ADOPTED

CITY OF PENDLETON

Water System Master Plan

MSA Murray, Smith & Associates, Inc.
Engineers | Planners

MAY 2015

PUBLIC HEALTH DIVISION
Drinking Water Services
Kate Brown, Governor

Oregon Health Authority

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June 4, 2015

Bob Patterson, P.E.
City of Pendleton
500 SW Dorion Avenue
Pendleton, Oregon 97801

Re: Plan Review #52-2015, City of Pendleton Water System Master Plan Final Approval

Drinking Water Services (DWS) has reviewed the revised draft Water System Master Plan (WSMP) for the **City of Pendleton, PWS ID #4100613**. The revisions have addressed the conditional items listed in my May 1, 2015 letter, and final approval is granted for the WSMP.

Please send a copy of the final version of the WSMP to my office for our files. If you have any questions or need this information in an alternate format please call me at 541-966-0900.

Sincerely,

William Goss

William Goss, P.E.
Regional Engineer

c. Julie Wray, OHA Drinking Water Services, Portland
Brian Ginter, P.E., Murray, Smith & Associates, Boise
David Stangel, P.E., Murray, Smith & Associates, Boise

ORDINANCE NO. 3862

AN ORDINANCE ADOPTING A WATER SYSTEM MASTER PLAN AS A COMPONENT OF THE COMPREHENSIVE PLAN

WHEREAS; the City owns and operates a public drinking water system, for which there is an adopted plan that was created in 1979 and amended in 1994; and

WHEREAS; pursuant to Oregon Statewide Goal 11 (Public Facilities), the City of Pendleton is required to adopt and/or update public facilities master plans for the 20 year planning horizon; and

WHEREAS; the City's drinking water system plan was last updated more than 20 years ago, which puts the City out of compliance with State requirements; and

WHEREAS; in the last 20 years, the City's Urban Growth Boundary (UGB) has been expanded; and

WHEREAS; expansion of the UGB necessitates planning for areas not previously planned for; and

WHEREAS; the proposed Water System Master Plan (WSMP) addresses the additional demand of and capacity necessary to serve the entire UGB; and

WHEREAS; the WSMP assumes growth according to the projections contained in the Comprehensive Plan both for the 20 year horizon and for full build out of the UGB; and

WHEREAS; the WSMP includes the following major components, consistent with Goal 11 requirements and specific needs identified by City staff:

- Description of the City's existing water system.
- Population and Demand Projections
- System Analysis
- Operations and Maintenance
- Capital Improvement Program
- Financial Plan

WHEREAS; the WSMP provides the City with a solid inventory and factual basis upon which to make informed decisions about future rates and expenditures; and

WHEREAS; the request is consistent with the City's responsibilities under Goal 11 (Public Facilities and Services); and

WHEREAS; the proposal is consistent with the standards and criteria for an amendment to the Comprehensive Plan because it adopts a formal Public Facilities component of the Comprehensive Plan in a manner consistent with Statute and Rule.

WHEREAS; notice was provided to the general public as set forth in Oregon Revised Statutes and the City of Pendleton Unified Development Code, and;

WHEREAS; the City of Pendleton Planning Commission held a hearing on May 7, 2015, and recommended adoption of the proposed master plan based on the findings and conclusions contained in the staff report; and

WHEREAS; a public hearing was held before the City of Pendleton City Council on May 19, 2015, and all written and oral testimony concerning the matter was received and addressed at the hearing;

NOW, THEREFORE, THE CITY OF PENDLETON ORDAINS AS FOLLOWS:

The City of Pendleton Comprehensive Plan is amended to include the attached Water System Master Plan (Exhibit A) as part of a Goal 11 (Public facilities) Element.

This ordinance is effective 30 days after passage.

PASSED by the City Council and approved by the Mayor June 2, 2015.

Approved as to form

Nancy Kerns, City Attorney

APPROVED

Phillip W. Houk, Mayor

ATTEST

Andrea Denton, City Recorder

CITY OF PENDLETON
INCORPORATED 1880
OREGON

WATER SYSTEM MASTER PLAN

FOR

THE CITY OF PENDLETON

MAY 2015

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13-1442

MSA-ID 05/15

ACKNOWLEDGMENTS

Appreciation is expressed to all who contributed to the completion of this report.

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COMMON ENGINEERING ACRONYMS & ABBREVIATIONS

A

AACE	AACE International
ABF	activated biological filter
AC	asbestos cement
ADA	Americans with Disabilities Act
ADD	average daily demand
AF	acre-feet
AIA	Airport Industrial Area
AMCL	alternative maximum concentration level
AMI	automated metering infrastructure
AMR	automated meter reading
AMZ	asset management zone
AOR	actual oxygen required
APWA	American Public Works Association
ASR	aquifer storage and recovery
AWWA	American Water Works Association

B

BFP	belt filter press
BLI	buildable lands inventory
BOD	biochemical oxygen demand
BWF	base wastewater flow

C

C&R	construction and replacement
CAA	Clean Air Act
CAD	computer aided drafting
CAS	cast iron
ccf	100 cubic feet
CCI	Construction Cost Index
CCR	Consumer Confidence Report
CCTV	closed-circuit television
cf	cubic feet
cfs	cubic feet per second
CHL	clarifier hydraulic loading
CIA	current impact area
CIP	capital improvement program
CMOM	capacity, management, operation and maintenance
CN	curve number
COD	chemical oxygen demand
COMPASS	Community Planning Association of Southwest Idaho
COSM	Central Oregon Stormwater Manual
CP	concrete pipe

CPI-U	Consumer Price Index, Urban Consumers
CSL	clarifier solids loading
CSMP	Collection System Master Plan
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
D	
DBP	disinfection byproducts
d/D	depth to diameter ratio
D/DBP	disinfectants and disinfection byproducts
DEQ	Department of Environmental Quality
DIP	ductile iron pipe
DOD	depth of flow over diameter of pipe
DOE	Department of Ecology
DWF	dry weather flow
E	
ENR	Engineering News Record
EOCI	Eastern Oregon Correctional Institution
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
EUAC	Equivalent Uniform Annual Cost
F	
FEMA	Federal Emergency Management Agency
FM	flow monitors
FMB	flow meter basin
FOG	fats, oils, grease
fps	feet per second
ft	foot, feet
FTE	full-time equivalent
FV	future value
FY	fiscal year
G	
GAC	granular activated carbon
GBT	gravity belt thickener
GIS	geographical information system
gpapd	gallons per acre per day
gpcpd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GPS	Global Positioning System
gpupd	gallons per unit per day
GWI	groundwater infiltration

H

HDPE	high-density polyethylene
HGL	hydraulic grade line
hp	horsepower
hr	hour
HRT	hydraulic retention time
HVAC	heating, ventilating and air conditioning

I

ID	inside diameter
IEEE	Institute of Electrical and Electronics Engineers
I/I	inflow/infiltration
in	inch, inches
IOC	inorganic compound

K

kVA	kilovolt-ampere
kW	kilowatt

L

L	liter
lb	pound
LCR	Lead and Copper Rule
lf	linear feet
LRAA	locational running annual averages
LS	lift station

M

M	million
ma	milliamp
MCL	maximum concentration level
MCLG	maximum concentration level goal
M/DBP	microbial and disinfection byproducts
MDD	maximum day demand
mg	milligram
MG	million gallons
mgd	million gallons per day
mgh	million gallons per hour
mg/L	milligrams per liter
MH	manhole
mL	milliliter
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeter
MRDL	maximum residual disinfectant levels
mrem	millirems

MSA	Murray, Smith & Associates, Inc.
MSL	mean sea level

N

NPDES	National Pollutant Discharge Elimination System
NPV	net present value

O

O&M	operations and maintenance
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation

P

%	percent (use with numerals – e.g., 13%)
PAL	provisionally accredited levee
pCi/L	picoCuries per liter
PDF	peak design flow
PDWF	peak dry weather flow
PER	Preliminary Engineering Report
PFP	Public Facility Plan
pH	measure of acidity of alkalinity
PHD	peak hour demand
ppb	parts per billion
ppm	parts per million
PRS	pressure-reducing stations
PRV	pressure reducing valve
psi	pounds per square inch
PSV	pressure-sustaining valve
PUD	public utility district
PV	present value
PVC	polyvinyl chloride
PWMP	Public Works Management Practices Manual
PWWF	peak wet weather flow

