet separation requirements set forth in *30 TAC Chapter 217.53*.

6.7 WASTEWATER MAIN MATERIALS AND EMBEDMENT

6.7.1 Material and embedment requirements shall be as defined in the City's Standard Construction Specifications and Details.

6.7.2 Trench Water Stops

6.7.2.1 *Groundwater* – If encountered during construction, or if groundwater is known to be present, trench water stops must be installed at 200-foot intervals to prevent migration of water within the water main trench.

6.7.2.2 *Other Requirements* – Trench water stops are required for wastewater mains when the following conditions are present:

6.7.2.2.1 Slopes exceeding 3%;

6.7.2.2.1.1 Trench water stops must be placed before each manhole and at 200 feet intervals; and

6.7.2.2.2 Downstream of any storm drain or water main crossing.

6.7.2.3 *Tree Ordinance* – If a project is within the jurisdiction of the current *City Code Appendix A, Zoning Regulations, Chapter 6 Section 6.302 (Tree Ordinance)*, all onsite underground utilities with backfill other than onsite material shall have a trench water stop every 200 feet for the entire length of the utility placement

6.8 CONNECTIONS TO EXISTING WASTEWATER MAINS

6.8.1 In accordance with TCEQ requirements, when connecting a proposed main to an existing main at a manhole, the connection should have the elevation of the outfall main level with the top inside elevation of the proposed main.

6.8.2 Manholes are required at Service Line connections meeting any of the following conditions:

6.8.2.1 6-inch, or larger, Service Lines

6.8.2.1.1 4-inch Service Lines shall be allowed to connect to a manhole only if the flow line of the 4-inch line is higher than the soffit of the wastewater main or at the upstream point of the wastewater system, and the wastewater main is 15-inches or less in diameter. Manholes containing internal drops are prohibited. An external drop shall be provided in accordance with the City's Standard Construction Specifications and Details.

6.8.2.1.2 6-inch and larger Service Lines are required to connect to a manhole.

6.8.2.1.3 Any connection, or alley paving improvements, to an existing manhole requiring rim elevation adjustment must be replaced with a 30-inch manhole opening.

6.8.2.2 The slope of a Service Line on public or private Property shall not exceed 4%.

6.8.3 *Drop Manholes* – When connecting a wastewater lateral to an existing manhole with an invert elevation more than 24 inches lower, the connection must use a lined, exterior drop and must meet the requirements set forth in the City’s *Standard Construction Specifications and Details*.

6.8.4 *Hydraulic Slides* – When connecting a wastewater lateral to an existing manhole with a manhole invert elevation of 24 inches or less than the lateral, a hydraulic slide is required in accordance with the City’s *Standard Construction Specifications and Details*.

6.8.5 *Flowlines of Wastewater Mains at Change in Diameter* – In manholes when a smaller diameter main is flowing into a larger main, the tops of pipes shall be placed at the same elevation (soffit to soffit).

6.9 MANHOLES

6.9.1 Manholes shall be placed at **all** points of change in alignment, grade, size, material, or inside diameter of the wastewater main. In addition, manholes shall be placed at an intersection of two or more wastewater mains, at the end of the main in accordance with **Section 3** (Policy), and any locations required to provide accessibility for maintenance, including, but not limited to, locations transitioning from a force main to a gravity main and where the housing for the air release valve on a force main is located.

6.9.2 Distance Between Manholes

6.9.2.1 The maximum distance between wastewater manholes on mains shall be in accordance with **Table 6-4**.

Table 6-4. Maximum Distance Between Manholes

Size of Wastewater Main	Distance Between Manholes (ft)
15-inch and smaller	500
18-inch to 30-inch	800
36-inch to 48-inch	1,000
54-inch and larger	2,000

6.9.3 Manhole Sizes and Types

6.9.3.1 The inside diameter of a manhole must not be less than 48 inches. The minimum manhole diameter shall be as required in **Table 6-5**.

Table 6-5. Minimum Manhole Diameter

Size of Wastewater Main	Minimum Manhole Diameter (ft)
21-inch and smaller	4
24-inch to 36-inch	5
Larger than 36-inch	6

6.9.3.2 Standard Manholes shall be specified on the drawings.

6.9.3.2.1 Type A Manholes – Type A manholes are required for wastewater mains 36-inch, and larger.

6.9.3.2.2 Shallow Manholes – All manholes that have a depth of 48 inches, or less, as measured from the surface to the manhole invert, shall be installed with a shallow manhole in accordance with the City’s Standard Construction Specifications and Details.

6.9.3.2.2.1 Wastewater access chambers are not allowed at the end of the main.

6.9.4 Manholes on new and rehabilitated wastewater lines must have a minimum clear lid opening of 30 inches.

6.9.4.1 Where a new or rehabilitated main connects to an existing manhole, the existing manhole must be brought up to the City’s current standards, including, but not limited to 30-inch openings, approved epoxy liners, grade rings, etc.

6.9.4.2 Each manhole section and grade ring joint shall be sealed with an external self-shrinking rubber sleeve coated with a butyl adhesive. This shall form a continuous seal on each joint to prevent water and soil from infiltrating.

6.9.5 Manhole Flowlines

6.9.5.1 Manholes shall be designed with a 0.10-foot drop from the inlet elevation to the outlet elevation for any flow direction changes exceeding 60 degrees.

6.9.5.2 For flowline elevation differences of 24-inches, or less, a hydraulic slide is required in accordance with the City’s *Standard Construction Specifications and Details*.

6.9.5.3 For flowline elevation differences greater than 24-inches, a drop manhole is required in accordance with the City’s *Standard Construction Specifications and Details*.

6.9.6 Corrosion Prevention

6.9.6.1 Manholes are required to be lined in accordance with the City's *Standard Construction Specifications and Details* for any of the following:

- 6.9.6.1.1 Manholes on wastewater mains 15 inches and larger in diameter;
- 6.9.6.1.2 Manholes transitioning from force mains to gravity mains;
- 6.9.6.1.3 Drop Manholes;
- 6.9.6.1.4 Manholes constructed with a hydraulic slide;
- 6.9.6.1.5 Manholes with entering or exiting wastewater main slopes of 3%, or greater; or
- 6.9.6.1.6 Manholes connecting wastewater mains exceeding 15 feet of cover from the top of the main to the surface.

6.9.7 *Wastewater Manholes in the Flood Plain* – In accordance with TCEQ requirements, wastewater main manholes located in the 100-year flood plain shall include manhole covers and rings with watertight gaskets or other means to prevent inflow.

6.9.7.1 Where gasketed, watertight manholes are required for more than 3 manholes in a sequence, a venting method, such as raising the rim a minimum of 2 feet (maximum 5 feet) above the 100-year flood plain, shall be provided on every third manhole.

6.9.8 *Manhole at End of a Main* – In accordance with 30 TAC Chapter 217.55, all wastewater mains that may be extended at a future date shall end (highest point) with a manhole, main stub-out of one joint of pipe or less, and the plug shall be blocked with concrete.

6.9.9 Concrete Collars

6.9.9.1 All wastewater main manholes within asphalt pavement, unpaved alleys, or other load bearing areas, shall have a concrete collar to secure the manhole frame. Risers shall consist of either composite grade rings or be cast in place for all manholes.

- 6.9.9.1.1 Manholes located in concrete paved areas within the street will not require concrete collars but must be saw cut in accordance with the City's *Standard Construction Specifications and Details*.

6.10 SPECIAL REQUIREMENTS FOR WASTEWATER SERVICE LINES

- 6.10.1 The design of wastewater Service Lines follows the same basic design procedures as those outlined for mains, except that the information required is reduced in complexity to conform to the reduced function of a lateral. No change in material is allowed along the length of a wastewater Service Line.
- 6.10.2 All Service Lines shall connect to a wastewater main at a 90° angle. All 6-inch diameter or larger wastewater Service Lines shall connect to a manhole on the wastewater main at a 90° angle.
- 6.10.3 *Slope of Wastewater Service* – In accordance with plumbing code requirements, the minimum slope for 4-inch Service Lines is 2% on private Property, and the minimum slope for 6-inch and larger Service Lines is 1% on private Property.
- 6.10.4 *Length of Wastewater Service Line* – Wastewater Service Lines shall be extended from the main to the Property line when the service is installed, in accordance with *City Standard Construction Specifications and Details*, and shall not exceed a length from main to cleanout of 55 feet, in accordance with **Section 3** (Policy).
- 6.10.5 *Wastewater Service Line Depth of Cover* – Wastewater Service Lines shall be installed with a minimum depth of cover of 36 inches as measured from the top of the Service Line to the surface.
 - 6.10.5.1 If a waiver is granted to allow a wastewater serve line to be installed with a depth of cover less than 36-inches, the lines must be installed with cement stabilized sand backfill in accordance with *City Standard Construction Specifications and Details*.
- 6.10.6 *Wastewater Service Lines Crossing Water Main/Storm Drain* – When a wastewater Service Line crosses a water main or storm drain (long side services), the Service Line shall be green in color and meet SDR-26 requirements, including pressure rated joints. Cement stabilized backfill shall be specified on the drawings.
 - 6.10.6.1 The clearance shall be 2 feet as measured from the outside diameter of the Service Line to the outside diameter of the storm drain or water line.
 - 6.10.6.1.1 When the minimum clearance cannot be achieved, the design must include casing the services line with ductile iron pipe 5 feet beyond the outside diameter of the crossing.
- 6.10.7 Each lot must contain its own wastewater Service Line. Public and private Service Lines are not allowed to cross any existing, proposed, or future lot line(s).
- 6.10.8 Wastewater Service Lines cannot be directly connected to wastewater mains with a 16-inch, or greater, diameter. The extension of a parallel main in accordance with **Section 3** (Policy) is required.

6.11 CLEANOUTS

- 6.11.1 Cleanouts shall not be used except at the end of a 4-inch wastewater Service Line.
- 6.11.2 Cleanouts must contain a concrete collar and be constructed in accordance with the City's *Standard Construction Specifications and Details*.
- 6.11.3 Cleanouts shall be located outside of driveways and sidewalks.
- 6.11.4 High-volume Customers, such as restaurants, multifamily Development or hotels, and Customers with 6-inch and larger Service Lines require a manhole at the Property line or easement line.

6.12 CLOSED CIRCUIT TELEVISION VIDEO (CCTV)

- 6.12.1 Post-construction CCTV is required for all wastewater main and Service Line construction projects and must be included as a separate bid item in the construction documents.
- 6.12.2 Pre-construction CCTV is required for all rehabilitation or relocation wastewater main projects where the existing main is more than 50 years old, is made of vitrified clay pipe, has a history of breaks, and/or has less than 42 inches of ground cover.
- 6.12.3 Pre-construction CCTV is required for grading projects where grading activities will occur over an existing wastewater main, where a structure (such as a pier or retaining wall) will be placed adjacent to an existing main, and/or where additional fill will be placed over an existing main. Pre-CCTV shall be included as a separate bid item in the construction documents.
- 6.12.4 All CCTV is required to be performed in accordance with the City's *Standard Construction Specifications and Details*. In accordance with the specifications, paving or pavement repair shall not be allowed to commence without approval of CCTV submittals.

6.13 INVERTED SIPHONS

- 6.13.1 Inverted siphons are not allowed. When a waiver is granted to allow an inverted siphon, the inverted siphon shall be designed in accordance with the requirements of *30 TAC Chapter 217.53* and the following additional criteria:
 - 6.13.1.1 Permanent access to all structures for maintenance of facilities must be provided;
 - 6.13.1.1.1 Junction structures/manholes shall have a minimum 15-foot all-weather access path for cleaning with a flushing truck;
 - 6.13.1.2 Stop logs are required for each barrel on the upstream side and shall be specified as part of the design;

- 6.13.1.3 Any barrels that are open cut shall be embedded with controlled low strength material in accordance with the City's *Standard Construction Specifications and Details*;
- 6.13.1.4 All structures must be lined with an approved lining system in accordance with the City's *Standard Construction Specifications and Details*;
- 6.13.1.5 Buoyancy calculations shall be submitted with designs for structures to ensure the prevention of floatation of the wall and floor sections during at a 100-year water surface elevation; and
- 6.13.1.6 Construction drawings and specifications must include provisions to restore and protect the entire easement area and any other disturbed areas with slope stabilization such as erosion control blankets, rip rap, gabion mattress, and/or gabion baskets in accordance with the City's *Standard Construction Specifications and Details*.

6.14 ODOR CONTROL UNIT

- 6.14.1 The Water Department requires the installation of odor control units at force mains, lift stations, inverted siphons, drop manholes, 24-inch (and larger) diameter gravity mains, or at the transition from the force main to gravity main. Odor control units must be designed in accordance with current requirements promulgated by the Water Department and be compatible with existing odor control units within the City.

6.15 PRE-TREATMENT

- 6.15.1 Commercial, industrial, and production facilities must comply with specific requirements related to limitations of wastewater discharges into the wastewater system. The provisions of the Clean Water Act, as regulated under the Pre-treatment Standards, require any industrial or commercial facility to control pollutants into the Publicly Owned Treatment Works (POTW). Pre-treatment requirements are set forth in the *City Code, Chapter 12.5 – Environmental Protection and Compliance* and in the *Title 40, Part 403-471 of the Code of Federal Regulations (CFR)*. The requirements apply to any new or existing facility subject to categorical pretreatment standards in accordance with 40 CFR Part 405-471 and those generating process wastewater of concern. Additionally, pretreatment requirements are applicable to facilities that generate process wastewater, but do not discharge production-based wastewater to the sewer.
- 6.15.2 Any facility that will generate pollutants from non-domestic sources shall meet local and federal wastewater limits prior to discharge into the POTW. Such facilities must be evaluated by the City of Fort Worth Pretreatment Services Division and may be required to obtain a permit prior to discharging processed wastewater to the wastewater system.

- 6.15.3 Commercial facilities (food service establishments, commercial laundries, car washes, etc.) must be designed with pre-treatment devices in accordance with the City of Fort Worth Guidance Document for Sizing and Installation of Grease Traps and Interceptors
- 6.15.4 As determined by *City Code, Chapter 12.5 – Environmental Protection and Compliance* and in the *Code of Federal Regulations Part 403*, if a permit is required, pre-treatment of wastewater through the best available technology may be necessary. Permitting, inspection, sampling, and analytical testing of wastewater to ensure compliance with local and federal discharge limits is a requirement of any permitted facility.
 - 6.15.4.1 If determined to be necessary by Staff based on the *Code of Federal Regulations Part 403*, an Industrial User proposing to generate non-domestic process wastewater shall submit a Wastewater Discharge Permit Application for review at least 90 days prior to commencement of discharge or start of operations. Any proposed or existing facility undergoing review that plans to discharge or generate wastewater as a result of production or manufacturing processes shall contact the City of Fort Worth Pretreatment Services Division for applicable pretreatment requirements.

6.16 ON-SITE SEWAGE FACILITIES

- 6.16.1 If allowed in accordance with **Section 3** (Policy), all On-Site Sewage Facilities (OSSF) shall be designed strictly in accordance with *30 TAC Chapter 285: On-Site Sewage Facilities* and approved by the appropriate permitting authority.
 - 6.16.1.1 A waiver request approved by the Water Department Director is required prior to coordination with other permitting agencies for an on-site water sewage facility within City limits.

6.17 WASTEWATER LIFT STATIONS AND FORCE MAINS

- 6.17.1 It is the intent of the Water Department to provide wastewater service by main extensions. Public and private lift stations and force mains are often discouraged due to their higher risk of causing a wastewater overflow and increased maintenance costs. A waiver approved by the Water Department Director is required for the construction of a lift station and force mains to serve a Development. Lift stations and force mains shall be designed in accordance the following sections.
 - 6.17.2 Preliminary Engineering Report

6.17.2.1 The engineer shall submit a Preliminary Engineering Report prepared by Licensed Professional Engineer in the state of Texas for the proposed lift station and force main in accordance with this section and the requirements of *30 TAC Chapter 217.59* through *30 TAC Chapter 217.63: Lift Station Requirements*. The Preliminary Engineering Report shall consist of, as a minimum, the following components:

- 6.17.2.1.1 Introduction and Justification for Proposed Lift Station;
- 6.17.2.1.2 Site Location, Property Dedication, and Access;
- 6.17.2.1.3 Wastewater Flow Analysis;
- 6.17.2.1.4 Force Main System Curves and Pump Curves;
- 6.17.2.1.5 Downstream Wastewater Main Capacity Available;
- 6.17.2.1.6 Electrical Power and Reliability; and,
- 6.17.2.1.7 Site Specific Issues.

6.17.3 Drawings and Specifications

6.17.3.1 Upon submittal and approval of the Preliminary Engineering Report, prepare construction drawings and specifications for review by the Water Department.

- 6.17.3.1.1 All drawings, including civil, mechanical, electrical, and instrumentation shall be signed and sealed by Licensed Professional Engineer in the State of Texas.

6.17.4 General Lift Station Design Requirements

6.17.4.1 *General Design* – Lift stations shall consist of a wet well with submersible pumps.

6.17.4.2 *Regulatory Requirements* – Lift station design and construction shall comply with federal and state requirements, including current *30 TAC Chapter 217.59: Lift Station Requirements* and all requirements of the Texas Department of Licensing and Regulation.

6.17.5 Civil Design Criteria

6.17.5.1 Wastewater Flow Projections

- 6.17.5.1.1 Projected wastewater inflow to a lift station must be calculated using the procedure outlined in Water and Sewer Study Guidelines included in the Appendix. The wastewater inflow calculations, shall contain, as a minimum, the following:

- 6.17.5.1.1.1 Total acreage in lift station watershed and total acreage proposed to be served by the lift station;
- 6.17.5.1.1.2 Total population and acreage of existing Developments to be served by lift station;
- 6.17.5.1.1.3 Total population, proposed land uses, and acreage of Developments to be served by lift station;
- 6.17.5.1.1.4 Harmon's peaking factor; and
- 6.17.5.1.1.5 Average day and maximum day inflows to lift station.
- 6.17.5.1.2 Lift Station Design Pumping Capacity – The firm (largest pump out-of-service) pumping capacity of the lift station shall be equal to or greater than the peak wastewater inflow.
- 6.17.5.2 Site Considerations
 - 6.17.5.2.1 Lift Station Site Survey and Platting – Site surveys containing the lift station site boundary legal description or plat boundaries shall be prepared and shall identify all adjoining properties. The lift station site shall be platted, and the City shall be granted fee title ownership of the lift station site upon filing of the plat.
 - 6.17.5.2.2 Access – A 12-foot wide minimum concrete driveway with provisions for turning vehicles around shall be provided in a dedicated Right-of-Way or permanent easement. The site shall be accessible by maintenance vehicles, including cranes and other large vehicles, obstruction free during all weather conditions, including 100-year, 24-hour rainfall event.
 - 6.17.5.2.3 Water Service – A 1-inch water service with hose bib on-site shall be provided.
 - 6.17.5.2.4 Lift Station Fence and Gate
 - 6.17.5.2.4.1 An intruder resistance fence shall be provided in accordance with *30 TAC Chapter 217.59(b)*.
 - 6.17.5.2.4.2 *Gates* – A gated entrance with two freestanding 8-foot wide gates across the access road shall be provided.

