

# FORT WORTH<sup>®</sup>

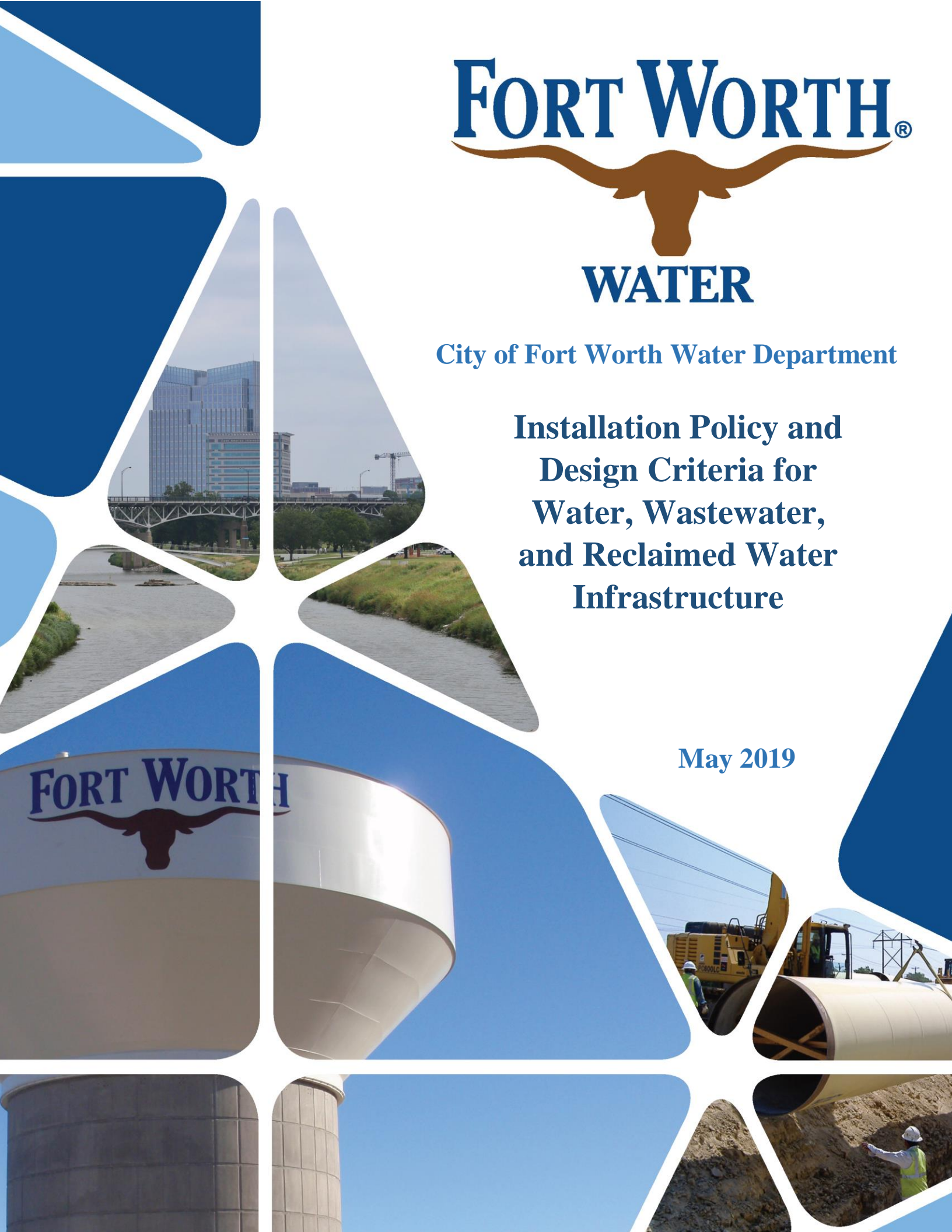


## WATER


City of Fort Worth Water Department

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

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## TABLE OF CONTENTS

SECTION 1 – INTRODUCTION ..... 1

    1.1 Purpose ..... 1

SECTION 2 – DEFINITIONS..... 2

SECTION 3 – POLICY..... 8

    3.1 General..... 8

    3.2 Requirements for Request for Service ..... 9

    3.3 Extension of Service ..... 9

    3.4 Cost Participation ..... 28

    3.5 Cost Recovery ..... 33

    3.6 On-Site Systems ..... 36

    3.7 Ownership and Maintenance..... 37

    3.8 Standard Easements..... 38

    3.9 Temporary Construction Easements..... 42

    3.10 Easements for Existing Wastewater Mains in Urban Infill Areas ..... 42

    3.11 Shared Utility Easements..... 43

SECTION 4 – PROCEDURE..... 46

    4.1 General..... 46

    4.2 Project Process ..... 46

    4.3 Fees and Charges..... 49

    4.4 Pre-Qualification Requirements for Contractors ..... 51

    4.5 Other Water/Wastewater Facilities ..... 52

    4.6 On-Site Systems ..... 53

    4.7 Pre-Treatment..... 53

    4.8 Backflow and Cross Connection ..... 53



SECTION 5 – DESIGN CRITERIA FOR WATER SYSTEMS .....54

5.1 General.....54

5.2 Pressure Plane Areas .....54

5.3 Minimum Water Main Size .....56

5.4 Sizing Water Mains .....56

5.5 Typical Layout of Water Mains, Service Lines, and Appurtenances within Right-of-Way.....60

5.6 Horizontal/Vertical Alignment and Clearance Requirements .....61

5.7 Water Main Separation from Wastewater Mains .....65

5.8 Water Main Materials and Embedment .....65

5.9 Connections to Existing Water Mains .....65

5.10 Dead End Water Mains.....66

5.11 Fire Hydrants.....67

5.12 Fire Lines .....68

5.13 Gate Valve and Butterfly Valve Requirements.....70

5.14 Cleaning Pigs and Wyes .....71

5.15 Combination Air Valve Assemblies .....72

5.16 Blow-off Assemblies .....72

5.17 Private Pressure Reducing Valves.....73

5.18 Service Line and Water Meter Requirements .....73

5.19 Water Sample Stations.....75

5.20 Cathodic Protection .....75

5.21 Backflow Protection .....75

5.22 Abandonment of Water Mains and Appurtenances .....81

5.23 Special Requirements for Critical Facilities .....81

5.24 Crossings.....82

5.25 Pavement Repair .....87

SECTION 6 – DESIGN CRITERIA FOR WASTEWATER MAINS .....88

6.1 General.....88

6.2 Minimum Wastewater Main Size.....88

6.3 Sizing Wastewater Mains .....88

6.4 Typical Layout of Wastewater Mains, Service Lines, and Appurtenances within Right-of-Way .....92



6.5 Horizontal/Vertical Alignment and Clearance Requirements .....93

6.6 Wastewater Main Separation from Water Mains .....96

6.7 Wastewater Main Materials and Embedment .....97

6.8 Connections to Existing Wastewater Mains .....97

6.9 Manholes .....98

6.10 Special Requirements for Wastewater Service Lines ..... 100

6.11 Cleanouts ..... 101

6.12 Closed Circuit Television Video (CCTV) ..... 102

6.13 Inverted Siphons ..... 102

6.14 Odor Control Unit ..... 103

6.15 Pre-Treatment ..... 103

6.16 On-Site Sewage Facilities ..... 103

6.17 Wastewater Lift Stations and Force Mains ..... 103

6.18 Low-Pressure Systems ..... 114

6.19 Bypass Pumping for Wastewater Mains ..... 115

6.20 Abandonment of Wastewater Mains and Appurtenances ..... 115

6.21 Crossings ..... 116

6.22 Pavement Repair ..... 121

**SECTION 7 – DESIGN CRITERIA FOR RECLAIMED WATER MAINS ..... 122**

7.1 General ..... 122

7.2 Sizing Reclaimed Water Mains ..... 122

7.3 Typical Layout of Reclaimed Water Mains, Service Lines, and Appurtenances within Right-of-Way ..... 123

7.4 Horizontal/Vertical Alignment and Clearance Requirements ..... 124

7.5 Reclaimed Water Main Separation from Water and Wastewater Mains ..... 127

7.6 Reclaimed Water Main Materials and Embedment ..... 127

7.7 Connections to Existing Reclaimed Water Mains ..... 128

7.8 Gate Valve Requirements ..... 128

7.9 Cleaning, Testing, and Sampling ..... 128

7.10 Combination Air Valve Assemblies ..... 129

7.11 Blow-off Assemblies ..... 130

7.12 Backflow Prevention Device ..... 130

7.13 Hose Bibs and Faucets ..... 130



7.14 Service Line and Reclaimed Water Meter Requirements..... 131

7.15 Cathodic Protection ..... 132

7.16 Abandonment of Reclaimed Water Mains and Appurtenances ..... 132

7.17 Crossings..... 132

7.18 Pavement Repair ..... 137

SECTION 8 – REQUIREMENTS FOR DRAWINGS..... 138

8.1 General Plan Sheet Requirements ..... 138

8.2 Survey Requirements..... 140

8.3 Water and Wastewater Main Plan and Profile Sheet Requirements ..... 142

8.4 Standard Abbreviations ..... 150

8.5 Standard Drafting Symbols..... 151

SECTION 9 – VARIANCE PROCESS ..... 156

9.1 Request for Variance ..... 156

9.2 Criteria for Granting of Variance ..... 156

9.3 Additional Requirements for Approval of Variance ..... 156

9.4 Deviations Approved by Water Department Staff ..... 157

9.5 Request for Variance Form..... 160

APPENDIX A – WATER AND SEWER STUDY GUIDELINES ..... 161

APPENDIX B – TYPICAL LAYOUTS ..... 171

APPENDIX C – URBAN INFILL EASEMENT EXHIBIT..... 175

APPENDIX D – SHARED UTILITY EASEMENT EXHIBIT..... 177

## LIST OF TABLES

Table 3-1. Minimum Easement Widths for Mains .....	40
Table 3-2. Easement Widths for Facilities and Appurtenances.....	41
Table 3-3. Minimum Width Requirements .....	43
Table 5-1. Water Demands per Capita .....	57
Table 5-2. PVC Pipe Joint Restraint .....	62
Table 5-3. Flushing Requirements.....	67
Table 5-4. Combination Air Valve Assemblies.....	72
Table 5-5. Blow-off Valve Size.....	73
Table 5-6. Backflow Prevention for Fire Lines .....	78
Table 6-1. Minimum and Maximum Slopes.....	88
Table 6-2. Wastewater Load per Capita.....	90
Table 6-3. Wastewater Peaking Factor .....	91
Table 6-4. Maximum Distance Between Manholes.....	98
Table 6-5. Minimum Manhole Diameter .....	99
Table 7-1. PVC Pipe Joint Restraint Length .....	124
Table 7-2. Combination Air Valve Assemblies.....	129
Table 7-3. Blow-off Valve Size.....	130

## LIST OF FIGURES

Figure 3-1. SINGLE FRONTAGE .....	14
Figure 3-2. SINGLE FRONTAGE – Water Service > 55 feet.....	15
Figure 3-3. SINGLE FRONTAGE – WW Service > 55 feet .....	15
Figure 3-4. SINGLE FRONTAGE – Water Crossing Non-City ROW .....	16
Figure 3-5. SINGLE FRONTAGE – WW Crossing Non-City ROW .....	17
Figure 3-6. SINGLE FRONTAGE – Water Main Size/Depth.....	18
Figure 3-7. SINGLE FRONTAGE – WW Main Size/Depth.....	18
Figure 3-8. SINGLE FRONTAGE – Condition/Criticality .....	19
Figure 3-9. SINGLE FRONTAGE – Water Looping.....	19
Figure 3-10. SINGLE FRONTAGE – Looping and Water Service Line Length .....	20
Figure 3-11. SINGLE FRONTAGE – Looping and Non-City ROW.....	21
Figure 3-12. SINGLE FRONTAGE – Looping and Water Size/Depth.....	22
Figure 3-13. SINGLE FRONTAGE/Single Entrance Development .....	22
Figure 3-14. MULTIPLE FRONTAGE DEVELOPMENT.....	23
Figure 3-15. MULTIPLE FRONTAGE DEVELOPMENT - On-Site Mains.....	25
Figure 3-16. Wastewater Mains Along a Creek .....	26
Figure 3-17. Wastewater Mains Along and Across a Creek .....	27
Figure 3-18. Wastewater Mains Along and Across a Creek .....	27



## SECTION 1 – INTRODUCTION

### 1.1 PURPOSE

- 1.1.1 The purpose of this 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 discussion and approval of a variance by the Water Department Director.



## 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 commercial building proposed to operate 24 hours per day such as, but not limited to, hospitals, nursing homes, water-based or fire service reliant food processing or manufacturing, hotels, incarceration facilities, telecommunication facilities, data centers, or power supply facilities. Other commercial buildings that may not operate 24 hours per day, but are considered critical facilities include dialysis centers, outpatient surgery centers, convention centers, coliseums, auditoriums, and large-event arenas.

**Cross-Connection**

An unprotected actual or potential connection, mechanical or hydraulic union 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**

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.

**Director**

The director of the Water Department, or their designee.

**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 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 one that provides service within a development.

**On-Site Sewage Facilities**

Wastewater systems designed to treat and dispose of effluent on the same property the 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. Typically, the City maintains public improvements after expiration of any applicable maintenance bonds.

**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 Agreement 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 within as designated in the City's Shared Access Agreement 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.

**TCEQ**

Texas Commission on Environmental Quality.

**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.”

**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) connecting to the City’s public water system shall connect 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. A brief description of each section is outlined below:
- 3.1.2.1 **Section 3.2 Requirements for Service** – This section includes references to City Code and statutory requirements for connecting to the City’s water, wastewater, or reclaimed water system.
- 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 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:
- Development cost responsibilities;
  - Situations that allow for request of City participation in cost of improvements; and,
  - 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, or Wastewater Per Acres Charges.

### 3.2 REQUIREMENTS FOR REQUEST FOR SERVICE

- 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 *Texas Local Government Code (TLGC) 212.0115* and *City Code Chapter 31*.
  - 3.2.1.2 Be located within the limits of the City, or the Landowner must either 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*, 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 current Certificates of Convenience and Necessity (CCN) for water and wastewater of the City. If the property is located outside the City’s existing water or wastewater CCN, the Landowner must consent the City’s petition to the Public Utility Commission in accordance with provisions set forth in the agreement for service.

### 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). Deviations from these requirements may be allowed for certain circumstances that meet the general intent of this section through a variance request in accordance with **Section 9** (Variance Process).
- 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. 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.

For these examples, a variance request may be submitted in accordance with **Section 9** (Variance Process). Elevations and grades for all wastewater approach and frontage main extensions shall be designed to account for service to surrounding properties.

- 3.3.3 *Main Extension Requirements for New Development Areas* – A water, wastewater, or reclaimed water main extension 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.
- 3.3.3.1 Connecting a property to a water, wastewater, and/or reclaimed water main located beyond the property boundary.
- 3.3.3.2 Connecting a property to a water main and/or wastewater main through a shared utility easement.
- 3.3.3.3 Connecting a property to a 16-inch, or greater, water main or 15-inch, or greater, wastewater main located along the frontage of property or within the boundary of the property.
- 3.3.3.4 Connecting a property to a water, wastewater, and/or reclaimed water main that requires a service line to:
- Cross a State Highway;
  - Cross a property line;
  - Cross a river, creek, or other water feature; or,
  - Exceed 55 feet from the water/reclaimed water main to the meter or from the wastewater main to the property line.
    - Water/Reclaimed water service lines for residential properties may be an exception to this requirement provided that their service lines are no larger than 1 inch in diameter and the service line is not spliced.
- 3.3.3.5 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.
- 3.3.3.6 Relocating an existing water, wastewater, or reclaimed water main in conflict with some element of the Development.
- 3.3.3.7 *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).

- 3.3.4 *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.
- 3.3.4.1 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).
- 3.3.4.2 Connecting a property to a water and/or wastewater main which has been identified for replacement by the City’s Risk Assessment Programs.
- Risk Assessment is generally based upon main condition and criticality factors, such as, but not limited to:
    - Age;
    - Material;
    - Maintenance/Work Order History;
    - Pressure Impacts (water/reclaimed water);
    - Actual Field Condition Data;
    - Access Issues;
    - Critical Facilities;
    - Resiliency;
    - Customers Served;
    - Diameter; and/or,
    - Sensitive Areas/Crossings.
- 3.3.5 *Water, Wastewater, or Reclaimed Water Facility Requirements* – A water, wastewater, or reclaimed water facility is required to:

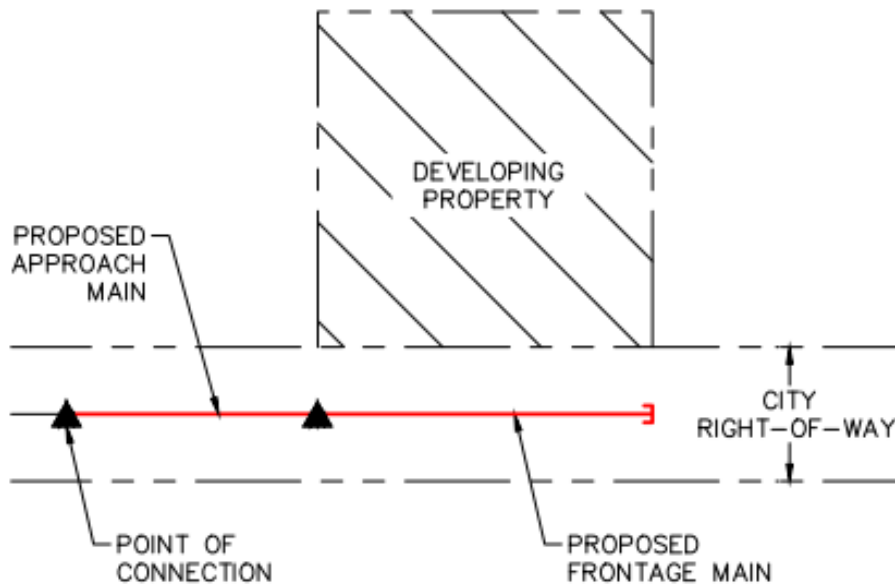
- 3.3.5.1 Connect a property to a water, wastewater, or reclaimed water main in accordance with the Design Criteria and the requirements of an approved Loading Analysis or Study warrants:
- A water or reclaimed water pump station to meet pressure or capacity requirements;
  - A water or reclaimed water elevated or ground storage tank;
  - A wastewater lift station and force main; or
  - A wholesale customer water, wastewater, or reclaimed water meter station.
- 3.3.6 Oversize Requirements for Water, Wastewater, or Reclaimed Water Main Extension or Facilities
- 3.3.6.1 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:
- The City’s Water, Wastewater, or Reclaimed Water Master Plans;
  - A City Area Plan; or,
  - To meet general growth requirements, as determined by the City.
- 3.3.7 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 responsibility of the City as determined and set forth in **Section 3.4** (Cost Participation).
- 3.3.8 Water, Wastewater, and Reclaimed Main Extension Examples
- 3.3.8.1 *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.

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

- 3.3.8.2 *Full Frontage* – Frontage Mains shall be extended across the full frontage of the developing property to allow for service to future development.
- There may be situations that may not require a full frontage main extension such as topography, dead ends, or service area limitations. For these examples, a variance request may be submitted in accordance with **Section 9** (Variance Process).
- 3.3.8.3 Elevations and grades for all wastewater approach and frontage main extensions shall be designed to account for service to surrounding properties.
- 3.3.8.4 *Parallel Main Concept* – Factors such as service line length, non-City right-of-way crossings, main size, main depth, or other situations may require an extension of a parallel main. Locations of proposed Point of Connections to existing mains will be reviewed by the City to ensure that the connection benefits the overall water/wastewater/reclaimed water system and does not adversely impact its existing customers.
- Multiple connections to mains in similar locations will be prohibited in most cases in lieu of a connection to an already extended main, even if connecting to the existing main results in a shorter extension length.
  - Certain situations may be prohibitive for the installation of a parallel main, such as, but not limited to, congested corridors, limited numbers of connections, geometry, topography, and depth. In these limited situations, a variance request may be submitted for consideration in accordance with **Section 9** (Variance Process).
- 3.3.8.5 *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.
- 3.3.8.6 *Multiple Frontage Developments* – Developments with frontage along more than one City right-of-way 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.

- 3.3.8.7 *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.
- 3.3.8.8 *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).
- 3.3.8.9 Extension Examples with Figures:
  - *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**. 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.