Q

QA	quality assurance
QC	quality control

R

RDII	rainfall dependent infiltration/inflow
ROW	right-of-way
RRF	resource recovery facility
RSSD	Rieth Sanitary Sewer District

S

SBOD	soluble biochemical oxygen demand
SCADA	supervisory control and data acquisition
SDC	system development charge

SDR	standard dimension ratio
sec	second (measurement of time)
SOC	synthetic organic compound
SOW	scope of work
SRT	solids retention time
SSOAP	Sanitary Sewer Overflow Analysis and Planning
SVI	sludge volume index
SWMP	Stormwater Master Plan

T

TAZ	traffic analysis zones
Tc	time of concentration
TCR	Total Coliform Rule
TDH	total dynamic head
TMDL	total maximum daily load
TP	transite pipe
T/S	transit/storage
TSS	total suspended solids
Tt	travel time
TTHM	total trihalomethanes

U

UGA	urban growth area
UGB	urban growth boundary
UIC	underground injection control
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

V

VFD	variable-frequency drive
VCP	vitrified clay pipe
VFD	variable frequency drive
VOC	volatile organic compound
VSS	volatile suspended solids

W

WAS	waste-activated sludge
WFP	water filtration plant
WMCP	Water Management and Conservation Plan
WRF	water reclamation facility
WSMP	Water System Master Plan
WWTP	wastewater treatment plant

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Engineers/Planners

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SECTION 1
EXECUTIVE SUMMARY

Introduction

The City of Pendleton (City) owns and operates a public drinking water system. This Water System Master Plan (WSMP) documents key water system information and provides analysis and recommendations that inform infrastructure development and operational decisions by City staff.

How This Plan Should Be Used

This WSMP serves as the guiding document for future water system improvements, and should:

- Be reviewed annually to prioritize and budget needed improvement projects.
- Have its mapping updated regularly to reflect ongoing development and construction.
- Have its specific project recommendations regarded as conceptual. (The location, size and timing of projects may change as additional site-specific details and potential alternatives are investigated and analyzed in the preliminary engineering phase of project design.).
- Have its cost estimates updated and refined with preliminary engineering and final project designs.

Scope of Work

The City selected Murray, Smith & Associates, Inc. (MSA) to create master plans for the drinking water, stormwater, and sewer collection systems. The scope of work (SOW) for this WSMP includes the following major tasks and deliverables:

- Describe the City's existing water system.
- Develop and calibrate a hydraulic model.
- Develop population and water demand projections consistent with the City's 2011 Comprehensive Plan Update.
- Develop performance criteria.
- Evaluate the water system's hydraulic capacity to identify deficiencies for existing, 5-year, 10-year, 20-year, and build-out planning horizons.
- Conduct and summarize benchmarking data comparing the City's operations and maintenance (O&M) practices to similar municipalities.
- Review the City's current O&M program and present recommendations.
- Develop an ongoing repair and replacement program for distribution mains.

- Develop capital improvement program (CIP) recommendations and cost estimates for projects required through build-out.
- Develop a specific future improvement plan for the Airport Industrial Area (AIA) in northwest Pendleton.
- Develop a water system financial plan that identifies a funding strategy for the CIP, aging infrastructure repair and replacement, and staffing.

Organization of the WSMP

This WSMP is organized into seven sections, as described in Table 1-1. Detailed technical information and support documents are included in the appendices.

Table 1-1
WSMP Organization

Section	Description
1 – Executive Summary	Purpose and scope of the WSMP and summary of key components of each part of the plan.
2 – Existing System Description	Description of the service area and overview of the existing system and facilities.
3 – Population and Demand Projections	Population projections and water demand estimates for existing and future service area boundaries.
4 – System Analysis	Overview of system performance criteria. Discussion of supply, storage, and pumping capacity, and distribution system hydraulic analysis and deficiencies for existing and future planning horizons.
5 – Operations and Maintenance	Describes current operations and maintenance procedures, summary of benchmarking results comparing the City to similar municipalities, summary of recommendations.
6 – Capital Improvement Program	Improvement project recommendations including cost estimates and timeframe for implementation.
7 – Financial Plan	Strategy for funding water system improvements.

Existing System Description

The Public Works Director manages the City-owned water system and supervises the Water Division Superintendent, who oversees the system's operation. The existing Pendleton water system serves approximately 17,600 people at 5,800 residential and commercial service connections. The City's ultimate future water service area includes all land within the Urban Growth Boundary (UGB).

Pendleton draws its water supply from seven active groundwater wells located throughout the City and one well near the City of Mission that is filtered at the Water Filtration Plant (WFP) along with surface water from the Umatilla River. Five of the City's wells are configured for Aquifer Storage and Recovery (ASR). ASR is a water management tool whereby potable water is injected into a well during periods when excess and inexpensive surface water supply is available. This injected water is stored in the aquifer for use during periods of low surface water supply availability and high demands, generally in summer.

The City's water distribution system is divided into 13 pressure zones served by 8 distribution storage facilities, 13 booster pump stations (nine establish pressure zones and four are 4 within zones), and 9 pressure-reducing valves (PRV). The system includes approximately 107 miles of pipeline and approximately 700 fire hydrants.

Prior to the water master planning process, MSA and the City undertook an effort to create a Geographic Information System (GIS) database of the water, sewer, and stormwater systems. The new water system database was created based on existing hard copy and CAD maps showing the size and location of water mains and other facilities. This water system GIS was used to develop a hydraulic model of the distribution system. The City recently hired a GIS Coordinator who is working to improve the quality of the information in addition to collecting new data points and attributes.

Population and Water Demand Projections

Population growth and water demand projections were developed for; existing (2013), 5-year, 10-year, 20-year, and build-out planning horizons. Current water demands were estimated from historical customer billing records and water production data. The Eastern Oregon Correctional Institution, housing approximately 1,600 people, is the City's single largest water user with an average daily demand of 225 gallons per minute (gpm).

Future water demand projections were based on current water use characteristics, projected land development and forecasted population growth. Population growth was forecast based on current land use and zoning designations, estimated residential population density, vacancy rates and other assumptions consistent with the City's 2011 Comprehensive Plan Update.

The location and rate of anticipated development was based on a review of developable land and input from City staff. Projected water demands are used to assess the capacity of existing water system facilities and develop recommended water system improvements to serve anticipated growth. The timing of recommended system improvements should be scrutinized based on actual growth and water demand at the time the improvement is to be constructed. Population and water demand projections are presented in Table 1-2.

Table 1-2
Population and Water Demand Projections by Pressure Zone

Pressure Zone	Existing (2013)		5-Year		10-Year		20-Year		Build-Out	
	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)
Airport	0.065	0.159	0.301	0.738	0.353	0.865	0.353	0.865	0.894	2.189
Airport NW 49th	0.009	0.021	0.009	0.022	0.009	0.022	0.031	0.076	0.196	0.479
Airport Road	0.0006	0.001	0.001	0.001	0.0006	0.001	0.0006	0.001	0.027	0.066
Airport NW 47th	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	0.208	0.510
Cemetery	0.463	1.139	0.623	1.525	0.708	1.736	0.912	2.233	1.369	3.355
Future 1420	-	-	-	-	-	-	-	-	0.006	0.014
Future 1570	-	-	-	-	0.035	0.085	0.035	0.085	0.067	0.164
Gravity	2.947	7.249	3.130	7.667	3.370	8.257	3.467	8.494	4.798	11.756
Jr. High	0.047	0.115	0.047	0.115	0.047	0.115	0.079	0.194	0.079	0.195
Mt. Hebron	0.025	0.061	0.025	0.061	0.025	0.061	0.025	0.061	0.030	0.073
Murietta	0.003	0.007	0.003	0.007	0.003	0.007	0.003	0.007	0.271	0.665
North	0.056	0.137	0.073	0.178	0.088	0.216	0.088	0.216	0.095	0.234
Royal Ridge	0.007	0.017	0.016	0.040	0.029	0.071	0.046	0.113	0.046	0.113
SE 20th	0.003	0.007	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.013
Skyline	0.269	0.662	0.291	0.712	0.305	0.748	0.309	0.756	0.364	0.892
Total Water Demand	**3.9**	**9.6**	**4.5**	**11.1**	**5.0**	**12.2**	**5.4**	**13.1**	**8.5**	**20.7**
Estimated System Population	17,611		19,716		21,897		23,970		31,324	

