

CITY OF DENTON
WATER DISTRIBUTION SYSTEM MASTER PLAN
SCOPE OF SERVICES
02/16/2017

PROJECT UNDERSTANDING:

Freese and Nichols, Inc. (FNI) understands that the City of Denton is engaging engineering services to perform an update to its Water Distribution System Master Plan. The previous Water Distribution System Master Plan was started in 2007 and completed in 2008. The 2008 Study was based on population and water demand data from 2006. Since the 2008 Study, City of Denton staff have invested in maintaining, improving, and updating the H2OMAP Water model. Several fire flow tests have been performed on a yearly basis and have been used to continuously update the Hazen-Williams Roughness Coefficients (C-Factors) in the water model. This scope of services assumes that the H2OMAP Water model is reasonably reflective of the existing water system and only minor updates will be required. The scope includes some temporary pressure testing as a validation exercise to ensure that the water model matches real-world conditions. This Water Distribution System Master Plan Update will consist of developing and updating water demand projections, performing distribution system hydraulic modeling analyses, development of a phased Water Distribution System CIP, and a Water Distribution System Master Plan Report.

The scope also includes assistance for the development water impact fees. FNI will not be calculating the maximum allowable water impact fee, but will rather provide eligible water CIP costs to the City to deliver to the impact fee consultant.

SCOPE OF SERVICES:

WATER DISTRIBUTION SYSTEM MASTER PLAN

A. Project Management

- A1. Project Kick-Off Meeting: Freese and Nichols, Inc. (FNI) will meet with the City to review scope, project team and schedule of the project, and present a data request memorandum. FNI will obtain input on customer complaints to determine areas of pressure concerns during summer conditions.
- A2. Data Collection: FNI will request and compile information from the City including current water system GIS, updated water model, water system improvements completed since the last update, wholesale customer water data, wholesale historical water usage, metered billing data, and other information.
- A3. Monthly Reporting and Status Updates: FNI will develop monthly one-page progress reports and invoicing, providing status updates and documentation of decisions made.

B. Water Model Review and Update

- B1. Update All-Pipes H2OMAP Water Model: FNI will review the updated H2OMAP Water model that the City has been maintaining and perform any necessary updates based on the City's most recent GIS database and any modifications made to water system facilities and pipelines since the 2008 Study.
- B2. Develop and Distribute Existing Demand Data: FNI will utilize data from the City's billing system database to allocate base year demands to the model by customer class. The data will consist of address, parcel ID, and metered usage fields for each customer account. The metered billing data will be geocoded to street centerline or parcel data and then distributed to the model using Thiessen polygons.

- B3. Obtain and Evaluate SCADA Data and Update Diurnal Curves: FNI will obtain SCADA data for the last several years including two weeks of peak summer usage and two weeks of typical average day usage. SCADA data will be used for model updates, development of diurnal curves, and to assist in model calibration. FNI will update the 24-hour diurnal demand curves by pressure plane.
- B4. Identify and Map Field Pressure Testing Locations: FNI will identify locations for field testing based on model update needs and areas of concern from City. Ten pressure testing recorders will be furnished by FNI and utilized along with 10 recorders from the City for a total of up to 20 locations. FNI will prepare procedures for field testing showing proposed location of testing, duration of testing, required SCADA data during testing period, and assistance from utility department.
- B5. Conduct Pressure Testing: FNI will assist and coordinate with City in performing pressure testing at up to 20 locations. Testing will consist of recording pressure readings for a two-week time period within each pressure plane along with needed SCADA data during field testing. FNI will provide the pressure recorders to the City and City staff will install the pressure recorders on the selected hydrants.
- B6. Conduct EPS Model Validation: FNI will conduct a 24-hour extended period simulation (EPS) model validation by adjusting c-factors, peaking factors, and diurnal curves for domestic and commercial loads, and demand distribution until modeling results reasonably match the field pressure measurements and pump/tank operation.
- B7. Meet with City to Review Water Model Review and Update: FNI will attend a meeting with the City to review the water model review and update.