- 6.17.5.2.4.2.1 The gate entrance shall be set back at least 20 feet from the road to allow vehicles to pull off the road before opening the gate.

6.17.5.2.5 Flood Protection

- 6.17.5.2.5.1 The lift station shall be protected from 100-year flood events including wave action. The following Items shall be indicated in the drawings:

- 6.17.5.2.5.1.1 The 100-year base flood elevation (BFE) and/or floodplain delineation;
- 6.17.5.2.5.1.2 The elevation of the top of the wet well;
- 6.17.5.2.5.1.3 The elevation of the vent pipe outlet; and
- 6.17.5.2.5.1.4 The elevation of base of all motor control centers.

- 6.17.5.2.5.2 The site must be graded to drain away from the lift station wet well, and to remove storm water runoff from the site in a non-erosive manner.

- 6.17.5.2.5.3 *Flood Study* – A flood Study shall be provided to the City if the lift station is susceptible to localized flooding, or the 100-year or 25-year flood event is not known.

6.17.5.3 Wet Wells

- 6.17.5.3.1 Wet wells shall be sized and configured in accordance with 30 TAC Chapter 217.60 – Lift Station, Wet Well, and Dry Well Designs, with the following additions:

- 6.17.5.3.1.1 *Wet Well Materials* – Only reinforced concrete wet wells are acceptable;
- 6.17.5.3.1.2 *Wet Well Coatings* – The interior of the lift station wet well shall be coated with a structural epoxy liner in accordance with the City's *Standard Specifications*;
- 6.17.5.3.1.3 *Baffle Walls* – Anti-vortexing baffle walls for lift station with firm pumping capacity greater than 5.0 MGD, shall be provided per the requirements of the Hydraulic Institute, or the pump manufacturer;

- 6.17.5.3.1.4 *Wet Well Level* – Bubbler systems are prohibited. Wet well water levels shall be by ultrasonic with float switches provided as a back-up;
- 6.17.5.3.1.5 *Hydrostatic Test* – Before backfilling the wet well, a hydrostatic test shall be performed on the wet well structure, performed in accordance with *ACI 350 – Environmental Engineering Concrete Structures*;
- 6.17.5.3.1.6 *Ventilation*– Ventilation for the wet well shall be designed as a passive gravity ventilation system;
- 6.17.5.3.1.7 *Minimum Acceptable Diameter of Air Vents* – The minimum allowable passive vent diameter shall be 6 inches. Stainless steel screens shall be provided to prevent bird or insect entry into the wet well; and
- 6.17.5.3.1.8 *Odor Control* – Odor control facilities shall be required. Coordinate with Water Department to determine odor control requirements. An aeration system may be required.

6.17.6 Structural Design Criteria

- 6.17.6.1 *Geotechnical Report* – A geotechnical report, prepared with information determined from a soil boring at the lift station site, shall be required for the structural design of the lift station wet well and valve vault. The geotechnical report shall contain, at a minimum, soil classifications, information on the water table location, the soil bearing capacity, and the lateral earth pressure coefficients.
- 6.17.6.2 *Buoyancy* – The wet well and valve vault shall be designed to resist the buoyancy due to the presence of the ground water table located at finished grade or the 100-year base flood elevation, whichever is higher. Buoyancy calculations shall be submitted to the City for review.
- 6.17.6.3 *Structural Design Considerations* – The wet well and valve vault shall be constructed using pre-cast or cast-in-place reinforced concrete. Structural design calculations for the wet well and valve vault shall be submitted to the City for review.
 - 6.17.6.3.1 At a minimum, the wet well and valve vault shall be designed for the following loading conditions:
 - 6.17.6.3.1.1 *Loading Condition #1* – Wet well empty with full lateral loads developed from groundwater and soil surcharge conditions; and

6.17.6.3.1.2 *Loading Condition #2* – Wet well filled to the top slab level with water without the backfill in place.

6.17.6.4 *Structural Details* – Detailing of reinforcement shall follow the requirements of *ACI 315*, *ACI 318*, and *ACI 350R*. All construction joints in water containing and below grade elements shall be provided with water-stops.

6.17.6.5 *Access Hatches* – Access hatches shall be aluminum frame with stainless steel hardware. Hatches shall be lockable with recessed hasp and shall be designed for 300 pounds per square foot load rating. .

6.17.6.5.1 Access hatches provided for removal of a pump shall be sized to accommodate build-out conditions of the station and allow for pump removal while mounted on rails with a 12-inch horizontal clearance.

6.17.6.5.2 Fall prevention systems for hatches which provide access into the wet well shall be provided, reference City's Standard Products List.

6.17.6.5.3 Access hatches which provide access to a valve vault without a grated top shall be sized to accommodate removal of the largest sized valve with a 6-inch horizontal clearance.

6.17.6.6 All hardware used within the wet well shall be Grade 316 stainless steel.

6.17.6.7 *Pipe Penetrations* – Pipe penetrations into the lift station wet well shall be waterproof and gas proof. Pipe penetrations shall use manufactured wall pipe.

6.17.6.8 *Electrical conduits* – Electrical conduits passing through concrete walls must be waterproof and gas proof..

6.17.7 Pumping and Mechanical Design Criteria

6.17.7.1 *Lift Station Pumps* – Lift Station Pumps shall be in accordance with *30 TAC Chapter 217.61 - Lift Station Pumps* with the following additions:

6.17.7.1.1 Pump and Motor Requirements:

6.17.7.1.1.1 Allowable pump manufacturers shall be pre-approved by Water Department; reference the City's *Standard Product List*;

6.17.7.1.1.2 Pumps shall be provided with moisture and temperature sensors that prevent running when in alarm. Alarms must be connected to SCADA to indicate pump failure;

- 6.17.7.1.1.3 Grinder type pumps shall contain a grinder/shredder type impeller;
- 6.17.7.1.1.4 Pumps shall use a stainless steel, rail mounted pump support system with a secured sealing surface that does not fall out during removal/installation of pump;
- 6.17.7.1.1.5 A stainless-steel lifting chain shall be attached to the pump and hung next to cables for pump removal. Chains must be rated for lifting more than the weight of the pump and cables;
- 6.17.7.1.1.6 Motors shall be non-overloading over the entire range of pump operation;
- 6.17.7.1.1.7 Hand-Off-Auto (HOA) switches should be provided for each pump with red running lights indicating true run status;
- 6.17.7.1.1.8 Submersible pumps shall be removable for inspection or service without entering the wet well;
- 6.17.7.1.1.9 Pumps impellers shall be certified to pass or shred flushable wipes;
- 6.17.7.1.1.10 The pump manufacturer shall supply the pump, motor, discharge elbow, anchor bolts, guide rails, and all miscellaneous stainless-steel hardware required to place the submersible pump within the wet well;
- 6.17.7.1.2 *Pump Head Calculations* – One system curve shall be developed using a friction coefficient (Hazen-Williams “C” value) of 120, and another system curve shall be developed using a friction coefficient (Hazen-Williams “C” value) of 140. The selected pumps must be able to pump at a minimum efficiency of 60% between the heads generated between these C factors.
- 6.17.7.1.3 *Net Positive Suction Head (NPSH)* – The NPSH available shall always be at least 5 feet greater than the NPSH required as calculated according to Hydraulic Institute Standards. Calculations shall be submitted to the Fort Worth Water Department. For Developer projects, calculations shall be submitted to IPRC with the construction plans.

6.17.7.2 Lift Station Pipes and Valve Vaults

- 6.17.7.2.1 Lift Station Pipes shall be in accordance with *30 Chapter TAC 217.62 - Lift Station Pipes*, with the following additions:
- 6.17.7.2.1.1 Each pump shall have an individual discharge pipe complete with flanged coupling adaptor, check valve, and shut off valve. Piping shall be sized so that the maximum discharge velocity does not exceed 5.5 feet per second;
 - 6.17.7.2.1.2 *Emergency Bypass Allowance* – The lift station piping shall allow an emergency bypass of the lift station wet well. A tee with a valve and quick connect on the discharge side of the isolation valves shall be provided;
 - 6.17.7.2.1.3 *Flexible Connections* – A flexible connection, consisting of a flange coupling adaptor, shall be installed on each pump’s discharge piping between the valve vault wall and the check valve in order to allow for removal and maintenance of valves and fittings;
 - 6.17.7.2.1.4 *Exposed Piping* – Exposed piping shall be flanged ductile iron and shall be painted with a primer and coating combination referenced in the City Standard Product List. Flanged pipe and fittings within the wet well and valve vault shall be supported sufficiently and allow for routine maintenance; and
 - 6.17.7.2.1.5 *Pressure Gauges* – Each pump discharge shall be fitted with a minimum 2-inch glycerin filled pressure gauge with shutoff valve. The gauge range shall be capable of gauging the pump discharge head over the entire range of operation.
- 6.17.7.2.2 *Check Valves* – A dedicated check valve shall be provided for each pump located within the valve vault.
- 6.17.7.2.2.1 Check valves shall not be installed vertically.
 - 6.17.7.2.2.2 Check valves may be swing type with a weighted lever if the check valves have less than 5 fps and the system head is less than 60 feet.

- 6.17.7.2.2.3 If Check Valves are greater than 5 fps or the system head is greater than 60 feet, the check valves shall be a cushioned check swing valve.
- 6.17.7.2.2.4 Check valves shall be of a type and manufacturer approved by the Water Department.
- 6.17.7.2.3 *Surge and Pressure Relief Valves* – Surge or pressure relief valves shall be required where the surge pressure exceeds the pressure rating of the pipe.
 - 6.17.7.2.3.1 The surge relief line shall be piped back into the wet well.
 - 6.17.7.2.3.2 Surge and pressure relief valves shall be of a type and manufacturer approved by the Water Department.
- 6.17.7.2.4 *Isolation Valves* – Each pump shall have a dedicated isolation valve.
 - 6.17.7.2.4.1 Isolations valves shall be a resilient seated OS&Y gate valve or plug valve with position indicator, placed downstream of the check valve, located in the valve vault.
 - 6.17.7.2.4.2 Isolation valves shall be of a type and manufacturer on the City's Standard Product List.
- 6.17.7.2.5 *Ladders and Ladder Safety Equipment (Valve Vault Only)* – The minimum allowable ladder width for the valve vault shall be 16 inches. Rung spacing shall be 12 inches, center to center. The top rung shall be placed no more than 12 inches from the top hatch elevation. Bottom rungs shall be placed a maximum of 12 inches from valve vault finished floor.
 - 6.17.7.2.5.1 *Ladder-Up Safety Devices* – A ladder safety extension shall be provided with the ladder. The ladder extension shall be easily reachable from the top slab of the valve vault.
- 6.17.7.2.6 The minimum vertical distance from the valve vault top slab or grate walking surface to the valve vault finished floor shall be 6 feet, 8 inches.

- 6.17.7.2.7 The overall length and width of the valve vault must provide at least 24 inches of horizontal clearance between the outside edge of the check valves and the valve vault walls.
- 6.17.7.2.8 Valve vault floors shall be sloped to the sump to a float activated sump pump. The sump pump must pump water directly into the wet well. The sump pump shall be located in a minimum 24-inch deep by minimum 24-inch diameter sump. Sump pumps shall be accessible and provided with double check valves and shutoff valve located in the valve vault.
- 6.17.7.2.9 A valve vault with a grated top shall normally not require mechanical ventilation. Mechanical ventilation shall be required where grated valve tops are not utilized. Mechanical ventilation systems under intermittent operation shall be designed to provide a minimum of 30 air changes per hour. Mechanical ventilation systems under continuous operation shall be designed to provide a minimum of 6 air changes per hour
- 6.17.7.2.10 The slope of the valve vault floor shall drain all water to the sump.
- 6.17.7.2.11 Valve vault floors shall be sloped to a 24-inch diameter sump pit.
- 6.17.7.2.12 A float-activated sump pump, located in the sump pit, shall be provided.
- 6.17.7.2.13 A check valve and shutoff valve for the sump pump shall be provided and accessible in the valve vault.
- 6.17.8 *Emergency Provisions for Lift Stations* – Emergency provisions shall be included in the system design in accordance with 30 TAC Chapter 217.63 – *Emergency Provisions for Lift Stations*.
- 6.17.9 Force Mains
 - 6.17.9.1 Lift station force mains shall be in accordance with 30 TAC Chapter 217.64 - *Material for Force Main Pipes*, 30 TAC Chapter 217.65 - *Force Main Pipe Joints*, 30 Chapter TAC 217.66 - *Identification of Force Main Pipes*, 30 TAC Chapter - 217.67 *Force Main Design*, and 30 TAC Chapter 217.68 - *Force Main Testing*, with the following additions:
 - 6.17.9.1.1 *Alignment* – Force mains shall be aligned to minimize peaks and valleys which require combination air/vacuum valves;

6.17.9.1.2 *Surge Pressure Design Considerations* – The engineer shall calculate the surge pressures expected within the force main during pump operation and provide the preliminary engineering report to the City;

6.17.9.1.2.1 Surge valves shall be placed downstream of the check valve and shall discharge back into the wet well;

6.17.9.1.3 *Receiving Gravity Wastewater System* – Due to odor considerations, the manhole at the transition from the force main to the gravity main shall be located in the City Right-of-Way and as far away as possible from existing or proposed residences. The transition manhole shall be designed to prevent surcharging and/or overflow conditions;

6.17.9.1.4 A corrosion resistant coating shall be placed at the transition between the wastewater force main and the receiving gravity main;

6.17.9.1.5 *Air and Vacuum Valves* – Combination air and vacuum valves shall be placed as required to vent air accumulation in the force main and to prevent negative pressures from occurring within the force main;

6.17.9.1.5.1 Combination air and vacuum valves shall be required at all peak/high points and all valleys/low points along the force main vertical profile; and

6.17.9.1.5.2 Combination air and vacuum valves shall be of a type and manufacturer according to the Water Department Standard Product List.

6.17.10 Electrical and Instrumentation Design Criteria

6.17.10.1 *Pump Cables* – Pump cables must be designed to terminate in a junction box on top of the wet well with a termination strip. The junction box must be a minimum of 3 feet away from the box opening to facilitate pump removal. Cables shall be removable from conduits without entering the wet well. Conduits shall be sealed with removable sealant inside termination/junction box.

- 6.17.10.2 *Pump Control and Level Monitor* – Submersible pump lift stations shall be controlled using a control system and equipment with ultrasonic level control. A high-level and low-level alarm float shall be included within the monitoring system. The low-level float shall lock out the pump from running dry when water is below the set level. A manual low-level override switch through relay logic shall be provided for maintenance.
- 6.17.10.3 *Load Analysis* – A load analysis must be prepared to size the main disconnect, switches, generator (if required), motor breakers and starters, transformer, wiring and conduit, and enclosures. The electrical system shall meet the requirements of the City of Fort Worth *Electrical Code*.
- 6.17.10.4 *Single Line Diagrams* – A single line diagram of the lift station electrical system shall be prepared and the diagram shall be included within the engineering drawings.
- 6.17.10.5 *Control System Wiring Diagrams* – Control wiring diagram(s) shall be included within the engineering drawings.
- 6.17.10.6 *Enclosure Layout Diagrams* – A schematic of the electrical enclosure layout, motor control center, and support structures shall be included within the engineering drawings.
- 6.17.10.7 *Enclosures* – All exterior enclosures shall meet NEMA 4 standards, and be Grade 304 or Grade 316 stainless steel. Enclosures must be mounted above the 100-year base flood elevation. Motor control centers placed inside a control building shall be NEMA 3R.
- 6.17.10.8 *Lighting* – The lift station site shall be lighted with an outdoor site light with photocell and manual switch. In addition, valve vaults and motor control center buildings and enclosures shall be lighted.
- 6.17.10.9 *Supervisory Control and Data Acquisition (SCADA) Control* – A SCADA monitoring system shall be included within the engineering drawings and specifications. SCADA remote monitoring system shall be of the type and manufacturer required by the Fort Worth Water Department. For sites requiring radio telemetry, a radio frequency Study shall be provided.
- 6.17.11 Start-up and Project Closeout.
 - 6.17.11.1 *Start-up* – Start-up shall be conducted by the pump manufacturer’s factory trained start-up representative. The start-up and operational test shall be conducted in the presence of the engineer, Water Department Staff, and the contractor.
 - 6.17.11.2 *Pump Warranty* – The pump manufacturer shall warrant, in writing, the pump system to be free from defects in materials for a period of 2 years starting from the date of final acceptance.

- 6.17.11.3 *Project Closeout* – The contract documents shall include requirements for Submittals, Operation and Maintenance Manuals, Record Drawings, Cleaning, and Closeout requirements in accordance with Division 01 of the City’s *Standard Construction Specifications*.

6.18 LOW-PRESSURE SYSTEMS

- 6.18.1 It is the intent of the Water Department to provide wastewater service by main extensions. If a waiver is granted allowing the design and construction of a low-pressure system to serve a Development, at a minimum, the low-pressure system shall be designed in accordance with the section and *30 TAC Chapter 217.97 – Pressure Sewers*.
- 6.18.2 The design for the low-pressure system shall include grinder pumps, vault/wet well, Service Lines, electrical/mechanical and enclosures, discharge mains, and collection mains. The design shall be sealed by a Licensed Professional Engineer in the State of Texas and submitted to the Water Department for review.
- 6.18.3 Permanent access must be provided for any facilities to be maintained by the City.
- 6.18.4 An agreement between the Water Department and the private entity responsible for the system is required to clearly outline the division between privately maintained and City maintained facilities and the terms for maintenance of said facilities.

6.19 BYPASS PUMPING FOR WASTEWATER MAINS

- 6.19.1 In the event that construction necessitates abandoning an existing wastewater main before the new wastewater main is put in service, provisions must be made for temporary bypass. Any necessary bypass pumping shall be indicated on the construction drawings by requiring the contractor to provide a bypass pumping submittal in accordance with the City’s *Standard Construction Specifications and Details*.

6.20 ABANDONMENT OF WASTEWATER MAINS AND APPURTENANCES

- 6.20.1 The engineer shall identify all wastewater Service Lines connecting into the existing wastewater main to be transferred to the new main, so that a live wastewater main is not abandoned during construction.
- 6.20.2 Wastewater Mains, Manholes, and Junction Structures
- 6.20.2.1 Wastewater mains shall be abandoned by removal if the proposed main is within the same trench as the existing main.
- 6.20.2.1.1 All other wastewater mains shall be abandoned by draining the existing main, cutting and filling the existing main with grout, and plugging in accordance with the City’s *Standard Construction Specifications and Details*.