System Analysis

The water system analysis includes an evaluation of water supply, storage and pumping capacity. A calibrated hydraulic model was developed to assess existing pressure zones, service pressure and distribution main capacity. Proposed pressure zones to serve future development within the City's UGB were identified as part of this WSMP. The following general conclusions were developed through the water system analysis and subsequent validation with City staff:

Supply Capacity

- The City has adequate total and firm capacity (Well 5 out of service) to meet existing maximum day demands (MDD).
- ASR injection of approximately 885 million gallons (MG) into the City's aquifer in 2013 resulted in a 0.5 ft water level increase in the aquifer. This annual water level increase is projected to continue with the ASR program. This projected increase in aquifer water level will increase pumping capacity in the City's wells by approximately 0.21 mgd in 10 years and 0.41 mgd within the 20-year timeframe.
- An additional 0.12 mgd of firm supply capacity will be required within 5 years, 1.18 mgd within the 10-years, 1.97 mgd within 20-years and 9.57 mgd of additional firm supply capacity is required to meet forecast demands at build-out.
- The City's water rights are adequate to support the additional supply development identified in this WSMP, as documented in the City's 2012 Water Management and Conservation Plan.

Water Quality Goals

The City strives to deliver consistent water quality to its customers and to comply with all Safe Drinking Water Act requirements. The City provides an annual water quality report to customers that indicates consistent, high quality water and full compliance with all Safe Drinking Water Act requirements.

Pressure Zone Performance

- The City's 13 existing pressure zones provide adequate service pressures between 40 and 80 pounds per square inch (psi) to most water system customers.
- A new 1570 Zone is proposed to serve customers at high elevations north of the existing Skyline Zone, as well as some existing high-elevation Skyline customers with low service pressures.

Distribution Storage Capacity

- The City has adequate distribution storage to meet operational, equalization, fire and emergency storage requirements under existing demand conditions.

- The City has a system-wide future distribution storage deficit of 0.29 MG within the 20-year planning horizon and 1.04 MG at build-out.
- The Airport Pressure Zone has a projected 20-year distribution storage deficit of 0.17 MG and build-out deficit of 0.89 MG. This assumes that the zone will continue to be served from a constant pressure pump station.
- The Skyline Pressure Zone has a projected 20-year distribution storage deficit of 0.12 MG and build-out deficit of 0.15 MG.

Pumping Capacity

- Backup power is recommended at the pump stations serving zones without gravity storage. The City recently added backup power to Mt. Hebron Pump Station and is currently adding backup power at the Airport Pump Station. None of the other booster pump stations have backup power.
- Of the existing booster pump stations, six have existing capacity deficiencies. These deficiencies increase over the 20-year planning horizon. A seventh pump station is recommended to serve the proposed 1570 Zone.

Distribution System Performance

- Using the calibrated hydraulic model of the existing City water system developed for this analysis, six areas were identified in the distribution system which exhibit pressures below 20 psi under existing MDD plus fire flow conditions. Piping improvements are recommended to mitigate these deficiencies.
- Model results indicate that during ASR injection a reduction in service pressures of 9 to 12 psi occurs in the west end of the City's Gravity Zone from Northgate (Hwy 37) near the Rudy Rada Skate Park west to Pendleton Sanitary Services. The water system grid is limited in this area. A water main improvement to reduce service pressure fluctuations during ASR injection is recommended as described in the CIP.
- Proposed system looping is recommended to provide service to identified distribution system expansion areas consistent with anticipated development timeframes. Actual development patterns and timing may change the priority of future improvements.

Operations and Maintenance

Assessment of the City's water system O&M program included reviewing information from City staff, comparing with the O&M practices of similarly sized utilities and reviewing regulatory requirements. Staff from the City's water utility are responsible for the maintenance and operation of the distribution and treatment systems. Based on the system size, the state requires a Water Treatment Level 2 and Water Distribution Level 3 operator certification for the individual in direct charge of the system. The water utility is structured and currently operated with 5.5 full-time equivalent employees (FTEs).

Routine operations implement procedures to ensure that the facilities within the water system function efficiently and meet regulations. Ongoing procedures include inspecting system facilities, monitoring flow and reservoir-level recording, and responding to customer inquiries and complaints.

For a benchmark comparison, four other utilities in the region were surveyed in order to compare their O&M practices to the City's current program. The performance indicators show that each FTE in the City is responsible for more water supplied (daily average) and total length of the distribution system piping than the other utilities. In general, the City operates with fewer staff than the rest of the survey group.
The City is working to update their O&M program through pursuing Public Works Accreditation, which is the implementation of best practices as outlined in the American Public Works Association's *Public Works Management Practices Manual-8th Edition* (PWMP Manual). The following conclusions and recommendations are based on a review of the City's O&M practices, accreditation goals and benchmarking of other water systems:

- Develop a comprehensive water system O&M program based on incorporation of the PWMP Manual best management practices to provide for consistent long-term O&M.
- Hire 3.5 additional FTEs. Three FTEs to implement the flushing and valve exercising programs and for leak detection, and a partial FTE is required to implement the comprehensive water system O&M program and associated record keeping.
- Hire two additional FTEs, which will be part of a second crew of four full time staff with dedicated equipment to perform the ongoing pipe replacement program on a 100-year cycle. The other two FTEs on the crew would be shared and funded with the Sewer and Storm Utilities.

Advanced Metering Infrastructure Evaluation

As part of this WSMP, an assessment was completed to evaluate the cost effectiveness of converting the City's customer meter reading system from manual reading to advanced metering infrastructure (AMI); AMI's potential benefits were evaluated, and a summary of the findings and recommendations is presented below:

- The AMI financial analysis indicates that manual meter reading services will be more cost-effective if meters continue to be read nine months out of the year, but if the City switches to year-round meter reading, an AMI system is financially justified.
- The City has placed endpoints for handheld meter reading on approximately two-thirds of the customer meters, and it is recommended that the remainder of the endpoints should be "migrateable" models. This type of endpoint will allow the continued use of handheld probes, and should the City decide to convert to an AMI system, is fully compatible with mobile and fixed-data collectors. The cost of migrateable endpoints, which constitutes the majority an AMI system's expense, is similar to that of the endpoints the City is currently installing.

It is recommended that the City continue adding meter endpoints and consider using migrateable endpoints, which would support conversion to an AMI system in the future. Installation of automated data collection infrastructure should be reevaluated beyond the current 5-year timeframe.

Capital Improvement Program

The CIP describes projects identified to address existing and future capacity deficiencies and to plan for ongoing repair and replacement of aging infrastructure. Identified CIP projects are grouped into four implementation timeframes; 5-Year, 10-Year, 20-Year and Beyond 20 years. CIP projects are summarized in Table 1-3 and illustrated in Figure 1-1.

The CIP includes $14 million in improvement projects over the 5-year horizon and $60.9 million over the 20-year horizon. Through build-out, $162.1 million in improvements are identified to address existing deficiencies and provide for anticipated development and system expansion.

Supply and Transmission Projects

- To meet supply needs in the 5-, 10- and 20-year planning horizons, it is recommended that the City construct one 1,500 gpm (2.2 mgd)-well in the next 5 years at an estimated project cost of $1.5 million.
- The 30-inch diameter concrete transmission main from the Water Filtration Plant to the South Hills Reservoirs is nearing the end of its useful life and should be replaced with a new 24-inch diameter transmission main (CIP ID T-55) within the 10-year timeframe at an estimated project cost of $1.6 million.