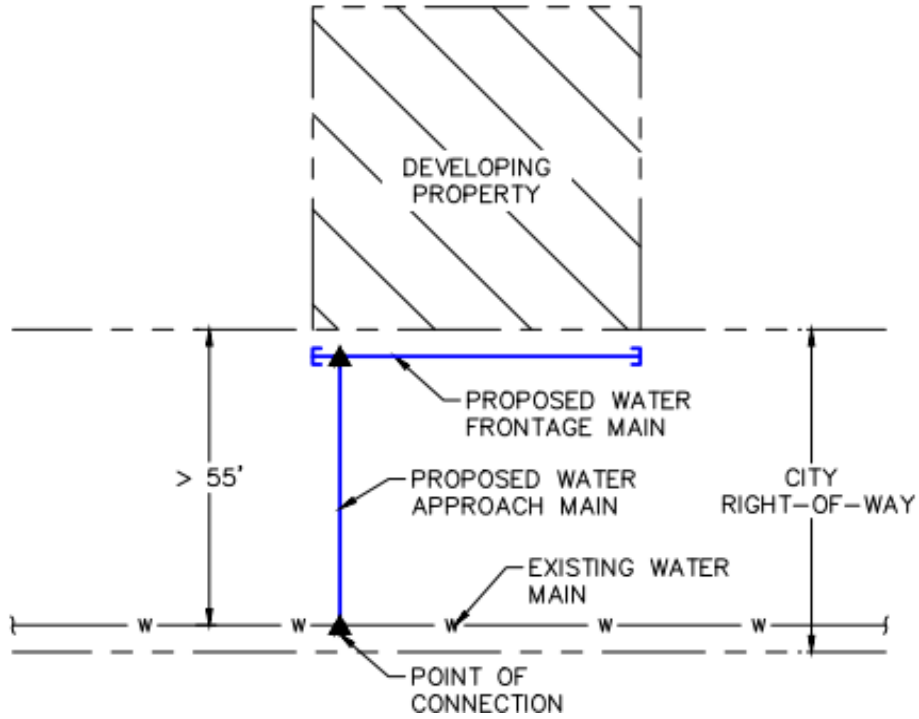


Figure 3-2. SINGLE FRONTAGE – Water Service > 55 feet

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

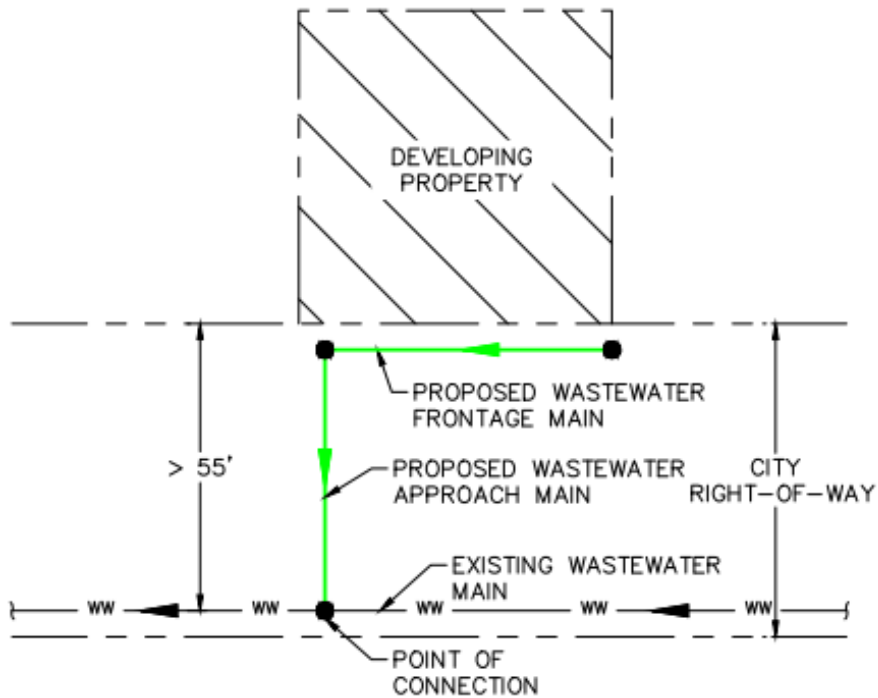


Figure 3-3. SINGLE FRONTAGE – WW Service > 55 feet

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

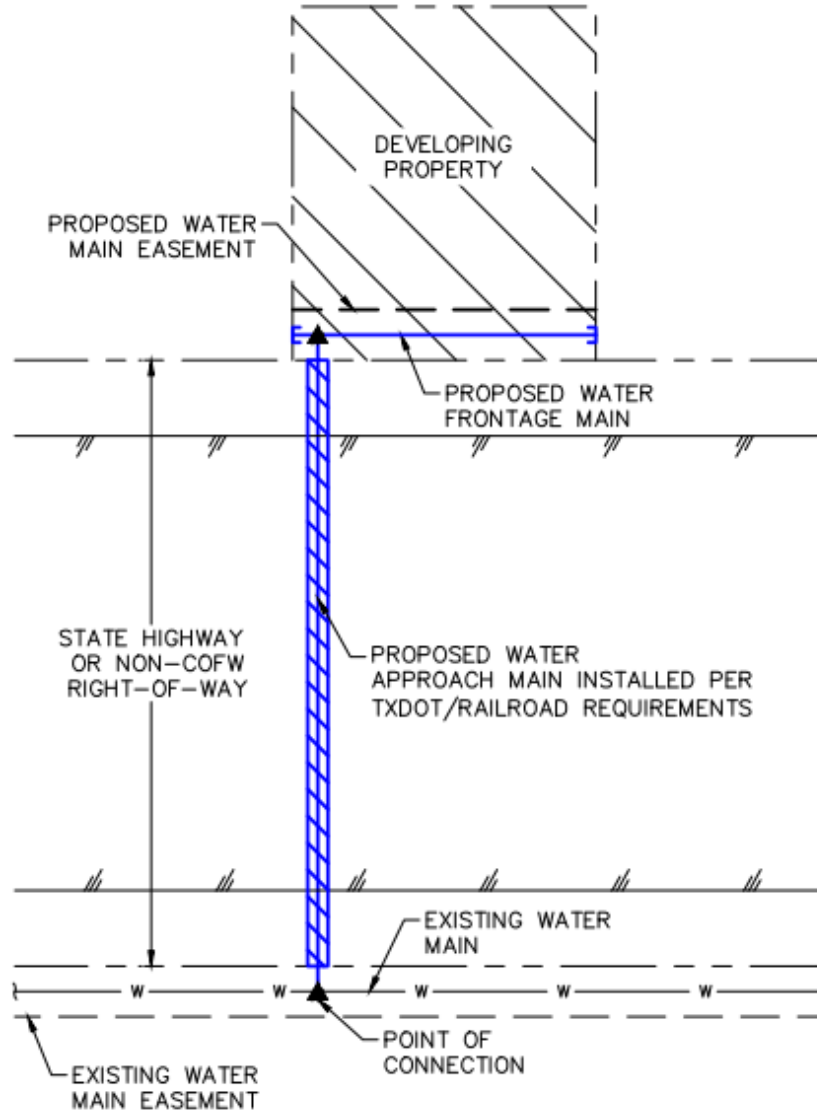


Figure 3-4. SINGLE FRONTAGE – Water Crossing Non-City ROW

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



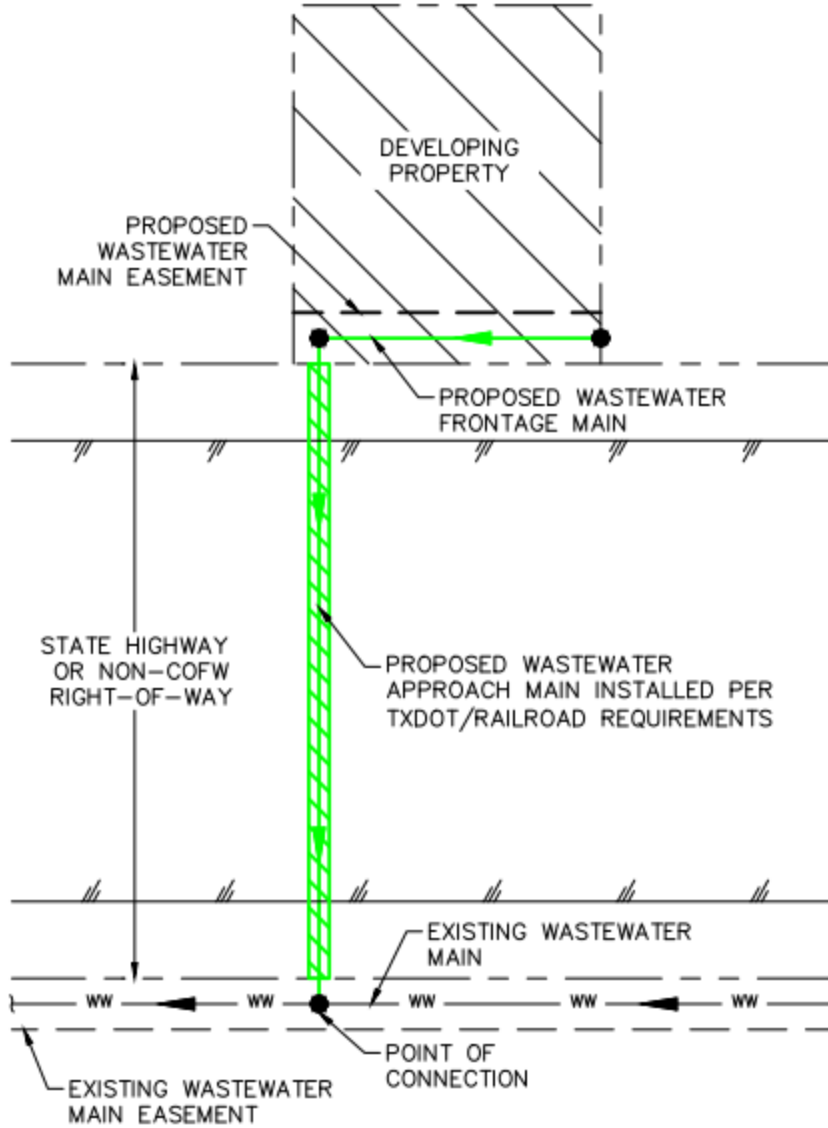


Figure 3-5. SINGLE FRONTAGE – WW Crossing Non-City ROW

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

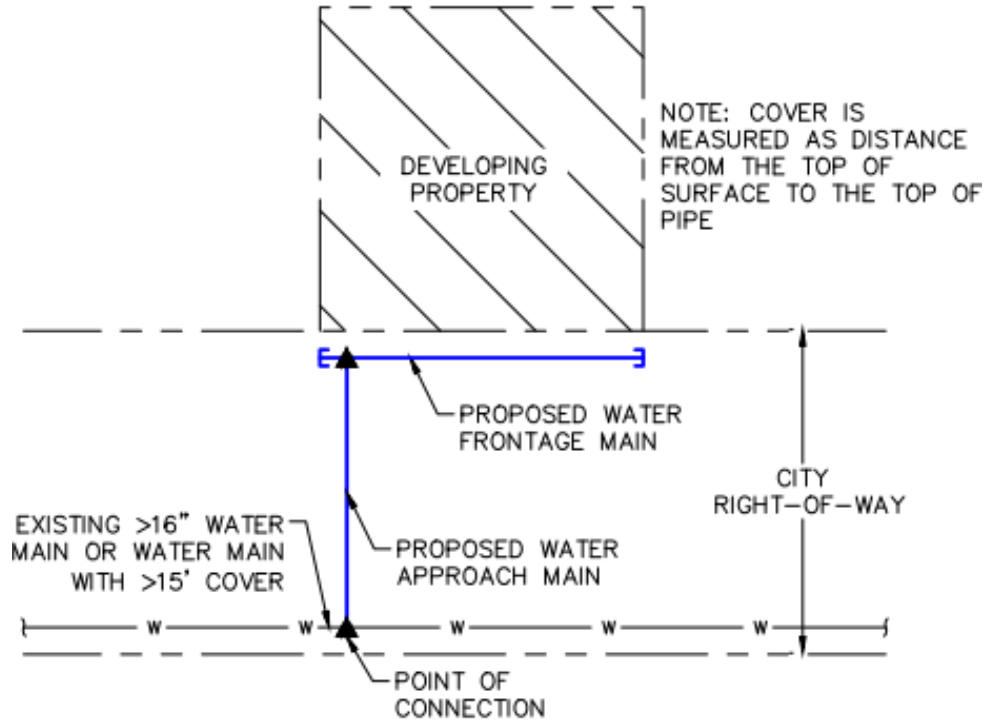


Figure 3-6. SINGLE FRONTAGE – Water Main Size/Depth

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

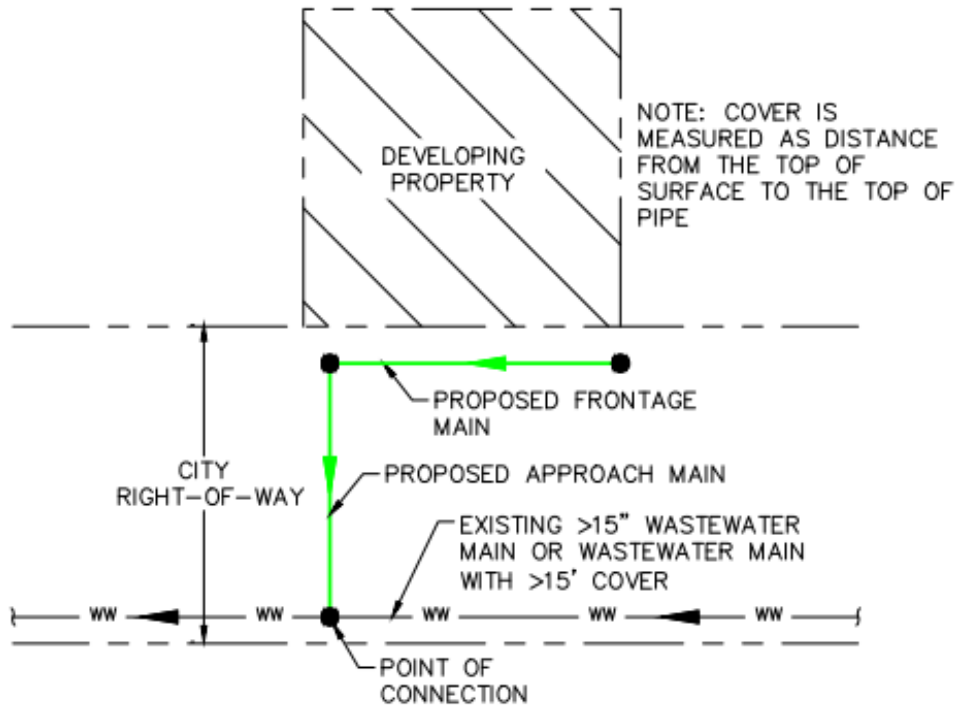


Figure 3-7. SINGLE FRONTAGE – WW Main Size/Depth

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

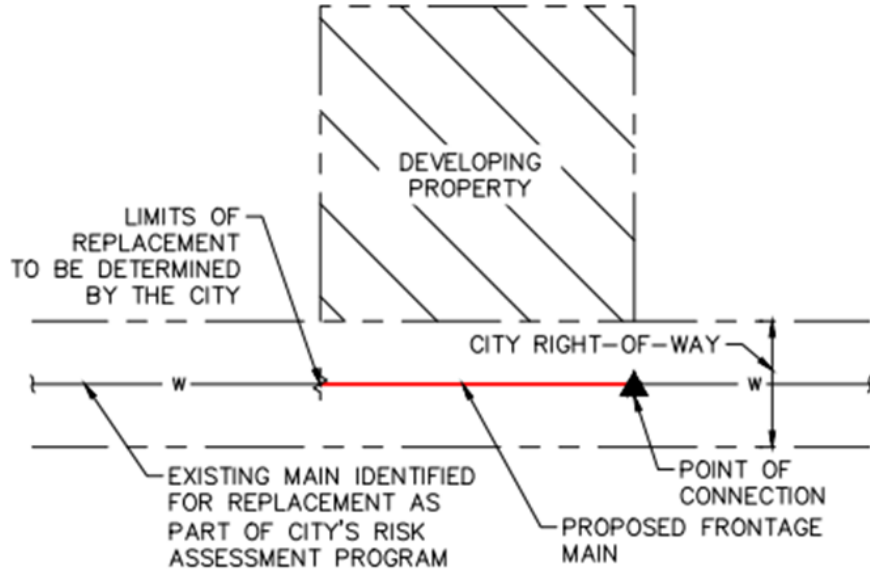


Figure 3-8. SINGLE FRONTAGE – Condition/Criticality

**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.

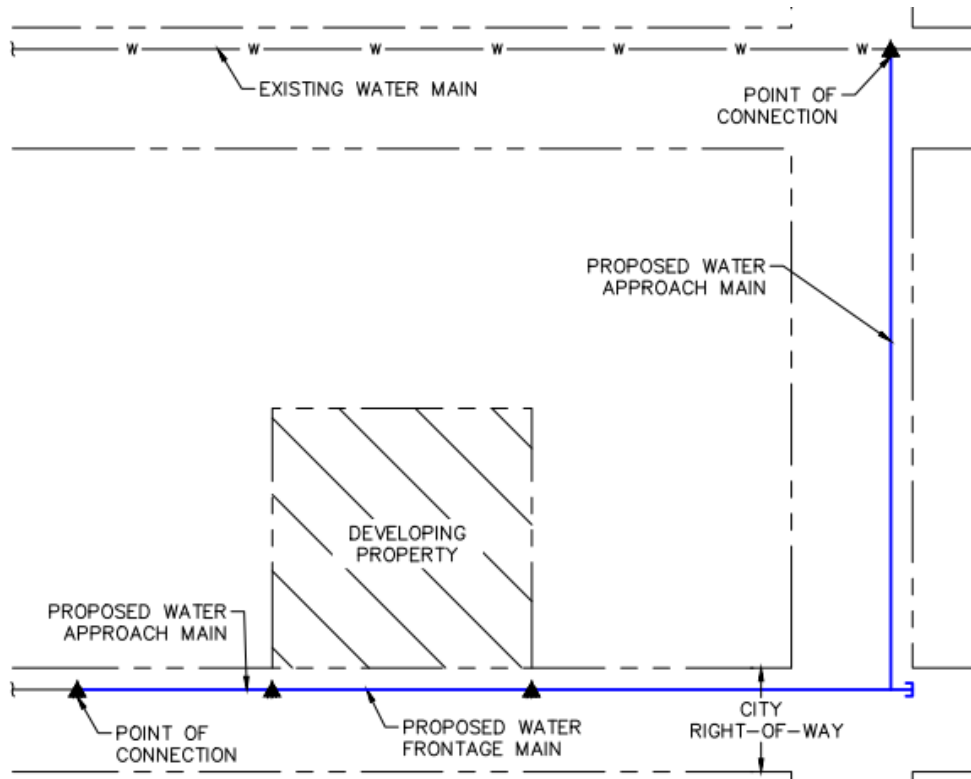


Figure 3-9. SINGLE FRONTAGE – Water Looping

**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 requirements of the *Water and Sewer Study Guidelines*.**

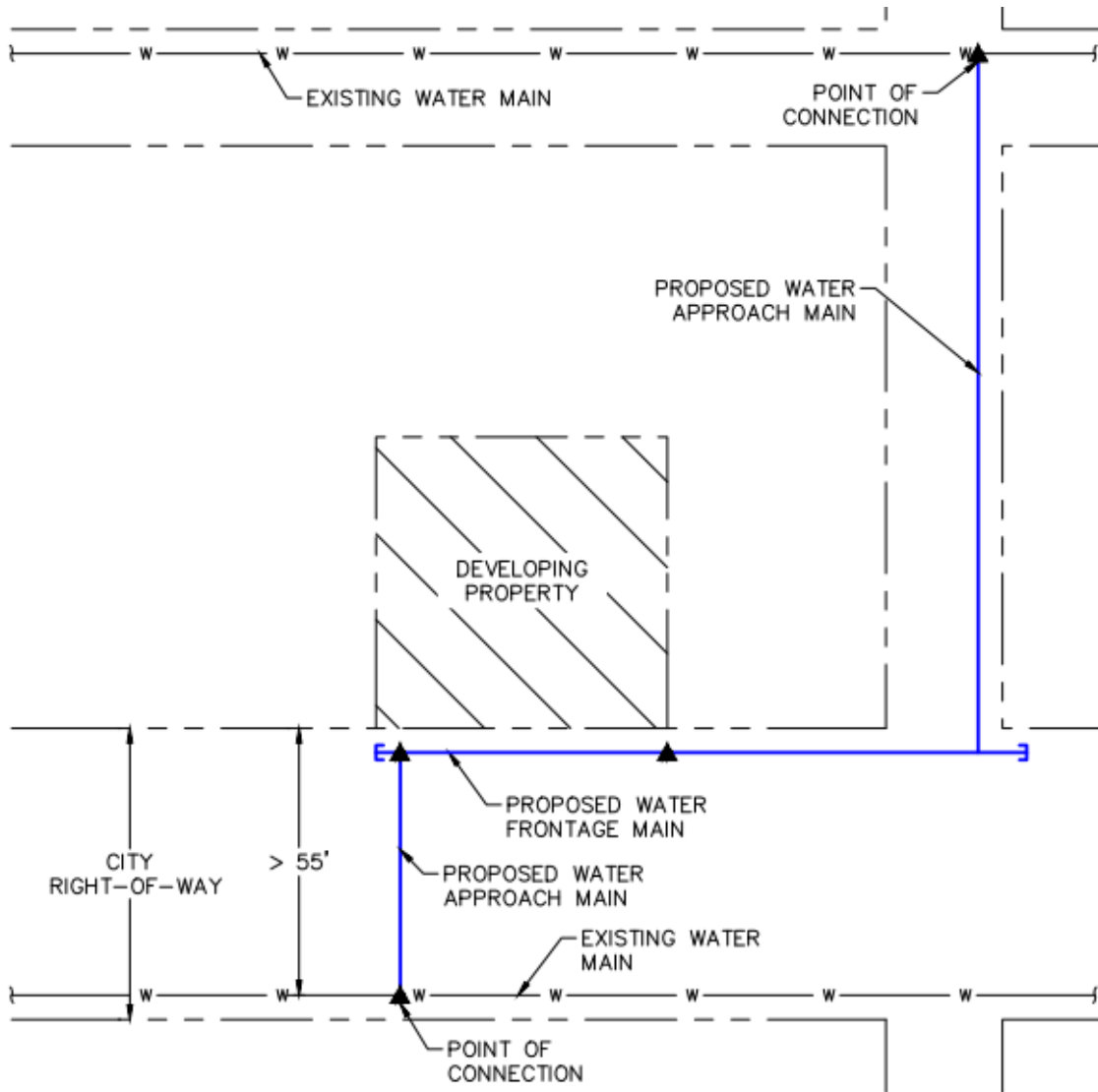


Figure 3-10. SINGLE FRONTAGE – Looping and Water Service Line Length

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 requirements of the *Water and Sewer Study Guidelines*) and where Service Line exceeds a length of 55 feet from Main to Meter.

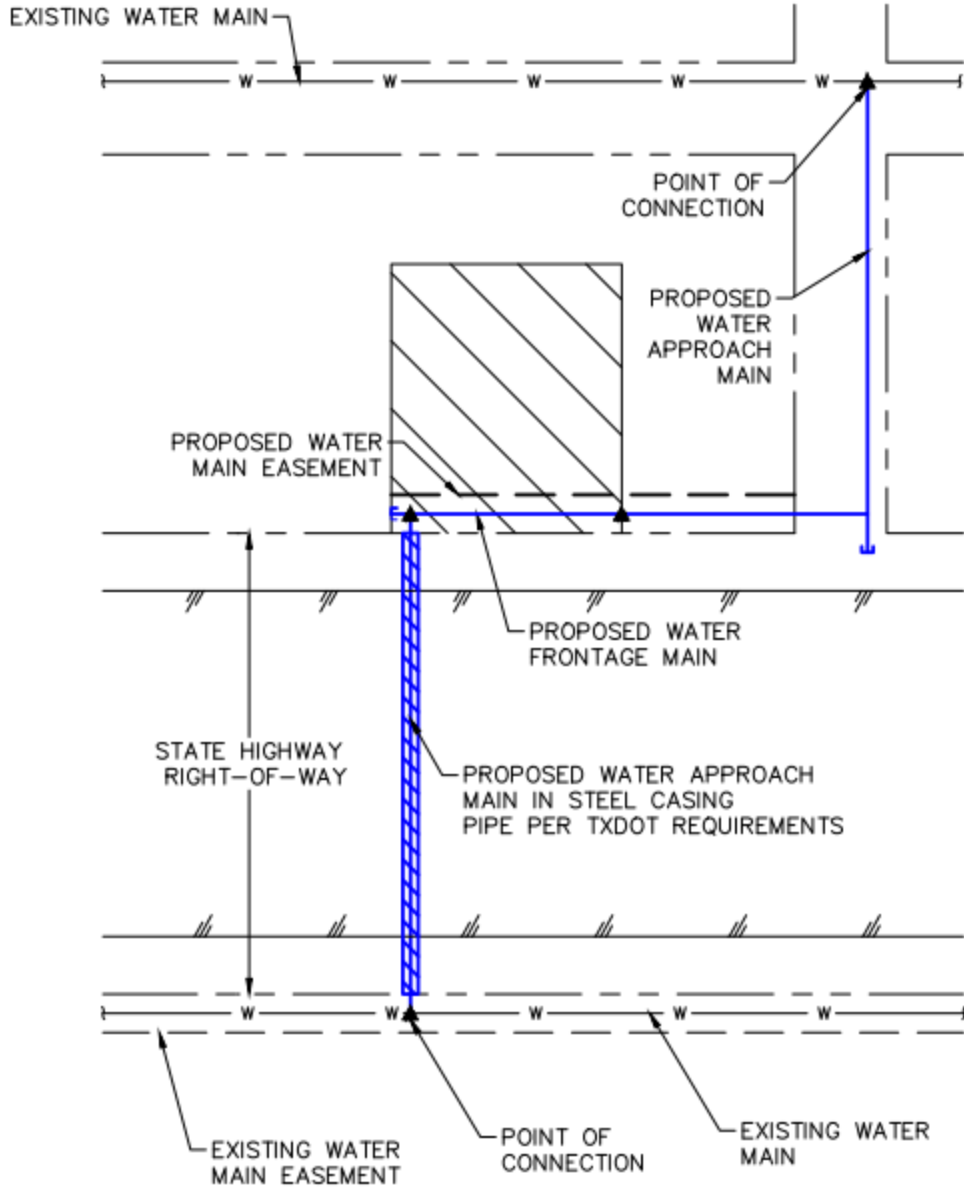
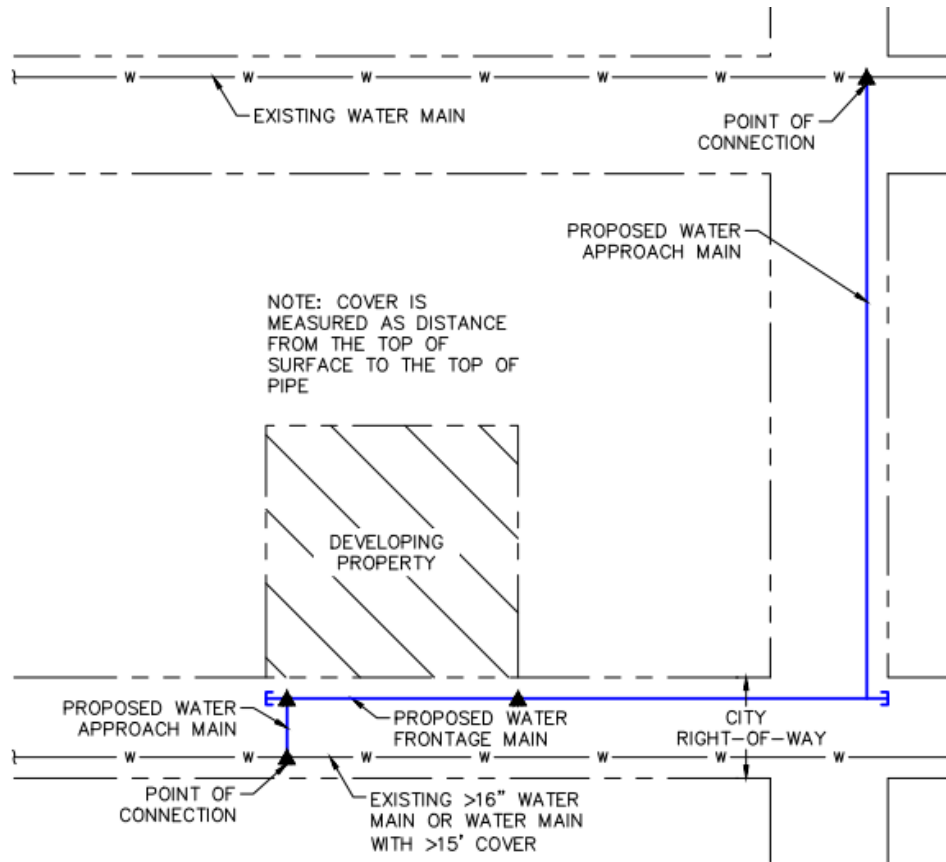


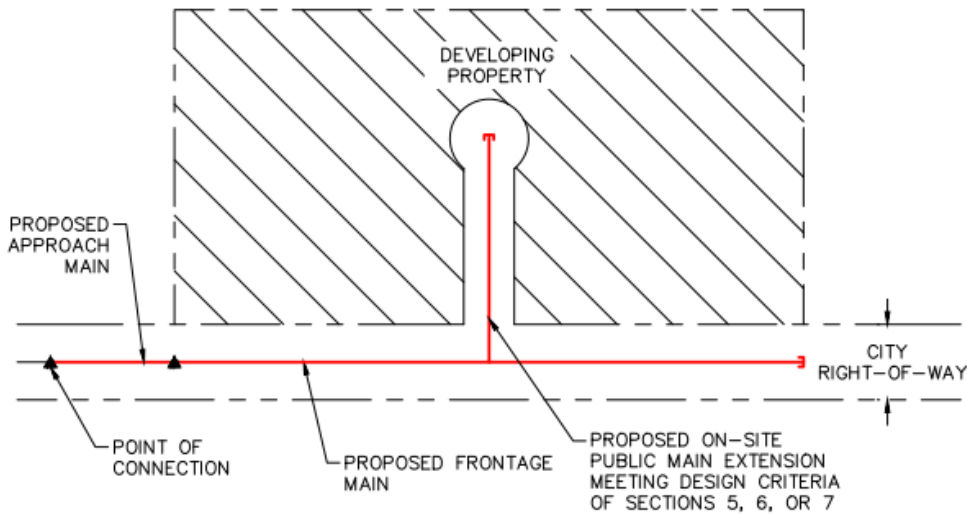
Figure 3-11. SINGLE FRONTAGE – Looping and Non-City ROW

Crossing Property Frontage from a Point of Connection to a Water or Reclaimed Water Main to a Second Point of Connection 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 Greater than 16 inches or Exceeding 15 feet of Cover to a Second Point of Connection**

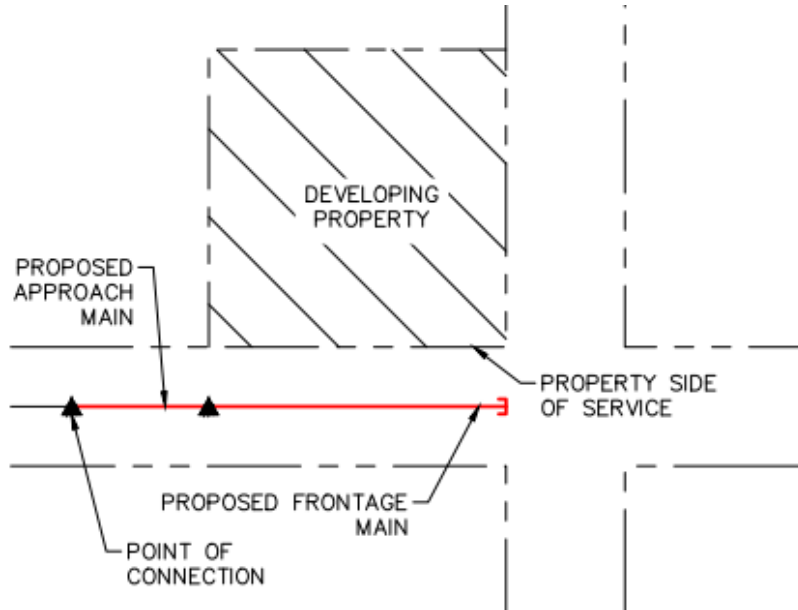


**Figure 3-13. SINGLE FRONTAGE/Single Entrance Development**

**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.

- 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**

- 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**.
- 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**.
- Multiple Frontage with Large/Deep Mains* – A main extension is required to and across a property’s full frontage connecting to a water main greater than 16 inches, a wastewater main greater 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**.
- *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**.
  - *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.
    - 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**.
    - 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**.
    - 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**.
    - A main extension is required to and across a property’s full frontage connecting to a water/reclaimed main greater than 16 inches or exceeding 15 feet from the top of the main to the surface, see **Figure 3-12**.
  - *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.

