WATER SYSTEM MASTER PLAN

Prepared for

City of Central Point, Oregon

August 2009

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LIST OF ACRONYMS AND ABBREVIATIONS

ADD	average of average day demand
CIP	capital improvements plan
City	City of Central Point
CMS	Construction Management Services
ENR	Engineering New Record
EPS	extended period simulation
FCV	Flow Control Valve
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
MDD	average of maximum day demand
MG	million gallons
mgd	million gallons per day
MMD	average of minimum month demand
MMS	master meter station
MWC	Medford Water Commission
PHD	peak hour demand
psi	pounds per squate inch
PVC	polyvinyl chloride pipe
QA/QC	quality assurance/quality control
SCADA	supervisory control and data acquisition
UGB	Urban Growth Boundary
URA	Urban Reserve Area
VFD	Variable Frequency Drive
WTP	Water Treatment Plant

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EXECUTIVE SUMMARY

This is an executive summary of the Water System Master Plan Report for the City of Central Point, Oregon (City).

Project Summary

The purpose of the Water System Model Build and Master Plan Project was to 1) provide a hydraulic computer model of the City water system and 2) create a master plan to provide the basis for a capital improvements plan (CIP). The model is intended to serve as a tool for the City's evaluation, planning, and design activities. The master plan, and more specifically the CIP, is intended to provide the plan to improve and expand the City water system in the most cost-effective manner. Specific attention was given to the improvements needed to limit the City's peak demand on the Medford Water Commission (MWC) water system.

The project was completed in two phases. Phase I included the model development, calibration, and training for City staff to use the model. Phase II included a hydraulic analysis of the system using the model and the master planning efforts. A report was provided at the completion of Phase I, documenting the existing system information and computer model development. This Master Plan report includes information from the Phase I report and documentation of the master planning effort.

Description of the Existing System

The City owns and operates the water system which services the majority of the residential, commercial, and industrial customers within its city limits. A small number of customers within the city boundaries are served directly by MWC. The City also serves a few industrial customers north of the city limits near Highway 99. **Figure 2-1** shows the layout of the distribution system facilities. **Figure 2-2** shows a hydraulic schematic of the system, which illustrates the relationship between the delivery points (called master meter stations), reservoirs, and the pump station.

The City purchases water from MWC, which is delivered to the system at three locations. The distribution system consists of two storage reservoirs, a pump station, and a network of transmission mains and distribution piping. The system is operated as a single pressure zone.

Water Demands

An important part of the plan is the establishment and projection of water demands. It provides the basis for water supply needs and the determination of required transmission and storage capacity. This section provides a description of both existing and future demands.

Existing water system demand scenarios were developed based on historical data for maximum day demands (MDD), average day demands (ADD), and average of minimum month demands (MMD).

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Future demands were calculated for three planning horizons: 2015 "Short-Term," 2030 "Mid-Range," and build-out of the urban reserve area (URA) or "Long-Term." Year 2015 and 2030 demands were based on population projections and the long-term demands were based on land area due to a lack of a population projection for build-out of the URA. All undeveloped land within the urban growth boundary (UGB) and the total land area within the City URA were used to calculate additional demand at URA build-out.

A summary of existing and future water system demands is provided in **Table ES-1**.

Table ES-1. Summary of Water Demands

Year	ADD (mgd)	MMD (mgd)	MDD (mgd)
Existing	2.77	1.32	6.26
2015	3.44	1.63	7.76
2030	4.86	2.31	10.94
URA build-out	5.68	2.70	12.81

Fire flow demands are another important component of the water system plan. Fire flow demands are used to evaluate the system capacity to supply adequate water for fire suppression. **Table ES-2** lists the assigned fire flow rates for both existing and future system evaluations for each land-use type in the City's planning information. Estimates are based on general information provided by the fire district. The City did not provided fire demands for any structures within the system service area that exceeded the demands listed in **Table ES-2**.

Table ES-2. Fire Flow Demands

Land Use	Fire Flow (gpm)	Duration (hr)	City Lot Type Code[1]
Industrial	3,500	3	HI, LI
Institutional (Public)	3,500	3	PUBLIC
Commercial	2,500	3	GC, HC, LC
Mixed Use	2,000	2	MU
Multi-Family Residential	1,500	2	MFD, MFR, MH, MHP
Single Family Residential	1,000	2	SFR

[1] Suffixes of the codes used in the "Lottype" field of the City's zoning shapefile (ZONING.shp).

Computer Model Development

A hydraulic computer model of the City's water distribution system was developed to be used as a tool for evaluating the existing system and any proposed improvements to the system. Two versions of the model, a stand-alone version and a City/MWC combined version, were created and delivered to the City. The stand-alone model was delivered to the City at the completion of Phase I. The combined model was developed in Phase II for the evaluations performed for this master plan. This report documents the process of integrating the City and MWC models, model scenarios, demand allocation, and model calibration. For a detailed description of the model attributes and methodology used to create the model, refer to **Appendix B,** *Model Creation Memorandum*.

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Level of Service Goals

Level of service goals and system evaluation criteria were developed to ensure the desired level of service to each customer and to maximize the efficiency of the future system. The criteria for system supply, conveyance, storage, and reliability were reviewed and compared to Oregon state regulations and recommendations and to industry standards. The level of service goals and system evaluation criteria are documented in this report.

System Evaluation

The level of service goals and system evaluation criteria were used to evaluate the existing and future system. A number of improvements were developed to address deficiencies identified in the evaluation. The improvements were designed to the standards laid out in the evaluation criteria.

Existing System Evaluation

The existing water system evaluation included an analysis of the City transmission piping, pumping, storage, and supply facilities. The combined computer model developed for this project was used to simulate the demand conditions that represent the greatest strain on the system: a 24-hr MDD simulation and a steady state MDD plus fire flow simulation. Model results were compared to evaluation criteria. Areas in the existing system that did not meet the criteria are identified as deficiencies that should be addressed.

Pump Stations

There is one pump station in the system, which is used to boost distribution system pressure during peak hour demands. However, current operations of the pump station and the 1 MG Tank supply flow control valve (FCV) limit the effectiveness of this pump station.

Supply

The system supply was evaluated on capacity, quality, and reliability. The capacity, quality, and reliability of the City's supply is heavily dependent on the capacity and reliability of its supplier, the MWC water system. Water quality testing performed by the City indicates that the water supply meets state and federal regulations.

Currently, the City is limited to 4,800 gpm or 6.8 mgd according to their agreement with MWC. The City is responsible for serving demand greater than 4,800 gpm, such as peak hour demand, from equalization storage. However, historical records and model evaluation indicate that during maximum day conditions, the hydraulic grade provided by MWC through the mater meter stations (MMS) is inadequate to refill equalization storage.

Storage

Available storage capacity was compared to the required equalization, fire and emergency storage for the system and it was found that an additional 0.49 MG is needed to meet storage requirements of the existing system.

Piping

Evaluation of the existing system piping included analysis of standard operating pressures, velocity, headloss, and fire flow capacity. **Figures 6-3** and **6-4** show pressure and fireflow deficiencies in the existing system.

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Future System Evaluation

The URA build-out scenario was evaluated first in the combined model to develop the improvements needed to meet the level of service goals at build-out of the future City service area. The 2030 and 2015 scenarios were then model to estimate the year at which each improvement will be needed. Improvements were developed for the URA build-out system first so that all improvements could be sized to meet build-out demands. All improvements were tested under the appropriate 24-hour extended period and fire flow conditions. The system improvements developed through the future system evaluation are shown in **Figure 6-5**. A hydraulic schematic of the future system at URA build-out is shown in **Figure 6-6**.

Recommendations

A CIP was developed to assist the City in budgeting for the improvements needed to provide the required level of service to the City water customers. The improvement projects developed in the future system analysis were prioritized to meet system demands through build-out of the future City service area. All projects were categorized into short, mid, and long-term projects. Planning level costs were estimated for each project. The CIP is summarized in **Table 7-1**. **Figures 7-2** through **7-9** show the layout of each improvement project *(Figures 7-3 through 7-9 will be included in the final report)*.

Report Limitations

This document was prepared solely for the City in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell in May 2008. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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1. INTRODUCTION

This report documents the Water System Master Plan for the City of Central Point, Oregon (City). The project was completed in two phases. Phase I included the model development, calibration, and training for City staff to use the model. Phase II included a hydraulic analysis of the system using the model and the master planning efforts. A report was provided at the completion of Phase I, documenting the existing system information and computer model development. This Master Plan report includes information from the Phase I report and documentation of the master planning effort. This section of the report describes the purpose and activities of the master plan study.

1.1 Statement of Purpose

The purpose of the Water System Model Build and Master Plan Project was to 1) provide a hydraulic computer model of the City water system and 2) create a master plan to provide the basis for a capital improvements plan (CIP). The model is intended to serve as a tool for the City's evaluation, planning, and design activities. The master plan, and more specifically the CIP, is intended to provide the plan to improve and expand the City water system in the most cost-effective manner. Specific attention was given to the improvements needed to limit the City's peak demand on the Medford Water Commission (MWC) water system.

1.2 Study Activities

This project included the creation of a combined computer model of the MWC and Central Point water systems, an evaluation of the existing water system for deficiencies, the development of projects for upgrading the water system, and the preparation of cost estimates for improvements. City staff was consulted to gain a comprehensive understanding of the water system, to ensure the accuracy of the information being analyzed, and to determine practical and effective improvement alternatives.

Phases I and II both included the project management and data gathering tasks described below. All other tasks for Phase I and II are described separately.

Task 1 – Project Management. This task included meetings with City personnel and internal quality assurance/quality control (QA/QC) and technical reviews. Regular meetings and telephone conferences were held between Brown and Caldwell and City personnel to review project progress and issues. Brown and Caldwell conducted internal QA/QC meetings and held periodic meetings with technical experts within the company during the project.

Task 2 – Data Gathering. A project kickoff meeting was held during which Brown and Caldwell collected data from the City and discussed the project schedule. Interviews were conducted with City personnel to gather information on the operation and maintenance of the system and any known deficiencies. Site visits were made to specific facilities to gain a greater understanding of the system. The City also provided requested information throughout the course of the project.

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1.2.1 Phase I Tasks

Task 3 – Water Demand Study. Total system water use was calculated from the City's water purchase records for three demand conditions: average annual or average day demand (ADD), average winter or minimum month demand (MMD), and maximum day demand (MDD). Demands were calculated for each customer from the City's water billing records for each demand condition. Customer demands were adjusted to match total system water use to include unaccounted for water. Two system wide diurnal use patterns were developed from the City's supervisory control and data acquisition (SCADA) records: one for MDD and one for ADD and MMD. Fire flow demands were developed with the City's input for each land use type within the city.

Task 4 – Hydraulic Model. A computer model of the City's water distribution system was created for this project. Brown and Caldwell prepared a technical memorandum detailing the methods and assumptions used in the development of the model (included in **Appendix B**). The memorandum provides a reference for the City's future use of the model. The model was created in MWH Soft's InfoWater software from the City's Geographical Information System (GIS) data and from information gathered through interviews with City staff. The demands developed in the Water Demand Study were allocated in the model based on the tax lot number or street address of each existing customer. The model includes scenarios for the three demand conditions: ADD, MMD, and MDD. The model was created as an extended period simulation (EPS) by adding the appropriate diurnal pattern, pump controls, and flow control valve settings for each scenario. Facility elevations were interpolated from the City's most recent contour data. Hydrant junctions were created in the model and assigned the appropriate fire flow demand.

Task 5 – Model Calibration. The distribution system model was calibrated by adjusting model settings so that model results matched field data. Brown and Caldwell created a technical memorandum outlining the calibration testing plan (included in **Appendix C**). A Brown and Caldwell representative assisted staff from Public Works Management (PWM) and the City to perform the testing. Calibration testing of the distribution system included hydrant testing for the hydraulic calibration of the model and collection of SCADA data for two 24-hour periods for the operational, or dynamic, calibration.

Task 6 – Model Build Technical Report and Model Training. A draft version of this report was submitted to the City for review and comment. The report was modified to incorporate the City's comments and three printed copies of the final report were submitted to the City. A digital copy of the final submittal (pdf format) and the computer model were also provided to the City. The City was also trained to use and maintain the computer model of the water system.

1.2.2 Phase II Tasks

Task 3 – Develop Future Water System Model. Future water demand projections were developed from land use planning and population projections. The proposed future system facilities were added to model scenarios representing the 2015, 2030, and build-out planning horizons. The projected water demands were allocated in the computer model.

Task 4 – Evaluate Water Distribution System. Criteria, or level of service goals, were established with input from City staff for evaluating the existing water system and designing proposed improvements to the system. The criteria were used to: 1) evaluate the existing system, and 2) design improvements required to address any existing deficiencies and serve future growth in the system.

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Task 5 – Develop Capital Improvements Plan. Improvements developed during the water system evaluation were grouped into projects that were prioritized in order of importance. A completion year was assigned to each project based on the evaluation of the different planning horizons (2015, 2030, and build-out). Planning level cost estimates were developed for each project and the costs were compared to the City's financial plan to ensure that the capital improvements plan could be financed by the City.

Task 6 – Prepare Master Plan Report. A draft version of this report was submitted to the City for review and comment. The final copy is a revision of the draft based on the comments provided by the City.

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2. EXISTING SYSTEM

The City of Central Point, Oregon (City) owns and operates the water system which services the majority of the residential, commercial, and industrial customers within its city limits. A small number of customers within the city boundaries are served directly by the Medford Water Commission (MWC). The City also serves a few industrial customers north of the city limits near Highway 99. **Figure 2-1** shows the layout of the distribution system facilities. **Figure 2-2** shows a hydraulic schematic of the system, which illustrates the relationship between the delivery points (called master meter stations), reservoirs, and the pump station.

The City purchases water from MWC, which is delivered to the system at three locations. The distribution system consists of two storage reservoirs, a pump station, and a network of transmission mains and distribution piping. The system is operated as a single pressure zone. This section summarizes the existing facilities that are included in the computer model.

2.1 Water Supply

The City obtains its water through a wholesale agreement with MWC, a regional water provider that also supplies water to the City of Medford and five neighboring communities. MWC has two sources of supply. The primary source is Big Butte Springs, which supplies approximately 25.4 million gallons per day (mgd) of water year round to the MWC system. When demands exceed the supply from Big Butte Springs, MWC operates the 45 mgd Duff Water Treatment Plant (WTP) on the Rogue River. The Duff WTP usually operates from May through October. The maximum day demand (MDD) for the entire MWC system in 2006 was 52 mgd.

MWC delivers water to the City by gravity at the three master meter stations. Each master meter station has a flow control valve (FCV) and a flow meter to regulate inflow to the City's system and check valves to prevent backflow to the MWC system. Each master meter station is referred to by the street name where it is located. **Table 2-1** describes each of the delivery points.

Table 2-1. Master Meter Station Summary

Station	Location	Supply Line Diameter (inches)	Elevation (feet)[1]	Delivery Pressure Range[2] (psi)	Resulting Hydraulic Grade (feet)[3]	
					Low	High
Beall	1253 Beall Lane	36	1297	50-99	1412	1525
Hopkins	625 Hopkins Road	16	1280	57-115	1411	1545
Vilas	240 Vilas Road	36	1288	61-114	1429	1551

[1] Ground elevation interpolated from City contour data.

[2] Minimum and maximum from three summer weeks of SCADA records.

[3] Delivery pressure in feet of head plus elevation.

Pressures fluctuate over a broad range at the master meter stations. This occurs because MWC must pump water from the Duff WTP through a series of pump stations to supplement water supply during the high demand months. Operation of these pumps creates the large pressure fluctuations at the Central Point meter stations listed in **Table 2-1**. The pressures listed were compiled from three separate weeks of SCADA data provided for this project (the first week of June 2007, the first week of July 2007, and the second week of August 2007). The City reports that pressures have dropped as low as 45 psi at the master meter stations.

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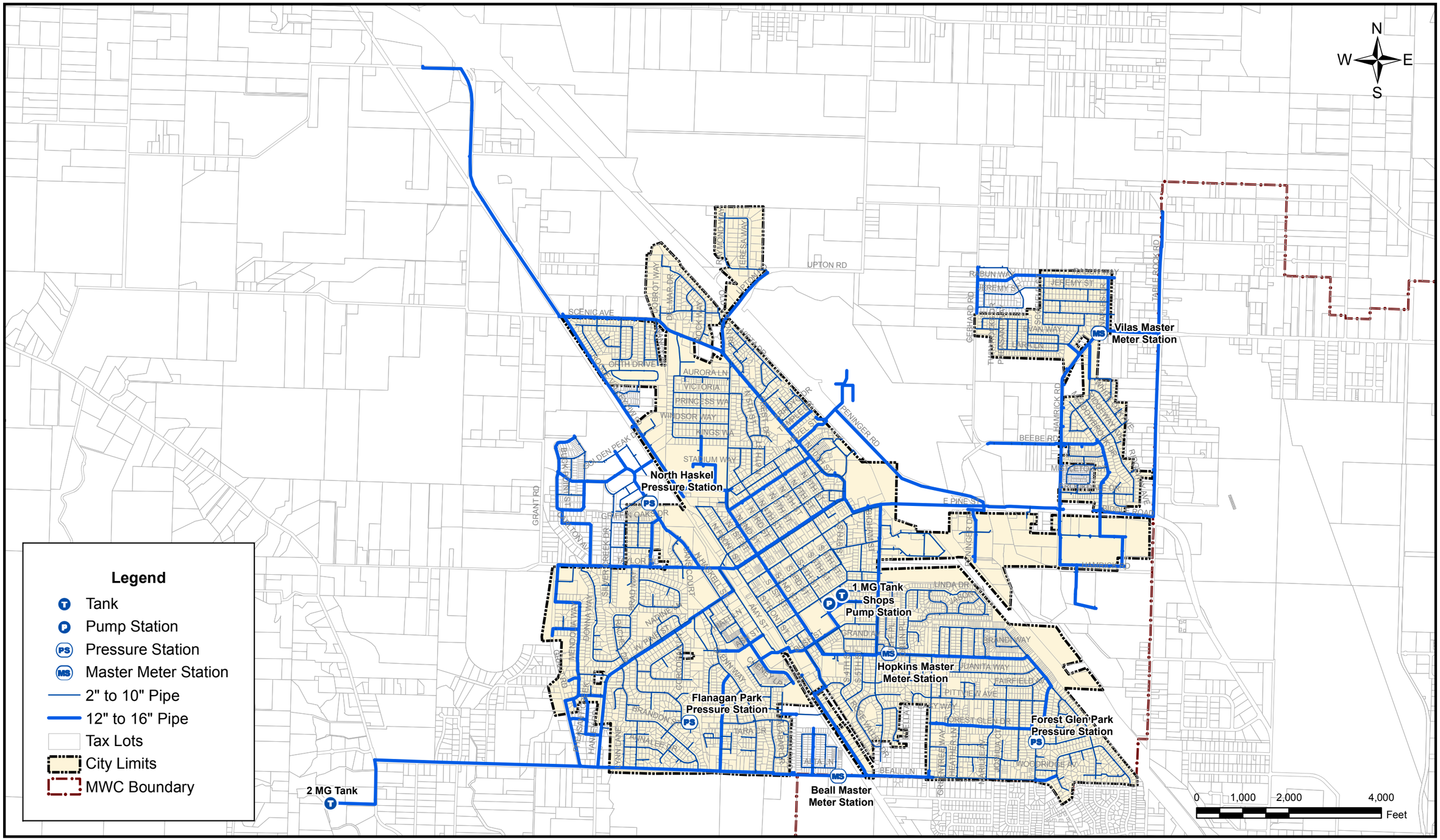

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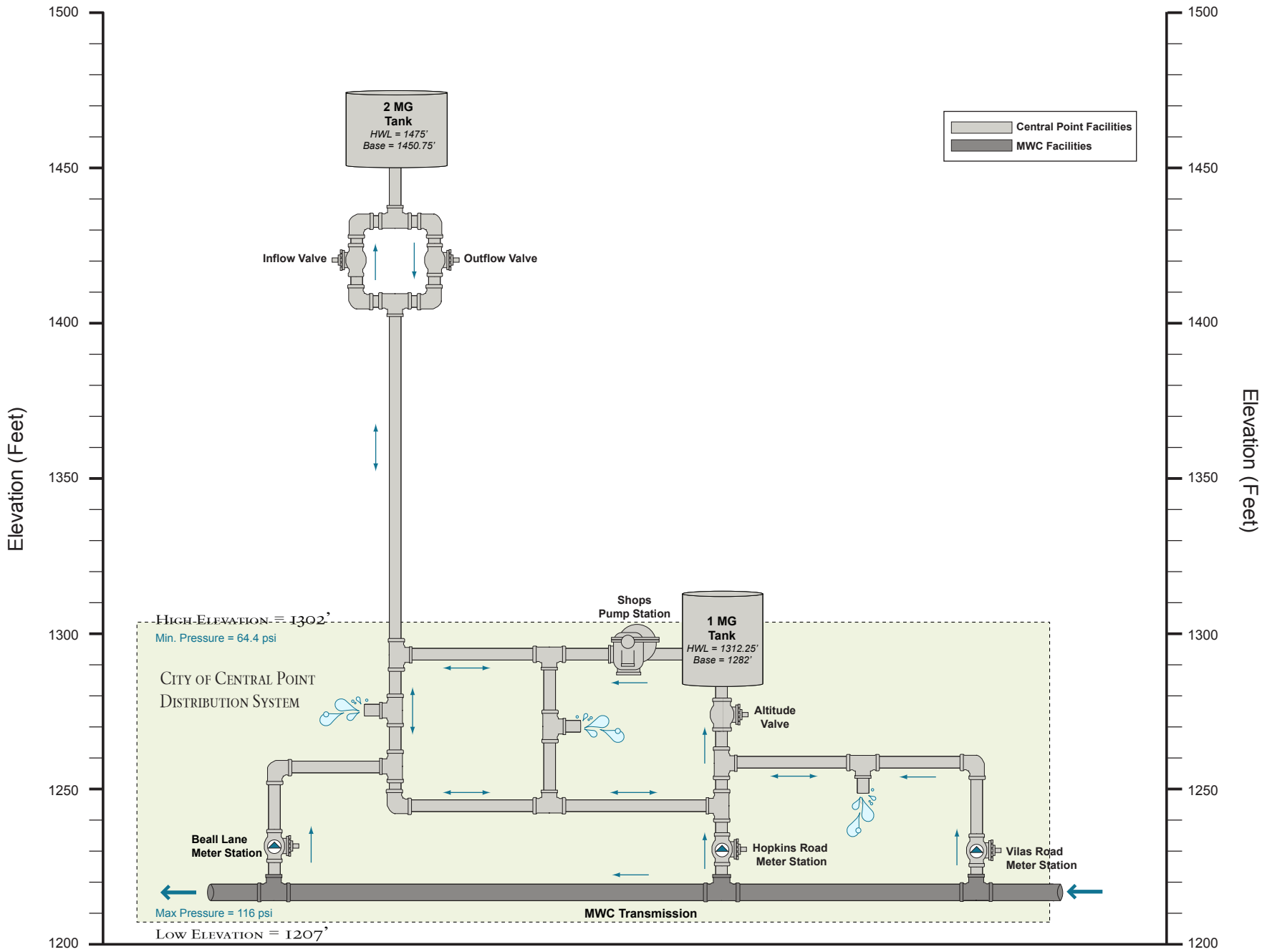
CENTRAL POINT

CITY OF CENTRAL POINT

WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

FIGURE 2-1



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CITY OF CENTRAL POINT
Water System Master Plan
Existing System Hydraulic Schematic
Figure 2-2

2.1.1 Water Rights

To be included with final draft.

2.1.2 Water Quality

To be included with final draft.

2.2 Storage Tanks

There are two water storage tanks in the City's water distribution system: the 1 million gallon (MG) tank and the 2 MG tank. The 1 MG tank is a ground-level, concrete tank located at the Public Works Department maintenance shops. Water is supplied to this tank through an altitude valve. Flow from the tank must be pumped to the hydraulic grade of the system. When system pressures drop below a set pressure, the Shop Pump Station pumps out of the tank to the distribution system. **Figure 2-3** shows the 1 MG tank.

Figure 2-3. 1 MG Tank

The 2 MG tank is a partially-buried, concrete tank located at a higher elevation in the hills west of the City. The tank has separate inflow and outflow control valves. The inflow valve is an altitude valve with a check valve that only allows flow into the tank. The outflow valve is a flow control valve that regulates flow to prevent the tank from draining during summer time operations, when the pressures at the master meter stations are low and the hydraulic grade in the system drops below the elevation of the tank during much of the daytime. The 2 MG tank is pictured on the cover of this report. **Table 2-2** lists details about the two storage tanks.

Table 2-2. Storage Tanks Details

Tank	Type	Base Elevation (feet)	Overflow Height (feet)	Diameter (feet)	Capacity (gallons)
1 MG	Ground-Level Concrete	1282	30.25	75	1,000,000
2 MG	Partially-Buried Concrete	1450.75	24.25	122	2,120,000

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2.3 Flow Control Valves

There are six FCVs in the City's water system, including one at each master meter station—two at the 2 MG tank, and one at the 1 MG tank. Details for the six flow control valves are listed in **Table 2-3**. Different settings are used for the master meter station valves for the summer and the low demand seasons. The meter station valves frequently operate fully open during the summer without meeting the maximum flow setting due to inadequate head in the MWC system.

Table 2-3. Flow Control Valve Details

Valve	Control Type	Summer Setting	Low Demand Setting
Beall Meter Station	Pressure regulating	80 psi	70 psi
Hopkins Meter Station	Flow regulating	3000 gpm	500-1200 gpm
Vilas Meter Station	Pressure regulating	80 psi	70 psi
1 MG Tank Inflow	Altitude valve	Opens @ Tank Level <60% Closes @ Tank Level =100%	Same
2 MG Tank Inflow	Altitude valve	Opens @ Tank Level <70% Closes @ Tank Level =100%	Same
2 MG Tank Outflow	Percent open based on tank level	Tank Level / % Open 80-100% / 30% 70-80% / 20% 60-70% / 10% 50-60% / 5% <50% / 0%	Same

2.4 Pump Station

The only pump station in the City's water system is located at the Public Works Department maintenance shops. The pump station pumps from the 1 MG tank to the distribution system. There are two identical pumps at the pump station and a pad for a third pump. Information provided by the vendor for the pumps can be found in **Appendix A**. The following list summarizes the information for each pump:

- Horsepower: 40 hp
- Drive: Constant Speed
- Reported Impeller Size: 8.52 inches
- Stages: 4
- Operating Point: 900 gpm @ 130 feet

The total dynamic head for the operating point of the pumps was calculated from the suction and discharge pressures recorded in SCADA data. Flow rate through the pump station is not metered, so flow for the operating point of the pumps was calculated from the rate of change in 1 MG tank level when the supply FCV to the tank was closed. **Figure 2-4** shows the operating point compared to the manufacturer's pump curve for one pump running. The pump curve was adjusted to match the current operating point of the pumps.

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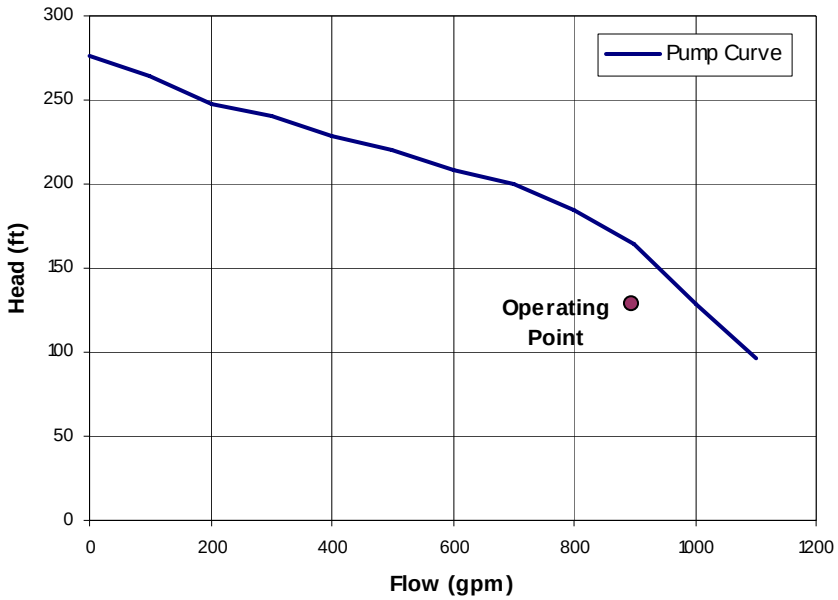

Figure 2-4. Shop Pumps Operating Point vs. Pump Curve

Under existing operations, the pump station frequently discharges water from the 1 MG tank to the distribution system at the same time that the tank is filling from the distribution system. When this occurs, much of the flow from the pump station circulates back into the 1 MG tank.

2.5 Pipe Network

The City's existing distribution system is comprised of piping ranging in diameter from 2 to 16 inches. The majority of the 16-inch piping serves as transmission piping from the 2 MG tank and the Beall and Vilas master meter stations. The City has created a network of 12-inch transmission piping throughout the water system, which conveys water from the tanks and master meter stations to the distribution mains. The total length of piping in the system is about 450,000 feet. **Table 2-4** lists the length of piping in the water system by pipe material and diameter.

Table 2-4. Water System Piping

Pipe Material	Length (feet) by Pipe Diameter (inches)								
	2	3	4	6	8	10	12	16	Total
Asbestos cement (AC)			4,313	32,721	27,822	3,365	24,584		92,805
Cast iron (CI)			36,387	3,242	666		2,229		42,523
Copper	232								232
Ductile iron (DI)	135		2,909	24,261	146,536	2,784	91,958	16,939	285,522
Galvanized steel	54								54
Polyvinyl chloride (PVC)	187	23		2,163	5,455				7,828
Unknown				474	11,520		8,146		20,140
Total	608	23	43,609	62,861	191,998	6,149	126,917	16,939	449,105

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3. WATER DEMANDS

This section describes how the demands used to evaluate the City of Central Point, Oregon (City) water system were developed. A description of both existing and future demands is provided. Section 4 of this report describes how the demands were allocated in the computer model used in the master plan.

3.1 Existing System Demands

Existing water system demand scenarios were developed for maximum day demands (MDD), average day demands (ADD), and average of minimum month demands (MMD). The City provided the monthly Medford Water Commission (MWC) water purchase records from which total system ADD and MMD were calculated. The historical system MDD was provided by City staff. 2006 data was the most recent full year of data available at the time that the existing system demands were calculated. **Table 3-1** lists total system demands for the existing water system.

Table 3-1. Total Existing System Demand

Demand Condition	Daily Demand (mgd)	Demand (gpm)	Scaling Factor from ADD
ADD[1]	2.77	1,927	1.0
MMD[1]	1.32	916	0.48
MDD[2]	6.26	4,349	2.25

[1] From year 2006 MWC water purchase records.

[2] Reported by City Staff. Occurred August 18, 2006.

Monthly water demands were calculated for each customer for 2006 from the City's water billing database. Total metered consumption is typically less than total system demand as calculated from water production records. This is primarily due to unaccounted for water losses in the system. Individual customer demands were scaled up to proportionally distribute the unaccounted for water throughout the system. The customer demands were assigned as model demands to the model junction located nearest to the customer address listed in the water billing database. **Table 3-2** provides a comparison of the total customer demand, the total system demand, and the percent unaccounted for water.

Table 3-2. Unaccounted for Water

Water Use	ADD (mgd)	MMD (mgd)	MDD (gpm)
Total consumption	2.62	1.26	Not available
Total system demand	2.77	1.32	6.26
% Unaccounted for water	6	4	Not available

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3.2 Future System Demands

Demands were calculated for the future service area of the water system for three planning horizons: 2015 "Short-Term", 2030 "Mid-Range", and build-out of the urban reserve areas (URA) (URA build-out or "Long-Term"). The URA build-out future service area includes the City's established urban growth boundary (UGB) and the URA designated to the City. **Figure 3-1** shows the planned URA build-out service area of the City system.

3.2.1 2015 and 2030 Demand

Year 2015 and 2030 demands were based on population projections. The 2030 population of 29,000 was taken from the City's Transportation Master Plan. The population at year 2015 was linearly interpolated to be 20,510 from the existing and 2030 population. For consistency with the existing system demand calculations, the City's 2006 population of 16,550 was used for existing population.

A demand of 168 gallons per day (gpd) per person was calculated from the 2006 water demand and population data. The total system ADD was calculated from the population projections and the 168 gpd per person. The scaling factors listed in **Table 3-1** were again used to calculate MMD and MDD from ADD. 2015 and 2030 demands are summarized in **Table 3-3**.

Table 3-3. 2015 and 2030 Demand Summary

Year	ADD (mgd)	MMD (mgd)	MDD (mgd)
2015	3.44	1.63	7.74
2030	4.86	2.31	10.94

3.2.2 URA Build-out Demand

Due to the lack of a population projection for build-out of the URA, URA build-out demands were based on land area. All undeveloped land area within the UGB and the total land area within the City URA were used to calculate additional demand at URA build-out. Tax lots not included in the water billing records were assumed to be undeveloped area within the UGB. This assumption was verified by reviewing aerial photos.

The demands for undeveloped areas were calculated by first finding the total area of each land use type for the undeveloped UGB area and the URA. The City planning department provided a breakdown by land use of the City URA. Land use of the undeveloped area within the UGB was extracted from the City's Land Use Plan. The demands were then calculated by multiplying the areas by a unit use rate developed for each land use type. The unit use rates were calculated for ADD from existing water use records and land use information. **Table 3-4** lists total additional demand by land use for the undeveloped UGB and URA.

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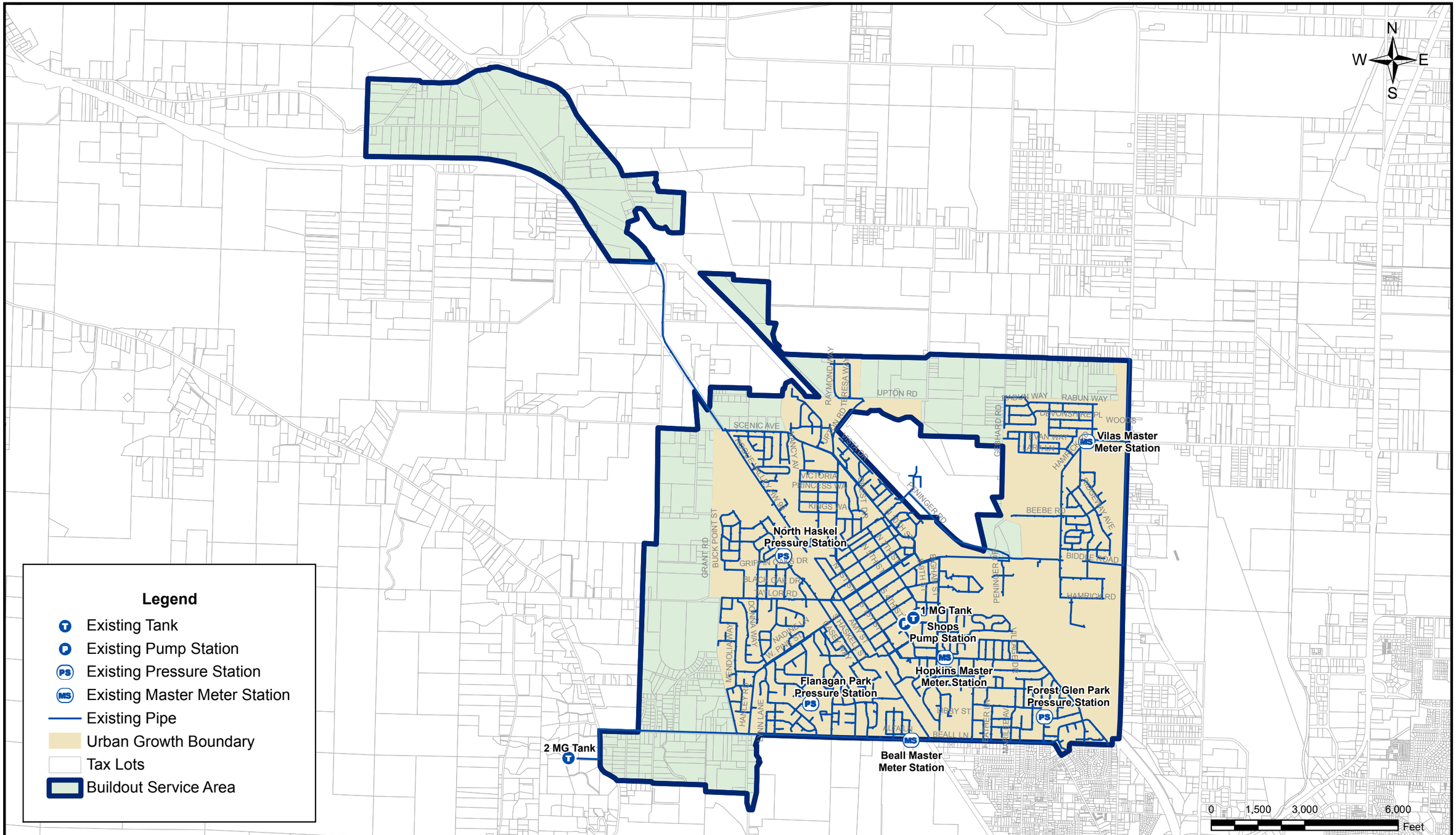

BROWN AND CALDWELL

CENTRAL POINT

CITY OF CENTRAL POINT

WATER SYSTEM MASTER PLAN

PLANNED FUTURE SERVICE AREA

FIGURE 3-1

Table 3-4. URA Build-out Demand Area			
Land Use	Area (acres)	Unit Use Rate (gpm/ac)	Unit Use Rate (gpd/ac)
Undeveloped UGB Area			
Bear Creek Greenway (BCG)	65	No Demand	No demand
Commercial – Medical District (C-2(M))	3	1.02	1,472
Tourist and office (C-4)	67	0.91	1,316
Thoroughfare commercial (C-5)	12	0.91	1,310
Civic	22	0.67	965
Neighborhood commercial (CN)	13	0.29	421
Employment commercial (EC)	14	0.88	1,274
General commercial (GC)	17	0.34	493
High mix residential/commercial (HMR)	25	0.74	1,071
I-5 Highway (I5)	25	No demand	No demand
Low mix residential (LMR)	59	1.24	1,790
Industrial (M-1)	141	0.10	149
General industrial (M-2)	37	0.07	106
Medium mix residential (MMR)	32	1.10	1,577
Open space (OS)	56	0.83	1,189
Oregon Dept. of Transportation (ODOT)	11	No demand	No demand
Park	8	1.20	1,734
Single-family residential-10,000 (R-1-10)	21	1.26	1,815
Single-family residential-6,000 (R-1-6)	76	1.02	1,470
Single-family residential-8,000 (R-1-8)	47	1.21	1,746
Two-family residential (R-2)	31	1.24	1,783
Multiple family residential (R-3)	44	1.22	1,751
Low density residential (R-L)	31	0.30	438
Central Point URA			
Residential	900	1.1	1,583
Commercial	85	0.67	967
Industrial	580	0.48	688
Institutional	54	0.67	965
Open Space	221	0.83	1,189

Table 3-5 summarizes the projected future demand at URA build-out calculated from the land use area and unit use rates listed in **Table 3-4**. The MMD and MDD were calculated using the scaling factors listed in **Table 3-1**.

Table 3-5. URA Build-out Demand Summary			
Demand Source	ADD (mgd)	MMD (mgd)	MDD (mgd)
Existing customers	2.77	1.32	6.26
Additional undeveloped UGB	0.69	0.33	1.55
Additional URA	2.22	1.06	5.00
Total	5.68	2.71	12.81

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3.3 Diurnal Pattern

The daily water use pattern, or diurnal pattern, represents the fluctuation in demand over a given day. The diurnal patterns were calculated from SCADA records of tank levels and flow rates through the master meters. Separate diurnal patterns were calculated for typical average and maximum demand days. The average day diurnal pattern was used for the MMD and ADD scenarios and the maximum day diurnal pattern was used for the MDD scenario. **Figure 3-2** shows the two diurnal patterns.

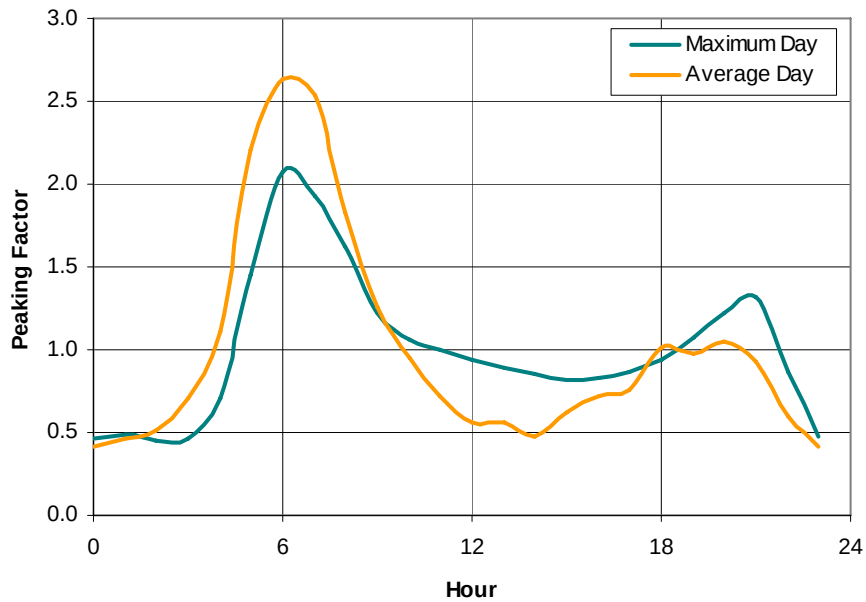

Figure 3-2. Diurnal Patterns

3.4 Fire Flow Demands

Fire flow demands are used to evaluate the system capacity to supply adequate water for fire suppression. Each land use type in the City's planning information was assigned a fire flow demand. **Table 3-6** lists the assigned fire flow rates for both existing and future system evaluations. These estimates are based on general information provided by the fire district. The City did not provided fire demands for any structures within the system service area that exceeded the demands listed in **Table 3-6**.

Table 3-6. Fire Flow Demands

Land Use	Fire Flow (gpm)	Duration (hr)	City Lot Type Code[1]
Industrial	3,500	3	HI, LI
Institutional (public)	3,500	3	PUBLIC
Commercial	2,500	3	GC, HC, LC
Mixed use	2,000	2	MU
Multi-family Residential	1,500	2	MFD, MFR, MH, MHP
Single-family residential	1,000	2	SFR

[1] Suffixes of the codes used in the "Lot type" field of the City's zoning shapefile (ZONING.shp).

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3.5 Demand Summary

The system demands, diurnals, and fire flow patterns presented in this section will be used in the evaluations performed for this master plan. The total system demands are summarized in **Table 3-7**.

Table 3-7. Summary of Water Demands

Year	ADD (mgd)	MMD (mgd)	MDD (mgd)
Existing	2.77	1.32	6.26
2015	3.44	1.63	7.76
2030	4.86	2.31	10.94
URA build-out	5.68	2.70	12.81

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4. COMPUTER MODEL DEVELOPMENT

A hydraulic computer model of the City of Central Point's (City) water distribution system was developed to be used as a tool for evaluating the existing system and any proposed improvements to the system. Two versions of the model, a stand-alone version and a City/Medford Water Commission (MWC) combined version, were created and delivered to the City. The stand-alone model was delivered to the City at the completion of Phase I. The combined model was developed in Phase II for the evaluations performed for this master plan. This section provides a basic description of the model, including the process of integrating the City and MWC models, model scenarios, demand allocation, and model calibration. For a detailed description of the model attributes and methodology used to create the model, refer to the Model Creation Memorandum in **Appendix B**.

4.1 General Model Description

City records and GIS data were used to create a hydraulic computer model of the water distribution system. City staff were interviewed to understand system operations and to clarify questions about the available data. MWH Soft® was chosen as the selected modeling software so that the City's model could be combined with the MWC InfoWater® model.

A copy of the combined model is included on the CD in this report. The model consists of an ArcGIS .mxd file (CP_WSMP_Model.mxd) and a .IWDB folder which contains the model attribute data (CP_WSMP_Model.IWDB).

4.2 Model Integration

A combined model of the City and MWC water systems was created to provide a more accurate representation of the effects of MWC system improvements and operational changes on the City water system. The combined model was needed to evaluate projects that could potentially be shared between the City and MWC. A copy of the City's stand-alone model, called "CP_ExistWaterModel," was delivered to the City with the Phase I Report. The stand-alone model only included existing system scenarios and City system facilities. The stand-alone model was combined with the MWC model dated November 18, 2008, which was the most current version of the model at the time. The combined City/MWC combined model is called "CP_WSMP_Model."

The combined model was used for all evaluations done for this Master Plan. City and MWC facilities were assigned a prefix of 'CCP-' or 'MWC-' respectively in the model. The combined model includes the existing system scenarios and all future scenarios created for the Master Plan. The combined model provides a more accurate representation of the interaction between the City and MWC system; however, it is also more complicated to use because it includes all MWC facilities, some of which have complex control strategies.

4.3 Model Scenarios

Several scenarios were created for this project to simulate system performance with different system demands and operational settings. Scenarios were also added to the model to include different facilities for future planning purposes. All of the scenarios included in the model can be categorized as follows:

- Base–Not used for evaluation purposes, only to store model facility data for the other scenarios.

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- Calibration–Simulate the system at the time of each field test, used to calibrate the model to field data.
- Existing System (2008)–Evaluate the existing system
- Future System–Evaluate the proposed future improvements for the 2015, 2030, and URA build-out horizons.

All scenarios except for the Base scenario are extended period simulations, to simulate 24 hour operations in the system.

4.4 Model Demands

The existing and future demands described in Section 3 of this report were allocated in the model as described below. The MWC demands used in the combined computer model are also described.

4.4.1 Existing System Demand Allocation

Existing system demand allocation consists of appropriately distributing the total system demand in the computer model. The following steps describe how the existing system demands were assigned to the model. **Figure 4-1** illustrates the process graphically.

1. Obtain billing data including addresses for each customer and calculate the MDD of each (described in Section 3).
2. Geocode (locate geographically) each of the customers either by matching the customer to a parcel or by street address (described in Section 3).
3. Flag each junction in the model as a demand junction or non-demand junction. Non-demand junctions will not have a demand, such as junctions on a transmission pipeline or at a pump station or storage tank.
4. Calculate the total demand at each demand junction as the sum of the demand for the customers closest to each junction. This step was done using MWH InfoWater tools.

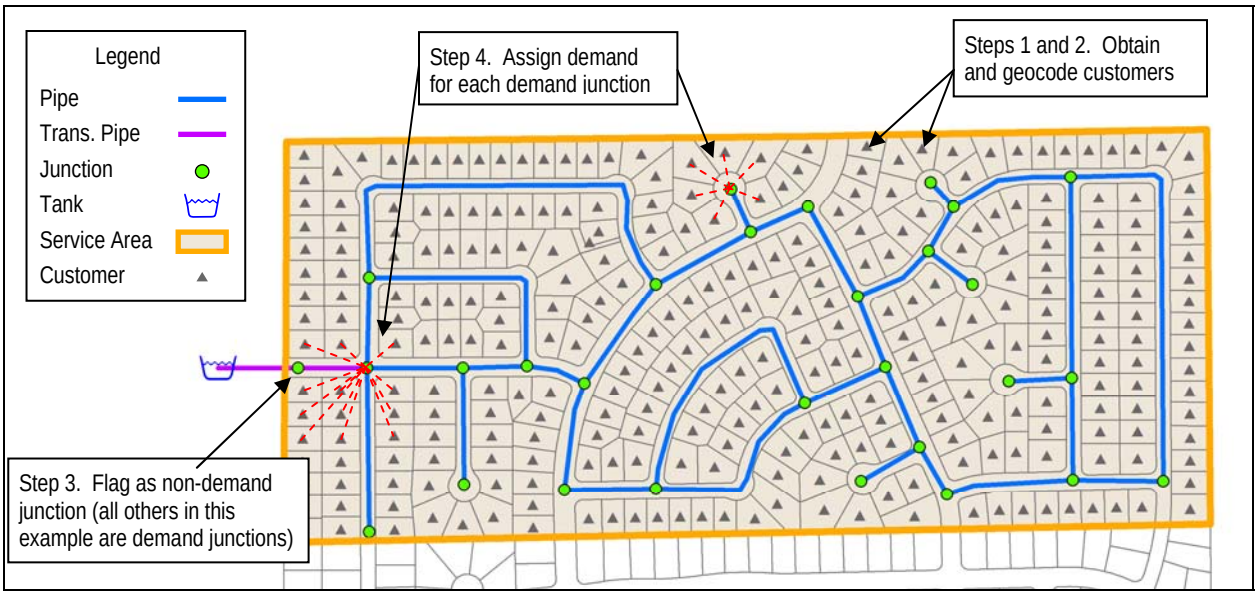

Figure 4-1. Existing Demand Allocation from Billing Data

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4.4.2 Future System Demand Allocation

Future system demand allocation involves distributing the projected future system demands to the appropriate nodes in the computer model. The following steps describe how the future system demands were assigned to the model.

1. Obtain shapefiles of the general land use plan and develop unit-use rates for each land use category. Calculate the total demand for each land use area (described in Section 3).
2. Flag each junction in the model as a demand junction or non-demand junction. Non-demand junctions will not have a demand, such as junctions on a transmission pipeline or at a pump station.
3. Create Thiessen polygons around each demand junction and calculate the area of each polygon. Thiessen polygons define the area of influence around each demand junction (as shown in **Figure 4-2**).
4. Calculate the total demand for a junction by multiplying the area of each land use category that falls within the junction's Thiessen polygon by the corresponding unit-use rates.