Distribution Storage Projects

- Due to an existing storage deficit in the Airport Zone and anticipated near-term industrial expansion in this zone, it is recommended that existing Airport Reservoirs 1 and 2 be replaced by a single 2 MG reservoir (CIP ID R-1) within 10 years at an estimated project cost of $3.6 million.
- A new 0.5 MG Skyline Reservoir (CIP ID R-2) is recommended beyond the 20-year planning horizon to address condition issues with the existing reservoir and mitigate a projected future storage deficit at an estimated project cost of $906,000. The new Skyline Reservoir is recommended for construction at a new site as part of the Skyline and 1570 Zone reconfiguration.
- Inspect and clean all City reservoirs on a regular basis.

Pump Station Projects

- Review of the City’s existing pump stations reveals a current pumping capacity deficit in almost every pressure zone. Recommended pump station improvement projects include both capacity upgrades when space for additional pumps is available and replacements when a new facility is required to provide adequate capacity. Pump station upgrades and improvements have a total estimated project cost of $1.8 million within the 5-year horizon, $12.7 million between 6 and 10 years, $3.5 million between 11 and 20 years and $2.3 million beyond 20 years.

- Develop a plan to address pump life cycle replacement costs in future CIPs, after addressing capacity upgrades identified in current CIP.
- In addition to recently installing a generator at Mt. Hebron Pump Station and currently installing one at the Airport Pump Station, backup power generators are recommended in the next 10 years at three constant pressure pumps stations: Royal Ridge, Jr High and SE 20th at an estimated total project cost of $600,000.

PRV Projects

- Several PRV projects are recommended to eliminate dead-end mains through future development areas and provide fire flow, emergency redundancy and a means of circulating water between zones to mitigate potential water quality issues. PRV improvements have a total estimated project cost of $300,000 within the 20-year planning horizon. PRV projects beyond 20-years have a total estimated project cost of $750,000.

Water Main Projects

Water main projects are recommended to:

- Mitigate fire flow deficiencies identified through hydraulic modeling of the distribution system.
- Reduce pressure fluctuations at the western edge of the system during ASR injection.
- Create a new 1570 Zone to improve service pressure and fire flow for existing high-elevation Skyline Zone customers.
- Provide water service and system looping through future development areas.
- Provide ongoing repair or replacement of water mains consistent with a 100-year life cycle. The pipe replacement program has an annual CIP cost of $250,000 for the first five years, increasing to $970,000 annually.

Airport Industrial Area (AIA) CIP

- In order to provide adequate fire service to anticipated development in the AIA, it is recommended that the City construct two interim non-potable supply systems over the 5-year planning horizon at an estimated project cost of $5.4 million. These interim systems allow the City to make incremental investments in the water system infrastructure and serve significant fire suppression demands for near term development.
- As previously mentioned, a new Airport Reservoir and Pump Station are recommended to serve anticipated future development within 10 years at an estimated project cost of $12.5 million.

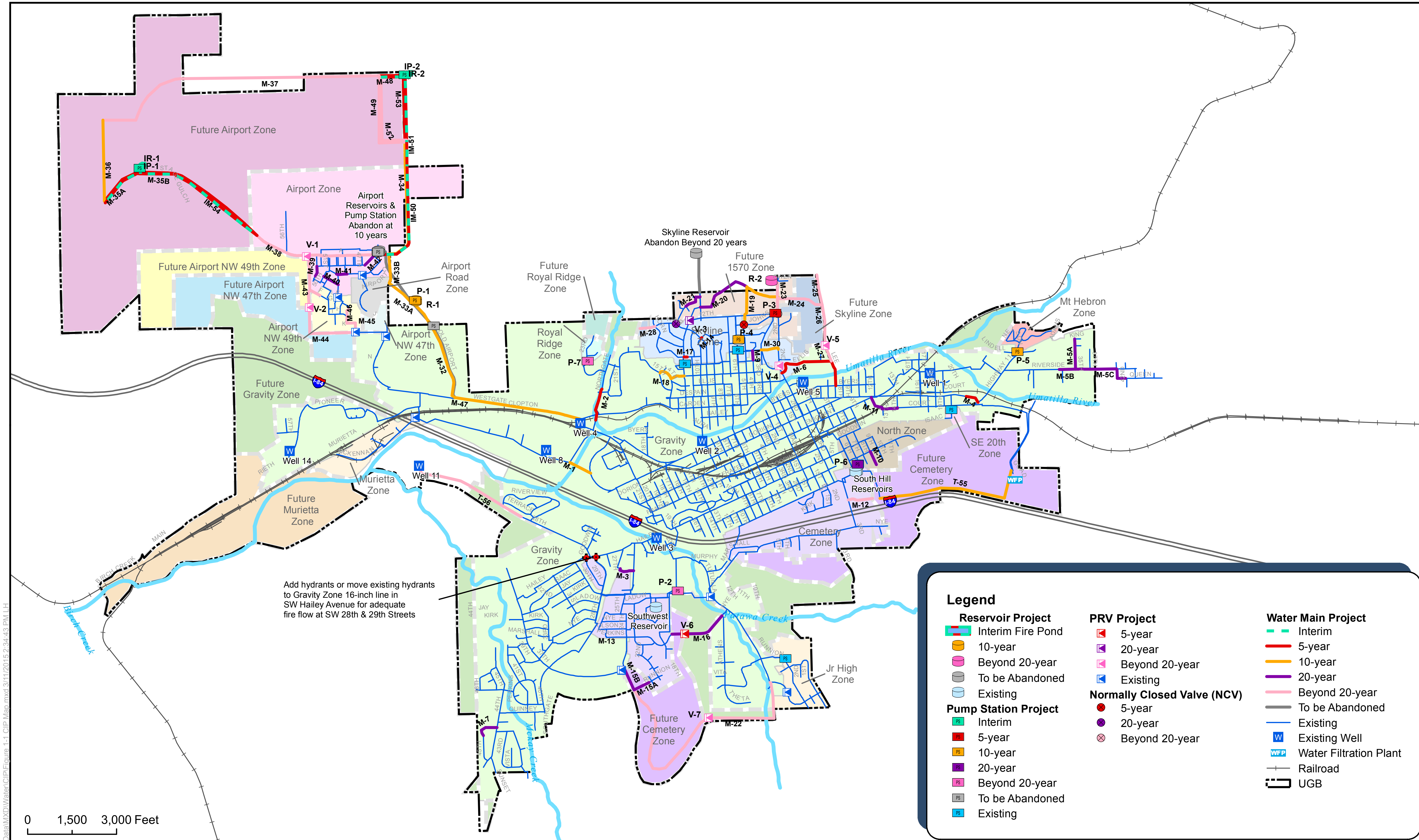
General Planning Projects

- Plan to update the City's Water System Master Plan approximately every five years.
- Update the City's Water Management and Conservation Plan as required by the State of Oregon.

Table 1-3
CIP Summary

Project Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				
			5-Year	10-Year	20-Year	Beyond 20-Year	Total
Supply and Transmission		First additional well	$1,500,000				$1,500,000
		Additional groundwater capacity beyond 20 years				$3,000,000	$3,000,000
	T-56	Connect Well 11 to Gravity Zone distribution system				$1,850,000	$1,850,000
	T-55	WFP High Level transmission main to South Hill Reservoirs		$1,552,000			$1,552,000
Supply and Transmission Projects Subtotal			**$1,500,000**	**$1,552,000**		**$4,850,000**	**$7,902,000**
Distribution Storage	R-1	2 MG Airport Reservoir replacement		$3,625,000			$3,625,000
	R-2	0.5 MG Skyline Reservoir replacement				$906,000	$906,000
Distribution Storage Projects Subtotal				**$3,625,000**		**$ 906,000**	**$ 4,531,000**
Pump Station	P-1	Airport PS replacement		$8,900,000			$8,900,000
	P-2	Cemetery PS capacity upgrade				$1,192,000	$1,192,000
	P-3	Future 1570 Zone PS	$1,760,000				$1,760,000
	P-4	North Hill PS replacement		$2,080,000			$1,600,000
	P-5	Mt Hebron PS replacement		$1,760,000			$1,760,000
	P-6	SE 7th Street PS replacement			$3,520,000		$3,520,000
	P-7	Royal Ridge PS capacity upgrade				$1,080,000	$1,080,000
		Backup power	$200,000	$400,000			$600,000
Pump Station Projects Subtotal			**$1,960,000**	**$13,140,000**	**$3,520,000**	**$2,272,000**	**$20,892,000**
Water Mains	M-2, 4, 6, 13, 14, 17, 35B	5-Year	$2,655,000				$2,655,000
	M-1, 18, 19, 30, 32-34, 36, 47	10-Year		$6,012,000			$6,012,000
Water Mains	M-3, 5, 7, 9-11, 15, 16, 20, 21, 39-42	20-Year			$3,993,000		$3,993,000