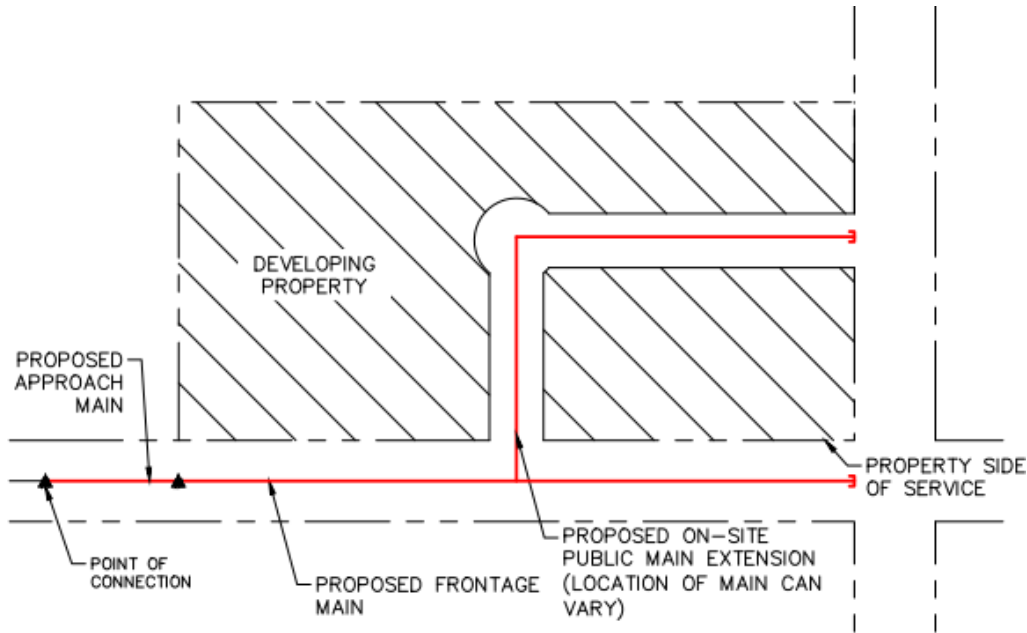


Figure 3-15. MULTIPLE FRONTAGE DEVELOPMENT - On-Site Mains

**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.

- *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.
  - 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.

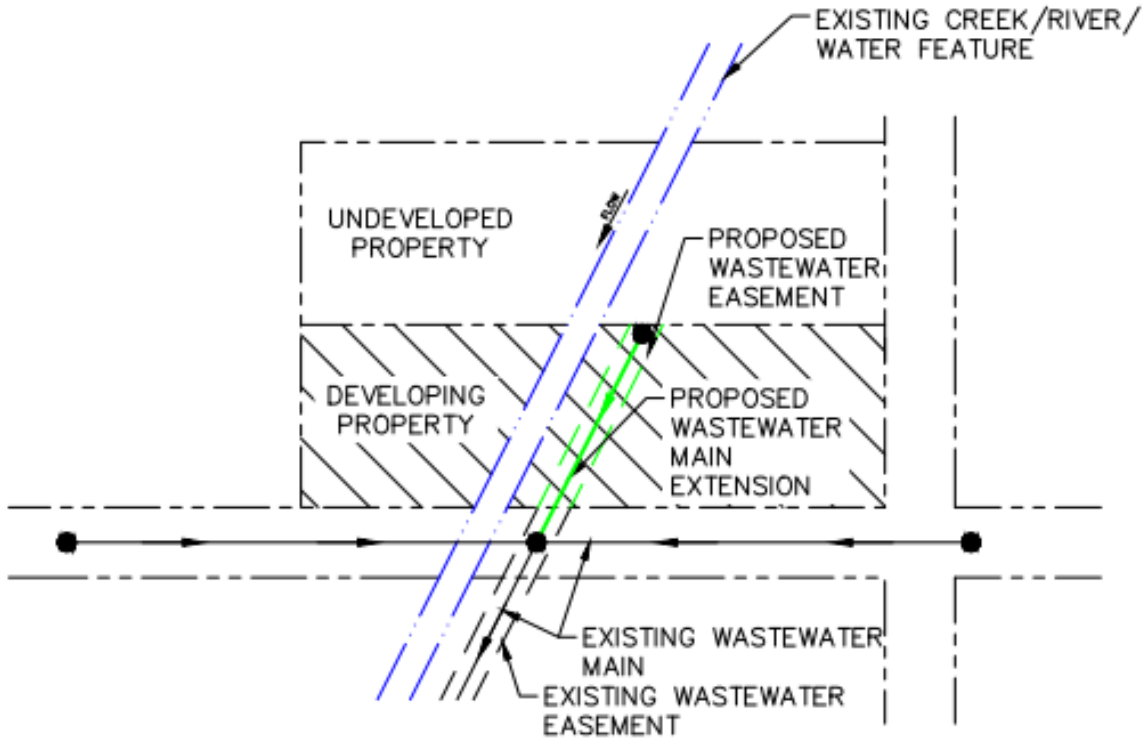
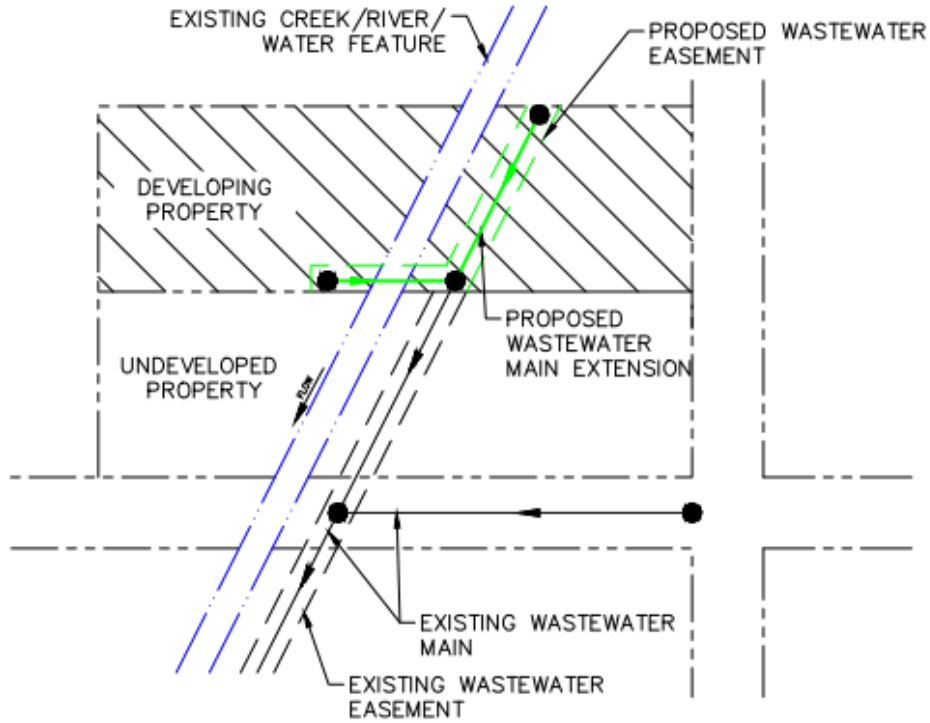


Figure 3-16. Wastewater Mains Along a Creek

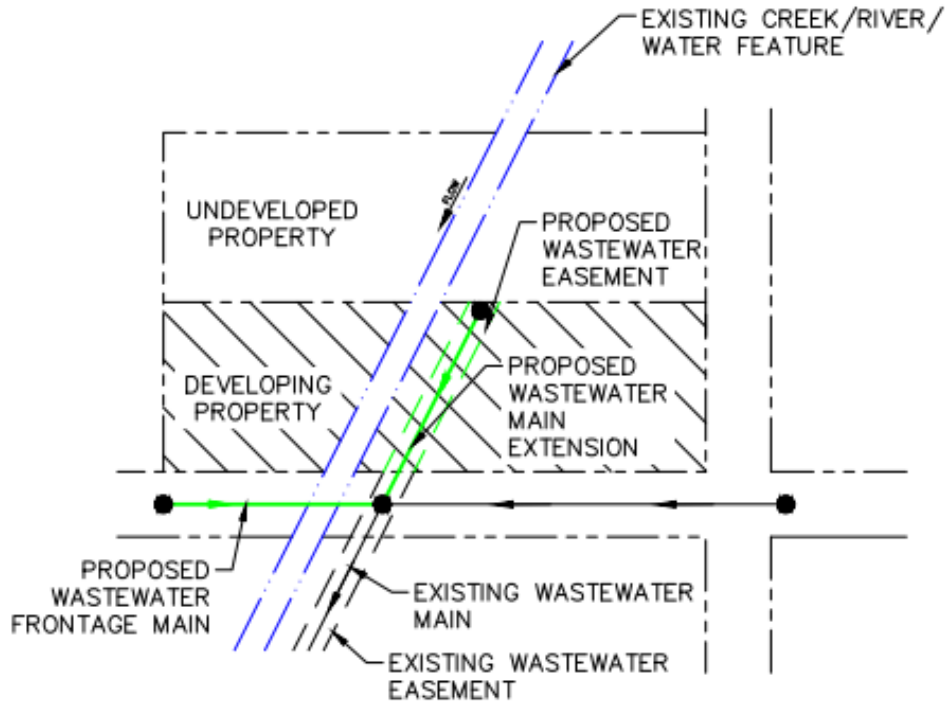
Crossing Property Following a Creek/River/Water Feature

- 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:
- Capacity improvements to serve the development;
  - Relocation of mains due to a conflict created by the development, regardless of the condition of the main; and/or,
  - Replacement of mains with insufficient capacity to serve the development.
  - 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 –
- *Water or Wastewater* – The City's minimum main size of 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 may request cost participation for the main if the improvement is a water or wastewater main that has a diameter of greater than 8 inches and the main capacity is greater than size of the main required to serve the development as shown in the *Water and Sewer Study Guidelines*.
  - *Reclaimed Water* – The City's minimum reclaimed water main size of 6-inch diameter per **Section 7** (Design Criteria for Reclaimed Water Mains). The Developer may request cost participation if the improvement is a reclaimed water main with a diameter greater than 6 inches and the main capacity is greater

than required to serve the development as shown in the *Water and Sewer Study Guidelines*.

- 3.4.2.2 *City Facility Oversize* – 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* – The Developer may request 100% cost participation from the City if an existing water, wastewater, or reclaimed water main 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* – A Landowner may request cost participation when an existing service tap is proposed to be replaced as part of an existing CIP project and the Landowner requests the service tap size to be increased from the size of the existing tap.
- 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.
- 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 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). The following sections describe other eligible City participation scenarios:

- *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.
  - City will pay for and install the main extension. Landowner shall pay for the tap and impact fees.
- *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.
  - City will pay for the cost of extending the main a distance of 200 linear feet.
  - 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*.
    - Payment shall be made prior to the beginning of construction. 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.
    - 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.
    - All cost of filing of the mechanic’s lien shall be the responsibility of the property owner.



- 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.
- *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.
  - Additional Credits for Multiple, Existing, Occupied Parcels
    - 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.
    - Any main length in excess of 200 linear feet will be paid for at the actual cost of the total excess length.
    - 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.
    - 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.
  - *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:
    - 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.
    - To receive this credit, 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.

- 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.
  - Design will begin once all service installation fees have been paid by at least 25% of the proposed customers.
- 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.
- 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.
  - Construction will be released once all service installation fees have been paid by at least 50% of the proposed customers.
  - Parcels not choosing to connect for service will be subject to Front Foot Charges in accordance with *City Code Chapter 35-58*.
- 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.
  - 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.
- 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

- 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, or Wastewater Per Acre Charges. Reimbursement may not exceed the cost of the improvements as described in the following sections.

#### 3.5.1.2 Front Foot Charges

- *Eligibility* – A Developer is eligible for reimbursement of Front Foot Charges when cost for a water or wastewater approach main are incurred beyond the development property’s frontage(s), and/or costs are incurred for a frontage main.
  - 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 to the Developer’s property is owned by a separate landowner not affiliated with the Developer.
- *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.
- Reimbursement of Front Foot Charges
  - Front Foot Charges will be collected by City and shall be subject to the following conditions:
    - The City will collect front foot charges per the provisions set forth in *City Code Chapter 35-58*.
    - Approach main reimbursement may be equal to, but not greater than, 100% of the cost for the water or wastewater approach main incurred by Developer.

- Frontage main reimbursement may be equal to, but not greater than 50% of the cost for the frontage main incurred by the Developer.
- Front foot charges will be assessed for a period of 20 years, commencing on the date that the City accepts the water or wastewater main.
- Collections and reimbursements of front foot charges will cease when the Developer has been fully reimbursed or the time period for assessment of front foot charges has lapsed, whichever occurs first.
- 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.
- Any assignment of front foot charges must be approved by the Water Department Director prior to the execution of the assignment.
- Existing community facilities agreements with mains, or other facilities, eligible for front foot charge collections will continue under the policy that was in effect at the time the agreement was executed.
- The reimbursement limit, together with the project number, date construction was completed, permanent record number of main, limits of portion of the main upon which front foot charges are collectible, and name of the entity entitled to the refund shall be documented by the City.
- Upon written request by the Developer, reimbursements will be made annually during the last 2 months of the calendar year from front foot charges paid to the City.
- It is the responsibility of the developer/landowner requesting the refund to prove their eligibility to receive the reimbursement due.
- In the event the developer/single customer property owner fails to request a reimbursement of front foot charges within 6 months after the expiration of the

eligibility to receive funds, such un-reimbursed front foot charges shall become the property of the City.

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

- *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 and/or water main capacity charges.
- *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.
- *Reimbursement* – The Developer will be reimbursed in accordance with the provisions set forth in Division 3 of *City Code Chapter 35* (Sewer per Acre Charges) and/or Division 4 of *City Code Chapter 35* (Water Main Capacity Charges).

## 3.5.2 City Cost Recovery

### 3.5.2.1 Front Foot Charges

- *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.
- *Reimbursement* – Front Foot Charges will be collected by City and shall be subject to the following conditions:
  - The City will collect front foot charges per the provisions set forth in *City Code Chapter 35-58*.
  - 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/Water Main Capacity Charge

- *Eligibility* – The City is eligible for reimbursement of Wastewater Per Acre 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.
- *Reimbursement* – City reimbursement shall be in accordance with in provisions set forth in Division 3 of *City Code Chapter 35* (Sewer per Acre Charges) and/or Division 4 of *City Code Chapter 35* (Water Main 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, 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.

## 3.6 ON-SITE SYSTEMS

- 3.6.1 In accordance with *City Code Chapter 35-3*, any property within 50 feet of an existing public water main is required to connect to the City main. In accordance with *City Code Chapter 35-135*, any property within 100 feet of an existing City wastewater main is required to connect to the City wastewater main. Developments within the city limit shall be required to have approved water supply and wastewater facilities and shall be required to connect to the Water Department facilities, unless alternative on-site systems have been approved by the Water Department Director. See *City Code Chapter 35 Article V* and **Section 4** (Procedure) for on-site system requirements. Use of holding tanks for temporary sewage disposal is not allowed.
- 3.6.2 Property to be served by the City’s wastewater system but having individual water wells are required to install dry water mains and service lines to allow for a future connection to the City water system for domestic and fire protection purposes.
- 3.6.2.1 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*.

- 3.6.2.2 Deviations from this requirement require approval from the Water Department Director through a variance request in accordance with **Section 9** (Variance Process).

### 3.7 OWNERSHIP AND MAINTENANCE

3.7.1 *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.

3.7.2 Title to all Water and Wastewater Service Connections

3.7.2.1 Water Service Connections

- Domestic/Irrigation Service Connection
  - 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, to include the meter and meter box or vault, shall be vested in the City.
- Fire Line Connection
  - 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.
  - Installation of the double detector check shall be in accordance with the Water Department's *Backflow Prevention Policy*.
    - 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.
    - 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.

3.7.2.2 Wastewater Service Connections

- 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.

#### 3.7.2.3 Reclaimed Water Service Connections

- 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.

#### 3.7.3 City Responsibility for Water, Wastewater, and Reclaimed Water Mains and Facilities

- ##### 3.7.3.1
- 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 permits, or within water, wastewater, or reclaimed water easement.

### 3.8 STANDARD EASEMENTS

- #### 3.8.1
- 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 fully executed and submitted to the City prior to commencing construction activity within the easement.

- ##### 3.8.1.1
- If a water, wastewater, or reclaimed main is proposed to be within, or cross, an existing dedicated City Park, a park conversion will be necessary in accordance with the City's Parks and Recreation Department's requirements.

#### 3.8.2 Standard Plat Provisions

- ##### 3.8.2.1
- Fort Worth Water Department easements are in accordance with Standard Plat Provisions as follows:

- 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, shrub, 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.



- 3.8.3 *Format* – All easement instruments shall be in a standard City format with standard City language.
- 3.8.3.1 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.
- 3.8.3.2 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.
- 3.8.4 *Filling* – Excessive filling of material should not be allowed on top of any easement. 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.
- 3.8.5 *Minimum Vertical Clearance* – The minimum vertical clearance for items such as, but not limited to, structures, awnings aerial walkways, etc., above any easement is 25 feet. 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.
- 3.8.5.1 Overhead utilities may be allowed to cross with a clearance of less than 25 feet but should be avoided when possible.
- 3.8.5.2 Vertical clearance requirements for Shared Access Developments are outlined in **Section 3.11** (Shared Utility Easements)
- 3.8.6 *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.
- 3.8.6.1 For horizontal clearance requirements for Certain Urban Infill Areas and Shared Utility Easements, see **Sections 3.10** and **3.11**, respectively.
- 3.8.7 *Proximity of Lot Lines* – Easements parallel to lot lines shall be wholly contained on one lot and shall not cross lot lines.
- 3.8.8 **Minimum Easement Widths**
- 3.8.8.1 **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 or accessibility, may dictate the necessity for the City to acquire additional easement.

3.8.8.2 *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)
<b>Water/Reclaimed Water Mains</b>	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
<b>Wastewater/Force Mains</b>	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
<b>Combined Mains</b>	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

3.8.8.3 *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. is outside diameter of pipe.

Easement shall not exceed 70 feet in width, unless required by special circumstances.

3.8.8.4 If depths of mains vary across the easement, the largest resulting easement width shall apply, unless approved otherwise at the discretion of the Water Department Director.

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

3.8.9 Facility/Appurtenance Easement Widths

3.8.9.1 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**.

**Table 3-2. Easement Widths for Facilities and Appurtenances**

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

3.8.10 Easements for Off-Site Facilities

3.8.10.1 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).

3.8.10.2 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.

3.8.10.3 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.

3.8.10.4 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.

- 3.8.11 *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 TEMPORARY CONSTRUCTION EASEMENTS

- 3.9.1 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.

### 3.10 EASEMENTS FOR EXISTING WASTEWATER MAINS IN URBAN INFILL AREAS

- 3.10.1 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 3.7** (Standard Easements), cannot be accommodated due to existing physical conflicts, a variance may be granted by the Water Department Director for a minimum wastewater easement width of 10 feet or use of a substandard alley, provided that all of the following conditions are satisfied:
- 3.10.1.1 Franchise utilities are located outside of the wastewater easement.
  - 3.10.1.2 The existing wastewater main does not exceed 8-inches in diameter with a maximum depth of cover of 6.5 feet.
  - 3.10.1.3 No water mains or storm drains exist within the alley.
  - 3.10.1.4 No physical encroachments exist with the easement or alley.
  - 3.10.1.5 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.
  - 3.10.1.6 A minimum vertical clearance of 18 feet is provided above the wastewater main.
- 3.10.2 A request for variance meeting these conditions can be submitted in accordance with **Section 9** (Variance Process).

**3.11 SHARED UTILITY EASEMENTS**

3.11.1 In the event that a Standard Easement cannot be provided per **Section 3.7** (Standard Easements) and the development satisfies all of the City’s requirements for the creation of a Shared Utility Easement; upon the approval of the Water Department Director, a combined water/wastewater easement may be allowed provided that the following requirements are met:

3.11.1.1 *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.

3.11.1.2 General Requirements

- Water or wastewater mains located in a shared utility easement may only provide service to lots directly adjacent to the shared utility easement.
- The minimum vertical clearance above the water and wastewater easement shall be 18 feet.
- Traffic rated water meter lids and wastewater cleanout covers are required.
- No parking is allowed over the water and wastewater easement.
- No public or private storm drainage is allowed within the water and wastewater easement.
- Water and Wastewater separation must be 4 feet as measured from the outside edge of the water and wastewater mains.
- The maximum length of the street is 150 feet.

3.11.1.3 Water Main Requirements

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

- *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.
  - The minimum horizontal clearance between the water main and the franchise gas main is 5.5 feet as measured from the centerlines of each main.
  - An alternative layout includes 5-foot public utility easements on each side of the Water and Wastewater Easement and is shown in the Appendix.
- *Cover* – 4 feet maximum cover, 3 feet minimum cover
- A 6-inch isolation gate valve shall be provided at the boundary line of the shared access development and the public right-of-way.
- No fire line connections or fire hydrants can be located within the shared access development.
- Dead end mains cannot exceed 150 feet in length.
  - Any main terminating as a dead-end may be required to install an automatic flushing device. A water meter should 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.

### 3.11.2 Wastewater Main Requirements

- *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.
  - PVC pipe must be green in color.
- *Size* – 8-inch
  - Developments requiring larger than 8-inch wastewater mains, must meet standard easement width requirements.
- *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.

- An alternative layout includes 5-foot public utility easements on each side of the Water and Wastewater Easement and is shown in the Appendix.
  - *Cover* – 6.5 feet maximum cover
    - Depth of cover cannot be shallower unless it can be demonstrated that all service mains (including franchise) can be adequately installed in the corridor.
  - Wastewater mains shall terminate with a manhole. Wastewater Access Chambers may only be considered in narrow corridors where vehicular access is prohibited.
  - The minimum slope of the wastewater main shall be 0.75% due to anticipated low flow condition.
- 3.11.3 The City has no obligation to maintain the Shared Utility Easement, including its surface. If a Shared Utility Easement is not maintained in compliance with the requirements set forth in the Shared Access Agreement, the City shall have the right, but not the obligation, to take those actions necessary to repair the surface. Any cost associated with surface repairs will be the development's responsibility in accordance with the agreement.

## 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 *Policy for the Installation of Community Facilities*.

### 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:

- General overview and location of the development project;
- Summary of proposed water, wastewater, and/or reclaimed water demands; and,
- 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:

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



- Upon submittal 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 may proceed to Cost Participation Determination, if necessary.
- Study
  - 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.
  - Upon submittal 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 may proceed to Cost Participation Determination, if necessary.
- Developments containing Loading Analysis and Study Requirements
  - 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) prior to 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)* – 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.

- *IPRC Process* – Upon determination of City Participation, the development may begin the IPRC process for preparation and review of construction drawings and specifications in accordance with the City’s *Community Facilities Agreements Ordinance*.
- *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).

4.2.2.3 *Miscellaneous Contracts* – The Department’s Miscellaneous Contract process in 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.

- Miscellaneous Contracts are intended for the following types of infrastructure:
  - Fire line taps
  - Water service lines 2-inches, or smaller
  - Water service taps greater than 2-inches
  - Water or wastewater mains 16-inch, or smaller and less than 600 linear feet.
- At the discretion of Water Department Staff,
  - 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.

- Special, or unique, challenges may prohibit the Department from accepting a Miscellaneous project.
- *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.
- Any facilities or services that require a street cut on a newly paved street are not eligible for the Miscellaneous Contract process.
- If a project eligible and accepted for the Water Department’s Miscellaneous projects process, all required fees must be paid to the City before any CFA-related holds on the Project may be released.
  - Miscellaneous contract projects will be reconciled upon completion, and any outstanding fees more than \$200 must be paid to the City by the Developer. In the case of overpayment, the difference shall be refunded by the City to the Developer.

4.2.2.4 *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. Some of the more common fees include Impact Fees, Tapping Fees, and Meter Deposits and are described in more detail below. Depending upon the type of development, 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.

- *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 are required to be paid prior to issuance of 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.

- *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 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.
  - Tap fees are not required for service connections to new mains constructed as part of the development.
- *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.
- *Water Testing Lab Fee* – Prior to placing a newly constructed water main in service, water sample testing is required by the City. Testing of the water sample is conducted at a City laboratory and a Water Testing Lab Fee must be paid by the Developer in accordance with the City's *Community Facilities Agreements Ordinance*. Fee only applies to testing of water sample at the water laboratory. Fee does not include collection of the water sample.

#### 4.3.1.2 Water and Wastewater Main Charges

- Wastewater per Acre Charges
  - 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*
- Water Main Capacity Charges
  - 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*.

#### 4.3.2 Front Foot Charges

4.3.2.1 Connections to an existing water, wastewater, or reclaimed water main may 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:

- Service connections made to a main constructed by a developer or single customer property owner before December 31, 1983;
- 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;
- 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,
- 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 may 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*.

- 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:
  - Financial Statement;
  - General Scope of Project Containing Public Water and/or Wastewater Infrastructure;
  - Work References;
  - Equipment Schedule; and,
  - 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. In the rare occasion that a main extension is not a feasible service alternative for a development, the Water Department may require the installation of booster pump stations, pressure regulating valves, lift stations, and/or storage facilities to insure proper water/wastewater services are provided to the development. However, the Water Department reserves the right to require the developer to design and install these facilities as essential components of the water/wastewater system necessary to serve the development. 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 ON-SITE SYSTEMS

4.6.1 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.

4.6.1.1 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.