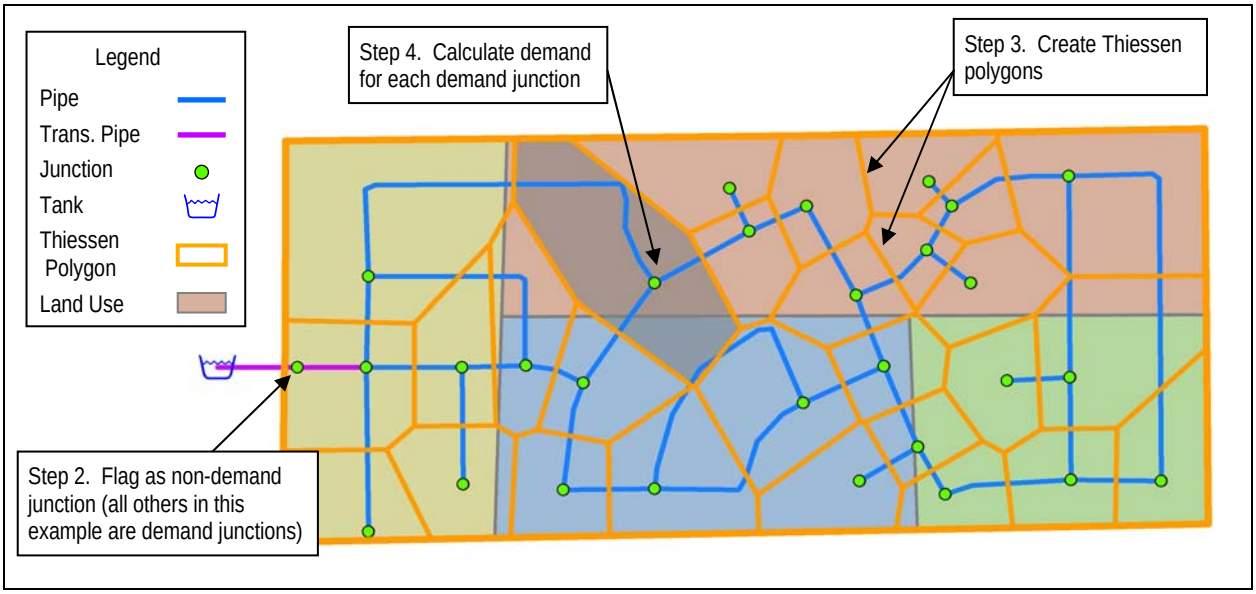

Figure 4-2. Demand Allocation by Land Area

4.4.3 Diurnal Pattern

For extended period model scenarios, a diurnal pattern is assigned to each junction to represent the fluctuation in demand over a given time period. Section 3 of this report describes how the diurnal patterns were developed. The appropriate diurnal pattern was assigned to each junction in the model.

4.4.4 Fire Flow Demand Allocation

Fire flow sets were created for the fire flow evaluation of the existing and future system. Fire flow requirements by land use type were established in Phase I of the project. The fire demands used are listed in

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Table 3-6. Each hydrant in the GIS shapefile of the City fire hydrants was assigned a fire flow based on the surrounding land use types. The closest model nodes to each hydrant in the GIS was designated as fire nodes and assigned the fire flow demand required at the hydrant closest to it.

4.4.5 MWC Demands

MWC and their consultant provided 2008 and 2026 demands in the MWC computer model. The 2008 demands were used for the existing system evaluation. After the existing system evaluation was performed using the provided demands, MWC reported that the 2008 demands were higher than actual 2008 demands. However, the MWC demands for the existing system were not adjusted because the affect on the evaluation of the City system was assumed to be negligible.

The MWC model did not include scenarios for 2015, 2030 or URA build-out; therefore, demands and operational controls in the MWC system were not available for those timeframes. As a result, the MWC 2008 demands and controls were used in the combined model for the existing system and 2015 analyses and the MWC 2026 demand and controls were used for the 2030 and URA build-out analyses. It is assumed that for the purposes of the hydraulic analysis in the City master plan this approach provides an adequate representation of the hydraulic grade in the MWC system at the City master meter stations. The MWC model demands are summarized in **Table 4-1.**

Table 4-1. MWC Model Demands[1]

Year	MDD (gpm)	MDD (mgd)	City Scenarios in Which They Were Used
2008	37,282	53.7	Existing (2008) and 2015
2026	60,079	86.5	2030 and URA build-out

[1] *Includes all MWC, retail, and wholesale, customers except for Central Point.*

4.5 Model Calibration

The model was calibrated to ensure that model results are representative of actual system operations. Model calibration involves adjusting model parameters until model results match field test data. Brown and Caldwell calibrated the stand-alone model of the City system in Phase I and calibrated the combined City/MWC model in Phase II. In both cases, calibration testing plans were created for collecting field data for the model calibration (see **Appendix C**). Representatives from Brown and Caldwell and the City then performed the field testing. Both hydraulic (steady-state) and operational (dynamic) calibrations were performed on the model.

4.5.1 Steady-State Calibration

The purpose of steady-state calibration is to verify pipe connectivity (how pipes connect to other pipes), pipe roughness factors, and the elevation of facilities (i.e., tanks, pumps and valves) in the model. In Phase I of the project, field data from the six hydrant tests performed on the system were used for the steady-state calibration. In Phase II, results of the combined model were verified with field data from three additional hydrant tests performed on the system.

The steady-state calibration scenarios in the model were set-up to represent the system on the day of testing. Demands for each scenario were scaled to match system demands at the time of the test. Pump status and tank levels were set to match SCADA records at the time of each test. For Phase I calibration, pressures at the master meter stations were set to match SCADA records at the time of each test. For the combined model in Phase II, pressure at the master meter stations was calculated in the combined model.

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Adjustments were made to the model until pressures in the model matched the recorded field data from before and during the hydrant test. Some connectivity issues were corrected and some closed isolation valves were identified in areas that were under construction at the time of the test. Some of the roughness factors were also decreased slightly to better match field results. The steady-state calibration also indicated that field pressure readings at the Hopkins Master Meter Station are high.

The model calibrated well. Pressures in the model matched within 5 psi of pressures recorded during the field tests for seven of the nine tests. The SCADA records showed that a sudden drop/spike in pressure occurred in the MWC system at the time of the 2 tests that could not be matched in the model. It is assumed that the starting/stopping of one or more of the MWC pumps interfered with the test results of the two non-matching tests. The field test data and the steady-state calibration results are summarized in **Appendix D**.

4.5.2 Dynamic Calibration

The purpose of dynamic calibration is to verify the operational control settings in the model (i.e., valve settings and pump on/off controls). The City's SCADA records provided the information needed for the dynamic calibration. In Phase I of the project, the model was calibrated to match field data for two 24-hour periods. A third 24-hour period was used to verify results of the combined model created in Phase II of the project.

For the Phase I calibration, an extended period scenario was created in the model for each 24-hour period. Demands in the model were scaled to match total system demands for the two calibration days. Initial tank levels were set to match SCADA records for the 2 days. The hydraulic grade at the master meter stations was set based on the SCADA records. Model results were compared with data extracted from the SCADA records for the pressure stations, master meter flow rates, tank levels, and pumping status.

For the Phase II calibration, a scenario was created in the model for a third 24-hour period. Again, demands in the model were scaled to match total system demands for the calibration day and initial tank levels were set to match SCADA records for the two days. In the combined model, the hydraulic grade at the master meter stations was calculated as part of the model results. The hydraulic grade is primarily governed by pump station controls in the MWC system so controls on the MWC pumps were set to match operations for the calibration day.

Dynamic calibration verified the results of the steady-state calibration and showed that the model provides an accurate representation of the water system. Phase I Calibration results raised questions about the 2 MG Tank base elevation. However, between Phase I and II, City staff verified the design drawing elevation of the 2 MG Tank at 1450.75 feet. Dynamic calibration in Phase II showed that model results were accurate with the 2 MG Tank base elevation at 1450.75 feet.

The model is operationally well calibrated. Graphs of dynamic calibration results are shown in **Appendix E**. The model pressure results are within approximately 5 psi of the average field pressures.

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5. LEVEL OF SERVICE GOALS

This section describes level of service goals and other criteria to be used for evaluating the existing drinking water system and for the design of future improvements in the model. The section lists the specific capacity, operations, and reliability requirements for supply, piping, pumping, and storage facilities. The criteria were developed to ensure the desired level of service to each customer served by the City of Central Point, Oregon (City) and to maximize the efficiency of the future system.

5.1 Reference Documents

The criteria herein are based on state regulations and industry standards. Where not otherwise established, criteria are based on engineering experience. The documents reviewed to develop the criteria include:

- Oregon Administrative Rule (OAR) 333-061-0050 [OAR, 2008]–This document contains the state regulations for transmission, supply, pumping, and storage facilities.
- *Recommended Standards for Water Works* [WSC, 2007]–This document, frequently referred to as the Ten State Standards, is produced by the Water Supply Committee of the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. It is widely accepted in the industry as a standard for the evaluation and design of water systems.
- Manual of Water Supply Practices, M32, *Computer Modeling of Water Distribution Systems* [AWWA, 2005]–This document was referenced where criteria were not provided by the documents listed above.
- International Fire Code (IFC) [ICC, 2003]–All fire flow criteria are based on this document and should be approved by the fire department.
- *Medford Water Commission Water Distribution System Facility Plan* [MWC, 2007]–This document includes the criteria used by the Medford Water Commission (MWC) for the evaluation and design of water distribution system facilities.

5.2 Supply Criteria

The City obtains its water through a wholesale agreement with MWC. The agreement is included in **Appendix F**. The wholesale agreement establishes a maximum flow rate to be supplied to the City master meter stations. The City is responsible for limiting demand on the MWC system to that flow rate, and MWC is responsible to ensure that there is adequate capacity and reliability in their system supply facilities. The wholesale agreement with MWC is updated every 5 years, and the maximum flow rate specified in the agreement is based on the estimated average of maximum day demand (MDD) for the City during the 5-year term of the agreement. The maximum flow rate to the City specified in the current agreement is 4,800 gallons per minute (gpm) or 6.8 million gallons per day (mgd). The agreement will be updated in 2010.

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To ensure that City storage tanks can be used appropriately to serve peak hour demand (PHD) in the system, water must be supplied to the City system at a hydraulic grade that is consistently at or above the overflow elevation of the 2 MG tank. Results from previous studies indicate that the City will be required to construct and operate pump stations at one or more of the master meter stations to supply the system at a consistent hydraulic grade. **Table 5-1** lists the criteria that will be used to design any future City supply pump stations.

Table 5-1. Supply Criteria

Criteria	Value\Description	Reference
Capacity		
Flow rate	Equal to MDD	[WSC, 2007]
Head	Maintain the hydraulic grade of the system supply high enough to recharge storage tanks MDD	
Reliability		
Redundant capacity	Meet capacity requirements with the largest producing pump out of service	[WSC, 2007]
Power supply	At least two independent power sources or a standby/auxiliary source should be provided (e.g., generator)	[WSC, 2007]

5.3 Pipe criteria

Water system piping is categorized as transmission or distribution piping. Transmission piping conveys water between major facilities such as wells, pump stations, and reservoirs and from those facilities to the distribution system. Distribution piping provides local distribution of water to individual user service laterals. **Table 5-2** lists the capacity and reliability criteria for evaluating and designing the water system piping.

Table 5-2. Pipe Criteria

Criteria	Value\Description	Reference
Capacity		
Required size	As calculated to meet pressure, velocity and headloss requirements for all flow conditions (minimum of 6-inches)	[OAR, 2008]
System Pressures		
Maximum operational	120 psi	City
Minimum		
At PHD	35 psi	City
MDD with fire demand	20 psi	[OAR, 2008]
Fire demands[1]		
Single-family residential	1000 gpm, 2 hour duration	[ICC, 2003][2]
Multi-family residential	1500 gpm, 2 hour duration	[ICC, 2003][2]
Mixed use	2000 gpm, 2 hour duration	[ICC, 2003][2]
Commercial	2500 gpm, 3 hour duration	[ICC, 2003][2]
Industrial	3500 gpm, 3 hour duration	[ICC, 2003][2]
Institutional	3500 gpm, 3 hour duration	[ICC, 2003][2]
Velocity		
Maximum for design pipe[3]	5 feet / second	[AWWA, 2005]
Maximum for existing pipe	10 feet / second	[AWWA, 2005]
Maximum headloss for MDD (Design)[4]		
Transmission pipe	2 feet / 1000 feet	[AWWA, 2005]
Distribution pipe	6 feet / 1000 feet	[AWWA, 2005]

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Table 5-2. Pipe Criteria		
Criteria	Value\Description	Reference
Reliability		
Transmission	Redundant supply lines to hydraulically isolated areas wherever feasible	[WSC, 2007]
Distribution	Looping wherever feasible	[OAR, 2008]
Location	Water mains should be installed in public streets or other public access ways wherever possible	[OAR, 2008]

[1] *Also listed in Section 3.*

[2] *Flow rates and durations shown are typical fire flows for the land use listed based on calculations done by the fire department using the IFC [ICC, 2003].*

[3] *AWWA recommends a maximum of 5 fps to avoid high headloss. The cost of adding piping to meet this criterion may exceed the benefit; therefore, this criterion is provided by way of recommendation rather than requirement.*

[4] *AWWA recommends these criteria to avoid high operating costs. The cost of adding piping to meet these criteria may exceed the benefits; therefore, these criteria are provided as recommendations rather than requirements.*

5.4 Pump Station Criteria

Two types of pump stations are considered in this study: pump-storage and booster. Pump-storage pump stations pump from a storage tank directly to the distribution system and are frequently used to serve PHD. Booster pump stations add energy, or head, to maintain a flow rate and/or a hydraulic grade from a pressure zone or water system to another which is served by one or more storage tanks.

The existing pump station in the City's water system is a pump-storage station located at the Public Works Department maintenance shops. **Table 5-3** summarizes the evaluation and design criteria for the existing and future pump stations.

Table 5-3. Pump Station Criteria		
Criteria	Value\Description	Reference
Minimum Capacity		
Pump-storage	Designated portion of PHD (PHD minus the flow rate from elevated storage tanks in the system)	Engineering judgment
Booster	Average of MDD	[WSC, 2007]
Reliability (All three types of pump stations)		
Redundancy	Areas served by pumps should have a minimum of two supply pumps	[WSC, 2007]
Redundant pump sizing	Pumps should be sized to meet the minimum capacity requirement with the largest pump out of service (redundant fire pumps are not necessary)	[WSC, 2007]
Power supply	At least two independent power sources or a standby/auxiliary source (e.g., generator) should be provided	[WSC, 2007]
Suction tanks	Wherever possible, booster pumps shall take suction from tanks and reservoirs to avoid the potential for negative pressures on the suction line which can result when the pump suction is directly connected to a distribution main	[OAR, 2008]
Operations (All three types of pump stations)		
Minimum suction pressure	Pumps which take suction from distribution mains for the purpose of serving areas of higher elevation shall be provided with a low pressure cut-off switch on the suction side set at no less than 20 psi	[OAR, 2008]
Control settings	Provide adequate range between high/low pressure or tank level settings to prevent excessive cycling of the pump	[WSC, 2007]
Pressure zones served	Pump stations will lift water a maximum of two pressure zones (serving additional pressure zones results in wasted energy)	Engineering judgment

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5.5 Storage Criteria

The volume of storage required for a service area consists of three components: equalization, fire, and emergency storage. Equalization storage is used to meet demands when they exceed supply to the system (e.g., during peak demand periods). **Figure 5-1** shows a sample diurnal demand pattern versus supply. Supply is assumed to be equal to the average of MDD and is fairly constant over the day. The equalization storage is equal to the shaded area when the tank is emptying.

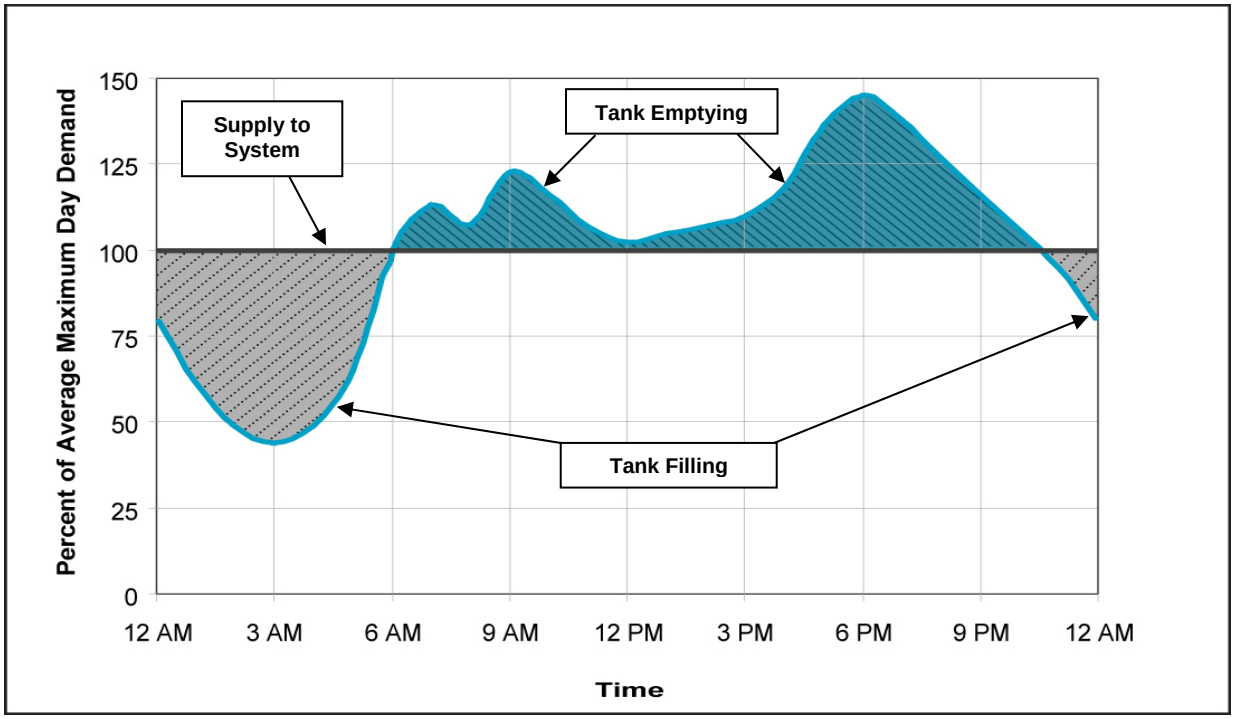

Figure 5-1. Required Equalization Storage for a Sample Diurnal Demand Curve

Fire storage is reserved to supply fire demand for the duration of a fire event. Emergency storage is reserved to provide water during events such as power outages, standard maintenance procedures, natural disasters, facility failures, etc. **Table 5-4** summarizes the standards for determining the total volume needed to meet the three required components of storage capacity and includes guidance on storage tank operations.

Table 5-4. Storage Criteria

Criteria	Value\Description	Reference
Capacity		
Equalization	Volume to serve demand in excess of supply to the tank service area for MDD	[WSC, 2007]
Fire	Volume required to supply the largest needed fire flow of the service area for the required fire flow duration	[WSC, 2007]
Emergency	1/3 of MDD	[MWC, 2007]
Operations		
Water quality	Excessive storage capacity should be avoided to prevent water quality issues	[WSC, 2007]
Controls	Use adequate controls to prevent unintentional overflow or draining of the storage tanks (e.g., pump controls, altitude valves)	[WSC, 2007]

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6. SYSTEM EVALUATION

The purpose of this section is to summarize the evaluation of the City water transmission and storage system. It includes the findings of both the existing and future system evaluation.

6.1 Existing System Evaluation

The existing water system evaluation included an analysis of the Central Point transmission piping, pumping, storage, and supply facilities. The combined computer model developed for this project was used to simulate the demand conditions that represent the greatest strain on the system: a 24-hr MDD simulation and a steady state MDD plus fire flow simulation. Model results were compared to the criteria listed in Section 5 of this report. Areas in the existing system that did not meet the criteria are identified as deficiencies that should be addressed.

6.1.1 Pump Stations

A specific flow rate is not required through the Shops Pump Station, because the purpose of the pump station is to boost distribution system pressure during peak hour demand periods. The pumps appear to be sized appropriately for this; however, current operations of the pump station and the 1 MG Tank supply FCV limit the effectiveness of the pump station. As previously mentioned, the Shops Pump Station frequently discharges water from the 1 MG Tank to the distribution system at the same time that the tank is filling from the distribution system. When this occurs, much of the flow from the pump station circulates back into the 1 MG Tank. This results in wasted energy and limits the ability of the booster station to increase system pressures.

6.1.2 Supply

The system supply is evaluated on capacity, quality, and reliability. As the wholesales supplier, MWC has responsibility for the water quality of supply to the system. Water quality testing performed by the City indicates that the water supply meets state and federal regulations. The capacity and reliability of the City's supply is also heavily dependent on the capacity and reliability of the MWC water system.

As previously mentioned, the current supply limit to the City in the agreement with MWC is 4,800 gpm or 6.8 mgd. This is greater than the City's existing MDD. The City is responsible for serving and demand greater than the 4,800 gpm from equalization storage. The City system was designed to supply any demand over MDD, including peak hour, from its storage tanks and to refill storage when system demand is less than MDD. However, historical records and model evaluation indicate that during summer demand and operating conditions, the hydraulic grade provided by MWC through the master meter stations (MMS) is inadequate to refill storage.

The combined computer model was used to evaluate hydraulic grade of the supply to the system. **Figure 6-1** shows the hydraulic grade from the MWC system for existing MDD conditions compared to the tank overflow elevation.

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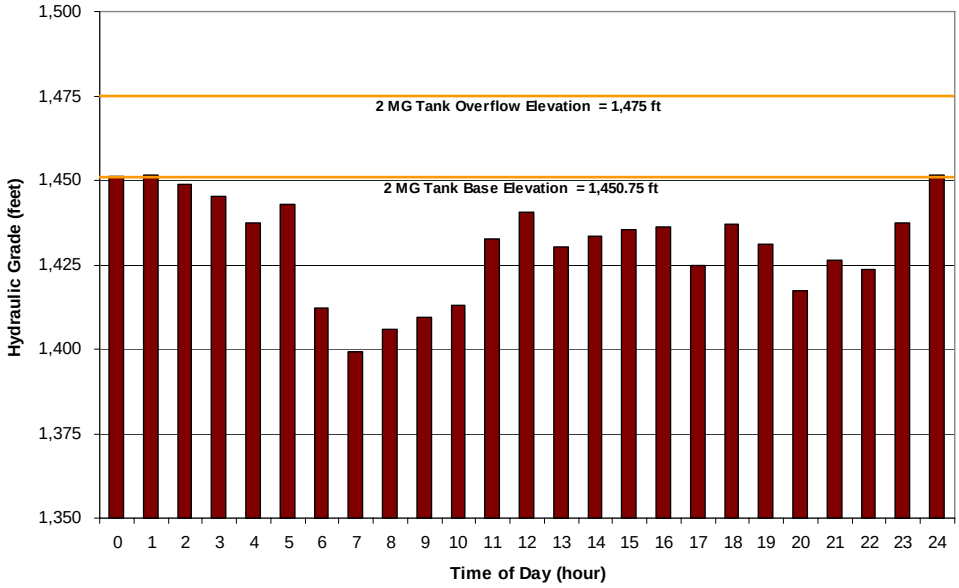

Figure 6-1. Existing Hydraulic Grade Supplied Under MDD

As a result of the low hydraulic grade from MWC, the City's 2 MG tank cannot fill during MDD, leaving it unable to store water to meet PHD. Therefore, the City currently uses water directly from the MWC system for peak hour demands. **Figure 6-2** shows the maximum flow rate specified in the contract compared to the flow rate through the MMSs from the existing MDD model results.

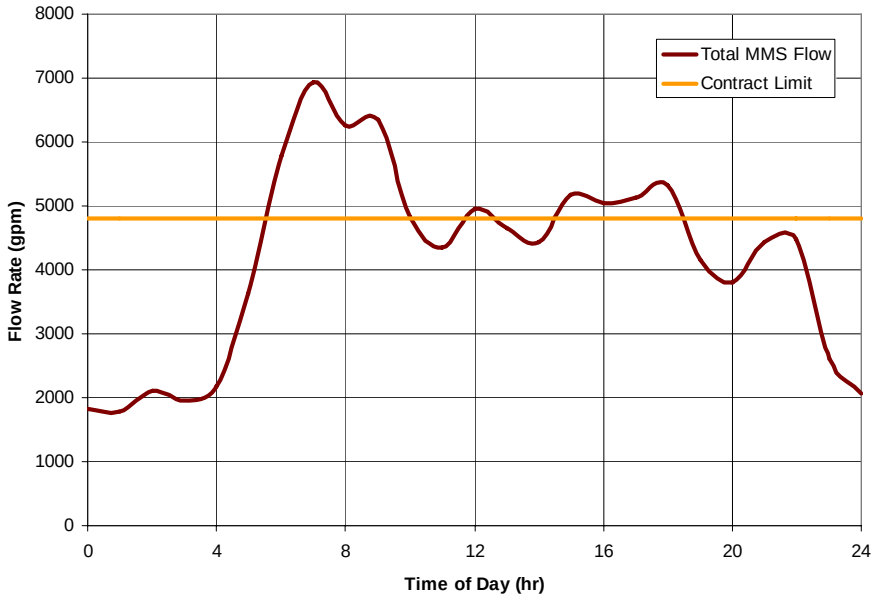

Figure 6-2. Existing System Flow through Master Meters

The City cannot limit demand on the MWC system to average of MDD until the issue of inadequate hydraulic grade at the master meter stations is addressed.

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6.1.3 Storage

Available storage capacity was compared to the required equalization, fire, and emergency storage for the system. As indicated in **Table 6-1**, an additional 0.49 MG is needed to meet storage requirements of the existing system.

Table 6-1. Existing System Storage Analysis (MG)

Available Storage (1 and 2 MG Tanks)	Required Storage				Deficient Storage
	Fire Flow (3,500 gpm for 3 hours)	Equalization	Emergency (1/3 day of MDD)	Total	
3.12	0.63	0.88	2.10	3.61	0.49

6.1.4 Piping

Evaluation of the existing system piping included analysis of standard operating pressures, velocity, headloss, and fire flow capacity.

Operating Pressures

Overall, the City water system provides water to service connections at adequate pressures. Areas in the system where water pressure drops below the minimum allowable pressure of 35 psi under PHD are shown in **Figure 6-3**. The low pressures are caused by a lack of head from the MWC system, as discussed in Section 6.1.1, rather than by a lack of capacity in the City piping. Model results did not show any high pressures in the water system for current MDD conditions.

Velocity and Headloss

Model results showed that the existing system meets the velocity requirements of less than 10 ft/s. No areas of excessive headloss were identified.

Fire Flow Deficiencies

Figure 6-4 shows areas in the system that do not have the capacity to meet the fire flow requirements established for this study. The majority of the deficiencies are due to undersized distribution piping and a lack of looping in certain areas of the distribution system. Recommendations to eliminate fire flow deficiencies can be found in the Capital Improvements Plan (Section 7).

Reliability

Overall, the City has good looping in the transmission and distribution piping. However, the following piping reliability issues were identified:

1. Single supply pipeline to the service area to the far northwest portion of the City
2. Single supply pipeline to the existing 2 MG tank
3. Limited connectivity between the west and east sides of the City, which are separated by I-5

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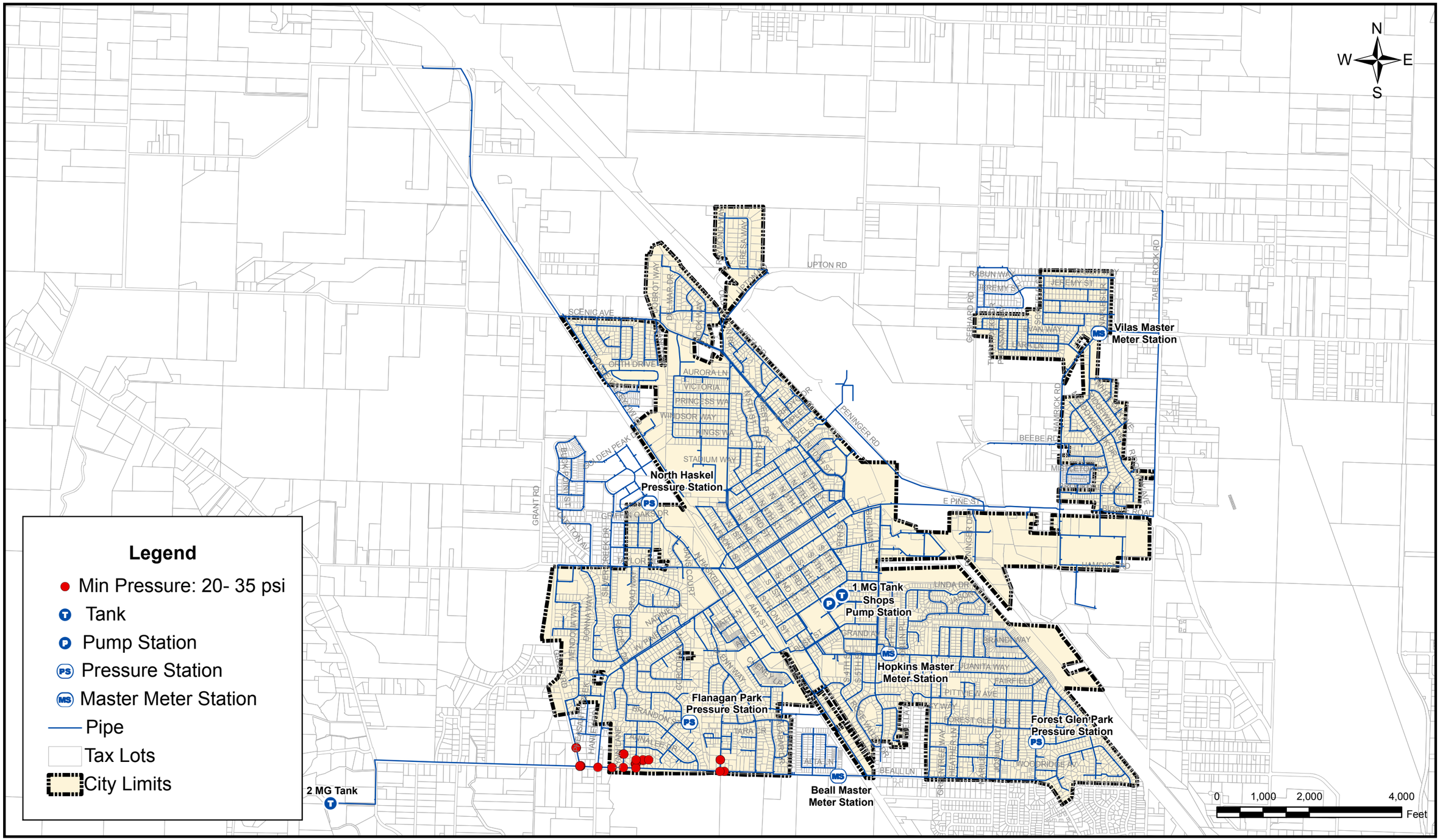
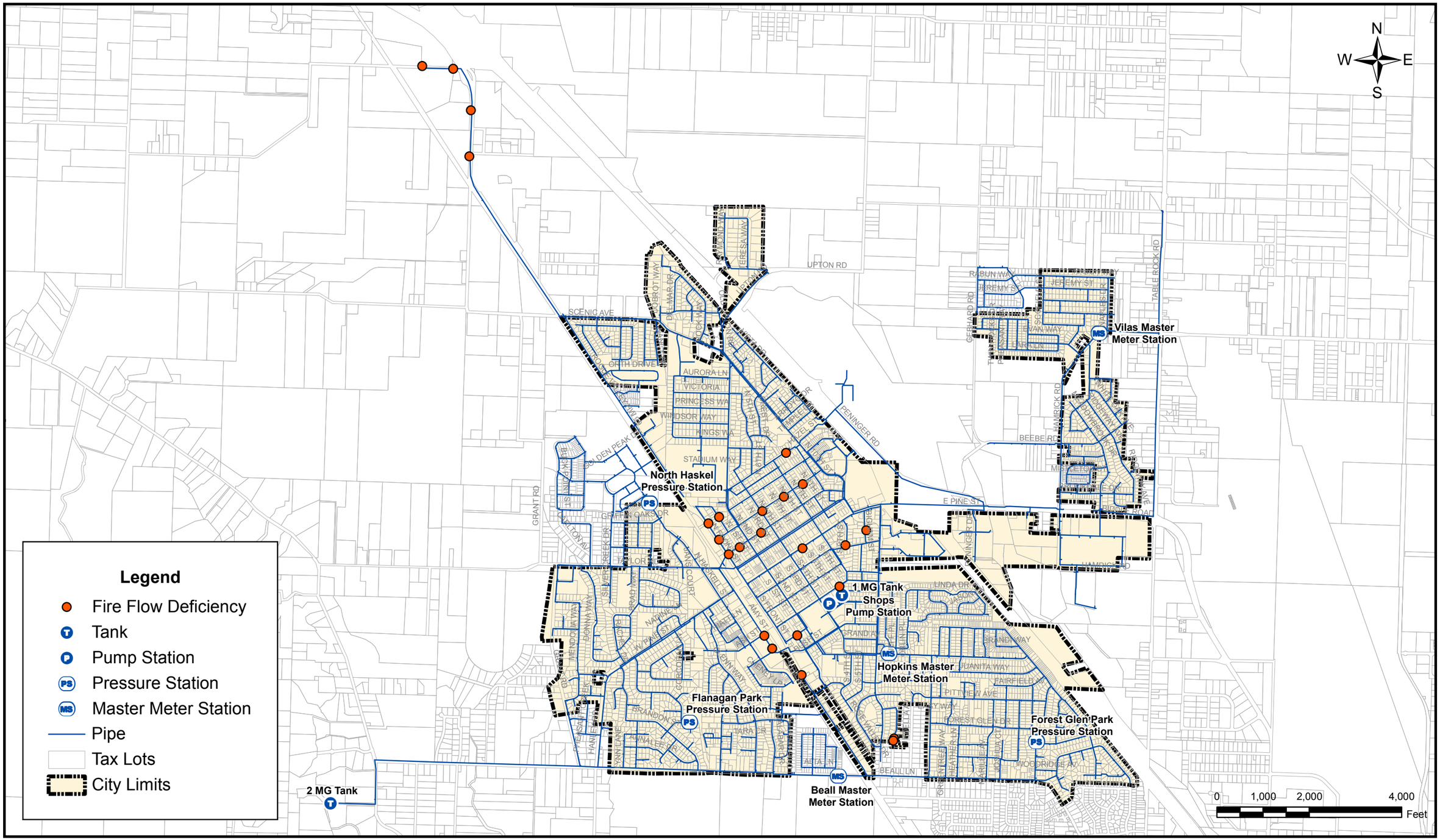


BROWN AND CALDWELL

CENTRAL POINT

CITY OF CENTRAL POINT
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM
LOW PRESSURES
FIGURE 6-3



BROWN AND CALDWELL

CENTRAL POINT

CITY OF CENTRAL POINT
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM
FIRE FLOW DEFICIENCIES
FIGURE 6-4

6.2 Joint Modeling Evaluation

A joint modeling evaluation was completed by Brown and Caldwell as a precursor to this master planning study. The objectives of the study were:

- Develop a MWC-Central Point combined water system model
- Determine the impacts of routine/seasonal operational changes
- Develop operational strategies for minimizing the City's peak hour demand on the MWC system
- Look into the benefits and liabilities of shared storage
- Develop capital improvements alternatives

The completion of this study revealed that the MWC system does not provide a high enough hydraulic grade to fill the City's 2 MG storage tank at MDD conditions, which forces the City to draw water directly from the MWC system to meet their peak hour demand, as described in Section 6.1.3 of this report. The first avenue to improve system function was to investigate operational improvements. The following operational improvements were evaluated in the combined model and are listed below:

1. Optimize utilization of the Central Point Master Meters and Shops Pump Station
2. Coordinate filling of the City's 2 MG tank with operations in the MWC system
3. Minimize utilization of the MWC Rossanley Control Station pumps
4. Supply a constant flow rate from the Duff WTP

Model results indicate that operational improvements alone will not allow the City to limit their water use to the average of MDD from the MWC system while maintaining adequate system pressures and storage. This conclusion led to the evaluation of the following capital improvement alternatives:

1. New MWC booster stations at Four Corners and Midway
2. New supply line to Central Point from White City
3. New City booster pumps at the existing master meter locations
4. Additional storage tanks in the Central Point system

Ultimately, a combination of capital improvement alternatives three and four were used for this master planning study and are described further in this section and in Section 7. Full documentation of the alternatives evaluation can be found in **Appendix G**, *Joint Modeling Study Technical Memorandu*m.

6.3 Future System Analysis

This section presents a summary of the analysis of the future 2015, 2030 and URA build-out scenarios. The URA build-out scenario was evaluated first in the combined model to develop the improvements needed to meet the level of service goals at build-out of the future City service area. The 2030 and 2015 scenarios were then model to estimate the year at which each improvement will be needed. Improvements were developed for the URA build-out system first so that all improvements could be sized to meet build-out demands. All improvements were tested under the appropriate 24-hour extended period and fire flow conditions. This process ensures that all recommended improvements come together in a cohesive master plan.

The improvements evaluated for build-out of the URA are shown in **Figure 6-5**. **Figure 6-6** shows the schematic of the future system. Discussion of the improvements below is categorized into pumping, supply, storage, and piping.

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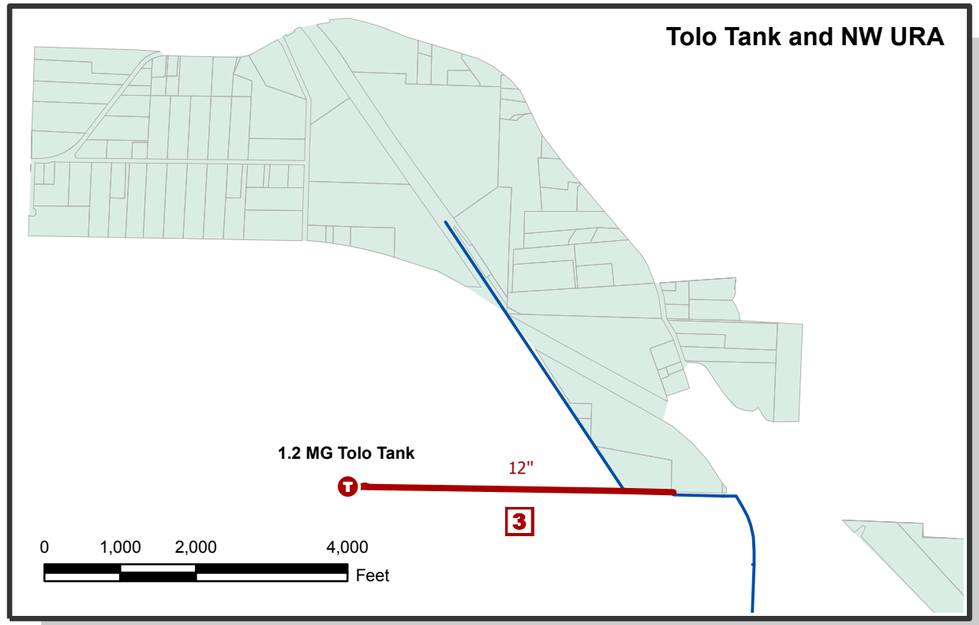
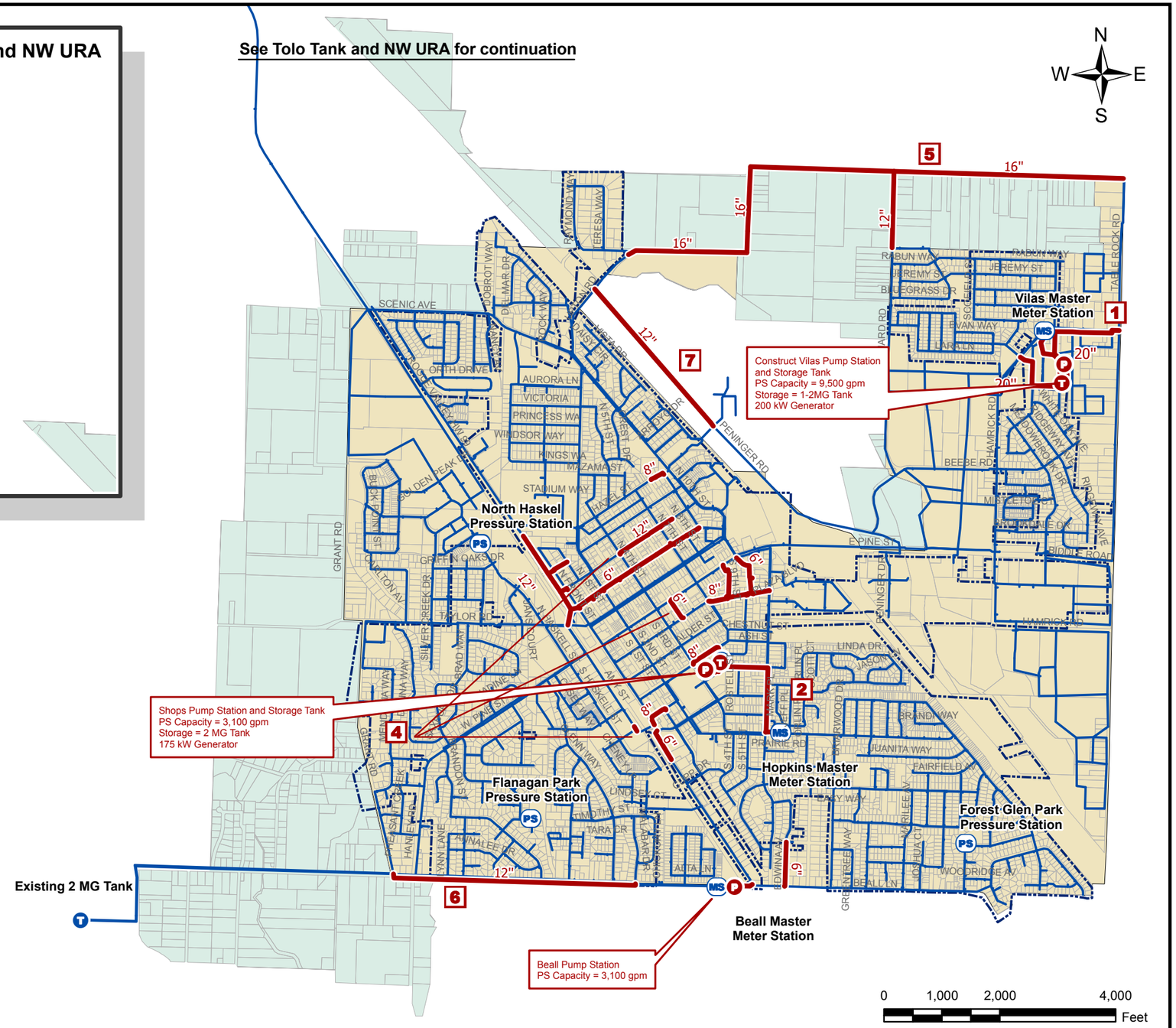




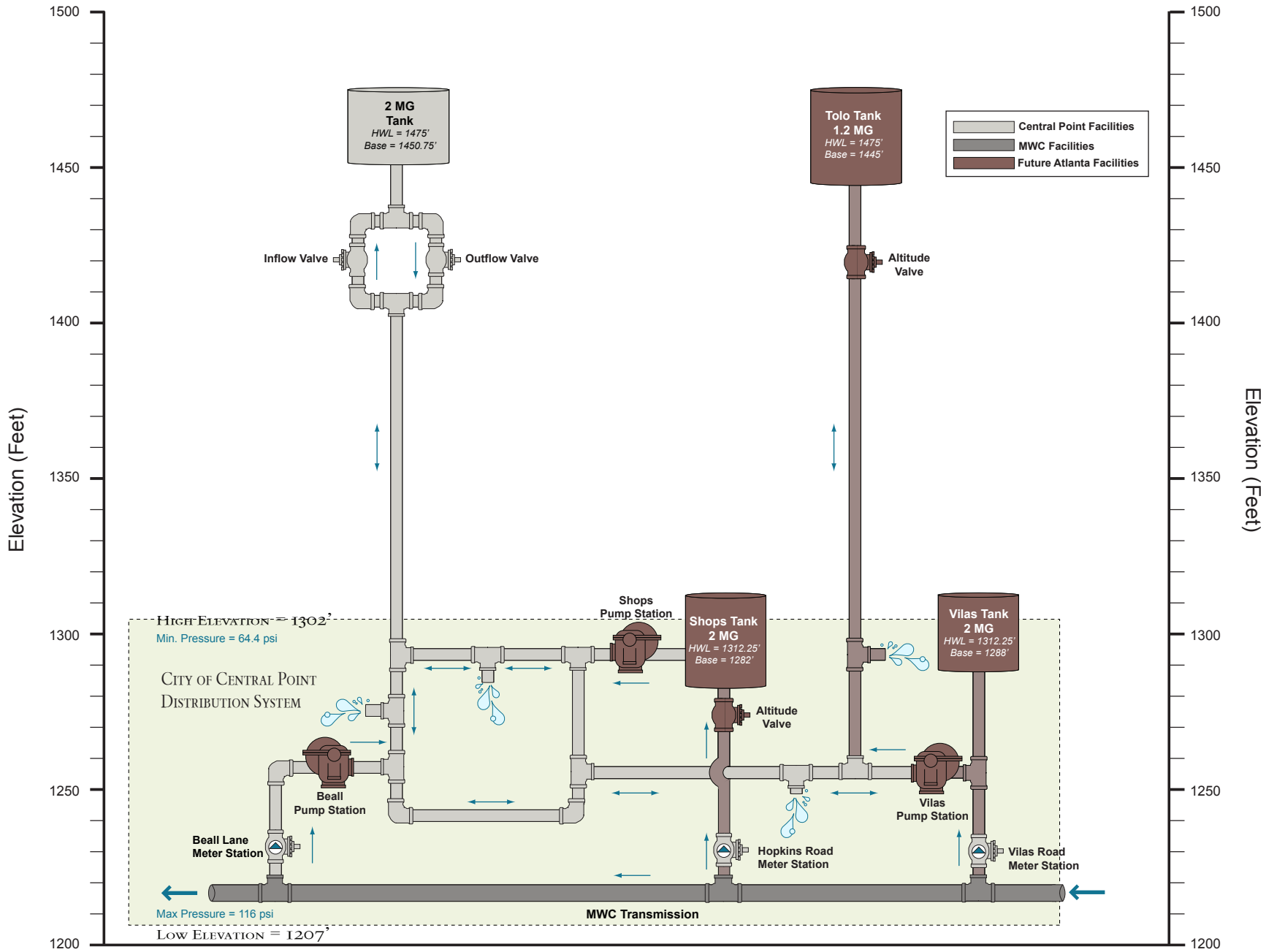
Legend

- Proposed Pump Station
- Proposed Tanks
- Existing Tank
- Existing Pump Station
- Proposed Piping
- Existing Pipe
- Existing City Limits
- Tax Lots
- UGB
- URA at Buildout
- # Project No. from Section 6.3.4

BROWN AND CALDWELL

CENTRAL POINT

CITY OF CENTRAL POINT
WATER SYSTEM MASTER PLAN
URA BUILDOUT
FUTURE IMPROVEMENTS
FIGURE 6-5



CITY OF CENTRAL POINT
Water System Master Plan
Future System Hydraulic Schematic
Figure 6-6

BROWN AND CALDWELL

6.3.1 Pump Improvements

Due to the large fluctuations in hydraulic grade from the MWC system, it is recommended that pump stations be used to provide a steady hydraulic grade from the MWC system. The Shops Pump Station does not have adequate capacity to increase head from the MWC supply to fill the storage tanks at URA build-out. New booster stations are needed at the three master meter stations to fill tanks during URA build-out MDD conditions. Evaluation of the 2030 and 2015 scenarios indicates that the implementation of the pump station improvements can be spaced out over time. The pump improvements are described below.

Vilas Pump Station is a new 9,500 gpm pump station near the Vilas MMS to maintain system pressures and increase supply capacity from the Vilas MMS. The pump station will pump water from a proposed storage tank near the Vilas MMS or directly from the Vilas MMS. One or more of the pumps in the pump station should be equipped with a variable frequency drive (VFD) to adjust the speed of the pump to maintain a specified discharge pressure. A generator for back-up power supply at the pump station would be needed because the pump station will become the primary supply to the system during summer operations. The Vilas Pump Station is needed immediately to make it possible for the City to limit their demand on the MWC system to MDD.

Beall Pump Station is a new 3,100 gpm pump station at the Beall master meter to pump water from the MWC supply at the master meter to the existing 2 MG tank and increase pressures at the southern end of the Central Point service area. The pump should be equipped with a VFD to adjust the motor speed with changes in upstream pressure. Evaluation results indicate that with the addition of the Vilas Pump Station and modifications to the Shops Pump Station described below, the new Beall Pump Station is needed immediately after 2015.

Shops Pump Station is a new 3,100 gpm pump station at the Shops to replace the existing 1,500 gpm pump station. The new pump station will pump water out of the Shops tank, which is served by the Hopkins master meter, to increase system pressures. A generator for back-up power supply at the pump station is recommended. Evaluation results indicate that construction of the new 3,100 gpm pump station can be delayed until after the year 2030 if minor piping improvements are made to allow the existing Shops Pump Station to operate without circulating water back to the 1 MG Tank. The piping improvements are described in Section 6.3.4.

6.3.2 Supply Improvements

All issues related to supply are addressed with the recommended pump improvements described in Section 6.3.1.

6.3.3 URA Build-out Storage Improvements

A storage analysis was completed for each planning horizon to identify additional storage capacity required to meet the design and evaluation criteria. The required storage capacity is listed in **Table 6-2**.

Table 6-2. URA Build-out System Storage Analysis (MG)

Planning Horizon	Available Storage (1 and 2 MG Tanks)	Required Storage				Deficient Storage
		Fire Flow (3,500 gpm for 3 hours)	Equalization	Emergency (1/3 day of MDD)	Total	
2015	3.12	0.63	0.88	2.10	3.61	0.49
2030	3.12	0.63	1.53	3.64	5.80	2.68
URA build-out	2.12	0.63	1.79	4.27	6.69	4.57

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6.69 MG of storage is required at URA build-out. The existing 2 MG tank is expected to still be in service at URA build-out; however, the existing Shops Tank is expected to have reached its useful life by that time. A description of the storage improvements evaluated is provided below.

Vilas Tank is a new 2 MG storage tank near the Vilas MMS. The new storage tank would provide equalization, fire flow, and emergency storage for the City system. The tank could be located on a portion of the 3 acres adjacent to the Vilas MMS that is owned by the City. The tank would be supplied directly from the Vilas MMS and would serve as the suction tank for the new Vilas Pump Station. A new flow control valve would be needed to regulate flow from the Vilas MMS into the Vilas Tanks. The new Vilas Tank is needed immediately to facilitate operation of the new Vilas Pump Station and meet the storage requirements of the system.

Tolo Tank is a new 1.2 MG storage tank along Willow Springs Road in the northwestern portion of the service area. The new tank is primarily needed to provide reliable fire flow to that area of the system. The tank should be sized to provide equalization storage to serve industry in this portion of the system as well. The alternative, which would involve installing a parallel transmission main to serve this area, was preliminarily investigated and determined to be more costly than adding storage. The tank would serve the system by gravity and would improve the reliability of the system. An altitude valve would also be required at the new 1.2 MG tank to regulate tank level. If the Vilas Tank is constructed then additional storage capacity will not be needed until 2023. Current fire capacity of the system in the Tolo area is 2,800 gpm. Construction of the Tolo Tank can be delayed until the year 2023 unless a structure requiring a greater fire flow capacity than 2,800 gpm is constructed before then.

2 MG Shops Tank is a new 2 MG storage tank to replace the existing 1 MG Tank at the Shops. City staff report that the City plans to move the Public Work Department maintenance facilities to a new site by year 2030 which will leave room for a larger tank at the Shops Tank Site. The new tank would be served by a dedicated transmission line from the Hopkins MMS. The new shops Tank would provide emergency and fire flow storage to the system through the Shops Pump Station. A new flow control valve would be needed to regulate flow from the Hopkins MMS into the new Shops Tank. The additional storage capacity provided by the new Shops Tank would not be needed until after 2030.