Project Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				
			5-Year	10-Year	20-Year	Beyond 20-Year	Total
Water Mains	M-12, 22-28, 37, 38, 43-46, 49, 52	Beyond 20-Year				$10,274,000	$10,274,000
	M-35A	Airport West interim non-potable main, permanent distribution main	$304,000				$304,000
	M-48	Airport East interim non-potable main, permanent distribution mains	$205,000				$205,000
	M-53		$448,000				$448,000
		Pipe Replacement Program	$1,250,000	$4,850,000	$9,700,000	$81,200,000	$97,000,000
Water Main Projects Subtotal			**$4,862,000**	**$10,862,000**	**$13,693,000**	**$91,474,000**	**$120,891,000**
PRV	V-1	53rd Ave - Airport 49th Zone				$150,000	$150,000
	V-2	53rd & H - Airport 47th Zone				$150,000	$150,000
	V-3	12th Dr - Skyline Zone			$150,000		$150,000
	V-4	2nd & Furnish - Gravity Zone				$150,000	$150,000
	V-5	Lee - Gravity Zone				$150,000	$150,000
	V-6	Perkins-Nye - Gravity Zone	$150,000				$150,000
	V-7	Southern Loop- Gravity Zone				$150,000	$150,000
PRV Projects Subtotal			**$150,000**		**$150,000**	**$ 750,000**	**$1,050,000**
Other	IR-2, IP-2, IM-50, IM-51	Airport East interim non-potable system – pond, supply main and pump station	$2,841,000				$2,841,000
	IR-1, IP-1, IM-54	Airport West interim non-potable system – pond, supply main and pump station	$2,520,000				$2,520,000
		Existing Airport Pump Station & Reservoir Demolition			$200,000		$200,000
		Update Water Master Plan	$150,000	$150,000	$300,000		$600,000
		Update Water Management & Conservation Plan	$50,000	$50,000	$100,000		$200,000
Other Projects Subtotal			**$5,561,000**	**$200,000**	**$600,000**		**$6,361,000**
Total			**$14,033,000**	**$29,379,000**	**$17,963,000**	**$100,252,000**	**$161,627,000**



MSA
Murray, Smith & Associates, Inc.

City of Pendleton
Water System Master Plan

Figure 1-1
CIP Map

March 2015 13-1442

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Financial Plan

Background

The water system is an enterprise fund of the City, and is supported by water system fees and charges, as opposed to general City revenues. The primary funding source is monthly water rates charged to customers inside and outside the City. Existing water rates include a base monthly charge that varies based on the type of customer or meter size (for most commercial and industrial customers), plus an additional volume rate per 100 cubic feet (ccf) or 748 gallons of water consumed. The current monthly bill for a typical residential customer with monthly water use of 15 ccf is $37.40 for a customer inside the City, and $56.15 for a residential customer outside the City.

The *2013 Washington/Oregon Water Rate Survey* by Raftelis Financial Consultants, Inc., found the City's residential water bill to be the eleventh lowest out of the 41 utilities surveyed. At the time of the survey, the median bill for utilities surveyed was $42.01 per month, compared to the City's monthly bill of $32.60. This represents just the water portion of monthly bills and does not include sewer or other service charges.

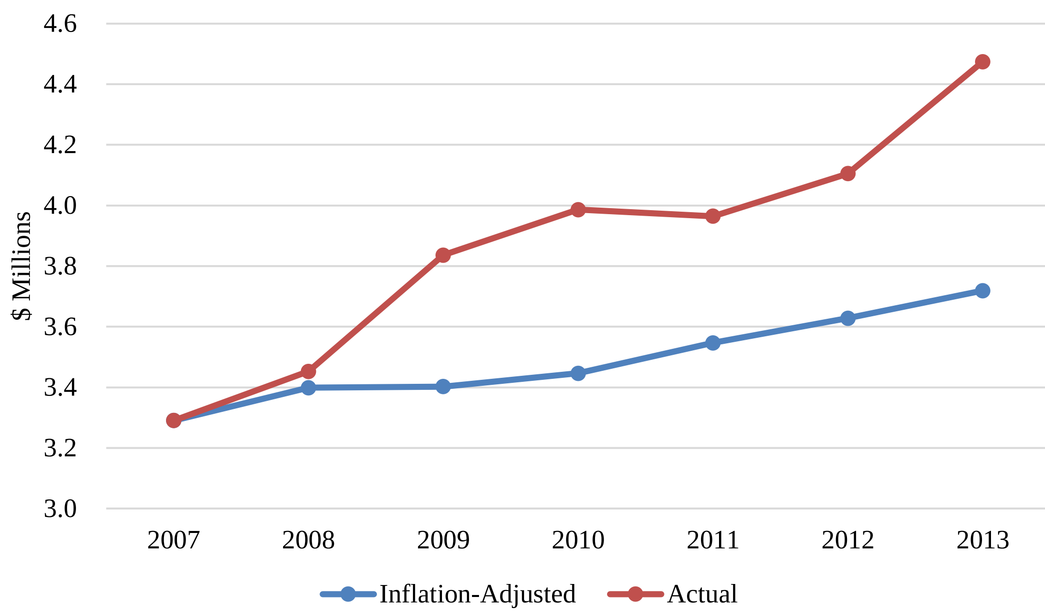
The City established an annual inflationary adjustment to its water and sewer rates in 2006. In April of each year, rates are adjusted by an amount equal to the lesser of either 3.5%, or the year-to-year percentage change in the Portland-Salem Consumer Price Index, Urban Consumers (CPI-U). Rate increases beyond inflationary adjustments have been limited to regulatory-driven cost increases. The 2014 increase was specifically targeted to fund new membranes at the WFP. Non-inflationary rate increases over the past ten years are as follows:

- 2005 – 12%
- 2013 – 5%
- 2014 – 7%

Financial Capacity

Since the inflationary adjustment was implemented in 2006, it has not kept pace with rising costs for water and sewer system operations. Figure 1-2 shows a comparison of inflation-adjusted operating expenses for the water and sewer systems combined, compared to actual historical expenses. The CPI-U (used to adjust rates annually) has increased at an average annual rate of 2.3% since 2007, compared to an average increase in operating costs of about 5.3%. This disparity is due to a number of factors, including higher cost escalation for electricity and chemicals (a large part of the system operating costs), franchise fees (related to non-inflationary rate increases), and City-allocated services costs (primarily personnel costs).

