WATER AND SEWER COMPREHENSIVE STUDY
REQUIREMENTS
(Revised 12/2012)

The Water and Sewer Comprehensive 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.

A complete analysis of water supply system will be necessary to determine the sizes of water mains and facilities required to furnish adequate water service for both immediate and ultimate conditions and so that the project will be coordinated with water distribution planning in the area.

A study of the drainage area will be required for sanitary sewer projects. The size and complexity of the design will determine the amount of information needed in the study report for the project.

A layout of the proposed water and sanitary sewer system is required. Water and sanitary sewer mains shall not be located within the side and back lots without approval from the City of Fort Worth.

Water Demand Assumptions

Computations for the Water and Sewer Impact Analysis:

The following design criteria are taken from the City of Fort Worth Water Department Policy and Procedure for Processing Water and Sewer Design Manual, April 1999.

Assumptions for water impact analysis:

- Average Day water use = 215 gallons per capita day
- Maximum Day water use = Average Day water use x 2.25
- Maximum Hour water use = Maximum Day water use x 2.00
- Population Density = 18 person (if proposed zoning or existing zoning is unknown)
- Persons per Residential Connection = 3.5 people per connection
- Persons per Multi-family Connection = 2.5 people per unit
- Head-loss & Velocities: Maximum rate of head-loss due to friction in a water main should not exceed 7 feet per 1000 feet of pipe length for non fire flow scenarios. Maximum rate of velocity in a water main should not exceed 7 feet/second. In a fire flow scenario only the velocity will be considered.
- System pressure minimum of 40 psi is preferred. Minimum pressure at fire flow nodes during fire flow analysis is 20 psi.
- Fire flow demand must be conformance with the 2003 or currently accepted version of the International Building Code with respect to construction type, and the 2003 or currently accepted version of the International Fire Code with respect to fire flow quantity and duration. In no case shall the fire flow demand be less than 1,500 gallons per minute for 3-hour duration of flow.
- Fire flow calculation see attached examples.
- Pipe size: Water mains should be sized to meet Maximum Hour or Maximum Day plus Fire Flow, whichever is greater. No water main shall be less than 8 inches in diameter.

For conditions or situations not addressed in City of Fort Worth Water Department Policy and Procedure for Processing Water and Sewer Design Manual, April 1999, please refer to 30 TAC.
Chapter 290 (water) or 30 TAC 317 (sewer) of the Texas Commission on Environmental Quality rules and regulations. These rules can be found at http://www.tceq.state.tx.us/rules/indexpdf.html.

**Water Model**

- Request the water model from Fort Worth Water Department.
- Existing model demands are Maximum Day Demands. Enter the proposed node demands as Maximum Day Demands.
- To find the hour representing the Maximum Day condition, use the value from the diurnal pattern that is closest to 1.00. If two separate values are equally different from the value of 1.00 (e.g. 0.99 and 1.01), use the larger value. In the report, state the corresponding hour in which that value occurs.
- To find the hour representing the Maximum Hour condition, use the value from the diurnal pattern that is the highest number. In the report, state the corresponding hour in which the value occurs.
- Extended Period Simulation Time is 24 hours.
- Include a copy of the Diurnal Curve in the report. Boldface the hours of the day and diurnal values used for Maximum Day and Maximum Hour.

**Modeling Scenarios, Analysis, Print outs and Exhibits**

- **First Run: Existing Maximum Day and Maximum Hour Before Proposed Development**
  - Run the existing model (Base condition) as is.
  - Print out the results for all the nodes and pipes. State on the print outs which hour was used for Maximum Day and Maximum Hour.
  - Print the network map that shows the project area and appropriate radius around the project. This distance depends on if the project is in or near a developed area or a rural area. If it’s in or near a developed area, then include a ½ mile radius. If it’s in a rural area, then include a 2-mile radius or more. Include legible pipe and node I.D.’s on this map. Do not show the pressure and friction loss information on this map. Title this map: “Exhibit 1, System Network Map”.

- **Second Run: Maximum Day with Proposed Development**
  - Add proposed Maximum Day Demands to the existing model.
  - Assign the diurnal pattern to the proposed demands from the diurnal table above and run the model.
  - In the report you will identify the proposed nodes and nearby system nodes with pressure less than 40 psi or greater than 80 psi and proposed pipes and nearby system pipes having friction loss greater than or equal to 5-7 feet/1000 feet.
  - Print out the result data for all the nodes and pipes. Title the print outs, “Maximum Day with Proposed Development.”
  - Print the network maps showing the project area and appropriate radius around the project. Title the network maps, “Exhibit 2A Pipe Results for Maximum Day with Proposed Development” showing legible pipe I.D.’s, pipe size and friction loss/1000 feet, and “Exhibit 2B Node Results for Maximum Day with Proposed Development” showing legible node I.D.’s with pressure. As an alternative, exhibit’s 2A and 2B can be combined as Exhibit 2, as long as the displayed data is labeled clearly and legibly. Exhibit 2 should be titled, “Exhibit 2 Node & Pipe Results for Maximum Day with Proposed Development”.