After constructing the tanks listed above, the total storage, calculated assuming all tanks are full, would equal 7.35 MG, which is approximately 0.66 MG more than the build-out storage requirement. However, all tanks would not operate full during every demand condition. In particular, the Tolo tank would operate at a lower level during MDD. The additional 0.66 MG is factored in to provide additional storage in the event that tanks are not operating at their maximum capacity, which will allow the City to maintain required equalization, fire flow, and emergency storage.

6.3.4 Piping Improvements

Piping improvements needed under build-out demand include new transmission piping to convey water from the master meter stations to City storage and distribution and distribution piping to achieve required fire flows. The proposed piping was added to the model and laid out along the existing and future transportation corridors where possible. The major piping improvements are described below and shown in **Figure 6-5**.

1. **Vilas Pump Station and Tank Supply and Discharge Piping** is new transmission piping needed to convey water from the Vilas MMS to the new Vilas Pump Station and Tank and from the new pump station to the existing distribution system. Evaluation results indicate that the pipeline from the Vilas MMS to the new pump station and tank should be 24-inch diameter pipe. Results also indicate that two 20-inch diameter pipelines are needed to convey water from the new pump station to the existing distribution system piping. One of the 20-inch diameter pipes will connect to existing City transmission piping at the intersection of Hamrick Road and Naples Drive and the other will connect

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at the intersection of Table Rock Road and W. Vilas Road. The pipelines must be constructed immediately with the Vilas Pump Station and Tank.

2. **Hopkins Pipeline** is a new transmission pipeline to convey water from the Hopkins MMS to the Shops tank and pump station. The new pipeline will be a dedicated transmission line (no distribution or service connections). Evaluation results indicate that the pipe must be a 16-inch diameter pipe. Analysis of the different planning horizons shows that construction of the Hopkins Transmission pipeline can be phased over time. The portion along Hopkins Road is needed immediately to connect the Hopkins MMS to an existing 8-inch dedicated pipeline that runs from the Shops Tank to the intersection of Hopkins Road and Freeman Road. This will provide a dedicated supply pipe from the Hopkins MMS to the Shops Pump Station. The remainder of the Hopkins Transmission Pipeline and can be delayed until the new Shops Pump Station is constructed.

3. **Willow Springs Road Pipeline** is a new transmission pipe to convey water between the current end-point of the Central Point system on Willow Springs Road and the proposed 1.2 MG Tolo Tank in the area. Evaluation results indicate that a minimum of 12-inch diameter pipe is needed to convey water to and from the tank.

4. **Fire flow Improvements** are miscellaneous piping needed to ensure that the transmission and distribution systems have adequate capacity to meet fire flow requirements. These piping improvements are primarily located in the downtown area and range in size from 6-inch to 12-inch diameter piping. The improvements are needed as soon as the City can fund them.

5. **Wilson Road Pipeline** is a new transmission pipeline to convey water from the Vilas MMS to the existing transmission pipe crossing I-5 on Upton Road. Evaluation results indicate that the pipe must be a 16-inch-diameter pipe. The new Wilson Road Transmission pipeline is not needed until the 2025-2030 timeframe.

6. **Beall Road Pipeline** is a new transmission pipeline between Grant Road and Malabar Drive to increase transmission capacity between the Beall MMS and the existing 2 MG Tank.. Evaluation results indicate that a 12-inch diameter pipeline is needed. The Beall Road Transmission pipeline is not needed until the 2025-2030 timeframe.

7. **Penniger Road Pipeline** is a new transmission pipeline to convey water along the east side of I-5 on Penniger Road between Upton Road and the fairgrounds. This pipeline is needed to convey more water from the Wilson Road Transmission pipeline to the west side of I-5 in the event that the existing transmission pipeline on Pine Street is out of service. Evaluation results indicate that this pipeline should be 12-inch diameter pipe. The Penniger Road Transmission pipeline is not needed until the 2025-2030 timeframe.

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7. RECOMMENDATIONS

This section presents the Capital Improvements Plan (CIP) for the City of Central Point's water system and summarizes the City's financial plan to execute the CIP.

7.1 Capital Improvements Plan

A CIP was developed to assist the City in budgeting for the improvements needed to provide the required level of service to the City water customers. The improvement projects developed in the future system analysis were prioritized to meet system demands through build-out of the future City service area. All projects were categorized into short, mid, and long-term projects. Planning level costs were estimated for each project.

Table 7-1 lists the improvements and probable estimates of construction costs. **Figure 7-1** shows the location of the proposed improvement projects. **Figures 7-2** to **7-9** show a detailed view of each improvement project *(to be included in the final report)*.

7.1.1 Prioritization of Projects

As described in Section 6, the system was evaluated at four planning horizons to determine the need for improvement projects. Projects within each category were assigned a year for completion based on the importance of each project to meet system demands. For short-term projects, the completion year of 2011 was used as a benchmark for the completion of projects needed to limit use of the supply to the average of MDD in the existing system.

There is some flexibility on the completion years assigned to each project. The foreseeable consequences of delaying the completion of a given project have been listed in **Table 7-1**. The provided dates are dependent on the accuracy of development, population, and demand projections. The projections were made prior to the current slowdown in growth that the City is experiencing. If the slowdown in growth continues, it may be possible to delay the projects that are primarily growth related. The CIP should be updated regularly (every 5 years is recommended) to refine the implementation dates as planning, population, and water use trends change.

7.1.2 Description of Cost Estimates

Cost estimates provided in **Table 7-1** are based on a budgetary, planning level, engineer's opinion of probable project costs. The detailed cost estimates are included in **Appendix H**. The costs for each recommended improvement are presented in present day value. The cost information should be updated regularly using the Engineering News Record (ENR) Construction Cost Index Value to account for fluctuations in construction cost over time. The current ENR Construction Cost Index is 8,566 (ENR, 2008).

Unit costs were developed from Brown and Caldwell's recent project experience in the area and were verified with information from bid tabs on projects recently constructed for the City and MWC. All unit prices represent installed costs and include excavation, bedding, backfill, compaction, materials, appurtenances, and delivery to the site.

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Table 7-1. Capital Improvements Plan

Project Number	Project Name	Completion Year	Facilities to Construct	Project Description	Direct Cost	Indirect Cost		Total Estimated Cost
						Contingency (25%)	EAC (15%)	
Short-Term Projects								
S-1	Vilas Tank, Pump Station, and Piping	2011	New Pump Station Including: • Pump house • Three vertical turbine pumps with combined capacity of 9,500 gpm @ 177 ft TDH • One additional back-up pump • 200 kW generator New Storage Tank Including: • 2 MG partially buried concrete tank • 24-inch flow control valve • New Piping Including • 2,580 LF of 20-inch Dia. Pipe	New ground storage with booster pumping to add storage capacity to the City system and provide a constant hydraulic grade from supply. The storage tank will provide equalization, fire, and emergency storage to the system. One or more of the pumps in the pump station will be equipped with a VFD to adjust the speed of the pump to maintain a specified discharge pressure. The pump station has been sized to supply at least 1/3 of the peak hour demand at URA Buildout.	$6,462,100	$1,615,500	$1,211,600	$9,289,200
S-2	Dedicated 16-inch line from Hopkins to Existing 8-inch	2011	• 250 LF of 16-inch Dia. Pipe	New pipeline to provide a direct connection from the Hopkins MMS to the existing dedicated, 8-inch pipeline to the Shops Tank. 16-inch pipe is recommended, because the existing 8-inch pipeline should be replaced with 16-inch pipe when the Shops Tank and Pump Station are upgraded (see Project L-1). This improvement will make it possible to pump water from the Hopkins MMS to the distribution system using the Shops Tank and Pump Station.	$37,100	$9,300	$7,000	$53,400
Total Short-Term					$6,499,200	$1,624,800	$1,218,600	$9,342,600
Mid-Term Projects								
M-1	Beall Pump Station	2015-2020	New Pump Station Including: • Pump house • Two vertical turbine pumps with a combined capacity of 3,130 gpm @ 46 ft TDH New Piping Including: • 590 LF of 12-inch Dia. Pipe with One railroad crossing and one Hwy 99 crossing • 170 LF of 16-inch Dia. Pipe	New booster pump station to provide a constant hydraulic grade from supply to the system. Without this project, supply from the Beall MMS will be constrained when the Vilas and Hopkins Pump Stations are in operation. Pump should be equipped with a VFD to adjust the motor speed with changes in upstream pressure.	$1,191,500	$297,900	$223,400	$1,712,800
M-2	Fire Flow Improvements on Hwy 99	2015-2020	New Piping Including: • 360 LF of 8-inch Dia. Pipe • 2,130 LF of 12-inch Dia. Pipe with one railroad crossing and one Hwy 99 crossing	Pipeline improvements to meet fire flow capacity requirements in the area.	$365,500	$91,400	$68,500	$525,400
M-3	Fire Flow Improvements on Laurel Street	2015-2020	New Piping Including: • 2,700 LF of 6-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$166,700	$41,700	$31,300	$239,700
M-4	Fire Flow Improvements near Hwy 99 and Bush	2015-2020	New Piping Including: • 680 LF of 6-inch Dia. Pipe • 410 LF of 8-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$75,300	$18,800	$14,100	$108,200
M-5	Fire Flow Improvements on Maple	2015-2020	New Piping Including: • 300 LF of 6-inch Dia. Pipe • 810 LF of 12-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$118,100	$29,500	$22,100	$169,700
M-6	Fire Flow Improvements at the Shops	2015-2020	New Piping Including: • 410 LF of 6-inch Dia. Pipe • 560 LF of 8-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$71,200	$17,800	$13,300	$102,300
M-7	Fire Flow Improvements between Oak and Pine on 9th and Bigham	2015-2020	New Piping Including: • 1,550 LF of 6-inch Dia. Pipe • 1,140 LF of 8-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$188,900	$47,200	$35,400	$271,500
M-8	Fire Flow Improvements on Hazel and 9th	2015-2020	New Piping Including: • 270 LF of 8-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$22,000	$5,500	$4,200	$31,700

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Table 7-1. Capital Improvements Plan

Project Number	Project Name	Completion Year	Facilities to Construct	Project Description	Direct Cost	Indirect Cost		Total Estimated Cost
						Contingency (25%)	EAC (15%)	
M-9	Fire Flow Improvements on Edwina	2015-2020	New Piping Including: • 770 LF of 6-inch Dia. Pipe	Pipeline improvements to meet fire flow capacity requirements in the area.	$47,400	$11,900	$8,900	$68,200
M-10	Tolo Tank and Supply Piping	2020-2025	New Storage Tank Including: • 1.2 MG partially buried concrete tank • 16-inch altitude valve • Instrumentation and Controls New Piping Including • 4,400 LF of 12-inch Dia. Pipe with one stream crossing and one railroad crossing	New high-level ground storage tank to provide equalization, fire, and emergency storage capacity to the system. The tank will also increase fire flow capacity in the northwest region of the system.	$2,391,700	$597,900	$448,500	$3,438,100
M-11	Wilson Road Transmission	2020-2025	New Piping Including: • 1,320 LF of 12-inch Dia. Piping • 9,980 LF of 16-inch Dia. Piping	New pipeline to increase conveyance capacity from the Vilas MMS to the west side of the system. The pipeline will also supply the distribution system on the east side of I-5.	$1,654,400	$413,600	$310,200	$2,378,200
M-12	Beall Road Transmission	2020-2025	New Piping Including: • 4,270 LF of 12-inch Dia. Piping • Three stream crossings	New pipeline to increase conveyance capacity from the Beall MMS to the existing 2 MG Tank.	$674,000	$168,500	$126,400	$968,900
M-13	Penniger Road Transmission	2020-2025	New Piping Including: • 3,080 LF of 12-inch Dia. Piping	New pipeline that connects the new Wilson Road Transmission pipe (project M-10) to the existing Interstate-5 crossing at the fairgrounds. The new pipeline will add redundancy to transmission from the Vilas MMS to the west side of Interstate-5.	$379,600	$94,900	$71,200	$545,700
Total Mid-Term					$7,346,300	$1,836,600	$1,377,500	$10,560,500
Long-Term Projects								
L-1	Shops Pump Station, Tank, and Dedicated Transmission	2030-Buildout	New Pump Station Including: • Pump house • Two vertical turbine pumps with combined capacity of 3,130 gpm @ 147 ft TDH • One additional back-up pump • 200 kW generator New Storage Tank Including: • 2 MG concrete tank • 16-inch flow control valve • Instrumentation and Controls New Piping Including • 280 LF of 12-inch Dia. Pipe • 1,920 LF of 16-inch Dia. Pipe	New ground storage with booster pump station to increase supply from the MWC system to the City to meet URA Buildout demand. Includes a new 16-inch pipeline from the Hopkins MMS to the new storage tank at the Shops Site. Pumps in the pump station will be all constant speed, and the tank will provide fire and emergency storage.	$4,601,200	$1,150,300	$862,700	$6,614,200
Total Long-Term					$4,601,200	$1,150,300	$862,700	$6,614,200
Combined Total					$18,446,700	$4,611,700	$3,458,800	$26,517,300

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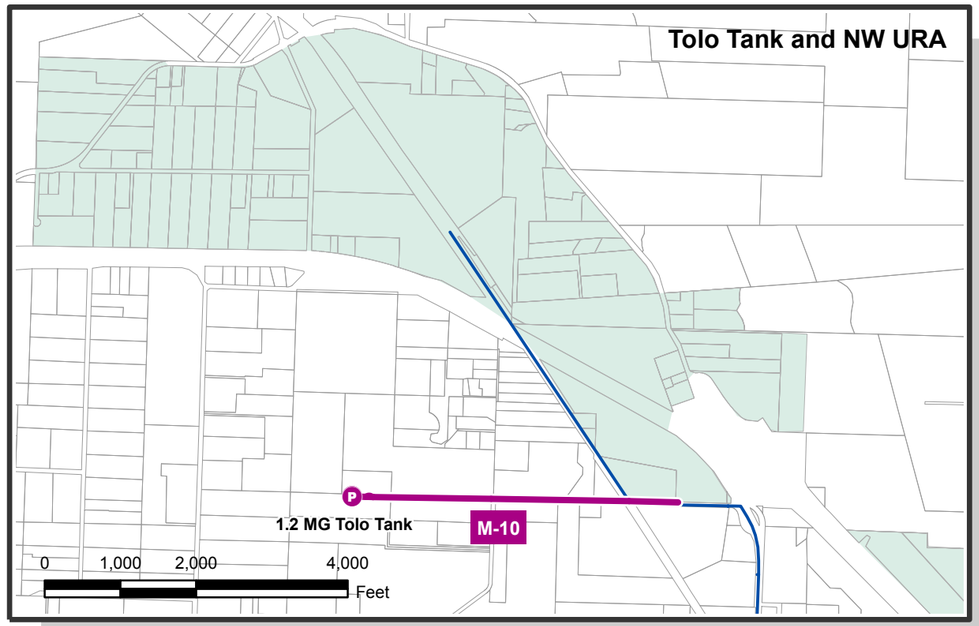


See Tolo Tank and NW URA for continuation

N
W
E
S

M-11
16"
16"
16"
12"
12"
M-13
M-8
M-5
M-3
M-7
M-2
M-6
M-4
M-9
M-12
M-1
L-1
S-1
S-2
8"
12"
6"
8"
6"
8"
6"
8"
6"
6"
12"
20"
20"

Vilas Master Meter Station

North Haskel Pressure Station

Flanagan Park Pressure Station

Forest Glen Park Pressure Station

Beall Master Meter Station

Existing 2 MG Tank

SCENIC AVE
ROLLING HILLS DRIVE
DOBROT WAY
DEL MAR DR
ROCK WAY
RAYMOND WAY
TERESA WAY
DAISY LN
AURORA LN
VICTORIA
PRINCESS WAY
WINDSOR WAY
KINGS WAY
MT ZAMA ST
STADIUM WAY
HASELL ST
N 5TH ST
FIRST DR
BOULDER PEAK
GRANT RD
BLACKSTONE ST
DUXTON AV
GRIFFIN OAKS DR
TAYLOR RD
SILVER CREEK DR
DONNA WAY
MENDOCINO DR
BRAD WAY
NARINE ST
W PINE ST
S HASKELL ST
AMY ST
CASEY WAY
CHENEY
LINDSEY CT
TIMOTHY ST
TARA CR
ANNALEE CR
LYNN LANE
HANLEY
S 4TH ST
S 5TH ST
ROSTEL
MARK PL
DAVID PL
SCOTT CT
CHESTNUT ST
ASH ST
ALDER ST
N 2ND ST
N 1ST ST
N HASKELL ST
N PINE ST
E PINE ST
PENINGER RD
LINDA DR
JASON
HEMLOCK AV
FAIRFIELD AV
ELLA AV
EDWINA AV
BURSE
SYDNEY
SHYLA LN
MARLEE AV
MOSHA CT
GREENTREE WAY
BEALL LN
WOODRIDGE AV
LAURA LN
ALTA LN
RABUN WAY
JEREMY ST
BLUEGRASS DR
EVAN WAY
GEBHARD RD
HAMRICK RD
BEEBE RD
MISTLETOE ST
HOLLY LANE DR
BIDDLE ROAD
HAWKINS RD
TABLE ROCK RD
SILVER GEAWAY AVE
RIDGEWAY AVE
WHITE AVE
WILLOWBROOK DR
0
1,000
2,000
4,000
Feet

Legend

- Tank
- Pump Station
- Pressure Station
- Master Meter Station
- Short-Term Projects
- Mid-Term Projects
- Long-Term Projects
- Existing Pipe
- Existing City Limits
- Tax Lots
- UGB
- URA at Buildout

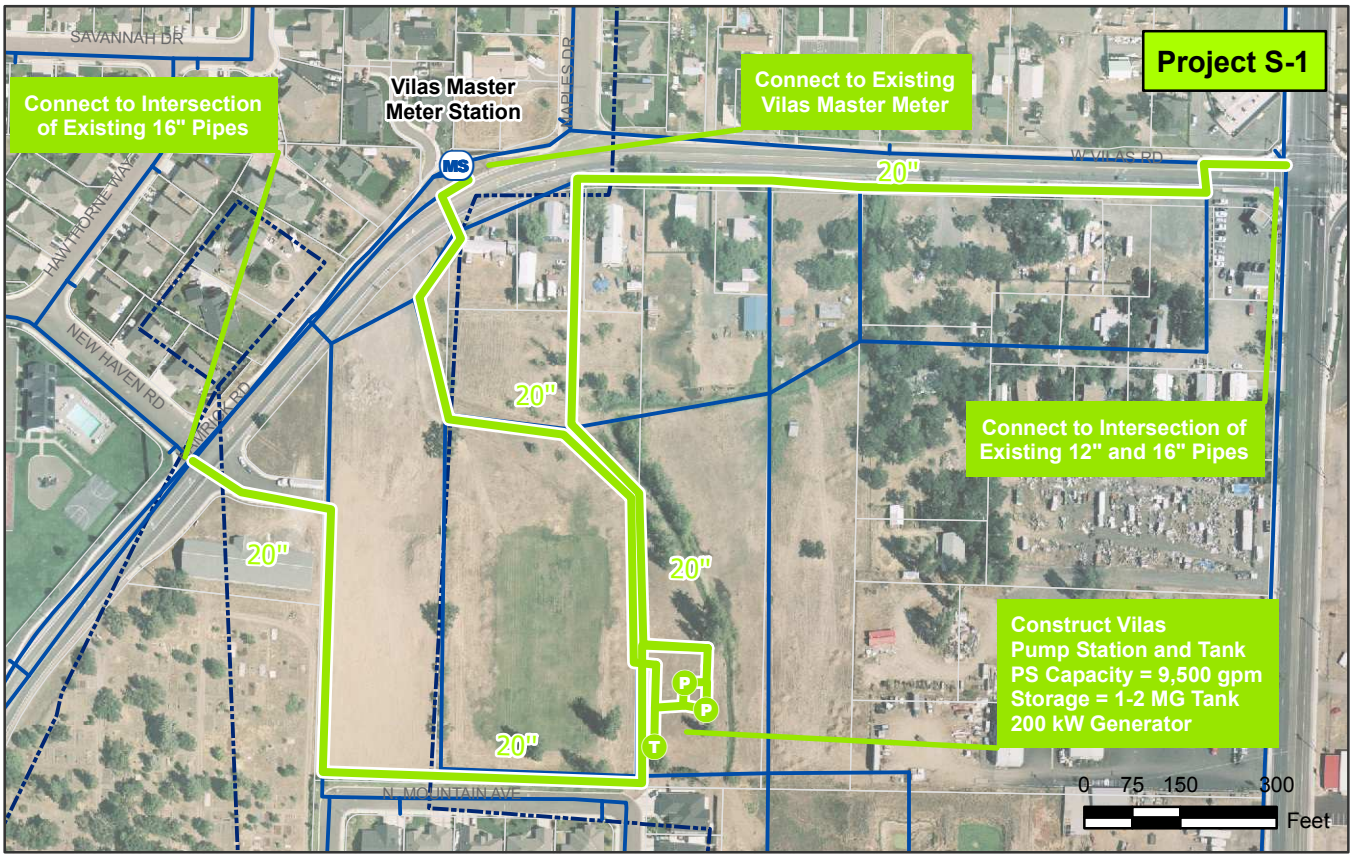
BROWN AND CALDWELL

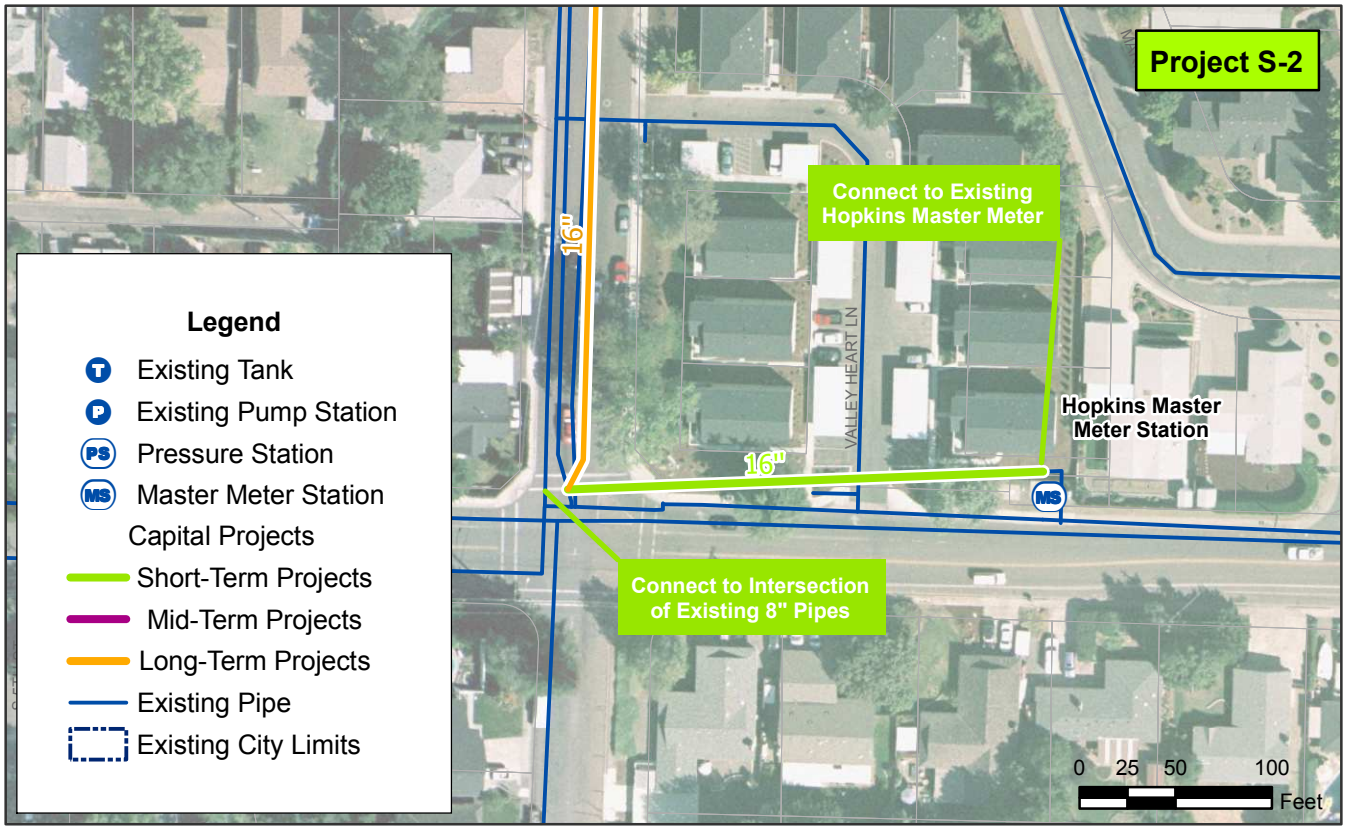
CENTRAL POINT

CITY OF CENTRAL POINT
WATER SYSTEM MASTER PLAN

CAPITAL IMRPOVEMENTS PLAN

FIGURE 7-1





BROWN AND CALDWELL

CENTRAL POINT

CITY OF CENTRAL POINT
WATER SYSTEM MASTER PLAN
IMPROVEMENT PROJECTS S-1 AND S-2
FIGURE 7-2

The cost estimates include 25 percent for construction contingency and 15 percent for engineering, legal, administration, and construction management services (CMS). The cost estimates are based on Brown and Caldwell's perception of current conditions in the project location. The estimates reflect Brown and Caldwell's professional opinion of accurate costs at this time and are subject to change. Brown and Caldwell has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's method of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Brown and Caldwell cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented herein.

7.2 City Financial Plan

The City has contracted with FCSG to evaluate its current water user rates. Brown and Caldwell will provide the CIP presented in the section to FCSG to be included in the water rate study. The growth related cost and service improvement costs provided below were also provided to FCSG. The findings of the water rate study, which will include a description of the how the CIP will be funded, will be summarized in the final copy of this master plan report.

7.2.1 Growth vs. Service Improvement Cost Share

After the cost estimates were developed for each improvement project, the costs were divided into growth related costs and service improvement costs. To divide the costs, the projects were each assigned to one of the allocation categories listed in **Table 7-2**. The cost estimate for each project was then divided according to the percentages listed in the table for the selected allocation category.

Table 7-2. Cost Allocation Assumptions

Allocation Category	Percent of Total Cost Allocated	
	Growth	Service Improvement
Project serves new growth only	100%	0%
Primary driver for project is to serve new growth but provides added benefit to the existing system	75%	25%
Projected is needed equally for new growth and service improvements	50%	50%
Primary driver for project is to improve existing service but is partially brought on by new growth	25%	75%
Project is to improve existing service only	0%	100%

Table 7-3 lists the division of the growth related costs and service improvement costs for each project. Assignment of an allocation category to each project was based on engineering judgment and is intended for budgetary use only. The City should further quantify the specific growth related benefits and service improvement related benefits of each project to determine project funding sources.

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Table 7-3. Capital Improvements Plan Cost Allocation					
Project Number	Project Name	Completion Year	Total Estimated Cost[1]	Cost Allocation	
				Growth Cost	Service Improvement Cost
Short-Term Projects					
S-1	Vilas Tank, Pump Station, and Piping	2011	$9,289,200	$4,644,600	$4,644,600
S-2	Dedicated 16-inch line from Hopkins to Existing 8-inch	2011	$53,400	$0	$ 53,400
Total Short-Term			$9,342,600	$4,644,600	$4,698,000
Mid-Term Projects					
M-1	Beall Pump Station	2015-2020	$1,712,800	$1,712,800	$0
M-2	Fire Flow Improvements on Hwy 99	2015-2020	$525,400	$0	$525,400
M-3	Fire Flow Improvements on Laurel Street	2015-2020	$239,700	$0	$239,700
M-4	Fire Flow Improvements near Hwy 99 and Bush	2015-2020	$108,200	$0	$108,200
M-5	Fire Flow Improvements on Maple	2015-2020	$169,800	$0	$169,800
M-6	Fire Flow Improvements at the Shops	2015-2020	$102,300	$0	$102,300
M-7	Fire Flow Improvements between Oak and Pine on 9th and Bigham	2015-2020	$271,500	$0	$271,500
M-8	Fire Flow Improvements on Hazel and 9th	2015-2020	$31,700	$0	$31,700
M-9	Fire Flow Improvements on Edwina	2015-2020	$68,200	$0	$68,200
M-10	Tolo Tank and Supply Piping	2020-2025	$3,438,100	$3,438,100	$0
M-11	Wilson Road Transmission	2020-2025	$2,378,200	$1,783,650	$594,550
M-12	Beall Road Transmission	2020-2025	$968,900	$726,675	$242,225
M-13	Penniger Road Transmission	2020-2025	$545,700	$272,850	$272,850
Total Mid-Term			$10,560,500	$7,934,075	$2,626,425
Long-Term Projects					
L-1	Shops Pump Station, Tank, and Dedicated Transmission	2030-Buildout	$6,614,200	$4,960,650	$1,653,550
Total Long-Term			$6,614,200	$4,960,650	$1,653,550
Combined Total			$26,517,300	$17,539,300	$8,977,900

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8. LIMITATIONS

8.1 Report Limitations

This document was prepared solely for the City of Central Point, Oregon in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Central Point and Brown and Caldwell in May 2008. This document is governed by the specific scope of work authorized by the City of Central Point; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Central Point and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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APPENDIX A

Existing Facilities Information

Central Point CLA-VAL numbers

2MG Reservoir (inflow)

Size & Cat No.: 16-210-ANAB
Stock No.: 210-AN-2A Code MP

2MG Reservoir (discharge)

Size & Cat No.: 10-131-01-BCESY
Stock No.: 131-01-324 Code-XO

Hopkins Road

Size & Cat No.: 10-131-27ABDKC
Stock No.: 251-0001H Code-MP

Beall Lane

Size & Cat No.: 10-131-02 BCSY
Stock No.: 20162202A

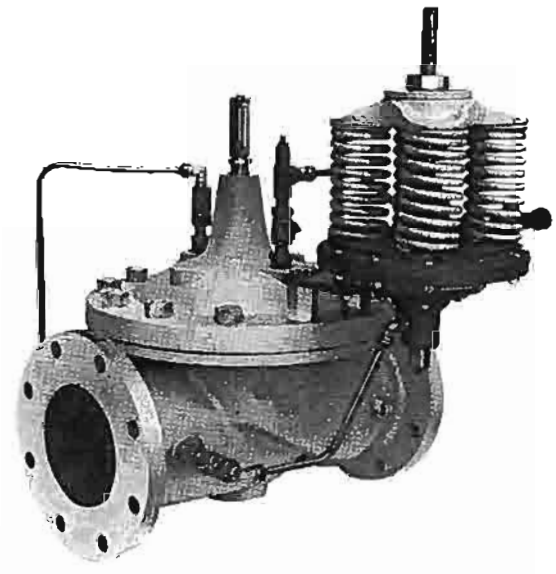
Vilas Road

Size & Cat No.: 10-133-01 BCSY
Stock No.: 133-01-15G. Code-ZO

210-16
610-16 + - MODEL— 2mg Res. inflow

Altitude Valve For Two-Way Flow

CLA-VAL



- **Accurate and Repeatable Level Control**
- **Drip Tight Positive Shut-off**
- **Reliable Hydraulic Operation**
- **Easily Adjustable Control**
- **Completely Automatic Operation**

The Cla-Val Model 210-16/610-16 Altitude Valve controls the high water level in reservoirs without the need for floats or other devices. It is a non-throttling valve that remains fully open until the shut off point is reached. This valve closes at a high water level, and opens for return flow when the pressure at the valve inlet is less than the reservoir pressure.

This valve is hydraulically operated and pilot controlled. The pilot control operates on the differential in forces between a spring load and the water level in the reservoir. When the force of the spring is overcome by the force of the reservoir head, the pilot closes the main valve. The desired high water level is set by adjusting the spring force. The pilot control measures the reservoir head through a customer supplied sensing line* connected directly to the reservoir.

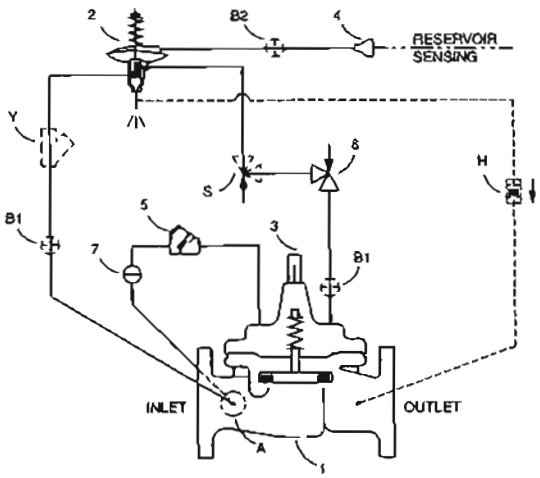
This valve can also be furnished with auxiliary controls to meet the need for multiple functions, such as: pressure sustaining, pressure reduction, rate of flow control, solenoid override, etc.

Schematic Diagram

Item	Description
1	Hytrol (Main Valve)
2	CDS6 Altitude Control
3	X101 Valve Position Indicator
4	Bell Reducer
5	Check Valve
6	CV Flow Control (Closing)
7	CK2 Cock

Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Cock (Isolation Valve)
H	Dry Drain
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer



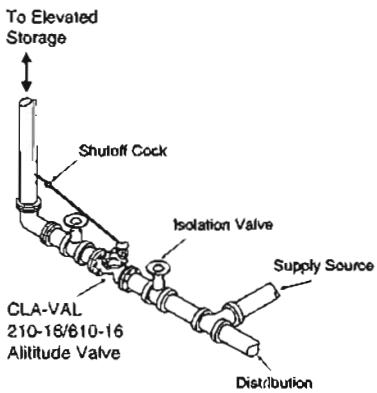
Typical Applications

Used on reservoirs where water is withdrawn through the Altitude Valve. The valve closes at the high water level and opens for return flow when the pressure at the valve inlet lowers below the reservoir pressure.

For more information see data sheet E-CDS6

*Note: The reservoir pressure sensing line should be ¾" minimum I.D. installed with a 2° slope from valve to reservoir to avoid air pockets.

We recommend protecting tubing and valve from freezing temperatures.



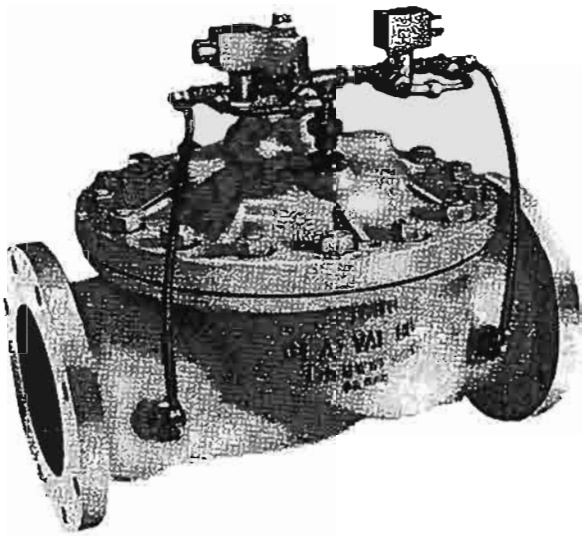
CLA-VAL

2mg res. discharge

CLA-VAL

MODEL 131 ÷ 631

Electronic Control Valves



- Simple Proven Design
- Quality Solenoid Pilot Controls
- Ideal For SCADA Systems
- Multi-Function Capability; Hydraulic Backup
- Easy To Maintain

The Cla-Val Series 131/631 Electronic Control Valves are designed specifically for applications where control of the valve with electrical signals is preferred. It is a hydraulically operated, pilot controlled, diaphragm valve. The solenoid pilot controls are actuated by electrical signals from the optional 131VC Electronic Valve Controller. The solenoid pilots either add or relieve line pressure from the cover chamber of the valve, causing it to open or close as directed by the electronic controller.

Series 131/631 valves can be configured to perform a wide range of functions, such as; pressure reducing, pressure sustaining, flow control, or level control. The electric controls can also be combined with hydraulic controls to create dual function, or fail-safe capability.

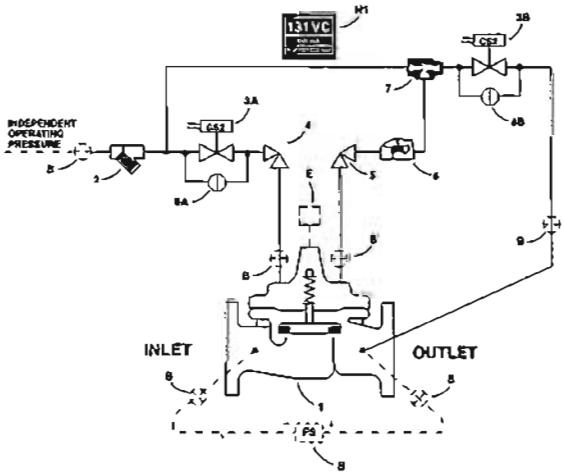
The basic 131-01/631-01 Electronic Control Valve (Schematic shown below) includes the main valve and dual solenoid pilot controls. Optional features include the 131VC Electronic Valve Controller and the X117C Valve Position Transmitter. If the check feature option is added, and a pressure reversal occurs, the downstream pressure is admitted into the cover, closing the valve.

Schematic Diagram

Item	Description
1	Hytrol (Main Valve)
2	CS2 Solenoid Control
3	CK2 Cock (Solenoid By-pass)

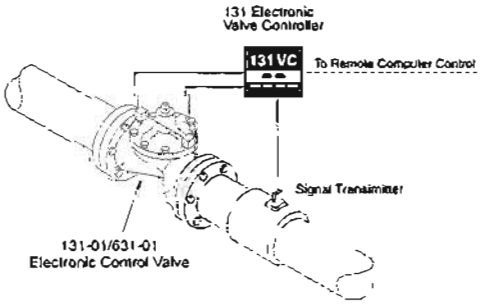
Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Cock (Isolation Valve)
C	CV Flow Control (Closing)
D	Check Valves With Cock
E	X117C Position Transmitter
F	Independent Operating Pressure
H	Atmospheric Drain
N	Electronic Controller
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer



Typical Applications

The Model 131-01/631-01 Electronic Control Valve is typically installed in a pipeline with an electronic signal transmitter and the Model 131VC Electronic Valve Controller. This system can be designed to control flow, pressure, tank level or valve position. The 131VC Electronic Valve Controller enables remote computer control over valve operations.

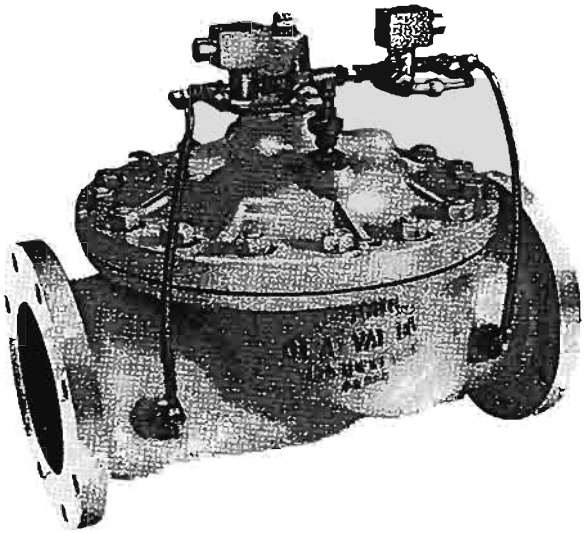


CLA-VAL

Hopkins

—MODEL— 131 / 631

Electronic Control Valves



- Simple Proven Design
- Quality Solenoid Pilot Controls
- Ideal For SCADA Systems
- Multi-Function Capability; Hydraulic Backup
- Easy To Maintain

The Cla-Val Series 131/631 Electronic Control Valves are designed specifically for applications where control of the valve with electrical signals is preferred. It is a hydraulically operated, pilot controlled, diaphragm valve. The solenoid pilot controls are actuated by electrical signals from the optional 131VC Electronic Valve Controller. The solenoid pilots either add or relieve line pressure from the cover chamber of the valve, causing it to open or close as directed by the electronic controller.

Series 131/631 valves can be configured to perform a wide range of functions, such as; pressure reducing, pressure sustaining, flow control, or level control. The electric controls can also be combined with hydraulic controls to create dual function, or fail-safe capability.

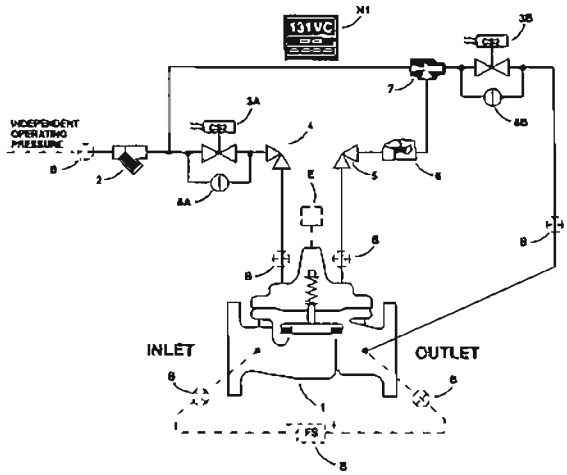
The basic 131-01/631-01 Electronic Control Valve (Schematic shown below) includes the main valve and dual solenoid pilot controls. Optional features include the 131VC Electronic Valve Controller and the X117C Valve Position Transmitter. If the check feature option is added, and a pressure reversal occurs, the downstream pressure is admitted into the cover, closing the valve.

Schematic Diagram

Item	Description
1	Hytrol (Main Valve)
2	CS2 Solenoid Control
3	CK2 Cock (Solenoid By-pass)

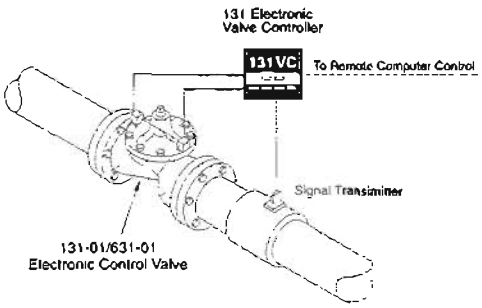
Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Cock (Isolation Valve)
C	CV Flow Control (Closing)
D	Check Valves With Cock
E	X117C Position Transmitter
F	Independent Operating Pressure
H	Atmospheric Drain
N	Electronic Controller
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer



Typical Applications

The Model 131-01/631-01 Electronic Control Valve is typically installed in a pipeline with an electronic signal transmitter and the Model 131VC Electronic Valve Controller. This system can be designed to control flow, pressure, tank level or valve position. The 131VC Electronic Valve Controller enables remote computer control over valve operations.

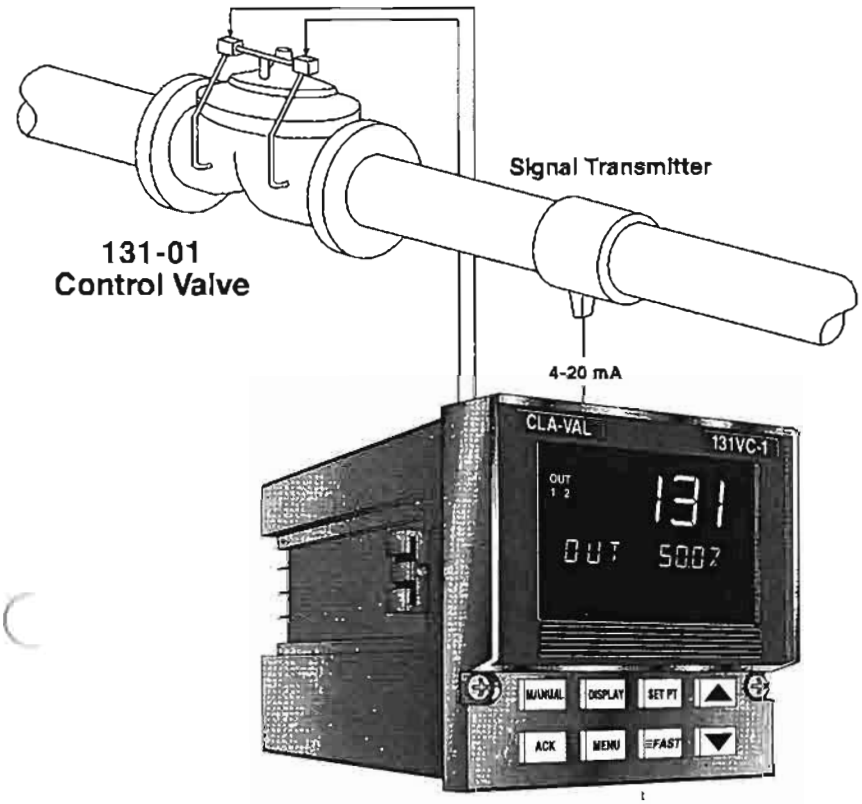


131VC — SERIES —

Hopkins

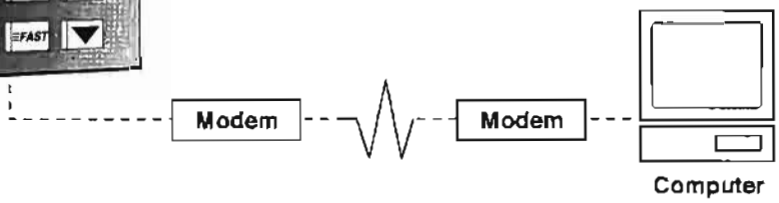
Electronic Control Systems

CLA-VAL



- Electronic control of hydraulic Cla-Val valves.
- Programmable monitoring and control of flow, pressure, delta P, level or valve position.
- Accurate control of valve speed and response.
- Remote set-point control.
- Control backup systems in the event of an emergency.

The Cla-Val 131VC-1 Electronic Control System is designed to achieve unprecedented valve control accuracy and stability. Ideal for remote valve control, the 131VC-1 Electronic Control System provides the interface between SCADA system computers and hydraulic control valves sites.



Electronic Control of Hydraulic Valves

The 131VC-1 Electronic Control System is designed to work in conjunction with Cla-Val 131 Series hydraulic control valves— a combination that takes advantage of the simplicity of hydraulic valve operation and the control possibilities available with electronics.

The 131VC-1 Electronic Control System receives transmitted signals and activates dual solenoid pilots on the hydraulic control valve. These pilots direct hydraulic pressure within the system to position and regulate the valve. By continuously comparing system conditions to the programmed set-point, the system is automatically maintained at the desired value.

Additional important control features, unique to this type of valve control, are offered as standard. They are designed for user friendly operation and system safety and are addressed in this brochure.

Key Advantages

- Proven reliable hydraulic control valve.
- Low electric power requirement.
- Solid state electronic components.
- No motors, bearings, bushings or packings to wear out or leak.

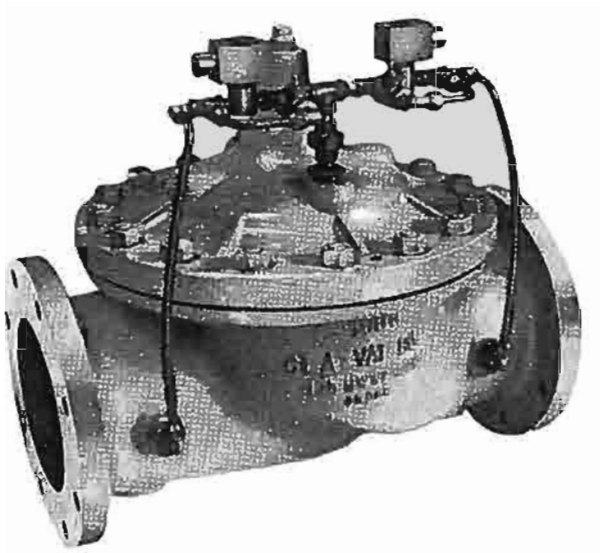
We Not Only Sell Valves—
We Provide Solutions

CLA-VAL

Beall

—MODEL— 131 ÷ 631

Electronic Control Valves



- **Simple Proven Design**
- **Quality Solenoid Pilot Controls**
- **Ideal For SCADA Systems**
- **Multi-Function Capability; Hydraulic Backup**
- **Easy To Maintain**

The Cla-Val Series 131/631 Electronic Control Valves are designed specifically for applications where control of the valve with electrical signals is preferred. It is a hydraulically operated, pilot controlled, diaphragm valve. The solenoid pilot controls are actuated by electrical signals from the optional 131VC Electronic Valve Controller. The solenoid pilots either add or relieve line pressure from the cover chamber of the valve, causing it to open or close as directed by the electronic controller.

Series 131/631 valves can be configured to perform a wide range of functions, such as; pressure reducing, pressure sustaining, flow control, or level control. The electric controls can also be combined with hydraulic controls to create dual function, or fail-safe capability.

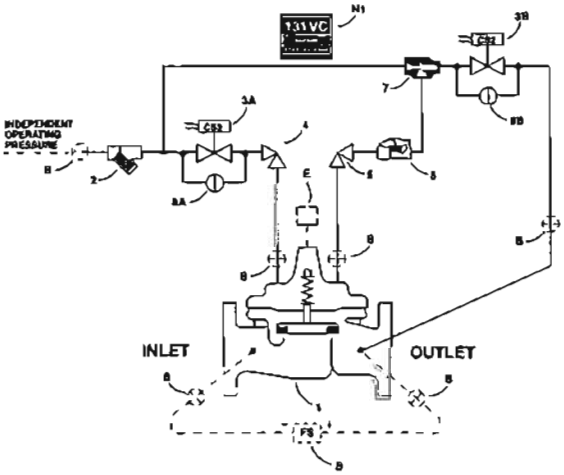
The basic 131-01/631-01 Electronic Control Valve (Schematic shown below) includes the main valve and dual solenoid pilot controls. Optional features include the 131VC Electronic Valve Controller and the X117C Valve Position Transmitter. If the check feature option is added, and a pressure reversal occurs, the downstream pressure is admitted into the cover, closing the valve.

Schematic Diagram

Item	Description
1	Hytrol (Main Valve)
2	CS2 Solenoid Control
3	CK2 Cock (Solenoid By-pass)

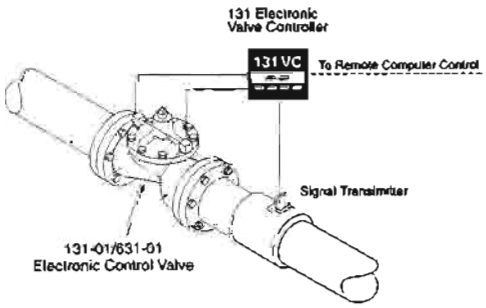
Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Cock (Isolation Valve)
C	CV Flow Control (Closing)
D	Check Valves With Cock
E	X117C Position Transmitter
F	Independent Operating Pressure
H	Atmospheric Drain
N	Electronic Controller
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer



Typical Applications

The Model 131-01/631-01 Electronic Control Valve is typically installed in a pipeline with an electronic signal transmitter and the Model 131VC Electronic Valve Controller. This system can be designed to control flow, pressure, tank level or valve position. The 131VC Electronic Valve Controller enables remote computer control over valve operations.