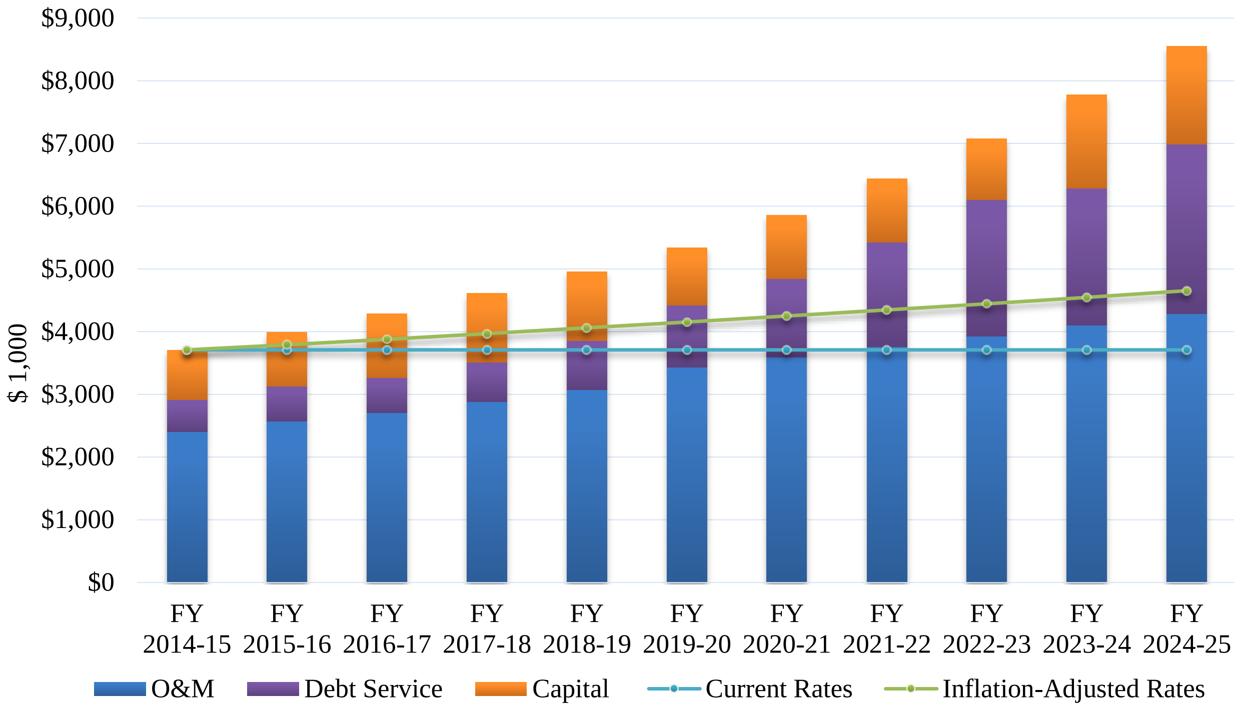
Figure 1-2
Historical Operating Expense Comparison (Combined Water & Sewer)



Given that the historical rate increases have not kept pace with operating cost inflation, and the City has had only one small increase in rates for non-CPI related cost increases (like funding capital improvements related to rehabilitation and repair, and capacity expansion) since 2005, the current rates do not provide sufficient financial capacity to address the future projected system needs (both operating and capital). Figure 1-3 shows the forecasted current and inflation-adjusted rate revenue, compared to projected annual operating, debt service, and capital outlay requirements for the next 10 years (capital requirements shown in this figure do not include improvements associated with Airport Industrial Area projects).

In FY2015-16, current rates adjusted for the historical average CPI of 2.3% would provide funding for about $325,000 of additional expenses over current operating costs (about $2.6 million), debt service ($550,000), and membrane replacement ($250,000). Given the significant capital improvement costs and additional staffing requirements identified in this WSMP, along with other repair and replacement needs for the WFP, wells and booster stations, additional revenue will be needed beginning in fiscal year 2015-16 to adequately fund the system. Although an annual transfer from the water fund to a fund intended for improvements at the WFP is included in the financial analysis, no evaluation of the improvements needed or adequacy of this funding amount for the WFP are included in this WSMP.

Figure 1-3
Projected Water System Revenue Requirements from Rates



General note: Debt Service and Capital Outlay do not include AIA projects.

It is recommended that the additional revenue come from both increases to the City's existing water rates, as well as implementation of new System Development Charges (SDCs). The City currently charges SDCs for the street system, but not for the water, wastewater, or stormwater systems, and is missing an important funding source for capital improvements. Following industry standards for development of SDCs, the recommended CIP would support an SDC of approximately $3,770 per equivalent residential unit. A recent survey by the League of Oregon Cities indicated the range for water SDCs is about $500 to $15,000, with the median equal to $2,730 per unit.

While SDCs are generally an important part of a capital funding strategy, they are only a portion of the solution, as rate increases will be needed to fund the majority of capital improvements related to rehabilitation and replacement, and remedying existing deficiencies, and all increases to operating costs (SDCs may not be used for system O&M). Table 1-4 shows the total percentage increase from current revenue needed for additional revenue requirements within the 10-year planning window. The system has experienced limited customer growth in recent years; if this trend continues, the majority of increased revenue will need to come from water rate increases. The required increases shown in Table 1-4 are total for the 10-year planning period.

Table 1-4
Additional Revenue Requirements (10-Year Period)

Item	Annual Cost	Required Percentage Increase
Current Rate Revenue	$3,706,050	
Additional Requirements[1]		
New Staff	$607,398	16%
Franchise Fee on Rate Increase	$381,879	10%
Other Operating Costs	$939,733	25%
Rate-supported CIP Costs	$145,930	4%
WFP Transfer	$150,000	4%
Debt Service		
AIA Projects	$399,699	11%
Other Projects	$2,347,345	63%
Reserve on New Debt	$567,452	15%
Total Additional Requirements	**$5,539,437**	**149%**

[1] *Annual amount needed in FY 2024-25 above current (FY 2014-15) requirements including projected inflation.*

Recommendations

The following recommendations related to funding the additional staffing and capital improvements as identified in the WSMP are offered for the City's consideration:

- Adopt a new SDC based on the growth-related portion of this WSMP CIP. Adjust the SDCs annually for inflation based on the Engineering News Record (ENR) Construction Cost Index (20 City average). Update SDCs as necessary to incorporate significant changes to the CIP, including additional source improvements.
- Budget an annual operating contingency equal to 30 to 90 days of O&M costs (consistent with industry standards).
- Change the index for annual inflation adjustments to rates from the CPI to the ENR. The current index has not kept pace with utility cost increases since it was adopted in 2006. The average annual increase in the ENR (20-city average) has been 3.0%, compared to 2.3% for the CPI.
- Increase revenues. Given the significant financial investments identified in this WSMP, additional debt funding will likely be needed for major projects in the 10-year planning period in order to minimize short-term rate impacts. The revenue increases shown in Table 1-4 assume approximately 75% of WSMP CIP costs will be funded through long-term debt in the first 10 years in order to mitigate short-term rate impacts. However, the City will need to evaluate available financing options as it implements specific CIP projects, and update the rate revenue requirements accordingly, as financing commitments are secured.

- Set water rates sufficient to fund additional cash reserves for ongoing repair and replacement of existing facilities beyond those included in this WSMP (currently estimated at $400,000 per year for WFP facilities, wells, and booster stations).
- Review the financial plan annually, and make modifications to planned rate increases and capital phasing as needed to meet system performance targets.

Summary and Overall WSMP Recommendations

This WSMP constituted a major investment of time and resources for City staff and the consultant team. The City and, in particular, the Public Works Department should be commended for its foresight in initiating such a comprehensive scope of work in order to successfully operate, maintain and improve the City's water system. This WSMP utilized industry standard approaches by compiling and converting information to a GIS database and utilizing hydraulic modeling software to identify system deficiencies and refine recommended improvement projects.

Prior to this WSMP no single water system inventory nor hydraulic model existed. Collecting and compiling system data allowed for a more accurate and comprehensive look at the water system as a whole than what was previously available. The hydraulic modeling allowed for the evaluation of water system alternatives based on system hydraulics. The capital projects that have been identified provide the City with a plan, phased over the next 20 years and beyond, that is affordable and implementable.

As a result of this WSMP, the following recommendations are made:

- Implement short term (1-10 years) improvements as identified in the CIP to address existing capacity and condition issues as well as provide for planned development in the AIA. In order to maintain infrastructure an annual repair and replacement program should be implemented.
- O&M programs should be implemented to increase the lifecycle of infrastructure and to reduce unplanned maintenance.
- Reassess long-term improvements (beyond 10 years) using future WSMP updates: the GIS, hydraulic model and water consumption and production data.
- Continue improving the quality of available water system information, specifically:
  - Continue to refine existing GIS water system information.
  - Track customer complaints and unplanned repair data and link to the GIS database to identify priorities for system maintenance and pipe replacement.
  - Continue utilizing the hydraulic model as a tool for testing the potential distribution system impact of future development and operational changes.