- 6.20.2.2 Manholes and junction structures shall be abandoned by removal. Manholes and junction structures to be abandoned must be shown to be removed on the construction drawings.

6.20.2.2.1 If a waiver is granted to not require removal of a manhole or junction structure, the manhole or junction structure shall be abandoned by removing the top 3 feet of the manhole/structure and filling with controlled low strength material (CLSM) in accordance with *City Code Chapter 35-57.5* and the City of Fort Worth *Standard Construction Specifications and Details*.

- 6.20.2.3 If approved by the Water Department, wastewater mains within a single lot can be abandoned or converted to Service. The end of the public wastewater main will require a manhole if one does not already exist.

6.21 CROSSINGS

6.21.1 Texas Department of Transportation (TxDOT) Highway Crossings

- 6.21.1.1 The design of wastewater mains within or crossing a state highway must be in compliance with all applicable TxDOT requirements, including *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*, unless a variance is approved by TxDOT.
- 6.21.1.2 Wastewater mains shall be located to avoid or minimize the impact to future highway projects and improvements, to allow other utilities in the Right-of-Way, and to permit access to water mains and other utility facilities for their maintenance with minimum interference to highway traffic.
- 6.21.1.3 New wastewater mains crossing a highway shall be installed at 90° to the centerline of the highway.
- 6.21.1.4 New wastewater mains located longitudinally along a highway shall be designed parallel to and outside of the Right-of-Way within a separate easement.
- 6.21.1.5 All wastewater crossings shall be cased with steel casing pipe, in accordance with the City's Standard Construction Specifications and Details. Limits of casing pipe shall be in accordance with *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.
- 6.21.1.6 Manholes and other wastewater appurtenances shall not be placed in the pavement or shoulder of highway.
- 6.21.1.7 Wastewater main crossings shall include a manhole on each side of the highway crossing. Concrete collars shall be required.

- 6.21.1.8 The Engineer shall prepare draft permits with all required drawings and attachments and deliver the draft permits to the City. Drawings must be signed and sealed by a Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permit to TxDOT.

6.21.2 Railroad Crossings

- 6.21.2.1 The design of wastewater mains within railroad Right-of-Way must be in compliance with the requirements of the appropriate railroad authority. The engineer should determine which railroad company Right-of-Way is being crossed and obtain their utility accommodation policies prior to beginning the design. These include, but are not limited to, insurance and licensing agreement requirements.
- 6.21.2.2 *License Agreement* – Construction of mains cannot occur until a permit or license agreement has been executed.
- 6.21.2.3 *Transverse Crossing* – New mains crossing the railroad shall be installed at approximately 90° to the centerline of the railroad, if possible.
- 6.21.2.4 *Longitudinal/Encroachment Alignment* - New wastewater mains located longitudinally along railroad Right-of-Way shall be designed parallel to and outside of the Right-of-Way within a separate easement.
- 6.21.2.4.1 If a waiver is granted allowing longitudinal installation, the wastewater main shall be located on uniform alignments to and outside of the Right-of-Way line within an easement to provide space for future railroad construction and possible future utility installation.
- 6.21.2.4.2 All new mains shall be located on top of the back slope at the outer limits of railroad Property, and outside of the Zone of Influence of any structure.
- 6.21.2.4.3 If the wastewater main is located 40 feet or less from centerline of the track, the mains shall be encased in a steel pipe as approved by the railroad authority under jurisdiction. No pipe shall be placed closer than 25 feet from the centerline of the track, or as required by the appropriate railroad authority.
- 6.21.2.5 All mains crossing under railway tracks shall be placed in a steel casing pipe, unless otherwise approved by railroad authority. Casing pipe crossing railroad tracks shall be designed to withstand E80 railroad loadings in accordance with the City's *Standard Construction Specifications and Details* and shall extend to the Right-of-Way lines.

- 6.21.2.6 Manholes, cleanouts and other appurtenances shall be placed outside the limits of the Right-of-Way.
 - 6.21.2.7 Wastewater main crossings shall include a manhole on each side of the railroad crossing.
 - 6.21.2.8 The Engineer shall be responsible for preparing draft permits with all required drawings and attachments and delivering the draft permits to the City. Drawings must be signed and sealed by a Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permit to Railroad. Any application costs/fees associated with the railroad permit will be the responsibility of the Engineer.
- 6.21.3 Creek, River, or other Water Feature Crossings
- 6.21.3.1 Creek, river, or other water feature crossings are required to meet jurisdictional determination and permitting requirements in accordance with the United States Army Corps of Engineers and other regulatory agencies.
 - 6.21.3.2 Main crossings of existing, or proposed, detention or retention ponds are not allowed.
 - 6.21.3.3 A primary consideration in the design of creek, river, or other water feature crossings is the prevention of soil erosion at the areas of trench backfill. At a minimum, slope protection for such crossing shall be designed by a Licensed Engineer in the State of Texas from top of bank to top of bank. In lieu of design calculations for rock riprap, rock filled gabion basket, or other approved stabilization method designed by the Engineer, from top of bank to top of bank is required. The Engineer shall provide details. Additional permitting such as an Floodplain Development Permit requirements may apply.
 - 6.21.3.3.1 If velocities of the flowing water in the creek/river exceed 10 fps, the cement stabilized backfill shall be covered with riprap and/or stone-filled caged baskets from top of bank to top of bank.
 - 6.21.3.3.2 In areas where there is a planned channel improvement, the stabilized backfill shall be used up to the line of planned improvement. The area above this planned line of improvement shall be compacted fill.

- 6.21.3.3.3 All mains must be designed with a minimum clearance from the top of the pipe to the bottom of the channel of 5 feet, or 1.5 multiplied by the outside diameter of the pipe, whichever is greater.
- 6.21.3.3.4 Wastewater main crossings shall include a manhole on each side of the creek, river or water feature crossing.
- 6.21.3.3.5 Wastewater mains are laid under any flowing stream or semi-permanent body of water require casing,

6.21.4 Trenchless Construction

- 6.21.4.1 Construction by other than open cut are methods used for wastewater main placement under restrictive conditions when open cut construction is not allowed.

6.21.4.2 Auger Boring

- 6.21.4.2.1 Engineers shall consider the location, size and depth of boring and receiving pits when choosing the beginning and ending stations for boring. Bore pit width varies depending on the depth and size of pipe. The minimum length of a bore pit shall be 20 feet and the minimum width of a bore pit shall be 5 feet.

- 6.21.4.2.2 Auger boring shall be designed in accordance with the City's Standard Construction Specifications and Details. The anticipated size and location for all bore pits shall be included in the design for the main and shown on the drawings. Launching pits shall be located at the lower elevation end of the tunnel.

- 6.21.4.3 *Other Trenchless Construction* – When traditional auger boring is not feasible for the construction of the improvements, other trenchless methods of construction such as hand tunneling, pipe enlargement, and slip lining shall be designed by the engineer in accordance with the City's *Standard Construction Specifications and Details*. Any designs not meeting the City's *Standard Construction Specifications and Details* such as, but not limited to, micro-tunneling, open shield pipe jacking, and horizontal directional drilling, shall require a waiver and submission of design and technical specifications to the City with the waiver request.

6.21.5 Elevated Crossings

6.21.5.1 Except as provided below, elevated crossings are prohibited because they create special design problems in which no set of circumstances is duplicated from one design to another. The two methods of elevated crossings acceptable to the City are:

6.21.5.1.1 Hanging the wastewater main on a roadway bridge; or

6.21.5.1.2 Designing a specific utility bridge for the support of the wastewater main crossing.

6.21.5.2 All elevated crossings must satisfy the following criteria:

6.21.5.2.1 Elevated crossings must maintain gravity flow to meet capacity requirements;

6.21.5.2.2 Prior to proceeding with design for attaching a main to a bridge, documentation of correspondence approving the placement of the main on the bridge must be provided to the Water Department;

6.21.5.2.3 Design must account for the increased loading effects on the bridge created by a full main and its supports;

6.21.5.2.4 Design must include access to the main and appurtenances for maintenance purposes;

6.21.5.2.5 Design must include coatings or methods of corrosion control for elevated pipe sections and pipe supports;

6.21.5.2.6 PVC pipe shall not be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight;

6.21.5.2.7 The freeze potential of small diameter or low flow mains must be evaluated and the design must ensure that small diameter or low flow mains will not freeze;

6.21.5.2.8 Design must ensure positive restraint in all directions; each joint of pipe must have (2) support straps. Spacing of pipe supports must be in accordance with the length of pipe joints specified and one of the supports must be placed near the bell end of the pipe;

6.21.5.2.9 Placement of the expansion joints must coincide with the expansion joints of the roadway bridge; and

6.21.5.2.10 Wastewater main crossings shall include a manhole on each side of the elevated crossing.

6.21.5.3 For bridge sections:

- 6.21.5.3.1 Pipe with restrained joints or monolithic pipe is required between manholes on each end of bridged sections;
- 6.21.5.3.2 The bridge section must be designed to withstand the hydraulic forces applied by the occurrence of a 100-year flood, including buoyancy;
- 6.21.5.3.3 Pipe material shall also be capable of withstanding impact from debris;
- 6.21.5.3.4 Bank stabilization shall be provided to prevent erosion of bank sections;
- 6.21.5.3.5 Pier supports shall be spaced and designed to ensure that adequate grade, slope and structural integrity are maintained; and
- 6.21.5.3.6 The proposed elevation of the main shall meet low chord bridge requirements and must be at least 2 feet above the 100-year water surface elevation to prevent damage to the main.

6.22 PAVEMENT REPAIR

- 6.22.1 Mains designed to be placed within existing pavement shall contain provisions for pavement repair in accordance with the City of Fort Worth *Utility Construction Policy* based upon the street's Pavement Condition Index (PCI) as well as the *Standard Construction Specifications and Details*.

SECTION 7 – DESIGN CRITERIA FOR RECLAIMED WATER MAINS

7.1 GENERAL

- 7.1.1 The design, construction and incorporation of all reclaimed water improvements into the Fort Worth Reclaimed Water System must comply with this section and meet the requirements of *30 Texas Administrative Code (TAC) Chapter 210, 217, and 290*, and current editions of the *City of Fort Worth Subdivision Ordinance*, the *City of Fort Worth Community Facilities Agreements Ordinance*, and *City Code Chapter 35*.
- 7.1.2 Once a reclaimed water service agreement is executed for reclaimed water to be provided by the City, all public and privately owned and maintained reclaimed water mains must meet the requirements of the standard reclaimed water agreement set forth in *City Code Chapter 35* as well as the requirements within *30 TAC Chapter 210*.
- 7.1.3 Reclaimed water mains must be designed in accordance with acceptable engineering practices, including *30 TAC Chapter 210* and *International Plumbing Code Section 1304*, and must be labeled and separated from other mains to protect human health and the environment.

7.2 SIZING RECLAIMED WATER MAINS

- 7.2.1 *Standard Sizes* – New reclaimed water mains shall consist of the following diameters (in inches): 4, 6, 8, 12, 16, 20, 24, 30, 36, and multiples of 6-inch thereon.
 - 7.2.1.1 The minimum size for reclaimed water mains is 4-inches.
- 7.2.2 The reclaimed water mains shall be sized in accordance with applicable Master Plan established for that area, if available. If a Master Plan is not available, the sizing of the main must be based on engineering analysis of initial and future demand of the reclaimed water users. A Loading Analysis or Water Study shall be performed to determine the demand/loads created by proposed Development and if any necessary improvements to the existing system to support the Development are needed. *Water and Sewer Study Guidelines* are included in the Appendix.
- 7.2.3 Reclaimed water main pipe design requires an additional allowance for transient pressures due to system operation. This allowance shall be coordinated with the Water Department Staff to determine an appropriate pressure to be applied to account for possible transient conditions in the system.
- 7.2.4 Continuous supply or pressure of reclaimed water is not guaranteed. All system designs should incorporate provisions to accommodate an alternate supply, if needed.

- 7.2.5 An alignment walk with Development Department – Water Section Staff and a Study shall be required if the water main is outside of the public Right-of-Way. Reclaimed water mains 16-inch, and larger, in diameter will require an alignment walk. Alignment walks are valid for one year after the issuance of the alignment approval letter.

7.2.5.1 The alignment walk must show that the reclaimed water main:

- 7.2.5.1.1 Has access that is maneuverable by construction equipment, is unobstructed, and has no obstacles to future maintenance;
- 7.2.5.1.2 Is located outside heavily wooded areas containing protected trees;
- 7.2.5.1.3 Is not located in historically preserved areas;
- 7.2.5.1.4 Is not located on gas well pads or fee simple properties owned by a utility company;
- 7.2.5.1.5 Is not in TxDOT and/or railroad rights-of-way;
- 7.2.5.1.6 Is not less than 10 feet from the top of a creek bank;
- 7.2.5.1.7 Easement does not contain side slopes of an embankment or drainage feature.;
- 7.2.5.1.8 Is not located in areas with ground slopes steeper than 4:1;
- 7.2.5.1.9 Is perpendicular to ground slopes;
- 7.2.5.1.10 Is not located inside a designated Floodplain, except for water transmission mains; and
- 7.2.5.1.11 Is not located within a Floodway, or Cemetery Burial Site.

- 7.2.6 *Water Demand Calculations* – Demand calculations and assumptions must be submitted for review. Calculations and criteria must adhere to the guidelines set forth in the *Water and Sewer Study Guidelines* which are included in the Appendix.

7.3 LAYOUT OF RECLAIMED WATER MAINS, SERVICE LINES, AND APPURTENANCES WITHIN RIGHT-OF-WAY

- 7.3.1 All new reclaimed water mains shall be located on the opposite side of the street from any existing or proposed water mains. Reclaimed water mains must be located where maintenance can be accomplished with the least interference with traffic, structures, and other utilities. When reclaimed water mains are located outside of the Right-of-Way, they shall be within a dedicated reclaimed water main easement.

- 7.3.2 *Valves* – Valve locations for reclaimed water mains must meet the same requirements.

7.3.2.1 Valves must be located at all reclaimed water main intersections and should be located within the street intersection at reclaimed water main crosses or tees.

7.3.2.2 Valve locations shall align with projected Property line.

7.3.2.3 For sizing and spacing of valves, refer to **Section 7.8** (Gate Valve and Butterfly Valve Requirements),

7.3.3 *Service Locations* – Reclaimed water Service Lines must be located within the parkway in front of the Right-of-Way line, and adjacent to the opposite Property line from the water service.

7.3.3.1 Reclaimed water Service Lines must be separated a minimum distance of 9 feet from any water Service Lines and 4 feet from the wastewater Service Lines as measured from the outside diameters of each line.

7.4 HORIZONTAL/VERTICAL ALIGNMENT AND CLEARANCE REQUIREMENTS

7.4.1 *Radius of Curvature/Joint Deflection* – Minimum radius of curve and maximum deflection angle of pipe joints will be restricted to 50% of manufacturer's recommendation, after which the use of horizontal or vertical bends will be required. No bending of pipe is allowed.

7.4.2 *Bends* – All bends shall be 45° or less. Two 45° bends in a series must be used in lieu of 90° bends. Tee fittings must be used in lieu of a 90° bend to allow for proper restraint for future maintenance or connections.

7.4.3 *Restrained Joints* – All vertical and horizontal fittings and valves shall be designed with restrained joints in addition to concrete thrust blocking. Anchor tees or anchor couplings must be used to secure all branch valves to fittings. Pipe shall be restrained for 8-inch and 12-inch PVC reclaimed water mains in accordance with **Table 7-1**.

Table 7-1. PVC Pipe Joint Restraint Length

Pipe Size (inches)	Plugs, Tees, and Valves	Bends*			
		90°	45°	22.5°	11.25°
8	88 ft	33 ft	14 ft	7 ft	4 ft
12	126 ft	45 ft	19 ft	9 ft	5 ft

*Length to be restrained on each side of the bend, tee, or valve.

Assumptions: 250 psi test pressure, 1.5 safety factor, SP soil type, Type 4 trench

7.4.4 Depth of Cover Requirements:

7.4.4.1 12-inch and smaller reclaimed water mains shall be designed for a minimum cover of 48-inches measured from the top of ground to the top of pipe.

7.4.4.2 16-inch, and larger, reclaimed water mains shall be designed for a minimum cover of 60-inches measured from the top of ground to the top of pipe.

7.4.5 *Existing Appurtenances* – If grade changes or pavement improvements are proposed, all existing reclaimed water appurtenances shall be adjusted to the proposed final grade.

7.4.6 Clearance Requirements

7.4.6.1 Other Water Mains

7.4.6.1.1 If a reclaimed water main is required to be laid parallel to an existing water or reclaimed water main, a minimum horizontal clearance of 5 feet shall be maintained as measured from the outside diameter of each main. In no case shall the excavation of either main impact the bedding or embedment of the other main. The Engineer is responsible for determining proper clearance between mains based upon soil conditions. Trench boxes, hydraulic shoring, or other means shall be necessary to achieve 5 feet, or more, clearance.

7.4.6.2 Storm Drain

7.4.6.2.1 When reclaimed water mains are parallel to storm drains, the minimum horizontal clearance shall be 5 feet as measured from the outside diameters of each main.

7.4.6.2.2 When reclaimed water mains cross storm drains, the reclaimed water main must cross over the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.

7.4.6.2.2.1 If the minimum clearance of 2 feet crossing over the storm drain cannot be achieved, casing or an alternate alignment shall be required.

7.4.6.2.2.2 If crossing over the storm drain cannot be achieved, the reclaimed water main must cross under the storm drain in accordance with the City's *Standard Construction Details*.

- 7.4.6.2.2.3 Crossings beneath storm drains larger than 24" and all box culverts shall require steel casing.
- 7.4.6.2.3 *Storm Drain Junction Structure Separation* – Storm drain junction structures must have 5 feet of separation from the reclaimed water main.
- 7.4.6.2.4 If a reclaimed water main is proposed to be laid parallel to an existing or proposed drainage channel or feature, a horizontal clearance of 10 feet is required between the reclaimed water main and the top of drainage channel or feature as measured from the outside diameter of the reclaimed water main to the top of bank of the drainage channel or top of the drainage feature.
- 7.4.6.3 *Franchise Utilities* – A minimum clearance of 3 feet horizontally and vertically shall be maintained from all franchise utilities such as gas, electric, fiber optic, and cable within City Right-of-Way or easement.
- 7.4.6.3.1 A franchise utility may require a greater minimum clearance distance. Where the City's minimum clearance requirement and the franchise utility's minimum clearance requirement differ, the greatest minimum clearance requirement shall be used.
- 7.4.6.4 *Non-Franchise Utilities* – Reclaimed water mains proposed to parallel or cross existing non-franchise utility lines, such as gas or energy pipelines, shall adhere to all clearance and other requirements of the non-franchise utility. Privately owned water, sewer, storm drain, or other lines crossing a public water main shall be meet the requirements of this section. At a minimum, a reclaimed water main shall maintain a horizontal clearance of 3 feet and vertical clearance of 3 feet, as measured from the outside diameters of each main. However, if the non-franchise utility contains an impressed current cathodic protection system, a minimum horizontal clearance of 5 feet and vertical clearance of 3 feet is required as measured from the outside diameters of each main to minimize the impacts of stray current to the main, fittings, and appurtenances. Where the City's minimum clearance requirement and the non-franchise utility's minimum clearance requirement differ, the greatest minimum clearance requirement shall be used.
- 7.4.6.5 *Drilled Shafts* – Reclaimed water mains adjacent to drilled shafts shall be designed with a minimum horizontal clearance of 10 feet as measured from the outside diameter of the main to the outside edge of the drilled shaft.