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

## 4.7 PRE-TREATMENT

4.7.1 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 BACKFLOW AND CROSS CONNECTION

4.8.1 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). The program includes the installation of backflow prevention assemblies where deemed appropriate, or necessary. In accordance with this requirement:

4.8.1.1 Annual testing is required for all commercial users.

4.8.1.2 All alternative water sources and contracted meters are required to contain a backflow protection assembly.

4.8.1.3 Meters must be protected by a backflow assembly or air gap and the assembly must be tested upon installation.

- All newly installed, replaced, relocated, or removed backflow assemblies for commercial, irrigation, and residential (when applicable) services require initial testing to be performed by a City approved Certified Backflow Prevention Assembly Tester.

4.8.1.4 More specific backflow information is included in the *Backflow Guidelines, Installation Standards & Specifications* and can be viewed on the City's Website.



## 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 *Policy for the Installation of Community Facilities* 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. Prior to 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 so that 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. Following is a listing of standard pressure planes within the City. These pressure plane elevations may 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 Upon approval of Water Department Staff, smaller residential developments, such as cul-de-sacs, may be allowed in certain cases 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 valves).

5.3.2 *Industrial Water Mains* – The minimum water main size for an industrial zoned area is recommended to be 12-inch (I.D.), or such larger size as may be necessary to properly serve the proposed and existing development. 8-inch (I.D.) water mains may be allowed in some situations, upon review and approval of a Water Study. However, the maximum velocity allowed in accordance with the *Water and Sewer Study Guidelines* is 10.0 feet per second (fps). In no case can water mains be allowed smaller than recommended by the City’s Fire Department.

### 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 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.

5.4.3 An alignment walk and/or study may be required if the water main is outside of the existing public right-of-way.

5.4.3.1 All water mains 16-inch and larger in diameter will require an alignment walk.

5.4.3.2 When special circumstances exist at the discretion of the Water Department, an alignment walk may be required for 12-inch water mains and smaller that are within the right-of-way.

5.4.4 Water Demand Calculations and Modeling Criteria

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

- *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)
<b>High Density Residential</b>	180	-
<b>Medium Density Residential</b>	180	-
<b>Low Density Residential</b>	180	-
<b>Manufactured Housing</b>	125	-
<b>Single Family</b>	200	-
<b>Mixed Use Growth Center</b>	180	50
<b>Commercial</b>	-	50
<b>Heavy Industrial*</b>	-	75
<b>Light Industrial*</b>	-	50
<b>Industrial Growth Center*</b>	-	50
<b>Hospitals</b>	-	350
<b>Institutional/Schools</b>	-	50
<b>Institutional/Schools without Showers</b>	-	40

\*Additional processes and maximum operating rate of water usage will need to be added to the water study for proper pipe sizing calculations.

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

- *Commercial* – 1 person per 400 square feet of structure for non-residential use
- For mixed use land types, population density shall be calculated for residential and non-residential buildings separately.
- Persons per Residential Connection
  - 3.5 people per connection for single-family residential buildings
  - 2.5 people per connection for multi-family buildings
- Computations
  - Maximum Day/Connection =  $\frac{(2.25)(200 \text{ GPCD})(3.5 \text{ p/c})}{1,000,000} = 0.001575 \text{ MGD}$
  - Maximum Hour/Connection =  $(2.00)(0.001575 \text{ MGD}) = 0.00315 \text{ MGD}$

5.4.4.2 Velocity and Head Loss

- For maximum hour demand condition, 12-inch and smaller water mains shall be designed for a maximum velocity of 5 fps and a maximum friction loss of 5 feet per 1,000 feet (ft/1,000-ft) of water main length during 24 hours of extended period simulation.
- For maximum hour demand condition, 16-inch and larger water mains shall be designed for a maximum velocity of 7 fps and a maximum friction loss of 7 ft/1,000-ft of water main length during 24 hours of extended period simulation.
- For maximum day plus fire flow demand condition, water mains shall be designed for a maximum velocity of 10 fps.

5.4.4.3

*Fire Flow* – Fire flow may 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. 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:

- One and two-family dwellings and townhomes:

- 1,000 gallons per minute (gpm) in one and two-family dwellings and townhomes for proposed dwellings smaller than 3,600 square feet
  - 1,500 gpm if dwelling's square footage is greater than 3,600 square feet
  - The minimum fire flow duration is 1 hour.
  - Other than one and two-family dwellings and townhomes:
    - 1,500 gpm, or per current Fire Code requirements (contact City of Fort Worth Fire Department for additional information)
    - The minimum fire flow duration should be 2 hours.
- 5.4.4.4 *Supply Storage versus Pumping* – The “Maximum Hour” demand should be supplied with not less than 60% from pumping capacity and not more than 40% from available elevated storage.
- 5.4.4.5 *Elevated Storage Tank Depletion* – Elevated water storage should be maintained not less than 5 feet above the storage tank's bottom capacity level.
- 5.4.4.6 *Minimum Working Pressure*
- A minimum of 40 psi must be maintained at all times under normal conditions.
  - *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.
- 5.4.4.7 *Design* – Water mains should be sized to meet “Maximum Hour” or “Maximum Day” plus Fire Flow, whichever is greater. Full consideration shall be given to fire flow requirements as superimposed upon the maximum day conditions, elevation, and the type of development proposed, in arriving at the final water main capacity.
- 5.4.4.8 *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).
- 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 TYPICAL LAYOUT OF WATER MAINS, SERVICE LINES, AND APPURTENANCES WITHIN RIGHT-OF-WAY

5.5.1 *Typical Locations* – The following design criteria shall be considered to be the normal locations for water mains, service lines, and appurtenances in the Fort Worth Water distribution system:

5.5.1.1 *Normal Residential Water Mains* – The normal location of residential water mains shall be in the north or east  $\frac{1}{4}$  of the street, as appropriate.

- *Other Street Types* – Typical layouts for water mains within cul-de-sacs and roundabouts are included in the Appendix.
- *Streets Containing Large Storm Drain* – For streets containing greater than 36-inch storm drain, collaborative approval from the Transportation/Public Works Department and Water Department must be obtained for the water main to remain within the pavement. If this cannot be achieved, the water main shall be placed within the parkway 5 feet from the north or east property line.

5.5.1.2 *Residential Water Service Lines* – The normal location of the residential water service line shall be in the parkway in front of the property and 1-foot offset from the property line.

- Public or private service lines are not allowed to cross property lines.

5.5.1.3 *Meters* – The normal location for domestic and irrigation water meter boxes (with meters) is 2.5 feet behind the back of curb. In no case shall the water meter box (and meter) be outside of the public right-of-way or water easement.

5.5.1.4 Valves

- Valves should be located at all water main intersections and should typically be located within the street intersection at water main crosses or tees.
  - Ring connections should be provided for water mains 16-inch and larger instead of crosses in accordance with the *City's Standard Construction Details*.
- Valve locations shall align with projected property line, unless other locations are approved by the Water Department Staff.

- To provide proper valve restraint, large water mains containing flanged connections require valves to be flanged to the tee, or outlet fitting.
- Valves shall not be located within curb ramps, or driveways.
- In-line valves, not located at intersections but required due to spacing, should be placed before a fire hydrant lead line.
- For sizing and spacing of valves, refer to **Section 5.13** (Gate Valve and Butterfly Valve Requirements).

5.5.1.5 Fire Hydrants

- Fire hydrants should be placed at intersections, 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.
- Normal location is 3 feet behind the back of curb, but must avoid placement within sidewalks, driveways, loading areas, etc. Location for fire hydrants should be selected to provide shortest possible lead under street pavement.
- For spacing and separations requirements, refer to **Section 5.11** (Fire Hydrants).
- A standard blue raised reflective pavement marker shall be placed on a highway, street, or road to mark fire hydrant locations. In general, these makers should be placed 0.5 foot from the centerline stripe, or approximate center of the pavement where there is no centerline stripe, on the side nearest the fire hydrant. Markers should be in accordance with Federal Highway Administration Manual of Uniform Traffic Control Devices Chapter 3A requirements.

5.5.1.6 *Typical Layouts* – Typical layouts for water and wastewater mains and appurtenances 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 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.
- 5.6.2 *Bends* – All bends shall be 45° or less, where practicable. Two 45° bends in a series should be used in lieu of 90° bends. Tee fittings should 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 should 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.
- To accommodate water main appurtenances requiring vaults, depths exceeding 60 inches may be necessary.
- 5.6.5 Clearance Requirements
- 5.6.5.1 Other Water Mains within City Right-of-Way
- If a 12-inch, or smaller, water main is proposed to be laid parallel to an existing 12-inch, or smaller, water main, and a horizontal clearance of 10 feet cannot be maintained as measured from the outside diameter of each main, an alternate alignment should be considered. If an alternate alignment is not feasible, as agreed to by Water Department Staff, special coordination and review will be required to be approved. In no case shall the excavation of either main impact the bedding or embedment of the other main.
  - If a 16-inch, or larger, water main is proposed to be laid parallel to an existing 16-inch, or larger, water main, and a horizontal clearance of 20 feet cannot be maintained as measured from the



outside diameter of each main, an alternate alignment should be considered. If an alternate alignment is not feasible, as agreed to by Water Department Staff, special coordination and review will be required to be approved. In no case shall the excavation of either main impact the bedding or embedment of the other main.

#### 5.6.5.2 Storm Drain

- 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, or as required by the Transportation/Public Works Department, whichever is greater.
- When water mains cross storm drains, the water main should cross over the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.
  - If the minimum clearance of 2 feet crossing over the storm drain cannot be achieved, casing or an alternate alignment may be required.
  - If crossing over the storm drain cannot be achieved, the water main should cross under the storm drain in accordance with the City's *Standard Construction Specifications and Details*.

5.6.5.3 *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. Proposed franchise utilities shall cross beneath water mains. Where the minimum clearance cannot be accommodated, less than minimum clearance may be allowed at the discretion of Water Department Staff.

- Coordination with each utility is required to confirm clearance requirements.
- The more stringent clearance requirements will be enforced.

5.6.5.4 *Non-Franchise Utilities* – Water mains proposed to parallel or cross existing non-franchise utility lines, such as gas/energy pipelines, shall adhere to the owner of the gas pipeline's clearance, and other, requirements. 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. 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.

- Coordination with the non-franchise utility line owner is required to confirm clearance requirements. The more stringent clearance requirements will be enforced.

5.6.5.5 *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.

5.6.5.6 Drainage Headwalls and Inlets

- Water mains shall not cross under headwalls and inlets.
- 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.
  - In right-of-way sections where this clearance is not feasible, an alternate alignment for the water main may be allowed at the discretion of the Water Department Staff.
- 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.

5.6.5.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

- 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.
- 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.

5.6.5.8 *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.

5.6.5.9 *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 should be provided for review.

## 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 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 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 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*.
- 5.8.2 Trench Water Stops
- 5.8.2.1 If encountered during construction, or if groundwater is known to be present, trench water stops should be installed at 500-foot intervals to prevent migration of water within the water main trench, unless otherwise determined by the Engineer.
- 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 are to 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 are the preferred method of connecting a new water main to an existing water main. If this method is determined not to be feasible by the Water Department Staff, a tapping sleeve and valve may be used.
- 5.9.1.1 Cut-in connections may require an additional valve on the existing main to reduce the number of service disruptions.

- 5.9.1.2 For tapping sleeves, if allowed, 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 are to be designed to facilitate future replacements and improvements. To accommodate future 12-inch or smaller extensions and minimize future outages, the water main should terminate with a gate valve and one joint 18-20 feet of water main. Water mains 16-inch and larger will require a longer 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 24-inch in diameter, or larger, the Engineer shall make 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, unless otherwise approved by the Water Department Director. Prior to submittal of final plans, 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 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.

## 5.10 DEAD END WATER MAINS

- 5.10.1 Dead-end mains shall be avoided and may only be considered when a looped or interconnected water main system is not available. The design of all water distribution systems should 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 may be allowed to be reduced down to 4-inch diameter, upon approval by the Water Department Staff.
- 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.
- 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 Connection to Existing Wastewater Main

- 5.10.3.1 The flushing requirements outlined above shall be provided unless otherwise approved by the Water Department Director.
- 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 should 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 should be connected to two different existing water mains to provide system redundancy, unless otherwise approved by the Water Department Director.

**5.11 FIRE HYDRANTS**

- 5.11.1 *Fire Hydrant Spacing and Separation* – The following design criteria shall be considered to be the normal locations for fire hydrants in the Fort Worth distribution system. 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 residence and must be within 600-foot 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 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 in a standard installation shall be set even with the elevation of the top of the adjacent existing or proposed curb (elevation specified). 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 (specified) at the point of installation.
- 5.11.2 *Private Fire Hydrants* – Where the fire hydrant is on a metered line, fire hydrant must be maintained by Owner and not obstructed. Paint in red color to differentiate from public fire hydrant (aluminum color).
- 5.11.3 *Fire Department Connection* – Fire Department Connection shall be within 300 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*.

## 5.12 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 *Double Detector Check Valve Backflow Preventer*– All fire lines are required to have a double gate double detector check valve backflow preventer assembly. The double detector check valve and vault is to be located on private property in accordance with the requirements set forth in **Section 5.21** (Backflow Protection).
- 5.12.3 *Fire Department Connection* – When a Fire Department Connection is required, it must be located on the discharge (customer) side of the backflow preventer.
- 5.12.4 *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 owner side of meter, gate valve, or backflow preventer.
- 5.12.5 *Maximum Fire Line Length* – The maximum length of fire lines is 100 feet from the backflow preventer to the City water main, in accordance with **Section 5.21** (Backflow Protection). If the backflow preventer is located within a vault, the vault shall be located adjacent to the right-of-way.

Deviations from this requirement require approval from the Water Department Director through a variance request in accordance with **Section 9** (Variance Process).

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

- 5.12.6.1 All fire lines on existing water mains to be replaced shall be clearly identified on the drawings and when necessary, detailed sequence of construction should 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). The Fort Worth Fire Department may require a construction permit depending on the nature or extent of the work.
- 5.12.6.2 The Engineer may need to visit with affected property owners to obtain fire flow and pressure requirements and incorporate the data into the fire service reconstruction design.
- 5.12.6.3 The Engineer must coordinate with Water Department Field Operations during the design to coordinate design requirements. For situations where the water main is removed and replaced in the same trench, special attention should be given to maintaining adequate fire protection. The transfer time of the fire line to the new water main must be kept to a minimum.
- 5.12.6.4 Where necessary, design and appropriate pay items must be provided for adequate temporary water service to feed fire service lines during construction. If there is any question about the adequacy of the temporary service to the fire line, then the inspector or project manager will request field operations to 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 project manager will assess the situation and make a determination as to the appropriate action.
- 5.12.6.5 The Engineer is responsible for locating and identifying fire services to applicable buildings. The construction drawings should notify contractors that it is their responsibility to maintain fire service to such buildings. The proposed sequence of reconnection for fire lines should be discussed at the pre-construction meeting and adhered to during construction.



- 5.12.6.6 The construction drawings should require contractor to coordinate with the inspector to notify 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. Such notification should be in written form, on company letter head, and the City Inspector shall receive a copy. No fire line shut outs will be allowed without this letter.
- 5.12.6.7 *Fire Department Connection* – When it is required that an immediate water source be provided for a fire protection system, and upon approval by the Fire Department, arrangements shall be made to provide enough water pressure and flow to the system through an alternate means, 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.
- 5.12.6.8 *Standpipe* – When it is required that a standpipe be kept operational from the Fire Department Connection, documents shall be submitted to the Bureau of Fire Protection indicating 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. This may require a visual inspection by a Fire Inspector.
- 5.12.6.9 *Fire Watch Requirements* – When it is required that a fire watch be provided, and upon approval by the Fire Marshal, provisions shall be placed on the construction drawings to ensure 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 this duty so that all portions of the building may 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 (water services, 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* – Unless approved otherwise by the Water Department Staff, 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 should 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 and 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 gate valves shall be located on the construction drawings to allow isolation of specific section of the distribution system to prevent shutting off more than once, services those customers who are served by water lines outside. Usually this will be a water main under a street between two cross streets.

## 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.

- 5.14.1.1 Locations for insertion of cleaning pigs and clean-out wyes shall be located on the construction drawings and in accordance with the City’s *Standard Construction Specifications and Details*. The Water Department Staff will review the cleaning pig insertion locations and clean-out wyes on the drawings.
- 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 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. Refer to *AWWA M51* for suggested 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
<b>16-inch and smaller</b>	2-inch	Combination
<b>24-inch to 30-inch</b>	4-inch	Combination
<b>36-inch</b>	6-inch	Combination
<b>42-inch</b>	6-inch	Combination
<b>48-inch</b>	8-inch	Combination
<b>54-inch and larger</b>	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 may exceed 80 psi, construction drawings should contain provisions for 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 and should avoid conflicts with existing/proposed utilities, including street lighting.
- 5.18.1.3 When in the opinion of the Water Department Staff, the integrity of the water service lines may be jeopardized due to proximity of other utilities, structures, etc., the service line will be required to be placed within casing or sleeve.
- 5.18.1.4 *Location within cul-de-sacs* – Services within cul-de-sacs shall be placed perpendicular to the main, unless otherwise directed by Water Department Staff. A typical layout for water mains and service lines within a cul-de-sac is included in the Appendix.
- 5.18.1.5 *Staggering of Services* – When providing service to both sides of the street, service lines shall be staggered a minimum of 12 inches.
- 5.18.1.6 *Service Lines for Wide Paved Streets* – Wide paved streets resulting in a service length of greater than 55 linear feet will require a parallel main system (water main extension) in accordance with **Section 3** (Policy).
- 5.18.1.7 *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. In no case can a 2-inch or smaller domestic service line and meter be combined with a 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 may be either ¾ -inch or 1-inch.
- 5.18.2.1 A 1-inch water service with two ¾-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 can only be installed in non-paved areas.
- Irrigation meters are not allowed for bullhead installations unless the service tap and line size is increased.
- 5.18.3 *Meters Larger than 2-inches in Size* – Water meters that are larger than 2-inches in size shall contain the following design criteria:
- 5.18.3.1 *Meter Vault* – Meter shall be installed in a vault in accordance with City of Fort Worth Standard Construction Specifications and Details.
- 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 be a combination meter in accordance with *City of Fort Worth Standard Construction Specifications and Details*
- 5.18.3.4 *Purchase* – All meters 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 shall not be shared, split or bullheaded with an irrigation tap.
- 5.18.5 *Sub-metering Requirements*
- 5.18.5.1 Owners shall comply with private sub-metering requirements established by *Plumbing Code* and TCEQ Requirements.
- 5.18.5.2 Water service to multi-unit facilities; including condominiums, apartments, manufactured home rental community and multiple use facilities, will be provided through a master meter, if construction is on one lot.

- Sub-meters and plumbing after the master meter will be installed and maintained at the customers' expense.
- Sub-meters must conform to current *AWWA Standards C700*.
- Master meters will be furnished by the Water Department and paid for by the customer.

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

## 5.19 WATER SAMPLE STATIONS

5.19.1 Water sample stations are required to meet compliance regulatory requirements. These stations may be required to be installed at the request of the City at locations such as: major intersections, water transmission main tees/crosses, large water meters, schools, fire stations, or other locations to be designated by the Water Department.

## 5.20 CATHODIC PROTECTION

5.20.1 If materials other than PVC are proposed for City 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 should include provisions for Cathodic Protection in accordance with 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 the most restrictive requirements set forth by City Code and the City's *Backflow Guidelines, Installation Standards & Specifications*.

5.21.2 *Circumstances Requiring Use of Backflow* – At a minimum, a backflow prevention assembly will be required in each of the following circumstances:

5.21.2.1 When the nature and extent of any activity at a premise, or the materials used in connection with any activity at a premise, or materials stored at a premise, could contaminate or pollute the potable water supply.

5.21.2.2 When a premise has one or more cross connections.

- 5.21.2.3 When internal cross connections are present that are not correctable.
- 5.21.2.4 When intricate plumbing arrangements are present that make it impractical to ascertain whether cross connections exist.
- 5.21.2.5 When a premise has a repeated history of cross connections being established or re-established.
- 5.21.2.6 When entry to a premise is unduly restricted so that inspections for cross connections cannot be made with sufficient frequency to assure that cross connections do not exist.
- 5.21.2.7 When materials are being used such that, if backflow should occur, a health hazard could result.
- 5.21.2.8 When installation of an approved backflow prevention assembly is deemed by an Inspector to be necessary to accomplish the purpose of these regulations.
- 5.21.2.9 When an appropriate cross connection survey report form has not been led with the Water Department Director.
- 5.21.2.10 When a fire sprinkler system using non-potable piping material is connected to the City's water system.
- 5.21.2.11 In all new nonresidential construction there shall be installed an approved backflow assembly at the service connection (outside of City right-of-way or easement). The type of the assembly will be commensurate with the degree of hazard as determined by the inspector.
- 5.21.2.12 When a building is constructed on commercial premises, and the end use of such building is not determined or could change, a reduced pressure principle backflow prevention assembly shall be installed at the service connection (outside of City right-of-way or easement) to provide protection of the public water supply in the event of the most hazardous use of the building.
- 5.21.2.13 If a premise is required to have backflow prevention assemblies, but water cannot be turned off during the testing of such assemblies, the premises shall be equipped with dual backflow prevention assemblies of the same type so that testing, repair and maintenance can be performed.
- 5.21.2.14 Any used water return system that has received approval from the Water Department Director.
- 5.21.2.15 If a point-of-use assembly has not been tested or repaired as required by this Division, a premise isolation assembly shall be required.

- 5.21.2.16 If a Backflow or Plumbing Inspector determines that additions or rearrangements have been made to the plumbing system without the proper permits as required by the *Plumbing Code*, premise isolation shall be required.
- 5.21.2.17 All multistory buildings or any building with a booster pump or elevated storage tank.
- 5.21.2.18 Retrofitting shall be required on all health hazard connections and wherever else the Water Department Director deems retrofitting necessary.
- 5.21.2.19 Any premises requiring multiple service connections for adequacy of supply and/or requiring protection shall have a backflow assembly on each service connection (outside of City right-of-way or easement). The assembly shall be commensurate with the degree of potential hazard that could occur in the event of an interconnect between any of the buildings on the premises.
- 5.21.3 *Location Requirements* – Backflow preventer approval must be obtained from the City of Fort Worth Water Department, Cross Connection Section, prior to installation.
- 5.21.3.1 In the interest of protecting public health, any service that remains in a static condition from the property line to an ending point exceeding 100 linear feet requires installation of an approved backflow prevention device installed within said footage.
- 5.21.3.2 To install the Backflow Assembly inside the building, the distance from tap to assembly shall not be over 100 feet, unless otherwise approved by the Water Department Director. Branch lines from tap at the main to assembly are not allowed.
- 5.21.3.3 For unmetered, dedicated fire lines over 100 feet from tap to assembly, 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.
- 5.21.3.4 All installations shall be horizontal unless approved by the Water Department Director. To be installed in the vertical position, the assembly has to:
- Be approved by University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USCFCCCHR) for vertical installation.
  - Contain spring loaded checks.



- Be installed in the up-flow position.
- Be approved by the appropriate authority within the City.
  - Fire Line backflow approval and permitting is through Water Department’s Backflow Division.
  - All other backflow approvals and permitting is through the City’s building permit process.

5.21.4 Backflow Prevention for Fire Lines

5.21.4.1 Refer to **Table 5-6** for the required types of backflow prevention for fire lines.

**Table 5-6. Backflow Prevention for Fire Lines**

<b>Fire Line Type</b>	<b>Backflow Protection</b>
<b>Fire line with no chemical additive and no additional water supply</b>	Double Check Detector Assembly
<b>Fire line with fire hydrant with no chemical additive and no additional water supply</b>	Double Check Detector Assembly
<b>Fire line with chemical additive</b>	Air Gap Separation or Reduced Pressure Principle Assembly
<b>Fire protection system with access to an auxiliary water supply</b>	Air Gap Separation or Reduce Pressure Principle Assembly
<b>Fire line connected to metered domestic lines</b>	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 will be recommended to be installed to compensate for thermal expansion.

5.21.4.3 Systems containing more than one loop must provide backflow protection for the entire 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



- 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.
- Retrofitting low hazard existing fire line is not required unless size of main is changed or replaced to accommodate pressure loss for additional sprinkler heads.

#### 5.21.4.6 Testing Requirements for Fire Lines

- Backflow prevention for fire lines is permitted and tested through the Water Department.
- *New Fire Lines* – Coordinate with Water Department Backflow Division for specific testing requirements.
- *Existing Fire Lines* – Coordinate with Water Department Field Operations to schedule valve crew and associated testing.
- 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.
- 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, prior to installation. The installation shall conform to the *Backflow Guidelines, Installation Standards & Specifications*.

5.21.6 *Installation Requirements* – Backflow prevention assemblies shall be installed in accordance with the *Plumbing Code* and *City Code*. The assembly installer shall obtain the required plumbing permits prior to installation and shall have the assembly inspected by a certified cross connection inspector and as required by the *Plumbing Code*.

5.21.6.1 No part of a reduced pressure principle backflow prevention assembly (RP) shall be submerged in water or installed in a location subject to flooding. All assemblies installed below grade shall have non-ferrous threaded plugs inserted in the test ports.

5.21.6.2 Assemblies shall be installed at the point of delivery of the water supply, before any branch in the line, and on private property located just inside the boundary of the City's right-of-way. An Inspector may

- specify other areas for installation of the assembly. The assembly shall be protected from freezing and other severe weather conditions.
- 5.21.6.3 All vertical installations shall be approved, in writing, prior to installation and all vertical installations must be of an assembly approved by the USCFCCCHR.
  - 5.21.6.4 The assembly shall be readily accessible with adequate room for maintenance and testing. Assemblies 2 inches and smaller shall have at least a 6-inch clearance on all sides of the assembly. All assemblies larger than 2 inches shall have a minimum clearance of 12 inches on the back side, 24 inches on the test cock side, 12 inches below the assembly and 36 inches above the assembly.
  - 5.21.6.5 If the Water Department Director grants written permission to install the backflow assembly inside of a building, the assembly shall be readily accessible between 8:00 a.m. and 5:00 p.m., Monday through Friday.
  - 5.21.6.6 If an assembly is installed pursuant to *City Code Chapter 12.5-531, subsection (a)(8)*, and is 4 inches or larger and is installed 5 feet or higher above the floor, it shall be equipped with a rigidly and permanently installed scaffolding acceptable to the Water Department Director. This installation shall also meet all applicable requirements set out by the U.S. Occupational Safety and Health Administration and the State of Texas occupational safety and health laws.
  - 5.21.6.7 Reduced pressure principle assemblies may be installed in a vault only if relief valve discharge can be drained to daylight through a bore sight type drain. The drain shall be of adequate capacity to carry the full rated flow of the assembly and shall be screened on both ends.
  - 5.21.6.8 An approved air gap shall be located at the relief valve orifice of RP assemblies. This air gap shall be at least twice the inside diameter of the incoming supply line as measured vertically above the top rim of the drain and in no case less than 1-inch.
  - 5.21.6.9 All assemblies installed in a vault that is 5 feet from finish floor to top of lid must have a permanently installed ladder.
  - 5.21.6.10 Vaults must have BILCO type J, JD or equivalent. Vaults in high traffic areas must have BILCO type HLC, or equivalent
- 5.21.7 For further information related to the requirements for Backflow Prevention, refer to the *Backflow Guidelines, Installation Standards & Specifications* included in the Appendix.