C:\Documents and Settings\hzuniga\Local Settings\Temporary Internet Files\Content.Outlook\AHMGYWYK\Comprehensive Water and Sewer Study Instructions 12-2012.doc
• **Third Run: Maximum Hour with Proposed Development**
  o From second run, use the result of the hour that has the highest diurnal curve pattern for analysis.
  o Make adjustments to the proposed pipe sizes to eliminate the low pressure and the high head loss within the proposed development.
  o In the report you will identify the proposed nodes and nearby system nodes with pressure less than 40 psi or greater than 80 psi, and proposed pipes and nearby system pipes having velocities loss more than 5-7 feet/1000 feet and velocities more than 7 feet/second.
  o Print out the results for all the nodes and pipes. Title the print outs, “Maximum Day with Proposed Development.”
  o Print the network maps showing the project area and appropriate radius around the project. Title the network maps, “Exhibit 3A Pipe Results for Maximum Hour with Proposed Development” showing legible pipe I.D.’s, pipe size and friction loss/1000 feet, and “Exhibit 3B Node Results for Maximum Hour with Proposed Development” showing legible node I.D.’s with pressure. As an alternative, exhibit’s 3A and 3B can be combined as Exhibit 3, as long as the displayed data is labeled clearly and legibly. Exhibit 3 should be titled, “Exhibit 3 Node & Pipe Results for Maximum Hour with Proposed Development”.

• **Fourth Run: Maximum Day plus Fire flow with Proposed Development**
  o Add to the second run fire flow to the proposed node having the lowest pressure from the Maximum Day result. State this node number in the report. The fire flow demand should be for a 3-hour duration that includes the maximum day diurnal pattern time period. A separate 3-hour diurnal pattern should be used for all extended period simulation runs.
  o Make adjustments to pipe sizes to eliminate pressures at the fire flow node below 20 psi and velocities above 7 feet/second feet.
  o For fire flow analysis, print out Node #, static demand, static pressure, fire-flow demand, residual pressure, available flow and available flow pressure.
  o Also, print out the result data for all nodes and pipes for the development and the immediate surrounding area. Title the print outs, “Maximum Day plus Fire Flow with Proposed Development.”
  o Print the network maps showing the project area and appropriate radius around the project. Title the network maps, “Exhibit 4A Pipe Results for Maximum Day plus Fire Flow with Proposed Development” showing legible pipe I.D.’s, pipe size and friction loss/1000 feet, and “Exhibit 4B Node Results for Maximum Day plus Fire Flow with Proposed Development” showing legible node I.D.’s with pressure. Show the location of the critical node for fire flow. As an alternative, exhibit’s 4A and 4B can be combined as Exhibit 4, as long as the displayed data is labeled clearly and legibly. Exhibit 4 should be titled, “Exhibit 4 Node & Pipe Results for Maximum Day plus Fire Flow with Proposed Development”.

**Comprehensive Water and Sanitary Sewer Study Submittal**

The Comprehensive Water and Sanitary Sewer Study submittal should consist of the scenario exhibits 1, 2A, 2B, 3A, 3B, 4A and 4B. (Alternative 1, 2, 3, 4) 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 to practice engineering in the State of
Texas. The entire study with maps, layouts, exhibits, narrative and any other materials should be bound in a three-ring loose leaf binder. The binder should have a title cover sheet listing at a minimum the project name and the name, address and contact information of the consulting engineering firm that performed the analysis.

The engineering-type report should contain the maps, narrative, tables and additional information listed on the next page.

- A Location Map clearly identifying the site location with respect to the nearest named municipality.
- A Site Map for the immediate area of development and the surrounding properties that indicate the following.
- Hydraulic modeling files used in the analysis in H2Omap or EPAnet File (*.inp) file format.
  - Topographical Information
  - Existing Streets
  - Proposed Streets
  - Pressure plane (and boundaries if more than one pressure plane is involved)
  - Location, alignment, size and Department of Engineering (DOE) number of the existing water mains that will furnish water to the proposed development
  - Location and size of the proposed water mains
  - Phasing information
  - Legend
  - Scale and North arrow

The narrative portion of the engineering-type report should include the following sections:

- Purpose and scope
- Design criteria (demand assumptions, pressure plane, diurnal curve, hour used for Maximum Day and Hour and fire node #). Be sure to include the tables shown below.