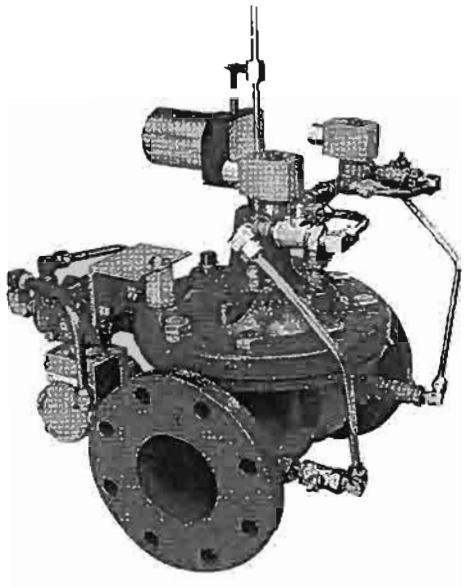


CLA-VAL

Vilas

MODEL 133-01 + 633-01

Metering Valve



- **Automatically Measures & Controls Flow Rate Without a Separate Metering Device**
- **Completely Self Contained**
- **Analog Or Digital Communications**
- **Retransmission Capabilities**
- **Ideal For Retrofitting Existing Valves**
- **Optional Totalizing Capabilities**

The Cla-Val Model 133-01/633-01 Metering Valve is a completely self contained valve and control system that accurately meters and/or controls flow rate when used on valves with pressure differentials of less than 100 PSID.

Using a 131VC-3 Cla-Val Microprocessor, data from differential pressure and position transmitters are assimilated into a proprietary algorithm program that is based on valve size and configuration to arrive at a flow measurement. This information can then be used for retransmission and/or compared with a local or remote set point for valve flow control.

The 131VC-3 Control System can also be installed on new or existing hydraulic pilot control valves such as: pressure reducing, pressure sustaining, flow limiting and level control to transmit flow rate without disturbing the valves primary hydraulic function(s). Specify 131VC-3KT Kit for these applications.

For all applications, specify voltage, minimum / maximum pressures & flow rates, valve size, pressure class and optional features. Consult your local representative or the factory for engineering assistance and valve selection if required.

Please refer to the 131VC "Electronic Control Systems" brochure for specific information regarding valve theory of operation, standard & optional features, control parameters and electrical component specifications.

Schematic Diagram

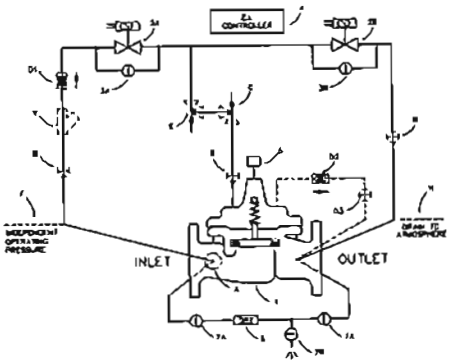
Item	Description
1	Hytrol (Main Valve)
2	CS2S Solenoid Control
3	CK2 Solenoid By-pass
4	DPT Delta P Transmitter
5	Electronic Controller
6	X117C (LS) Position Transmitter

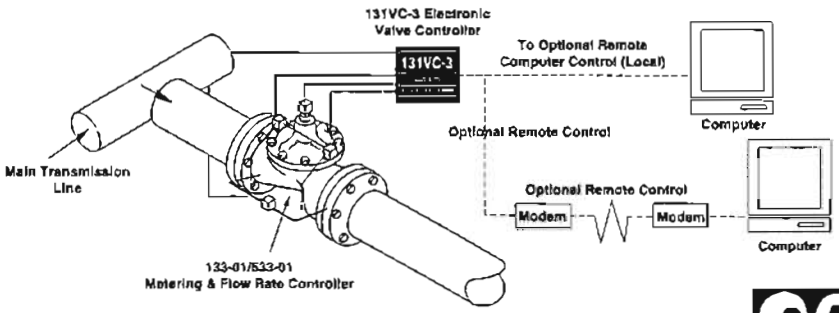
Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Isolation Valve
C	CV Flow Control (Closing)
D	Check Feature
F	Independent Operation Pressure
H	Atmospheric Drain
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer

Typical Applications

The Model 133-01/633-01 Metering and Flow Rate Controller is typically installed in a fluid delivery system where the flow rate is measured or changed from a remote location such as a SCADA system.





CLA-VAL

CORNELL PUMP COMPANY
2323 SE Harvester Drive
Por d, Oregon 97222-7592 USA

Phone: (503) 653-0330
Fax: (503) 653-0338

CORNELL
Efficiency by Design

FAXED 2/9/98

FAX MESSAGE

DATE: 2/5/98
TO: City of Central Point
ATTENTION: Rick Bartlet
REFERENCE: 4 Stage Turbine Pumps 12BC
MESSAGE:

FAX #: 541-664-6384
NO. OF PAGES SENT (Including Cover): 9

Rick,

Included with this cover are the bill of materials for the 4 stage 12BC. pumps that you have.

The story that I was told is that Cornell contracted with Johnston Pump to assymble and sell sale the Pump that you have. In the early 70's we stopped selling pumps and parts for Johnston Pump.

With this information you may be able to get parts or a replacement from Johnston Pump.

If you need any additional information please call me.

Trent Wheatlick
503-794-0227
Cornell Pump Co.

Post-It® Fax Note 7671	Date 2/9/98	# of pages ▶ 9
To Darrell	From Rick Bartlett	
Co./Dept. Goulds Pumps	Co. City of Central Point	
Phone #	Phone # 541/664-5522	
Fax # 800-453-7523	Fax # 541/664-6384	

Signature

RESERVE FILE

BILL OF MATERIAL

CORNELL MANUFACTURING CO. — PORTLAND, OREGON

BM 775 | SHEET NO. 1 of 2

GENERAL DESCRIPTION — TURBINE 12BC-4 Currently removed 7-10-07

Constant Speed CAN BOOSTER PUMP VARIABLE SPEED N/A

FOR CITY OF CENTRAL POINT

TYPE 8TH-26

JOB NO. J-17981

BY KAB | DATE 11/19/62

ITEM	QTY.	DRWG.	DESCRIPTION OF PART	MATERIAL	PATT. NO.
	1		12 BC-4, Suction Bell, without column		
	1	A-3971	Spacer	STL	
	1	A-3968	Shaft	S.S.	
	1	D-909	18" Suction Can	STL	
	16		½-13NC capscrews 2" lg.	STL.	
	1		Gasket 17 x 20 x 1/16	Gar 660	
	1	E-596	8TH-26 Discharge head mach. detail	STL	
	1	E-595	Weld detail (consisting of		
			2 - 3/16 plate 4 x 12 7/16	STL	
			2 - 1½ plate 12" dia.	STL	
			1 - 3/4 plate 12" dia.	STL	
			1 - 1" plate 20 1/8 dia.	STL	
			1 - 12" Std. pipe 23 9/16 lg.	STL	
			1 - 8" Std. pipe 7 1/4 lg.	STL	
			2 - 3/8 half coupling	STL	
			1 - A-2424-8 8" - 150# flange	STL	
	1	D-974	Brg. housing 8TH-26 mach. detail	STL	
	1	D-973	Weld detail (consisting of)		
			1 - 1" plate 20 1/8 dia.	STL	
			1 - 1½ plate 8" dia.	STL	
			1 - 1½ plate 12" dia.	STL	
			1 - 12" std. pipe 7 7/8 lg.	STL	
	4		½ - 13NC Capscrews 2½ lg.	STL	
	8		5/8-11 NC capscrews 1¼ lg.	STL	
	1	BM-280	1¼ seal box assembly W/ 4 3/8 P.C. TO HD.		

BILL OF MATERIAL

CORNELL MANUFACTURING CO. — PORTLAND, OREGON

BM 775 | SHEET NO. 2 of 2

GENERAL DESCRIPTION — TURBINE - 12 BC-4

CAN BOOSTER PUMP ~~VARIABLE SPEED~~

FOR CITY OF CENTRAL POINT

TYPE 8TH-26

JOB NO. J-17981

BY KAB | DATE 11/19/62

ITEM	QTY.	DRWG.	DESCRIPTION OF PART	MATERIAL	PATT. NO.
	2		Bearing SKF #7215		
	1	A-3965	Bearing Cover	STL	
	1	A-3967	Coupling adapter	STL	
	1		Snap ring truarc #5100-293	STL	
	1		¼ sq. key 2½ lg.	K.S.	
	1		1 3/16 Johnston nut	STL	
	4		⅜-13N.C. capscrew 1¼ lg.	STL	
	1		Fabco coupling #6SF	STL	
	1		¼ Zerk fitting	STL	
	1		¼ pipe plug.	STL	
	1		Motor 40HP GE		
			Frame A364UP		
			N/A — Constant speed		
X	1		E.M. ampli-speed magnetic		
			Drive model MDM-33		
			(Dwg. No. 139B095)		
			Referance Drawings:		
		E-605	Head Assembly		
		SC.1697	PERFORMANCE		
		A3977	FOUNDATION DRAWING		
		A3989	CAT. PAGE		

NOT Avail.

BILL OF MATERIAL

CORNELL MANUFACTURING CO. — PORTLAND, OREGON

BM 780 | SHEET NO. 2 of 2

GENERAL DESCRIPTION — TURBINE - 12BC-4

CAN BOOSTER PUMP

FOR CITY OF CENTRAL POINT

TYPE: 8TH-25

JOB NO.: J-17981

BY: KAB | DATE: 11/27/62

ITEM	QTY.	DRWG.	DESCRIPTION OF PART	MATERIAL	PATT. NO.
	1	A-2350	3.8 coupling assy. (consisting of)		
	1	A-1309-4	Pump flange	STL	
	1	A-1308-1	Nut	STL	
	1	A-2409	Motor Flange	STL	
	1	A-2324	Coupling spacer	STL	
	1	A-2322-2	Annular key	STL	
	1		3/8 sq. x 2½ lg. key	K.S.	
	1		¼ sq. x 1½ lg. key	K.S.	
	6		3/8- 16 N.C. x 2½ lg. capscrews	STL	
	6		3/8 - 16 N.C. Flexlock nuts	STL	
	1		Motor: 40HP O.E. 1800 RPM		
			solid shaft, dripproof high thrust		
			frame a 364UVT		
			REFERENCE DRAWINGS		
		SC/697	PERFORMANCE		
		A 3978	FOUNDATION DRAWING		

Not Avail.

RESERVE FILE

BILL OF MATERIAL

CORNELL MANUFACTURING CO. — PORTLAND, OREGON

BM	780
SHEET NO.	1 of 2
TYPE	8TH-25
JOB NO.	J-17981
BY	KAB
DATE	11/27/62

GENERAL DESCRIPTION — TURBINE - 12BC-4

CAN BOOSTER PUMP

FOR CITY OF CENTRAL POINT

ITEM	QTY.	DRWG.	DESCRIPTION OF PART	MATERIAL	PATT. NO.
	1		12BC-4, Suction Bell		
			WO/column Bowl shaft 1 11/16 Dia.		
			x 66¼ lg. turned down to 1¼ through seal box		
	1	A-3975	Bowl shaft	STL	
	1	A-3971	Spacer	STL	
	1	D-909	18" Suction can	STL	
	16		½-13N.C. Capscrews 2" lg.	STL	
	1		Gasket 17 x 20 x 1/16	GAR 660	
	1	E-517	8TH-25 Disch. head - mach. detail	STL	
	1	D-908	Weld detail (consisting of)		
			1 - 1" plate 12¼ dia.	STL	
			1 - 1¼ plate 12" dia.	STL	
			1 - 3/4 plate 12" dia.	STL	
			1 - 1¼ plate 20 1/8 dia.	STL	
			1 - 12" Std. pipe 30 1/16 lg.	STL	
			1 - 8" Std. pipe 7¼ lg.	STL	
			1 - ½" half coupling	STL	
			1 - A-2424-8 8" - 150# flange	STL	
	8		5/8 - 11 N.C. capscrews 1½ lg.	STL	
	1	BM-280	1¼ seal box assy. w/4 3/8 P.C. TO HD.		

J44087
Bob E
11-16-62

Pacific Inland Navigation 410
2 Stage 14 BC Johnston w/ 10½" diam Impeller
& 1 Stage 10 BC – 5 w/ Cutlass 10" ID
Column taper to 8" w/ shaft flange made to
fit spider 66½" long and all length of Cutlass
8" flange Column 27" long w/ 8" Discharge
head w/ John Crane seal 1½ NT 261 & Con
adapter plate w/ R.H. Johnston gear drive w/ ½
Coupling

CONSUMERS COOP. ASSN. 411
J44419 1 STAGE 10BC JOHNSTON BOWL 7 15/32 DIA.
11-26-62 BELL SUCTION, BASKET STRAINER, 6½' OF 6" COLUMN
1½" X 25½" S.S. BOWLSHAFT T.D. TO ¾", ¾" X 10¼"
S.S. 1-PC. HEADSHAFT, 12"X6" C.I. DISCHG. HEAD,
G.E. 5HP 1φ 1800 RPM V.H.S. MOTOR, NRR,
C.D. 2034 SHIPPED DIRECT BY G.E.

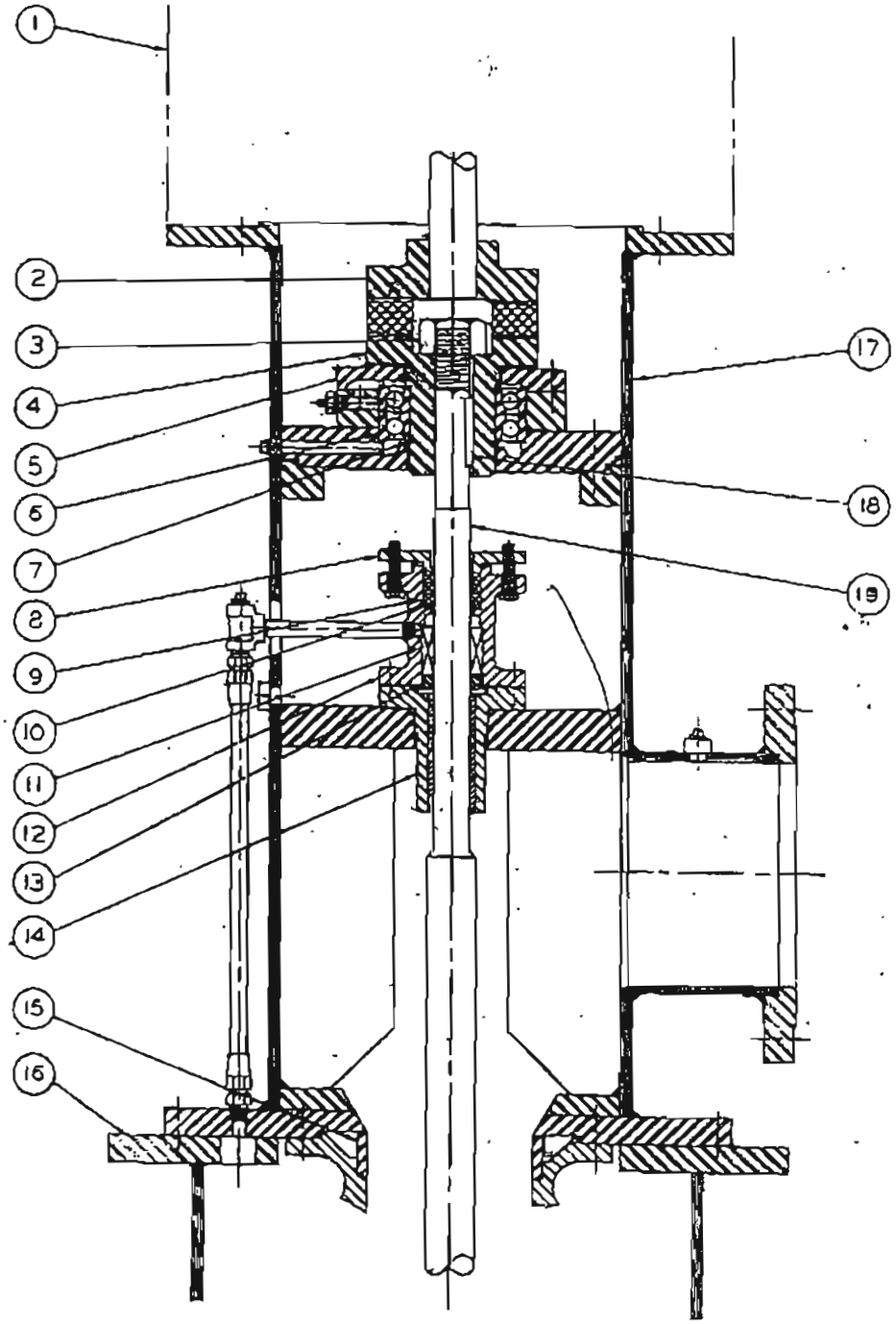
CITY OF CENTRAL POINT 412
J17981 4 STAGE 12BC JOHNSTON BOWL, FULL DIA., BELL TURNED
11-29-62 TO 12"OD., 1 11/16 X 66¼ SPECIAL SHAFT A3975, 8" X 12"
BM 780 FAB. HEAD E517, 1¼" CORNELL STUFFING BOX BM280,
D909 18" SUCTION CAN, A2350 3.8 COUPLING, GE
40HP 3φ 1800 V.S.S. MOTOR FR. 364UVY (SHIPPED DIRECT)

CITY OF CENTRAL POINT 413
J17981 4 STAGE 12BC JOHNSTON BOWL, FULL DIA, BELL TURNED
11-29-62 TO 12"OD, 1 11/16 X 67⅝ SPECIAL SHAFT A3968, 8" X 16½
BM 775 FAB. HEAD E596, 1¼" CORNELL STUFFING BOX BM280, D909 CAN,
SEE J17983 ALSO D794 SPECIAL BEARING HOUSING, AMPLI SPEED MAG-
NETIC MODEL MDM-13, SPECIAL UPPER BRG. SETUP W/
2-SKF 7215GM, GE 40HP 3φ 1800 V.S.S. MOTOR #6 FABCO + A3967 ADAPTER

VALLEY CONST. CO. 414
J44345 5 STAGE 10AC II FULL DIA, BELL SUCTION, COMB.
12-4-62 BOWL & HEAD SHAFT A3986, A3993 FLOW RING,
BM 781 E604 FAB. DISCHG. HEAD, W/ 1½" CORNELL STUFFING
BOX B132 W/ A1011 BOX, D796 SUCTION BARREL,
A2350 3.8 CORNELL COUPLING GE 10HP, 3φ, 1200 RPM
V.S.S. MOTOR

3540-6.1
NOV. 1962

TURBINE PUMP PARTS
DISCHARGE HEAD — FABRICATED
— MECHANICAL SEAL WITH AUXILIARY PACKING
— MOTOR COUPLING



PARTS LIST

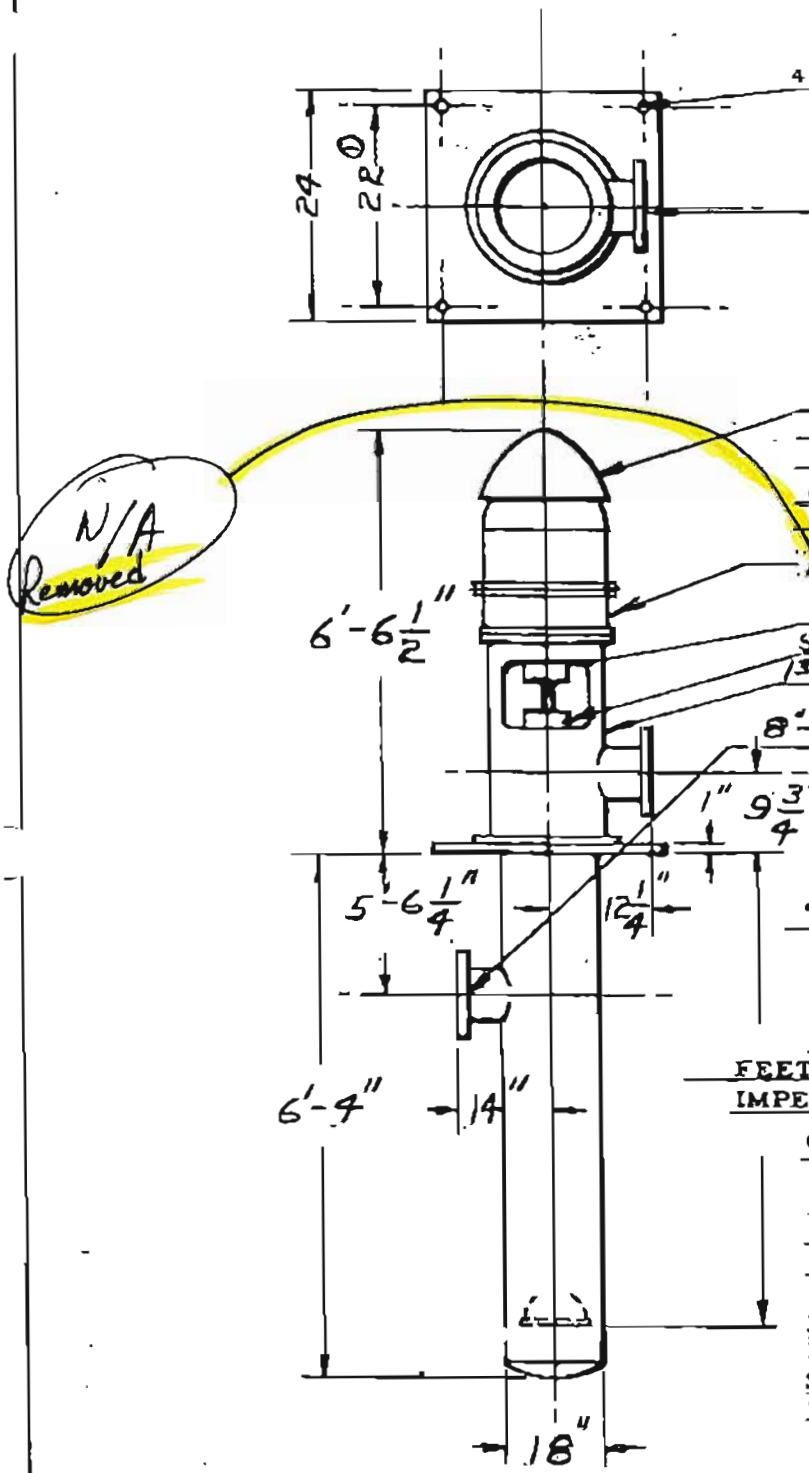
1. MOTOR
2. COUPLING
3. NUT
4. COUPLING ADAPTER
5. BEARING COVER
6. BEARING
7. RETAINING RING
8. GLAND
9. PACKING
10. PACKING RING
11. MECHANICAL SEAL
12. STUFFING BOX
13. LOCK COLLAR
14. THROAT BUSHING
15. SPACER
16. BARREL
17. DISCHARGE HEAD
18. SHAFT KEY
19. SHAFT

CORNELL MFG CO. — PORTLAND, ORE.

A 8985

A-3977

JOHNSTON VERTICAL TURBINE PUMP



GENERAL ELECTRIC
VERTICAL SOLID SHAFT MOTOR
40 HP 3 PHASE 60 CYCLE
220-440 VOLT 1800 RPM
DRIPPROOF ENCLOSURE

MDM-13 AMPLI-SPEED DRIVE

COUPLING

SEAL

13 1/2 x 8 TYPE "B" STEEL DISCHARGE HEAD

8"-150# x #ASA SUCTION FLANGE

12 BC

4 STAGE BOWL ASSEMBLY

BOWLS CI

IMPELLERS BRONZE

BEARINGS LEAD, BRONZE & BUNA N

SHAFT AISI 416

FEET TO SUCT. IMPELLER EYE

CONDITIONS:

USGPM

PSIG SUCTION PSIG DISCHARGE

DIFF. PSI MAXIMUM PSI

FT. TOTAL DYNAMIC HEAD

REQUIRED NPSH FT. @ ℄ SUCTION

EQUIPMENT

SPEC. GRAV. @ °F PUMPING TEMP.

VISCOSITY SSU @ PUMPING TEMP.

CUSTOMER: CITY OF CENTRAL POINT OREGON

PO#

DEALER PUMP, PIPE & POWER CO.

PO# PORTLAND, OREGON

JOHNSTON SERIAL #

JOHNSTON QUOTATION #

~~NOTE: DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED~~

THIS PRINT CERTIFIED CORRECT BY CORNELL MANUFACTURING CO.

Per _____

Date _____

JOHNSTON PUMP COMPANY
PASADENA, CALIFORNIA

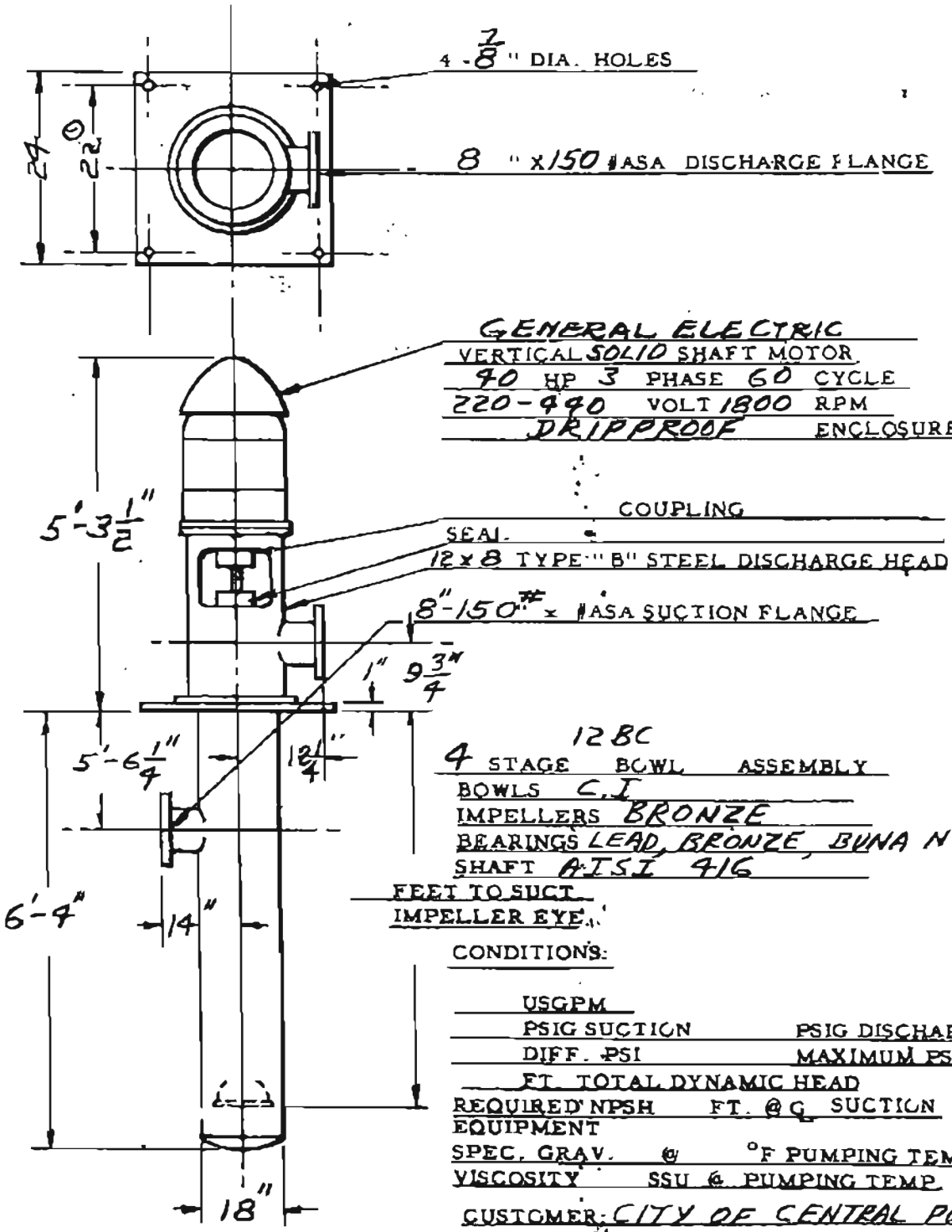
(1) REVISION - WAS 21 12-3-62

SC-1697

H-1268-A

A-3978

JOHNSTON VERTICAL TURBINE PUMP



THIS PRINT CERTIFIED
CORRECT BY
CORNELL MANUFACTURING CO.

Per _____

Date _____

JOHNSTON PUMP COMPANY
PASADENA, CALIFORNIA

(1) REVISION - WAS 21 12-3-62

5C-1697

H-1268-A

Public Works Department

City of CENTRAL POINT Oregon

Rick Bartlett, Field Ops Mgr
Max Woody, Supervisor

Public Works Department

FACSIMILE TRANSMITTAL

TO: Jeff Ballard
FROM: Max Woody
SUBJECT: Pump flow curves
DATE: 8/28/07
PAGES: 6

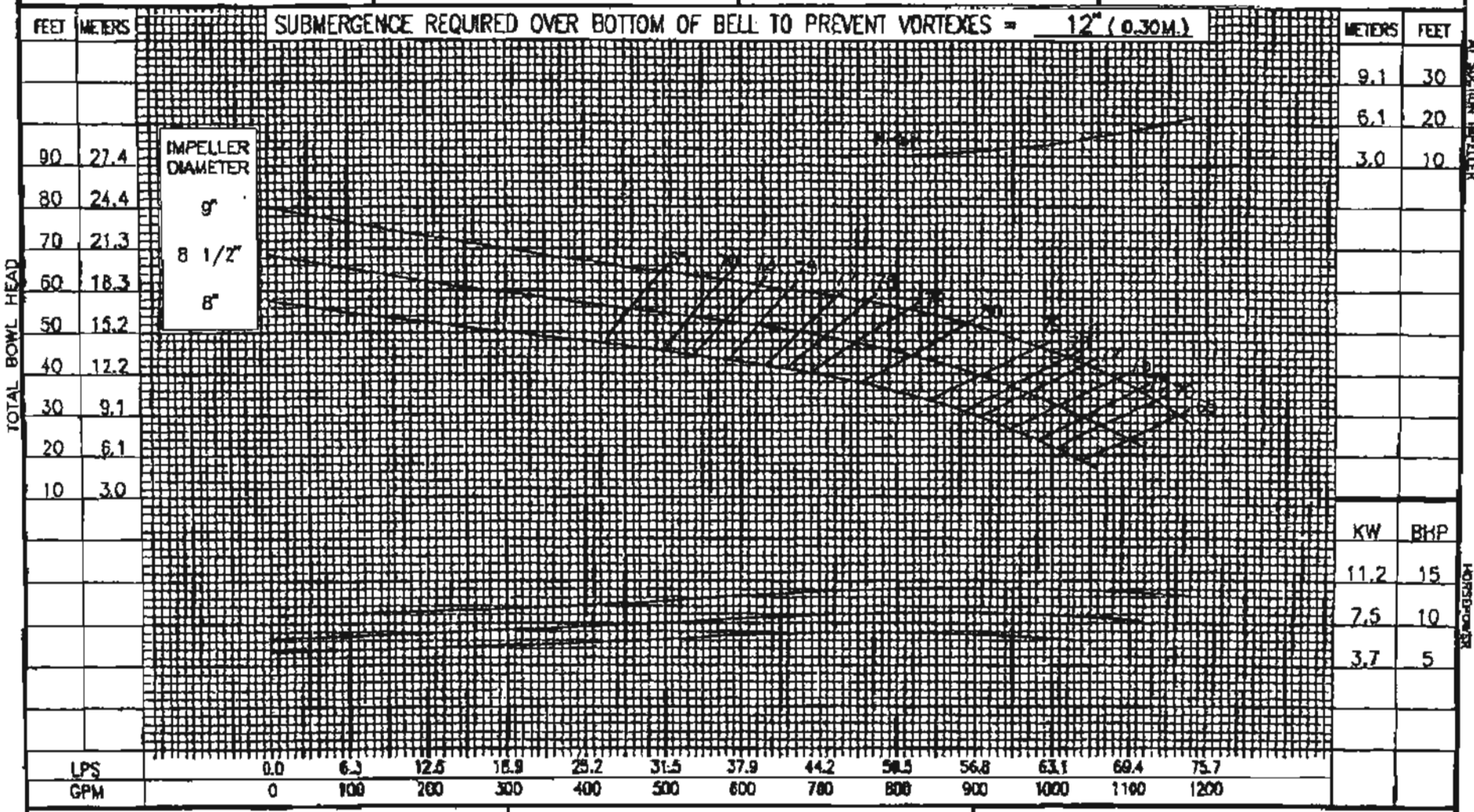
Jeff, this is what I recieved from Paco pumps. It is good for both pumps. The #1 pump has a freq drive, ~~#2~~ does not. I also included the SCADA info. Let me know if we need to flow the hydrant. We will have to discuss. I sent this to both the CP office and the Phoenix office.

140 South Third Street • Central Point, OR 97502 • 541.664.3321 • Fax 541.665.6000

665-5266 535-5062

BOWL PERFORMANCE CURVE PER STAGE	IMPELLER PART NO.: 33257 IMPELLER PATTERN NO.: 1229	THRUST CONSTANT: 11 WR^2 1 LB. FT^2/STAGE	PUMP SHAFT DIAMETER: 1 11/16 IN. (0.04 M.)

SUBMERGENCE REQUIRED OVER BOTTOM OF BELL TO PREVENT VORTEXES = 12" (0.30M.)



PERFORMANCE BASED ON MULTISTAGE TESTS PUMPING CLEAR COLD WATER, SPECIFIC GRAVITY OF 1.00

FOR 1 STAGE MULTIPLY HEAD & EFF. BY 0.95

FOR 2 STAGES MULTIPLY HD. & EFF. BY 0.98

	12/8/94	DLM	RDH

Johnston Pump Company
Brookshire, Texas 77423
ESTABLISHED 1900

12 BC TYPE — IMPELLER - BRONZE

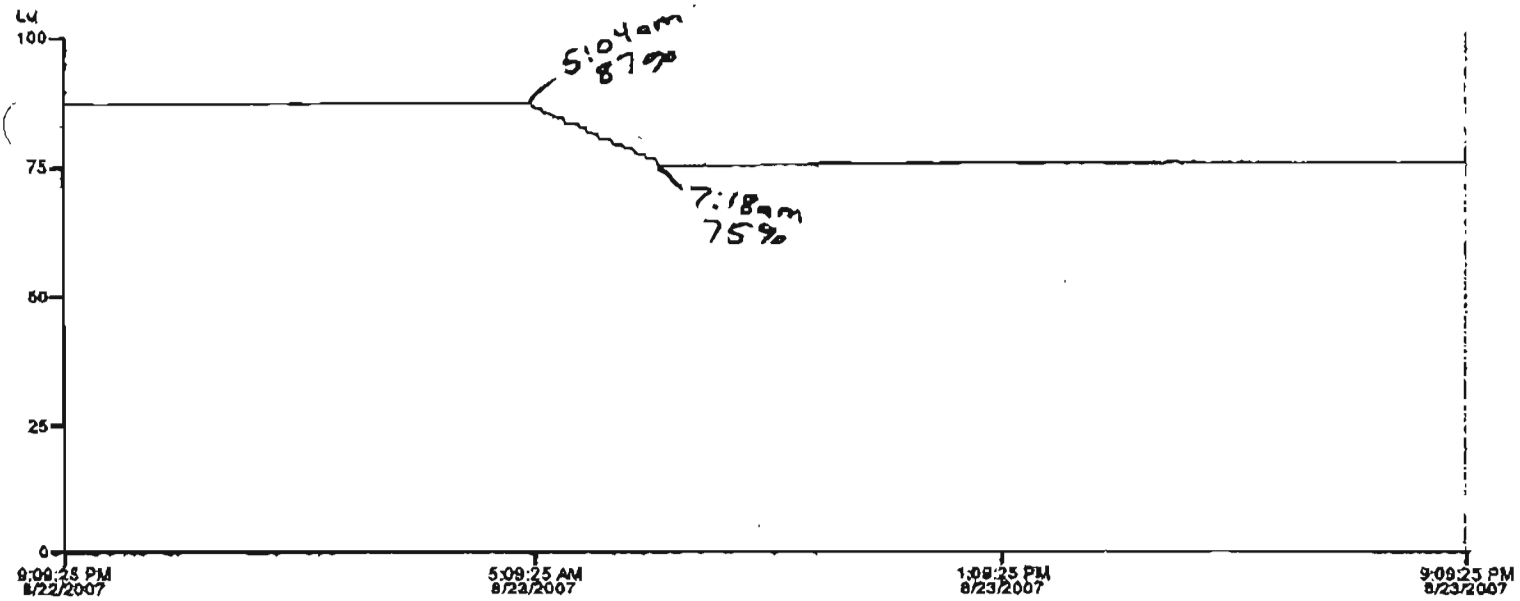
1770 R P M — BOWL - CAST IRON, VIT. COATING

LPS = LITERS PER SECOND
GPM = U.S. GALLONS PER MINUTE

CURVE SHEET # EC-251 REV. 1

1 MG RESERVOIR LEVEL

8/27/2007
9:11:14 AM



	Time	MIN	MAX	AVE
1MG RESERVOIR LEVEL	75 %	75	87	80

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

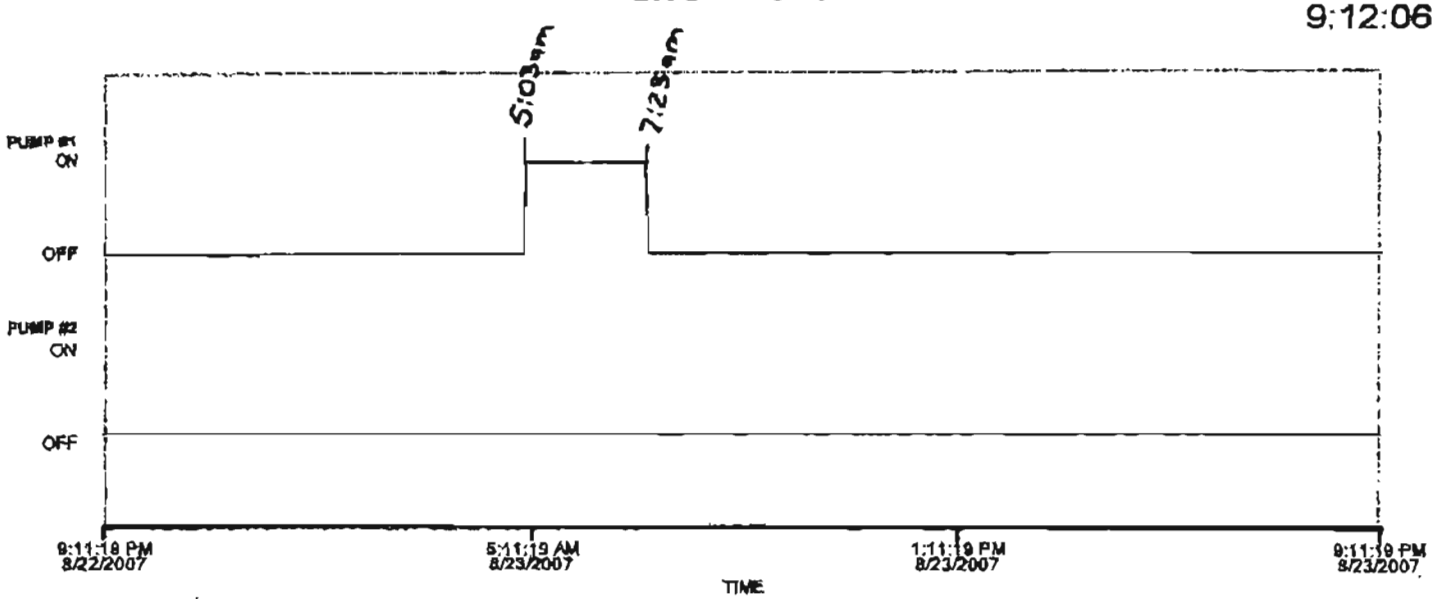
1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS | 1 DAY CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

SHOP PUMPS

8/27/200
9:12:06 A



SHOP PUMP 1 RUNNING	0	0 = OFF, 1 = ON
SHOP PUMP 2 RUNNING	0	0 = OFF, 1 = ON

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

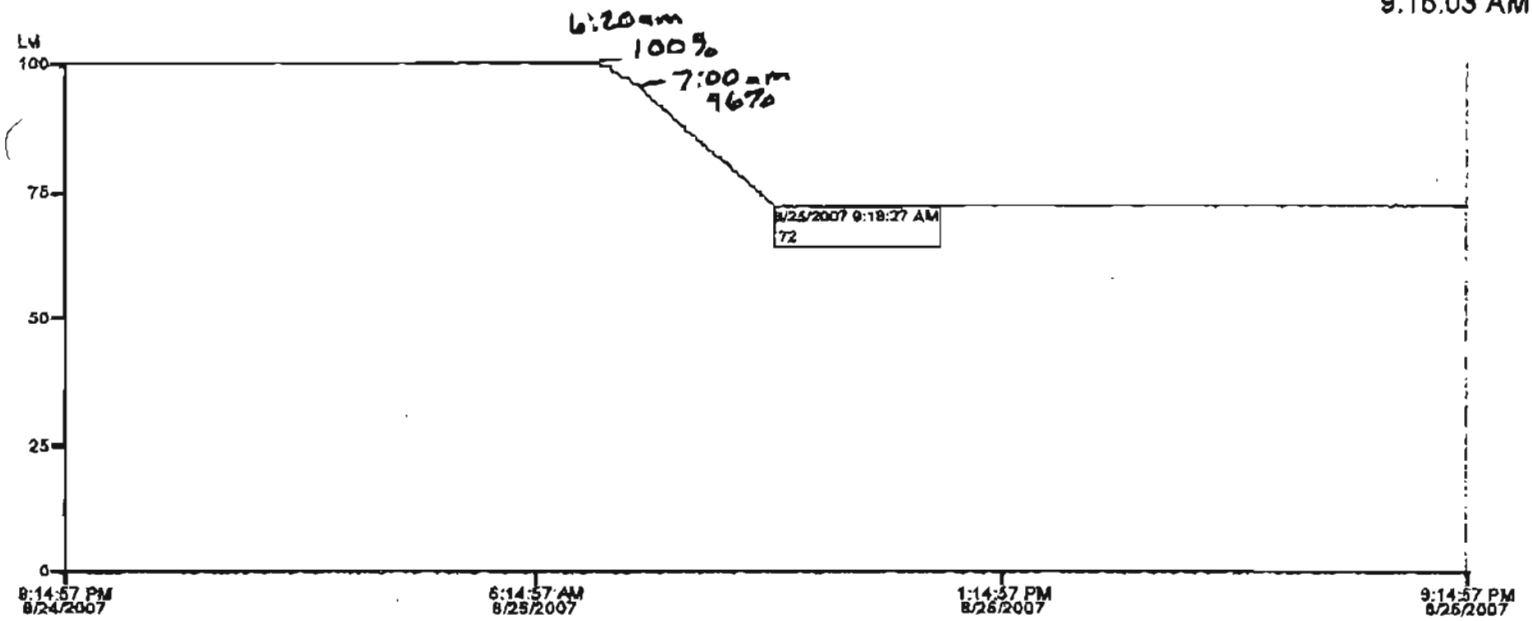
1 DAY CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

1 MG RESERVOIR LEVEL

8/27/2007
9:16:03 AM



		Time	MIN	MAX	AVE
1MG RESERVOIR LEVEL	72 %		72	100	84

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

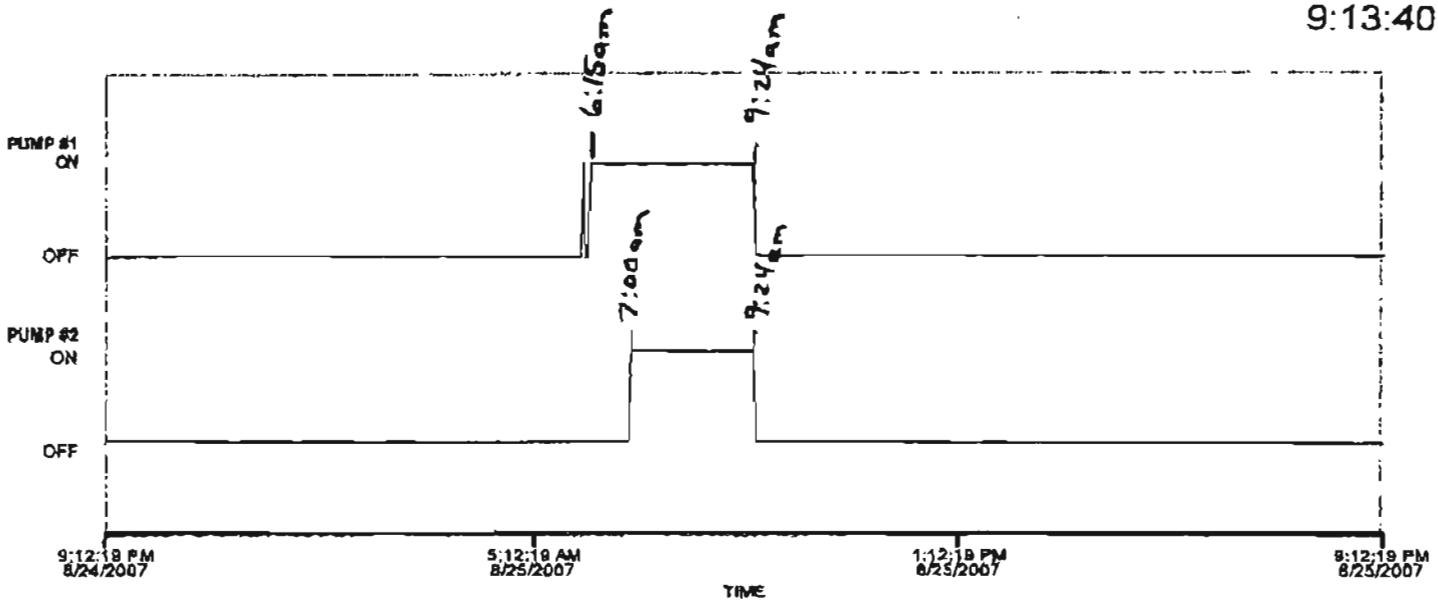
1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS | 12 HOUR CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

SHOP PUMPS

8/27/200
9:13:40 A



SHOP PUMP 1 RUNNING	1	0 = OFF, 1 = ON
SHOP PUMP 2 RUNNING	1	0 = OFF, 1 = ON

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

12 HOUR CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

Public Works Department

City of CENTRAL POINT Oregon

Rick Bartlett, Field Ops Mgr
Max Woody, Supervisor

Public Works Department

FACSIMILE TRANSMITTAL

TO: Jeff
FROM: Max
SUBJECT: Scada info
DATE: 8/29/07
PAGES: 16

average pressure while pumps are running is about 65psi. Is that close enough. It range between 60-70ps

I believe I have all the info on the Scada sheets.

I also included a drawing of the pumps. It shows 6'4 from ground level to bottom of bowl.

Finished floor of res is 1294.38 (1327.35). It is 30' tall. I don't Know how to get the difference from finished floor to ground level of pump. We should discuss. We have a laser but I can't shoot the floor so I think it would be a guess.