## 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 Concrete Water Vaults

5.22.3.1 In accordance City of Fort Worth *Standard Construction Specifications and Details*, abandonment for concrete vaults is as follows:

- Remove and salvage vault lid, valves, and meters;
- Remove and dispose of piping and other appurtenances; and/or,
- Demolish and remove entire concrete vault and backfill, unless determined by the Water Department Staff to be unfeasible.
  - Should the vault demolition and removal be determined by the Water Department Staff to be unfeasible, the vault may 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

- A minimum of 2 domestic and fire services shall be provided to provide for redundant operation of the entire facility.
  - Each domestic/fire service shall be located on separate water mains.
- Domestic and fire services line shall be separate service with separate taps from the water main.
  - Combined service lines are not allowed.

- Meters should be located at perimeter locations of the development and should be located within private property or vacated streets.
  - Meters cannot be located within a street or within a building with limited access such as a basement, tunnel, garage, etc.

#### 5.23.1.2 Isolation Valves

- Valve should be added as necessary to allow for service from 2 directions.
- Services proposed to be placed on existing water mains should include sufficient isolation at each intersection.
  - Cut-in valves will be required to achieve proper service from 2 directions if valve spacing exceeds 1,000 feet.

#### 5.23.1.3 Distribution Lines

- Water lines should be looped to ensure water quality, reliability, and capacity. Service are not allowed from dead-end water mains.
- Developments proposed adjacent to any existing cast iron water main may require replacement in accordance with **Section 3** (Policy).

## 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 approximately 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.

- Any water main proposed to be located longitudinally within state highway right-of-way requires approval from the Water Department Director.

- 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 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 be responsible for preparing draft permits with all required drawings and attachments 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.

#### 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 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.
- 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 approximately 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.
- Any water main proposed to be located longitudinally within railroad right-of-way requires approval from the Water Department Director.

- 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.
- All new mains shall be located on top of back slope at the outer limits of railroad property.
- If main is located 40 feet or less from centerline of track, the mains shall be encased in a steel pipe as approved by the railroad authority under jurisdiction. No main may be placed within 25 feet from the centerline of the track, or in accordance with railroad requirements, whichever 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 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 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 or 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. As a minimum, cement stabilized backfill shall be used from top of bank to top of bank in accordance with the City's *Standard Construction Specifications and Details*. Erosion control measures are also subject to review by the City's Transportation/Public Works Department.

- 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.
- 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.
- 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.

#### 5.24.4 Trenchless Construction

5.24.4.1 Construction by other than open cut are methods 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

- Engineers should 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. The design engineer is responsible for determining the appropriate bore pit size for the installation.
- 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 should 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 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 for an additional review by the Water Department Staff.

#### 5.24.5 Elevated Crossings

- 5.24.5.1 Elevated crossings for 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 for consideration by the engineer are:

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

- 5.24.5.2 The following basic criteria must be addressed by the engineer for all elevated crossing:

- Prior to proceeding with design for attaching a main to a bridge, documentation of correspondence approving the placement of the main on the bridge should be provided to the Water Department.
- Provisions for thrust restraints at the points of transition from a buried conduit to an elevated conduit and for all elevated changes of alignments and fittings.
- Water main must be fully restrained at changes in alignment and at fittings, as necessary.
- Increased loading effects on the bridge created by a full main and its supports.
- Access to main and appurtenances for maintenance purposes.
- Coatings or methods of corrosion control for elevated pipe sections and pipe supports.



- PVC pipe is not to be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight.
- Evaluate the freeze potential of small diameter or low flow mains.
- To ensure positive restraint in all directions, each joint of pipe is to have 2 support straps. Spacing of pipe supports is to be in accordance with the length of pipe joints specified and one of the supports should be placed near the bell end of the pipe.
- Air relief provisions are required where high points are created in the main.
- A minimum of one expansion joint fitting is recommended for a water main crossing on a roadway bridge. Placement of the expansion joints should coincide with the expansion joints of the road way bridge.
- Water main crossings shall include a valve on each side of the elevated crossing.
- Proposed elevation of the main shall meet low chord bridge requirements and be 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's Street Cut Policy as well as the *Standard Construction Specifications and Details*.

**SECTION 6 – DESIGN CRITERIA FOR WASTEWATER MAINS**

**6.1 GENERAL**

6.1.1 The following are the minimum standard Design Criteria that must be met for all wastewater main improvements in order to meet the requirements of 30 *Texas Administrative Code (TAC) Chapter 217, Sections 217.1 through 217.3*, the current edition of the City of Fort Worth *Subdivision Ordinance*, and the City of Fort Worth *Policy for the Installation of Community Facilities*, also to be approved for incorporation into the Fort Worth Wastewater Collection System.

**6.2 MINIMUM WASTEWATER MAIN SIZE**

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

**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.

6.3.2 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.

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

**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*
<b>Larger than 36</b>	See Section 6.3.D	

\*Minimum/maximum requirements per 30 TAC Chapter 217

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

6.3.4 For mains larger than 36 inches in diameter (I.D.), the slope may 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)

R<sub>h</sub> = hydraulic radius (feet)

S = slope (feet/feet)

6.3.5 *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.

6.3.6 An alignment walk with Water Department Staff and/or study may 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 will require an alignment walk.

6.3.6.1 A conceptual layout should be provided to Water Department Staff for review prior to scheduling the alignment walk.

6.3.7 Wastewater Demand Calculations and Modeling Criteria

6.3.7.1 *Single-Family Residential Demand* – Refer to **Table 6-2** for 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:

6.3.7.2 *Average Day Wastewater Flow for Other Land Uses* – Refer to **Table 6-2** for average day wastewater load for different land use types.

6.3.7.3 Computation Example:

- Single-Family Residential Buildings
  - Average load per person in GPM = 100/1440 = 0.0694 GPM

- Average load of a given population in GPM = (0.0694 GPM) x (population) = (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	-	35
Junior and High School (with showers and cafeteria)	-	20
Elementary School (with cafeteria and no showers)	-	15
Restaurant	-	10 gallons/meal
Restaurant (with bar and cocktail lounge)	-	12 gallons/meal
Hospitals	-	315

6.3.7.4 Peak Daily Flow (PDF)

- Each wastewater main shall be sized with a peaking factor to appropriately 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 absence of actual peaking flow, **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

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

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

Where: M = Ratio of Design Load to Average Load

P = Population in Thousand

- *Procedure for Design Flow Calculation* – Using the cumulative population at each load point based on residential and employment density, calculate the cumulative population load at each point of load increment to determine the load on each section below that point using:
  - Step 1:
    - Average load per person per day equal to 100 gallons for single-family buildings.
    - Average load per employee/person/student is 35 gallons per day for non-residential buildings.
  - Step 2:
    - Average load per person in GPM = 100/1440=0.0694 GPM
    - Average load per employee/person/student in GPM = 35/1440 = 0.0243 GPM
  - *Step 3:* Average load of a given population (in GPM) = (0.0694 GPM x population) + (0.0243 GPM x employment) = (load in GPM)
  - *Step 4:* Total Design Load = PDF x the average load generated by the ultimate population to be served by the main being designed

- *Special Considerations for Infiltration Load* - The Water Department has found through study that an infiltration load must be considered for use on projects serving large areas developed using clay pipes. An allowance of 1.5 times the total design load will be used in order to provide for excess infiltration in such areas.

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

- 6.4.1 *Typical Locations* – The following design criteria shall be considered to be the normal locations for wastewater mains, service lines, and appurtenances in the Fort Worth wastewater system
- 6.4.1.1 *Normal Residential Wastewater Mains* – The normal location of the wastewater main shall be in the south or west 1/4 of the street, as appropriate.
- 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).
- For situations where a main extension is impractical due to grade limitations or corridor/installation constraints, a Variance Request may be submitted for Water Department Director approval in accordance with **Section 9** (Variance Process)
- 6.4.1.3 *Residential Wastewater Service Lines* – The normal location for a wastewater service line shall be at the center of the lot frontage.
- Wastewater service lines should maintain a minimum horizontal separation of 9 feet from water service lines as measured from the outside diameters of each service line.
  - Wastewater services should avoid placement in driveways. If the normal location places the service in the driveway, the service line should be designed to placed south or west of the proposed driveway location.
  - 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.

- For wastewater mains serving each side of the street, service lines should be staggered such that a distance of 24 inches separates the centerlines of each service tap.

6.4.1.4 *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.

6.4.1.5 *Typical Layouts* – Typical layouts for 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.

- 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 top of bank of a creek, river, channel, or other water feature.

6.5.2 Depth of Cover Requirements

6.5.2.1 Wastewater mains should be laid with the top of the pipe at a minimum of 42 inches below the surface of the ground, or future ground, whichever is greater. The standard depth of cover is 72 inches. Wastewater mains laid with less than 42 inches of cover, as measured from the top of pipe to the surface, require approval from the Water Department Director.

- Where the topography requires that a wastewater main be installed with less than 42 inches of cover, upon approval from the Water Department Director, 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 *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*.

6.5.3.1 4-inch wastewater service line connections are not permitted to wastewater mains exceeding 15 feet of cover. An extension of a horizontally parallel wastewater main is required for wastewater service line connections in this case in accordance with **Section 3** (Policy). Vertically stacked mains are not allowed.

- *Exceptions* – In certain cases such as creek crossings, where mains are required to be deep to achieve proper clearance from the flowline of the crossing, parallel main extensions may not be required for service installations. This will be evaluated on a case-by-case basis by request of a variance in accordance with **Section 9** (Variance Process).

6.5.4 Clearance Requirements

6.5.4.1 Other Wastewater Mains

- 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. 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 4 feet, or more, clearance.

6.5.4.2 Storm Drain

- When wastewater mains are parallel to storm drains, the minimum horizontal clearance shall be 5 feet as measured from the outside diameters of each main, or as allowed by the Transportation/Public Works Department, whichever is greater.
- When wastewater mains cross storm drains, the wastewater main should cross the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main
  - Concrete Stabilized Sand (CSS) or Controlled Low Strength Material (CLSM) backfill is required for any storm drain crossings.



- If the minimum clearance of 2 feet crossing the storm drain cannot be achieved, casing, bridging structures, or other special engineered structural design may be required.
- At the discretion of Water Department Staff, crossings beneath large storm drains or box culverts may require steel casing.
- In no cases will wastewater mains to be permitted to cross through storm drains or storm drain junction structures.

6.5.4.3 *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. Proposed franchise utilities shall cross beneath wastewater mains. Where the minimum clearance cannot be accommodated, less than minimum clearance may be allowed at the discretion of Water Department Staff.

- Coordination with each utility is required to confirm clearance requirements.
- The more stringent clearance requirements will be enforced.

6.5.4.4 *Non-Franchise Utilities* – Wastewater mains proposed to parallel or cross existing non-franchise utility lines, such as gas/energy pipelines, shall adhere to the owner of the gas pipeline’s clearance, and other, requirements. 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. 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.

- Coordination with the non-franchise utility line owner is required to confirm clearance requirements. The more stringent clearance requirements will be enforced.

6.5.4.5 *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.

#### 6.5.4.6 Drainage Headwalls and Inlets

- Wastewater mains shall not cross under headwalls and inlets.
- Wastewater 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.
  - In right-of-way sections where this clearance is not feasible, an alternate alignment for the wastewater main may be allowed at the discretion of the Water Department Staff.
- 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.

#### 6.5.4.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

- 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.
- 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.

6.5.4.8 *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.

6.5.4.9 *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 Design 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 should be provided for review.

## 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 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. Wherever possible, 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 should be installed at 500-foot intervals to prevent migration of water within the water main trench, unless otherwise determined by the Engineer.
- 6.7.2.2 *Other Requirements* – Trench water stops are required for wastewater mains when the following conditions are present:
- Slopes exceeding 3%
    - Trench water stops should be placed before each manhole and at 200 feet intervals.
  - 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 preferred 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

- Manholes for 4-inch service lines require prior approval by the Water Department Staff.

6.8.2.2 In situations when the slope of a service line on public or private property is 5%, or greater. If multiple adjacent service lines result in this scenario, an alternate solution will need to be developed and discussed for consideration by the Water Department Staff.

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 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.

6.9.2 Distance Between Manholes

6.9.2.1 Refer to **Table 6-4** for the maximum distance between wastewater manholes on mains.

**Table 6-4. Maximum Distance Between Manholes**

Size of Wastewater Main	Distance Between Manholes (feet)
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 (feet)
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 unless conditions warrant another manhole type.

- *Type A Manholes* – Type A manholes are required for wastewater mains 36-inch, and larger.
- *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*.
  - Upon approval by Water Department Staff, wastewater access chambers may only be considered at the end of the main when shallow wastewater main conditions exist within narrow corridors, such as an alley, and within non-traffic areas. The Water Department will determine whether a wastewater access chamber can be used.

6.9.4 Manhole Flowlines

6.9.4.1 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.

6.9.4.2 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 Corrosion Prevention

6.9.5.1 Manholes are required to be lined in accordance with the City’s *Standard Construction Specifications and Details* when **any** of the following conditions exist:

- Manholes on wastewater mains 15 inches and larger in diameter;
- Manholes transitioning from force mains to gravity mains;
- Drop Manholes;
- Manholes constructed with a hydraulic slide;

- Manholes with entering or exiting wastewater main slopes of 3%, or greater; or,
- Manholes connecting wastewater mains exceeding 15 feet of cover from the top of the main to the surface.

6.9.6 *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.

6.9.6.1 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.

- If this cannot be accommodated, an alternate venting method to minimize inflow, shall be proposed for review by the Water Department Staff.

6.9.7 *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 plug shall be blocked with concrete.

6.9.8 Concrete Collars

6.9.8.1 All wastewater main manholes within asphalt pavement, unpaved alleys, or other load bearing areas, shall have a concrete collar to secure manhole frame.

- Manholes located in concrete paved areas within the street will not require concrete collars but must be sawcut 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, of course, 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-degree angle. 6-inch and larger wastewater service lines shall connect to a manhole on the wastewater main at a 90-degree 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 When allowed by Water Department Staff, any installations requiring a depth of cover less than 36-inches 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.
- When the minimum clearance cannot be achieved, the design should include casing the services line with ductile iron pipe sufficiently beyond the limits 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 larger than 15 inches. An extension of a parallel main is required in accordance with **Section 3** (Policy).

## 6.11 CLEANOUTS

- 6.11.1 Cleanouts may not be used except at the end of a 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 6-inch and larger service lines require a manhole at the property line.

6.11.3.1 If there is not sufficient space to meet this requirement, a variance request can be submitted for an alternate installation method for review in accordance with **Section 9** (Variance Process).

## 6.12 CLOSED CIRCUIT TELEVISION VIDEO (CCTV)

6.12.1 Post-CCTV is required for all wastewater main and service line construction projects and should be included as a bid item in the construction documents. Pre-CCTV is required for all rehabilitation or relocation wastewater main projects, as well as some grading projects, and should be included as a bid item in the construction documents. 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 may not be allowed to commence without approval of CCTV submittals.

## 6.13 INVERTED SIPHONS

6.13.1 Inverted siphons should be avoided and shall only be considered where avoidance or adjustment of the obstructing utility or structure is not practical. An inverted siphon can be designed to a portion of a wastewater main which dips below the hydraulic grade line to avoid any obstructions including, but not limited to a drainage structure, utility, tunnel or stream. When allowed by the Water Department Staff, siphons shall be designed in accordance requirements of *30 TAC Chapter 217.53.*, and the following additional requirements:

6.13.1.1 Provide permanent access to all structures for maintenance of facilities.

- Junction structures/manholes shall have adequate access 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 as approved by the Water Department.

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 should be lined with an approved lining system in accordance with the City's *Standard Construction Specifications and Details*.



- 6.13.1.5 Design for structures shall include a submittal of buoyancy calculations to ensure the prevention of floatation of the wall and floor sections during at a 100-year water surface elevation.
- 6.13.1.6 Construction drawings and specifications should 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 may require the installation of odor control units at force mains, lift stations, inverted siphons, drop manholes, or 24-inch (and larger) diameter gravity mains. Odor control units must be designed in accordance with requirements as determined by the Water Department and be compatible with existing odor control units within the City.

#### **6.15 PRE-TREATMENT**

- 6.15.1 Pre-treatment facilities should be designed and installed in accordance with the City of Fort Worth Guidance Document for Sizing and Installation of Grease Traps and Interceptors.

#### **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* as approved by the appropriate permitting authority on a case-by-case basis.

#### **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. In the rare occasion that a wastewater main extension is not a feasible service alternative, the Water Department Director may require design and construction of a lift station and force main to serve a development. Lift stations and force mains are often discouraged due to their higher risk of causing a wastewater overflow and increased maintenance costs. If service by a gravity wastewater main is not feasible upon agreement by the Water Department Director, lift stations and force mains shall be designed with the criteria described in the following sections.
- 6.17.2 Preliminary Engineering Report
  - 6.17.2.1 The design engineer shall submit Preliminary Engineering Report prepared by Licensed Professional Engineer in the state of Texas for the proposed lift station force main in accordance with this section

and the requirements of *30 TAC Chapter 217.59: Lift Station Requirements*. The Preliminary Engineering Report shall consist of, as a minimum, the following components:

- Introduction and Justification for Proposed Lift Station;
- Site Location, Property Dedication, and Access;
- Wastewater Flow Analysis;
- Force Main System Curves and Pump Curves;
- Downstream Wastewater Main Capacity Available;
- Electrical Power and Reliability; and,
- 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.

- 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* – Standard lift station consisting of 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 the Texas Department of Licensing and Regulation.

#### 6.17.5 Civil Design Criteria

##### 6.17.5.1 Wastewater Flow Projections

- Calculate projected wastewater inflow to a lift station using the procedure outlined *Water and Sewer Study Guidelines* included in the Appendix. The wastewater inflow calculations, shall contain, as a minimum, the following:
  - Total acreage in lift station watershed and total acreage proposed to be served by the lift station;

- total population and acreage of existing developments to be served by lift station;
- total population, proposed land uses, and acreage of developments to be served by lift station;
- Harmon’s peaking factor; and,
- average day and maximum day inflows to lift station.
- *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

- *Lift Station Site Survey and Platting* – Prepare site survey containing the lift station site boundary legal description or plat also indicating 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.
- *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. Site shall be accessible by maintenance vehicles, including cranes and other large vehicles, during all weather conditions, including 100-year, 24-hour rainfall event.
- *Water Service* – Provide a 1-inch water service with hose bib on-site.
- *Lift Station Fence and Gate*
  - Provide intruder resistance fence in accordance with *30 TAC Chapter 217.59*.
  - *Gates* – Provide a gated entrance with two 8-foot wide gates across the access road with a removable center pole.
    - Gates may be required to be upgraded as necessary depending on the size of the lift station and the equipment located on site.
    - Set gate entrance back at least 20 feet from the road to allow vehicles to pull off the road before opening the gate.

- Flood Protection
  - The lift station shall be protected from the 100-year flood event including wave action. The following Items shall be indicated in the drawings:
    - The 100-year base flood elevation (BFE) and/or floodplain delineation;
    - the elevation of the top of the wet well;
    - the elevation of the vent pipe outlet; and,
    - the elevation of base of all motor control centers.
  - Grade the site to generally to drain away from the lift station wet well, and to remove storm water runoff from the site in a non-erosive manner.
  - *Flood Study* – Provide a flood study 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

- Size and configure wet wells in accordance with *30 TAC Chapter 217.60 – Lift Station, Wet Well, and Dry Well Designs* with the following additions:
  - *Wet Well Materials* – Only reinforced concrete wet wells are acceptable.
  - *Wet Well Coatings* – Interior of the lift station wet well shall be coated with a structural epoxy liner in accordance with the City’s *Standard Specifications*.
  - *Baffle Walls* – Provide anti-vortexing baffle walls for lift station with firm pumping capacity greater than 5.0 MGD, when required by the requirements of the Hydraulic Institute, or the pump manufacturer
  - *Wet Well Level* – Bubbler systems are prohibited. Wet well water levels shall be by ultrasonic with float switches provided as a back-up
  - *Hydrostatic Test* – Prior to 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*.

- *Ventilation*– Ventilation for the wet well shall be designed as a passive gravity ventilation system.
- *Minimum Acceptable Diameter of Air Vents* – The minimum allowable passive vent diameter shall be 6 inches. Provide stainless steel screens to prevent bird and/or insect entry into the wet well.
- *Odor Control* – Odor control facilities may be required if there is potential odor to be a nuisance at the site. 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* – Design the wet well and valve vault 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. Submit buoyancy calculations to the Water Department upon request.
- 6.17.6.3 *Structural Design Considerations* – The wet well and valve vault shall be constructed using cast-in-place reinforced concrete. Structural design calculations for the wet well and valve vault shall be submitted to the Water Department, upon request.
  - At a minimum, design wet well and valve vault for the following loading conditions:
    - *Loading Condition #1* – Wet well empty with full lateral loads developed from groundwater and soil surcharge conditions.
    - *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. Provide hatch nets or other approved fall prevention system for hatches which provide access into the wet well. If not included in the City’s Standard Products List, acceptable manufacturers include Bilco, Flygt, or approved alternate. Unless otherwise specified, access hatches shall be designed for 300 pounds per square foot load rating and be sized to accommodate removal of a pump sized for build-out conditions of the station. Hatch size shall also be sufficient for pump removal while mounted on rails with a 12-inch horizontal clearance.
- 6.17.6.6 Hardware used within the wet well, to include pipe supports, pump guide rails, pump lifting chains, pipe fasteners, anchor bolts, clasps, etc., shall be stainless steel.
- 6.17.6.7 *Pipe Penetrations* – Pipe penetrations into the lift station wet well shall be waterproof and gas proof. Pipe penetrations use manufactured wall pipe or other approved method.
- 6.17.6.8 *Electrical conduits* – Electrical conduits must pass through concrete walls using use wall sleeves or core through walls and provide waterproof and gas proof seals using link seals, or other approved method.
- 6.17.7 Pumping and Mechanical Design Criteria
- 6.17.7.1 *Lift Station Pumps* – Lift Station Pumps and Mechanical shall be in accordance with *30 TAC Chapter 217.61 - Lift Station Pumps* with the following additions:
- Pumps shall be submersible only.
  - Pump and Motor Requirements:
    - Allowable pump manufacturers shall be pre-approved by Water Department
    - Pumps shall be non-clog submersible, or approved equal, capable of passing a minimum 3-inch diameter solid.
      - 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.
      - Grinder type pumps shall contain a grinder/shredder type impeller.

- 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.
- 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.
- Motors shall be non-overloading over the entire range of pump operation.
- HOA switches should be provided for each pump with red running lights indicating true run status.
- Submersible pumps shall be removable for inspection or service without entering the wet well.
- Pumps impellers shall be certified to pass or shred flushable wipes.
- The pump manufacturer shall be responsible for supplying 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.
- *Pump Head Calculations* – System curves versus the pump curve. One system curve shall be developed using a C factor of 120, and another system curve shall be developed using a C factor of 140. The selected pumps should be able to pump at a minimum efficiency of 60% between the heads generated between these C factors.
- *Net Positive Suction Head (NPSH)* – The NPSH available shall always at least 5 feet greater than the NPSH required as calculated according Hydraulic Institute Standards. Calculations shall be submitted to the Fort Worth Water Department, upon request.

6.17.7.2 Lift Station Pipes and Valve Vaults

- Lift Station Pipes shall be in accordance with *30 Chapter TAC 217.62 - Lift Station Pipes*, with the following additions:
  - 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 7 feet per second.

- *Emergency Bypass Allowance* – The lift station piping shall allow an emergency bypass of the lift station wet well. Provide a tee with a valve and quick connect on the discharge side of the isolation valves.
- *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.
- *Exposed Piping* – Exposed piping shall be flanged ductile iron and shall be painted with a primer and coating combination acceptable to the Water Department. Flanged pipe and fittings within the wet well and valve vault shall be supported sufficiently to avoid excessive stress to flanges and to allow for routine maintenance.
- *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 as required to gage the pump discharge head over the entire range of operation.
- *Check Valves* – Provide a dedicated check valve for each pump located within the valve vault.
  - Check valves shall not be installed vertically.
  - Check Valves with less than 5 fps and the system head is less than 60 feet, the check valves may be swing type with weighted lever.
  - Check Valves with greater than 5 fps or where the system head is greater than 60 feet, the check valves shall be cushioned check swing valve.
  - Check valves shall be of a type and manufacturer acceptable to the Water Department.
- *Surge and Pressure Relief Valves* – Surge or pressure relief valves shall be required where the surge pressure exceeds the pressure rating of the pipe.
  - The surge relief line shall be piped back into the wet well.
  - Surge and pressure relief valves shall be of a type and manufacturer acceptable to the Water Department.



- *Isolation Valves* – Each pump shall have a dedicated isolation valve.
  - 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.
  - Isolation valves shall be of a type and manufacturer acceptable to the Water Department.
- *Access Hatches* – Access hatches shall be aluminum frame with stainless steel hardware and lockable with a recessed hasp.
  - If not included in the City’s Standard Products List, acceptable manufacturers include Bilco, Flygt, or approved alternate and be sized to accommodate removal of a pump sized for build-out conditions of the station. Hatch size shall also be sufficient for pump removal while mounted on rails with a 12-inch horizontal clearance.
  - Unless otherwise specified, access hatches shall be designed for 300 pounds per square foot load rating.
- *Ladders and Ladder Safety Equipment (Valve Vault Only)* – The minimum allowable ladder width shall be 16 inches. Rung spacing shall be 12 inches, center to center. 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.
  - *Ladder-Up Safety Devices* – Ladder safety extension, shall be provided with the ladder. Ladder extension shall be easily reachable from the top slab of the valve vault.
- 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.
- 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.
- Valve vault floors shall be sloped to the sump to float activated sump pump. The sump pump will pump water directly into the wet well. The sump pump shall be located in a 24-inch deep by 24-inch diameter sump. Sump pumps shall be provided with a check valve and shutoff valve, located in the valve vault.