7.4.6.6 Drainage Headwalls and Inlets

- 7.4.6.6.1 Reclaimed water mains shall not cross under headwalls and inlets.
- 7.4.6.6.2 Reclaimed water mains adjacent to headwalls and inlets shall be designed with a minimum horizontal clearance of 10 feet to headwall and 5 feet to inlets as measured from the outside diameter of the main to the outside edge of the headwall or inlet.
- 7.4.6.6.3 Reclaimed water mains perpendicular to headwalls and inlets shall be designed with a minimum clearance of 10 feet to headwall and 5 feet to inlets as measured from the outside diameter of the main to the outside edge of the headwall or inlet.

7.4.6.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

- 7.4.6.7.1 Reclaimed water mains adjacent to MSE or other retaining walls shall be designed to be placed outside of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.
- 7.4.6.7.2 Reclaimed water mains crossing MSE, or other retaining walls, shall be designed with steel casing through the entirety of the Zone of Influence of the wall, as determined by a Licensed Professional Engineer.

7.4.6.8 *Other Bridge Features* – A minimum clearance of 5 feet horizontally and vertically shall be maintained from all other bridge features, unless required to be greater as regulated by the bridge owner.

7.4.6.9 *Coordination with Other Entities* – In situations where reclaimed water mains are required to be placed adjacent, within, or crossing easements or Right-of-Way of highway or railroad entities, the Engineer is responsible for coordinating with such entity to confirm that future expansions from the entity will not impact the proposed reclaimed water main. Documentation of such correspondence must be provided to the City for review. Reclaimed water mains shall not be placed within, or crossing, easements or right-way of a highway or railroad in an area that is designated for future expansion.

7.5 RECLAIMED WATER MAIN SEPARATION FROM WATER AND WASTEWATER MAINS

- 7.5.1 Reclaimed water mains shall meet the separation requirements in the Texas Administrative Code, including but not limited to *30 TAC Sections 210.25, 217.70, and 290.44*.

7.6 RECLAIMED WATER MAIN MATERIALS AND EMBEDMENT

- 7.6.1 All piping shall be manufactured in purple, painted purple, taped with purple metallic tape, or bagged in purple. Any exposed piping must be stenciled in white with a warning reading “Non-Potable Water”.
- 7.6.2 Pipe material and embedment requirements for reclaimed water mains shall meet potable water class material and comply with the City’s *Standard Construction Specifications and Details* for water mains.
- 7.6.3 Trench Water Stops
- 7.6.3.1 If encountered during construction, or if groundwater is known to be present, trench water stops must be installed at 500-foot intervals to prevent migration of water within the water main trench
- 7.6.3.2 If a project is within the jurisdiction of the current *City Code Appendix A, Zoning Regulations, Chapter 6 Section 6.302 (Tree Ordinance)*, all onsite underground utilities with backfill other than onsite material shall have a trench water stop every 200 feet for the entire length of the utility placement.

7.7 CONNECTIONS TO EXISTING RECLAIMED WATER MAINS

- 7.7.1 *Cut-in Tees* – Connections to existing reclaimed water mains shall be made in locations where existing valves can be closed to isolate the connection point while keeping as much of the surrounding system in service as possible. Cut-in tees shall be used to connect a new reclaimed water main to an existing reclaimed water main. If a waiver is granted to allow an alternative method, a tapping sleeve and valve shall be used.
- 7.7.1.1 Cut-in connections shall require an additional valve on the existing main to reduce the number of service disruptions.
- 7.7.1.2 For tapping sleeves, if allowed, the tap can only be connected to reclaimed water mains when the tap is at least one size smaller than the existing main size. For example: 12-inch existing reclaimed water main size and 8-inch tap and tapping valve size.

7.8 GATE VALVE AND BUTTERFLY VALVE REQUIREMENTS

7.8.1 *Valve Spacing*

7.8.1.1 Spacing between gate valves on a 16-inch, or smaller, reclaimed water main within a residential area shall be at least every 800 feet.

7.8.1.2 Spacing between gate valves for reclaimed water mains 16-inch and larger shall be at least every 2,000 feet.

7.8.2 All valves shall be placed on a flat horizontal grade.

7.8.3 *Mains* – All new reclaimed water main connections (including but not limited to reclaimed water services, mains, etc.) shall contain a valve at connections to an existing or proposed reclaimed water main.

7.8.3.1 A gate valve must be placed after the last service installed on the reclaimed water main.

7.8.4 *Gate Valves* – Only gate valves will be used in the distribution system for reclaimed water mains.

7.8.4.1 *Vaults for 16-inch Valves & Larger* – All valves that are 16-inches, or larger, shall be installed in a valve vault in accordance with City's Standard Construction Specifications and Details.

7.8.4.2 *Minimum Gate Valve Size* – The minimum size of gate valves shall be 6 inches. Any valves needed for 4-inch or smaller connections must be increased with a 6-inch reducer fitting and 6-inch gate valve.

7.8.4.3 *Valve Orientation* – All valves shall be installed in the vertical direction. No horizontal orientations will be allowed. Valves must be placed perpendicular to the existing/proposed ground elevation. Valves shall open in the clockwise direction.

7.8.4.4 *Butterfly Valves* – All valves installed on reclaimed water mains larger than 24 inches in diameter shall be butterfly valves contained within a vault in accordance with the City's *Standard Construction Specifications and Details*

7.8.4.5 *Special Requirements for Valves*

7.8.4.5.1 Plans shall contain a note that contractors are prohibited from operating existing valves in the field. Only Water Department Staff are authorized to operate valves.

7.8.5 *Gate Valve Boxes* - All gate valve boxes for reclaimed water mains shall be square and painted purple.

7.9 CLEANING, TESTING, AND SAMPLING

- 7.9.1 *Cleaning Pigs and Wyes* - In strategic locations along reclaimed water mains, cleaning wyes shall be provided for passing cleaning pigs through the reclaimed water main to sweep trash, dirt and debris from the pipe. These wyes can be supplemented with sampling points for testing of the reclaimed water main, as required. All reclaimed water mains 24-inch and smaller shall be cleaned using cleaning pigs.
- 7.9.1.1 Locations for insertion of cleaning pigs and clean-out wyes shall be located on the overall water layout of the construction drawings and shall be in accordance with *City of Fort Worth Standard Construction Specifications and Details*.
- 7.9.1.2 Cleaning wyes must include a receiving cage to accommodate pressure differentials during pigging operations.
- 7.9.1.3 Reclaimed water mains containing butterfly valves will require alternate methods for cleaning such as closed-circuit television video (CCTV) or physical inspection.
- 7.9.2 *Water for Cleaning and Testing* – If reclaimed water is not available for cleaning and testing, provisions must be made in the construction drawings to temporarily connect the reclaimed water main to a potable water main. The temporary connection must include a proper backflow prevention device to prevent a cross-connection, and the temporary connection shall be removed upon completion of testing.
- 7.9.3 *Sampling Points* – All sampling points, including automatic flushing devices, shall be designed with a direct discharge connection to a wastewater main. The connection must include a proper cross-connection design in accordance with TCEQ requirements.

7.10 COMBINATION AIR VALVE ASSEMBLIES

- 7.10.1 In accordance with American Water Works Association (AWWA) standards and manuals of practice, combination air release/vacuum valves shall be installed in locations such to exhaust trapped air from the water distribution system. These locations include, but are not limited to, high points, the downstream side of mainline valves, increased downslopes or decreased upslopes, long ascents or descents, and the beginning and end of horizontal runs. *AWWA M51* shall be complied with for all locations and types of air release/vacuum valves. Combination air valve assemblies shall be in accordance with **Table 7-2**.

Table 7-2. Combination Air Valve Assemblies

Water Main Size	Minimum Size of Relief Valve	Type of Relief Valve
16-inch and smaller	2-inch	Combination
24-inch to 30-inch	4-inch	Combination
36-inch	6-inch	Combination
42-inch	6-inch	Combination
48-inch	8-inch	Combination
54-inch and larger	8-inch	Combination

7.10.1.1 A smaller size relief valve may be used if approved by the Water Department, after submitting sealed calculations by a Licensed Professional Engineer demonstrating that the smaller valve size is sufficient for system design.

7.10.1.2 Combination relief valves shall be installed in vaults in accordance with *the City's Standard Construction Specifications and Details*.

7.11 BLOW-OFF ASSEMBLIES

7.11.1 Blow-off valves and vaults are required in the system to drain the mains and shall be placed at low points along transmission mains (16-inch and larger). Blow-off assembly valves shall meet the size requirements shown in **Table 7-3**. Blow-off assemblies must be designed to discharge into a wastewater main manhole with an appropriate backflow prevention device to prevent a Cross Connection. In addition, the capacity of the receiving discharge wastewater main must have sufficient capacity to receive the addition demand.

Table 7-3. Blow-off Valve Size

Water Main Size	Size of Blow-off Valve
16-inch	6-inch
24-inch and larger	8-inch

7.12 BACKFLOW PREVENTION FOR RECLAIMED WATER SYSTEM

7.12.1 The requirements contained in this section establish the minimum design and operational standards for all reclaimed water facilities connecting to or served by the City of Fort Worth reclaimed water distribution system. These requirements supplement applicable federal, state, and local regulations and may be more restrictive where necessary to protect the City's potable and reclaimed water infrastructure against backflow and cross-connection concerns.

7.12.2 Protection of the Reclaimed Water System

- 7.12.2.1 All customers connected to the reclaimed water distribution system shall install backflow prevention devices at each delivery point and each discharge point to prevent potential contamination of the reclaimed water system.
- 7.12.2.2 Acceptable methods of backflow prevention for reclaimed water connections include:
 - 7.12.2.2.1 Air gaps; or,
 - 7.12.2.2.2 Reduced Pressure Principle (RP) backflow prevention assemblies
- 7.12.2.3 These devices must be installed, maintained, inspected, and tested in accordance with the most current applicable regulations, including *City Code Chapter 12.5, Article VI Public Drinking Water, Division 3 Cross-Connection Control; 30 TAC Chapter 290 Subchapter D (Rules for Public Water Systems); 30 TAC Chapter 210 (Use of Reclaimed Water); and, where applicable, 30 TAC Chapter 344 (Landscape Irrigation).*
- 7.12.3 Protection of the Potable Water System (Premises Isolation)
 - 7.12.3.1 Any premises where reclaimed water is available or utilized and that also receives water from a public potable water supply must provide premises isolation on the potable water service line.
 - 7.12.3.2 Premises isolation shall be achieved by installing one of the following on the potable water service line:
 - 7.12.3.2.1 Air gaps; or,
 - 7.12.3.2.2 Reduced Pressure Principle (RP) backflow prevention assemblies
 - 7.12.3.3 This requirement is mandated by *30 TAC §290.44(h)(1)(A) and (B)*, which prohibit any unprotected connection between a public drinking water supply and a non-potable system and require backflow prevention at any location where contamination may occur.
 - 7.12.3.4 All backflow prevention assemblies installed on potable water lines must comply with:
 - 7.12.3.4.1 *30 TAC §290.44(h)(4) (testing and certification);*
 - 7.12.3.4.2 Local plumbing codes; and,
 - 7.12.3.4.3 Utility cross connection control program requirements found in *City Code Chapter 12.5, Article V, Division 3 Cross-Connection Control.*

7.12.4 Prohibition of Direct Cross Connections

- 7.12.4.1 No direct physical cross-connection shall exist between the City's reclaimed water system and any potable water system.
- 7.12.4.2 Under no circumstances may reclaimed water be introduced into any potable water piping, fixtures, or equipment.

7.13 HOSE BIBS AND FAUCETS

- 7.13.1 The language in this section is a summary from *30 TAC Chapter 210.25* requirements, effective February 12, 1997 and are included only for reference. The Engineer is responsible for adhering to the most current version of these requirements.
- 7.13.2 All hose bibs and faucets shall be painted purple and designed to prevent connection to a standard water hose.
- 7.13.3 Hose bibs shall be located in locked, below grade vaults which shall be clearly labeled as being of non-potable quality. As an alternative to the use of locked, below grade vaults with standard hose bibs services, hose bibs may be placed in a non-lockable service box which can only be operated by a special tool so long as the hose bib is clearly labeled as non-potable water. One of the following requirements must be met by the user or provider, for any area where reclaimed water is stored or where there exists hose bibs or faucets:
 - 7.13.3.1 Signs having a minimum size of 8 inches by 8 inches shall be posted at all storage areas and on all hose bibs and faucets reading, in both English and Spanish, "Reclaimed Water, Do Not Drink" or similar warning;
 - 7.13.3.2 The area shall be secured to prevent access by the public; or
 - 7.13.3.3 The following sign is posted:



7.14 SERVICE LINE AND RECLAIMED WATER METER REQUIREMENTS

- 7.14.1 *Service Lines* – Reclaimed Service Lines shall meet the same criteria as set forth in **Section 5.18** (Service Line and Water Meter Requirements) for water Service Lines.
- 7.14.2 *Meters* – Reclaimed water meters must meet the same criteria as set forth in **Section 5.18** (Service Line and Water Meter Requirements) for water meters. Additionally, the reclaimed water meter must meet the following:
 - 7.14.2.1 Drawings must show the location of the reclaimed meter and specify purple meter and lids;
 - 7.14.2.2 Meter boxes and vaults shall be locked, or accessible only with special tools, square, or rectangular, with “Reclaimed Water” cast into the lid; and
 - 7.14.2.3 Sample test points shall be required and shall be locked, plugged, or capped to prevent access to the reclaimed water system.
- 7.14.3 Drawings shall show irrigation lines, sizes, and specify pipe color to be purple. All sprinkler heads, control box, and meter covers shall be purple.
- 7.14.4 *Maximum Number of Meters per Lot* – The number of meters allowed on one lot shall not exceed 4.

7.15 CATHODIC PROTECTION

- 7.15.1 If materials other than PVC are proposed for City reclaimed water mains, a Cathodic Protection Study should be performed by a corrosion specialist. In accordance with recommendations from the Cathodic Protection Study, Construction Drawings and Specifications shall include provisions for Cathodic Protection in accordance with the *City of Fort Worth Standard Construction Specifications and Details*

7.16 ABANDONMENT OF RECLAIMED WATER MAINS AND APPURTENANCES

- 7.16.1 Reclaimed water mains shall be abandoned by removal if the proposed main is within the same trench as the existing main.
- 7.16.1.1 All other reclaimed water mains shall be abandoned by draining the existing main, cutting and filling the existing main with grout, and plugging in accordance with the City's *Standard Construction Specifications and Details*.
- 7.16.1.2 Reclaimed water appurtenances shall be removed and salvaged in accordance the City's *Standard Construction Specifications and Details*.

7.17 CROSSINGS

- 7.17.1 Texas Department of Transportation (TxDOT) Highway Crossings
- 7.17.1.1 The design of reclaimed water mains within a state highway must be in compliance with all applicable TxDOT requirements, unless a variance is approved by TxDOT. Reclaimed water mains shall comply with *43 TAC Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.
- 7.17.1.2 Reclaimed water mains shall be located to avoid or minimize the impact to future highway projects and improvements, to allow other utilities in the Right-of-Way, and to permit access to water mains and other utility facilities for their maintenance with minimum interference to highway traffic.
- 7.17.1.3 Reclaimed water mains crossing a highway shall be installed at approximately 90° to the centerline of the highway.
- 7.17.1.4 Reclaimed water mains located longitudinally along a highway shall be designed parallel to and outside of the Right-of-Way in a separate easement.
- 7.17.1.5 All reclaimed water crossings shall be cased with steel casing pipe, in accordance with the City's *Standard Construction Specifications and Details*. Limits of casing pipe shall be in accordance with *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.

- 7.17.1.6 Reclaimed water valves and other appurtenances shall not be placed in the pavement or shoulder of highway.
- 7.17.1.7 Reclaimed water main crossings shall include a valve on each side of the highway crossing.
- 7.17.1.8 Individual service meters shall be placed outside the limits of the Right-of-Way within an easement.
- 7.17.1.9 The Engineer shall be responsible for preparing draft permits with all required drawings and attachments and deliver the draft permits to the City. Drawings must be signed and sealed by Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permit to TxDOT.

7.17.2 Railroad Crossings

- 7.17.2.1 The design of reclaimed water mains within railroad Right-of-Way must be in compliance with the requirements of the appropriate railroad authority. The engineer must determine which railroad company Right-of-Way is being crossed and obtain their utility accommodation policies prior to beginning the design. These include, but are not limited to, insurance and licensing agreement requirements.
- 7.17.2.2 *License Agreement* – Construction of mains cannot occur until a permit or license agreement has been executed.
- 7.17.2.3 *Transverse Crossing* – Reclaimed water mains crossing the railroad shall be installed at approximately 90° to the centerline of the railroad, if possible.
- 7.17.2.4 *Longitudinal/Encroachment Alignment* - New reclaimed water mains located longitudinally along railroad Right-of-Way shall be designed parallel to and outside of the Right-of-Way within a separate easement.
 - 7.17.2.4.1 Longitudinal installation, if allowed, shall be located on uniform alignments to and outside of the Right-of-Way line within an easement to provide space for future railroad construction and possible future utility installation.
 - 7.17.2.4.2 All new mains shall be located on top of back slope at the outer limits of railroad Property.