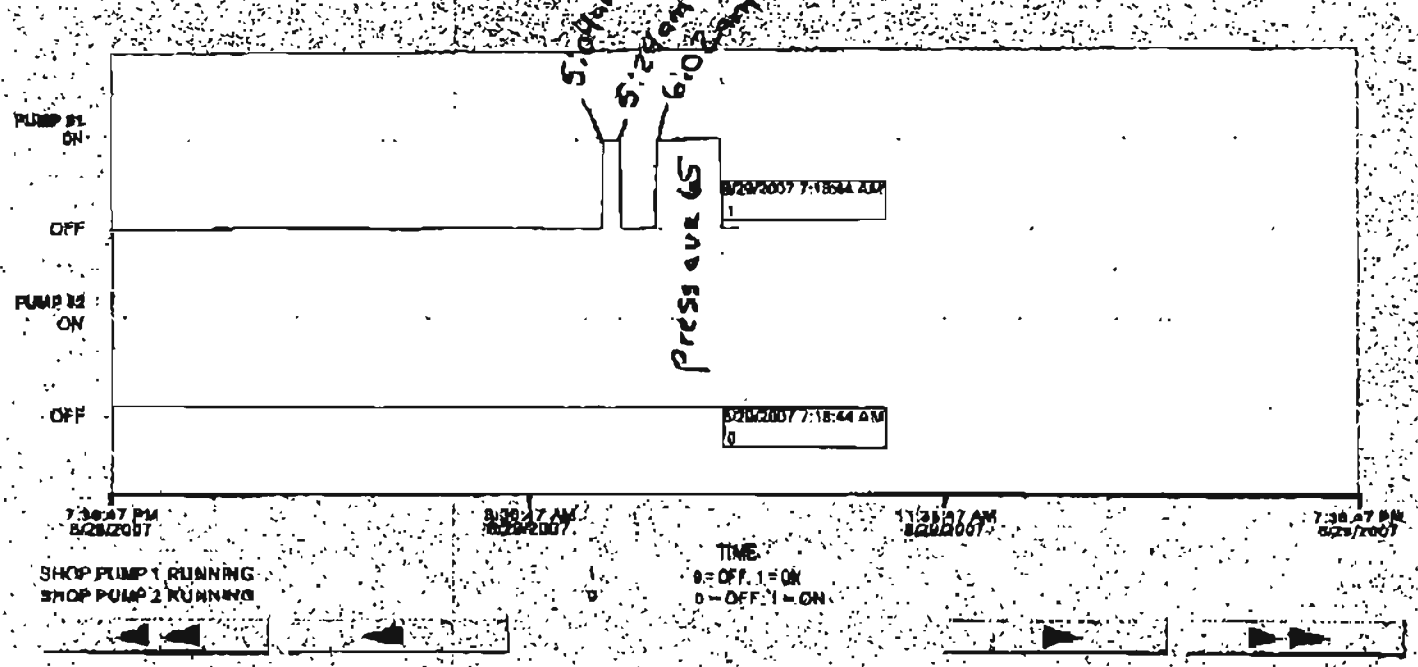
The impeller on pump #2 is 8.52". I would guess that pump #1 is also

140 South Third Street • Central Point, OR 97502 • 541.664.3321 • Fax 541.665.6000

535-5062

SHOP PUMPS

8/29/2007
7:37:03 AM



SHOP PUMP 1 RUNNING
SHOP PUMP 2 RUNNING

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

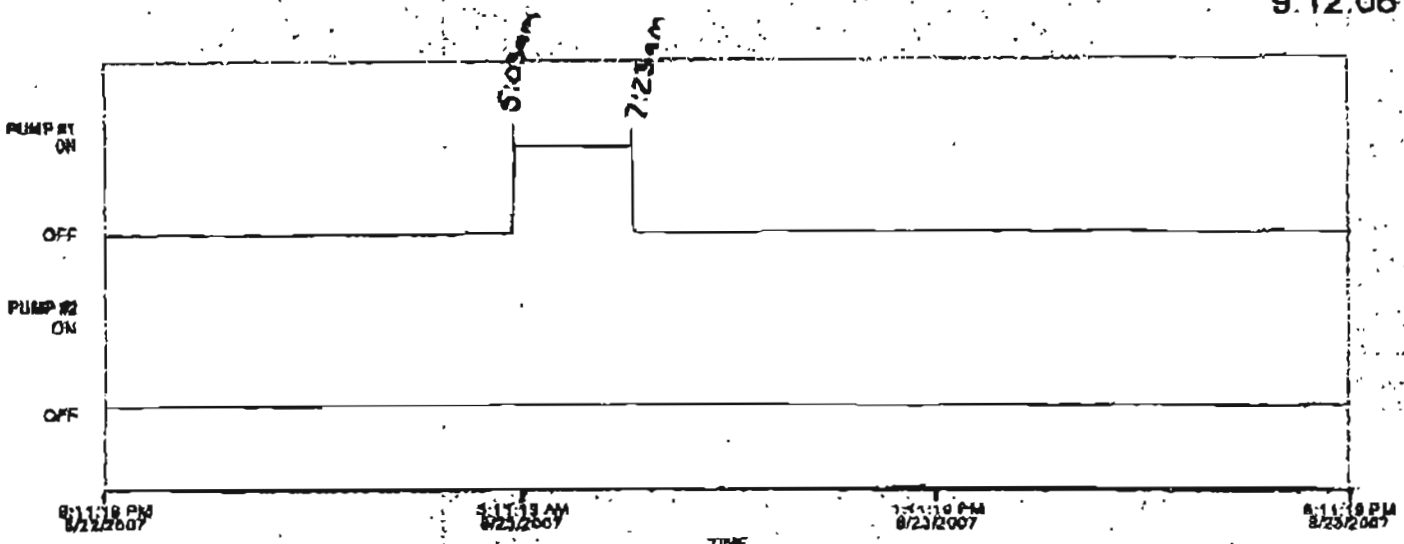
12 HOUR CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

SHOP PUMPS

8/27/200
9:12:06 A



SHOP PUMP 1 RUNNING 0
SHOP PUMP 2 RUNNING 0

TIME
0 = OFF, 1 = ON
0 = OFF, 1 = ON

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

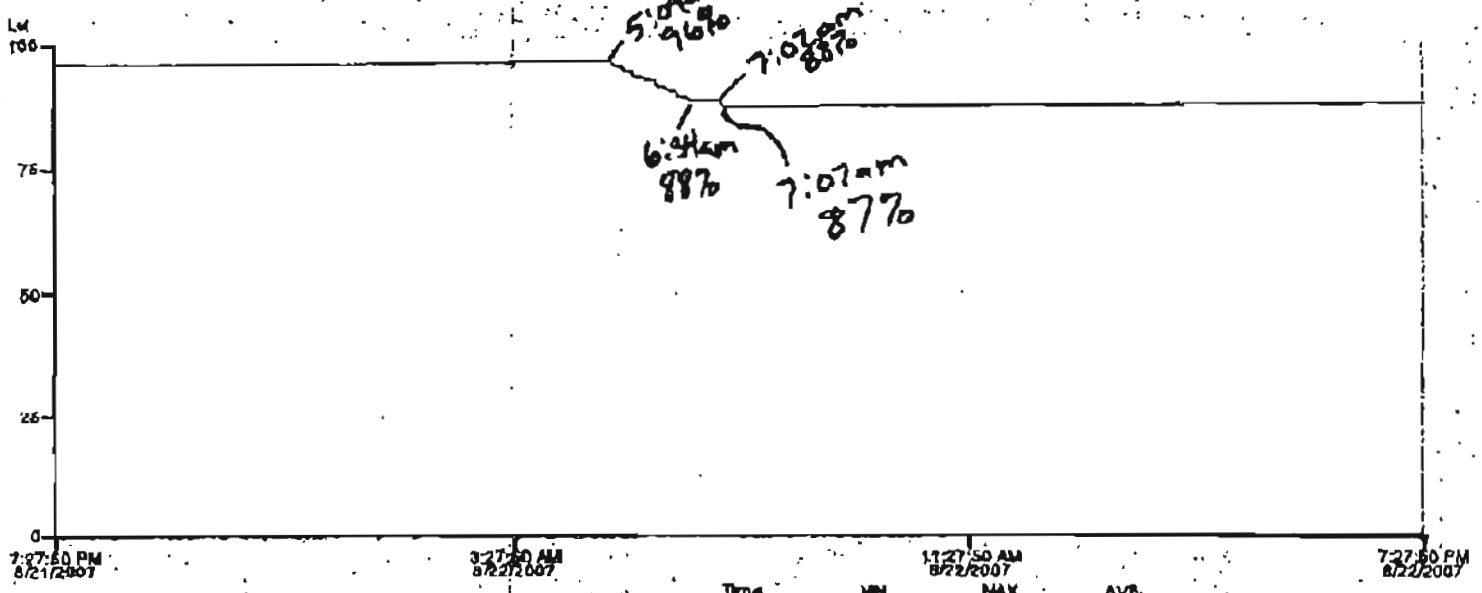
1 DAY CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

1 MG RESERVOIR LEVEL

8/29/2007
7:28:13 AM



	Time	MIN	MAX	AVE
1MG RESERVOIR LEVEL	87 %	87	98	91

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

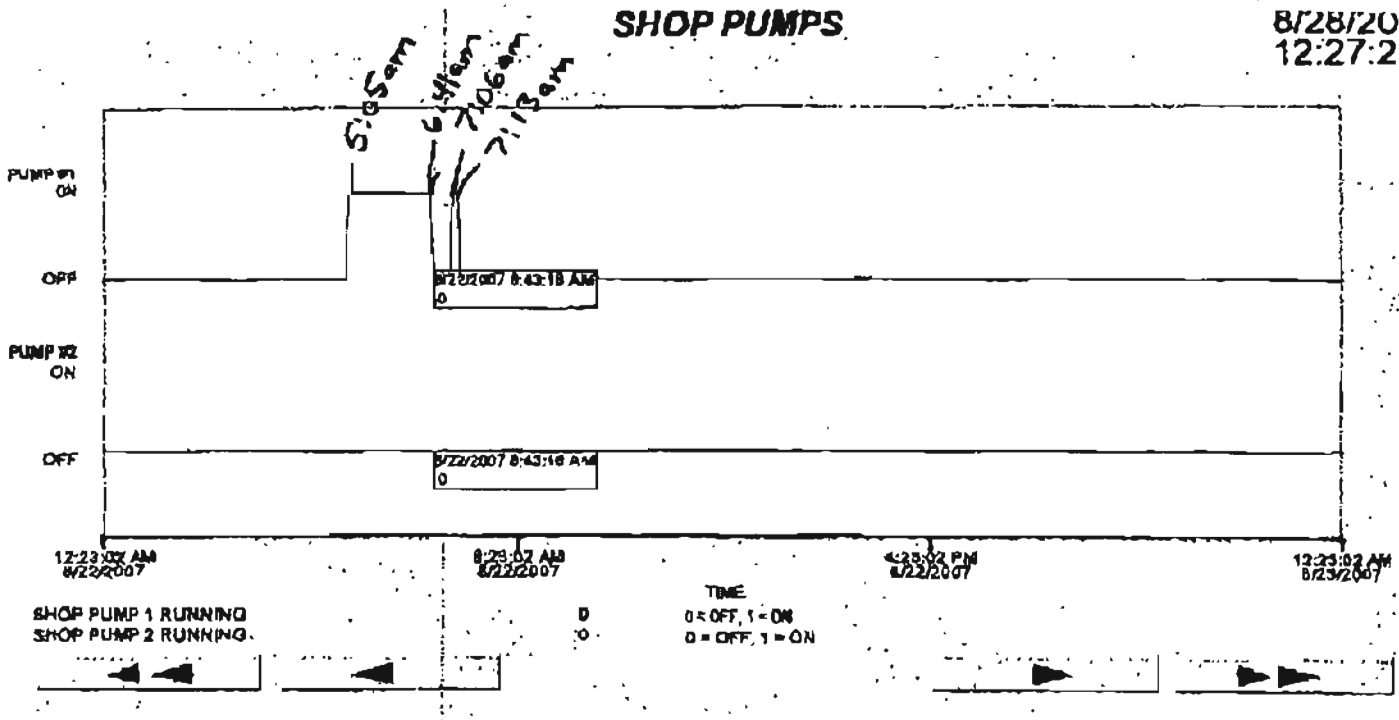
12 HOUR CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

SHOP PUMPS

8/28/200
12:27:28



RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 35 DAYS

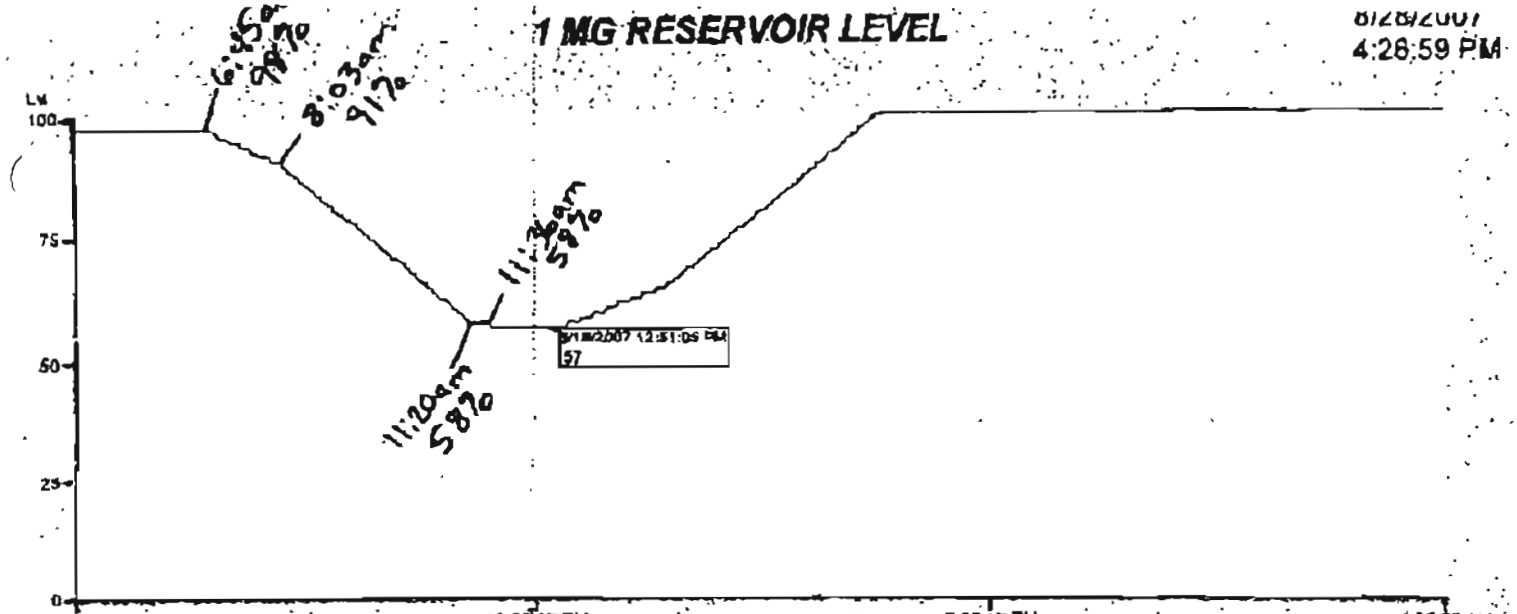
12 HOUR CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

1 MG RESERVOIR LEVEL

8/28/2007
4:26:59 PM



1MG RESERVOIR LEVEL	57 %	TIME	MIN 58	MAX 100	AVE 87

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

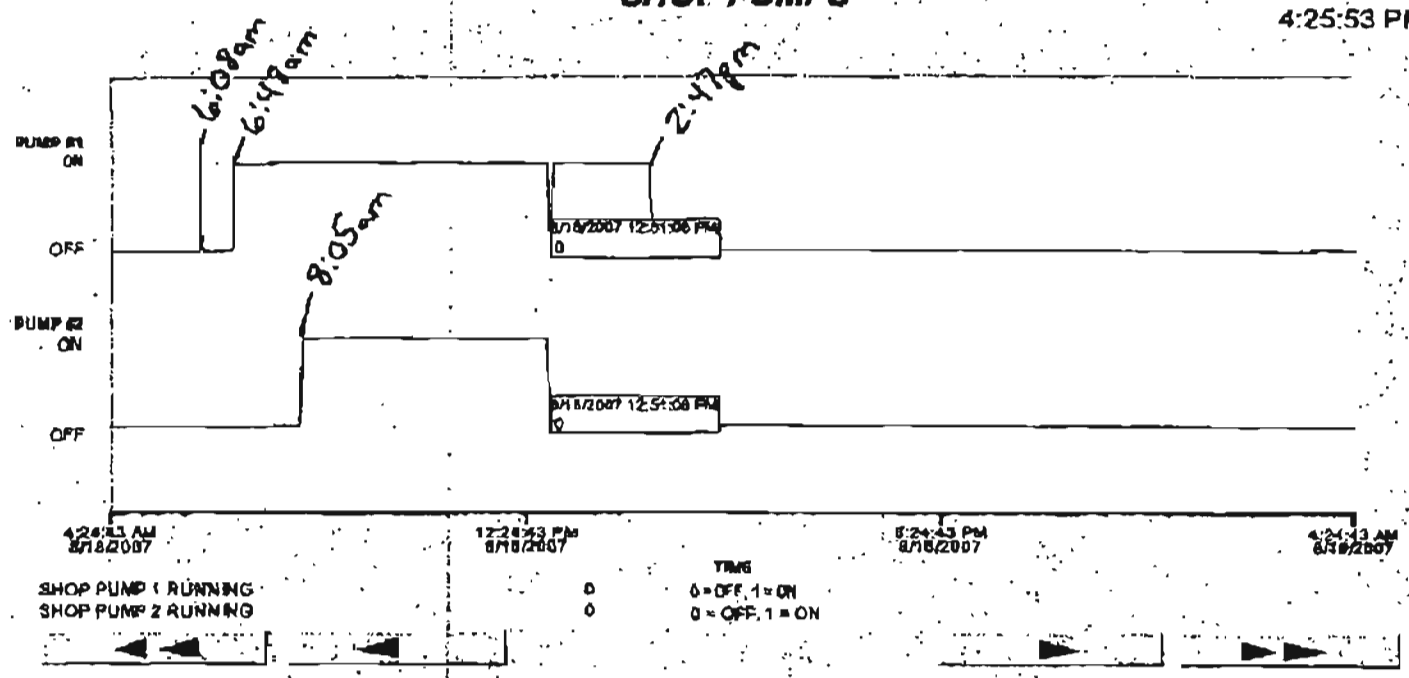
1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS | 1 DAY CHART DISPLAY

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

SHOP PUMPS

8/28/2007
4:25:53 PM



SHOP PUMP 1 RUNNING 0 0 = OFF, 1 = ON
SHOP PUMP 2 RUNNING 0 0 = OFF, 1 = ON

RIGHT CLICK ON CHART WINDOW TO SET THE ENDING TIME TO THE CURRENT TIME
TO CHANGE CHART RANGE CLICK ON THE DESIRED TIME BUTTON BELOW

1 HOUR | 12 HRS | 1 DAY | 7 DAYS | 30 DAYS

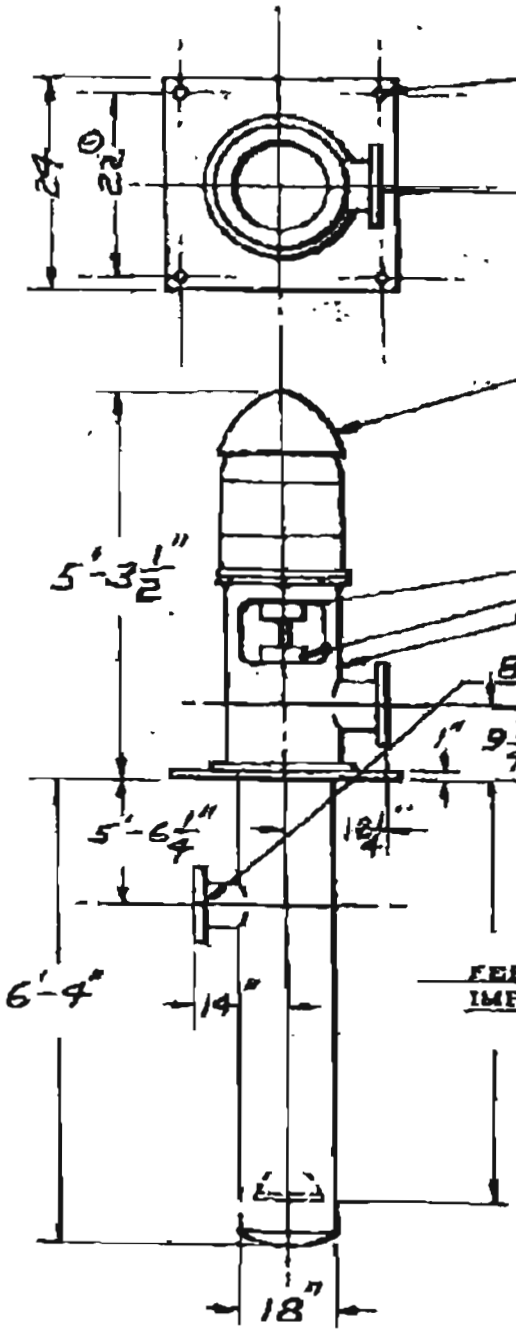
1 DAY CHART DISPLAY.

GOTO SHOP WINDOW | GOTO MAIN WINDOW

Login

A-3978

JOHNSTON VERTICAL TURBINE PUMP



4 - 7/8" DIA. HOLES

8" x 150 ASA DISCHARGE FLANGE

GENERAL ELECTRIC
VERTICAL SOLID SHAFT MOTOR
90 HP 3 PHASE 60 CYCLE
220-440 VOLT 1800 RPM
DRIPPROOF ENCLOSURE

COUPLING

SEAL

12 x 8 TYPE "B" STEEL DISCHARGE HEAD

8"-150# ASA SUCTION FLANGE

1297.5 Elevation

12 BC

4 STAGE BOWL ASSEMBLY
BOWLS C.I.
IMPELLERS BRONZE
BEARINGS LEAD, BRONZE, BUNA N
SHAFT AISI 416

FEET TO SUCT.
IMPELLER EYE

CONDITIONS:

USGPM
PSIG SUCTION PSIG DISCHARGE
DIFF. PSI MAXIMUM PSI
FT. TOTAL DYNAMIC HEAD
REQUIRED NPSH FT. @ ℄ SUCTION
EQUIPMENT
SPEC. GRAV. @ °F PUMPING TEMP.
VISCOSITY SSU @ PUMPING TEMP.
CUSTOMER: CITY OF CENTRAL POINT
POS OREGON
DEALER PUMP, PIPE & POWER CO.
POS PORTLAND, OREGON
JOHNSTON SERIAL #
JOHNSTON QUOTATION #
NOTE: ~~DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED~~

THIS PRINT CERTIFIED
CORRECT BY
CORNELL MANUFACTURING CO.

Per _____

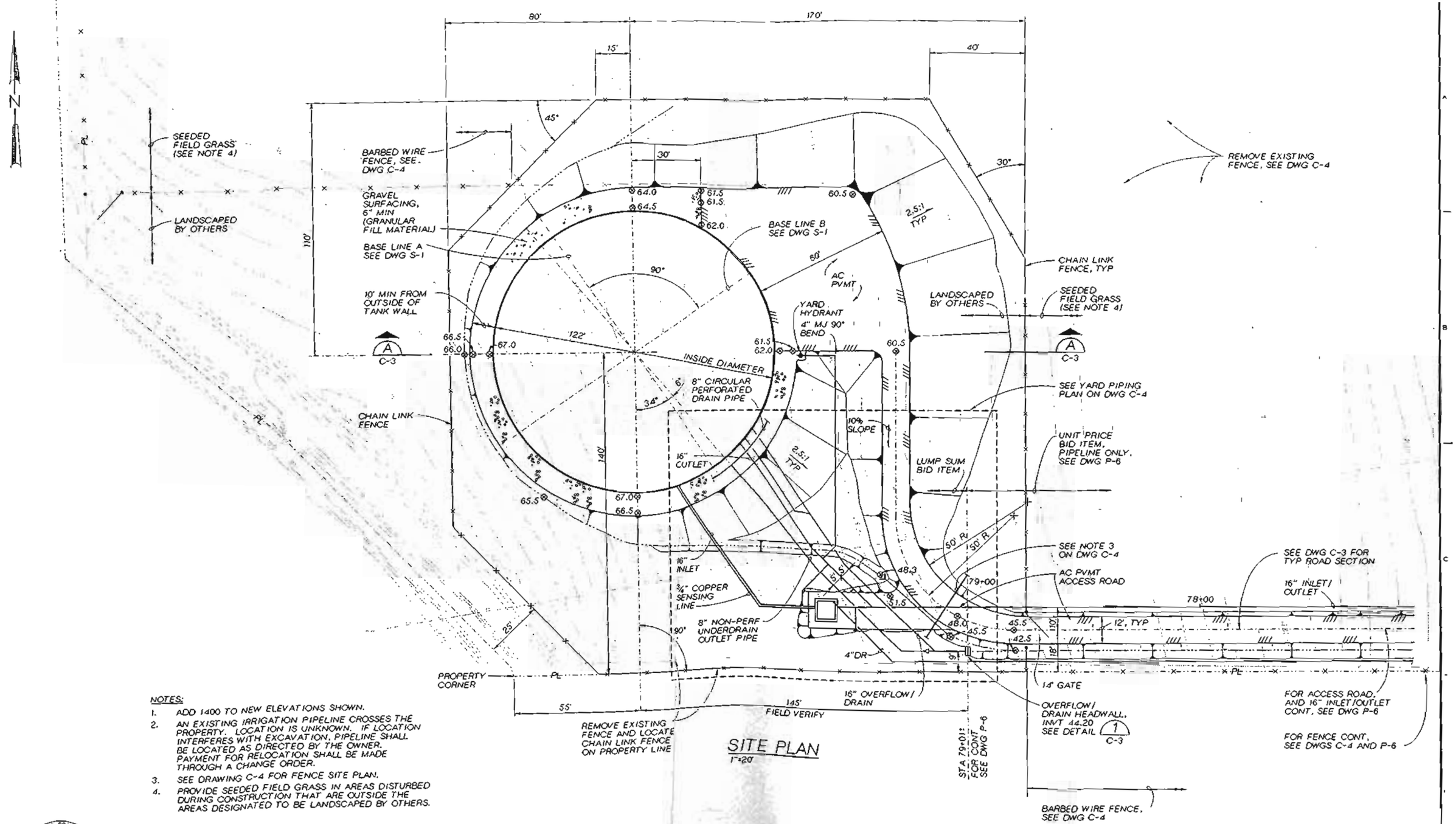
Date _____

JOHNSTON PUMP COMPANY
PASADENA, CALIFORNIA

(1) REVISION - WAS 21 12-3-62

5C-1697

H-1268-A



NOTES:

1. ADD 1400 TO NEW ELEVATIONS SHOWN.
2. AN EXISTING IRRIGATION PIPELINE CROSSES THE PROPERTY. LOCATION IS UNKNOWN. IF LOCATION INTERFERES WITH EXCAVATION, PIPELINE SHALL BE LOCATED AS DIRECTED BY THE OWNER. PAYMENT FOR RELOCATION SHALL BE MADE THROUGH A CHANGE ORDER.
3. SEE DRAWING C-4 FOR FENCE SITE PLAN.
4. PROVIDE SEEDED FIELD GRASS IN AREAS DISTURBED DURING CONSTRUCTION THAT ARE OUTSIDE THE AREAS DESIGNATED TO BE LANDSCAPED BY OTHERS.

SITE PLAN
1"=20'

REGISTERED PROFESSIONAL ENGINEER 6208 OREGON JUL 12, 1988 RONALD P. STAEHLIN

Ronald P. Staehlin

EXP. 12/31/94

CH2MHILL

DSGN G. SILBERNAGEL					
DR P VALENTINE 35838C1.DGN					
CHK P BERG					
APVD R STAEHLIN	NO.	DATE	REVISION	BY	APVD

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©CH2M HILL

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

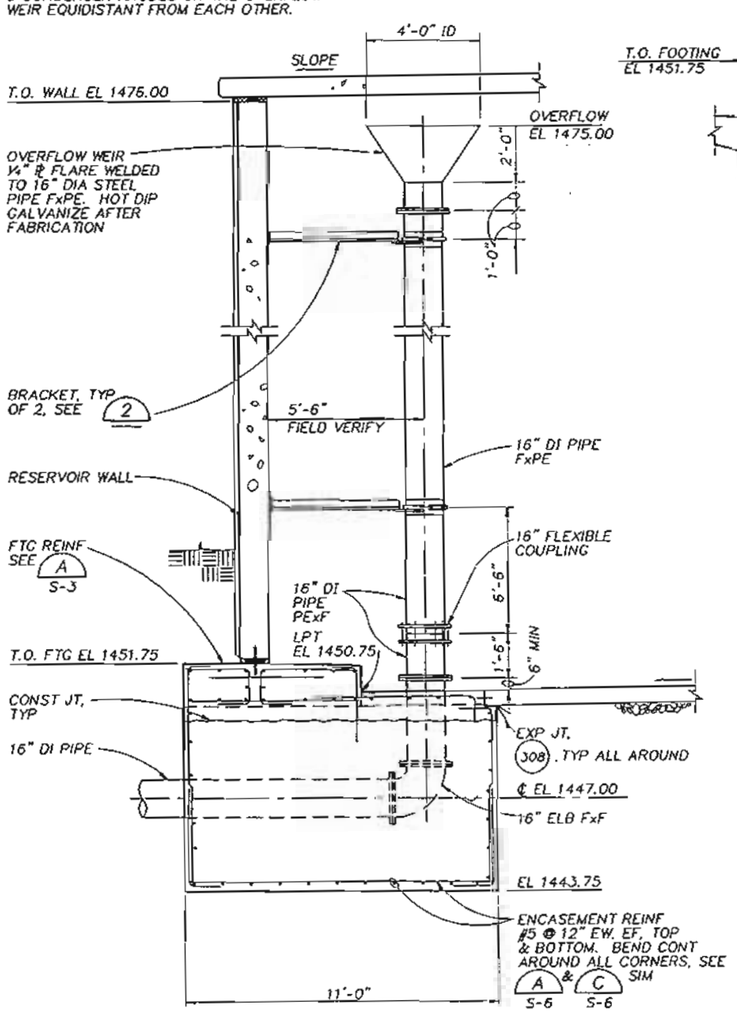
CITY OF CENTRAL POINT
2 MILLION GALLON RESERVOIR

CIVIL
SITE PLAN

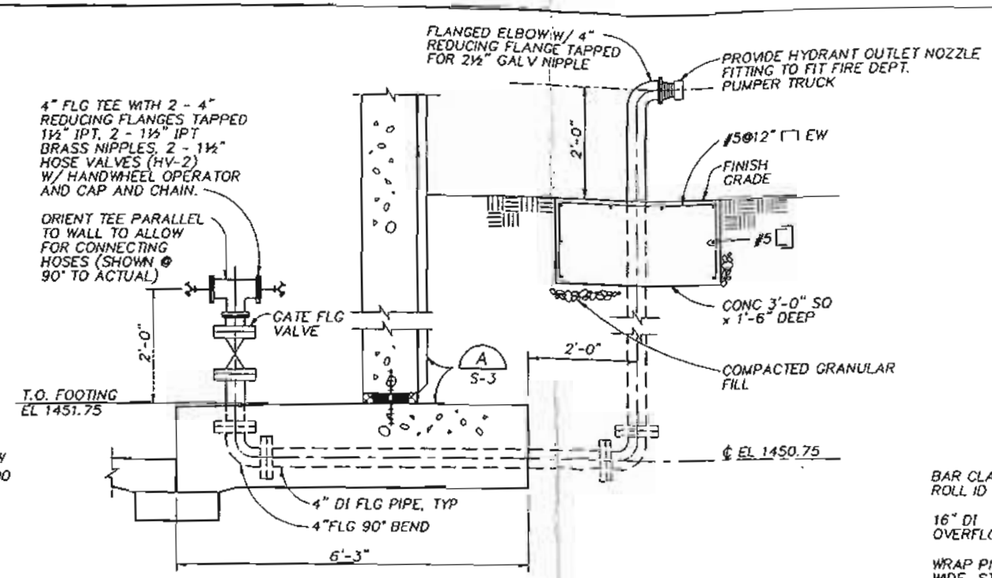
SHEET 3
DWG NO. C-1
DATE SEPT 1993
PROJ NO. CVO35838.A1

09-27-93 J:\CENTRPT\CV035838\J5BJ6507

NOTE:
INSTALL ONE CONDENSER ANODE AT EACH OVERFLOW PIPE WALL BRACKET AND 3 CONDENSER ANODES ON THE OVERFLOW WEIR EQUIDISTANT FROM EACH OTHER.



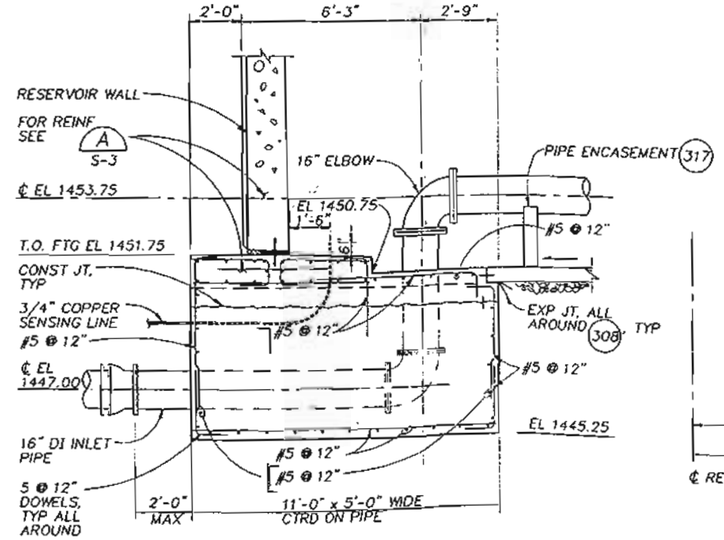
OVERFLOW PIPE SECTION D S-6
⅜" = 1'-0"



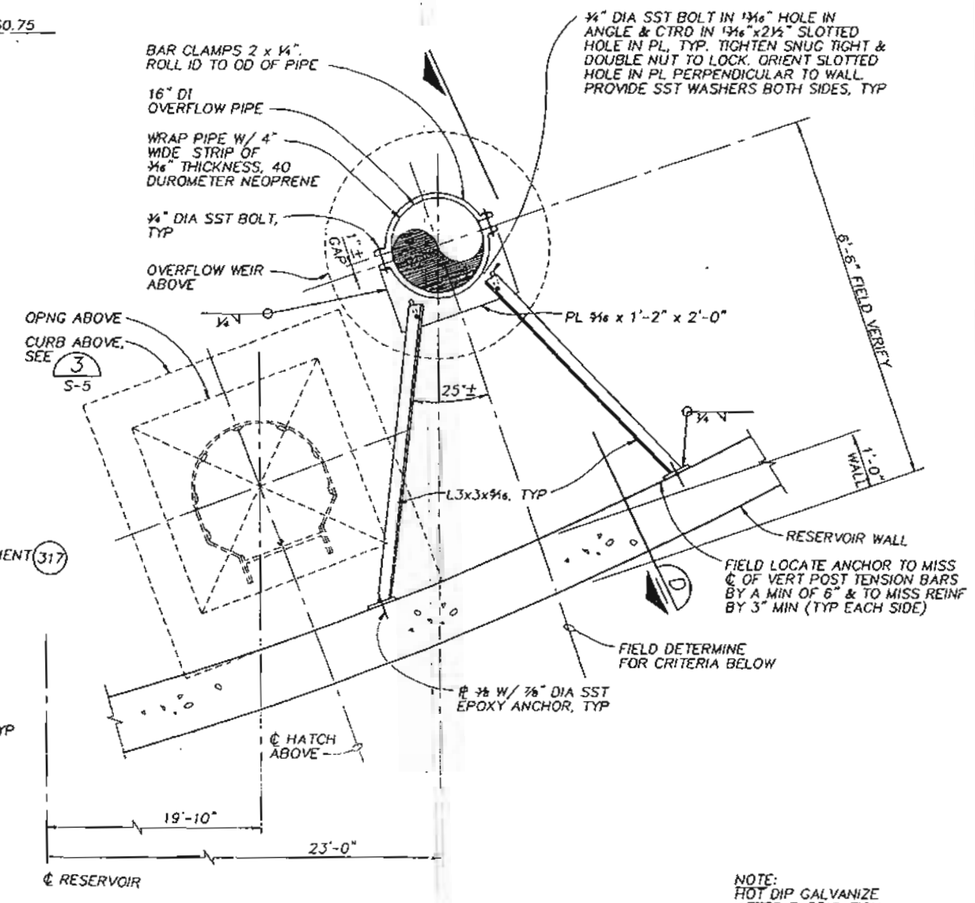
NOTE:
DRAIN STANDPIPE TO INSIDE PRIOR TO CLOSING GATE VALVE.

WASHDOWN STANDPIPE DETAIL 1 S-1
¼" = 1'-0"

COORDINATE PLACEMENT OF PIPING AND REINFORCING STEEL SO THAT NO CONTACT EXISTS BETWEEN THE TWO



INLET PIPE SECTION E S-1
⅜" = 1'-0"



NOTE:
HOT DIP GALVANIZE AFTER FABRICATION.

PLAN

OVERFLOW SUPPORT BRACKET DETAIL 2
¾" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER GEORGE F. DOTSON OREGON EXP. 30, 1993
1-32.0 Expires: 12/31/93

CH2M HILL

DSGN	GF DOTSON
DR	35838507 DL MONK
CHK	SM FREY
APVD	R STAEHLIN

NO.	DATE	REVISION	BY	APVD

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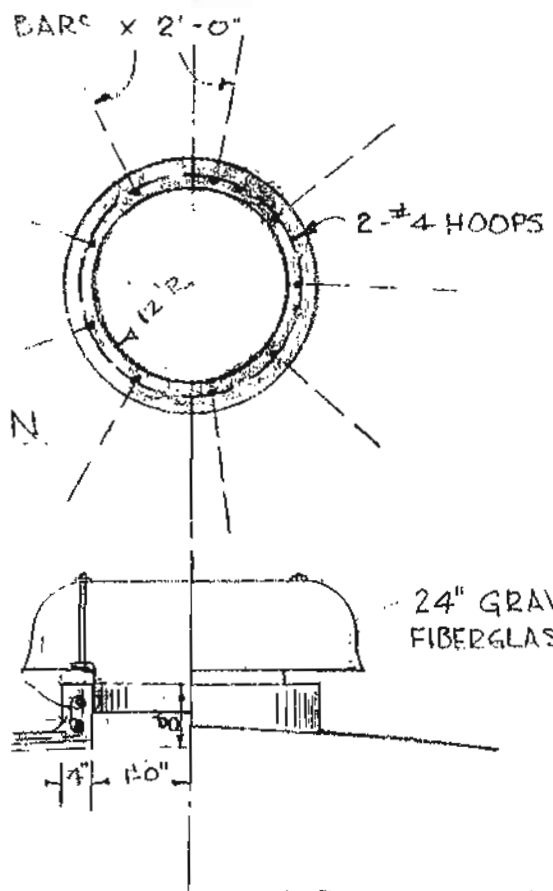
©CH2M HILL

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CITY OF CENTRAL POINT
2 MILLION GALLON RESERVOIR

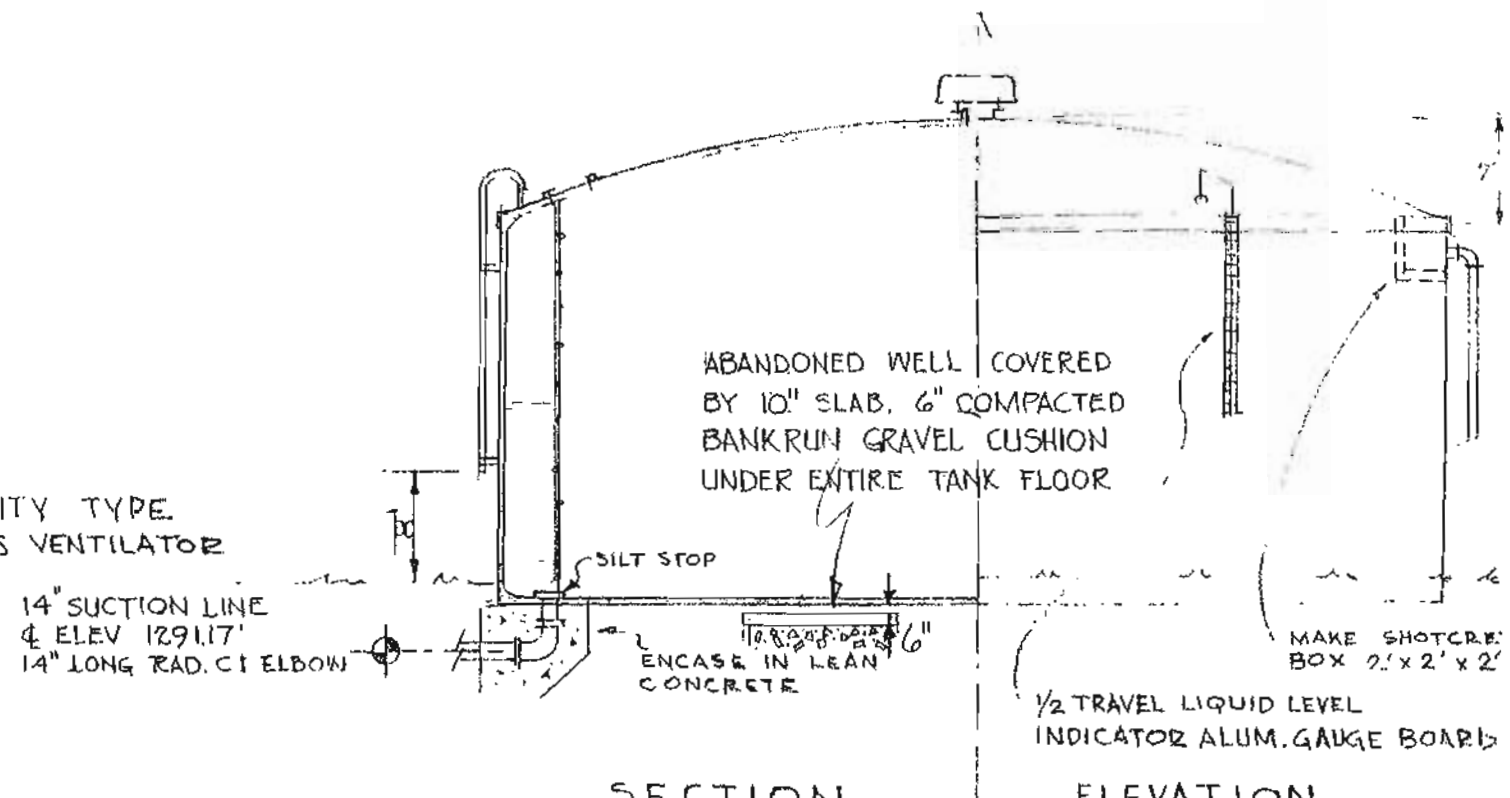
STRUCTURAL
PIPING SUPPORT
SECTIONS AND DETAILS

SHEET	14
DWG NO.	S-7
DATE	SEP 1993
PROJ NO	CV035838.A1

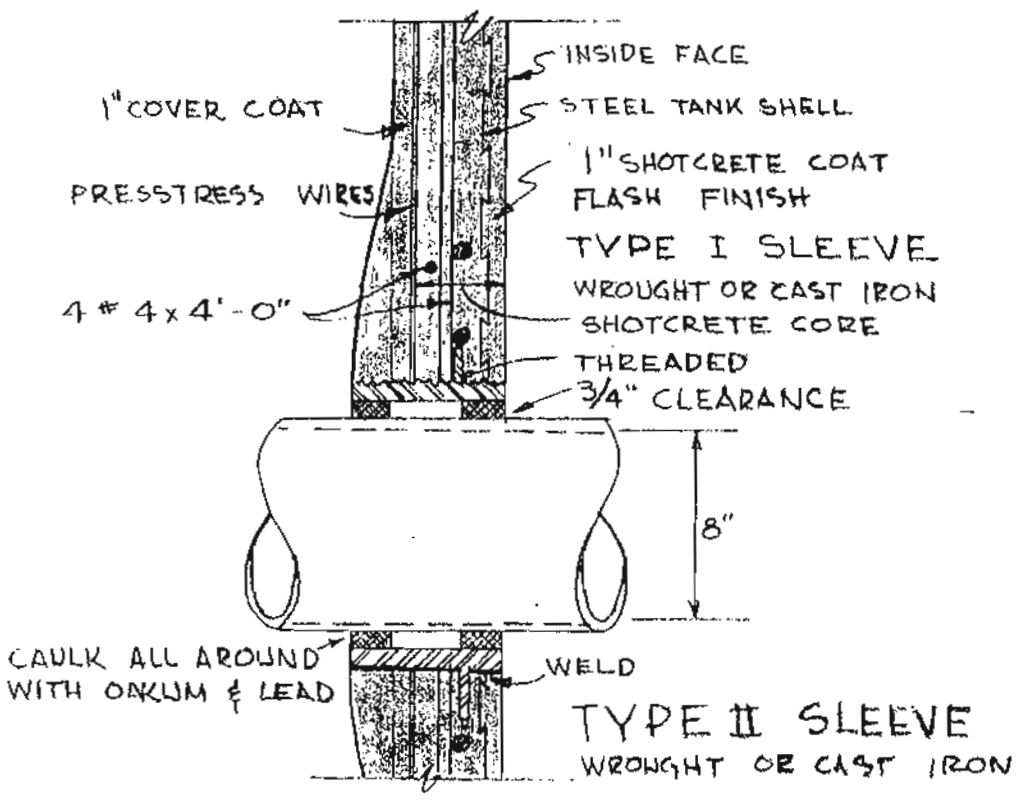


VENT CURB DETAIL

SCALE 1/2" = 1'-0"

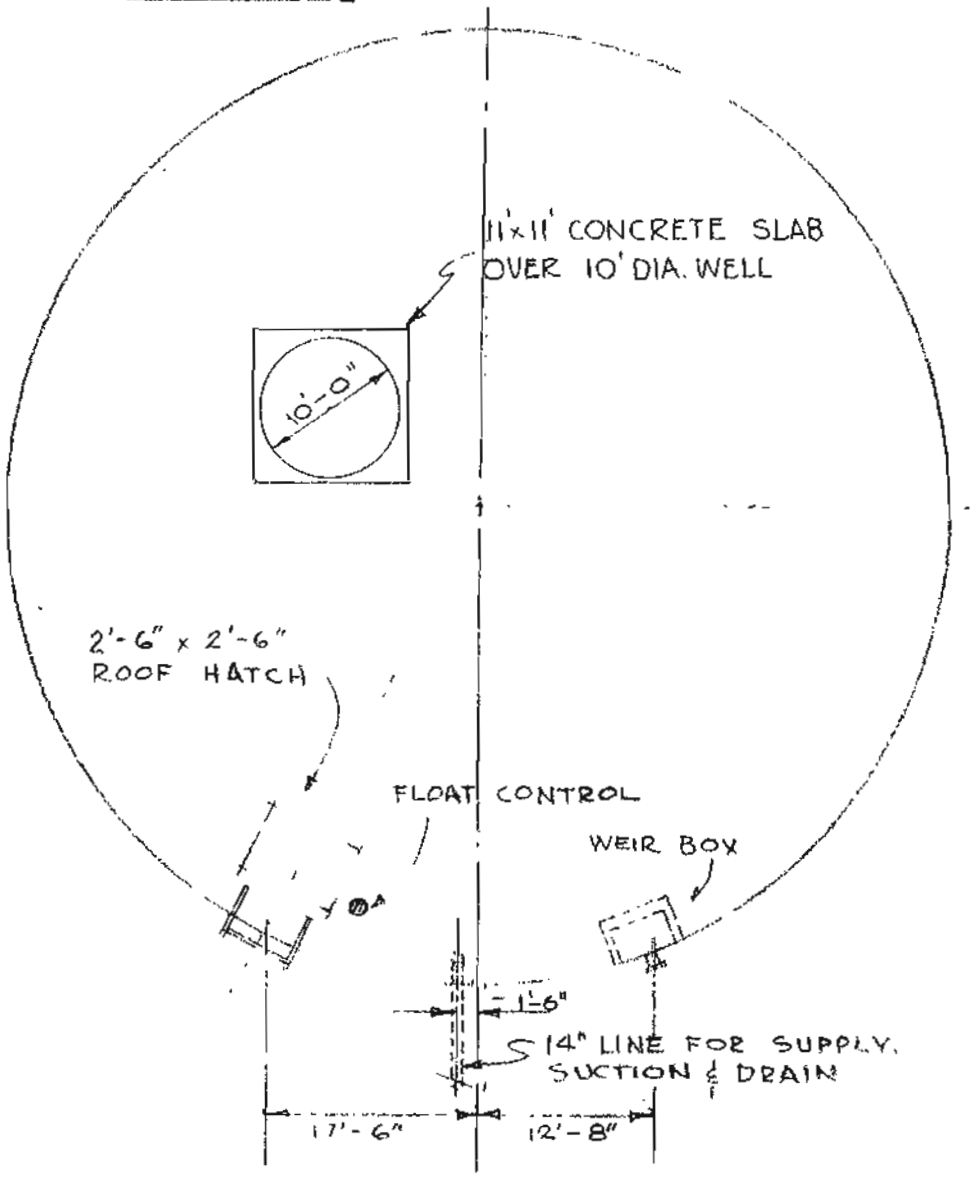


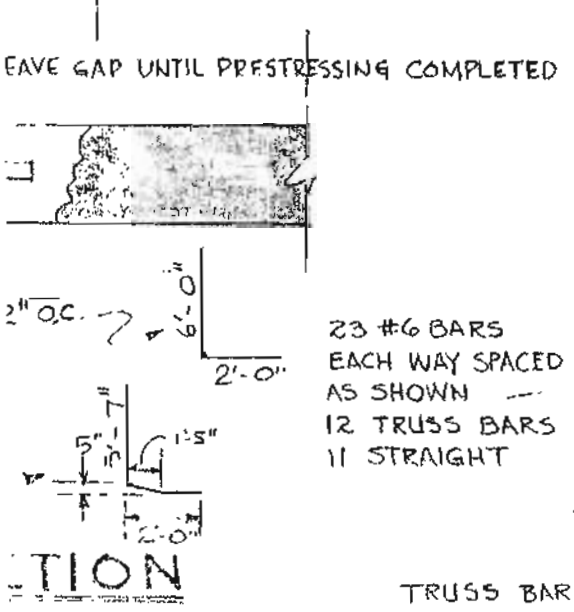
SECTION ELEVATION

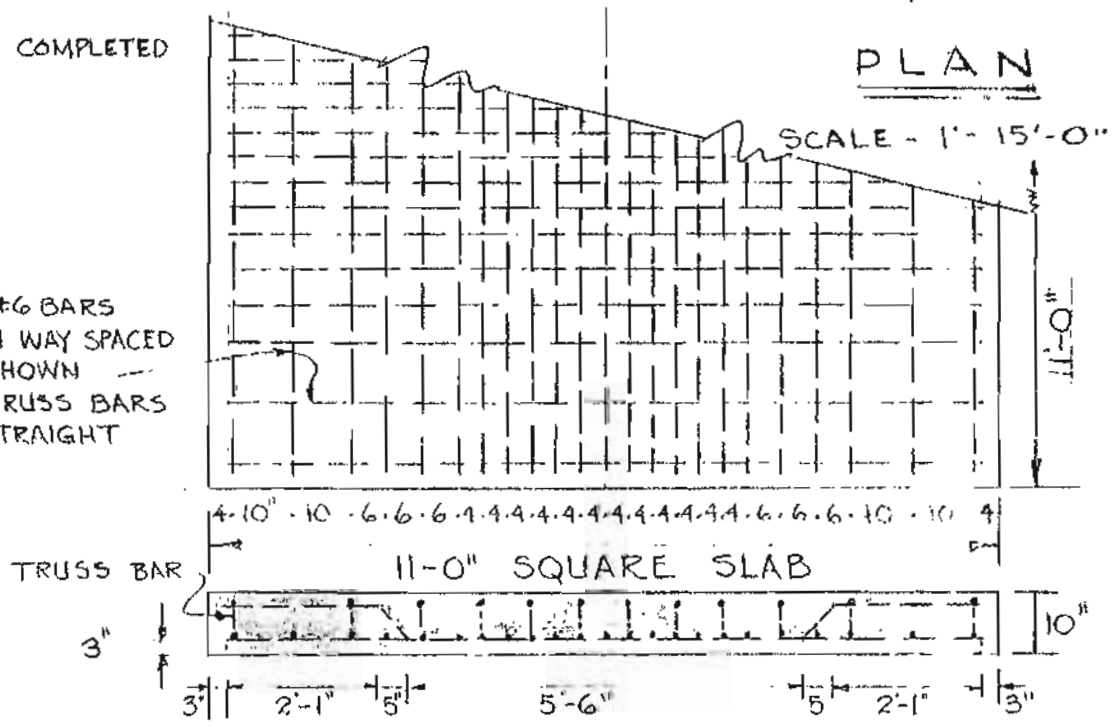


TYPICAL PIPE SLEEVE & HORIZONTAL WALL SECTION

SCALE 1 1/2" = 1'-0"







SLAB OVER ABANDONED WELL

WHERE STANDARD SPECIFICATIONS A
FLICT WITH CROM CORPORATION SPECI
OR WITH GOOD PRESTRESSING OR
PRACTICES, THE STANDARD SPECIFIC
SHALL BE SUBORDINATED.