- 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
- The slope of the valve vault floor shall drain all water to the sump.

6.17.8 *Emergency Provisions for Lift Stations* – Provisions for signage, alarms, alternate power sources, as a well as other requirements shall be included in the system design in accordance with 30 TAC Chapter 217.63 – *Emergency Provisions for Lift Stations*.

6.17.8.1 Emergency on-site electrical power generation is required.

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:

- *Alignment* – Force mains shall be aligned to minimize peaks and valleys which require combination air/vacuum valves.
- *Surge Pressure Design Considerations* – The engineer shall calculate the surge pressures expected within the force main during pump operation.
  - Where applicable, surge valves shall be placed downstream of the check valve and shall discharge back into the wet well.
- *Receiving Gravity Wastewater System* – Due to odor considerations, the manhole at the transition from the force main to gravity main shall be located in the City right-of-way and as far away from existing or proposed residences as possible. Transition manhole should be designed to prevent surcharging and/or overflow conditions.

- A corrosion resistant coating shall be placed at the transition between the wastewater force main and the receiving gravity main.
- *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.
  - Combination air and vacuum valves shall be required at all peak/high points and all valleys/low points along the force main vertical profile.
  - Combination air and vacuum valves shall be of a type and manufacturer acceptable to the Water Department.

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 appropriate termination strip. Junction box must be a minimum of 3 feet away from 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 approved control system and equipment with ultrasonic level control. A high-level and low-level alarm float shall be included within the monitoring system. Low-level float shall lock out 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* – Prepare a load analysis to size the main disconnect, switches, generator (if required), motor breakers and starters, transformer, wiring and conduit, and enclosures. Electrical system shall meet the requirements of the City of Fort Worth *Electrical Code*.
- 6.17.10.4 *Single Line Diagrams* – Prepare a single line diagram of the lift station electrical system and include the diagram within the engineering drawings.
- 6.17.10.5 *Control System Wiring Diagrams* – Prepare the control wiring diagram(s) and include the diagram(s) within the Drawings.
- 6.17.10.6 *Enclosure Layout Diagrams* – Prepare a schematic of the electrical enclosure layout, motor control center, and support structures and include the schematics within the Drawings.

- 6.17.10.7 *Enclosures* – All exterior enclosures shall be NEMA 4, type 304 or type 316 stainless steel. Enclosures must be mounted above the 100-year base flood elevation. Motor control centers placed inside a control building may be NEMA 3R.
- 6.17.10.8 *Lighting* – The lift station site shall be lighted with an approved 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* – Provide SCADA monitoring system within the 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, provide a radio frequency study.
- 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 design 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. In the rare occasion that a wastewater main extension is not a feasible service alternative, the Water Department Director may allow design and construction of a low-pressure system to serve a development. At a minimum, low-pressure systems shall be design in accordance with the section and *30 TAC Chapter 217.97 – Pressure Sewers*.
- 6.18.2 Design for the low-pressure system shall include grinder pumps, vault/wet well, service lines, electrical/mechanical and enclosures, discharge mains, and collection mains. 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 should be provided for any facilities to be maintained by the City.
- 6.18.4 Provisions should be made in the form of an agreement between the Water Department and the private entity responsible for the system 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 prior to the new wastewater main being 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 design 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.
- 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 to be abandoned should be shown to be removed on the construction drawings.
- Should manhole/structure removal be determined by the Water Department Staff to be unfeasible due to proximity of other structures or utilities, the manhole/structure may be abandoned by removing the top 3 feet of the manhole/structure and filling with controlled low strength material (CLSM) in accordance with *City of Fort Worth Standard Construction Specifications and Details*
- 6.20.2.3 Wastewater mains within a single lot can be abandoned or converted to service lines by written request to the Water Department. 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. The following reference applies: *43 TAC, Part 1, Chapter 21, Subchapter C – Utilities Accommodation*.
- 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 approximately 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.
- Any wastewater main proposed to be located longitudinally within state highway right-of-way requires approval from the Water Department Director.
- 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, unless allowed to be omitted at the discretion of Water Department Staff.
- 6.21.1.8 The Engineer shall be responsible for preparing draft permits with all required drawings and attachments 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.

## 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.
- Any wastewater main proposed to be located longitudinally within railroad right-of-way requires approval from the Water Department Director.
  - 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.
  - All new mains shall be located on top of back slope at the outer limits of railroad property, and outside of the zone of influence of any structure.
  - If main is located 40 feet or less from centerline of track, the mains shall be encased in a steel pipe as approved by the railroad authority under jurisdiction. No pipe may 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 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.
- 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 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 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. As a minimum, cement stabilized backfill shall be used from top of bank to top of bank in accordance with the City's *Standard Construction Specifications and Details*. Erosion control measures are also subject to review by the City's Transportation/Public Works Department.
- 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.
  - 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.
  - 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.



#### 6.21.4 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

- Design engineers should 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.
- 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 should 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 these standard 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 for an additional review by the Water Department Staff.

#### 6.21.5 Elevated Crossings

6.21.5.1 Elevated crossings for wastewater 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 for consideration by the engineer are:

- Hanging the wastewater main on a roadway bridge; or,
- Designing a specific utility bridge for the support of the wastewater main crossing.

6.21.5.2 The following basic criteria must be addressed by the engineer for all elevated crossings:

- Elevated crossings must maintain gravity flow to meet capacity requirements.
- Prior to proceeding with design for attaching a main to a bridge, documentation of correspondence approving the placement of the main on the bridge should be provided to the Water Department.
- Increased loading effects on the bridge created by a full main and its supports.
- Access to main for maintenance purposes.
- Coatings or methods of corrosion control for elevated pipe sections and pipe supports.
- PVC pipe is not to be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight.
- Evaluate the freeze potential of small diameter or low flow mains.
- To ensure positive restraint in all directions, each joint of pipe is to have (2) support straps. Spacing of pipe supports is to be in accordance with the length of pipe joints specified and one of the supports should be placed near the bell end of the pipe.
- Placement of the expansion joints should coincide with the expansion joints of the road way bridge.
- Wastewater main crossings shall include a manhole on each side of the elevated crossing.

#### 6.21.5.3 For bridge sections:

- Pipe with restrained joints or monolithic pipe shall be required between manholes on each end of bridged sections.
- Design to withstand the hydraulic forces applied by the occurrence of a 100-year flood, including buoyancy.
- Pipe material shall also be capable of withstanding impact from debris.
- Bank stabilization shall be provided to prevent erosion of bank sections.

- Pier supports shall be spaced and designed to ensure that adequate grade, slope and structural integrity are maintained.

## 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's Street Cut Policy as well as the *Standard Construction Specifications and Details*.

## SECTION 7 – DESIGN CRITERIA FOR RECLAIMED WATER MAINS

### 7.1 GENERAL

- 7.1.1 The following are the minimum Standard Design Criteria that must be met for all reclaimed water improvements in order to 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 *Policy for the Installation of Community Facilities*, and *City Code Chapter 35* to be approved for incorporation into the Fort Worth Reclaimed Water System.
- 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 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 should 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 should 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 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 Water Department Staff and/or study may 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.
- 7.2.6 *Water Demand Calculations* – Demand calculations and assumptions should be submitted for review. Where applicable, calculations and criteria should adhere to the guidelines set forth in the *Water and Sewer Study Guidelines* which are included in the Appendix.

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

- 7.3.1 Location of all new reclaimed water mains shall be considered on a case-by-case basis generally on the opposite side of the street from any existing or proposed water mains. Reclaimed water mains should be located where maintenance can be accomplished with the least interference with traffic, structures, and other utilities. When mains are located outside of the right-of-way, they shall be within a dedicated reclaimed water main easement.
- 7.3.2 *Valves* – In general, valve locations for reclaimed water mains should meet the same requirements as water mains.
  - 7.3.2.1 Valves should be located at all reclaimed water main intersections and should typically 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, unless other locations are approved by the Water Department Staff.
  - 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* – The preferred location for reclaimed water service lines is within the parkway in front of the right-of-way line, and adjacent to the opposite property line from the water service. However, minimum separation distances should be provided:
  - 7.3.3.1 Reclaimed water service lines should be separated a minimum distance of 9 feet from 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, where practicable. Two 45° bends in a series should be used in lieu of 90° bends. Tee fittings should 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 should be used to secure all branch valves to fittings. **Table 7-1** includes the minimum lengths of pipe to be restrained for 8-inch and 12-inch PVC reclaimed water mains.

**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 Clearance Requirements
  - 7.4.5.1 Other Water Mains
    - 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. 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 5 feet, or more, clearance.

#### 7.4.5.2 Storm Drain

- 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, or as required by the Transportation and Public Works Department, whichever is greater.
- When reclaimed water mains cross storm drains, the reclaimed water main should cross over the storm drain with a minimum clearance of 2 feet as measured from the outside diameters of each main.
  - If the minimum clearance of 2 feet crossing over the storm drain cannot be achieved, casing or an alternate alignment may be required.
  - If crossing over the storm drain cannot be achieved, the reclaimed water main should cross under the storm drain in accordance with the City's *Standard Construction Details*.

7.4.5.3 *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. Where the minimum clearance cannot be accommodated, less than minimum clearance may be allowed at the discretion of Water Department Staff.

- Coordination with each utility is required to confirm clearance requirements.
- The more stringent clearance requirements will be enforced.

7.4.5.4 *Non-Franchise Utilities* – Reclaimed water mains proposed to parallel or cross existing non-franchise utility lines, such as gas/energy pipelines, shall adhere to the owner of the gas pipeline's clearance, and other, requirements. At a minimum, reclaimed 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. 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.

- Coordination with the non-franchise utility line owner is required to confirm clearance requirements. The more stringent clearance requirements will be enforced.

7.4.5.5 *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.

7.4.5.6 Drainage Headwalls and Inlets

- Reclaimed water mains shall not cross under headwalls and inlets.
- 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.
  - In right-of-way sections where this clearance is not feasible, an alternate alignment for the reclaimed water main may be allowed at the discretion of the Water Department Staff.
- 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.

7.4.5.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

- 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.
- 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.

7.4.5.8 *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.

7.4.5.9 *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 should be provided for review.

## 7.5 RECLAIMED WATER MAIN SEPARATION FROM WATER AND WASTEWATER MAINS

- 7.5.1 In accordance with *30 TAC Chapter 210.25* requirements, where a reclaimed water main parallels a wastewater main, the reclaimed water main shall be constructed in accordance with subsection (1) of this section. The horizontal separation distance shall be 3 feet (outside diameter to outside diameter) with the reclaimed water main at the level of or above the wastewater main. Reclaimed water mains which parallel wastewater mains may be placed in the same benched trench. Where a reclaimed water main crosses a wastewater main, the requirements of *Chapter 290.44* shall be followed, with "reclaimed water main" substituted in for "water main."
- 7.5.2 In accordance with *30 TAC Chapter 217.70* requirements, a Type I reclaimed water pipe must be at least 4 feet from a potable water pipe, as measured from the outside surface of each of the respective pipes. A physical connection between a potable water pipe and a reclaimed water pipe is prohibited. Where a 4-foot separation distance cannot be achieved, a reclaimed water main must meet additional separation requirements set forth in *30 TAC Chapter 217.70*.

## 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 should be stenciled in white with a warning reading "Non-Potable Water".
- 7.6.2 Other material and embedment requirements for reclaimed water mains shall be as defined in 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 should be installed at 500-foot intervals to prevent migration of water within the water main trench, unless otherwise determined by the Engineer.
- 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 are to 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 are the preferred method of connecting a new reclaimed water main to an existing reclaimed water main. If this method is determined not to be feasible by the Water Department Staff, a tapping sleeve and valve may be used.
- 7.7.1.1 Cut-in connections may 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 REQUIREMENTS

- 7.8.1 *Valve Spacing* – Spacing between valves for reclaimed water mains shall be at a minimum of every 1,500 feet, or as needed for operation of the reclaimed water system.
- 7.8.2 *Mains* – All new reclaimed water main connections (reclaimed water services, mains etc.) shall contain a valve at connections to an existing or proposed reclaimed water main.
- 7.8.3 *Gate Valves* – Unless approved by the Water Department Staff, only gate valves will be used in the distribution system for reclaimed water mains.
- 7.8.3.1 *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.
- 7.8.3.2 *Minimum Gate Valve Size* – The minimum size of gate valve allowed is 6 inches. Any valves needed for 4-inch or smaller connections should be increased with a 6-inch reducer fitting and 6-inch gate valve.
- 7.8.4 *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.

## 7.9 CLEANING, TESTING, AND SAMPLING

- 7.9.1 *Cleaning Pigs and Wyes* - In strategic locations along 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 shall be

supplemented with sampling points, as required, for testing of the reclaimed water main.

- 7.9.1.1 Locations for insertion of cleaning pigs and clean-out wyes shall be located on the construction drawings and in accordance with *City of Fort Worth Standard Construction Specifications and Details*. The Water Department Staff will review the cleaning pig insertion locations and clean-out wyes on the drawings.
- 7.9.1.2 Cleaning wyes should include a receiving cage to accommodate pressure differentials during pigging operations.
- 7.9.2 *Water for Cleaning and Testing* – If reclaimed water is not available for cleaning and testing, provisions should be made in the construction drawings to temporarily connect the reclaimed water main to a potable water main. The temporary connection must include 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 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. Refer to *AWWA M51* for all suggested locations and types of air release/vacuum valves. **Table 7-2** includes general sizes of combination air valve assemblies but shall be verified by the Engineer.

**Table 7-2. 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

- 7.10.1.1 A smaller size relief valve may be used if calculations sealed by a Licensed Professional Engineer are provided to demonstrate 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 valve sizes are 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, capacity of the receiving discharge wastewater main must be evaluated to determine whether the main has 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 DEVICE**

- 7.12.1 A backflow prevention device shall be installed at each delivery point and discharge point to protect the reclaimed water system from potential cross contamination. Air gaps and reduced pressure principle backflow prevention assemblies are acceptable methods of backflow prevention for reclaimed water systems in accordance with *30 TAC Chapter 290.47(f)*, effective July 30, 2015. The Engineer is responsible for adhering to the most current version of these requirements.

**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.
- 7.13.3.3 An example sign is included below:



**DO NOT DRINK THE WATER**

**NO TOMAR EL AGUA**

**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 should meet the same criteria as set forth in **Section 5.18** (Service Line and Water Meter Requirements) for water meters, in addition to 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.
  - 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 should 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*.
- 7.16.2 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. The following reference applies: *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.
- Any reclaimed water main proposed to be located longitudinally within state highway right-of-way requires approval from the Water Department Director.
- 7.17.1.5 All reclaimed water crossings shall be cased with steel casing pipe, in accordance with 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 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 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.

- 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.
- Any reclaimed water main proposed to be located longitudinally within railroad right-of-way requires approval from the Water Department Director.
  - 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.
  - All new mains shall be located on top of back slope at the outer limits of railroad property.
  - If main is located 40 feet or less from centerline of track, the mains shall be encased in a steel pipe as approved by the railroad authority under jurisdiction. No pipe may 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 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 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. As a minimum, cement stabilized backfill shall be used from top of bank to top of bank in accordance with the City's *Standard Construction Specifications and Details*. Erosion control measures are also subject to review by the City's Transportation/Public Works Department.

- 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.
- 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.
- 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

- Engineers should 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.
- 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 should 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 for an additional review by the Water Department Staff.

#### 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 for consideration by the engineer are:

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

7.17.5.2 The following basic criteria must be addressed by the engineer for all elevated crossing:

- Prior to proceeding with design for attaching a main to a bridge, documentation of correspondence approving the placement of the main on the bridge should be provided to the Water Department.

- Provisions for thrust restraints at the points of transition from a buried conduit to an elevated conduit and for all elevated changes of alignments and fittings.
- Reclaimed water main must be fully restrained at changes in alignment and at fittings, as necessary.
- Increased loading effects on the bridge created by a full main and its supports.
- Access to main for maintenance purposes.
- Coatings or methods of corrosion control for elevated pipe sections and pipe supports.
- PVC pipe is not to be used for any exposed sections of elevated crossing because of the deterioration caused by the ultraviolet rays present in direct sunlight.
- Evaluate the freeze potential of small diameter or low flow mains.
- To ensure positive restraint in all directions, each joint of pipe is to have 2 support straps. Spacing of pipe supports is to be in accordance with the length of pipe joints specified and one of the supports should be placed near the bell end of the pipe.
- Air relief provisions are required where high points are created in the main.
- A minimum of one expansion joint fitting is recommended for a reclaimed water main crossing on a roadway bridge. Placement of the expansion joints should coincide with the expansion joints of the road way bridge.
- Reclaimed water main crossings shall include a valve on each side of the elevated crossing.
- Proposed elevation of the main shall meet low chord bridge requirements and be 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's Street Cut Policy as well as the *Standard Construction Specifications and Details*.

## SECTION 8 – REQUIREMENTS FOR DRAWINGS

### 8.1 GENERAL PLAN SHEET REQUIREMENTS

- 8.1.1 The cover sheet should include the following information:
- 8.1.1.1 Appropriate names and titles, such as 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, etc., their names should 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).
    - Project numbers consist of:
      - City Project Number;
      - “X” Number; and,
      - 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 Full size drawings shall be submitted on 22” x 34” paper.
- 8.1.3 Scales are to be shown on each sheet, both numerically and graphically. The standard scale is as follows:
- 8.1.3.1 Layout Sheets: 1 inch = 100 feet
  - 8.1.3.2 Profile Sheets: 1 inch = 4 feet vertical
  - 8.1.3.3 Plan Sheets: 1 inch = 40 feet horizontal
    - Exceptions may be allowed by the Water Department Staff when a double scale would show the overall layout more clearly.
- 8.1.4 Water Department Capital Improvements Plan (CIP) project drawings should include a standard title block, shown below. Development type projects should refer to the standard title block template included in Infrastructure Plan Review Center (IPRC) requirements.

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

- 8.1.5 *Contact Information* – Contact information for City Project Manager, DigTess, 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 Texas Department of Transportation (TxDOT), Railroad, etc., as necessary.
- 8.1.6 Use Fort Worth standard symbols and abbreviations. 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.
- 8.1.7 *Benchmarks* – Show the location of all benchmarks (permanent or temporary) on the plan layout sheets.
  - 8.1.7.1 Describe the location of the nearest permanent benchmark and show identify if the on-site benchmarks are temporary.
  - 8.1.7.2 Provide a minimum of 2 survey control points for each line segment.
- 8.1.8 Include a copy of the recorded (or proposed) Final Plat of the project area in the drawings.
- 8.1.9 Provide a legend, scale, north arrow, and Tarrant Appraisal District map number on each sheet.
- 8.1.10 Each sheet 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*.

### 8.1.11 Layout Sheet Requirements

- 8.1.11.1 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, as necessary.
- 8.1.11.2 Provide separate layout sheets for all water and wastewater improvements.
- 8.1.11.3 Include the following layout sheets, as appropriate for the project:
- Sheet Index and General Notes;
  - Control Point Layout (if applicable);
  - Existing Water Main Layout;
  - Existing Wastewater Main Layout;
  - Proposed Water Main Layout (include Water Study number, if applicable; can be included on Proposed Water Main Layout sheet for development projects);
  - Proposed Wastewater Main Layout (include Wastewater Study number, if applicable; can be included on Proposed Wastewater Main Layout sheet for development projects);
  - Water Main Abandonment Layout (can be included on Proposed Water Main Layout sheet for development projects);
  - Wastewater Main Abandonment Layout (can be included on Proposed Wastewater Main Layout sheet for development projects);
  - Existing and Proposed Easements with recording information (if applicable);
  - Wastewater Bypass Pumping (if applicable); and/or,
  - 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)
- North Central Zone coordinates for City of Fort Worth, Texas.

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

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

8.2.2 Survey the proposed main location, along with such alternate locations, to include the following:

8.2.2.1 Baseline/route surveys showing relation between property corners and proposed water/wastewater main centerline.

- 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.
- 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.
- For existing wastewater mains and appurtenances, survey of topographic features such as existing wastewater manhole rim elevations, junction structures.
- 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 typical topographic survey shall be as follows:

- *Alignments outside of City right-of-way* – 10 feet beyond required easement width in accordance with **Section 3** (Standard Easements).
- *Alignments within City right-of-way* – 10 feet beyond the right-of-way width.

8.2.2.3 Profile survey showing:

- Field-determined elevation of any existing manhole invert, stub, or wastewater main to which the proposed wastewater lines is to connect.

- Provide existing manhole and wastewater main material/size.
- Top of nut elevation for existing water valves, and water main elevation to which the proposed water main is to connect.
- Elevation of crossings for water mains, wastewater mains, or any other utility crossing.
- Elevation of the ground at centerline of the proposed main at each station, half station and/or ground break.
- For wastewater mains outside of right-of-way provide ground elevations 100 feet left and right of centerline at each station.
- 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.
- *Survey for wastewater services* – As appropriate elevation of service stub- out of each existing house or building to be served directly by the main.
  - In case service stub is not available, finish floor or basement elevation should be shown at the front and back of the house.
  - Care should be taken to properly locate the existing house and points of elevation taken with relation to centerline.

### 8.3 WATER AND WASTEWATER MAIN PLAN AND PROFILE 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.
- Water and wastewater main plan and profile sheets may 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 should 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:
- Trees, landscaping;
  - Monuments, signs, street lights, signals, signal boxes, etc;
  - Utilities and appurtenances such as, but not limited to, water mains, wastewater mains, storm drains, gas lines, underground cables, electric, telecommunication wires, poles, meter boxes, vaults, valves, manholes;
  - Pavement, access roads, curbs, gutters, driveways;
  - Label street names, right-of-way and pavement widths, types of surfacing;
  - Structures, railroad tracks, buildings;
  - 100-year floodplain and floodway;
  - Rivers, levees; and/or,
  - Right-of-way, easements
- 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, as appropriate.
- 8.3.1.7 Contour lines on a minimum basis of 2-foot intervals should 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.
- Provide caution notes for overhead and underground utilities.
- 8.3.1.9 Include notes to reconstruct any driveways, sidewalks, ramps, parking lots, fences, etc. 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 existing mains, label the main size and material. Include flow direction for all wastewater mains.

- 8.3.1.14 Auger Boring and Hand Tunneling
- 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*.
  - Include stationing callout for each beginning and end of the bore in the plan and profile view.
  - Show the location of bore pits (launching and receiving) and dimensions on the plan view.
- 8.3.1.15 Utility Crossings
- Include all existing utility crossings on the proposed water and wastewater main profiles.
  - For water mains that are required to be lowered to cross beneath 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*.
- 8.3.1.16 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 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.
- 8.3.1.20 Show surrounding property owners information, including public access easements and ownership.
- 8.3.1.21 Show and label TxDOT and railroad right-of-way, if applicable
- 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.).
- 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.
- The City's *Standard Water Line Lowering Detail* should be completed and included in the drawings for any proposed crossings beneath storm drain or wastewater mains.
- 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 water meters larger than 2-inch with the meter size and the type (domestic, irrigation, or fire).
- 8.3.2.5 Show and call out all existing and proposed (by others) backflow preventers/double detector check valves.
- 8.3.2.6 Pressure Planes
- For water mains located within a pressure plane that it is not serving, label the water main with its appropriate pressure plane.
  - Identify any existing or proposed pressure plane valve, including the appropriate symbol.
    - Include a note on the drawings that all proposed pressure plane valves shall remain closed at all times.
  - 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
- Indicate cleaning wyes required and show the location with the station number.
  - Indicate the station number where poly pigs are inserted and removed to verify location of additional fittings required.
- 8.3.2.9 Service Lines
- Show locations of all existing and proposed services (domestic, fire, irrigation).
  - Show the number of services and the type installed and/or replaced on each sheet.

- 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.

- 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.

- Profiles are required for 8-inch, or smaller, water mains, 4-inch and larger water meter service lines, and long water services when any of the following circumstances exist:
  - crossing congested corridors;
  - creek crossings;
  - by other than open cut crossings;
  - gas line crossings; and/or,
  - 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 should

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.

- Show outside diameter for any existing or proposed storm drain crossing.

8.3.3.7 Profile all water mains crossing channels, creeks, rivers, detention ponds, etc., regardless of size.

- Label encasement, casing, rip rap, channels, creeks, or detention ponds.

#### 8.3.4 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, etc.).

##### 8.3.4.2 Main Stationing

- 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.
  - Stationing should read from left to right on the plan sheet and be from downstream to upstream.
- Existing stationing on relocations and rehabilitations shall be used when intercepting the existing line.
- Existing wastewater main stations shall be shown at the point of connection.

8.3.4.3 Flow direction arrows should be shown for all wastewater mains.

##### 8.3.4.4 Service Lines

- Existing wastewater service lines that are relocated shall include a service relocation plan, including cutting and plugging existing services, if required.

- Wastewater service lines shown on wastewater mains must have wastewater main stationing or dimensions from the property line.
- 8.3.4.5 Label and provided stationing for all manholes and junction structures.
- 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 should be labeled on the wastewater main plan view.
- 8.3.5 Wastewater Main – Profile Sheets
- 8.3.5.1 Profile all wastewater mains.
- 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 **Section 6.9** (Manholes) and *City Standard Construction Specifications and Details* for manhole lining requirements, if applicable.
- 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 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).
- 8.3.5.8 Show proposed footings, retaining walls, piers, etc.

- 8.3.5.9 Show datum elevations, as necessary for clarification.
- 8.3.5.10 Call out floodplain, 100-year water surface elevations, and floodway (if applicable) on the profile.
  - Show the high and low banks of creeks, if nearby.

### 8.3.6 Water and Wastewater Details

- 8.3.6.1 Show all applicable standard details in accordance with the City *Standard Construction Details*.
- 8.3.6.2 Provide a typical utility location and typical lot service detail, if applicable.
- 8.3.6.3 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.
- 8.3.7.2 Identify any areas where encroachment agreements are required.
- 8.3.7.3 Show and label adjacent city limit boundaries.
- 8.3.7.4 Delineate temporary construction and permanent easements on the drawings.
  - Include the affected property owner's name and easement reference designation.
  - 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.
- 8.3.7.6 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 should be included on the record drawings provided to the City prior to Final Inspection in accordance with the City's *Standard Construction Specifications*.