- 7.17.2.4.3 If a reclaimed water main is located 40 feet or less from the centerline of the track, the mains shall be encased in a steel pipe as approved by the railroad authority under jurisdiction. No pipe shall be placed closer than 25 feet from the centerline of the track, or as required by the appropriate railroad authority.
- 7.17.2.5 All mains crossing under railway track shall be placed in a steel casing pipe, unless otherwise approved by railroad authority. Casing pipe crossing railroad tracks shall be designed to withstand E80 railroad loadings in accordance with the City's *Standard Construction Specifications and Details* and shall extend to the Right-of-Way lines.
- 7.17.2.6 Reclaimed water valves, meters and other appurtenances shall be placed outside the limits of the Right-of-Way.
- 7.17.2.7 Reclaimed water main crossings shall include a valve on each side of the railroad crossing.
- 7.17.2.8 The Engineer shall be responsible for preparing draft permits with all required drawings and attachments and deliver the draft permits to the City. Drawings must be signed and sealed by a Licensed Professional Engineer in the State of Texas. All drawings and attachments must be provided to the City in electronic format. The City will submit the permit to the Railroad. Any application costs/fees associated with the railroad permit will be the responsibility of the Engineer.
- 7.17.3 Creek, River, or other Water Feature Crossings
 - 7.17.3.1 Creek, river, or other water feature crossings are required to meet jurisdictional determination and permitting requirements in accordance with the United States Army Corps of Engineers and other regulatory agencies.
 - 7.17.3.2 Main crossings of existing, or proposed, detention or retention ponds are not allowed.
 - 7.17.3.3 A primary consideration in the design of creek, river, or other water feature crossings is the prevention of soil erosion at the areas of trench backfill. At a minimum, slope protection for such crossing shall be designed by a Licensed Engineer in the State of Texas from top of bank to top of bank. In lieu of design calculations for rock riprap, rock filled gabion basked from top of bank to top of bank is required. The Engineer shall provide details. Additional permitting such as a Floodplain Development Permit may apply.

- 7.17.3.3.1 If velocities of the flowing water exceed 10 fps, the cement stabilized backfill shall be covered with riprap and/or stone-filled caged baskets from top of bank to top of bank.
- 7.17.3.3.2 In areas where there is a planned channel improvement, the stabilized backfill shall be used up to the line of planned improvement. The area above this planned line of improvement shall be compacted fill.
- 7.17.3.3.3 All mains must be designed with a minimum clearance from the top of the pipe to the bottom of the channel of 5 feet, or 1.5 multiplied by the outside diameter of the pipe, whichever is greater.

7.17.4 Trenchless Construction

- 7.17.4.1 Construction by other than open cut are methods used for reclaimed water main placement under restrictive conditions when open cut construction is not feasible. Only straight pipe alignments for both horizontal and vertical alignment are allowed.

7.17.4.2 Auger Boring

- 7.17.4.2.1 Engineers must consider the location, size and depth of boring and receiving pits when choosing the beginning and ending stations for boring. A bore pit typically exceeds 20 feet in length to accommodate one joint of pipe. Bore pit width varies depending on the depth and size of pipe, with the narrowest width approximately 5-7 feet.

- 7.17.4.2.2 Auger Boring shall be designed in accordance with the City's *Standard Construction Specifications and Details*. The anticipated size and location for all bore pits must be included in the design for the main and shown on the drawings. Launching pits shall be located at the lower elevation end of the tunnel.

- 7.17.4.3 *Other Trenchless Construction* – When traditional auger boring is not feasible for the construction of the improvements, other trenchless methods of construction such as hand tunneling shall be designed by the engineer in accordance with City's *Standard Construction Specifications and Details*. Any designs not meeting these requirements, such as, but not limited to, micro-tunneling, open shield pipe jacking, and horizontal directional drilling, will require submittal of design and technical specifications to the City.

7.17.5 Elevated Crossings

7.17.5.1 Elevated crossings for reclaimed water mains should be avoided. Elevated crossings create special design problems in which no set of circumstances is duplicated from one design to another. Two methods of elevated crossings acceptable to the City are:

- 7.17.5.1.1 Hanging the reclaimed water main on a roadway bridge; or
- 7.17.5.1.2 Designing a specific utility bridge for the support of the reclaimed water main crossing.

7.17.5.2 All elevated crossings must satisfy all the following criteria:

- 7.17.5.2.1 Documentation approving the placement of the main on the bridge must be provided to the City.
- 7.17.5.2.2 Thrust restraints are required at the points of transition from a buried conduit to an elevated conduit and for all elevated changes of alignments and fittings.
- 7.17.5.2.3 The reclaimed water main must be fully restrained at changes in alignment and at fittings.
- 7.17.5.2.4 The design must adequately address increased loading effects on the bridge created by a full main and its supports.
- 7.17.5.2.5 Access to main for maintenance purposes must be included in the design.
- 7.17.5.2.6 Coatings or methods of corrosion control for elevated pipe sections and pipe supports must be included in the design.
- 7.17.5.2.7 PVC pipe shall not be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight.
- 7.17.5.2.8 The freeze potential of small diameter or low flow mains must be evaluated and the design must ensure that small diameter or low flow mains will not freeze.
- 7.17.5.2.9 To ensure positive restraint in all directions, each joint of pipe must have 2 support straps. Spacing of pipe supports must be in accordance with the length of pipe joints specified and one of the supports must be placed near the bell end of the pipe.
- 7.17.5.2.10 Air relief is required where high points are created in the main.



- 7.17.5.2.11 A minimum of one expansion joint fitting is required for a reclaimed water main crossing on a roadway bridge. Placement of the expansion joints must coincide with the expansion joints of the roadway bridge.
- 7.17.5.2.12 Reclaimed water main crossings shall include a valve on each side of the elevated crossing.
- 7.17.5.2.13 Proposed elevation of the main shall meet low chord bridge requirements and be at least 2 feet above the 100-year water surface elevation to prevent damage to the main.

7.18 PAVEMENT REPAIR

- 7.18.1 Mains designed to be placed within existing pavement shall contain provisions for pavement repair in accordance with the City of Fort Worth *Utility Construction Policy* as well as the City's *Standard Construction Specifications and Details*.



SECTION 8 – REQUIREMENTS FOR DRAWINGS

8.1 GENERAL PLAN SHEET REQUIREMENTS

- 8.1.1 The cover sheet must include the following information:
 - 8.1.1.1 Correct names and titles for the Mayor, City Manager, and Water Department Director.
 - 8.1.1.2 If the project affects other organizations, such as the Parks Department, another City or Governmental Agency, their names must be included
 - 8.1.1.3 Engineer's name, seal, and engineering firm name and registration number, in accordance with the Texas Board of Professional Engineers (TBPE) *Board Rules §137.33* and *§137.77*.
 - 8.1.1.4 Acceptable project name and project numbers, as approved by Infrastructure Plan Review Center (IPRC).
 - 8.1.1.4.1 Project numbers consist of:
 - 8.1.1.4.1.1 City Project Number;
 - 8.1.1.4.1.2 "X" Number; and,
 - 8.1.1.4.1.3 Water/Wastewater Fund Account Numbers.
 - 8.1.1.5 Location map in the center of the sheet.
 - 8.1.1.6 Project name and City Project Number on the right edge.
- 8.1.2 All cover sheets for Developer projects shall comply with the current version of the cover sheet template publicized by the City's Infrastructure Plan Review Center (IPRC).
- 8.1.3 Full size drawings shall be submitted on 22" x 34" paper for both paper and electronic submissions.
- 8.1.4 Scales are to be shown on each sheet, both numerically and graphically. The standard scale is as follows:
 - 8.1.4.1 Layout Sheets: 1 inch = 100 feet
 - 8.1.4.2 Profile Sheets: 1 inch = 4 feet vertical
 - 8.1.4.3 Plan Sheets: 1 inch = 40 feet horizontal
 - 8.1.4.3.1 A double scale is allowed if it would show the overall layout more clearly.

- 8.1.5 Water Department Capital Improvements Plan (CIP) project drawings must include a standard title block, shown below. For Developer projects the current version of the title block publicized by the City's Infrastructure Plan Review Center (IPRC) shall be used.

CITY OF FORT WORTH, TEXAS			
WATER DEPARTMENT			
PLAN & PROFILE			
DESIGNED :		SUBMITTED:	
REVIEWED:		RECOMMENDED:	
DESIGN:	SCALE	PROJECT NO.	SHEET
DRAWN:	DATE		OF
CHECKED:			

- 8.1.6 *Contact Information* – Contact information for City Project Manager, Texas811, electric, gas, and communication utilities shall be included in the City Standard General Notes as set forth in the City's *Standard Construction Specifications and Details*. Provide contact phone numbers for any other entities affected by the project such as TxDOT or Railroad.
- 8.1.7 Fort Worth standard symbols and abbreviations shall be used. Refer to **Section 8.3** (Water and Wastewater Main Plan and Profile Sheet Requirements) and **Section 8.4** (Standard Abbreviations) for standard abbreviation and drafting symbols.
- 8.1.8 *Benchmarks* – The location of all benchmarks (permanent or temporary) must be shown on the plan layout sheets.
- 8.1.8.1 The location of the nearest permanent benchmark must be described and the plans must indicate if the on-site benchmarks are temporary.
- 8.1.8.2 A minimum of 2 survey control points for each line segment shall be provided.
- 8.1.9 A copy of the recorded Final Plat, or Draft Horizontal Control Plan, of the project area must be included in the drawings for Developer projects.
- 8.1.10 A legend, scale, north arrow, and Tarrant Appraisal District map number shall be provided on each plan sheet.

- 8.1.11 Each sheet of the construction plans shall be sealed by a Licensed Professional Engineer in the State of Texas and include the engineering firm name and registration number, in accordance with the Texas Board of Professional Engineers (TBPE) *Board Rules §137.33* and *§137.77*.
- 8.1.12 All construction plans shall be submitted in black ink. Colored construction plans are not allowed.
- 8.1.13 Layout Sheet Requirements
 - 8.1.13.1 Layout sheets shall sufficiently show the entire scope of the project including fire hydrant coverage, main connections, isolation valves, wastewater flow direction in the project area, and bypass pumping operations.
 - 8.1.13.2 Separate layout sheets for all water and wastewater improvements shall be included in the plans.
 - 8.1.13.3 The following layout sheets, as appropriate for the project, shall be included in the construction plans:
 - 8.1.13.3.1 Sheet Index and General Notes;
 - 8.1.13.3.2 Control Point Layout (if applicable);
 - 8.1.13.3.3 Existing Water Main Layout;
 - 8.1.13.3.4 Existing Wastewater Main Layout (including lateral numbers);
 - 8.1.13.3.5 Proposed Water Main Layout (include Water Study number, if applicable; can be included on Proposed Water Main Layout sheet for Development projects);
 - 8.1.13.3.6 The pressure plane boundaries shall be identified;
 - 8.1.13.3.7 Water sampling stations/locations shall be identified;
 - 8.1.13.3.8 A water sampling table with calculations of water testing in accordance with **Section 5.19** (Water Sample Stations and Sampling Locations) shall be provided.
 - 8.1.13.3.8.1 Cleaning pig insertions, cleaning wyes, and sample locations shall be provided;
 - 8.1.13.3.9 Proposed Wastewater Main Layout (include Wastewater Study number, if applicable; can be included on Proposed Wastewater Main Layout sheet for Development projects);

- 8.1.13.3.10 Water Main Abandonment Layout (can be included on Proposed Water Main Layout sheet for Development projects);
- 8.1.13.3.11 Wastewater Main Abandonment Layout (can be included on Proposed Wastewater Main Layout sheet for Development projects);
- 8.1.13.3.12 Existing and Proposed Easements with recording information (if applicable);
- 8.1.13.3.13 Wastewater Bypass Pumping (if applicable); and
- 8.1.13.3.14 Water Main Shutdown and Construction Sequence (if applicable).

8.2 SURVEY REQUIREMENTS

8.2.1 Horizontal and Vertical Control

8.2.1.1 *Horizontal Control Datum* – North American Datum of 1983 (NAD83) as defined by National Geodetic Survey (NGS) shall be used.

8.2.1.1.1 North Central Zone coordinates for City of Fort Worth, Texas shall be provided.

8.2.1.2 *Vertical Control Datum* – Existing City of Fort Worth vertical datum (NAVD88), as defined by NGS shall be provided.

8.2.1.2.1 Set temporary benchmarks at a minimum of every 1,000 linear feet for construction.

8.2.2 A survey of the proposed main location, along with alternate locations, shall be provided and shall include the following:

8.2.2.1 Baseline/route surveys showing relationship between Property corners and proposed water/wastewater main centerline.

8.2.2.1.1 Provide sufficient detail to properly locate the proposed main on the preliminary plan sheet and to determine the number of properties involved for securing the necessary Right-of-Way and easements.

8.2.2.1.2 For existing water mains and appurtenances, provide survey of topographic features such as existing water meters, water valve covers, vaults, lids, blow off valve manhole rim elevations.

- 8.2.2.1.3 For existing wastewater mains and appurtenances, a survey of topographic features such as existing wastewater manhole rim elevations, junction structures shall be provided.
- 8.2.2.1.4 Provide survey for any other pertinent topographic features such as, but not limited to: Property corners, buildings/structures, pavement type, driveways, road signs, signal poles and boxes, franchise or other utility appurtenances, channels, outfall structures, culverts, storm drain inlet/manhole rims, storm drain junction structures, trees, fences, and gates.
- 8.2.2.2 *Width Limits of Survey* – The width of a topographic survey shall be as follows:
 - 8.2.2.2.1 *Alignments outside of City Right-of-Way* – 10 feet beyond required easement width in accordance with **Section 3.9** (Standard Easements).
 - 8.2.2.2.2 *Alignments within City Right-of-Way* – 10 feet beyond the Right-of-Way width.
- 8.2.2.3 A profile survey showing:
 - 8.2.2.3.1 Field-determined elevation of any existing manhole invert, stub, or wastewater main to which the proposed wastewater lines is to connect;
 - 8.2.2.3.1.1 Provide existing manhole and wastewater main material/size.
 - 8.2.2.3.2 Top of nut elevation for existing water valves, and water main elevation to which the proposed water main is to connect.
 - 8.2.2.3.3 Elevation of crossings for water mains, wastewater mains, or any other utility crossing.
 - 8.2.2.3.4 Elevation of the ground at centerline of the proposed main at each station, half station and/or ground break.
 - 8.2.2.3.5 For wastewater mains outside of Right-of-Way provide ground elevations 100 feet left and right of centerline at each station.
 - 8.2.2.3.6 Elevation at any draw, creek, depression, pond, lake or water course within any portion of the centerline at intervals not to exceed 10 feet, with proper reference made as to location with respect to centerline.

8.2.2.3.7 Survey for wastewater services –elevation of service stub-out of each existing house or building to be served directly by the main.

8.2.2.3.7.1 In case service stub is not available, finish floor or basement elevation shall be shown at the front and back of the house.

8.2.2.3.7.2 Properly locate the existing house and points of elevation taken with relation to centerline

8.3 WATER AND WASTEWATER MAIN PLAN, PROFILE, DETAIL, AND EASEMENT SHEET REQUIREMENTS

8.3.1 General

8.3.1.1 All mains requiring plan and profile drawings shall be shown within a combined plan and profile drawing with the plan sheet at the top half of the sheet and the profile view at the bottom half of the sheet.

8.3.1.1.1 Water and wastewater main plan and profile sheets shall not be combined on the same sheet.

8.3.1.2 All water and wastewater sheets shall include the Water/Wastewater Study Number, if applicable.

8.3.1.3 Stationing in the plan and profile drawings must align together at the left of the page.

8.3.1.4 Identify the following existing and proposed features in the plan and profile view:

8.3.1.4.1 Trees, landscaping;

8.3.1.4.2 Monuments, signs, street lights, signals, signal boxes, sign poles, and any other roadway appurtenances;

8.3.1.4.3 Franchise and non-franchise utilities and appurtenances such as, but not limited to, water mains, wastewater mains, public and private storm drains, gas lines, underground cables, electric, telecommunication wires, poles, meter boxes, vaults, valves, manholes;

8.3.1.4.4 Pavement, access roads, curbs, gutters, driveways;

8.3.1.4.5 Label street names, Right-of-Way and pavement widths, types of surfacing;

8.3.1.4.6 Structures, railroad tracks, buildings;

- 8.3.1.4.7 100-year floodplain and floodway;
- 8.3.1.4.8 Rivers, levees;
- 8.3.1.4.9 Right-of-way, easements;
- 8.3.1.4.10 Street centerline; and
- 8.3.1.4.11 Existing and proposed finish ground profile.
- 8.3.1.5 Locate any applicable approved design of proposed construction which may be pertinent to the design of the project.
- 8.3.1.6 Texas coordinate system information shall be provided in addition to stationing on plan or profile sheet.
- 8.3.1.7 Contour lines on a minimum basis of 2-foot intervals must be included as necessary for clarification of design.
- 8.3.1.8 Include “Warning to the Contractor” note requiring the location of any utilities 48 hours prior to any execution on each sheet.
 - 8.3.1.8.1 Provide caution notes for overhead and underground utilities.
- 8.3.1.9 Include notes to reconstruct any driveways, sidewalks, ramps, parking lots, fences, or other Property affected by design.
- 8.3.1.10 Provide notes pertinent to connections with existing water and wastewater mains.
- 8.3.1.11 Label the proposed surface repair for each disturbed area.
- 8.3.1.12 Bold all proposed mains, appurtenances, and Service Lines.
- 8.3.1.13 For proposed and existing mains, label the main size and material. Include flow direction for all wastewater mains.
- 8.3.1.14 Auger Boring and Hand Tunneling
 - 8.3.1.14.1 Label the size of steel casing or tunnel liner plate and reference appropriate specifications and details in accordance with the City’s Standard Construction Specifications and Details.
 - 8.3.1.14.2 Include stationing callout for each beginning and end of the bore in the plan and profile view.
 - 8.3.1.14.3 Show the location and size of bore pits (launching and receiving) and dimensions on the plan view.

8.3.1.15 Utility Crossings

8.3.1.15.1 Include all existing utility crossings on the proposed water and wastewater main profiles.

8.3.1.15.2 For water mains that are required to be lowered to cross beneath public or private storm drain or wastewater mains, reference City's Standard Water Line Lowering Detail on the plan view drawing in accordance with the City's Standard Construction Specification and Details.

8.3.1.15.3 Provide a water lowering table for more than 5 crossings beneath storm drains.

8.3.1.16 Dimension distance from the centerline of the main to the Right-of-Way or easement line.

8.3.1.17 For Urban Infill/redevelopment or Capital Improvement Projects (CIP), dimension water/wastewater services from the Property line, or provide stationing.

8.3.1.18 Show backflow prevention devices or public manholes and delineate the portion of work that is public and the portion that is private, when applicable.

8.3.1.19 *Main Connections* – Label the existing main with the City Project Number, "X" Number, size, and material at the Point of Connection.

8.3.1.19.1 For connections to infrastructure not yet constructed, include a label stating, "NOT EXISTING INFRASTRUCTURE", the Development phase name, and City Project Number

8.3.1.20 Show surrounding Property owner information, including public access easements and ownership.

8.3.1.21 Show and label TxDOT and railroad Right-of-Way, if applicable.

8.3.1.22 Show key map.

8.3.1.23 Show existing water and wastewater mains for street improvement projects and call out to adjust manhole, gate valve boxes, meter boxes, and valve vaults to the proposed finish grade.

8.3.1.24 Show enlarged detail of multiple service connections (i.e. domestic, irrigation and Fire Line services) for commercial and single-family Development.

8.3.1.25 All callouts and text shown on the construction plans shall be legible and shall not overlap other callouts.

8.3.2 Water Main and Service Lines – Plan Sheets

8.3.2.1 Show individual stationing for all water appurtenances (fittings, valves, fire hydrants, services, blow off valves, air release valves, flushing devices, meters, etc.).