Policy Recommendations

In order to prevent unnecessary large expenditures in the future, it is recommended that the City reconsider its financial and planning review policies, as follows:

Planning Review Policies

Although planning documents have detailed water system upgrades, there are no policies in place requiring regular updates, public discussion, or review. Consequently, as updated information becomes available and changes in the system occur, planning may be altered and significant investments could be made when an alternative based on new information may be a better option. The following policy recommendations will better define the requirements of future water system planning and help future City councils and the public plan for investments long before they are needed:

- Require City staff to provide an annual review to Council on the status of the master plan.
- Provide an updated or new master plan to City Council every five years for adoption.

Once the City revises its policies, it is crucial that future City councils and staff understand the rationale behind these policies. To realize the potential impact of any future policy revisions, the historical context and reasoning behind existing policies must be clearly understood.

Murray, Smith & Associates, Inc.
Engineers/Planners

SECTION 2
Existing System Description

SECTION 2
EXISTING SYSTEM DESCRIPTION

Introduction

This section provides an overview of the system location, service area, management structure, and existing water system infrastructure.

Location and Climate

The City of Pendleton is located in northeastern Oregon approximately 25 miles south of the Oregon-Washington Border. The City is located in Umatilla County along the Umatilla River, northwest of the Blue Mountains and west of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). Elevations within the City vary from 950 to 1,570 feet. Figure 2-1 presents a map of Oregon showing the location of the City.

Pendleton is located in a semi-arid climate with short, cool winters and hot summers. The average annual precipitation in this area is 12.7 inches with an average annual air temperature of 52^{o}F. Temperatures range from an average high of 87^{o}F in summer to an average low of 27^{o}F in winter.

System Management and Background

The City is governed under the direction of the Mayor and City Council with water operations overseen by the City Manager. The City Manager directs all City departments including those primarily involved in infrastructure considerations, which include Parks and Recreation, Community Development, Public Works, Finance and Facilities. The Public Works Director manages the wastewater, stormwater, water and street utilities as well as overseeing management of the levee system. The Water Division is directed by a superintendent and employs operations and maintenance staff. The Water Superintendent works closely with management from other City utility departments and reports to the Public Works Director, as depicted in Figure 2-2, which represents the collegial relationships across divisions within the Public Works Department.

The City began developing its present water system in the early twentieth century with the South Hill Reservoirs, which were constructed in 1914. Since that time, the City's water distribution system has grown to contain approximately 107 miles of pipeline, and includes 13 booster pump stations, nine pressure-reducing valves (PRV) and eight distribution storage facilities. The system draws from seven active groundwater wells located throughout the City and one well near the City of Mission that is filtered at the Water Filtration Plant (WFP) along with surface water from the Umatilla River. The water system has approximately 700 fire hydrants and is divided into 13 pressure zones.

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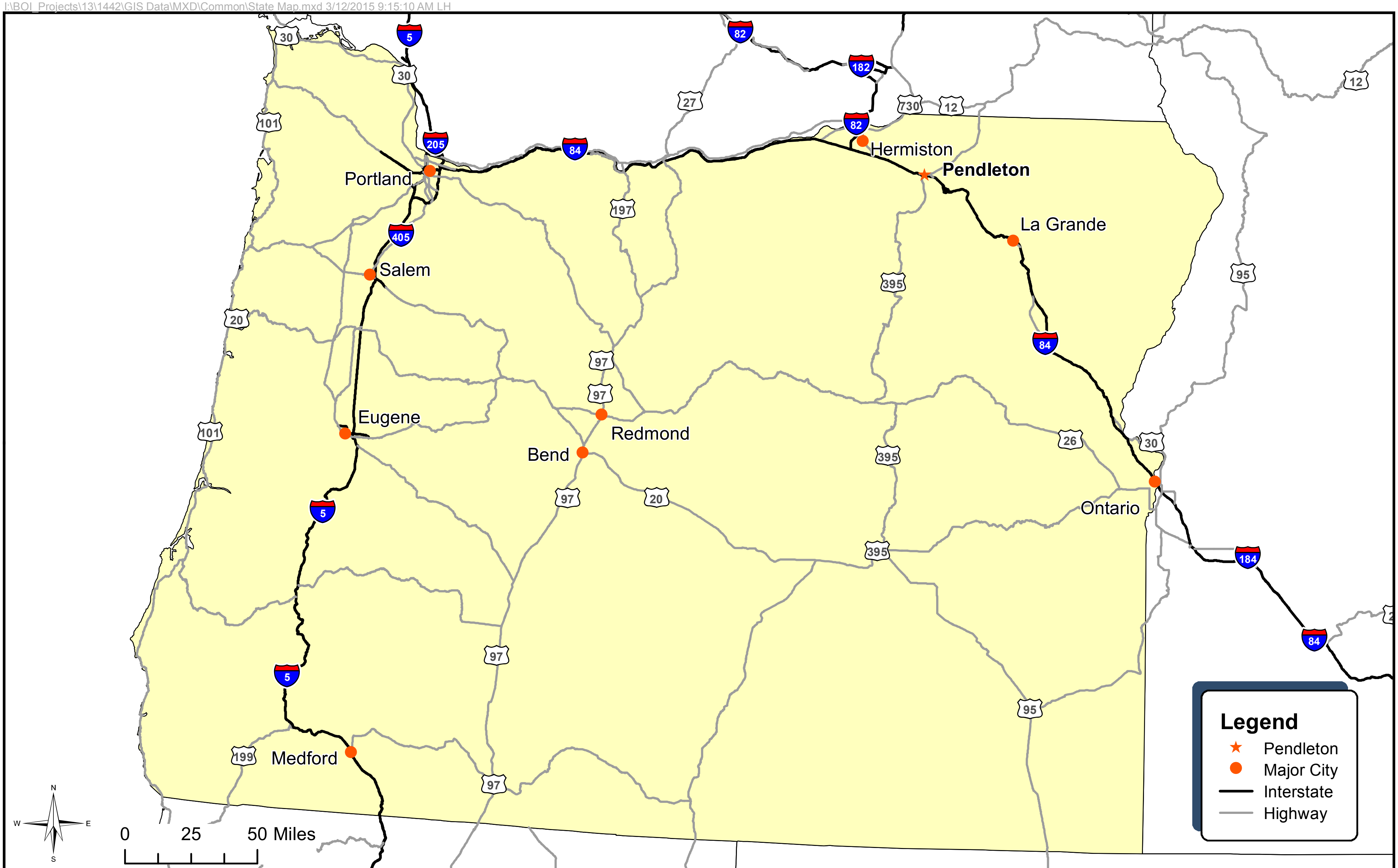