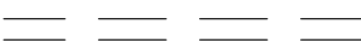
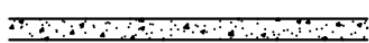



**8.4 STANDARD ABBREVIATIONS**

<b>STANDARD ABBREVIATIONS</b>			
<b>∠</b>	ANGLE	<b>LF</b>	LINEAR FOOT
<b>Δ</b>	DELTA ANGLE	<b>MH</b>	MANHOLE
<b>ARV</b>	AIR RELEASE VALVE	<b>MAX</b>	MAXIMUM
<b>AC</b>	ASBESTOS - CEMENT	<b>MJ</b>	MECHANICAL JOINT
<b>AFD</b>	AUTOMATIC FLUSHING DEVICE	<b>MIN</b>	MINIMUM
<b>ARV</b>	AIR RELEASE VALVE	<b>OHE</b>	OVERHEAD ELECTRIC CABLE
<b>BO</b>	BLOW OFF	<b>OHT</b>	OVERHEAD TELEPHONE CABLE
<b>BFV</b>	BUTTERFLY VALVE	<b>PE</b>	PLAIN END
<b>CI</b>	CAST IRON	<b>PCC</b>	POINT OF COMPOUND CURVE
<b>CL</b>	CENTERLINE	<b>PC</b>	POINT OF CURVE
<b>CONC</b>	CONCRETE	<b>PRC</b>	POINT OF REVERSE CURVE
<b>DM</b>	DEAD MAN	<b>PT</b>	POINT OF TANGENCY
<b>DI</b>	DUCTILE IRON	<b>PP</b>	POLYPROPYLENE PLASTIC
<b>ESMT</b>	EASEMENT	<b>PVC</b>	POLYVINYL CHLORIDE PLASTIC
<b>ELEV</b>	ELEVATION	<b>PP</b>	POWER POLE
<b>FRP</b>	FIBERGLASS REINFORCED PIPE	<b>RC</b>	PRE-CAST REINFORCED CONCRETE
<b>FOC</b>	FIBER OPTIC COMPONENTS	<b>PPV</b>	PRESSURE PLANE VALVE
<b>FH</b>	FIRE HYDRANT	<b>RCCP (C-301)</b>	PRE-STRESSED CONCRETE CYLINDER (C-301)
<b>FL</b>	FIRE LINE	<b>RCCP (C-303)</b>	PRE-STRESSED CONCRETE CYLINDER (C-303)
<b>FLG</b>	FLANGE	<b>R</b>	RADIUS
<b>FL</b>	FLOWLINE	<b>RCW</b>	RECLAIMED WATER
<b>GKT</b>	GASKET	<b>RT</b>	RIGHT
<b>G</b>	GAS LINE	<b>ROW</b>	RIGHT OF WAY
<b>GM</b>	GAS METER	<b>SS</b>	SANITARY SEWER
<b>GV</b>	GATE VALVE	<b>STA</b>	STATION
<b>GCD</b>	GENERAL CONTRACT DOCUMENTS	<b>SD</b>	STORM DRAIN
<b>GP</b>	GRINDER PUMP	<b>T</b>	TANGENT
<b>GL</b>	GROUND LINE	<b>UE</b>	UNDERGROUND ELECTRIC CABLE
<b>HDPE</b>	HIGH DENSITY POLYETHYLENE	<b>UT</b>	UNDERGROUND TELEPHONE CABLE
<b>HORIZ</b>	HORIZONTAL	<b>VERT</b>	VERTICAL
<b>IAW</b>	IN ACCORDANCE WITH	<b>VCS</b>	VITRIFIED CLAY (EXTRA STRENGTH)
<b>IAB</b>	IN ALLEY BETWEEN "STREET" AND "STREET"	<b>VC</b>	VITRIFIED CLAY (STANDARD STRENGTH)
<b>IEB</b>	IN EASEMENT BETWEEN "STREET" AND "STREET"	<b>WAD</b>	WASTEWATER ACCESS DEVICE
<b>IP</b>	IRON PIN/PIPE	<b>W</b>	WATER
<b>IPF</b>	IRON PIN/ROD FOUND	<b>WM</b>	WATER METER
<b>IPS</b>	IRON PIN/ROD SET	<b>WSS</b>	WATER SAMPLE STATION
<b>LT</b>	LEFT		



**8.5 STANDARD DRAFTING SYMBOLS**

<b>GENERAL DRAFTING SYMBOLS</b>		
	<b>EXISTING</b>	<b>PROPOSED</b>
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		

<b>GENERAL DRAFTING SYMBOLS</b>		
	<b>EXISTING</b>	<b>PROPOSED</b>
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
PLUG		
REDUCER		
PRESSURE PLANE VALVE		
SOLID SLEEVE		
STEEL CASING		
TEST STATION		
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 – VARIANCE PROCESS

### 9.1 REQUEST FOR VARIANCE

- 9.1.1 All requests for variances must be in writing and submitted to the Water Department with a cover letter accompanied by the Request for Variance Form included in **Section 9.5** (Request for Variance Form).
  - 9.1.1.1 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 variance is sought and include a justification for which the variance is requested.
  - 9.1.1.2 Request for Variance Form shall be submitted with the cover letter and be filled out completely with exception of the portions noted as “For Use by City”.
- 9.1.2 A grant of an alternative material, design, or method of construction shall not affect, nor relieve, the Engineer of the obligation and responsibility of such material, design, or method of construction for the intended purposes.
- 9.1.3 All variance requests require Water Department Staff recommendation and Water Department Director approval.

### 9.2 CRITERIA FOR GRANTING OF VARIANCE

- 9.2.1 An Engineer who wishes to request a variance 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 VARIANCE

- 9.3.1 In the event the Water Department Director determines the variance should be granted, the Water Department Director 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 Water Department Director, and at a minimum, shall be recordable so as to run with the property;

- 9.3.1.2 A written agreement that the City will not be responsible for any damages arising out of the granting of the variance. The form of the agreement shall be determined by the Water Department Director, and at a minimum, shall be recordable so as to run with the property; and/or,
- 9.3.1.3 Such other documents; in the discretion of the Water Department Director, deemed to be required.

**9.4 DEVIATIONS APPROVED BY WATER DEPARTMENT STAFF**

9.4.1 This section includes items that are minor deviations from the Design Criteria and will not require formal approval through the Variance Process. These items may, at the discretion of Water Department Staff, be allowed to deviate from the criteria upon approval by Water Department Staff on a project-by-project basis.

Section	Design Criteria
<b>4.2 - Project Process</b>	Final decision in determining whether a Loading Analysis or Study will be required.
<b>4.2 – Project Process</b>	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.
<b>5.3 - Minimum Water Main Size</b>	8-inch (ID) water mains may be allowed for some industrial water mains.
<b>5.5 - Typical Layouts</b>	Valve locations shall align with projected property lines
<b>5.6 - Horizontal/Vertical Alignment and Clearance Requirements</b>	In right-of-way sections where the clearance requirements are not feasible for drainage headwalls and inlets, an alternate alignment for the water main may be allowed.
<b>5.6 - Horizontal/Vertical Alignment and Clearance Requirements</b>	Where minimum clearance of 3 feet between franchise utilities and the main is not feasible, less than minimum clearance may be allowed.
<b>5.9 - Connections to Existing Water Mains</b>	If cut-in tees are determined not to be feasible, a tapping sleeve and valve may be used.

Section	Design Criteria
<b>5.10 - Dead End Water Mains</b>	Residential cul-de-sac dead-end lines may be allowed to be reduced down to 4-inch diameter.
<b>5.13 - Gate Valve and Butterfly Valve Requirements</b>	Only approved gate valves will be used in the distribution system for water mains 24-inch and smaller, unless otherwise approved.
<b>5.14 - Cleaning Pigs and Wyes</b>	Cleaning pig insertion locations and clean-out wyes on the drawings
<b>5.18 - Service Line and Water Meter Requirements</b>	Services within cul-de-sacs shall be placed perpendicular to the main.
<b>5.18 - Service Line and Water Meter Requirements</b>	Casing of water service lines due to situations that may jeopardize the integrity of the service line (i.e. proximity of other utilities).
<b>5.22 - Abandonment of Water Mains and Appurtenances</b>	Demolish and remove entire concrete vault and backfill, unless determined to be unfeasible.
<b>6.5 - Horizontal/Vertical Alignment and Clearance Requirements</b>	Crossings beneath large storm drains or box culverts may require steel casing.
<b>6.5 - Horizontal/Vertical Alignment and Clearance Requirements</b>	In right-of-way sections where the clearance requirements are not feasible for drainage headwalls and inlets, an alternate alignment for the wastewater main may be allowed.
<b>6.5 - Horizontal/Vertical Alignment and Clearance Requirements</b>	Where minimum clearance of 3 feet between franchise utilities and the main is not feasible, less than minimum clearance may be allowed.
<b>6.8 - Connections to Existing Wastewater Mains</b>	Manholes are required at service line connections in situations when the slope of a service line on public or private property is 5%, or greater. If multiple adjacent service lines result in this scenario, an alternate solution will need to be developed and discussed for consideration.



Section	Design Criteria
<b>6.8 - Connections to Existing Wastewater Mains</b>	4" services into manholes
<b>6.9 - Manholes</b>	Where gasketed 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. If this cannot be accommodated, an alternative venting method to minimize inflow, shall be proposed for review.
<b>6.10 – Special Requirements for Wastewater Service Lines</b>	Service line installations requiring a depth of cover less than 36-inches.
<b>6.13 - Inverted Siphons</b>	When allowed by the Water Department, all siphons shall be designed in accordance to the following criteria...
<b>6.20 - Abandonment of Wastewater Mains and Appurtenances</b>	Should manhole/structure removal be determined by the Water Department to be unfeasible due to proximity of other structures or utilities, the manhole/structure may be abandoned by removing the top 3 feet of the manhole/structure and filling with acceptable material
<b>6.21 – Crossings</b>	Concrete Collars for wastewater main crossings shall include a manhole on each side of the highway crossing.
<b>7.3 - Typical Layout</b>	Valve locations shall align with projected property line.
<b>7.4 - Horizontal/Vertical Alignment and Clearance Requirements</b>	In right-of-way sections where the clearance requirements are not feasible for drainage headwalls and inlets, an alternate alignment for the reclaimed water main may be allowed.
<b>7.4 - Horizontal/Vertical Alignment and Clearance Requirements</b>	Where minimum clearance of 3 feet between franchise utilities and the main is not feasible, less than minimum clearance may be allowed.
<b>7.8 - Gate Valve and Butterfly Valve Requirements</b>	Only approved gate valves will be used in the distribution system for reclaimed water mains.
<b>8.1 - General Plan Sheet Requirements</b>	Exceptions to allow for a double scale to show the overall layout more clearly.



9.5 REQUEST FOR VARIANCE FORM

WATER DEPARTMENT POLICY/DESIGN STANDARDS  
REQUEST FOR VARIANCE FORM

TO: Water Department Director \_\_\_\_\_  
PROJECT NAME/ADDRESS: \_\_\_\_\_  
PROJECT/STUDY NUMBER: \_\_\_\_\_ DATE: \_\_\_\_\_

We hereby submit for your consideration the following variance request for the above project:

<u>SECTION NUMBER/TITLE</u>	<u>SUBSECTION</u>	<u>DESCRIPTION</u>

Proposed Variance: \_\_\_\_\_  
\_\_\_\_\_

Reason for Variance Request: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Include complete justification for request for variance from Water Department Policy/Design Standards. Justification request must meet all requirements set forth in Section 9. If justification is included in the cover letter, or requires additional pages, describe or reference here.

**Requested By:**  
Printed Name \_\_\_\_\_  
Signature \_\_\_\_\_  
  
Firm \_\_\_\_\_  
Address \_\_\_\_\_  
  
Date \_\_\_\_\_  
Email \_\_\_\_\_  
Phone \_\_\_\_\_

**For Use by City:**  
 Recommended for approval  
 Recommended for approval with exceptions  
 Not recommended  
Water Department  
Staff Recommender \_\_\_\_\_  
Signature \_\_\_\_\_  
  
Date \_\_\_\_\_  
Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**For Use by City:**  
Variance Log Number \_\_\_\_\_  
 Approved  
 Rejected  
Signature \_\_\_\_\_ Date \_\_\_\_\_  
(Water Department Director)



## APPENDIX A – WATER AND SEWER STUDY GUIDELINES

A



# **WATER & SEWER STUDY GUIDELINES**

**Water Department  
City of Fort Worth**

**October 2018**

## 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 figures 3-16, 17, 18 of "2018 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

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.
- Label Diameters, 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
- Demonstrate how the proposed system connects to the existing system.

### 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 should 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 include the following.
  - ✓ Topographical Information.
  - ✓ Existing streets 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 2018 or currently accepted version of “Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure”, 2015 or currently accepted version of the “International Building Code” and currently accepted version of the “International Fire Code” 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), alignments, special features such as pressure reduction valves, 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

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 2018 or currently accepted version of “Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth.”

- Please provide water demand calculation and phasing summary tables (see example below)

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/office			1 person per 400 SF.					
School			60-75 students per acre					
Industrial								
Undeveloped			14 persons per acre					
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 2018 Installation Policy and Design Criteria for Water, Wastewater, and Reclaimed Water infrastructure for City of Fort Worth. Please either contact City of Fort worth Forth-Water Department (Water Planning, Strategic Developments and Asset Management Section) 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 Innowyze 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, 4, and 5. 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. Models between major pressure planes are not available.

- I. Request the pressure plane specific water model from Fort Worth Water Department. Contact [WPD@fortworthtexas.gov](mailto:WPD@fortworthtexas.gov)
- II. Existing model demands are Max Day Demands. Insert the proposed node demands as Maximum Day Demands. Apply the pressure plane specific demand pattern provided or other commercial/industrial specific pattern.
- III. 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.
- IV. Fire Flow duration: Typically set to 3 hours having the value closest to 1.0 at diurnal curve as the 2<sup>nd</sup> hour.
- V. Please include a copy of the diurnal curve pattern for specific pressure plane and Fire Flow pattern in the report.

#### **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. DO NOT provide all data from modeling results that encompasses every node and pipe in the provided in the modelled system. Instead, you should provide a data summary in a tabular format if necessary. The data in the summary table should also be displayed in figure form. The maximum figure size should be 11 X 17. Use different colors for pipes, nodes and texts and label them clearly.

#### **4.2.1 Simulation #1 – Base Condition: Maximum Day Demand with Existing Development**

- 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 in Exhibit 1 for the minimum pressure experienced in the area being developed.
- The existing system network map (i.e., Exhibit 1, Existing Water System Network Map) should 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 of the proposed system to the existing model.
- Assign the diurnal pattern to the proposed demands from the diurnal curve that corresponds to the appropriate pressure plane of the proposed development or other commercial/industrial specific pattern.
- 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 2018 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 extend the work that was done in simulation #2. In the second simulation, the node with the lowest pressure (typically the highest elevation) should be selected within the development. This node is taken as the critical fire node and should be used as the fire node to which the fire flow demand is applied.
- Assign the Fire Flow pattern to the proposed Fire Flow Demand applied to the fire node. Fire Flow duration is typically set to 3 hours having the value closest to 1.0 at diurnal pattern as the 2<sup>nd</sup> hour.
- 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 2018 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).

## 5. Comprehensive Sewer Study

Assumptions and minimum system requirements for analysis and design criteria are extracted from 2018 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)

Tables 1. Sewer development projections in different phases								
Sub-Basin ID	Size of Basin	Dwelling Units/ Acres	Population Served	Average Flow	Peaking Factor	Peak Flow	% of Total Flow	Sanitary Sewer Main ID
	(acres)		(capita)	(gpm)		(gpm)		
Phase #								
Onsite Total								
Upstream (off-site)*								
Region 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							
Beginning Design Point	Ending Design Point	Sewer Main ID	Sub-Basin Served		Cumulative Sub-basins Served	Cumulative Basin Size	
						(acres)	
Beginning – Ending Design Point	Sewer Main ID	Cumulative Population	Average Flow	Peaking Factor	Peak Flow	Proposed Pipe Size	Proposed Slope
		(capita)	(gpm)		(gpm)	(inches)	(%)

- 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](mailto:WPD@fortworthtexas.gov)

### **Reviewing Engineers**

Reza Broun PhD, PE (Reza.Broun@fortworthtexas.gov | 817-392-8073)  
Mark Wilson PE (Mark.Wilson2@fortworthtexas.gov | 817-392-6529)

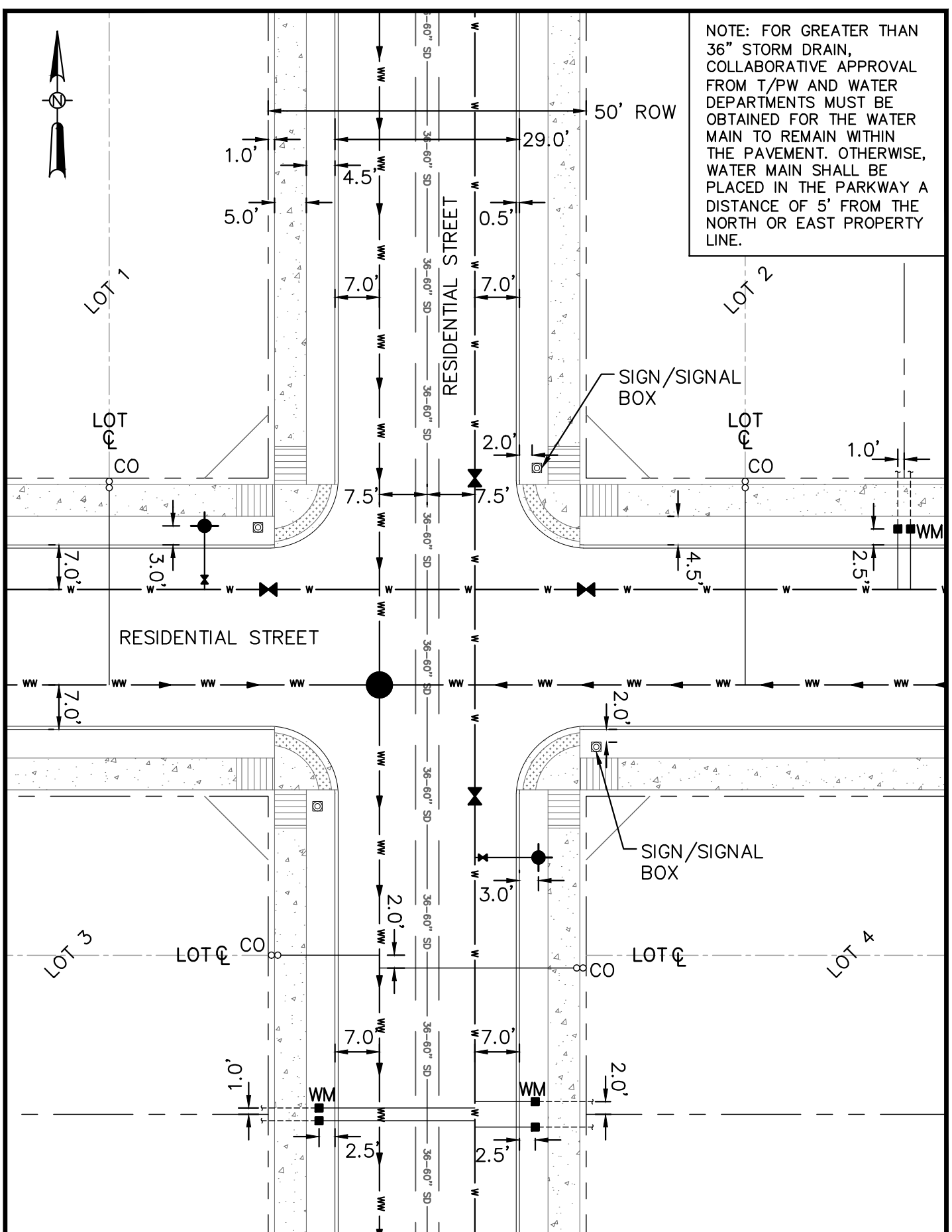


**APPENDIX B – TYPICAL LAYOUTS**





NOTE: FOR GREATER THAN 36" STORM DRAIN, COLLABORATIVE APPROVAL FROM T/PW AND WATER DEPARTMENTS MUST BE OBTAINED FOR THE WATER MAIN TO REMAIN WITHIN THE PAVEMENT. OTHERWISE, WATER MAIN SHALL BE PLACED IN THE PARKWAY A DISTANCE OF 5' FROM THE NORTH OR EAST PROPERTY LINE.



**RESIDENTIAL STREET  
TYPICAL WATER & WASTEWATER MAIN  
AND APPURTENANCE LAYOUT**

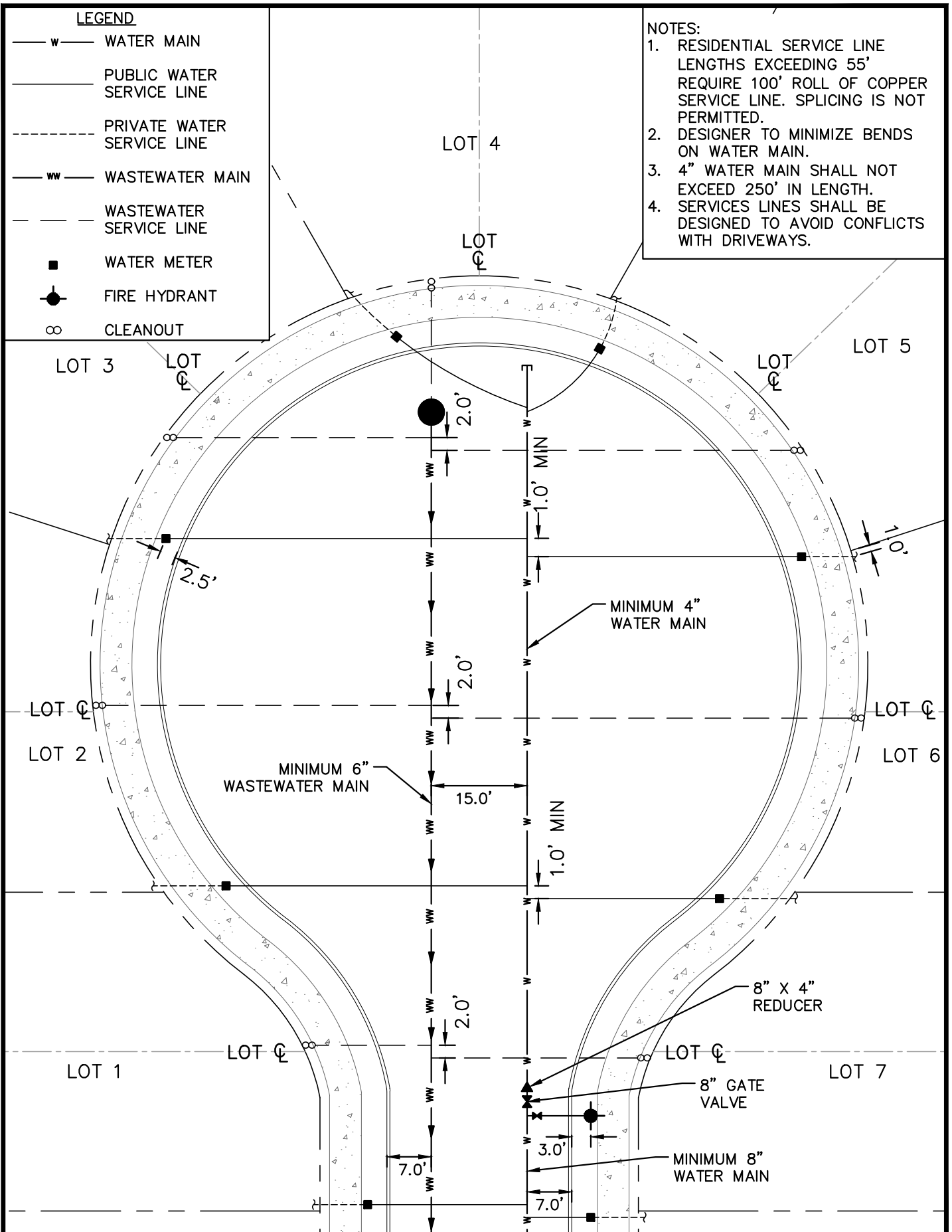
REVISED: May 2019  
**SCALE: 1" = 20'**

**LEGEND**

- w — WATER MAIN
- PUBLIC WATER SERVICE LINE
- - - PRIVATE WATER SERVICE LINE
- ww — WASTEWATER MAIN
- - - WASTEWATER SERVICE LINE
- WATER METER
- FIRE HYDRANT
- ∞ CLEANOUT

**NOTES:**

1. RESIDENTIAL SERVICE LINE LENGTHS EXCEEDING 55' REQUIRE 100' ROLL OF COPPER SERVICE LINE. SPLICING IS NOT PERMITTED.
2. DESIGNER TO MINIMIZE BENDS ON WATER MAIN.
3. 4" WATER MAIN SHALL NOT EXCEED 250' IN LENGTH.
4. SERVICES LINES SHALL BE DESIGNED TO AVOID CONFLICTS WITH DRIVEWAYS.