8.3.2.1.1 Stationing shall start at 0+00 for proposed mains.

8.3.2.2 For mains less than 12 inches that are not profiled, call out the clearance required between the top of water main and bottom of all utility crossings.

8.3.2.2.1 The City's Standard Water Line Lowering Detail must be completed and included in the drawings for any proposed crossings beneath storm drain or wastewater mains.

8.3.2.2.2 Call out top of pipe and bottom of pipe crossing elevations.

8.3.2.3 *Curve Data* – Curve data (if applicable) shall be provided including, but not limited to, stationing, point of curvature, point of tangency, and radius.

8.3.2.4 Label existing and proposed water services with the meter size, Service Line size, and the type of service (domestic, irrigation, or fire).

8.3.2.5 Show and call out all existing and proposed (by others) backflow preventers/double detector check valves. Reference **Section 5.21** (Backflow Protection) for requirements.

8.3.2.6 Pressure Planes

8.3.2.6.1 For water mains located within a pressure plane that it is not serving, label the water main with its appropriate pressure plane.

8.3.2.6.2 Identify any existing or proposed pressure plane valve, including the appropriate symbol.

8.3.2.6.2.1 Include a note on the drawings that all proposed pressure plane valves shall remain closed at all times.

8.3.2.6.3 Show pressure plane boundaries, as appropriate.

8.3.2.7 *Bends* – Call out all bends with standard manufactured fittings and note deflection angle in degrees.

8.3.2.8 Cleaning Wyes

8.3.2.8.1 Indicate cleaning wyes required and show the location with the station number.

8.3.2.8.2 Indicate the station number where poly pigs are inserted and removed to verify location of additional fittings required.

8.3.2.9 Service Lines

8.3.2.9.1 Show locations of all existing and proposed services and meters (domestic, fire, irrigation). Refer to **Section 5.5.1.4** (Meters) for buffer clearance requirements.

8.3.2.9.2 Show the number of services and the type installed and/or replaced on each sheet.

8.3.2.9.3 Multiple domestic, or irrigation services lines within a small area shall be shown in a separate, enlarged detail for clarity.

8.3.2.10 *Water Main Connections* – Show the existing water system within the immediate area to show how new mains will connect to the existing.

8.3.2.10.1 Call out the type of connection proposed for the installation, such as remove plug and connect, cut-in tee, tapping sleeve and valve, etc.

- Include existing main information such as shop drawing information (if applicable).
 - Label any meters required to be abandoned as part of the project.
 - Show and label all existing Fire Line services that will be impacted during shutdown for main connection.
 - Show, or note, location of isolation valves on existing mains.
 - Review shut-out limits to determine extent of Property owner notification required. Include appraisal district addresses for affected Property owners.
- If temporary water services will be required for construction, show or note the limits of the temporary services and include references to the applicable City *Standard Construction Specifications and Details*.

8.3.3 Water Main – Profile Sheets

8.3.3.1 A profile is required for all water mains 12-inch, or larger.

8.3.3.1.1 Profiles are required for 8-inch, or smaller, water mains, 4-inch and larger water meter Service Lines, and long water services when the water main or Service Line does any of the following:

- 8.3.3.1.1.1 Crosses a congested corridor;
- 8.3.3.1.1.2 Includes one or more creek crossings;
- 8.3.3.1.1.3 Is to be installed by some method other than open cut crossings;
- 8.3.3.1.1.4 Crosses a stormwater box culvert;
- 8.3.3.1.1.5 Crosses a railroad Right-of-Way;
- 8.3.3.1.1.6 Crosses TxDOT Right-of-Way;
- 8.3.3.1.1.7 Crosses a gas lines; and/or
- 8.3.3.1.1.8 Other circumstances requiring special design considerations.
- 8.3.3.2 Call out beginning and end stationing for water main.
- 8.3.3.3 Provide stationing and show all gate valves, air release valves, blow-off valve outlet, vaults, fittings, and grade changes. References must be included for each appurtenance to its respective City *Standard Construction Detail*.
- 8.3.3.4 Show percent grade and top of pipe elevations for existing and proposed mains.
- 8.3.3.5 Show water valve vaults for mains 16-inch, or larger, and ensure that all gate valves are placed on a level grade.
- 8.3.3.6 Label and show all utility crossings.
 - 8.3.3.6.1 Show outside diameter and elevation for any existing or proposed storm drain crossing. Reference **Section 8.3.1.15** for requirements.
 - 8.3.3.6.2 Encroachment agreements must be executed for all crossings over water mains in accordance with **Section 3** (Policy).
- 8.3.3.7 Profile all water mains crossing channels, creeks, rivers, and detention ponds, regardless of size.
 - 8.3.3.7.1 Label encasement, casing, rip rap, channels, creeks, or detention ponds.
- 8.3.4 Encroachment agreements must be executed for all crossings over water mains in accordance with **Section 3** (Policy). Wastewater Main and Service Lines – Plan Sheets

- 8.3.4.1 Show individual stationing for all wastewater appurtenances (manholes, junction structures, air release valves, flushing device connections, wastewater access devices,).
- 8.3.4.2 Main Stationing
 - 8.3.4.2.1 Station wastewater mains beginning at 0+00 from downstream to upstream. If continuing an existing wastewater main, use the existing main end stationing as the beginning station.
 - 8.3.4.2.1.1 Stationing must read from left to right on the plan sheet and be from downstream to upstream.
 - 8.3.4.2.2 Existing stationing on relocations and rehabilitations shall be used when intercepting the existing line.
 - 8.3.4.2.3 Existing wastewater main stations shall be shown at the Point of Connection.
 - 8.3.4.2.4 Provide station equations for connections to proposed or existing wastewater mains.
- 8.3.4.3 Flow direction arrows must be shown for all wastewater mains.
- 8.3.4.4 Service Lines
 - 8.3.4.4.1 Existing wastewater Service Lines that are relocated shall include a service relocation plan, including cutting and plugging existing services, if required.
 - 8.3.4.4.2 Wastewater Service Lines shown on wastewater mains must have wastewater main stationing or dimensions from the Property line.
- 8.3.4.5 Label and provide stationing for all manholes and junction structures.
 - 8.3.4.5.1 Include reference to City Standard Construction Specifications and Details for manhole lining requirements, if applicable.
- 8.3.4.6 If a water main flushing device contains a direct connection to a sewer manhole, the connection must be labeled on the wastewater main plan view.
- 8.3.4.7 Show an enlarged detail for fire hydrant and gate valve locations at street intersection (for residential subdivision Development).
- 8.3.4.8 Show an enlarged detail of ring connections.

8.3.5 Wastewater Main – Profile Sheets

8.3.5.1 Profile all wastewater mains.

8.3.5.1.1 Profiles are required for wastewater Service Lines crossing congested corridors, or gas lines, requiring special design considerations.

8.3.5.2 Profile from the left to right from the lowest flow line to the highest flow line elevation.

8.3.5.3 For 12-inch mains and larger, indicate the capacity, in millions of gallons per day, required and provided.

8.3.5.4 Identify manholes by station and line designation. Provide rim elevations. Show the flowline in and flowline out for manhole inverts, and reference manhole lining requirement in **Section 6.9** (Manholes) and *City Standard Construction Specifications and Details*, if applicable.

8.3.5.4.1 For manholes constructed within pavement, provide $\pm$ rim elevations and provide a note that the contractor is responsible for matching the rim elevation to the existing/proposed pavement surface.

8.3.5.5 Profiles shall show parallel storm drain facilities.

8.3.5.6 Profiles shall show all water main, storm drain, and/or utility crossings and the separation from the wastewater main.

8.3.5.7 Encroachment agreements must be executed for all crossings over wastewater mains in accordance with **Section 3** (Policy).

8.3.5.8 Call out any special or unusual backfill or embedment such as concrete encasement, select fill, cement stabilized sand (CSS), or controlled low strength material (CLSM).

8.3.5.9 Show proposed footings, retaining walls, piers, and any other structures.

8.3.5.10 Show datum elevations,

8.3.5.11 Call out floodplain, 100-year water surface elevations, and floodway (if applicable) on the profile.

8.3.5.11.1 Show and label the top and toe of banks of creeks in addition to flowlines,

8.3.5.12 Show the capacity of the pipe, design flow and velocity provided.

8.3.5.13 Show the percent grade and top of pipe elevations for existing and proposed mains.

8.3.5.14 Show station equation callout when connecting to existing sewer main.

8.3.6 Water and Wastewater Details

8.3.6.1 Provide only applicable standard details in accordance with the City *Standard Construction Details* related to the project.

8.3.6.2 All detail sheets provided in the construction plan set shall be comprised of at least one detail and a maximum of eight details to ensure that the details are not too small and all details are legible. This is dependent on the orientation and size of each detail.

8.3.6.3 A backfill, embedment and surface detail assembly for all water/sanitary sewer mains and services to be constructed shall be provided on the construction plans.

8.3.6.4 Provide a utility location and lot service detail, if applicable.

8.3.6.5 Provide a detail for any non-standard installations such as specialized junction structures or vaults.

8.3.7 Easements

8.3.7.1 Show and label existing and proposed easements.

8.3.7.1.1 Provide the instrument number for easements by separate instrument.

8.3.7.2 Identify any areas where Encroachment Agreements are required.

8.3.7.2.1 Encroachment agreements must be executed for all crossings over water or wastewater mains in accordance with **Section 3** (Policy).

8.3.7.3 Show and label adjacent city limit boundaries.

8.3.7.4 Delineate temporary construction and permanent easements on the drawings.

8.3.7.4.1 Include the affected Property owner's name and easement reference designation.

8.3.7.4.2 Include copies of executed easements in the Appendix of the Project Manual as part of the Special Conditions of the City's Standard Construction Specifications.

8.3.7.5 When crossing private Property, show the easement and Property owner.



8.3.7.5.1 Easements required for proposed stub outs that are not included on the proposed plat shall be included by separate instrument. Label recording information for easements by separate instrument.

8.3.7.6 Call out easements for any lines under future pavement.

8.3.7.7 *Easement Recording Information* – Recording information for any easements obtained for the project should be included in the drawings. If not recorded prior to issuance of construction drawings, easement recording information shall be included on the record drawings provided to the City prior to Final Inspection in accordance with the City's *Standard Construction Specifications*.

8.3.8 Project Closeout

8.3.8.1 Before project closeout, the Engineer shall provide record drawings in accordance with Division 01 of the City's *Standard Construction Specifications*.

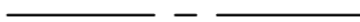
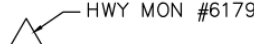
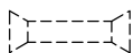
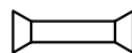
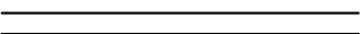
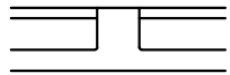
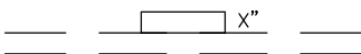
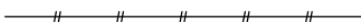
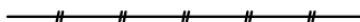
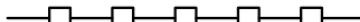
8.4 STANDARD ABBREVIATIONS

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STANDARD ABBREVIATIONS			
∠	ANGLE	LF	LINEAR FOOT
Δ	DELTA ANGLE	MH	MANHOLE
ARV	AIR RELEASE VALVE	MAX	MAXIMUM
AC	ASBESTOS - CEMENT	MJ	MECHANICAL JOINT
AFD	AUTOMATIC FLUSHING DEVICE	MIN	MINIMUM
ARV	AIR RELEASE VALVE	OHE	OVERHEAD ELECTRIC CABLE
BO	BLOW OFF	OHT	OVERHEAD TELEPHONE CABLE
BFV	BUTTERFLY VALVE	PE	PLAIN END
CI	CAST IRON	PCC	POINT OF COMPOUND CURVE
CL	CENTERLINE	PC	POINT OF CURVE
CONC	CONCRETE	PRC	POINT OF REVERSE CURVE
DM	DEAD MAN	PT	POINT OF TANGENCY
DI	DUCTILE IRON	PP	POLYPROPYLENE PLASTIC
ESMT	EASEMENT	PVC	POLYVINYL CHLORIDE PLASTIC
ELEV	ELEVATION	PP	POWER POLE
FRP	FIBERGLASS REINFORCED PIPE	RC	PRE-CAST REINFORCED CONCRETE
FOC	FIBER OPTIC COMPONENTS	PPV	PRESSURE PLANE VALVE
FH	FIRE HYDRANT	RCCP (C-301)	PRE-STRESSED CONCRETE CYLINDER (C-301)
FL	FIRE LINE	RCCP (C-303)	PRE-STRESSED CONCRETE CYLINDER (C-303)
FLG	FLANGE	R	RADIUS
FL	FLOWLINE	RCW	RECLAIMED WATER
GKT	GASKET	RT	RIGHT
G	GAS LINE	ROW	RIGHT OF WAY
GM	GAS METER	SL	SAMPLE LOCATION
GV	GATE VALVE	SS	SANITARY SEWER
GCD	GENERAL CONTRACT DOCUMENTS	STA	STATION
GP	GRINDER PUMP	SD	STORM DRAIN
GL	GROUND LINE	T	TANGENT
HDPE	HIGH DENSITY POLYETHYLENE	UE	UNDERGROUND ELECTRIC CABLE
HORIZ	HORIZONTAL	UT	UNDERGROUND TELEPHONE CABLE
IAW	IN ACCORDANCE WITH	VERT	VERTICAL
IAB	IN ALLEY BETWEEN "STREET" AND "STREET"	VCS	VITRIFIED CLAY (EXTRA STRENGTH)
IEB	IN EASEMENT BETWEEN "STREET" AND "STREET"	VC	VITRIFIED CLAY (STANDARD STRENGTH)
IP	IRON PIN/PIPE	WAD	WASTEWATER ACCESS DEVICE
IPF	IRON PIN/ROD FOUND	W	WATER
IPS	IRON PIN/ROD SET	WM	WATER METER
LT	LEFT	WSS	WATER SAMPLE STATION

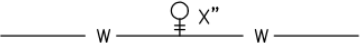
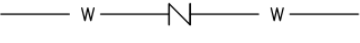
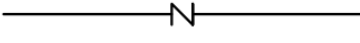
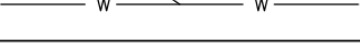
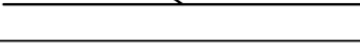
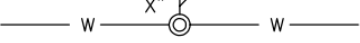
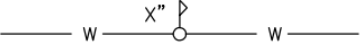
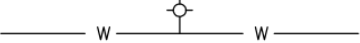
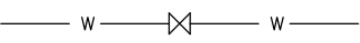
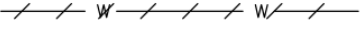
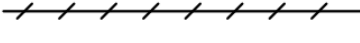
8.5 STANDARD DRAFTING SYMBOLS

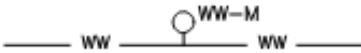
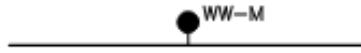
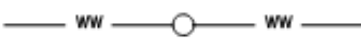
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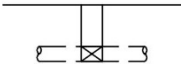
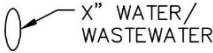
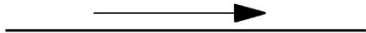
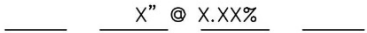
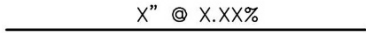
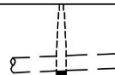
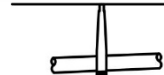
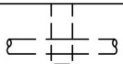
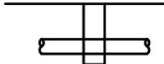
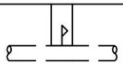
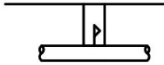
GENERAL DRAFTING SYMBOLS		
	EXISTING	PROPOSED
BENCHMARK		
BLOCK LINE		
CENTERLINE		
CITY OR HIGHWAY MONUMENT		
CONCRETE CULVERT (RCCP)		
CONCRETE CURB AND GUTTER		
CONCRETE DRIVEWAY AND SIDEWALK		
CONCRETE INLET AND SIZE		
CREEK		
EASEMENT		
EDGE OF PAVEMENT		
FENCE (BARBED)		
FENCE (CHAIN LINK)		
FENCE (OTHER)		
FENCE (WOOD)		
GAS LINE		



GENERAL DRAFTING SYMBOLS		
	EXISTING	PROPOSED
GEOTECHNICAL BORING LOCATION		
GUY WIRE		
IRON PIN/ROD AND SIZE		
LOT LINE		
UTILITY METERS		
OVERHEAD ELECTRIC CABLE		
OVERHEAD TELEPHONE CABLE		
POWER POLE		
STORM DRAIN		
SURVEY LINE		
UNDERGROUND ELECTRIC CABLE		
UNDERGROUND TELEPHONE CABLE		

WATER AND WASTEWATER DRAFTING SYMBOLS - PLAN VIEW		
	EXISTING	PROPOSED
BLOW OFF AND SIZE WITH SUMP MANHOLE		
BUTTERFLY VALVE		
CHECK VALVE		
CLEANING WYE		
CLOSURE SECTION		
COMBINATION AIR RELEASE VALVE AND ACCESS MANHOLE		
COMBINATION AIR RELEASE VALVE AND SIZE		
CRADLE BLOCKING		
FIRE HYDRANT		
GATE VALVE		
GATE VALVE (16-INCH AND LARGER)		
HORIZONTAL BLOCKING		
ABANDONED MAIN		

WATER AND WASTEWATER DRAFTING SYMBOLS - PLAN VIEW		
	EXISTING	PROPOSED
CATHODIC PROTECTION TEST STATION		
PLUG		
REDUCER		
PRESSURE PLANE VALVE		
SAMPLE LOCATION		
SOLID SLEEVE		
STEEL CASING		
THRUST BLOCKING		
VAULT		
VERTICAL TIE DOWN BLOCKING		
WASTEWATER CLEANOUT		
WASTEWATER MAIN		
WASTEWATER MAIN FLOW ARROW		
WASTEWATER MAIN FLOW METER		
WASTEWATER MANHOLE		
WATER MAIN		
WATER METER		

WATER AND WASTEWATER DRAFTING SYMBOLS - PROFILE VIEW		
	EXISTING	PROPOSED
BUTTERFLY VALVE		
CHECK VALVE		
GATE VALVE		
GATE VALVE IN VAULT		
UTILITY CROSSING		
WASTEWATER MAIN FLOW ARROW		
WASTEWATER MAIN FLOW LINE		
WASTEWATER MANHOLE		
WATER MAIN AND SIZE		
WATER MANHOLES – ACCESS MANHOLE AND SUMP MANHOLE		
WATER MANHOLES – COMBINATION AIR VALVE AND ACCESS MANHOLE		
UTILITY LOCATION BASED ON SUE LEVEL A		
UTILITY LOCATION BASED ON SUE LEVEL B		
UTILITY LOCATION BASED ON RECORD DRAWINGS		
UTILITY LOCATION IS UNKNOWN		

SECTION 9 – WAIVER PROCESS

9.1 REQUEST FOR WAIVER

- 9.1.1 Any deviations from the policies and procedures in this manual require a waiver to be approved by the City. All requests for waivers must be in writing and submitted with a cover letter accompanied by the Request for Waiver Form included in **Section 9.4** (Request for Waiver Form).
 - 9.1.1.1 The cover letter shall include all pertinent information on the facilities involved or to be involved. The request shall state specifically the portion of the policy or design standards for which a waiver is sought and include a justification for which the waiver is requested.
 - 9.1.1.2 The Request for Waiver Form shall be submitted with the cover letter and be filled out completely with exception of the portions noted as “For Use by City”.
 - 9.1.1.3 A scaled, detailed engineering drawing shall be attached to every Request for Waiver Form.
- 9.1.2 A grant of an alternative material, design, or method of construction shall not affect, nor relieve, the Engineer of the obligation and responsibility for the alternative material, design, or method of construction.
- 9.1.3 All waiver requests require Water Department Staff or Development Services – Water Section Staff recommendation and Development Services - Water Section Staff or Water Department Director and Development Service Directors approval.
- 9.1.4 *Waiver Expiration* – Approved Waivers shall expire 1 year from the date of approval if construction has not commenced on the project.
 - 9.1.4.1 *Waivers for CFA Projects* - A CFA must be executed within 6 months of approval of the waiver request. Otherwise, an additional request for waiver shall be submitted for approval by the City.