DESIGN SPECIFICATI

SHOTCRETE:

fc 1500 PSI
f'c 4000 PSI. +
fci < 0.55 f'ci at winding

CONCRETE:

fc
f'c 3750 PSI

PRESTRESS WIRE: ASTM 12

COLD DRAWN HIGH CARBON
Aw = 11" IN P
DIA. = "± IN P
ULTIMATE STRESS
INITIAL STRESS 140,00
WALL WORKING STRESS 110,00
DOME-WORKING STRESS - 115,000

THIS DESIGN AND DRAWING ORIGINATI
THE EXCLUSIVE PROPERTY OF THE CR

CITY OF CENTRAL POINT, ORE

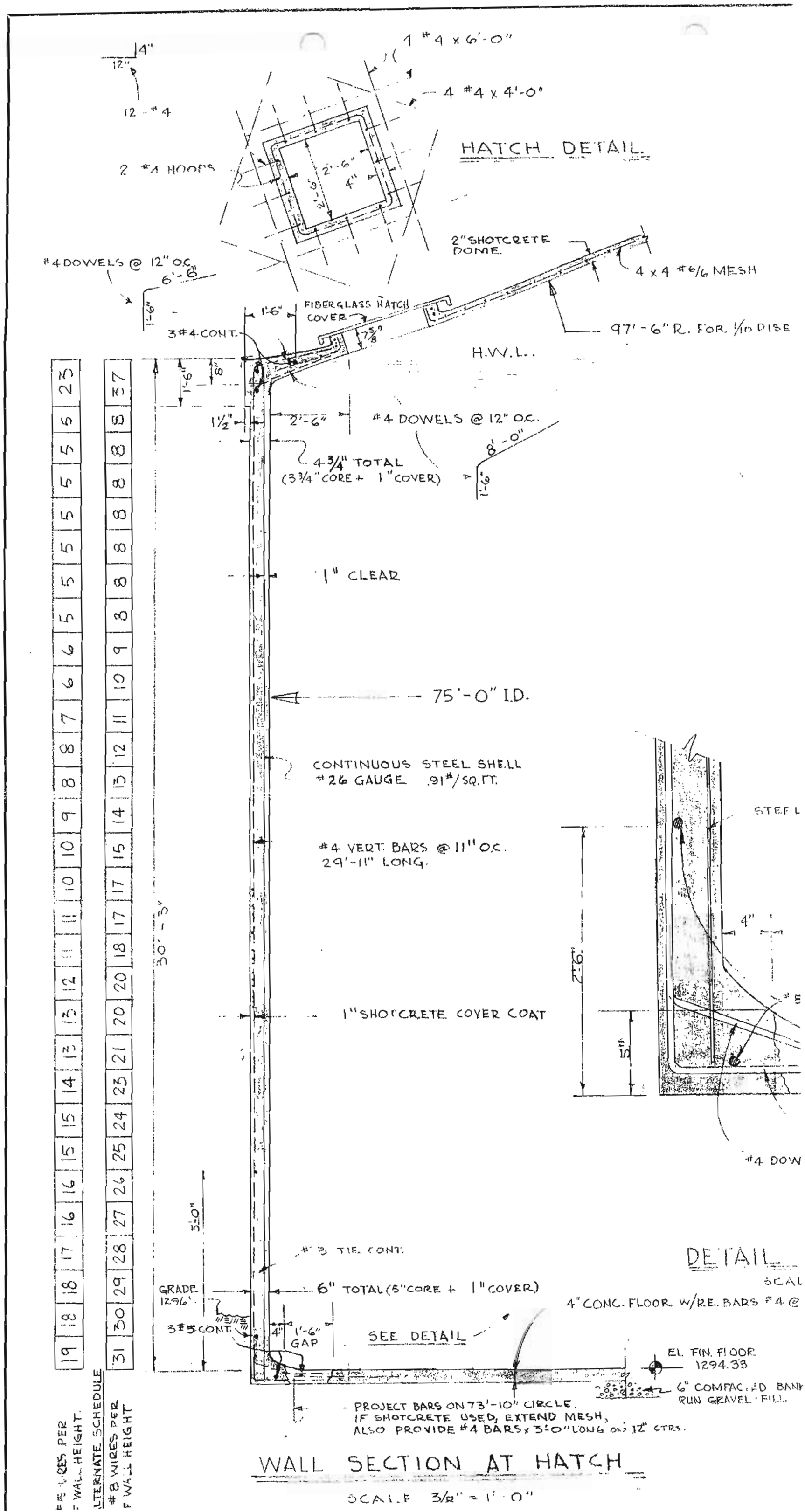
ONE M.G. PRESTRESSED RESERVOIR

THE CROM CORPORATION

212 S.E. FIRST STREET

GAINESVILLE, FLORIDA

SCALE: AS NOTED | REVISIONS: 4/5/62 - MIS. DETAILS - R.E.S.


4"
12"
12 - #4
1 #4 x 6'-0"
4 #4 x 4'-0"
HATCH DETAIL.
2 #4 HOOPS
2'-6"
4"
2'-6"
2"SHOTCRETE DOME.
#4 DOWELS @ 12" O.C.
6'-8"
1'-6"
4 x 4 #6/6 MESH
1'-6"
FIBERGLASS HATCH COVER
3#4 CONT.
7 5/8"
97'-6" R. FOR 1/10 RISE
H.W.L.
1'-6"
8"
1 1/2"
2'-6"
#4 DOWELS @ 12" O.C.
4 3/4" TOTAL
(3 3/4" CORE + 1" COVER)
8'-0"
1'-6"
1" CLEAR
75'-0" I.D.
CONTINUOUS STEEL SHELL
#26 GAUGE .91#/SQ.FT.
#4 VERT. BARS @ 11" O.C.
29'-11" LONG.
1" SHOTCRETE COVER COAT
30'-3"
5'-0"
#3 TIE CONT.
GRADE
1296'.
6" TOTAL (5" CORE + 1" COVER)
3#5 CONT.
4"
1'-6"
GAP
SEE DETAIL
4" CONC. FLOOR W/R.E. BARS #4 @
EL. FIN. FLOOR
1294.33
6" COMPACTED BANK
RUN GRAVEL FILL.
PROJECT BARS ON 73'-10" CIRCLE.
IF SHOTCRETE USED, EXTEND MESH,
ALSO PROVIDE #4 BARS x 3'-0" LONG ON 12" CTRS.
WALL SECTION AT HATCH
SCALE 3/8" = 1'-0"
STEEL
4"
#4 DOW
DETAIL
SCAL
ALTERNATE SCHEDULE
#8 WIRES PER
F WALL HEIGHT
#8 WIRES PER
F WALL HEIGHT

APPENDIX B

Final TM-1 Model Creation

BROWN AND CALDWELL

Technical Memorandum

To: City of Central Point **Date:** October 31, 2007

From: Jacob Young, Ed Olson

Project Name: Water System Model Build

Subject: Final TM-1 Model Creation

This technical memorandum (TM) describes the methods and data used in creating the hydraulic model of the water distribution system for the City of Central Point (City), Oregon. It includes a discussion of the modeling software used for the project, scenarios included in the model, and model elements.

MODELING SOFTWARE

The hydraulic model of the City's water system was created using MWH Soft's InfoWater software. InfoWater is a water distribution system modeling software that is fully integrated with ESRI ArcGIS. The City's water supplier, Medford Water Commission (MWC), recently completed a hydraulic model of their water system using InfoWater. Using InfoWater for the City's model will facilitate sharing data between the City and MWC and may allow for incorporation of the MWC model to the City's model.

MODEL SCENARIOS

Several different demand and operational conditions, or scenarios, are simulated in the model. Each scenario represents a different combination of demand conditions and operational settings for the existing system. The scenarios include:

1. Dynamic Calibration
2. Existing Minimum Month Demand
3. Existing Average Day Demand
4. Existing Maximum Day Demand
5. Hydrant Test Calibration

The first four scenarios are dynamic, or extended period simulations (EPS). The time period for each EPS simulations is 24 hours. The Hydrant Test Calibration Scenarios are steady-state simulations, which provide an instantaneous simulation of demands and operational settings at the time of each test.

Accuracy of a model is highly dependent on the accuracy of the distribution of demands in the model. Accurately simulating the daily fluctuation in demands is also very important for EPS scenarios. Below is a discussion of how demands were allocated in the model and how the daily use pattern will be calculated.

Demand Allocation

Demand allocation consists of calculating the total system demand and then distributing that demand appropriately throughout the system. Total system demand for a given day is equal to the water supplied to the system minus the water stored in the tanks. Demands for each calibration scenario were calculated from SCADA records for tanks in the system and the master meters from MWC. Demands for minimum month, average day and maximum day are from City records.

The distribution of demands was based on the City's 2006 billing records. To account for seasonal changes in water use throughout the system an average daily water demand for the maximum month, average month, and minimum month were calculated for each billing record. The demand for each billing record was geo-coded according to the tax lot number for the record. Records that could not be matched to tax lots in the tax lot shapefile were geo-coded using the meter identification number and the City's service meter shapefile. The geo-coded demands were assigned in the model to the closest demand nodes (all model junctions excluding hydrant junctions and junctions on designated transmission piping).

Demands for the Maximum Day Demand Scenario were scaled up from the maximum month average daily demand calculated from the billing records to match the historical total maximum day demand. Demands calculated from the billing records for the minimum month and annual average day were also scaled to match the historical total system demand for each condition. This is done to include unaccounted for water in the model demands.

Daily Water Use Pattern

The daily water use pattern, or diurnal pattern, was calculated from SCADA records of flow rate through the master meters and tanks levels. Separate diurnal patterns were calculated for the average demand and maximum demand days. The average day diurnal pattern is used for the Minimum Month Demand and Average Day Demand scenarios. Data were not available to calculate a diurnal pattern for the minimum month demand because the Vilas Rd. Master Meter was not connected to SCADA until the end of May 2006.

MODEL ELEMENTS

Model elements include all of the physical facilities in the City's water system, including pipes, tanks, pumps and control valves. Each of these elements is discussed in detail below.

General Model Attributes

Each model element has attributes that describe the element characteristics. **Table 1** describes the model attributes that apply to all facilities. The model attributes specific to each element type are described in the following sections.

Table 1. General Model Attributes

Attribute	Value
ID	ID numbering is alphanumeric, with a prefix and a unique identifier. The prefix indicates element type: J (Junction), P (Pipe), T (Tank), PU (Pump), or V (Valve). The unique identifier includes text describing the facility or a unique number.
Description	A text description is given of tank, pump, and valve.
Installation Year	The installation year will be set to 1999 for all existing facilities. Only facilities installed before or on 2007 are modeled in the Existing Scenario. This attribute will later be used to include future pipes in model scenarios based on the year that they are planned for.
Retirement Year	The retirement year will be set to 9999 for all existing facilities. This attribute will later be used to exclude proposed abandoned pipes from a model scenario based on the year that they are planned to be abandoned.

Junctions

Junction nodes are created in the model at all changes in pipe diameter, pipe connections, intersections, dead ends, and hydrant locations. As previously discussed, all demands are applied to junctions in the model. **Table 2** lists the attributes applied to the junctions and the source used.

Table 2. Junction Attributes

Attribute	Value		
ID	*Facility* J (Junction)	*Unique Identifier* 1, 2, …	*Sample ID* J-1, J-2, …
Elevation	Interpolated from 2 ft contour data provided by City. Verified with GIS data of fittings and meters.		
Demand1	*Scenario*	*Description*	*Data Source*
	Dynamic Calibration	Demands from selected calibration day	Calculated from SCADA and billing records
	Hydrant Test Calibration	Demand at time of test	
	Existing Max Day	Existing max day demands	
	Existing Min Day	Existing min day demands	
	Existing Avg. Day	Existing average day demands	
Demand2	*Scenario*	*Description*	*Data Source*
	Hydrant Test Calibration Scenarios	Measured flow rate from test hydrant (applied to junction representing the test hydrant only)	Measured during calibration testing
Pattern 1	*Scenario*	*Description*	*Data Source*
	Dynamic Calibration	Existing max day diurnal pattern	Calculated from SCADA records
	Existing Max Day		
	Existing Min Day	Existing min day diurnal pattern	
	Existing Avg. Day		
	Hydrant Test Calibration	None	

Pipes

Table 3 lists the model's pipe attributes. Pipes were created from GIS data provided by the City. The "OWNER" attribute field in the GIS data designates some pipes as abandoned, proposed, or part of the MWC water system. Pipes with either of these designations were not included in the model. InfoWater uses the Hazen-Williams equation to determine friction-related headloss. The roughness factor (C-Factor) used in the equation is assumed for each pipe based on pipe material, lining and age. Lower factors equate to higher headloss. Pipes in the model were initially assigned the C-Factors shown in **Table 3**. C-Factors for some of the pipe materials were adjusted slightly during calibration.

Table 3. Pipe Attributes

Attribute	Value			
ID	*Facility*	*Unique Identifier*	*Sample ID*	
	P (Pipe)	1, 2, …	P-1, P-2, …	
Length	Calculated by model based on actual GIS distance			
Diameter	From GIS data "DIAMETER" attribute field			
Roughness (Hazen-Williams C Factor)	*Pipe Material*	*Age*	*C Factor*	*Reference*
	Asbestos Cement		140	[2, Linsley]
	Concrete		130	[2, Linsley]
	Cast Iron, Unlined	New	130	[2, Linsley]
		5 Years Old	120	[2, Linsley]
		20 Years Old	100	[2, Linsley]
	Cast Iron, Mortar Lined		130	[2, Linsley]
	Ductile Iron, Cement Lined		130	[2, Linsley]
	Galvanized		120	[3, InfoWater]
	PVC		140	[1, AWWA]
	Steel		120	[2, Linsley]
	Transite		140	[2, Linsley]
Material	From GIS data "TYPE" attribute field, assumed Ductile Iron where type not known			

Tanks

Tanks are used to model storage reservoirs. The City's tank locations were taken from the GIS data. All other information was provided by City Staff. **Table 4** lists the model's tank attributes.

Table 4. Tank Attributes

Attribute	Value		
ID	*Facility*	*Storage Reservoir Name*	*Sample ID*
	TNK (Tank)	One Million Gallon, …	TNK-1MG
Type	All tanks are cylindrical tanks according to information provided by City staff.		
Elevation	Record drawings were in an unknown data so the tank bottom elevation for 1 MG Tank interpolated from 2 ft. contour data. The 2 MG Tank is partially buried so the record drawing base elevation was used as starting point and adjusted during calibration.		

Attribute	Value
Initial Level	Different for each scenario. Set based on SCADA records.
Max Level	Overflow elevation from record drawings provided by City staff.
Min Level	Assumed to be zero.
Diameter	Tank diameter form record drawings provided by City staff.

Pumps

There is only one pump station in the system. A pump curve was provided by the vendor for both pumps at the pump station. SCADA records were used to calculate an operating point for the pumps which was used to adjust the pump curves. **Table 5** lists the model's pump attributes.

Table 5. Pump Attributes

Attribute	Value		
ID	*Facility* PU (Pump)	*Pump Name* Shops Pump 1, …	*Sample ID* PU-SHOPS1, …
Type	Multipoint		
Pump Curve	From pump curve supplied by the pump vendor (adjusted to match field data).		

Valves

The only valves in the system are isolation valves and flow control valves (FCV) at the master meter stations. Isolation valves are not included in the model as a separate model element. Closed isolation valves are modeled by simply closing model pipes. The FCVs are set up to control flow according to certain parameters, such as tank level, pressure or flow rate, to match typical operations of the system. **Table 6** lists the model's flow control valve attributes.

Table 6. Valve Attributes

Attribute	Value		
ID	*Facility* FCV (Flow Control Valve)	*Connection Point Name* Vilas Road, …	*Sample ID* FCV-VILAS, …
Type	Pressure Reducing Valve, Flow Control Valve or Throtle Control Valve depending and field settings.		
Elevation	The elevation was interpolated from the contour data like the Junctions.		
Setting	Provided by City staff and adjusted slightly during calibration.		
Minor Loss	Standard minor loss coefficient of 5.		

Water Supply

Variable head reservoirs are used as the source of water at each of the 3 connections to the MWC water system. The reservoir head is varied to match fluctuations in delivery pressures from

MWC at the connections throughout the day. A typical head vs. time of day relationship was developed for each of the connection points from the SCADA records provided by the City. These relationships are applied to the reservoir at each connection. Calibration indicated that pressure readings at Hopkins Master Meter Station were too high, so the head vs. time relationship for Beall Master Meter Station was applied to Hopkins as well. **Table 7** lists the model's connection point reservoir attributes.

Table 7. Connection Point Reservoir Attributes

Attribute	Value		
ID	*Facility* C (Connection)	*Connection Point Name* Vilas, …	*Sample ID* C-VILAS, …
Type	"Variable Head Reservoir" to simulate pressure fluctuations at connection points		
Elevation	Initial pressure (in equivalent feet of head) at the connection points		
Pattern	Pattern of Head vs. Time calculated from SCADA records for each scenario		

REFERENCES

1. AWWA, *Computer Modeling of Water Distribution Systems*, M32, Second Edition, 2005, American Water Works Association, pp. 23.
2. Linsley, R. K. and Franzini, J. B., *Water Resources and Environmental Engineering*, Third Edition, 1979, McGraw-Hill Book Company, pp. 281.
3. MWH Soft, *InfoWater Help*, 2005.

APPENDIX C

TM-2 Calibration Test Plan

BROWN AND CALDWELL

Technical Memorandum

To: City of Central Point **Date:** August 6, 2007

From: Jacob Young, Josh Brown, Ed Olson

Project Name: Water System Model Build

Subject: TM-2 Calibration Test Plan

This technical memorandum (TM) describes the calibration field testing for the culinary water distribution system for the City of Central Point (City). This TM includes a discussion of the personnel and equipment needed for the testing, SCADA data to be collected, test procedures, and test locations. The purpose of calibration testing is to discover the actual operating conditions that occur in the water distribution system. The field testing data will be compared with computer model output to confirm that the model provides accurate results when executed.

PERSONNEL

A representative from Brown and Caldwell will be present to coordinate the calibration testing and to help collect and record test data. A representative from Public Works Management (PWM) and a City staff member will help in data collection and will operate hydrants, pumps, etc.

PREPARATION

The calibration test locations are attached at the end of this TM. Table 1 lists the equipment needed for the calibration testing. Equipment should be checked prior to the day of testing to verify that it is functional and/or accurate. Watches used to record the time of each test should be synchronized to the SCADA clock to ensure that the test data can be correlated accurately to SCADA data.

Table 1. Required Equipment for Calibration Testing

Item	Quantity	Provided By
Hydrant Key	1	City
Crescent Wrench	1	City
Flow-Metering Hydrant Diffuser	1	PWM
Calibrated 100 psi Pressure Gauge	1	PWM
Calibrated 200 psi Pressure Gauge	1	PWM
Hose Bib Connection for Pressure Gauge	1	PWM
Hydrant Cap w/ ¼” threaded tap (for pressure gauges)	1	PWM

SCADA DATA

Some of the data for calibration will be collected from the city's SCADA system historical database, including:

- Metered flow rates at the 3 connections to MWC
- Pump discharge flow rate and suction and discharge pressure
- Tank water levels at both tanks
- Pressures reading at all 7 active pressure stations
- Control valve settings at the 3 connections to MWC

The data should be collected for the entire week that includes the day of field testing. Data from the day of testing will be used for the steady-state calibration of the model while data from the other days of the week will be used for the dynamic calibration. The data should be provided in an electronic format (preferably excel) for the shortest time step available (i.e. 5 minute readings).

FIELD TESTING

Three types of field tests will be performed: fire flow tests, master meter tests, and a pump test. Each test should follow the procedures described below. The testing is expected to take approximately one day. All data and comments should be recorded on the forms provided by Brown and Caldwell. During the testing period, any valves in the system that are known or suspected to be closed should be reported to the Brown and Caldwell representative.

Fire Flow Tests

The objective of fire flow tests is to obtain instantaneous flow and pressure data at various locations throughout the distribution system. The fire flow tests must "stress" the distribution system so that the calibration data will reflect the system's reactions to a range of operating conditions. To accomplish this, water is released during each test from one or more hydrants until a minimum pressure drop of 5 psi (10 psi desired) is experienced at the test location. Up to six fire flow tests will be preformed through out the system. Test locations are strategically located to obtain good overall flow and pressure measurements for the City. (Note: These tests are not the same as hydrant tests performed to determine available flow from a hydrant.) The steps for setting up the fire flow tests are listed below.

Step 1 - Synchronize watches with the SCADA system.

Step 2 - Set up one pressure gage at the residual test site (remove cap from 2-1/2 inch nozzle and open hydrant valve to flush barrel before attaching pressure gauge or attach to a hose bib).

Step 3 - Record the static pressure at test site hydrant and the time of the test.

Step 4 - Set up the hydrant diffuser at the flow test site (flush the hydrant prior to installing the diffuser to clear debris that could damage the diffuser or interfere with the test).

Step 5 - By radio, the test coordinator instructs the person operating the flow hydrant to begin the test flow. The hydrant is opened until a minimum 5 psi pressure drop is observed at the residual test site hydrant. If a sufficient pressure drop cannot be obtained, an additional hydrant will be opened.

Step 6 - When pressure at the test site and flow from the hydrant(s) stabilize (usually three to five minutes), the coordinator calls for and records the flow from the hydrant(s) and records the pressure at the test site hydrant. The time of the reading is recorded. It is also important to record the location of each hydrant.

Step 7 - The coordinator instructs the flow hydrants to be closed. It is **VERY IMPORTANT** that the hydrants be closed **SLOWLY** (over about a one minute period) to prevent the rupture of pipes caused by water hammer.

Step 8 - The coordinator again reads and records the static pressure at the test location.

Step 9 - The test is concluded (remove equipment and replace hydrant caps). Move to the next site and perform the next test (Steps 2-9).

Pump Tests

A single operating point will be determined for each pump. Pressure gauges will be attached to the piping upstream and downstream of each pump where pressure gauges are not already attached or if the attached gauges are not functioning. While the pump is running, the pump flow rate and upstream and downstream pressures will be recorded. The steps for setting up the pump test are listed below.

Step 1 - Attach a pressure gauge on the discharge side (and suction side if possible) and record the pressure.

Step 2 - Record the time.

Step 3 - Collect flow from SCADA or a flow meter for the pump at the time the pressure is recorded (SCADA flows will be collected later).

Step 4 - If the pump has a variable frequency drive (VFD), record the pump speed.

Pressure Station Verification

Pressure station verification will be performed to confirm that the SCADA system is recording accurate pressure readings. The tests will provide a single pressure reading for each pressure station. Calibrated pressure gauges should be used to read the pressure at each of the 7 active pressure stations. The steps for performing the pressure station verification are listed below.

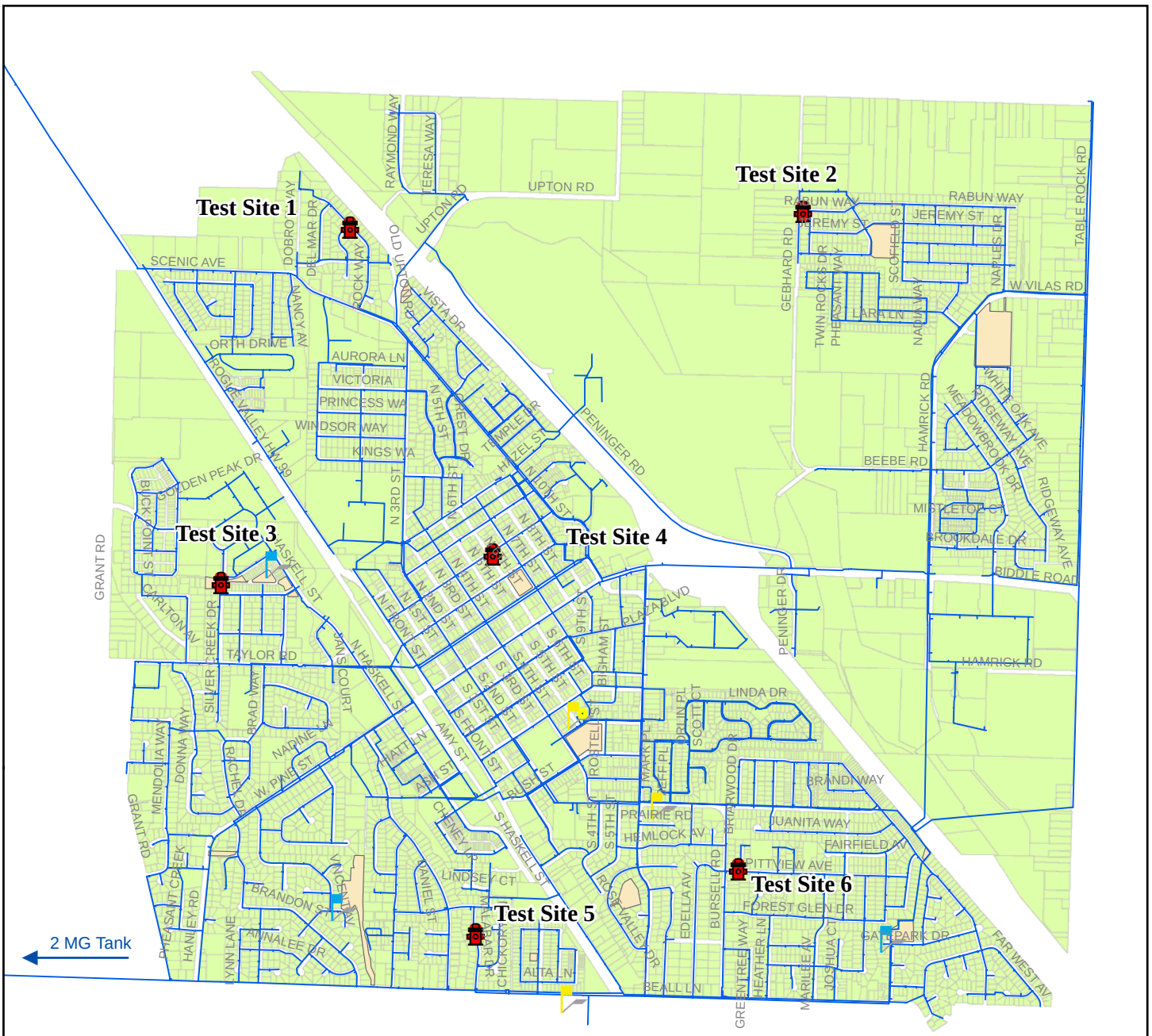
Step 1 - Attach a calibrated pressure gauge as close as possible to the SCADA system pressure sensor. If a ¼” tap is not accessible on the piping next to the SCADA sensor, the pressure gauge should be attached at the closest hose-bib or

hydrant. In this case, the difference in elevation between the SCADA sensor and pressure gauge should be recorded.

Step 2 - Record pressure and time of reading on the forms provided.

TEST LOCATIONS

The pressure station verification tests will be preformed at each of the existing pressure stations located throughout the City. The pump test will be performed on the pumps in the pump station near the 1 MG tank. The following figures show the fire flow test locations. Operating the hydrant over the 3-5 minutes needed for each test could cause flooding or erosion damage. The City should check the fire flow test location prior to the day of testing to ensure that each location is suitable. During field inspection or calibration testing, if any of the locations are not found to be suitable or operable, an alternate site will be selected and documented with approval of the Brown and Caldwell representative.



Legend

- Flow
- Exist Pressure Station
- Exist Pressure Station (Master Meter)
- Water Lines
- Water Reservoirs
- Parks
- Taxed Lots

0 750 1,500 3,000

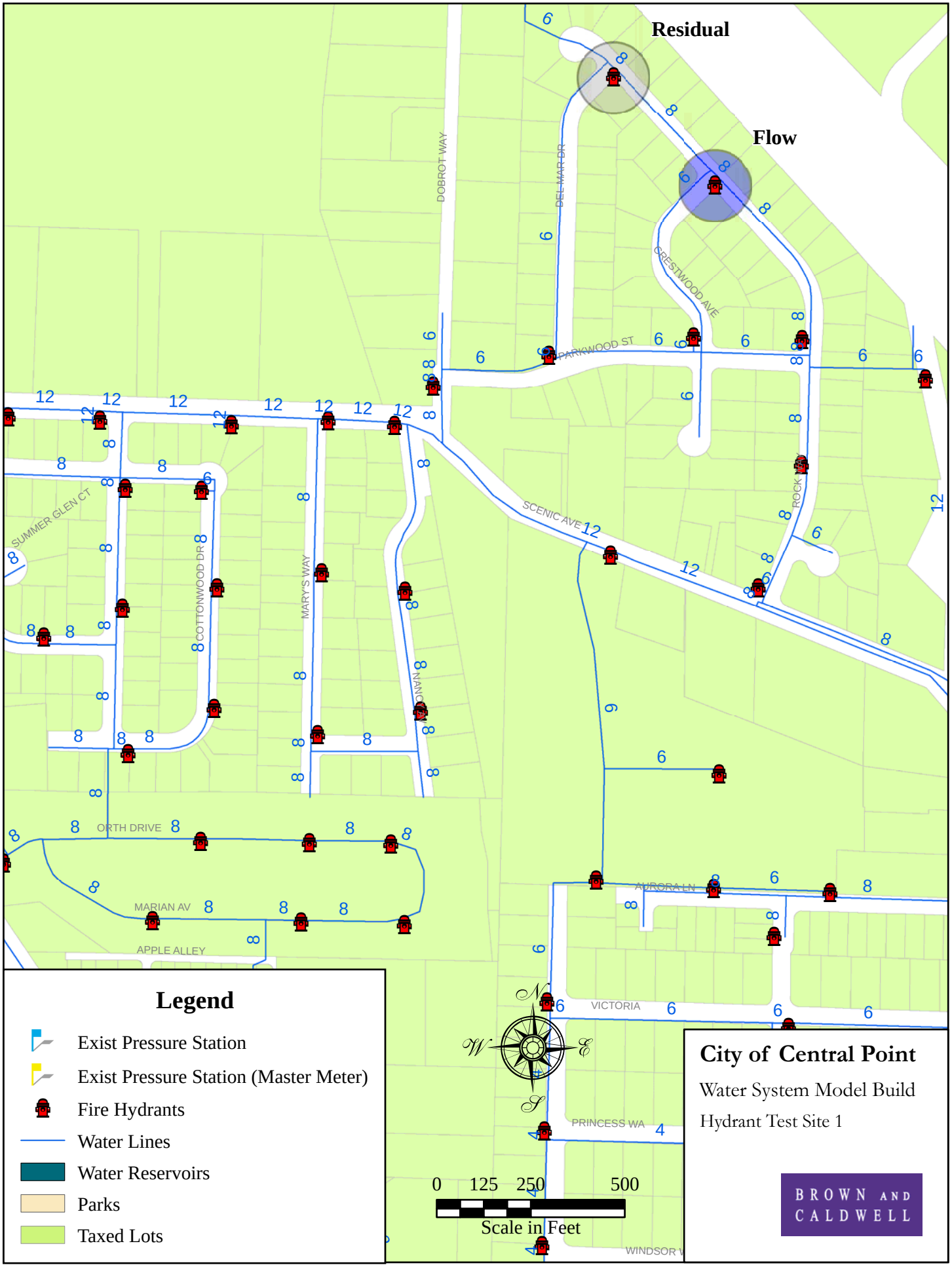
Scale in Feet

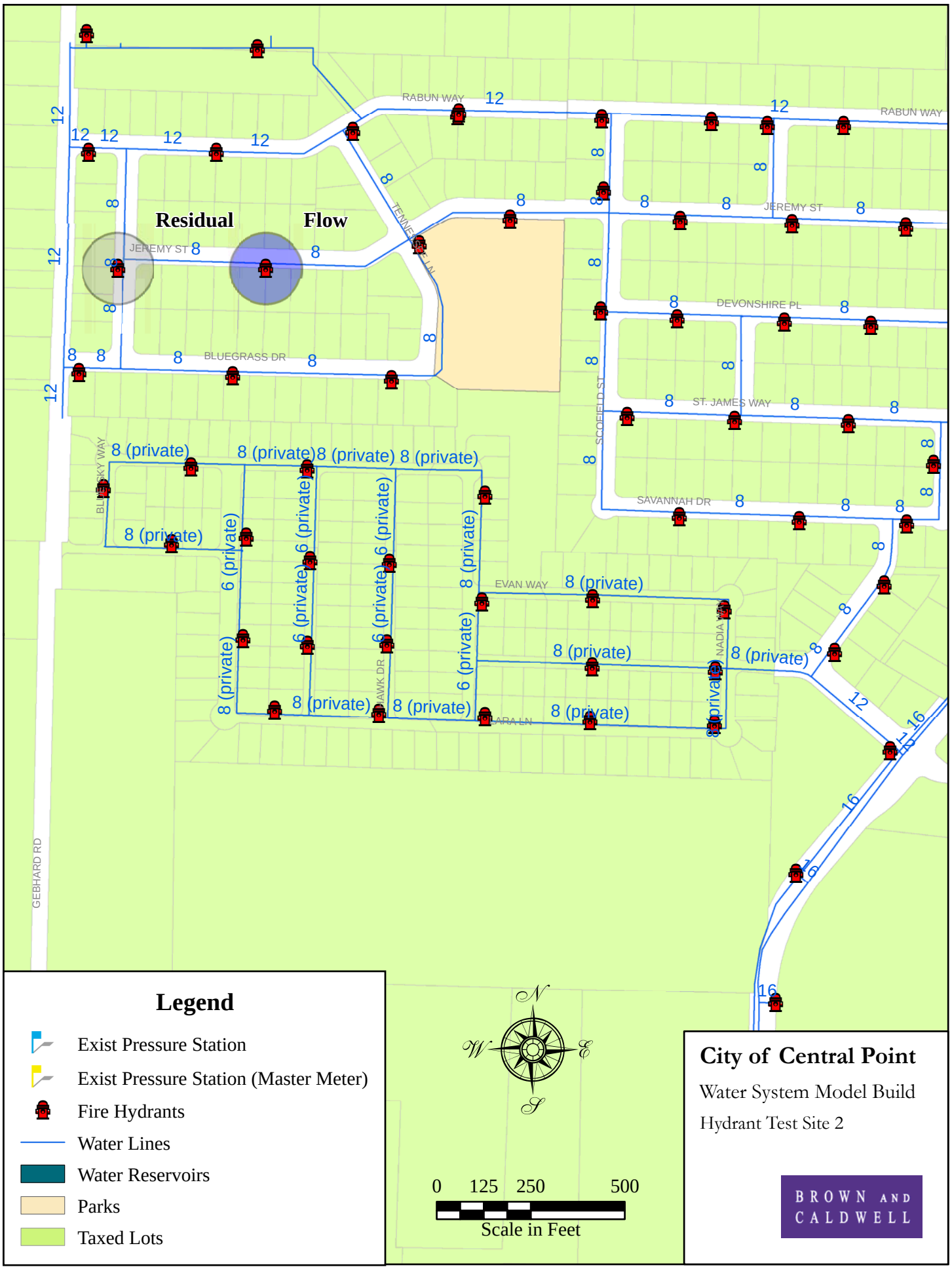
City of Central Point

Water System Model Build

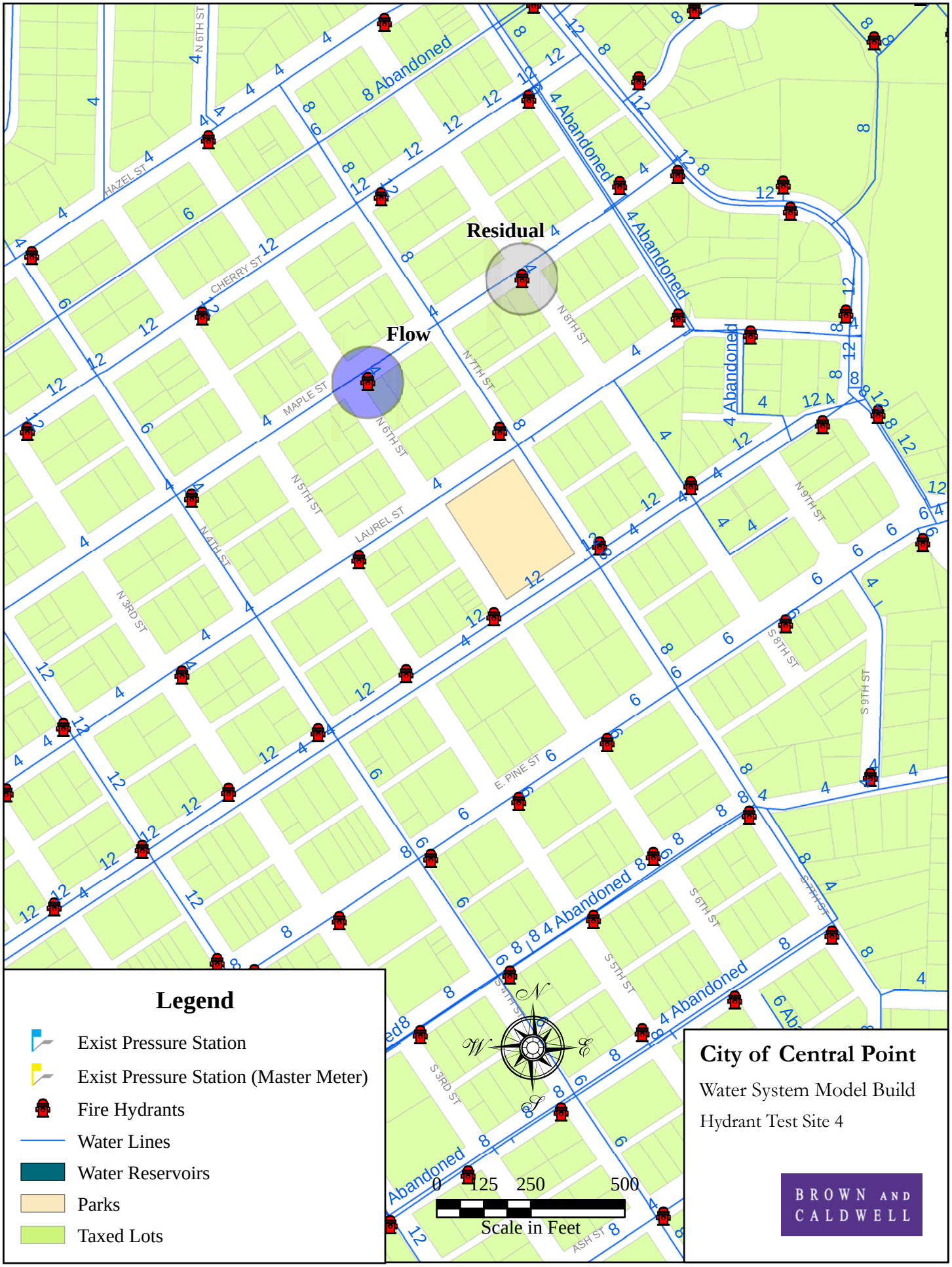
Hydrant Test Locations

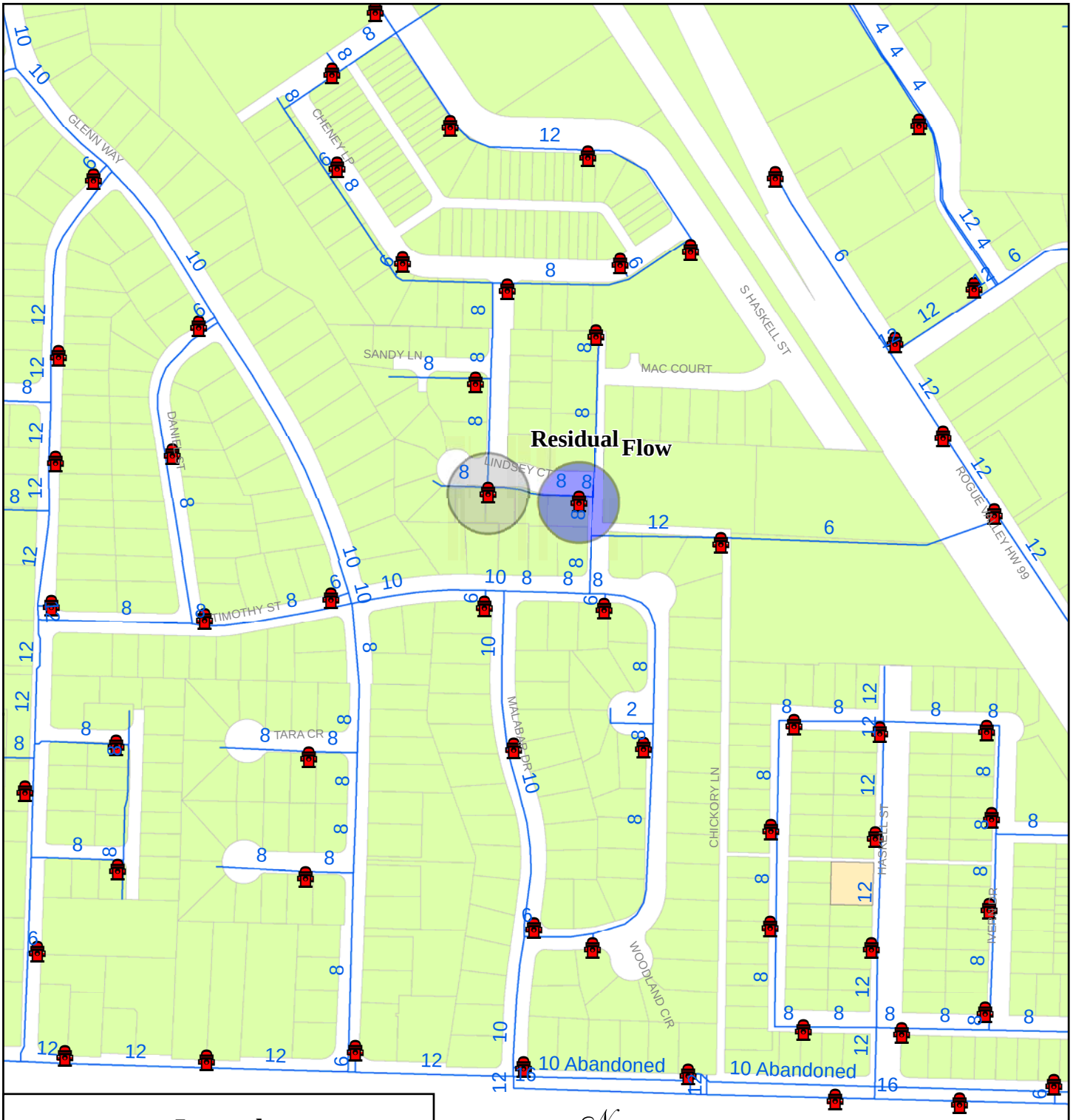
BROWN AND CALDWELL


Residual
Flow
DOBROT WAY
DEL MAR DR
CRESTWOOD AVE
PARKWOOD ST
SCENIC AVE
ROCK WAY
SUMMER GLEN CT
COTTONWOOD DR
MARY'S WAY
NANCY WAY
ORTH DRIVE
MARIAN AV
APPLE ALLEY
AURORA LN
VICTORIA
PRINCESS WA
WINDSOR
Legend
Exist Pressure Station
Exist Pressure Station (Master Meter)
Fire Hydrants
Water Lines
Water Reservoirs
Parks
Taxed Lots
N
W
E
S
0 125 250 500
Scale in Feet
City of Central Point
Water System Model Build
Hydrant Test Site 1
BROWN AND CALDWELL


Residual
Flow
RABUN WAY
JEREMY ST
BLUEGRASS DR
DEVONSHIRE PL
ST. JAMES WAY
SAVANNAH DR
SCOFIELD ST
EVAN WAY
NADIA WAY
HAWK DR
LARA LN
GEBHARD RD
8 (private)
6 (private)
Legend
Exist Pressure Station
Exist Pressure Station (Master Meter)
Fire Hydrants
Water Lines
Water Reservoirs
Parks
Taxed Lots
N
W
E
S
0 125 250 500
Scale in Feet
City of Central Point
Water System Model Build
Hydrant Test Site 2
BROWN AND CALDWELL

Flow
Residual
TWIN CREEKS CRS
SANDOZ ST
SHAKE DR
BUCK POINT ST
STEAMBOAT DR
BLUE MOON DR
N HASKELL ST
ROGUE VALLEY HW 99
GRIFFIN OAKS DR
TULANE AV
CARLTON AV
SUNLAND AV
OAKLEY DR
RED OAK ST
8 Abandoned
8 Abandoned
Legend
Exist Pressure Station
Exist Pressure Station (Master Meter)
Fire Hydrants
Water Lines
Water Reservoirs
Parks
Taxed Lots
0 125 250 500
Scale in Feet
City of Central Point
Water System Model Build
Hydrant Test Site 3
BROWN AND CALDWELL


Residual
Flow
N 6TH ST
HAZEL ST
CHERRY ST
MAPLE ST
N 7TH ST
N 8TH ST
N 5TH ST
N 4TH ST
N 3RD ST
LAUREL ST
N 9TH ST
S 8TH ST
S 9TH ST
E. PINE ST
S 6TH ST
S 7TH ST
S 5TH ST
S 4TH ST
S 3RD ST
ASH ST
8 Abandoned
4 Abandoned
6 Abandoned
Legend
Exist Pressure Station
Exist Pressure Station (Master Meter)
Fire Hydrants
Water Lines
Water Reservoirs
Parks
Taxed Lots
0 125 250 500
Scale in Feet
N
W
E
S
City of Central Point
Water System Model Build
Hydrant Test Site 4
BROWN AND CALDWELL



Legend

- Exist Pressure Station
- Exist Pressure Station (Master Meter)
- Fire Hydrants
- Water Lines
- Water Reservoirs
- Parks
- Taxed Lots

N
W E
S

0 125 250 500
Scale in Feet

City of Central Point

Water System Model Build

Hydrant Test Site 5

BROWN AND CALDWELL

BUSH ST
8 Abandoned
10 Abandoned
8 Abandoned
8 Abandoned
10 Abandoned
COPPER CT
ORLIN PL
HOPKINS RD
16 Medford
COUNTRYSIDE DR
PRIMROSE DR
SANDRA LN
PRAIRIE RD
HEMLOCK AV
Residual
Flow
ROSE VALLEY DR
ROSE VALLEY CT
SHAYLA LN
SYDNEY
LEVINGTON CT
EASY WAY
EDELLA AV
ISAAC WY
ARBORWOOD
Legend
Exist Pressure Station
Exist Pressure Station (Master Meter)
Fire Hydrants
Water Lines
Water Reservoirs
Parks
Taxed Lots
N
W
E
S
0 125 250 500
Scale in Feet
City of Central Point
Water System Model Build
Hydrant Test Site 6
BROWN AND CALDWELL

APPENDIX D

Steady-State Calibration Field Data and Results

This appendix presents the steady-state calibration field test data and model results. The Calibration Test Plan Memorandum (see **Appendix C**) shows the location of each test, with the exception of Test 5 which was moved to a near by hydrant. **Table D-1** shows a comparison of the field test data to the model results.

Table D-1. Steady State Calibration Results

Test	Model Pressure Results (psi)		Field Test Pressures (psi)		Difference (psi)[1]	
	Static	Residual	Static	Residual	Static	Residual
HT1	98	66	95	65	2	0
HT2	86	82	85	78	0	3
HT3	95	91	91	71	3	19
HT4	80	52	83	54	-4	-3
HT5	73	71	69	65	3	5
HT6	77	71	73	67	3	3

1) Difference between model results and field test pressures minus an additional 1 psi to account for height of the hydrant nozzle.

Table D-2 lists the assumptions and findings for each test. The two tables are followed by the field data gathered during the test and extracted from SCADA.

Table D-2. Steady-State Calibration Assumptions and Findings

Calibration Test	Comment
Hydrant Test 1	8" pipe on Dobrot Way appears to be the only open pipe to the area. 8" on Rock Way appears to be closed due to construction. New 12" not on line yet (not much difference if 12" is on line instead of old 8").
Hydrant Test 2	Left Vilas set to 73 psi instead of the 87 psi SCADA shows. There could be a closed or partially closed valve in the area creating the higher headloss seen in the field data but not in the model results during the hydrant flow.
Hydrant Test 3	Something appears to have occurred in the MWC system to create a large pressure drop during this test (i.e. pump station turned on). The pressure drop was system wide, so it in not likely to have been caused by the test.
Hydrant Test 4	4" Pipe on Maple between the two hydrants does not appear to connect to the 8" on 7th St. Adjusted all CI pipes with unknown istallation year down to a C-Factor of 105 from 130. (Re-ran all tests)
Hydrant Test 5	Adjusted C-Factor of all AC pipes from 140 to 130 and of DI pipes from 130 to 120 to match pressure drop during the hydrant flow. (Re-ran all tests)
Hydrant Test 6	Test results matched well with little adjustment.

HYDRANT FLOW TEST

Hydrant Location	Test Site #1	
Hydrant Number	481	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	10:41 AM	
Pressure		
Static Pressure	95	psi
Location Tested	Hydrant 482	
Residual Pressure	65	psi
Location Tested	Hydrant 482	
Hydrant Pressure	55	psi
	1250	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	78					-371	OPEN	15%	
Beall Lane				70	70	1017		99%	
Hopkins Road					83	1100			
Vilas Road					78	83		16%	
Shop	87				83				OFF
Flanagan					69				
Forest Glen					69				
North Haskell					83				

Daily Demand 4.75 mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

HYDRANT FLOW TEST

Hydrant Location	Test Site #2	
Hydrant Number	611	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	10:55 AM	
Pressure		
Static Pressure	85	psi
Location Tested	Hydrant 605	
Residual Pressure	78	psi
Location Tested	Hydrant 605	
Hydrant Pressure	70	psi
	1405	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	78					-152	OPEN	15%	
Beall Lane				68	70	147		99%	
Hopkins Road					82	1040			
Vilas Road					76	256		22%	
Shop	87				82				OFF
Flanagan					69				
Forest Glen					71				
North Haskell					79				

Daily Demand 4.75 mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

HYDRANT FLOW TEST

Hydrant Location	Test Site #3	
Hydrant Number	932	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	10:10 AM	
Pressure		
Static Pressure	91	psi
Location Tested	Hydrant 930	
Residual Pressure	71	psi
Location Tested	Hydrant 930	
Hydrant Pressure	72.5	psi
	1455	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	79					-1041	OPEN	21%	
Beall Lane				72	72	374		99%	
Hopkins Road					86	1289			
Vilas Road					79	134		18%	
Shop	87				86				OFF
Flanagan					69				
Forest Glen					65				
North Haskell					83				

Daily Demand 4.75 mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

HYDRANT FLOW TEST

Hydrant Location	Test Site #4 North 8th and Maple	
Hydrant Number	No #	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	10:30 AM	
Pressure		
Static Pressure	83	psi
Location Tested	North 6th and Maple	
Residual Pressure	54	psi
Location Tested	North 6th and Maple	
Hydrant Pressure	28	psi
	835	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	79					-362	OPEN	15%	
Beall Lane				73	72	915		99%	
Hopkins Road					86	1191			
Vilas Road					78	17		9%	
Shop	87				86				OFF
Flanagan					69				
Forest Glen					73				
North Haskell					85				

Daily Demand 4.75 mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

HYDRANT FLOW TEST

Hydrant Location	Test Site #5	
Hydrant Number	950	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	9:57 AM	
Pressure		
Static Pressure	69	psi
Location Tested	952	
Residual Pressure	65	psi
Location Tested	952	
Hydrant Pressure	58	psi
	1280	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	79					-3747	CLOSED	15%	
Beall Lane				66	66	940		99%	
Hopkins Road					79	1071			
Vilas Road					77	487		35%	
Shop	87				79				OFF
Flanagan					69				
Forest Glen					68				
North Haskell					79				

Daily Demand	4.75	mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

HYDRANT FLOW TEST

Hydrant Location	Test Site #6	
Hydrant Number	44	
Tester	Jeff Ballard	
Date	8/14/2007	
Time of Test	9:40 AM	
Pressure		
Static Pressure	73	psi
Location Tested	77	
Residual Pressure	67	psi
Location Tested	773	
Hydrant Pressure	60	psi
	1300	gpm

RELEVANT PRESSURES AND INFORMATION

	Level (% Full)	Discharge Pressure(psi)	Suction Pressure(psi)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (GPM)	Inflow Valve	Outflow Valve (% Open)	Pump
2 MG Reservior	79					-3747	CLOSED	15%	
Beall Lane				66	66	812		99%	
Hopkins Road					79	1129			
Vilas Road					76	366		30%	
Shop	87				79				OFF
Flanagan					69				
Forest Glen					64				
North Haskell					80				

Daily Demand	4.75	mgd

Comments: Pressure Measured from SCADA at Beall Meter was 2 psi below field gauge. Vilas and Hopkins SCADA pressures measured same as field gauges.