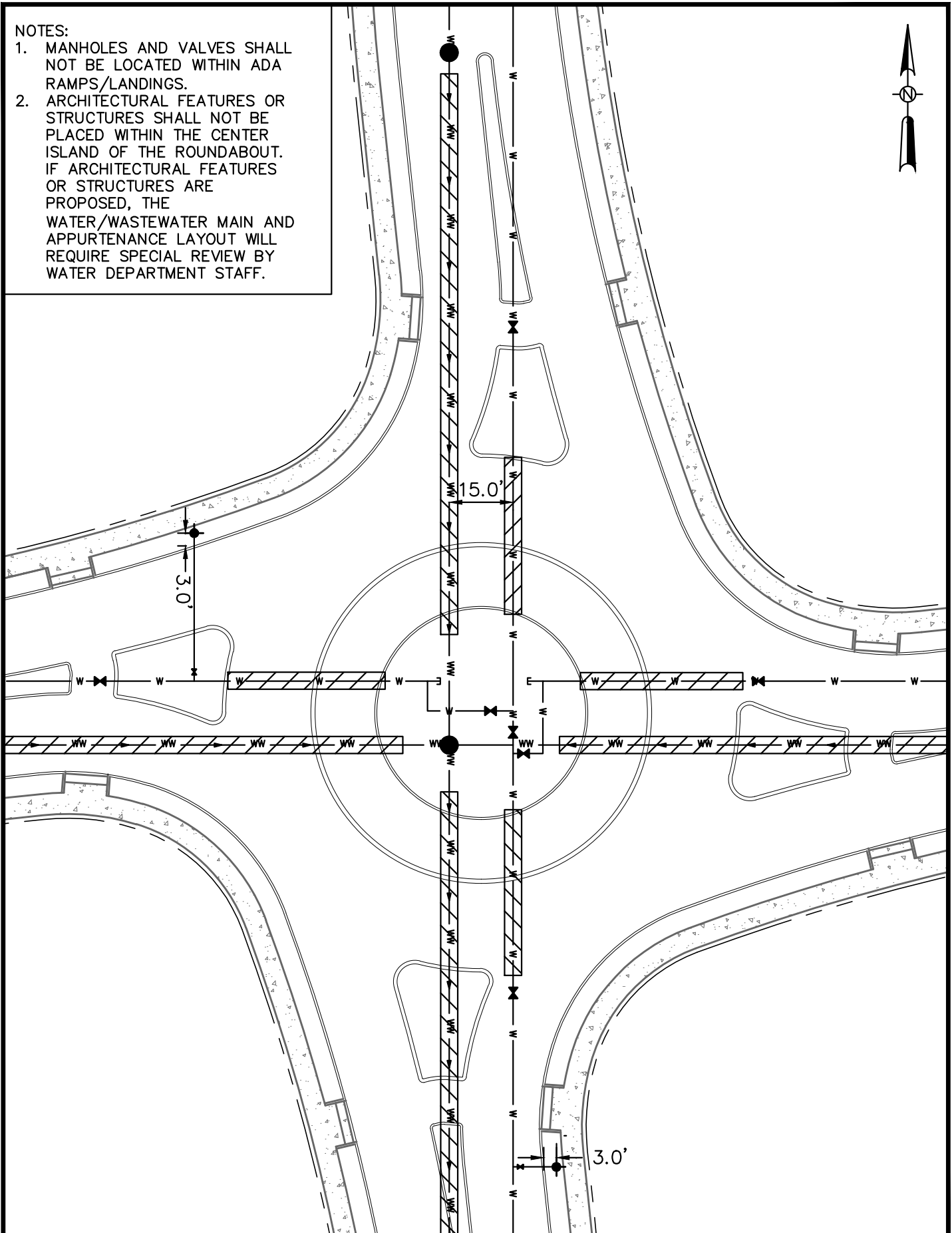
**RESIDENTIAL CUL-DE-SAC  
TYPICAL WATER & WASTEWATER MAIN  
AND APPURTENANCE LAYOUT**

REVISED: May 2019

**SCALE: 1" = 20'**

NOTES:

1. MANHOLES AND VALVES SHALL NOT BE LOCATED WITHIN ADA RAMP/LANDINGS.
2. ARCHITECTURAL FEATURES OR STRUCTURES SHALL NOT BE PLACED WITHIN THE CENTER ISLAND OF THE ROUNDABOUT. IF ARCHITECTURAL FEATURES OR STRUCTURES ARE PROPOSED, THE WATER/WASTEWATER MAIN AND APPURTENANCE LAYOUT WILL REQUIRE SPECIAL REVIEW BY WATER DEPARTMENT STAFF.



**RESIDENTIAL ROUNDABOUT  
TYPICAL WATER & WASTEWATER MAIN  
AND APPURTENANCE LAYOUT**

REVISED: May 2019

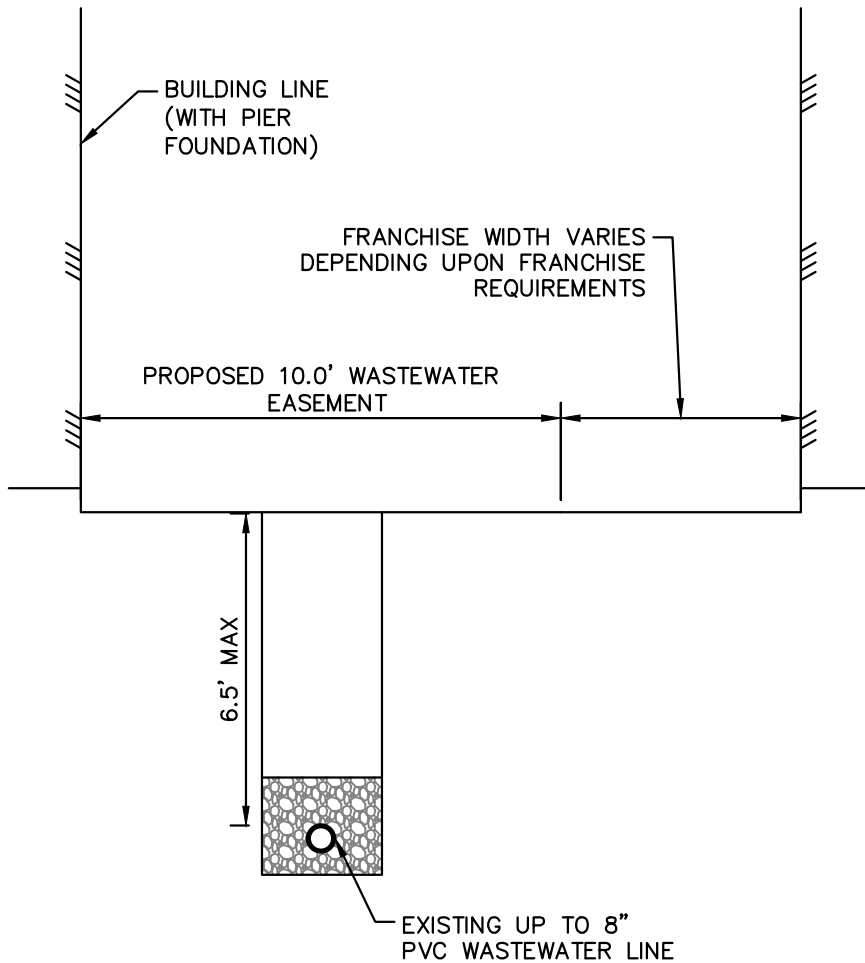
SCALE: 1" = 30'





**APPENDIX C – URBAN INFILL EASEMENT EXHIBIT**

C



**NOTES:**

1. A VARIANCE IS REQUIRED IF STANDARD ALLEY WIDTH OR EASEMENT WIDTH REQUIREMENTS CANNOT BE ACCOMODATED 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'.



**EASEMENTS FOR EXISTING  
WASTEWATER MAINS IN  
URBAN INFILL AREAS**

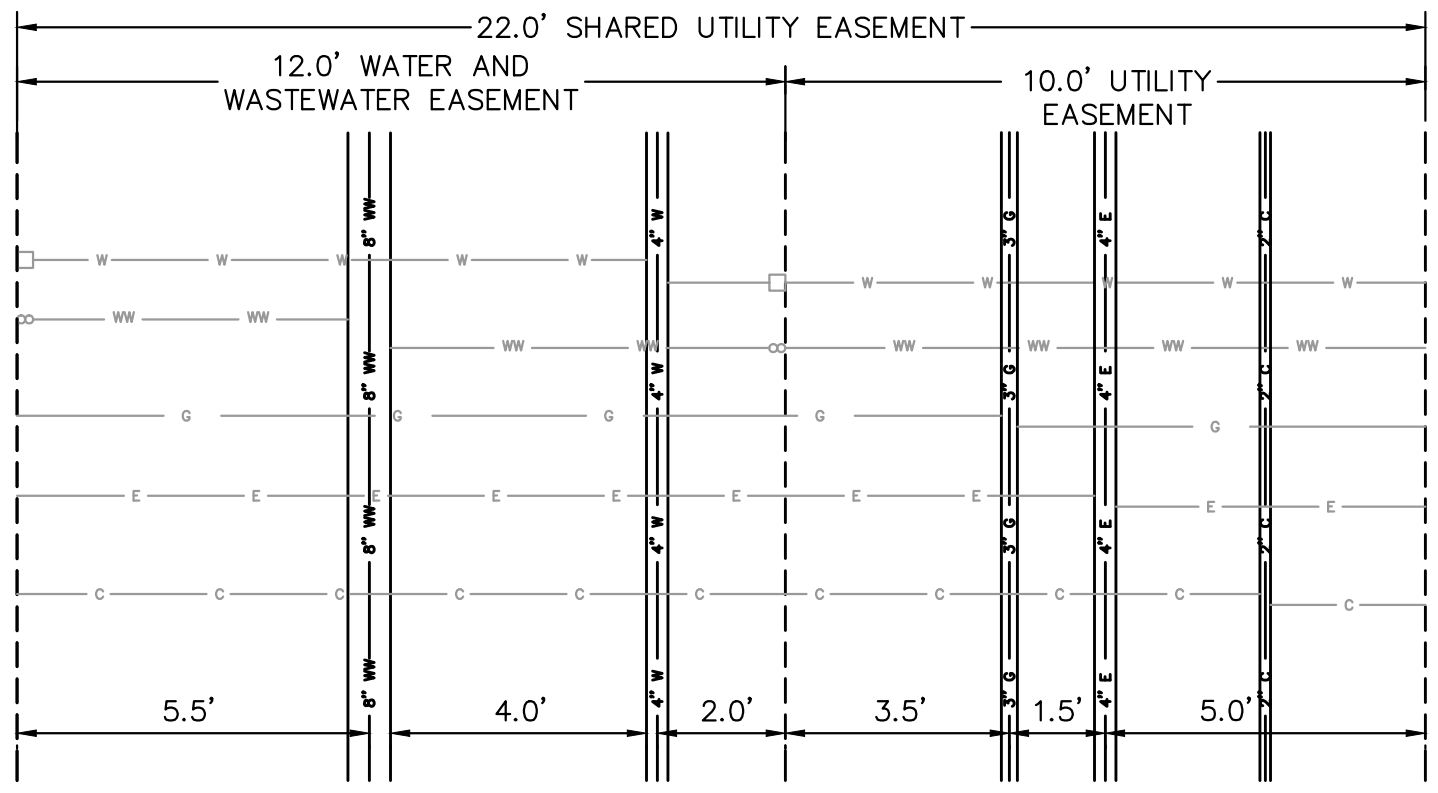
REVISED: May 2019

**SCALE: 1" = 4'**

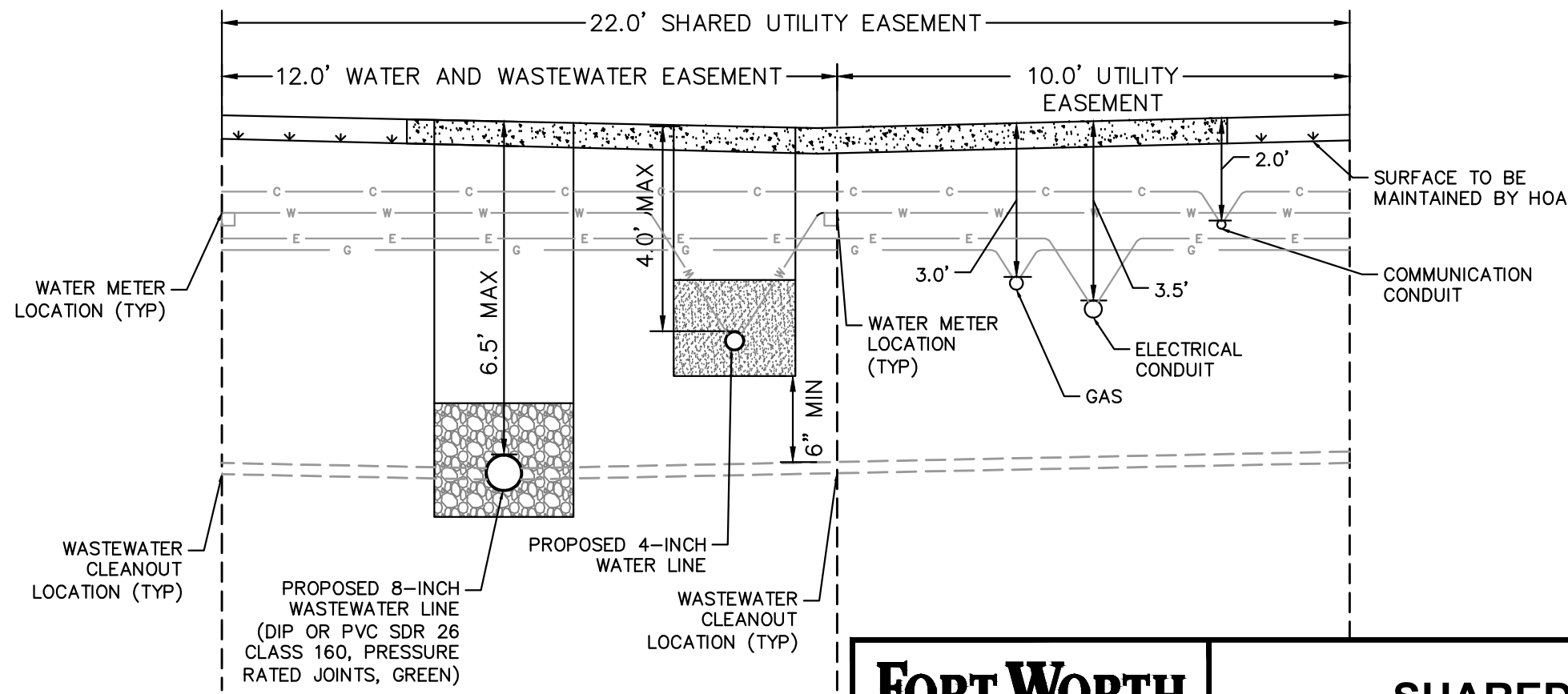


**APPENDIX D – SHARED UTILITY EASEMENT EXHIBIT**

**D**



**PLAN**



**GENERAL REQUIREMENTS**

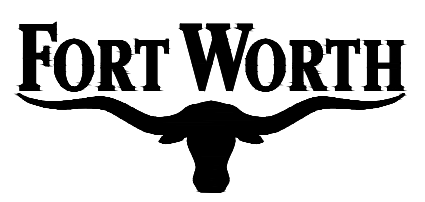
1. WATER AND WASTEWATER MAINS IN THE SHARED UTILITY EASEMENTS SHALL NOT BE USED TO SERVE ADJACENT PROPERTIES BEYOND THE SHARED ACCESS DEVELOPMENT.
2. THE MINIMUM VERTICAL CLEARANCE OF THE SHARED UTILITY AREA WHERE WATER/WASTEWATER MAINS ARE LOCATED IS 18 FT.
3. TRAFFIC RATED WATER METER LIDS AND WASTEWATER CLEANOUT COVERS ARE REQUIRED.
4. NO PARKING IS ALLOWED OVER THE WATER/WASTEWATER EASEMENT.
5. NO PUBLIC OR PRIVATE STORM DRAINAGE ALLOWED IN PUBLIC WATER AND WASTEWATER EASEMENT.
6. MAXIMUM LENGTH OF STREET IS 150'.
7. LOCATION OF FRANCHISE UTILITIES IS SCHEMATIC. COORDINATION IS REQUIRED WITH ALL AFFECTED FRANCHISE UTILITIES TO OBTAIN THEIR APPROVAL OF THE FINAL LAYOUT.

**WATER MAIN REQUIREMENTS**

1. A 6-INCH ISOLATION GATE VALVE SHALL BE PROVIDED AT THE BOUNDARY LINE OF THE SHARED UTILITY EASEMENT AND THE PUBLIC RIGHT-OF-WAY.
2. 4' MAXIMUM COVER/ 3' MINIMUM COVER
3. NO FIRE LINE CONNECTIONS OR FIRE HYDRANTS CAN BE LOCATED WITHIN THE SHARED UTILITY EASEMENT.
4. MAXIMUM LENGTH OF DEAD END MAINS IS RESTRICTED TO 150'.
5. DEAD END MAINS REQUIRE AUTO FLUSH HYDRANTS LOCATED OUTSIDE OF THE SHARED UTILITY EASEMENT, BUT LOCATED WITHIN THE WATER, DRAINAGE, AND WASTEWATER EASEMENT.

**WASTEWATER MAIN REQUIREMENTS**

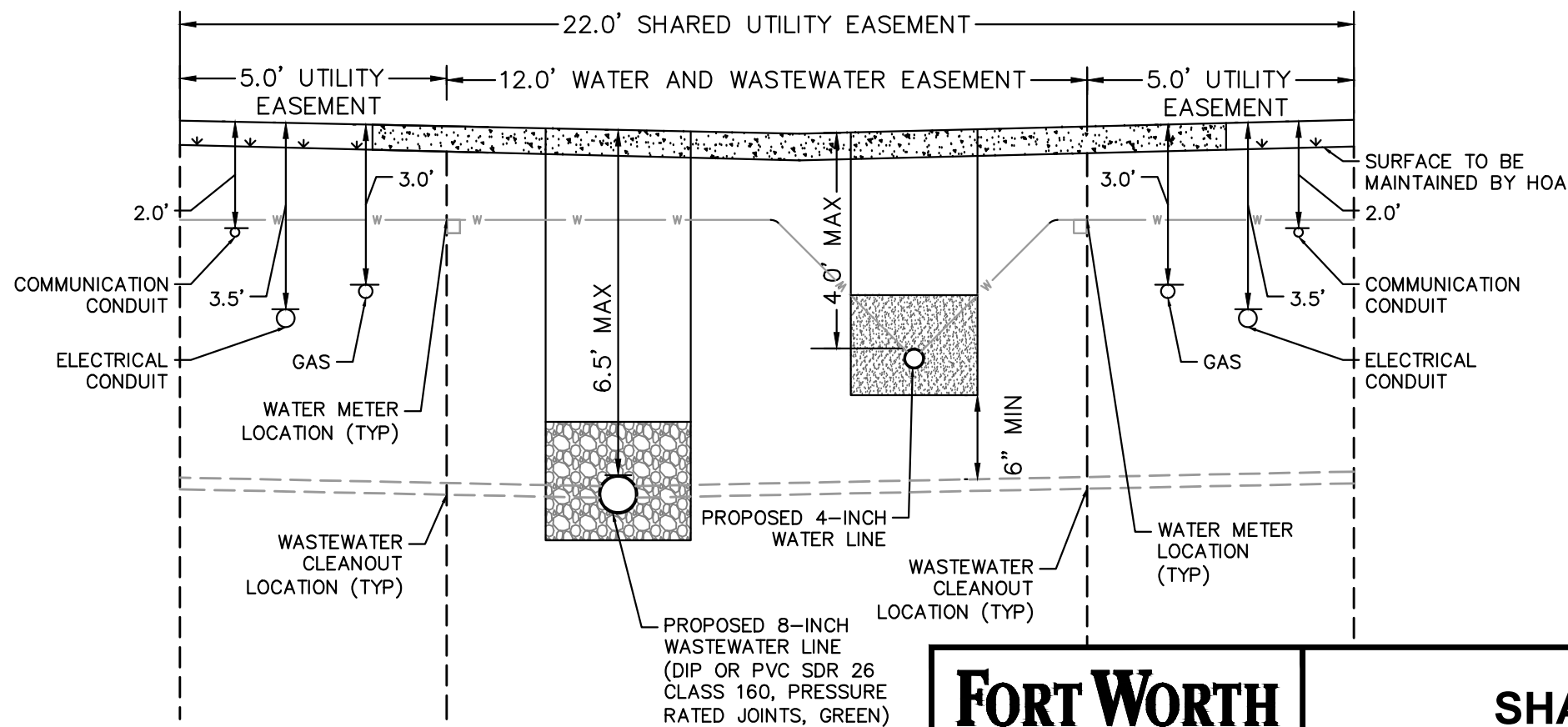
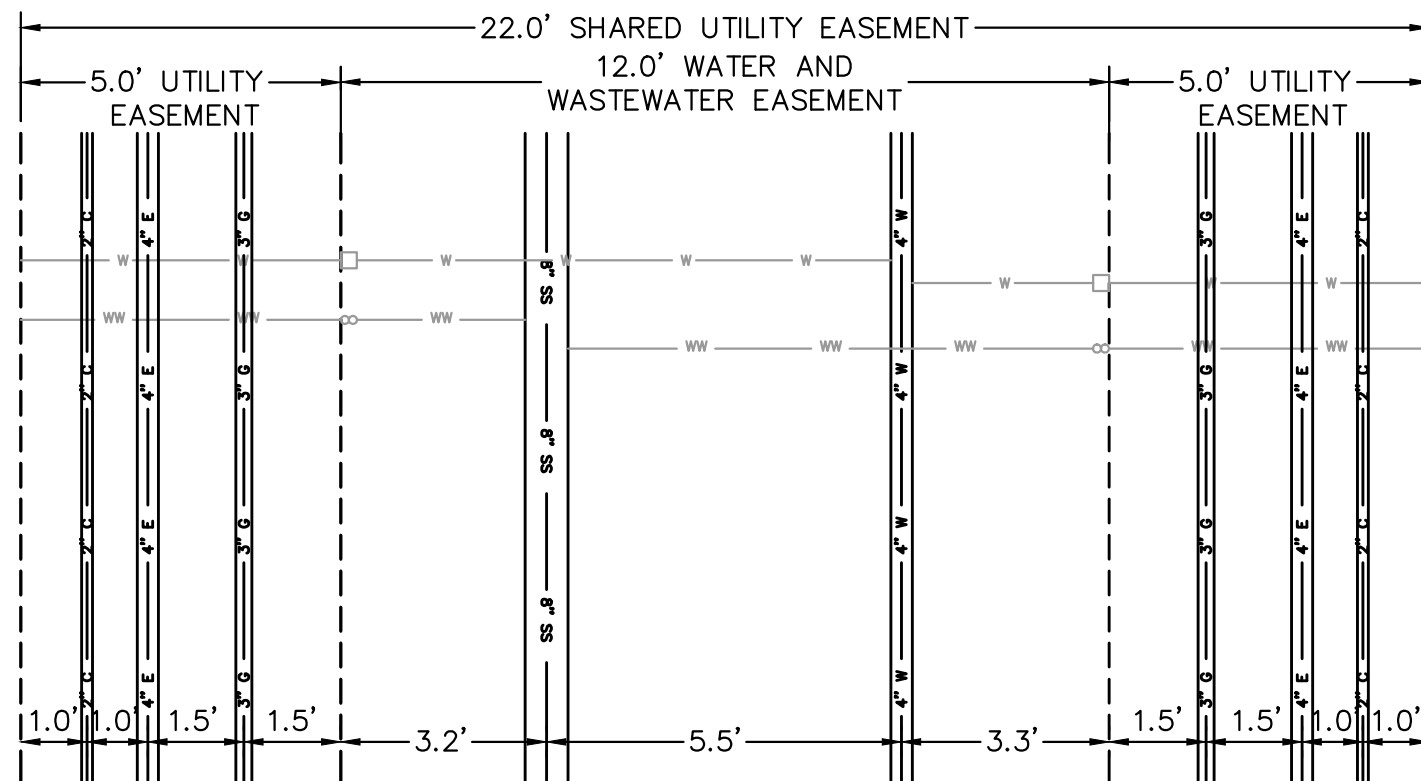
1. 6.5' MAXIMUM COVER
2. WASTEWATER MAINS SHALL BE CONSTRUCTED OF PVC SDR 26 CLASS 160 COLORED GREEN.
3. WASTEWATER MAINS SHALL TERMINATE EITHER WITH A MANHOLE. WASTEWATER ACCESS CHAMBERS MAY ONLY BE CONSIDERED IN NARROW CORRIDORS WHERE VEHICULAR ACCESS IS PROHIBITED.
4. THE MINIMUM SLOPE OF WASTEWATER MAINS SHALL BE 0.75% DUE TO SMALL FLOWS.



**SHARED UTILITY EASEMENT - OPTION 1**

REVISED: May 2019

**SCALE: 1" = 3'**



**GENERAL REQUIREMENTS**

1. WATER AND WASTEWATER MAINS IN THE SHARED UTILITY EASEMENTS SHALL NOT BE USED TO SERVE ADJACENT PROPERTIES BEYOND THE SHARED ACCESS DEVELOPMENT.
2. THE MINIMUM VERTICAL CLEARANCE OF THE SHARED UTILITY AREA WHERE WATER/WASTEWATER MAINS ARE LOCATED IS 18 FT.
3. TRAFFIC RATED WATER METER LIDS AND WASTEWATER CLEANOUT COVERS ARE REQUIRED.
4. NO PARKING IS ALLOWED OVER THE WATER/WASTEWATER EASEMENT.
5. NO PUBLIC OR PRIVATE STORM DRAINAGE ALLOWED IN PUBLIC WATER AND WASTEWATER EASEMENT.
6. MAXIMUM LENGTH OF STREET IS 150'.
7. LOCATION OF FRANCHISE UTILITIES IS SCHEMATIC. COORDINATION IS REQUIRED WITH ALL AFFECTED FRANCHISE UTILITIES TO OBTAIN THEIR APPROVAL OF THE FINAL LAYOUT.

**WATER MAIN REQUIREMENTS**

1. A 6-INCH ISOLATION GATE VALVE SHALL BE PROVIDED AT THE BOUNDARY LINE OF THE SHARED UTILITY EASEMENT AND THE PUBLIC RIGHT-OF-WAY.
2. 4' MAXIMUM COVER/ 3' MINIMUM COVER
3. NO FIRE LINE CONNECTIONS OR FIRE HYDRANTS CAN BE LOCATED WITHIN THE SHARED UTILITY EASEMENT.
4. MAXIMUM LENGTH OF DEAD END MAINS IS RESTRICTED TO 150'.
5. DEAD END MAINS REQUIRE AUTO FLUSH HYDRANTS LOCATED OUTSIDE OF THE SHARED UTILITY EASEMENT, BUT LOCATED WITHIN THE WATER, DRAINAGE, AND WASTEWATER EASEMENT.

**WASTEWATER MAIN REQUIREMENTS**

1. 6.5' MAXIMUM COVER
2. WASTEWATER MAINS SHALL BE CONSTRUCTED OF PVC SDR 26 CLASS 160 COLORED GREEN.
3. WASTEWATER MAINS SHALL TERMINATE EITHER WITH A MANHOLE. WASTEWATER ACCESS CHAMBERS MAY ONLY BE CONSIDERED IN NARROW CORRIDORS WHERE VEHICULAR ACCESS IS PROHIBITED.
4. THE MINIMUM SLOPE OF WASTEWATER MAINS SHALL BE 0.75% DUE TO SMALL FLOWS.



**SHARED UTILITY EASEMENT - OPTION 2**

REVISED: May 2019

**SCALE: 1" = 3'**