9.2 CRITERIA FOR GRANTING OF WAIVER

- 9.2.1 An Engineer who wishes to request a waiver regarding the design of Public Facilities may do so as long as the request, if granted:
 - 9.2.1.1 Is not detrimental to the public welfare;
 - 9.2.1.2 Does not adversely impact the operations of the system or the Public Facility in question;
 - 9.2.1.3 Is supported by a signed and sealed engineering analysis performed by a Licensed Professional Engineer in the State of Texas, if requested by the Water Department; and



- 9.2.1.4 Is not based solely on financial interests. The burden of proof shall be on the Developer/single Property owner to show exceptional hardship.

9.3 ADDITIONAL REQUIREMENTS FOR APPROVAL OF WAIVER

- 9.3.1 If in the event the City grants the waiver, the City may also require:
 - 9.3.1.1 The execution of an indemnity agreement by the Developer/single Customer Property owner. The form of the indemnity agreement shall be determined by the City and at a minimum, shall be recordable so as to run with the land;
 - 9.3.1.2 A written agreement that the City will not be responsible for any damages arising out of the granting of the waiver. The form of the agreement shall be determined by the City, and at a minimum, shall be recordable so as to run with the land; and/or
 - 9.3.1.3 Such other documents; in the discretion of the City, are deemed to be required.



9.4 REQUEST FOR WAIVER FORM

WATER DEPARTMENT POLICY/DESIGN STANDARDS REQUEST FOR WAIVER FORM

TO: Water Department Director _____

PROJECT NAME/ADDRESS: _____

PROJECT/PERMIT NUMBER: _____ DATE: _____

We hereby submit for your consideration the following waiver request for the above project:

<u>SECTION NUMBER/TITLE</u>	<u>SUBSECTION</u>	<u>DESCRIPTION</u>
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Proposed Waiver: _____

Reason for Waiver Request: _____

Include cover letter, construction sheets & other supporting documentation, describe or reference here. Justification request must meet all requirements set forth in **Section 9**

Requested By:

Printed Name _____

Signature _____

Firm _____

Address _____

Date _____

Email _____

Phone _____

For Use by Development Services Water Section:

Variance Log Number: _____

____ Recommended for approval

____ Recommended for approval with exceptions

____ Not recommended

Water Department

Staff Recommender _____

Signature _____

Date _____

Remarks _____

For Use by Water Department:

Signature _____

(Water Department Director)

Date _____

Signature _____

(Development Services Director)

Date _____



APPENDIX A – WATER AND SEWER STUDY GUIDELINES

A



WATER & SEWER STUDY GUIDELINES

**Water Department
City of Fort Worth**

August 2026

1. General Guidelines

A Water and Sewer Study of the immediate and surrounding area of Development is needed to evaluate the adequacy of existing and proposed facilities for present and future needs. This document is meant to serve as a general guideline for preparing and submitting demand/loading & layout and comprehensive studies. Every Study is unique; therefore, this guide is not designed to incorporate all possible design approaches. An application of sound judgment is necessary in preparing the comprehensive Study. A list of major goals that each Study must accomplish is provided below.

Major Study Goals:

- Describe the existing conditions and show the proposed facilities
- Calculate the demand/loads expected to be generated by the proposed Development
- Demonstrate the impact of the proposed Development
- Describe the potential issues associated with the proposed Development (if there are any) or demonstrate that the existing system is not likely to be impacted by the proposed Development
- Provide figure (s) and table (s) summarizing the existing conditions, identifying problems (i.e., potential issues) and proposed solutions
- Show how adjacent undeveloped properties are not blocked from future access to utilities (Please refer to the of "Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure" for more information.
- Provide recommendations for improvements needed to adequately serve the proposed Development
- Justify the water meter sizes and quantities are consistent with the Study demands

This guide recommends minimum requirements for submitting either a demand/loading & layout or comprehensive Study. Different approaches can be utilized as long as the primary goals of the demand/loading and Study are accomplished. However, required policies and procedures, i.e., design criteria, are not negotiable and must be used.

The demand/loading & layout and comprehensive studies serve the City of Fort Worth Water Department as a historical record of the assumptions and analysis methods utilized at the time the proposed Development is submitted. Please be sure to include any and all pertinent information that may not be known to future readers of this document. The document should be prepared as though the reader does not have any previous knowledge of the Development and any associated issues negotiated during the Development process.

2. Water and Sewer Loading & Layout Map

While this can be requested apart from performing an entire comprehensive water/sewer Study, these figures should be included as part of every comprehensive water/sewer (W/S) Study. General guidelines for preparing a water demand/sewer loading and layout map exhibits are provided below.

Goals:

- Provide overall summary of proposed water and sewer facilities.

DO include:

- Provide Color Coded water and sewer lines.
- Distinguish existing vs proposed lines.
- Demonstrate how the proposed system connects to the existing system
- Label Pipes, and Streets.
- Include a Vicinity Map with a North Arrow.
- Include W/S calculation table.
- PDF format of figures

DON'T include:

- Extraneous line layers
- Easements
- Non-Water/Sewer utility lines
- Storm water lines
- Street center lines
- Contours

3. Comprehensive Water and Sanitary Sewer Study Submittal

The comprehensive water and sanitary sewer Study submittal should consist of the scenario exhibits as discussed in Section 4 and Section 5. Include clearly labeled calculation result tables for the various modeling scenarios and an engineering-type report with a cover sheet signed and sealed by a licensed Professional Engineer currently licensed in the State of Texas. The Study shall be developed as an engineering report, including narrative, maps, layouts, exhibits, and other materials and should be submitted digitally as a single PDF document for review. The comprehensive Study report shall contain the following additional information:

- Hydraulic modeling software used in the analysis of water network, (e.g. InfoWater, WaterCad, H2Onet, H2Omap, EPANet2.0). All water model files should be submitted in (*.inp) format.
- A Map clearly identifying the site location with respect to nearby facilities.
- A Site Map for the immediate area of Development and the surrounding properties that includes the following:

✓ Topographical Information. ✓ Existing and proposed streets. ✓ Pressure plane (and boundaries if more than one pressure plane is involved). ✓ Drainage area (i.e., area from which wastewater flows).	✓ Location, alignment and size of the existing water/sewer that will provide service to the proposed Development. ✓ Legend. ✓ Scale and North arrow. ✓ Show potential sewer connection points for up gradient adjacent undeveloped parcels
---	---
- Phasing map identifying immediate and future phases of the proposed Development.
- Water and Sewer Study Loading & Layout Map (See Section 2)

The narrative portion of the Study report should include the following sections:

- Purpose and scope: Provide any necessary background information related to the project.
- Design criteria: Describe demand assumptions & site references
 - Verifiable citations from the current version of the “Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure”, the current version of the “International Building Code” adopted by the City and the current version of the “International Fire Code” adopted by the City that specify the type of construction and fire flow demand.



- Hydraulic Analysis: Discuss demand/load calculation, phasing, hydraulic analysis results, and the impact of the Development
- Figure(s): Exhibits of various scenarios, model network map (s) and site map(s)
- Recommendations: Final pipe size(s), slopes (sewer), alignments, special features such as pressure reduction valves, City required cost-participation, phasing of construction or any other aspect of the proposed Development that has direct bearing on the water and sewer service to the proposed Development. Contractual capacity or infrastructure obligations related to special utility districts, Development agreements, annexation requirements, or other agreements with the City should be referenced in the Study.

As a condition of receiving the approval letter, the engineering consultant shall submit the finalized digital copy of the report (or one bound hard copy) and water model files in (*.inp) format. The submittal should have (i) legal description of the project name, (ii) project address, (iii) Developer/owner's name and (iv) contact information of the consulting engineering firm that conducted the analysis and PE stamp.

4. Comprehensive Water Study

Assumptions, minimum system requirements for analysis and design criteria are extracted from the most recent version of “Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth.”

- In areas with high velocity, low pressure, or when the proposed Development projects a low water demand, the city may request a meter size and total meter count for the entire proposed Development. The meter size and count maximum flow rate shall be required to match the proposed demands in the Study.
- Please provide water demand calculation and phasing summary tables (see example below)

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Table 1. Summary of water demand calculation

Types of land use	Land areas (acre)	Population (persons)	Capita factor	Average Daily flow	Maximum Daily flow	Maximum Daily Flow + Fire flow	Maximum Hour flow	Design flow
				(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
Residential			3.5 persons per lot					
Multifamily			2.5 persons per unit					
Commercial			See design criteria					
School			60 – 75 students per acre					
Industrial			See design criteria					
Undeveloped (residential)			14 persons per acre					
Other			See design criteria					
Total								

Table 2. Phasing Summary

Development data (based on construction timeline)	Year 1	Year 5	Year 10	Built Out
Pressure plane				
Areas (acres)				
Population (persons)				
Average daily flow (gpm)				
Maximum daily flow (gpm)				
Fire flow (gpm)				
Design flow (gpm)				

For conditions or situations not addressed in City of Fort Worth Water Department Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth, please either contact City of Fort Worth Water Department (Water Planning) or refer to Title 30 Texas Administrative Code, Chapter 290 for rules regarding PUBLIC WATER SYSTEMS or 30 Texas Administrative Code, Chapter 217 for rules regarding DESIGN CRITERIA FOR DOMESTIC WASTEWATER SYSTEMS of the Texas Commission on Environmental Quality rules and regulations. These rules can be found at <https://www.tceq.texas.gov/rules/indxpdf.html>.

4.1 **Water Model Basics**

The water model was developed and is maintained using the Innovyze InfoWater software. A separate pressure plane specific model has been developed for each major Service Area (Northside, Southside, Westside, etc), which includes all the sub pressure planes as well. For example, the Northside water model includes Northside 2, 3, and 4. The South side model includes Southside 2, 3, and 4. This is provided to make it easier to analyze Developments that may be on the border of two pressure plane boundaries.

NO REVISIONS TO THE EXISTING PIPING NETWORK OR OPERATIONAL PARAMETERS IS ACCEPTABLE. Any revisions of existing network pipes, valves, or operating parameters will result in the Study being rejected and returned without review.

- I. Request the pressure plane specific water model from Fort Worth Water Department. Contact WPD@fortworthtexas.gov. Before every Study the applicant should check with Department to ensure the appropriate model is utilized.
- II. Existing model demands are Max Day Demands. Each existing demand in the model has a diurnal pattern specific to the overall water use pattern within each pressure plane. Existing wholesale water demands may be constant or have a demand pattern that reflects

their specific use pattern.

- III. Insert the proposed node demands as Maximum Day Demands. Apply the Development specific demand pattern shown at the end of Section 4. This pattern represents typical use patterns of new Developments and includes a 2.0 multiplier at the peak hour. Using this pattern allows the engineer to model maximum day demands as well as maximum hour conditions for proper sizing of pipes. For some industrial Developments, an alternate use pattern may be proposed if the engineer can show historical data from similar projects.
- IV. Fire flow will typically be 1,000 gpm for single family lot residential and 1,500 gpm for commercial and multi-family. The fire marshal may require an even higher flow rate depending on the type of Development and construction type. Fire flow duration is 3 hours. Use the fire flow diurnal pattern at the end of Section 4. Multiple locations may need to be tested and reported if there are multiple pressure planes serving the Development, multiple fire flow requirements (i.e. residential and commercial) and if there are multiple dead-end lines.
- V. Please include a copy of the diurnal patterns used in the Development (including the Fire Flow pattern) in the report.
- VI. Study for Phased Development: As for large Development with multiple phase construction, water and sewer Study requirements should meet the minimum standards for each phase of construction.
- VII. Hazen-Williams coefficient (C factor) should be assumed 130 for the proposed water lines.
- VIII. All water model files must be submitted in (*.inp) format

4.2 **Modeling Scenarios, Analysis and Exhibits**

The exhibits listed below are a minimum requirement for water comprehensive studies. Additional mapping may be required to demonstrate that the Study objectives (discussed in Section 1) are met. The maximum figure size shall be 11 X 17. Use different colors for pipes and nodes, and label them clearly.

When running the model simulations, the existing water model diurnal curves provided by the City shall not be edited or used for proposed Developments. Any proposed Developments shall use a unique, Development-only diurnal curve that represents the correct 2.0 multiplier for maximum hour required.

4.2.1 **Simulation #1 – Base Condition: Maximum Day Demand with Existing Developments**

- Run the existing model, and display results for all nodes and pipes in Exhibit 1.
- Provide Pipe and Node I.D.'s legibly on this map. Display the results for all the nodes and pipes for the minimum pressure experienced in the area being developed.
- The existing system network map (i.e., Exhibit 1, Existing Water System Network Map) shall include the project area and an appropriate radius around the project (typically

0.1 to 0.5 mile). For example, draw a 0.1 mile radius if the project is in or near a developed area. Draw at least a 0.5 mile radius around the project if the project is located in a rural area.

4.2.2 **Simulation #2: Maximum Day Demand with Proposed Development**

- Add the Maximum Day Demands (MDD) of the proposed system Development to the existing model.
- Assign the standard Development diurnal pattern (see end of Section 4) to the proposed demands. The standard pattern includes a 2.0 multiplier which represents maximum hour demand. Commercial patterns or industry specific patterns may be different than residential. If a pattern different from the standard pattern is proposed, include historical data based justification in the report as an appendix. A different pattern should be used only if maximum hour demand is larger than maximum day + fire flow demand.
- Adjust the proposed pipe sizes to eliminate any low pressure (lower than 40 psi), head loss above 5 ft/1000 ft, and velocity above 5 ft/s (for pipes 12-inches and smaller) and head loss above 7 ft/1000 ft, and velocity above 7 ft/s (for pipes 16-inches and larger).
- Run the model and analyze results. Report the minimum pressure, maximum velocity, and head loss obtained compared to the Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth.
 - Display minimum system pressure during 24 hours for all nodes in an exhibit including node Identification No. and corresponding pressure (i.e., Exhibit 2a).
 - Display maximum velocity and head loss during 24 hours for all pipes in an exhibit including pipe Identification No., corresponding pipe sizes, and corresponding velocity and head loss (i.e., Exhibit 2b).

4.2.3 **Simulation #3: Maximum Day + Fire Flow Demand with Proposed Development**

- Simulation #3 extends the work that was done in simulation #2. In the second simulation, the node with the lowest pressure in a well looped system (typically the highest elevation) shall be selected within the Development. This node is taken as the critical fire node and shall be used as the fire node to which the fire flow demand is applied. Some Developments with multiple pressure planes, multiple Development types or dead-end pipes may have to prove adequate fire flow performance at more than one junction.
- Assign the Fire Flow Development pattern to the proposed Fire Flow Demand applied to the fire node.
- Adjust the proposed pipe sizes to eliminate any low pressure (lower than 20 psi) and velocity above 10 ft/s in all pipes.
- For fire flow analysis, prepare mapping that shows the available pressure at each node and pipe velocity during the fire flow analysis with the full fire flow demand applied.
- Run the model and analyze results. Report the minimum pressure and maximum velocity obtained compared to the Installation Policy and Design Criteria for Water, Wastewater,

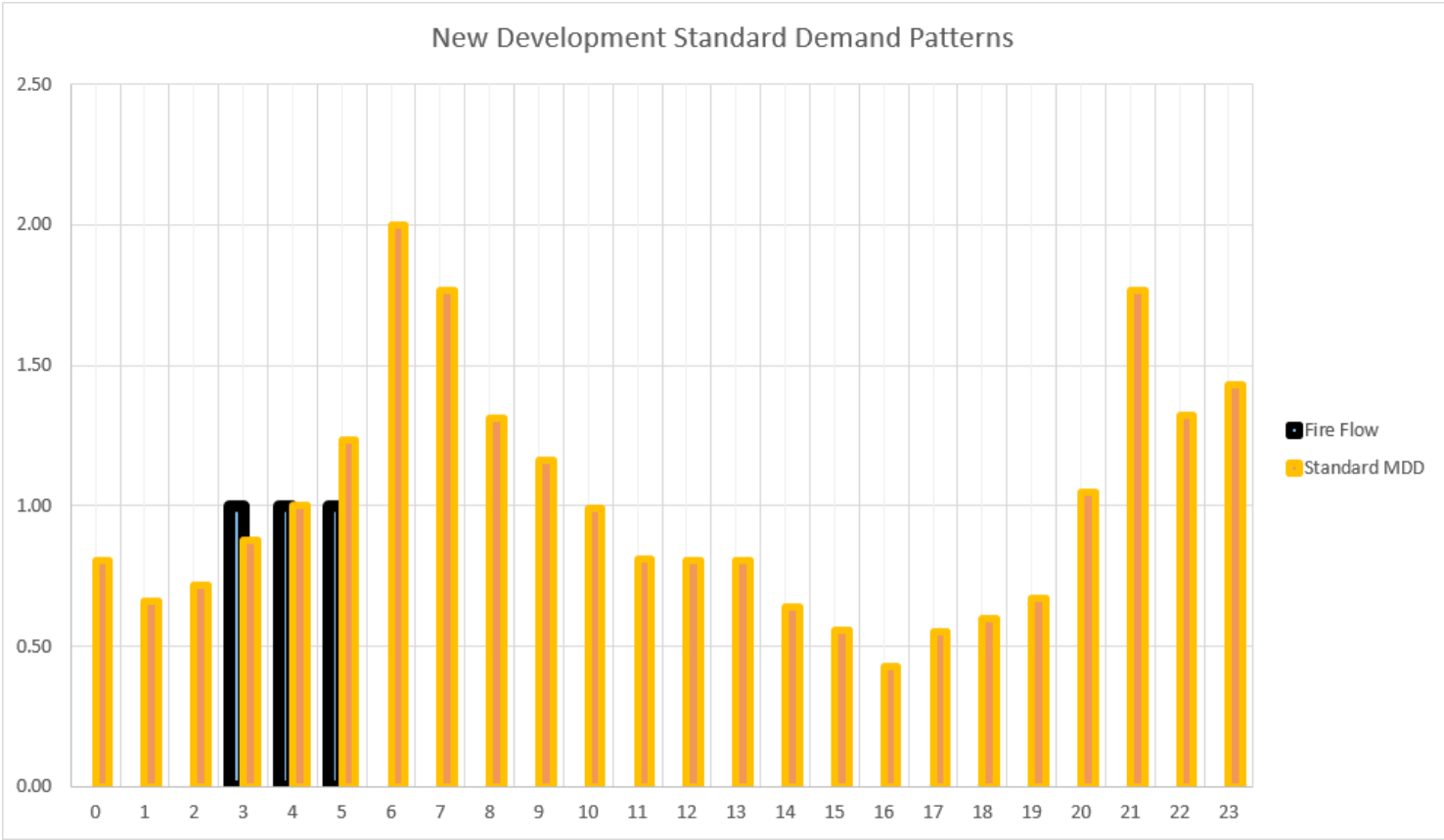


and Reclaimed Water infrastructure for City of Fort Worth.