Calibaration Scenario Input (SCADA Data)

				Beall					Hopkins			Vilas					2 MG Tank			1 MG Tank			Flanagan	Forest Glen	North Haskel
Test	**Day of Test**	**Time**	**Date and Time**	**Upstream Pressure (psi)**	**Upstream HGL (ft)**	**Downstream Pessure (psi)**	**Downstream HGL (ft)**	**Flow (gpm)**	**Pessure (psi)**	**HGL (ft)**	**Flow (gpm)**	**Upstream Pessure (psi)**	**Upstream HGL (ft)**	**Downstream Pessure (psi)**	**Downstream HGL (ft)**	**Flow (gpm)**	**Level (% Full)**	**Level (ft)**	**Flow (gpm)**	**Level (% Full)**	**Level (ft)**	**Pump**	**Pessure (psi)**	**Pessure (psi)**	**Pessure (psi)**
HT1	8/14/2007	10:41	14-Aug 10:41	69	1456.36	72	1463.28	229.152	81	1456.36	938	83	1479.08	73	1456.02	43.75	78%	18.92	-371	87%	26.32	OFF	69	71	87
HT2	8/14/2007	10:55	14-Aug 10:55	72	1463.28	71	1460.97	650.6528	85	1463.28	961	87	1488.31	87	1488.31	0	78%	18.92	-152	87%	26.32	OFF	69	71	84
HT3	8/14/2007	10:10	14-Aug 10:10	66	1449.44	68	1454.05	279.8432	78	1449.44	994	76	1462.94	73	1456.02	267.3	79%	19.16	-1041	87%	26.32	OFF	69	59	80
HT4	8/14/2007	10:30	14-Aug 10:30	69	1456.36	72	1463.28	24.9984	81	1456.36	766	82	1476.78	75	1460.63	11.11	79%	19.16	-362	87%	26.32	OFF	69	75	90
HT5	8/14/2007	9:57	14-Aug 09:57	71	1460.97	70	1458.67	919.3856	82	1460.97	859	81	1474.47	79	1469.86	378.4	79%	19.16	0	87%	26.32	OFF	69	68	83
HT6	8/14/2007	9:40	14-Aug 09:40	71	1460.97	70	1458.67	1072.154	83	1460.97	887	81	1474.47	79	1469.86	223.6	79%	19.16	0	87%	26.32	OFF	69	68	83

APPENDIX E

Dynamic Calibration Results

This appendix includes graphs comparing the model results to SCADA data for the two 24 hr periods used for dynamic calibration: July 8, 2007 and August 17, 2007. The following is a summary of the assumptions and findings from the dynamic calibration:

- Beall FCV set to 80 psi (summer time setting).
- Hopkins FCV set to 3000 gpm (summer time setting). The valve operates at fully open at this setting.
- Vilas FCV set to 77 psi. Recorded downstream pressures and flow rate indicate that the valve is operating slightly lower than the summertime setting of 80 psi.
- Vilas upstream SCADA pressure used to set HGL at Vilas Master Meter Station
- Beall upstream SCADA pressure used to set HGL at Beall and Hopkins Master Meter Station. The Beall, Shops and Forest Glen SCADA pressures all indicate that Hopkins pressure readings are high (consistent 10-15 ft in HGL).
- Set 2MG tank elevation to 1455 to match inflow and outflow. The tank elevation should be surveyed and entered into the model.
- Flow rate from the master meter stations could not be matched, but this appears to have little affect on system pressures.

SCADA data shows that the pump station turns on due to momentary drops in pressure at the Shops Pressure Station. These drops in pressure were not captured in the model because the diurnal pattern was created from hourly averages; as a result, time controls were used to turn the pumps on in the calibration scenarios.