C. Population and Water Demand Projections

- C1. Review and Evaluate Historical Water Usage Records: FNI will review and evaluate historical water usage by residential usage and commercial/ industrial over the last 10 years. Calculate and summarize historical per-capita usage and peaking factors.
- C2. Meet with City to Discuss Future Service Areas Boundaries, Land Use Plan, CCN Issues: FNI will meet with City utility personnel on future service area boundaries, land use plan, and discuss path forward on these issues as well as CCN issues as related to developing future water demand projections. FNI will solicit input from the City on known developments, densities, and projected timing and phasing of new development and infill.
- C3. Develop and Distribute Population and Future Land Use Projections: FNI will compile available data from the City and NCTCOG to develop population and non-residential land use projections by Traffic Survey Zone (TSZ) for existing, 5-year, 10-year, and 25-year planning periods.
- C4. Develop and Distribute Water Demand Projections: Utilizing historical water usage and City provided land use assumptions, FNI will develop updated population projections and projected average day, maximum day, and peak hour demands for 5-year, 10-year and 25-year planning periods for retail customers. FNI will compile this information with wholesale customer projections to develop total water demand needs for each of the future planning periods. FNI will distribute projected water demands for 5-year, 10-year and 25-year conditions by pressure plane for average day, maximum day, and peak hour using TSZ population projections, per capita usage, and peaking factors.
- C5. Develop Technical Memorandum – Water Demand Projections: FNI will prepare a technical memorandum that documents the analysis of historical consumption data, and future water demand projections. FNI will submit an electronic PDF copy of the TM.
- C6. Meet with City to Review Water Demand Projections: FNI will attend a meeting with the City to review the population and water demand projections. City comments on the TM will be incorporated into the Water Master Plan Report for simplicity.

D. Distribution System Hydraulic Capacity Analysis

- D1. Perform Modeling of Existing Water System: FNI will conduct EPS modeling of the existing water system under maximum day (including peak hour) demand conditions to determine capacity and deficiencies within the existing water system. FNI will prepare charts and full scale color mapping to document existing system analysis results.
- D2. Conduct Fire Flow Analysis: FNI will utilize water system model to conduct fire flow analysis under existing maximum day demands to identify areas with less than adequate fire flow capacity. Fire flow analysis will be shown using contour mapping of available fire flows.
- D3. Evaluate Pressure Plane Delineation: FNI will analyze existing pressure plane delineation based on modeling results, field testing data, and water supply locations. Identify specific areas with low pressures at normal operating conditions. Evaluate and recommend modifications to the existing pressure plane boundaries. FNI will present mapping showing proposed water system pressures throughout City under new pressure plane boundary alternatives vs. existing pressure plane delineation.
- D4. Utilize 25-year Water Model to Determine Sizing of Water System Improvements: FNI will utilize water model to determine water system transmission, elevated and ground storage, and pumping facilities needed to serve 25-year demands throughout each pressure plane service area using the EPS model analyses under maximum day (including peak hour) demand conditions. The minimum line size for recommended piping improvements will be 12-inches.
- D5. Meet with the City to Review 25-year Water System Improvement Alternatives: FNI will meet with the City to discuss future water system improvement options for 25-year conditions and the proposed pressure plane boundaries.
- D6. Utilize Interim Model Scenarios to Determine Phasing of Water System Improvements: FNI will use interim 5-year and 10-year EPS maximum day model runs to determine phasing of water system improvements. System improvements will include transmission, storage, pumping and distribution system related needs.
- D7. Water Age Modeling: FNI will perform water age modeling using the EPS model. Water age modeling will be conducted for up to three operational scenarios jointly defined by the City and FNI. FNI will investigate operational modifications to reduce water age for areas of concern. FNI will prepare full scale color mapping that document the water age modeling analyses.
- D8. Meet with the City to Phased Water System Improvement Alternatives: FNI will meet with the City to discuss phased water system improvement options for 25-year conditions and the proposed pressure plane boundaries.

E. Water System Capital Improvement Plan, Master Plan Report & Model Training

- E1. Develop Draft Capital Improvement Plan (CIP) Costs and Project Schedule: FNI will develop planning level cost estimates for each proposed project in Year 2017 dollars including engineering and contingencies. Project prioritization and phasing will be developed. FNI will develop one-page CIP project sheets showing project drivers, justification, cost estimates, and location map. FNI will develop large scale citywide mapping showing proposed projects and phasing.
- E2. Prepare Draft Master Plan Report: FNI will prepare a Draft Master Plan Report summarizing water demand projections, and Capital Improvement Plan along with descriptions of need for individual projects. FNI will deliver 5 hard copies and one electronic PDF copy of the draft report to City.
- E3. Meet with City to Review Draft Capital Improvement Plan and Draft Master Plan Report: FNI will meet with City to discuss draft CIP and the Draft Master Plan Report.