The following tables must be included in the “Design Criteria” portion of the report:

<table>
<thead>
<tr>
<th>Types of Use</th>
<th>Acres</th>
<th>Units</th>
<th>Capita Factor</th>
<th>Average Flow</th>
<th>Average Flow</th>
<th>Max Day</th>
<th>Max Day + Fire Flow</th>
<th>Max Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.5 capita per lot</td>
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<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td>(MGD)</td>
<td>(gpm)</td>
<td>(gpm)</td>
<td>(gpm)</td>
<td>(gpm)</td>
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<tr>
<td>Commercial</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<td>School</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Park</td>
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<td></td>
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<td></td>
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<tr>
<td>Industrial</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Undeveloped</td>
<td></td>
<td></td>
<td>18 capita per acre</td>
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<td></td>
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<tr>
<td>Etc</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Development Data | Year 1 | Year 5 | Year 10 | Built Out
--- | --- | --- | --- | ---
Pressure Plane |  |  |  |  
Acres |  |  |  |  
Units |  |  |  |  
Population (capita) |  |  |  |  
Average Flow (gpm) |  |  |  |  
Max Day (MGD) |  |  |  |  
Fire Flow (gpm) |  |  |  |  
Max Day + Fire Flow (MGD) |  |  |  |  
Max Hour (MGD) |  |  |  |  

- Method of analysis (H2ONET, WaterCad, etc)
- Results, conclusions and a discussion of the model results for each of the required scenarios. For each run, be sure to clearly identify all existing and proposed nodes with pressure greater than 80 psi or less than 40 psi and all existing and proposed pipes that exhibit head-losses greater than or equal to 7 feet per 1000 feet of length.
- Verifiable citations from the 2003 or currently accepted version of the International Building Code and 2003 or currently accepted version of the International Fire Code that specify the type of construction and fire flow demand. Remember: In no case shall the fire flow demand be less than 1,500 gallons per minute for 2-hour duration of flow.
- Recommendations for 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 service to the proposed development
- Supporting data, print outs of various scenarios, model network map(s) and site map(s)
**Sewer Comprehensive Study**

Assumptions for sewer impact analysis:

- Average sewer load per capita = 0.0694 gpm (100 gpd).
- Population per acre = 18 people (if proposed zoning or existing zoning is unknown)
- Use a Manning’s “n” value of 0.013
- Persons per Residential Connection = 3.5 people per connection
- Persons per Multi-family Connection = 2.5 people per unit

Please provide the following in the report:

- Assumptions used to calculate sewer demands.
- Tables and calculations. The following tables must be included in the “Design Criteria” portion of the report:

<table>
<thead>
<tr>
<th>Sub-Basin ID</th>
<th>Size of Basin (acres)</th>
<th>Dwelling Units (capita)</th>
<th>Population Served</th>
<th>Average Flow (gpm)</th>
<th>Peaking Factor</th>
<th>Peak Flow (gpm)</th>
<th>% of Total Flow</th>
<th>Sanitary Sewer Main ID</th>
<th>Sub-Basin ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase #</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Phase #</td>
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<tr>
<td>Onsite Total</td>
<td></td>
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<td>Onsite Total</td>
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<tr>
<td>Off-site</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Off-site</td>
</tr>
<tr>
<td>Region Total</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Region Total</td>
</tr>
</tbody>
</table>

- Domestic, industrial or pool sewer load (gpm) for the proposed area of development and the surrounding tributary properties.

- The size, material, slope, design capacity and existing load of the existing sewer main that will receive the sewer flow from the proposed development.
Result and Conclusion

Discuss and summarize the results and findings.

Recommendation

Propose the final pipe sizes and other phasing requirements if applicable. Include a site map for the immediate area of development and the surrounding properties that indicate the following:

- Topographical information
- Existing streets
- Proposed streets
- Major and sub-drainage basin boundaries and designations
- Acres of each major and sub-drainage basins (onsite of proposed property or offsite of proposed property)
- Location and size of the existing sewer mains to receive proposed flows
- Location and size of the proposed sewer mains
- Legend
- Scale and North arrow
- Phasing information

Submit the finished study to:
Soon Wong, P.E.
Water Engineering & Fiscal Services Division
1000 Throckmorton
Fort Worth, Texas 76101-0870
(817) 392-8369