Dynamic Calibration Results

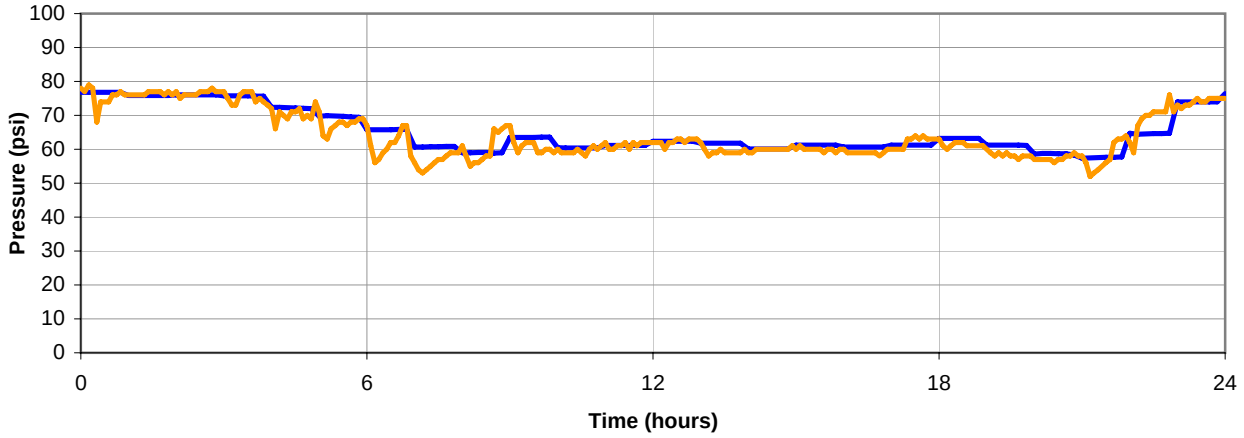
System Pressure

Test Day: 07/08/07

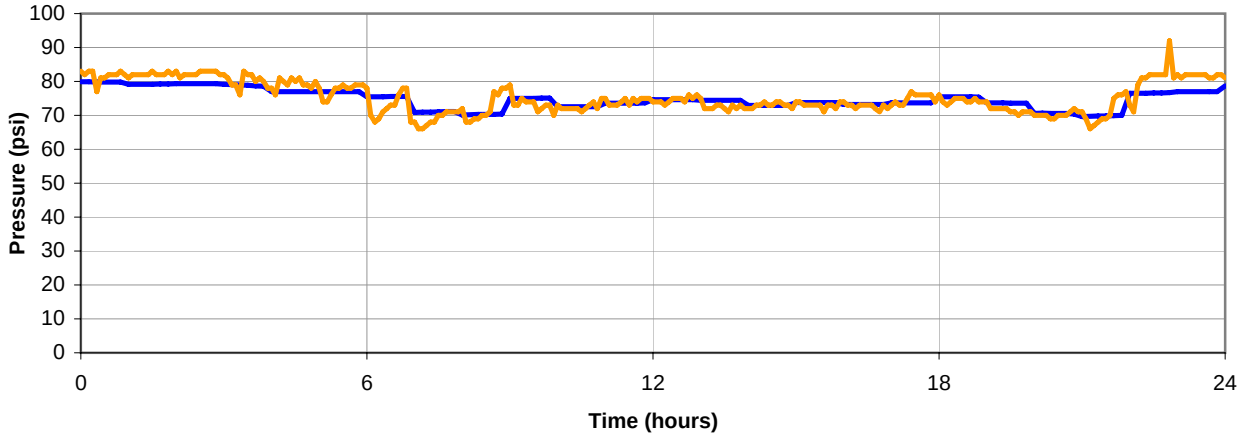
Model Results

Field Data

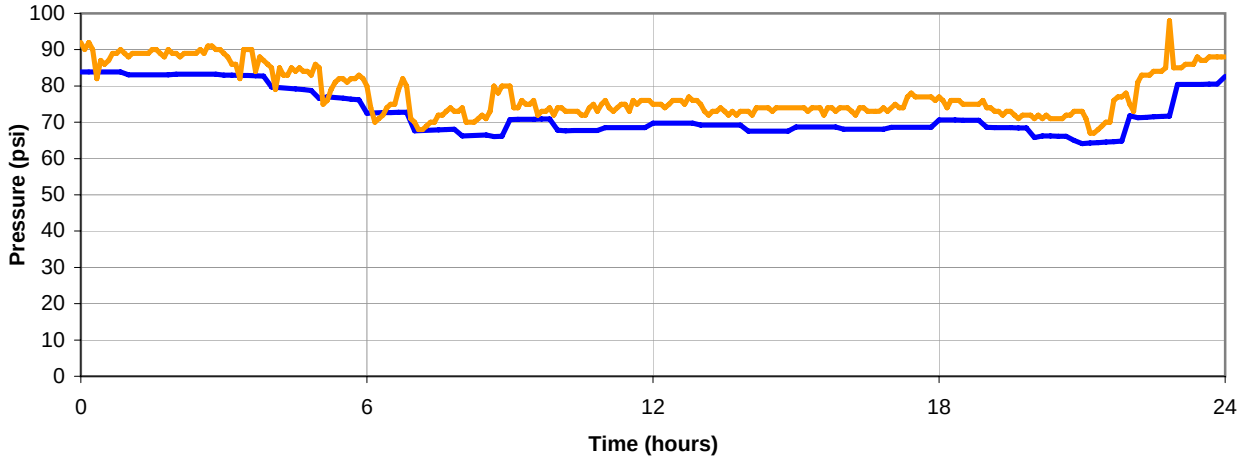
Beall Master Meter Station



Vilas Master Meter Station



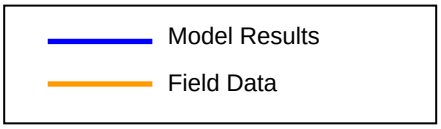
Hopkins Master Meter Station



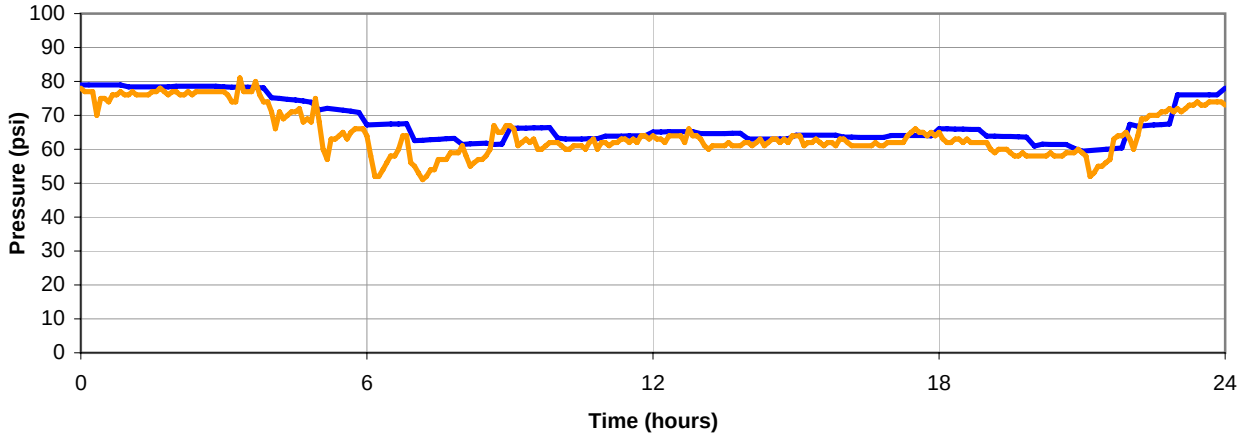
Dynamic Calibration Results

System Pressure

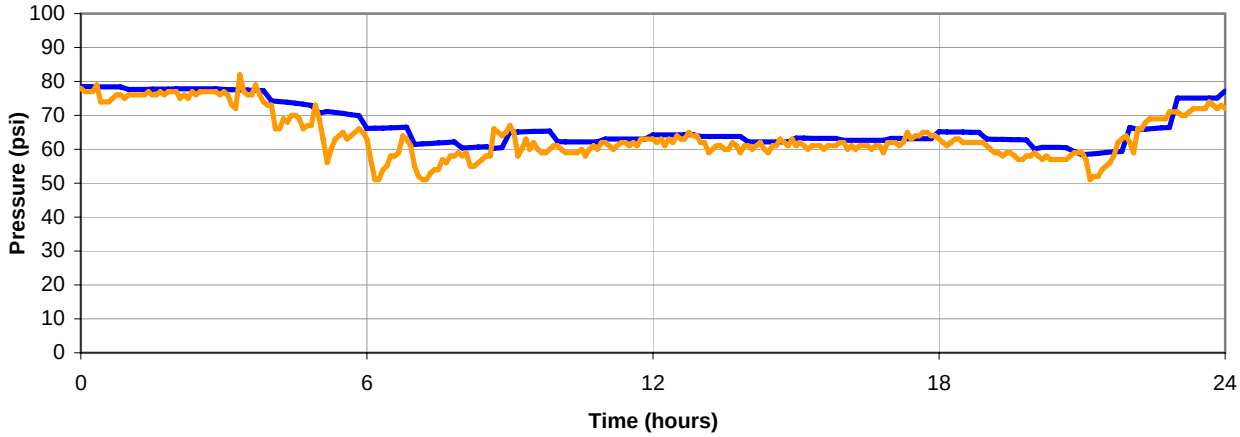
Test Day: 07/08/07



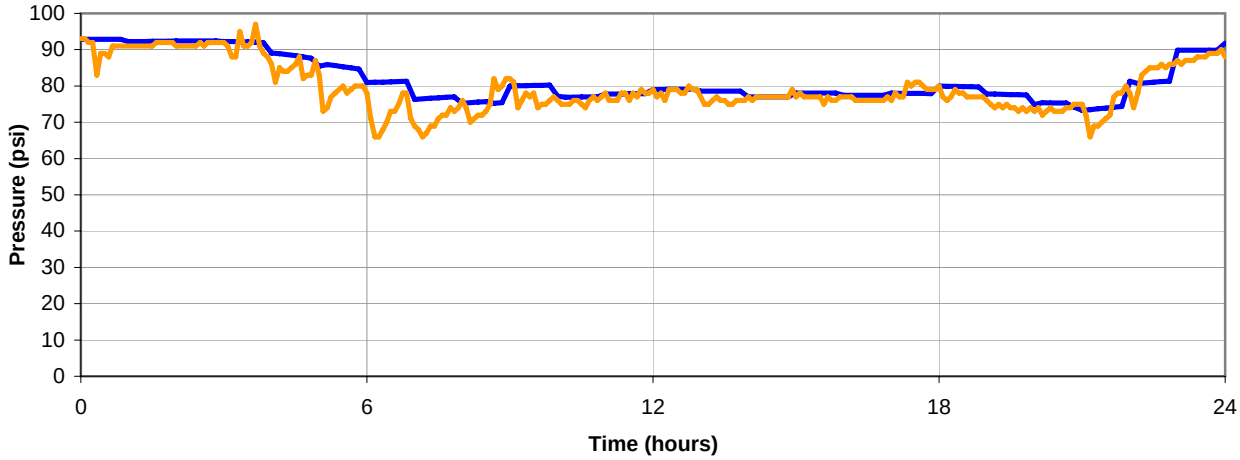
Flanagan Park Pressure Station



Forest Glen Park Pressure Station



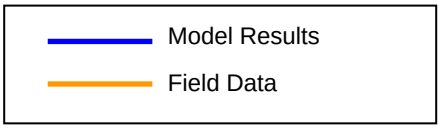
North Haskel Pressure Station



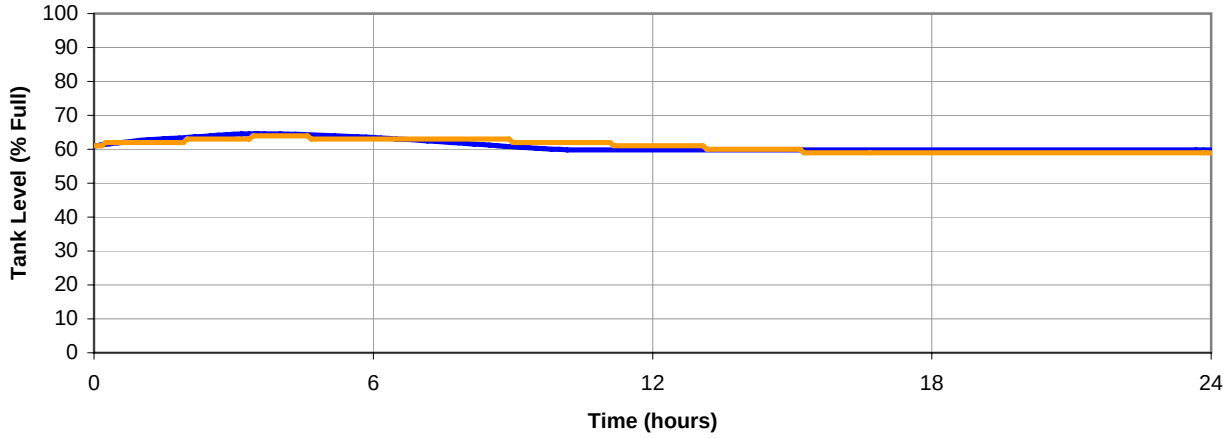
Dynamic Calibration Results

2 MG Tank Site

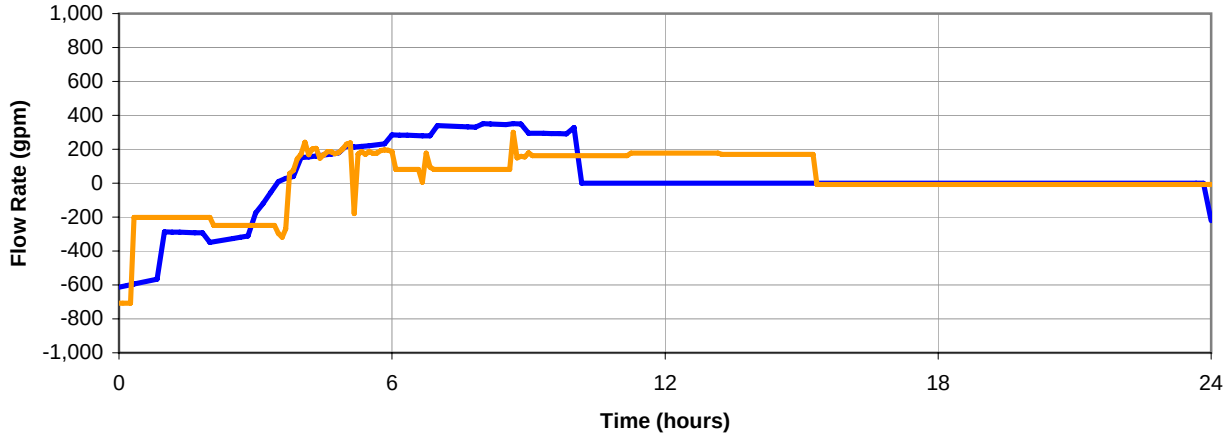
Test Day: 07/08/07



2 MG Tank



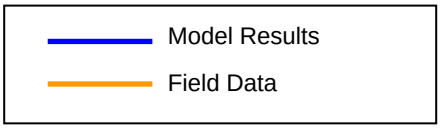
2 MG Tank Flow Meter



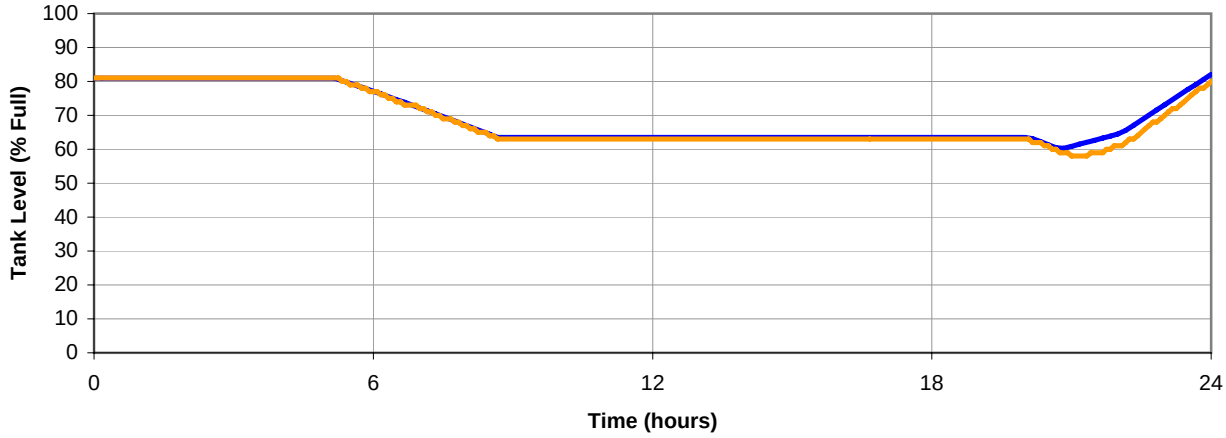
Dynamic Calibration Results

1 MG Tank Site

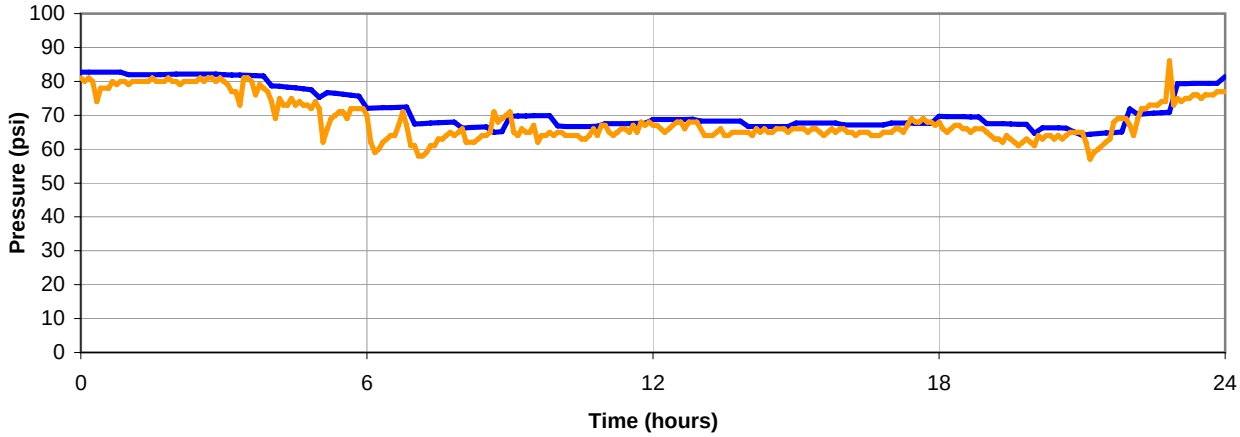
Test Day: 07/08/07



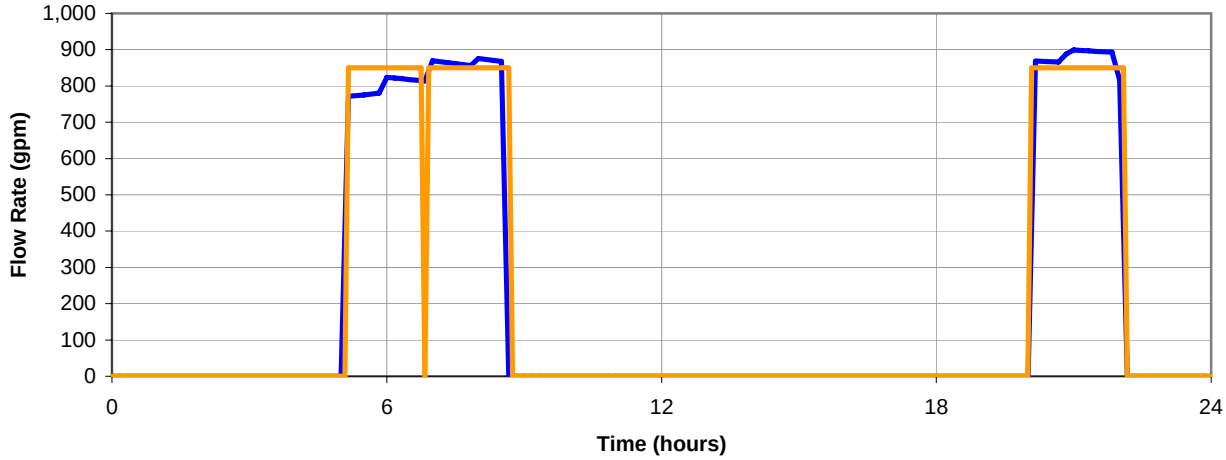
1 MG Tank



Shops Pressure Station



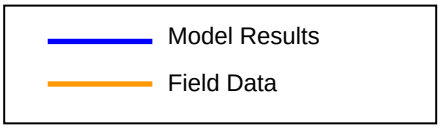
Shops Pumps



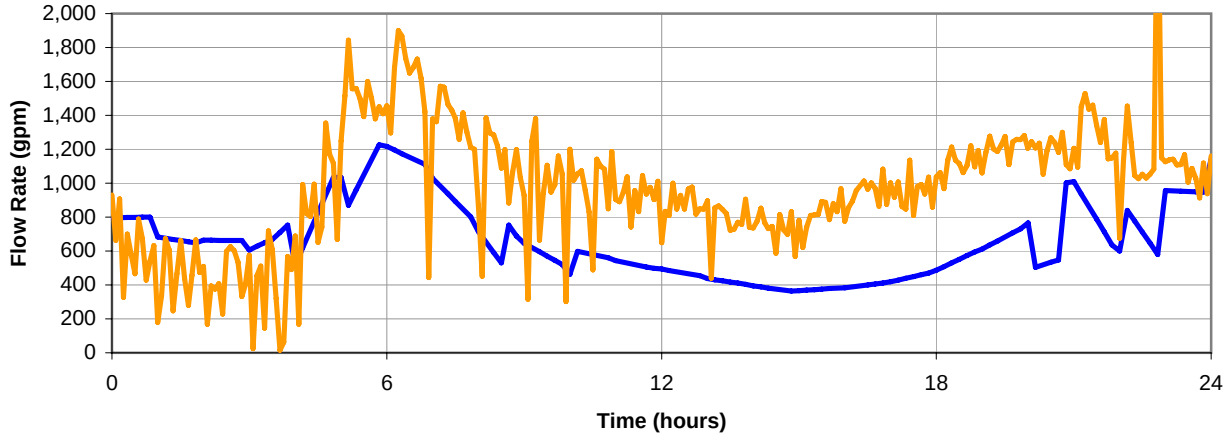
Dynamic Calibration Results

Master Meter Flow Rate

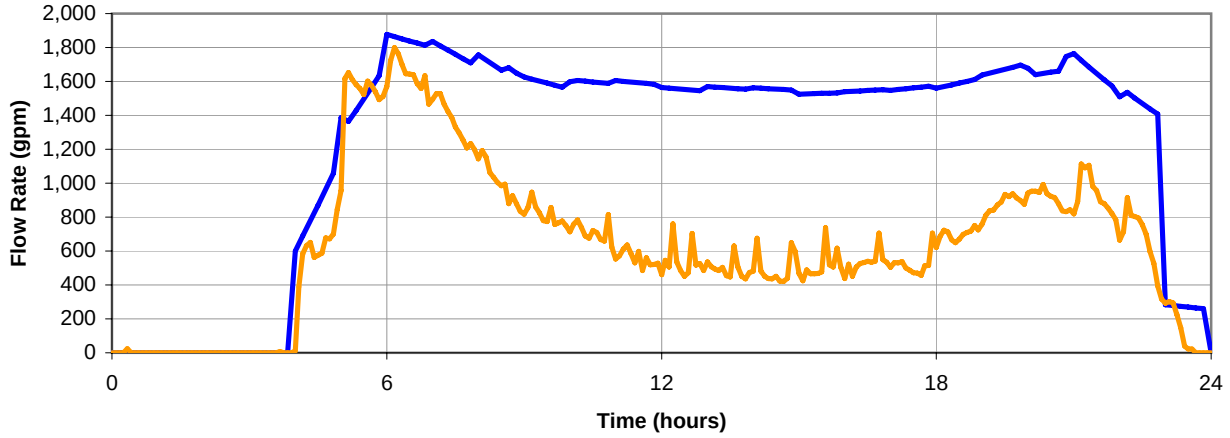
Test Day: 07/08/07



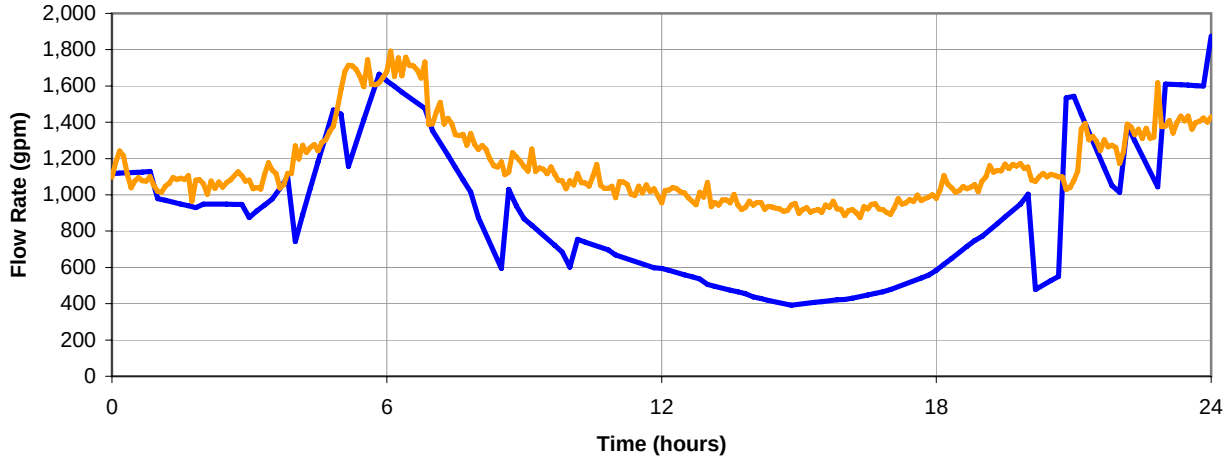
Beall Master Meter Station



Vilas Master Meter Station



Hopkins Master Meter Station



Dynamic Calibration Results

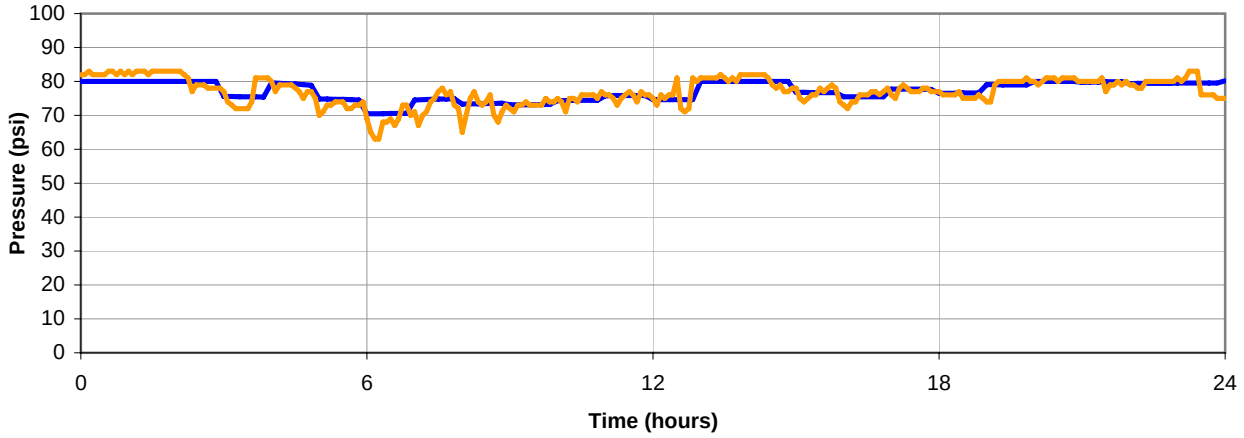
System Pressure

Test Day: 08/17/07

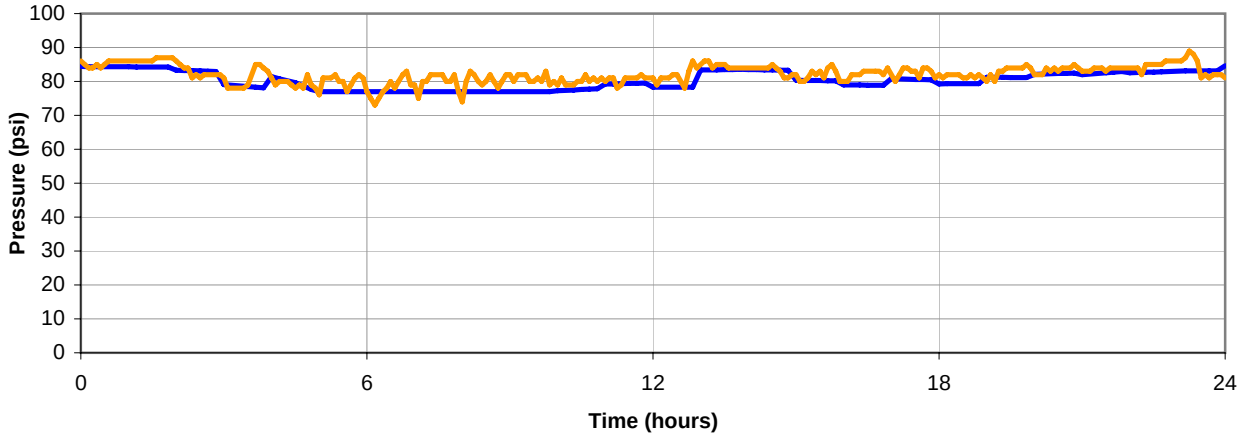
Model Results

Field Data

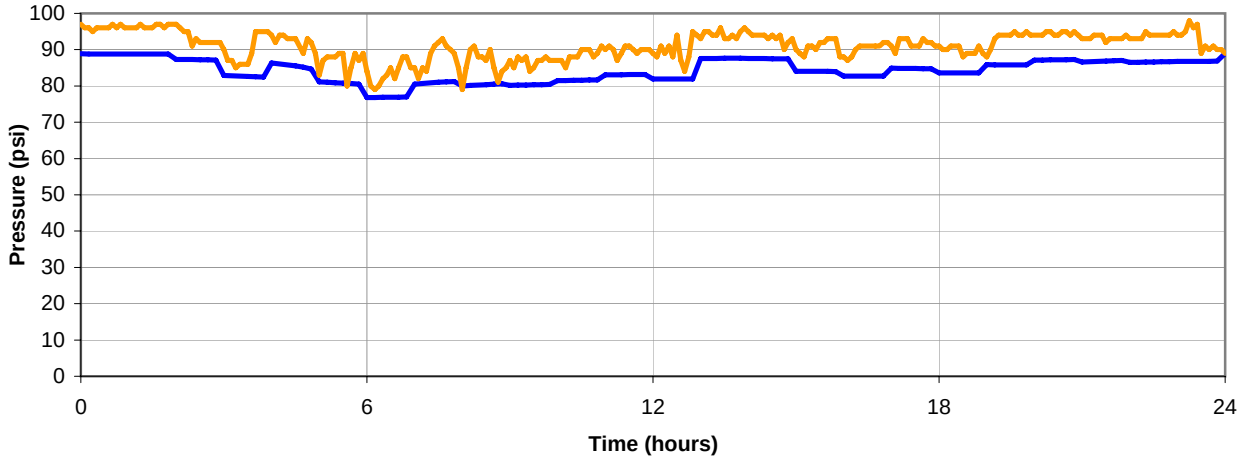
Beall Master Meter Station



Vilas Master Meter Station



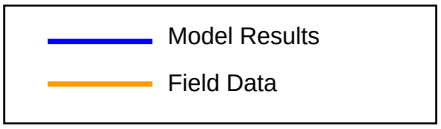
Hopkins Master Meter Station



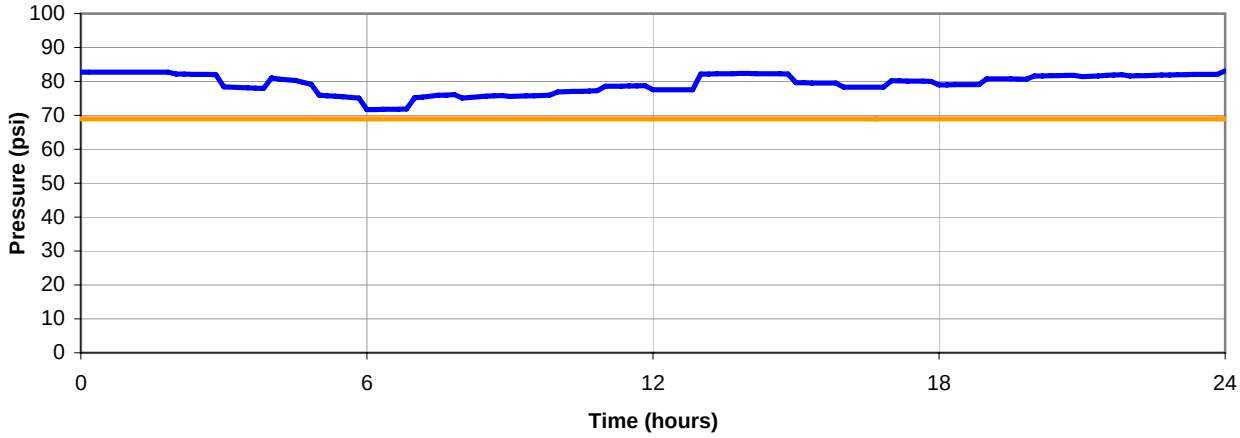
Dynamic Calibration Results

System Pressure

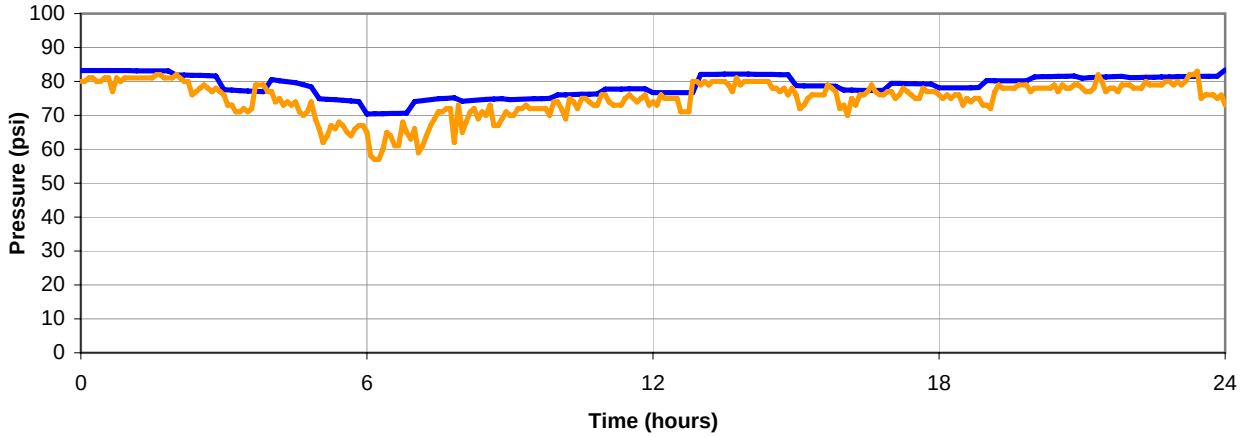
Test Day: 08/17/07



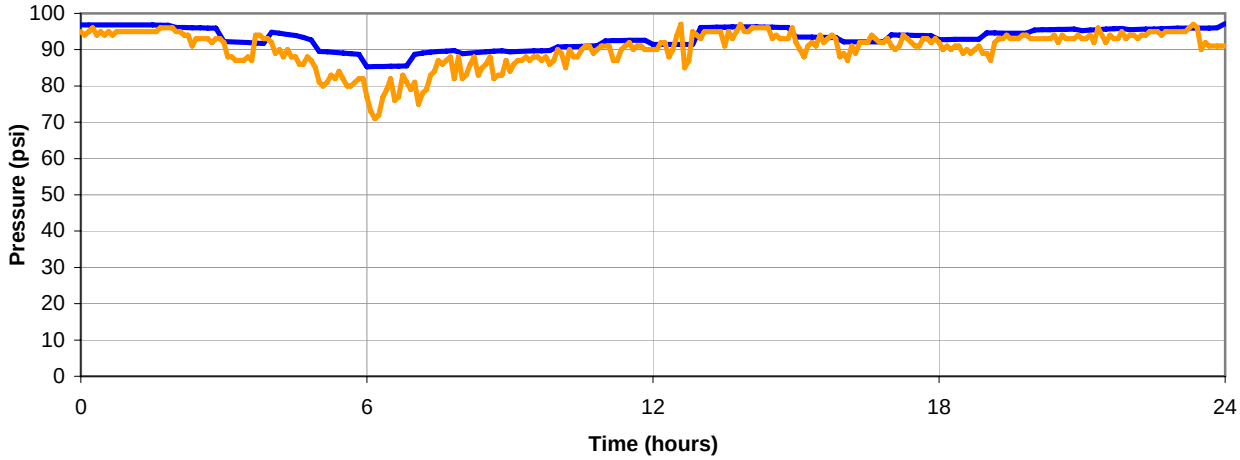
Flanagan Park Pressure Station



Forest Glen Park Pressure Station



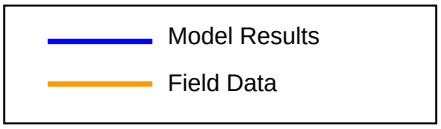
North Haskel Pressure Station



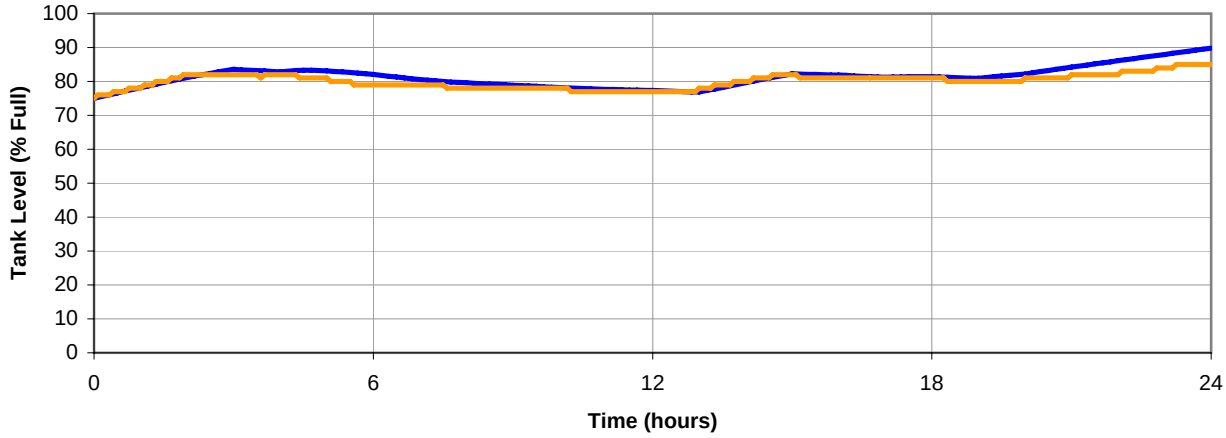
Dynamic Calibration Results

2 MG Tank Site

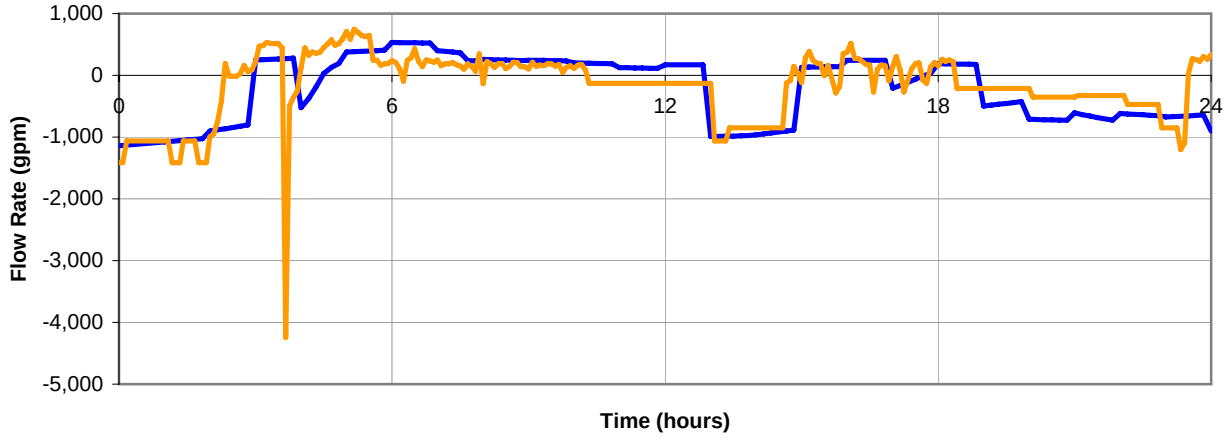
Test Day: 08/17/07



2 MG Tank



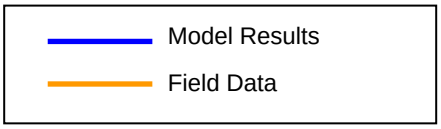
2 MG Tank Flow Meter



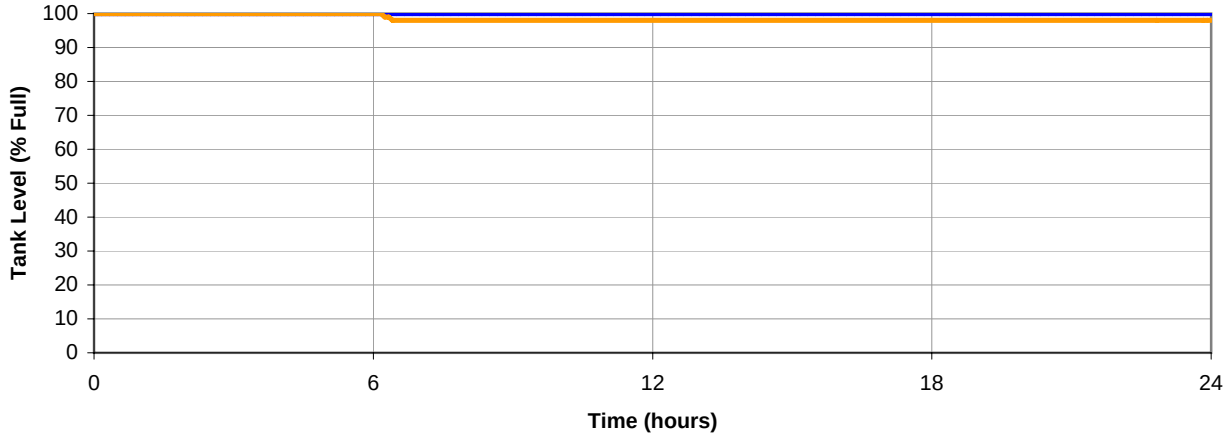
Dynamic Calibration Results

1 MG Tank Site

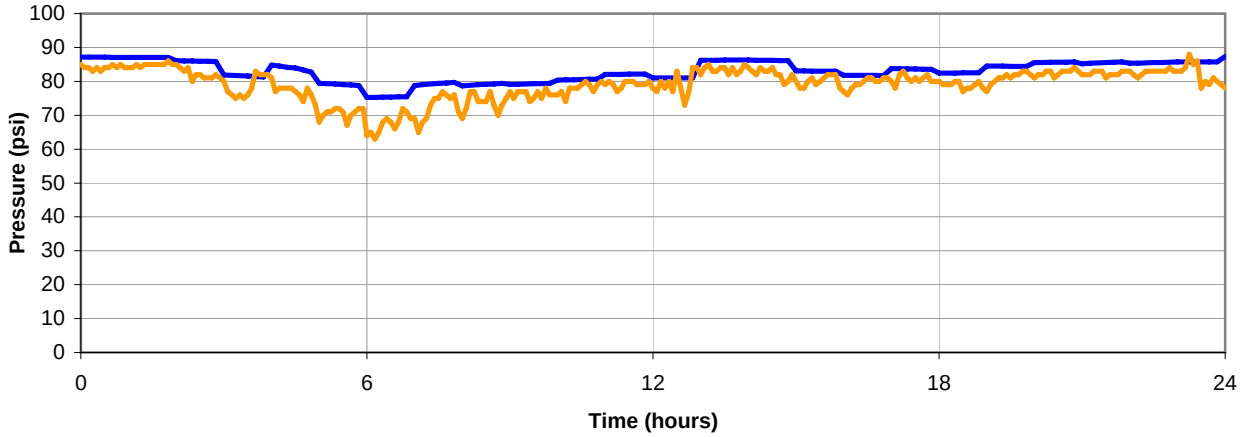
Test Day: 08/17/07



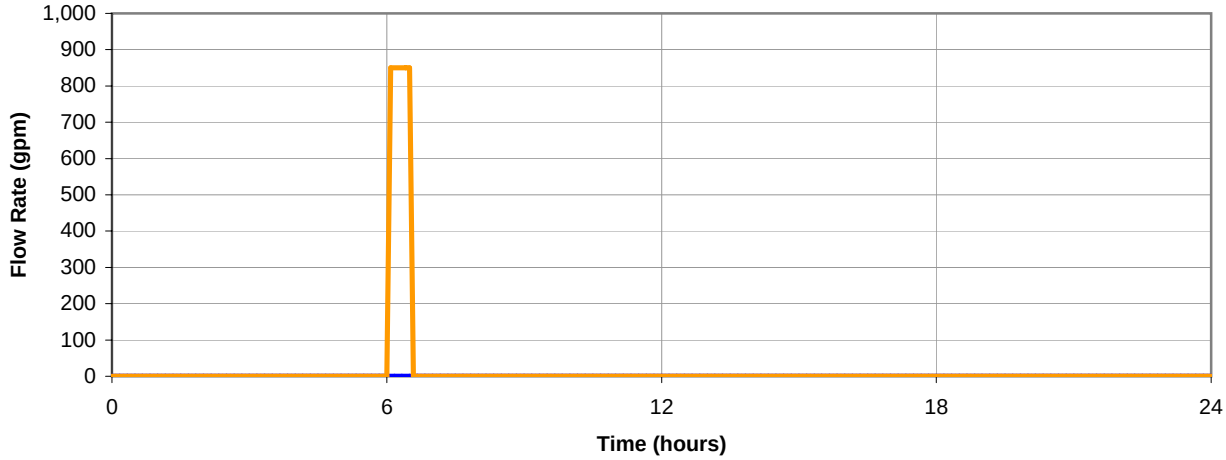
1 MG Tank



Shops Pressure Station



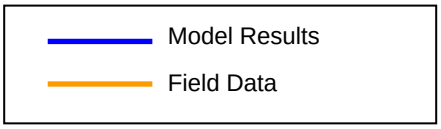
Shops Pumps



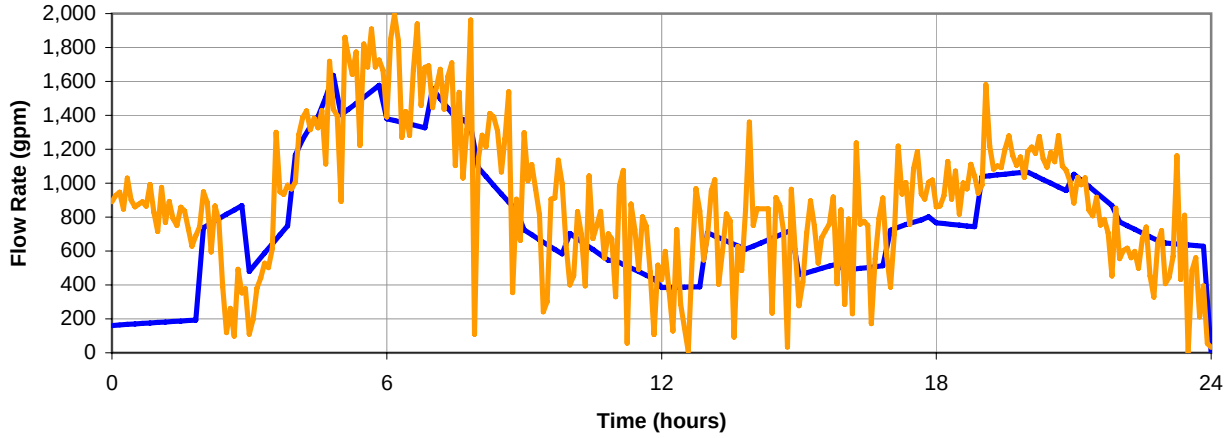
Dynamic Calibration Results

Master Meter Flow Rate

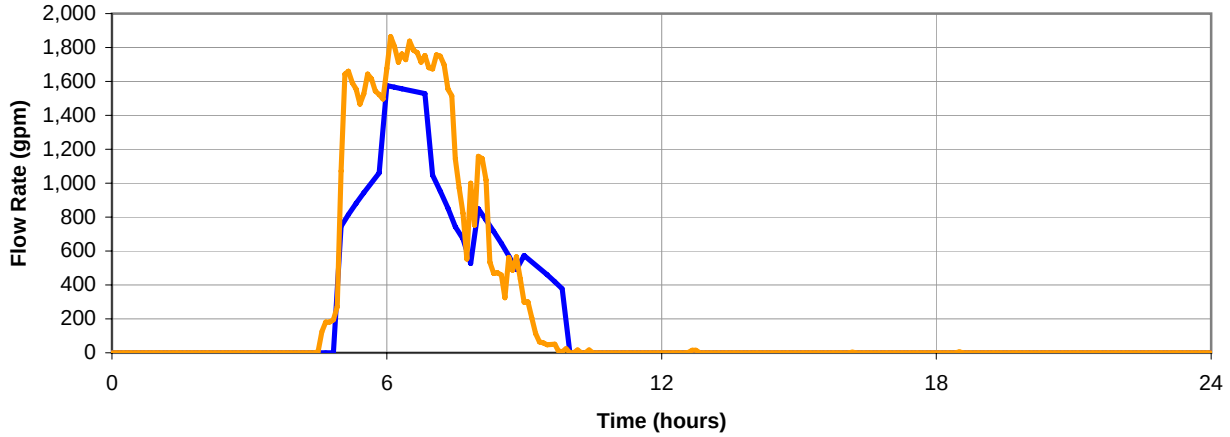
Test Day: 08/17/07



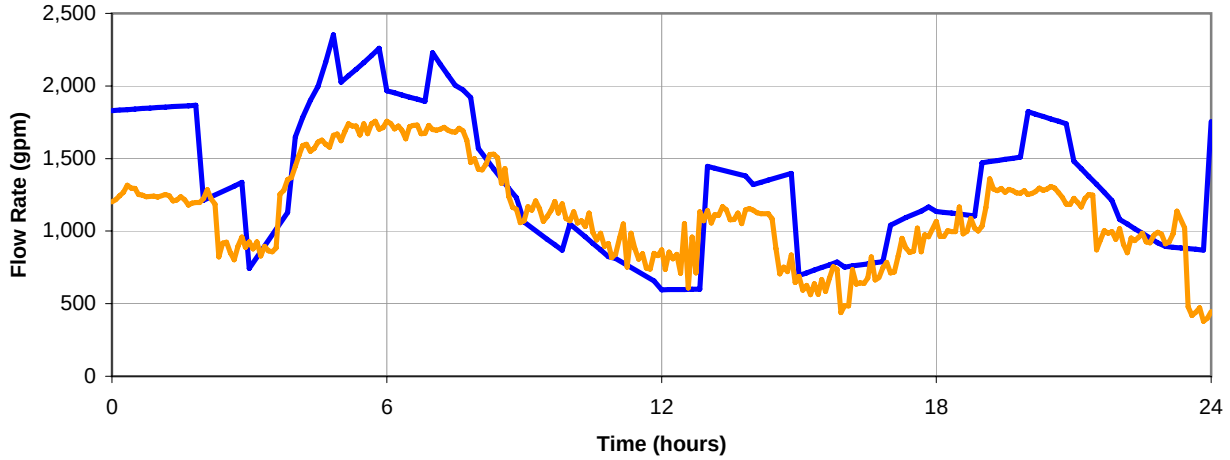
Beall Master Meter Station



Vilas Master Meter Station



Hopkins Master Meter Station



Dynamic Calibration Results

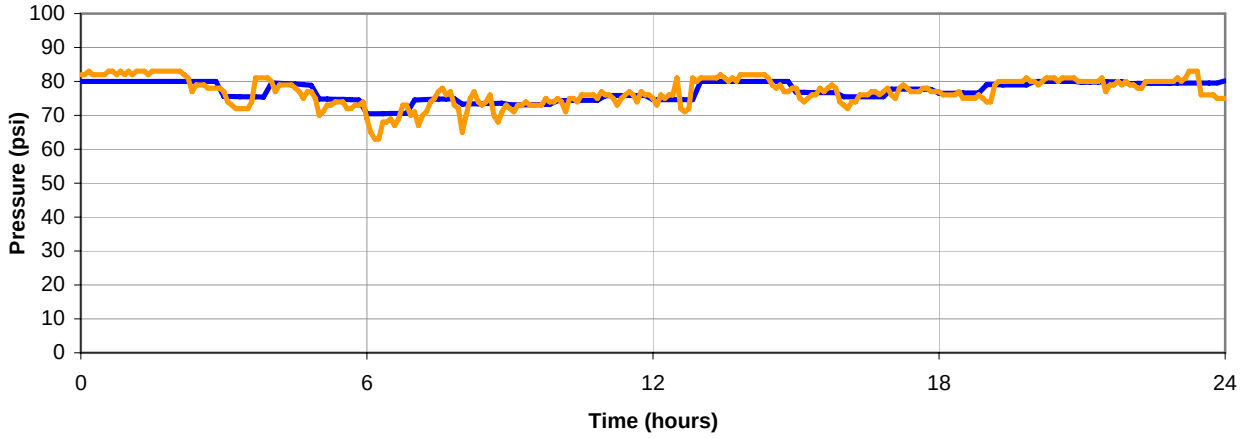
System Pressure

Test Day: 08/17/07

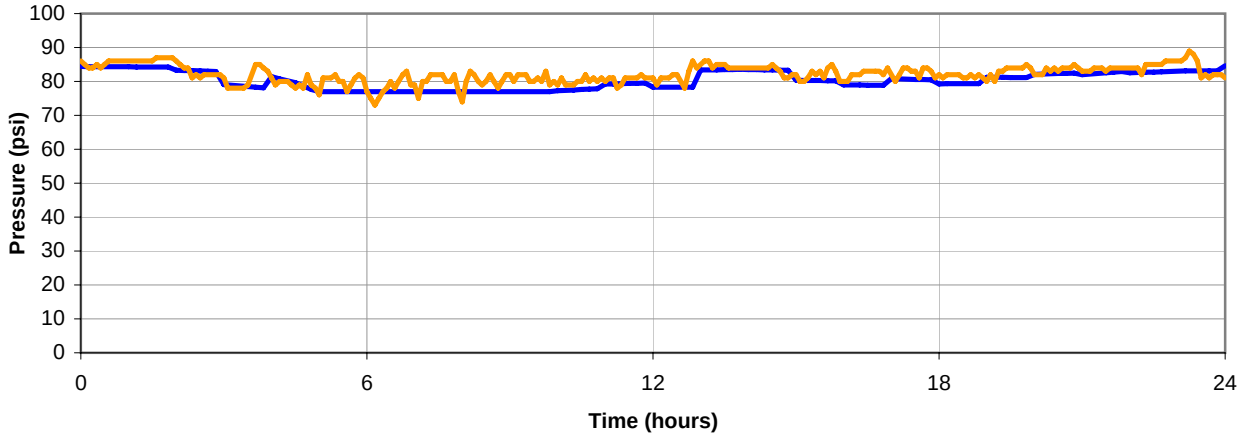
Model Results

Field Data

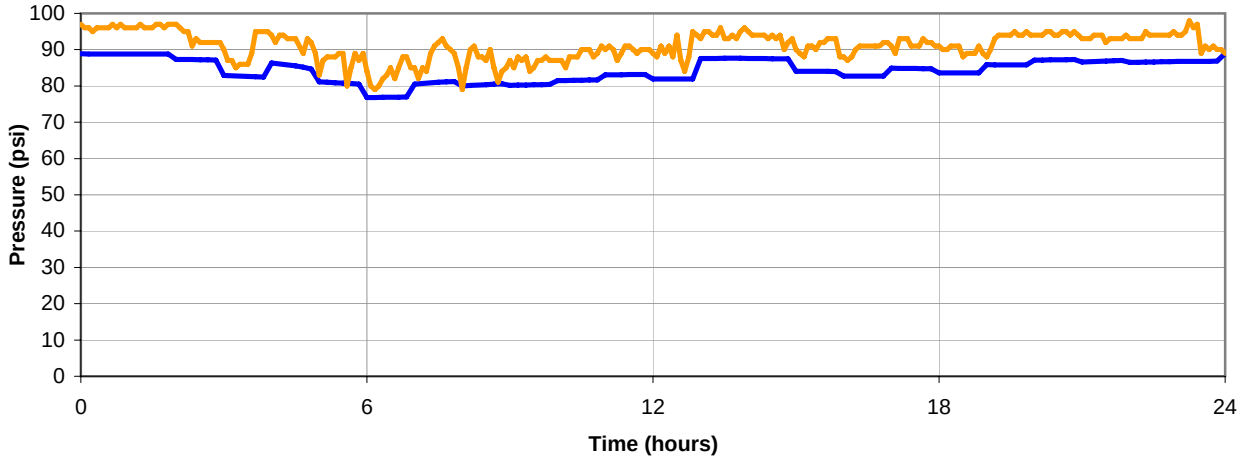
Beall Master Meter Station



Vilas Master Meter Station



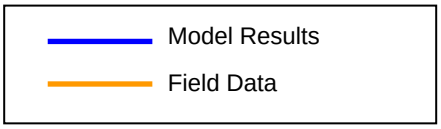
Hopkins Master Meter Station



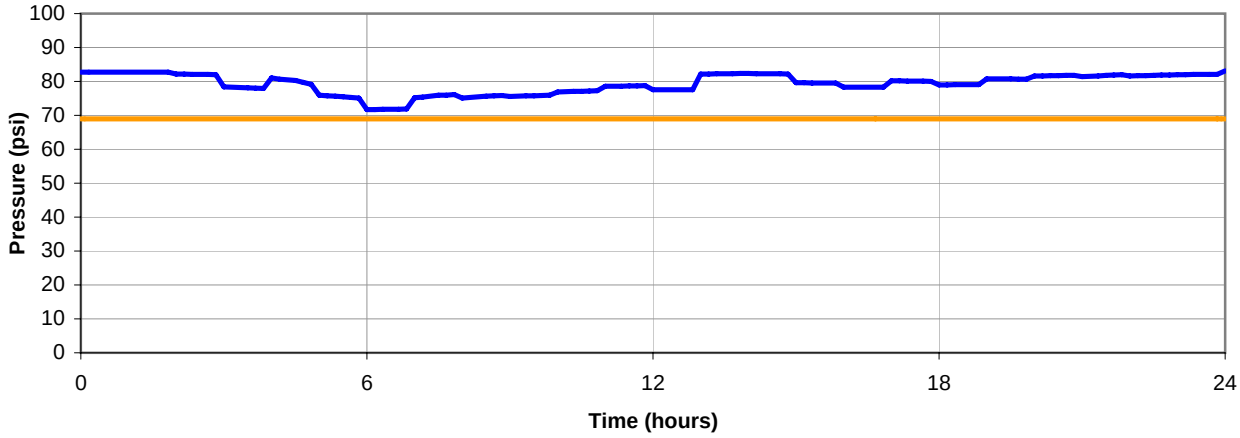
Dynamic Calibration Results

System Pressure

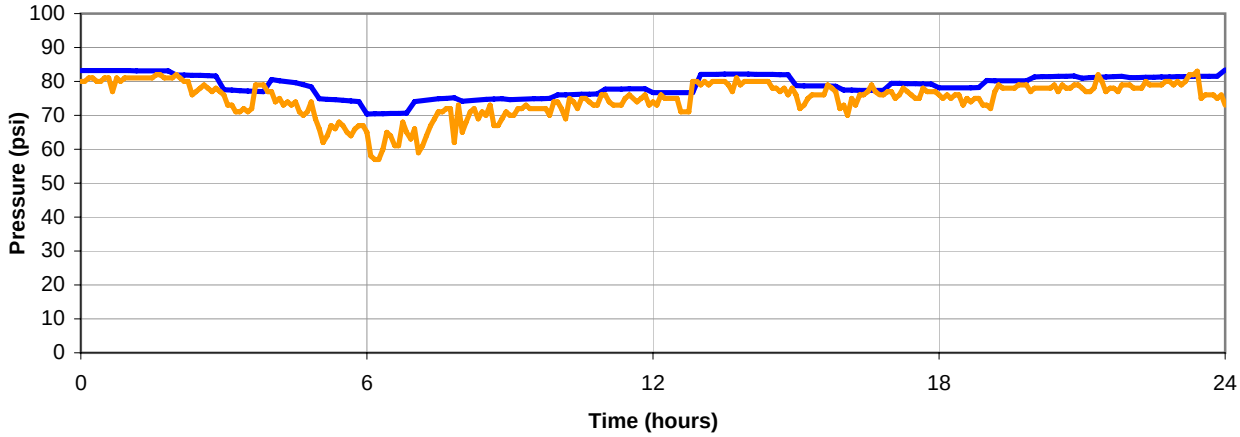
Test Day: 08/17/07



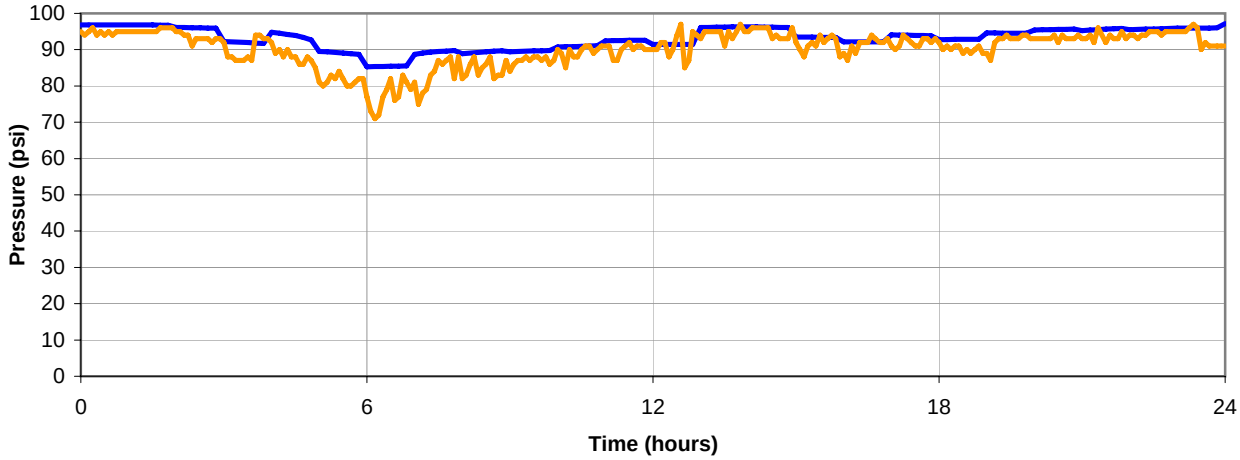
Flanagan Park Pressure Station



Forest Glen Park Pressure Station



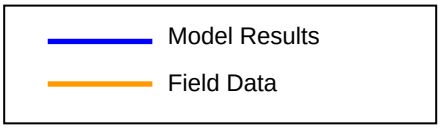
North Haskel Pressure Station



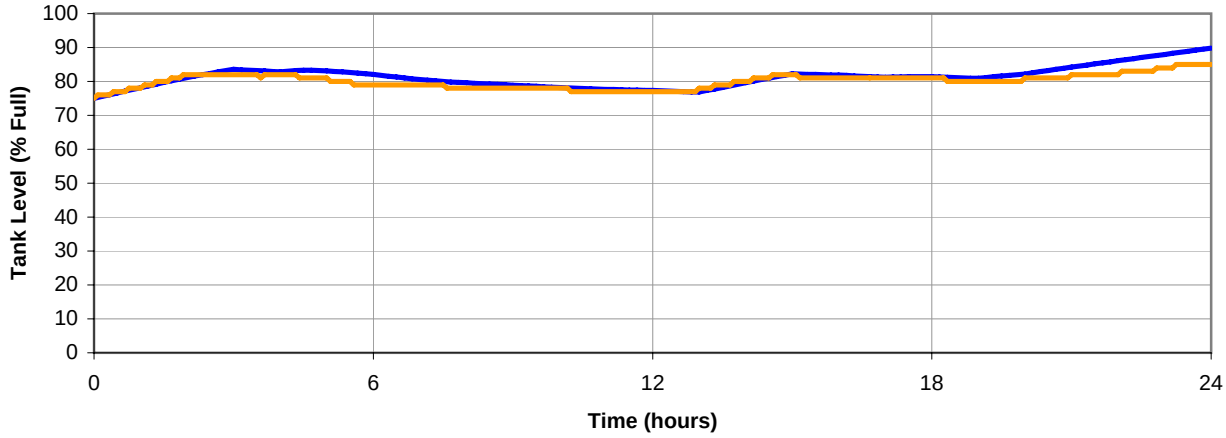
Dynamic Calibration Results

2 MG Tank Site

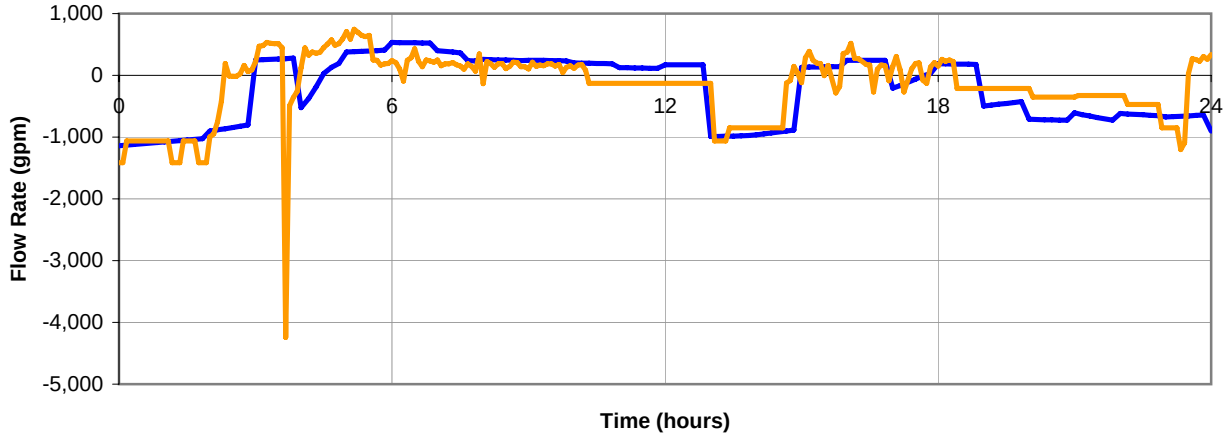
Test Day: 08/17/07



2 MG Tank



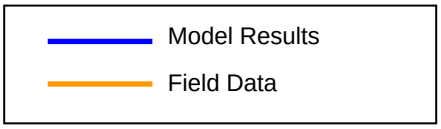
2 MG Tank Flow Meter



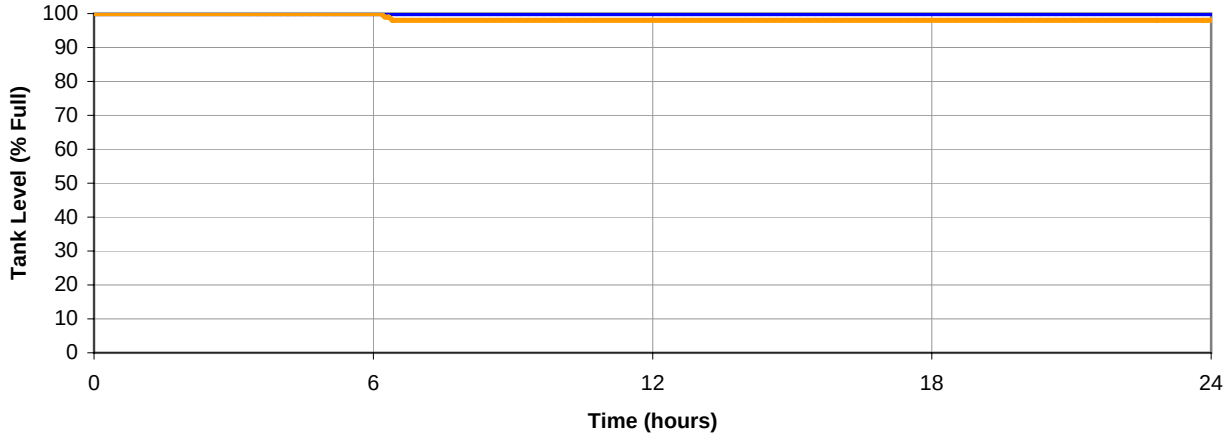
Dynamic Calibration Results

1 MG Tank Site

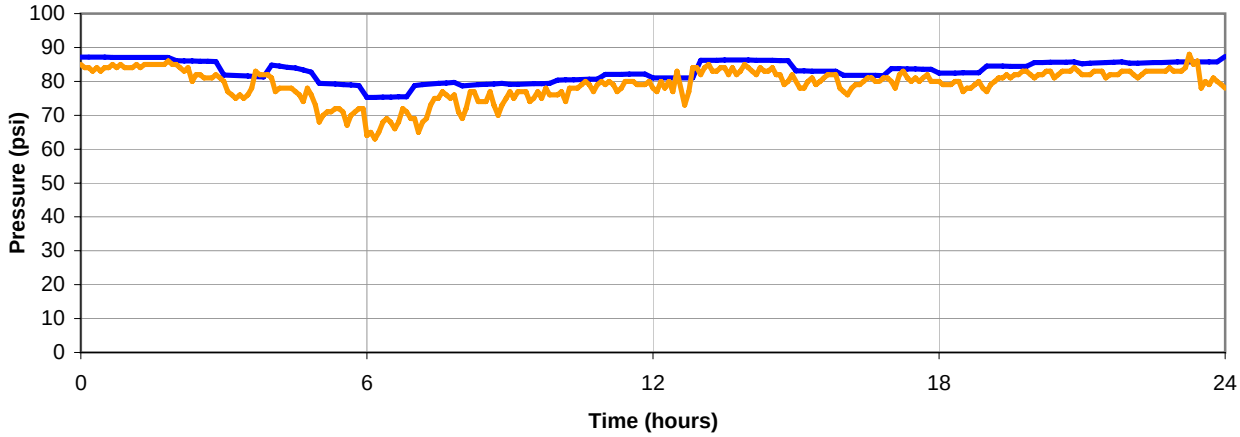
Test Day: 08/17/07



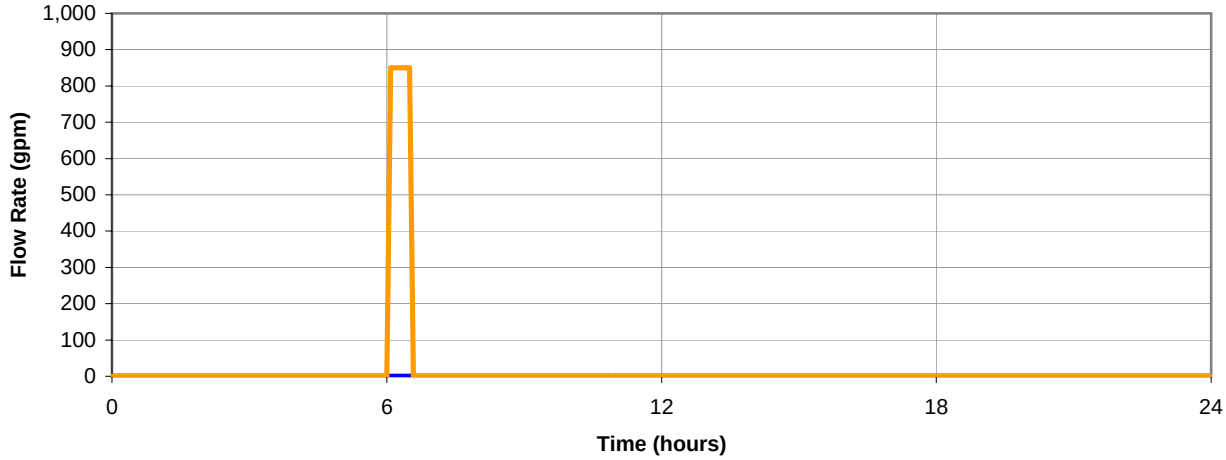
1 MG Tank



Shops Pressure Station



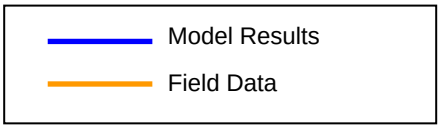
Shops Pumps



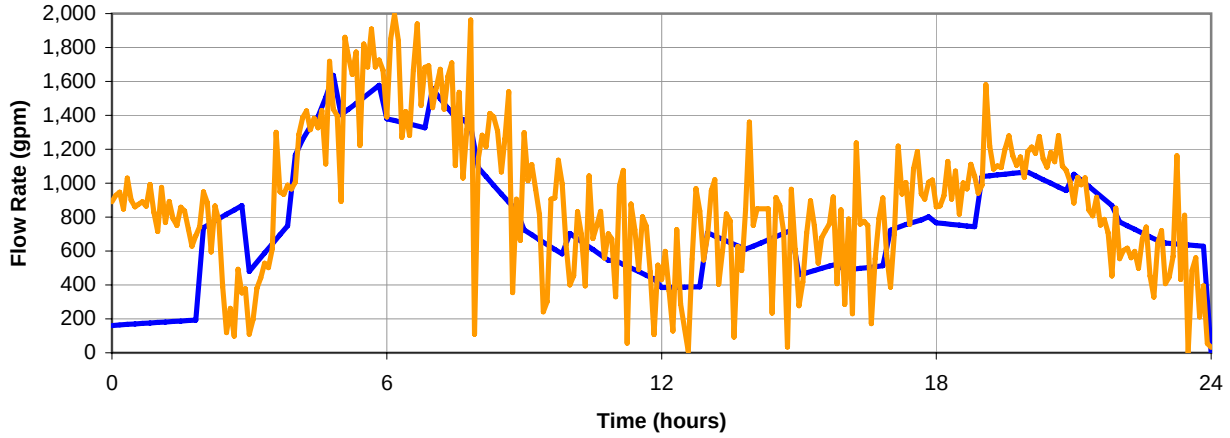
Dynamic Calibration Results

Master Meter Flow Rate

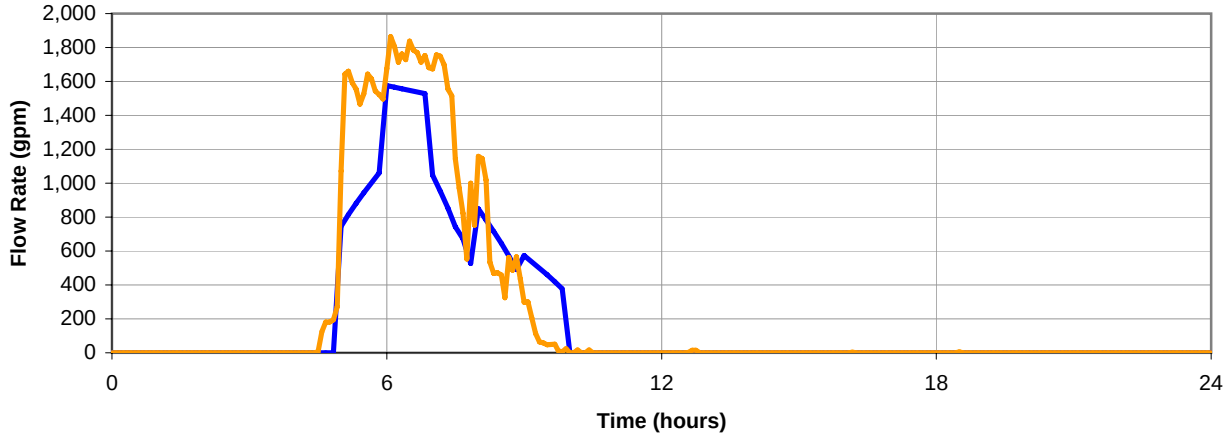
Test Day: 08/17/07



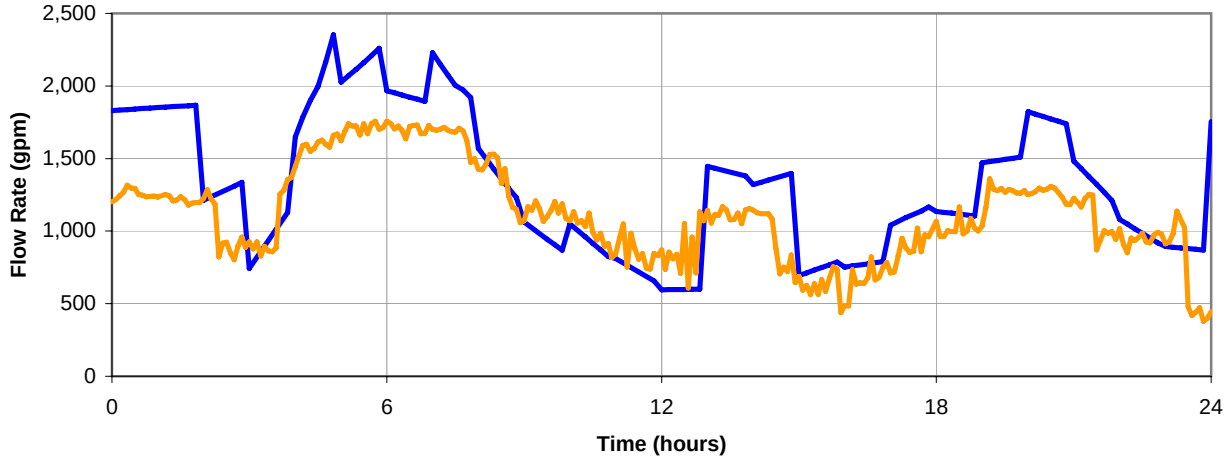
Beall Master Meter Station



Vilas Master Meter Station



Hopkins Master Meter Station



APPENDIX F

Wholesale Agreement with MWC

AGREEMENT

THIS AGREEMENT, made and entered into in duplicate on the 7 day of September, 2005, by and between the City of Central Point, a municipal corporation of the State of Oregon, (hereinafter referred to as PURCHASER), and the City of Medford, a municipal corporation of the State of Oregon, acting by and through its Board of Water Commissioners, (hereinafter referred to as VENDOR),

W I T N E S S E T H:

WHEREAS, VENDOR has surplus water available in its municipal water system and;

WHEREAS, PURCHASER desires to purchase surplus water from the municipal water system of VENDOR;

NOW, THEREFORE, for and in consideration of the foregoing and of the mutual promises hereinafter expressed, and intending to be legally bound hereby, the parties hereto do mutually agree as follows:

ARTICLE 1. SCOPE OF WATER SUPPLY SERVICE

VENDOR owns and operates the treatment and transmission facilities which supply "surplus" water to PURCHASER. VENDOR routinely attempts to anticipate the water demands of its customers, including those of PURCHASER. VENDOR needs reasonably accurate forecasts of future water demands in order to ensure sufficient "surplus" capacity in these facilities to meet the growth needs of its customers. Therefore, PURCHASER agrees that at the five-year renewal period it will convey to VENDOR a reasonable estimate of its maximum daily demand for the next five-year period. VENDOR agrees to continue to supply surplus water up to a maximum 3,200 gallons per minute (GPM) or 4,500,000 gallons per day, for the months of October through April and up to a maximum of 4,800 GPM, or 6,800,000 gallons per day, for the months of May through September. In the case of an emergency, VENDOR agrees to increase the supply within the limits of its system. PURCHASER shall immediately take all necessary steps to remedy the emergency.

Both parties understand and acknowledge that PURCHASER'S estimated demand is just a forecast and may prove to be too low, and that a large industrial or commercial customer may alter the demands of PURCHASER. In the event that PURCHASER becomes aware that it shall exceed its estimated maximum day demand, it shall notify VENDOR with a new estimated demand. VENDOR shall then determine if it has sufficient surplus treatment and transmission capacity to meet this anticipated demand. If sufficient capacity does not exist, then VENDOR shall provide PURCHASER a timeline for VENDOR to meet the demand.

In the case of an extremely large industrial or commercial user (those who utilize over 2.0 MGD), VENDOR shall make a determination whether furnishing that particular user with its needed water supply is in the best interest of the citizens of Medford and makes the best use of the region's

VENDOR shall, however, apply the same standard, as related to service to larger users, evenly across all the jurisdictions supplied by VENDOR.

ARTICLE 2. CONNECTIONS

PURCHASER'S primary water supply connections from VENDOR'S system are through an eight-inch (8") connection on Beall Lane, a 10-inch (10") connection on Hopkins Road, and a 10-inch (10") connection on Hamrick Road. The connections are available for utilization on a year-round basis. All piping and control valves downstream of these master meters shall be the responsibility of PURCHASER.

ARTICLE 3. RULES AND REGULATIONS

All rules and regulations of the Board of Water Commissioners relating to water users outside of the City of Medford as now in effect, or as the Board of Water Commissioners of the City of Medford may from time to time prescribe, shall be deemed a part of this Agreement, and PURCHASER agrees to comply therewith and its rights for the supply of water shall be governed thereby. No such rules or regulations shall relieve VENDOR of its obligation to supply water in accordance with the terms of this Agreement except as may be dictated by federal and state regulations or other items beyond VENDOR's control. Nothing contained in this Agreement shall be deemed to modify, alter or repeal any such regulations now or hereinafter adopted. PURCHASER acknowledges that it has received a copy of all rules and regulations governing water service of VENDOR relating to water users outside the City of Medford. VENDOR shall promptly, upon passage, supply to PURCHASER a copy of any amendments or additions to said rules and regulations.

ARTICLE 4. URBANIZATION POLICY

PURCHASER agrees that water supplied to its customers is an "urban" service and should be confined to current or future city residents. PURCHASER may establish its own urbanization and outside water service policies based on this premise or may utilize VENDOR's policy. In order to avoid future service conflicts, a general water service boundary map is attached to this Agreement. This map is intended to be modified as urban boundaries change due to regional and local planning decisions.

PURCHASER agrees that it shall not serve any areas outside their city limits other than:

a) Areas within PURCHASER'S Urban Growth Boundary

b) Areas within PURCHASER'S Future Urban Reserve Area; and

c) Areas within the Seven Oaks Interchange "Area of Mutual Planning Concern";

all as defined and described in PURCHASER'S Comprehensive Plan, which may be duly modified from time to time, PURCHASER also agrees to notify VENDOR in writing of all annexations or modifications to any of the boundaries described above.

ARTICLE 5. MEETING FUTURE WATER DEMANDS

PURCHASER understands that this Agreement calls for the sale of surplus water from VENDOR and that by the Year 2020 – 2030, with current growth trends, VENDOR will completely utilize all of its natural stream flow rights from the Rogue River. This will mean that VENDOR will not have sufficient "surplus" water to meet the summertime demands of PURCHASER. Additional stored water for municipal and industrial uses is currently available from the U.S. Army Corps of Engineers at Lost Creek Reservoir; or other alternatives may be available to meet summertime demands. Even though it is still 20 years until the system utilizes all of its current surplus water, plans and actions are needed now in order to avoid future water shortages. PURCHASER agrees, that during the term of this Agreement, it will maintain a reserve account to set funds aside for the purchase of Lost Creek Reservoir water or other alternate water supplies. During the term of this Agreement, PURCHASER shall maintain a water resource plan and financial plan to demonstrate to VENDOR that it will obtain sufficient stored water or other water rights to meet its 2020 summertime demand. PURCHASER agrees, that prior to August 1, 2006, it shall purchase or acquire the first one-third (1/3) of its 2020 demand including, but not limited to, any required water right permits, change of use, or point of diversion. Prior to the expiration date of the current Agreement, PURCHASER also agrees to purchase or acquire the second one-third (1/3) of its 2020 demand. The last one-third (1/3) increment shall be secured in five to ten years; so that all of the PURCHASER's 2020 summertime demand shall be obtained prior to 2015. PURCHASER shall secure and maintain the required demand water rights in perpetuity. Current growth and demand projections indicate that PURCHASER will need 2,341 acre-feet of water to meet its 2020 summertime demand. Demand projections will be reviewed by VENDOR and PURCHASER on the renewal date of this Agreement.

VENDOR has included the service area of PURCHASER on water right certificates and permits; however, PURCHASER acknowledges that the surplus water used by VENDOR to supply PURCHASER's demands comes from water right certificates and permits in the name of VENDOR and PURCHASER shall lay no claim to these rights under this Agreement for past or future usage. PURCHASER also acknowledges that VENDOR can re-designate or change areas of service of noted surplus water for future agreements.

VENDOR maintains water-measuring equipment at the Duff Water Treatment Plant for recording the amount of water withdrawn from the Rogue River covering all valid water rights and all data acquired is of public record. VENDOR also maintains master water meters at three locations noted in Article 2 for the purposes of recording the amount of water used by PURCHASER. VENDOR provides on a monthly bill the usage of water by PURCHASER pertaining to this Agreement.

ARTICLE 6. PAYMENTS TO VENDOR

PURCHASER shall pay monthly to VENDOR for all water thus purchased from VENDOR at VENDOR's regularly scheduled rates for water service to incorporated cities in effect at a particular time. VENDOR reserves the right to change said rates at any time upon sixty (60) days written

notice to PURCHASER. VENDOR agrees to make reasonable effort to notify PURCHASER annually, at least two months prior to the end of PURCHASER's fiscal year of VENDOR's opinion as to the need for rate adjustment during the subsequent fiscal year.

ARTICLE 7. TERM OF AGREEMENT

VENDOR has every intention of selling water to PURCHASER for as long as PURCHASER desires to purchase from VENDOR and VENDOR has surplus water to sell. In furtherance of that understanding, VENDOR agrees to negotiate in good faith with PURCHASER for renewal of the Agreement. In the event that VENDOR does not renew the Agreement, then the current Agreement will continue in effect as long as reasonably necessary to allow PURCHASER to secure other sources of water. However, Section 19 of the Charter of the City of Medford limits the term of water service contracts to 20 years and, therefore, the obligations of VENDOR under this Agreement shall not, under any circumstances, exceed that period of time. PURCHASER shall make no assignment of the rights or interests herein granted without written permission. In the event of any occurrence rendering PURCHASER incapable of performing under the Agreement, any successor of PURCHASER, whether the result of legal process, assignment, or otherwise, shall succeed to such right of PURCHASER hereunder.

The term of this Agreement shall be five (5) years from the date hereof. PURCHASER may, at its option, extend the term for three additional five-year periods, which periods would run through 2015, 2020, and 2025 respectively. Written notice of the election to exercise a five-year extension of the contract must be given to VENDOR not later than January 1st of the year in which the agreement would expire if there was no extension.

ARTICLE 8. WATER CURTAILMENT PLAN

VENDOR, on June 15, 1992, passed Resolution No. 710 adopting a Water Curtailment Plan for VENDOR's service area. Sections IV and V of this plan call for the curtailment of water use by all types of customers using water provided by VENDOR during periods of drought or emergency. PURCHASER, on August 11, 1992, adopted a similar ordinance, No. 4-70. The City of Medford's Water Curtailment Plan is hereby incorporated into and made a part of this Agreement by this reference. During emergency or drought periods, VENDOR shall give PURCHASER as much advance warning as possible prior to curtailment of water supplies. The level of curtailment shall be determined by VENDOR based on the severity of the proposed shortage. PURCHASER shall be responsible for enforcing the curtailment plan in its service area.

ARTICLE 9. INDEMNITY AND COMPLIANCE WITH LAWS AND REGULATIONS

To the extent PURCHASER is to perform work pursuant to the terms of this Agreement, PURCHASER agrees that it will be solely responsible for any damage or trespass to or upon adjacent property or injury thereto and any and all other liability or damages resulting from or in connection with its operation, and that it will hold VENDOR harmless from any claim, liability, damages or obligation arising therefrom and indemnify VENDOR for the amount of any obligation it may incur on account thereof or arising therefrom. Provided, however, that PURCHASER shall not

be required to indemnify VENDOR against liability for damage arising out of death or bodily injury to persons or damage to property caused in whole or in part by the negligence of VENDOR, except to the extent that the death or bodily injury to persons or damage to property arises out of the fault of PURCHASER or PURCHASER's agents, representatives or subcontractors.

To the extent PURCHASER is to perform work pursuant to the terms of this Agreement, PURCHASER shall at all times observe and comply with all federal and state laws and local ordinances and regulations, in any manner affecting the conduct of the work, and all such orders or decrees as exist at the present and those which may be made or enacted later by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless VENDOR and all its officers, agents and servants against any claim or liability arising or based on the violation of any such law, ordinance, regulation, order or decrees, whether by themselves or their employees.

ARTICLE 10. PARTIAL INVALIDITY

If any term, covenant, condition, or provision of this Agreement is found by a court of competent jurisdiction to be invalid, void, or unenforceable, the remainder of the provisions hereof shall remain in full force and effect, and shall in no way be affected, impaired, or invalidated thereby.

ARTICLE 11. INTEGRATION

This Agreement represents the entire understanding of VENDOR and PURCHASER as to those matters contained herein. No prior oral or written understanding shall be of any force or effect with respect to those matters covered herein. This Agreement may not be modified or altered except in writing signed by both parties.

ARTICLE 12. JURISDICTION

This Agreement shall be administered and interpreted under the laws of the State of Oregon. Jurisdiction of litigation arising from this Agreement shall be in that state.

In the event any suit, action or other proceeding is brought with regard to this Agreement, or to enforce any of the provisions hereof, the prevailing party in any such suit, action or other proceeding, or any appeal therefrom, shall be entitled to reasonable attorney's fees.

ARTICLE 13. DEFAULT

It is further understood and agreed by and between the parties hereto that this Agreement is conditioned upon the faithful performance by PURCHASER of all terms and provisions hereof, which, on its part, are to be kept and performed and any failure to do so or any default which is not remedied within ten (10) days after the mailing of written notice from VENDOR to PURCHASER specifying the particulars of the alleged default, shall give VENDOR the right to discontinue furnishing water as herein provided and VENDOR may, at its option, terminate this Agreement. Notwithstanding the foregoing, PURCHASER shall not be deemed in default hereunder if the default is of such a nature that it cannot be remedied within ten (10) days and PURCHASER proceeds in good faith to cure such default.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be signed by their proper officers the day and year first above written.

VENDOR:

CITY OF MEDFORD
BY AND THROUGH ITS
BOARD OF WATER COMMISSIONERS

Leigh T. Johnson
Chair

Karen M Spegert
City Recorder
Deputy

PURCHASER:

CITY OF CENTRAL POINT

Hank Helton
Mayor

Deanna Gregory
City Recorder

City of Central Point
2
City Limits
Urban Growth Boundary
JACKSON COUNTY

APPENDIX G

Joint Modeling Study Technical Memorandum

To be included in final.

APPENDIX H

Detailed Cost Estimates

Appendix H: Central Point WSMP Detailed Cost Estimate

Description	Unit	Unit Cost	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total
Completion Year			2011		2011		2015 - 2020		2015 - 2020		2015 - 2020		2015 - 2020		2015 - 2020		2015 - 2020	
Project			S-1: Vilas Tank, Pump Station and Piping		S-2: Dedicated Transmission from Hopkins to Existing 8-inch		M-1: Beall Pump Station		M-2: Fireflow Improvements on Hwy 99		M-3: Fireflow Improvements on Laurel		M-4: Fireflow Improvements near Hwy 99 and Bush St		M-5: Fireflow Improvements on Maple		M-6: Fireflow Improvements at the Shops	
PIPING																		
6-in	LF	$ 61.66		$ -		$ -		$ -		$ -	2,704	$ 166,718	676	$ 41,679	296	$ 18,250	406	$ 25,032
8-in	LF	$ 82.21		$ -		$ -		$ -	357	$ 29,348		$ -	409	$ 33,623		$ -	561	$ 46,119
12-in	LF	$ 123.31		$ -		$ -	588	$ 72,459	2,129	$ 262,531		$ -		$ -	810	$ 99,883		$ -
16-in	LF	$ 149.46		$ -	248	$ 37,065	168	$ 25,109		$ -		$ -		$ -		$ -		$ -
20-in	LF	$ 171.02	4,693	$ 802,616		$ -		$ -		$ -		$ -		$ -		$ -		$ -
24-in	LF	$ 199.18		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Major Road Crossings	LS			$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Railroad Crossings	LS			$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Stream Crossings	LS			$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
PUMP STATIONS	Total			$ 3,121,470				$ 1,035,000										
Pump Station	LS			$ 3,121,470				$ 985,000										
Land	ACRE	$ 100,000		$ -			1	$ 50,000										
WATER STORAGE TANKS	LS		2	$ 2,538,000		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Tank				$ 2,452,500														
Control Valve				$ 85,500														
SCADA				$ -														
Land	ACRE	$ 50,000																
RAILROAD CROSSING																		
12" Casing J/B	LF	$ 294.60					200	$ 58,920	100	$ 29,460								
16" Casing J/B	LF	$ 420.00																
STREAM CROSSING																		
12" Casing J/B	LF	$ 294.60																
16" Casing J/B	LF	$ 420.00																
MAJOR ROAD CROSSING																		
12" Casing J/B	LF	$ 294.60							150	$ 44,190								
16" Casing J/B	LF	$ 420.00																
PROJECT SUB-TOTAL				**$ 6,462,086**		**$ 37,065**		**$ 1,191,488**		**$ 365,530**		**$ 166,718**		**$ 75,303**		**$ 118,133**		**$ 71,151**
25% Contingency	25%			1,615,521		9,266		297,872		91,382		41,679		18,826		29,533		17,788
DIRECT COST				**8,077,607**		**46,331**		**1,489,360**		**456,912**		**208,397**		**94,128**		**147,666**		**88,939**
15% EAC	15%			1,211,641		6,950		223,404		68,537		31,260		14,119		22,150		13,341
PROJECT TOTALS				**$ 9,289,248**		**$ 53,281**		**$ 1,712,764**		**$ 525,449**		**$ 239,657**		**$ 108,247**		**$ 169,816**		**$ 102,280**

SUM of Short-Term Projects	**$ 9,342,529**
SUM of Mid-Term Projects	**$ 10,560,376**
SUM of Long-Term Projects	**$ 6,614,168**

Appendix H: Central Point WSMP Detailed Cost Estimate

Description	Unit	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total	Qty	Total
Completion Year		2015 - 2020		2015 - 2020		2015 - 2020		2020-2025		2020-2025		2020-2025		2020-2025		2030 - Buildout	
Project		M-7: Fireflow Improvements between Oak and Pine near 9th		M-8: Fireflow Improvements on Hazel and 9th		M-9: Fireflow Improvements on Edwina		M-10: Tolo Tank and Supply Piping		M-11: Wilson Road Transmission		M-12: Beall Road Transmission		M-13: Penniger Road Transmission]		L-1: Shops Tank, Pump Station, and Piping and Dedicated Transmission	
PIPING																	
6-in	LF	1,548	$ 95,443		$ -	769	$ 47,398		$ -		$ -		$ -		$ -		$ -
8-in	LF	1,137	$ 93,470	268	$ 22,032		$ -		$ -		$ -		$ -		$ -		$ -
12-in	LF		$ -		$ -		$ -	4,404	$ 543,066	1,316	$ 162,279	4271	$ 526,666	3078	$ 379,554	279	$ 34,404
16-in	LF		$ -		$ -		$ -		$ -	9,984	$ 1,492,169		$ -		$ -	1919	$ 286,806
20-in	LF		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
24-in	LF		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Major Road Crossings	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Railroad Crossings	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
Stream Crossings	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -
PUMP STATIONS	Total								$ -								$ 1,890,450
Pump Station	LS																$ 1,890,450
Land	ACRE								$ -								
WATER STORAGE TANKS	LS		$ -		$ -		$ -	1	$ 1,775,000		$ -		$ -		$ -	2	$ 2,389,500
Tank									$ 1,600,000								$ 2,272,500
Control Valve									$ 65,000								$ 49,500
SCADA									$ 110,000								$ 67,500
Land	ACRE							1	$ 37,500								
RAILROAD CROSSING																	
12" Casing J/B	LF							100	$ 29,460								
16" Casing J/B	LF																
STREAM CROSSING																	
12" Casing J/B	LF							150	$ 44,190			500	$ 147,300				
16" Casing J/B	LF																
MAJOR ROAD CROSSING																	
12" Casing J/B	LF																
16" Casing J/B	LF																
PROJECT SUB-TOTAL			**$ 188,914**		**$ 22,032**		**$ 47,398**		**$ 2,391,716**		**$ 1,654,447**		**$ 673,966**		**$ 379,554**		**$ 4,601,160**
25% Contingency	25%		47,228		5,508		11,850		597,929		413,612		168,491		94,889		1,150,290
DIRECT COST			**236,142**		**27,540**		**59,248**		**2,989,645**		**2,068,059**		**842,457**		**474,443**		**5,751,450**
15% EAC	15%		35,421		4,131		8,887		448,447		310,209		126,369		71,166		862,718
PROJECT TOTALS			**$ 271,564**		**$ 31,671**		**$ 68,135**		**$ 3,438,092**		**$ 2,378,268**		**$ 968,825**		**$ 545,609**		**$ 6,614,168**

SUM of Short-Term Projects	**$ 9,342,529**
SUM of Mid-Term Projects	**$ 10,560,376**
SUM of Long-Term Projects	**$ 6,614,168**