- E4. Revise Capital Improvement Plan and Master Plan Report: FNI will revised the scheduling of the CIP and resubmit final Capital Improvement Plans and resubmit 20 final hard copies and one electronic copy in PDF format of the Master Plan Report to the City.
- E5. Deliver Project Files to City: FNI will deliver GIS and hydraulic model files to the City.
- E6. Conduct Training for Water System Model: FNI will conduct two consecutive days of model training on the use of the water system model. The training will include providing instructional material and training in setting up the model, running and modifying the model, and printing results.

WATER IMPACT FEE ASSISTANCE

F. Water Impact Fee Assistance

- F1. Identify Water Impact Fee Service Areas: FNI will examine existing impact fee zones and evaluate and identify the future service areas for impact fees.
- F2. Identify Water Improvements Eligible for Impact Fees: FNI will determine impact fee eligible projects based on recently constructed project and proposed projects from the updated water CIP. Maps will be prepared showing the proposed projects included in the impact fee calculation.
- F3. Conduct Water Impact Fee Capacity Analysis for Eligible Projects: FNI will utilize water model to analyze existing recently completed projects for excess capacity and new capital improvement projects for impact fee cost recovery for 10-year projected growth. The capacity analysis will be conducted one time based on the land use assumptions provide by the City. If the land use assumptions are revised after the initial capacity analysis, additional services would be required to update the demands and capacity analysis.
- F4. Calculate Project Costs Eligible for Impact Fee Cost Recovery: FNI will calculate eligible CIP costs for impact fee calculations. The capacity analysis will be utilized to calculate percentage of project cost eligible for impact fee cost recovery.
- F5. Prepare Draft Technical Memorandum: FNI will prepare a draft technical memorandum to document the CIP development and impact fee analysis. A map showing the impact fee capital improvement projects will be prepared. Utilization percentages for each project will also be included. Calculation of the maximum allowable impact fee will not be included. An electronic PDF copy will be submitted for City review.
- F6. Meeting with City to Discuss Technical Memorandum: FNI will conduct a meeting with City to discuss the Draft Technical Memorandum. FNI will solicit comments and incorporate City comments into the final memorandum.
- F7. Finalize Technical Memorandum: FNI will revise the memorandum based on City comments and submit five hard copies and one electronic PDF copy.

SUMMARY OF DELIVERABLES

1. Technical Memorandum: Water Demand Projections
2. Draft Capital Improvements Plan
3. Draft Master Plan Report
4. Final Master Plan Report
5. GIS Mapping and Modeling Files
6. Model Training Material
7. Technical Memorandum: Water Impact Fee Assistance

PROJECT SCHEDULE

Task Name	2017												2018		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
Task A: Project Management															
Task B: Water Model Review and Update															
Task C: Population and Water Demand Projections															
Task D: Distribution System Hydraulic Capacity Analysis															
Task E: Water System CIP, Master Plan Report & Model Training															
Task F: Water Impact Fee Assistance															

ENGINEERING FEE SUMMARY

Task	Description	Hours	Labor	Expenses	Subs	Total
A	Project Management	114	\$ 18,970	\$ 1,090	\$ -	\$ 20,060
B	Water Model Review and Update	180	\$ 24,320	\$ 3,880	\$ -	\$ 28,200
C	Population and Water Demand Projections	204	\$ 28,240	\$ 1,970	\$ -	\$ 30,210
D	Distribution System Hydraulic Capacity Analysis	364	\$ 52,210	\$ 3,360	\$ -	\$ 55,570
E	Water System CIP & Master Plan Report	320	\$ 46,410	\$ 3,890	\$ -	\$ 50,300
F	Water Impact Fee Assistance	190	\$ 27,080	\$ 1,880	\$ -	\$ 28,960
	Total	1,372	\$ 197,230	\$ 16,070	\$ -	\$ 213,300