- Display minimum system pressure during 24 hours for all nodes in an exhibit including node Identification No. and corresponding pressure (i.e., Exhibit 3a).
- Display maximum velocity during 24 hours for all pipes in an exhibit including pipe Identification No., corresponding pipe size, and corresponding velocity (i.e., Exhibit 3b).

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Standard MDD	Fire Flow
0.81	0.00
0.66	0.00
0.72	0.00
0.88	1.00
1.00	1.00
1.24	1.00
2.00	0.00
1.77	0.00
1.31	0.00
1.16	0.00
0.99	0.00
0.81	0.00
0.80	0.00
0.81	0.00
0.64	0.00
0.56	0.00
0.43	0.00
0.55	0.00
0.60	0.00
0.67	0.00
1.05	0.00
1.77	0.00
1.32	0.00
1.43	0.00



5. Comprehensive Sewer Study

Assumptions and minimum system requirements for analysis and design criteria are extracted from the Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth.

- Provide sewer load calculation and phasing summary table for existing, proposed and ultimate(if applicable) conditions (i.e., Table 1).
- Proposed Condition includes existing and proposed Developments, while Ultimate Condition includes proposed condition and off-site areas.

Table 1. Sewer Load Summary Table for each condition (Proposed and Ultimate)

Sub-Basin ID	Type of Land Use	Size of Basin	Dwelling Units	Population Per Dwelling Units/acres	Population Served	Sewer flow per capita (gpcd)	Average Flow	Peaking Factor	Peak Design Flow
		(acres)		(Persons/units)	(capita)		(gpm)		(gpm)
Total									

* Off-site area is not part of the Development, but its sewer flow is upstream of the proposed Development

Table 2. Sewer modeling results summary

Table 2. Sewer modeling results summary						
Beginning Design Point	Ending Design Point	Sewer Main ID	Sub-Basin Served		Cumulative Sub-basins Served	Cumulative Basin Size
						(acres)
Cumulative Population	Average Flow	Peaking Factor	Peak Flow	Proposed Pipe Size	Proposed Slope	Proposed Pipe Capacity
(capita)	(gpm)		(gpm)	(inches)	(%)	(gpm / MGD)

- Sewer Study includes domestic, industrial, or commercial sewer load (gpm) for the proposed area of Development and the surrounding properties.
- Sewer Study Includes total flow summaries for the overall Development by sub-basin for any existing/proposed/ultimate flows.
- Display design points, sewer lines and corresponding slopes in an exhibit (i.e., Exhibit 1).



6. Conclusion and Recommendations

Discuss and summarize the results and findings. Propose the final pipe sizes, system deficiency, water and sewer system improvements (Pump stations, Lift stations, etc.) and requirements for Developments with multiple phase construction, if applicable.

Water and Sewer Study Submission

Water Planning, Strategic Developments and Asset Management Section

Water Department – City of Fort Worth

200 Texas St.

Fort Worth, Texas 76102-6311

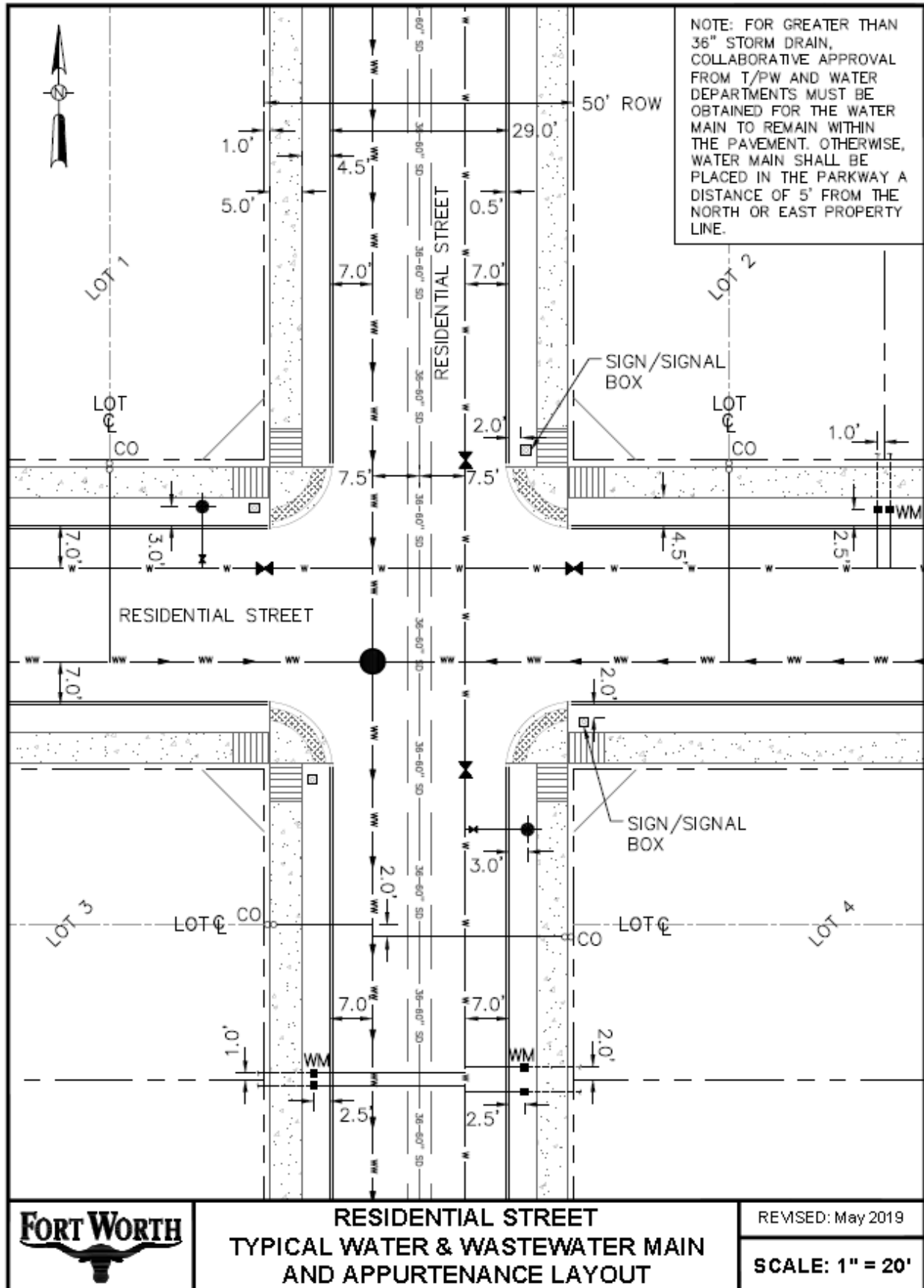
WPD@fortworthtexas.gov

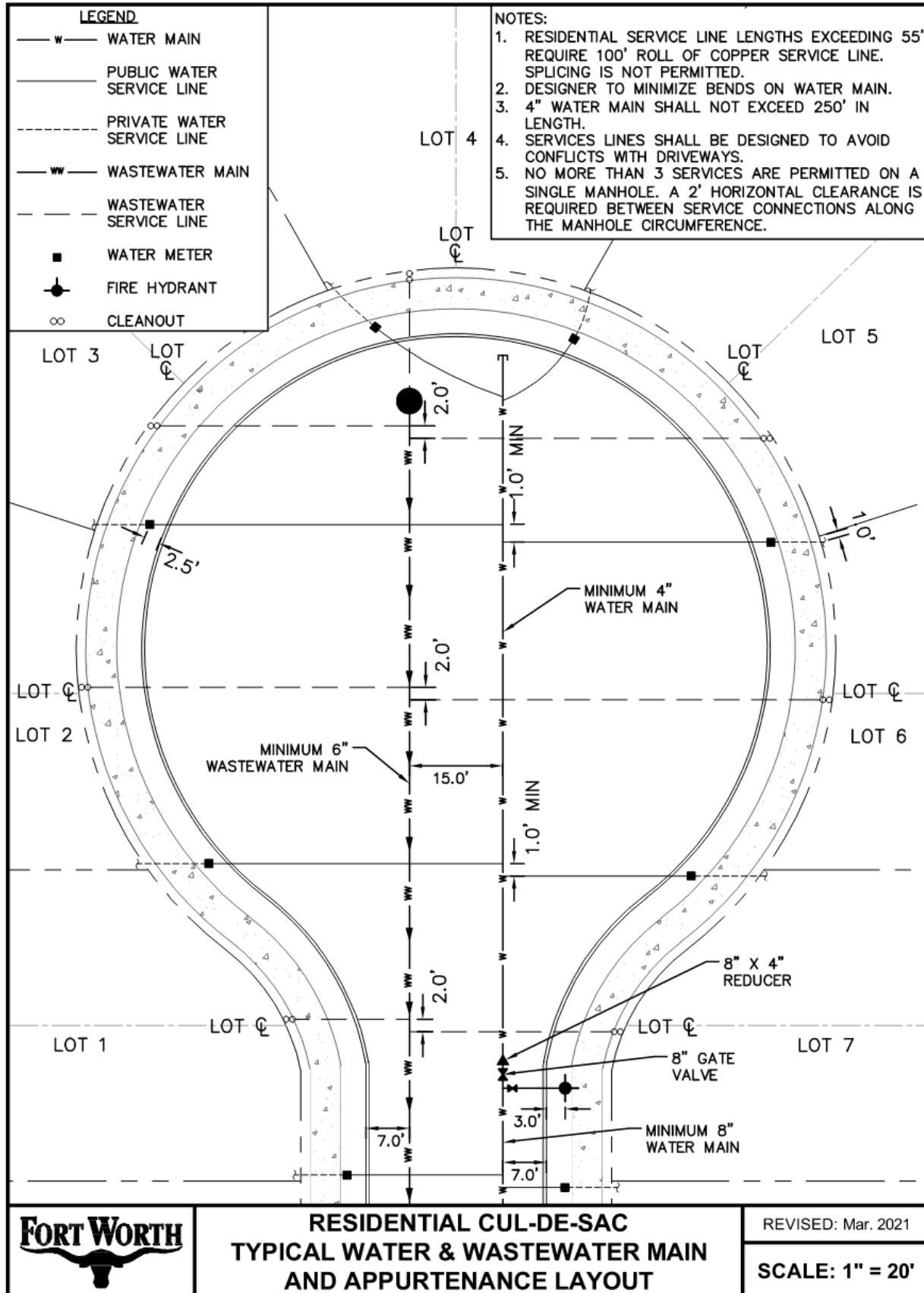
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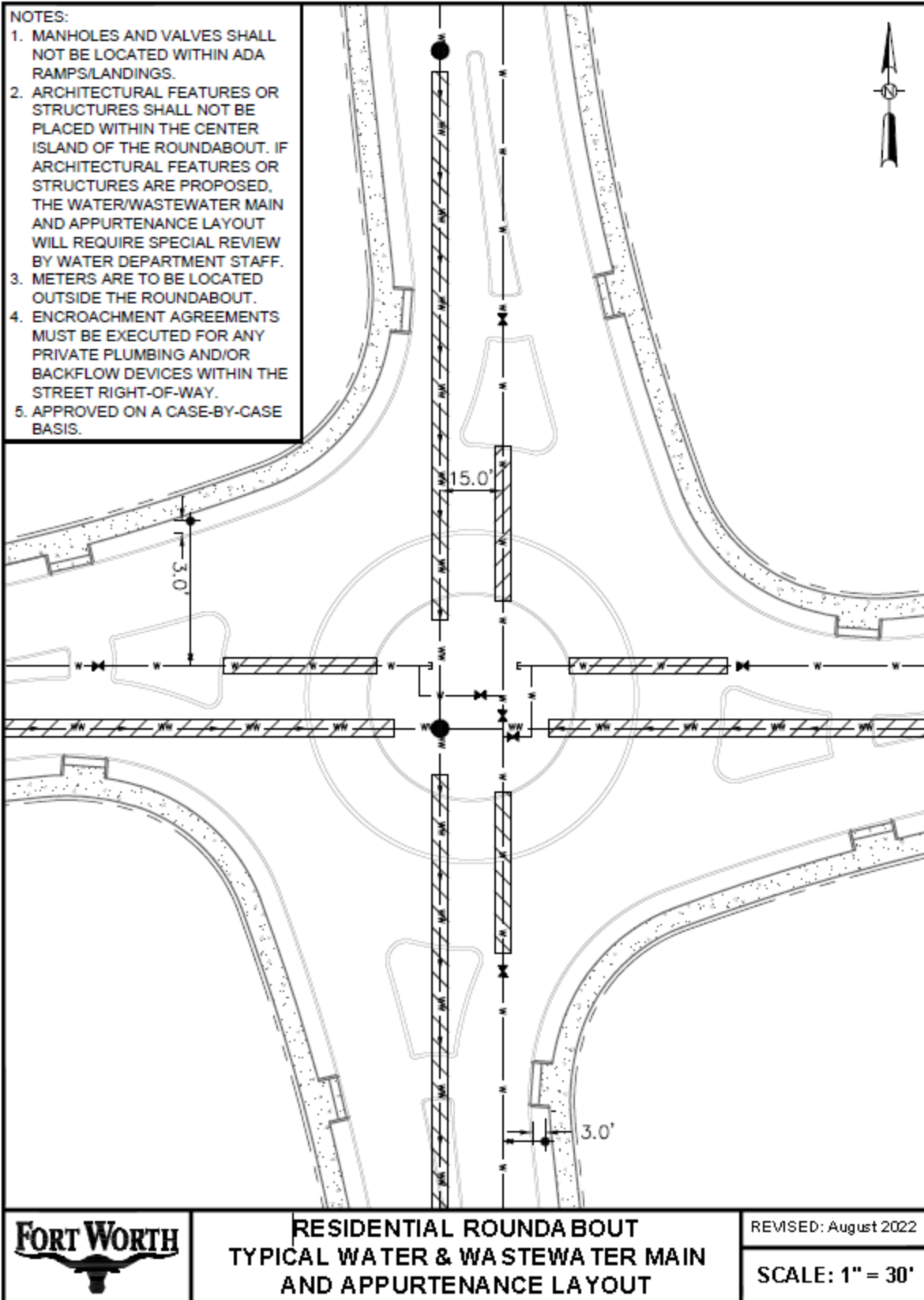


APPENDIX B – STANDARD LAYOUTS

B



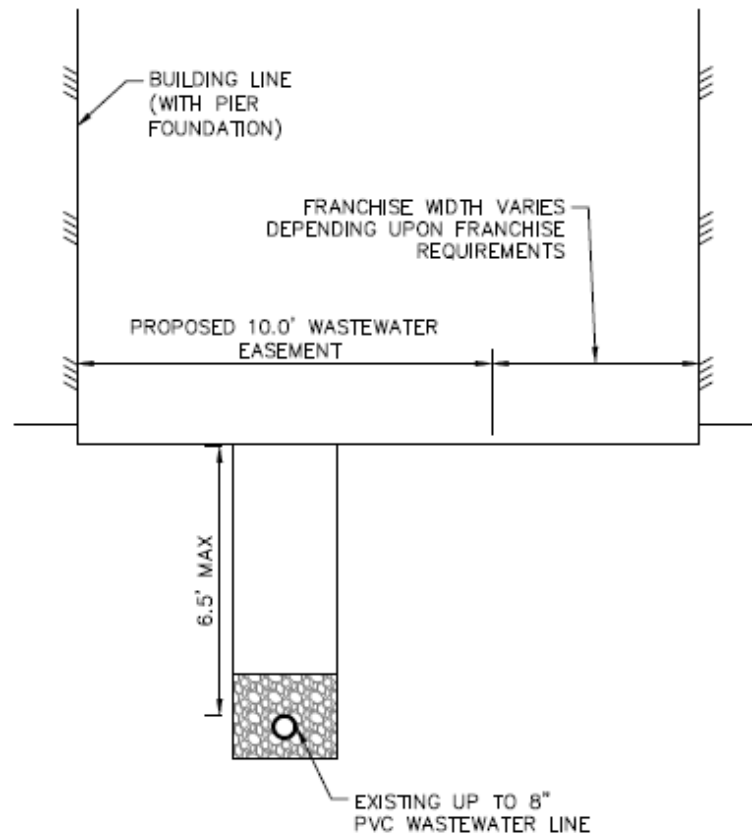






APPENDIX C – URBAN INFILL EASEMENT EXHIBIT

C



NOTES:

1. A VARIANCE IS REQUIRED IF STANDARD ALLEY WIDTH OR EASEMENT WIDTH REQUIREMENTS CANNOT BE ACCOMMODATED DUE TO EXISTING PHYSICAL CONFLICTS.
2. WASTEWATER LINES SHALL BE WITHIN A DESIGNATED URBAN INFILL AREA BEING REDEVELOPED.
3. ONLY WASTEWATER LINE SHALL EXIST WITHIN ALLEY.
4. NO UTILITY OR PHYSICAL ENCROACHMENTS SHALL EXIST WITHIN ALLEY/EASEMENT.
5. BUILDINGS ON EACH SIDE OF UTILITY SHALL CONTAIN DEEP FOUNDATIONS (NOT SLABS), OR THE BUILDINGS SHALL BE SET BACK SUCH THAT A MINIMUM HORIZONTAL CLEARANCE FROM BUILDING TO CENTER LINE OF WASTEWATER LINE IS 7.5'.
6. THE MINIMUM VERTICAL CLEARANCE OF THE EXISTING ALLEY/EASEMENT WHERE WASTEWATER LINES ARE LOCATED SHALL BE 18'.



APPENDIX D – SHARED UTILITY EASEMENT EXHIBIT

D

