WATER & SEWER STUDY GUIDELINES

Water Department
City of Fort Worth

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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 Innovyze Infowater software. A separate pressure plane specific model has been developed for each major service area (Northside, Southside, Westside, etc), which includes all the sub pressure planes as well. For example, the Northside water model includes Northside 2, 3, 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
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 2nd 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 2nd 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

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