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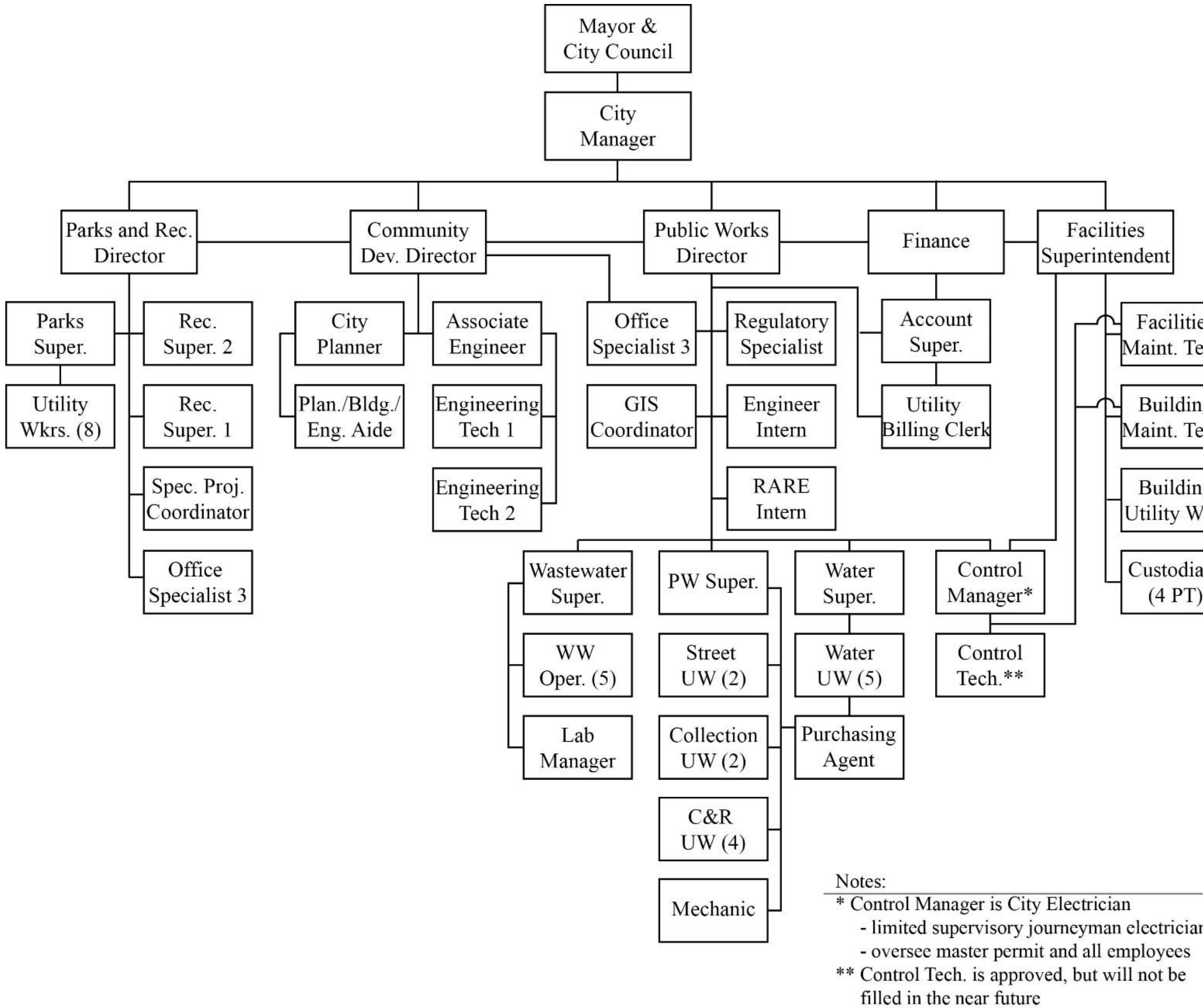
City of Pendleton
Water System Master Plan

Figure 2-1
State Map

March 2015 13-1442

Figure 2-2
Organizational Chart



Water Service Area

The city limits include approximately 11.3 square miles (approximately 7,200 acres) and the current urban growth boundary (UGB) encompasses 13.4 square miles (approximately 8,600 acres). For the purposes of this WSMP, the current water service area is the entire area within the city limits. The UGB delineates the boundary of the future water service area which is used for 20-year and build-out growth projections. Build-out occurs when all developable land within the UGB has been developed. The public water system currently supplies water for approximately 17,600 people at 5,800 connections within the UGB.

Existing System

Each of the water system's facilities are described in the following paragraphs and illustrated in Figure 2-3 and Figure 2-4 at the end of this section.

Water Rights

The City's 2012 Water Management and Conservation Plan (WMCP) includes a tabulation of the City's water rights. Excerpts from the WMCP, including Table 2 – City of Pendleton Water Rights, are included in Appendix A.

Water Supply

The potable water for the City's system is supplied by both groundwater and surface water sources. The distribution system has eight active wells and one surface water intake.

Surface Water

The surface water source supplies the majority of water used in the City and draws water from the Umatilla River. The Umatilla River Intake Pump Station has four pumps with a total design capacity of 8,900 gallons per minute (gpm). However, the pumping capacity is impacted by river water levels and temperature, which vary significantly throughout the year. Typically, all four pumps are operated during winter months, when the river flow is over 250 cubic feet per second (cfs), to meet domestic demands and to supply injection water for the City's Aquifer Storage and Recovery (ASR) wells. During summer months, when the river is low and water temperatures are high, a single pump is typically in operation. The City has backup power at the Umatilla River Intake Pump Station.

Water Filtration Plant

The Umatilla River Intake Pump Station delivers water to the WFP. After filtration, finished water is conveyed to the distribution system by gravity and through the High Level Booster Pumps to the South Hill Reservoirs. Well 7 groundwater and Umatilla River surface water are filtered at the WFP. The WFP was constructed in 2003 and is an ultra-filtration membrane facility with 9.8 million gallons per day (mgd) (6,800 gpm) existing capacity and expansion capacity up to 15 mgd. The City has backup power at the WFP.

Groundwater Wells

The City's eight active wells have depths ranging from 500 to 1,000 feet below ground surface. Six of the wells, Wells 1, 2, 3, 4, 8 and 14, pump directly into the distribution system's Gravity Zone after on-site disinfection. Well 5 pumps into the small, ground-level Stillman Reservoir to alleviate air entrainment issues and is then boosted into the Gravity Zone. Well 7, located east of Pendleton near the town of Mission, pumps to the WFP. Well 6 is currently inactive and the City plans to abandon the well in the near future. The current operational capacity of the seven active wells, Wells 1, 2, 3, 4, 5, 8 and 14, supplying the City's distribution system directly is approximately 8,300 gpm (11.95 mgd).

Wells 1, 4, 5, 8 and 14 are configured for ASR. ASR is a water management tool whereby potable water is injected into a well during periods when excess and inexpensive surface water supply is available. This injected water is stored in the aquifer for use during periods of low surface water supply availability and high demands, generally the summer season.
Well 11 is currently isolated from the City system as part of a small, private system that serves a few customers, including the Resource Recovery Facility (RRF). Well 11 is permitted through the Oregon Water Resources Department (OWRD) and may be considered for connection to the City system in the future. The City has three additional permitted wells, numbers 9, 10 and 12 that have not been developed yet.

Table 2-1 lists attributes of each well and of the Umatilla River Intake pumps. The locations of the supply pumps are shown in Figure 2-3 at the end of this section.

Table 2-1
Supply Pumps

Supply	Pressure Zone	Pump Horsepower (HP)	Pump Capacity[1]		Current Operational Capacity		ASR
			gpm	mgd	gpm	mgd	
Well 1	Gravity	250	1,250	1.80	1,213	1.75	Yes
Well 2	Gravity	450	2,225	3.20	2,175	3.13	No
Well 3	Gravity	100	475	0.68	475	0.68	No
Well 4	Gravity	250	1,080	1.56	800	1.15	Yes
Well 5	Gravity	400	2,800	4.03	1,850	2.66	Yes
Well 6	Inactive	-	-	-	-	-	No
Well 8	Gravity	200	1,000	1.44	950	1.37	Yes
Well 14	Gravity	100	540	0.78	540	0.78	Yes
Total Well Capacity to System			**9,370**	**13.49**	**8,003**	**11.52**	
Well 11	RRF	7.5	60	0.09	60	0.09	No
Well 7	WFP	100	900	1.30	300	0.43	No
River Intake	WFP	125-250	8,900	12.8	8,900	12.8	-

[1] *Represents capacity of existing pump and not actual well capacity.*

Pressure Zones

The distribution system is currently separated into 13 pressure zones. The zones are configured to deliver water at a service pressure of 40 to 130 pounds per square inch (psi). The maximum service pressure allowed by the *Oregon Plumbing Specialty Code* is 80 psi. Individual PRVs are required on services in areas where mainline pressures exceed 80 psi.

Pressure zone hydraulic grade lines (HGLs) are set by overflow elevations of distribution storage facilities or discharge pressures of pump stations or PRVs serving each zone. The zone HGL determines the pressure available at each service in the zone. Table 2-2 summarizes the existing pressure zones, their HGLs and facilities serving each zone.

Table 2-2
Pressure Zone Summary

Pressure Zone	HGL (ft)	Served by
Airport	1,624	Airport Pump Station
Airport NW 49th	1,600	Airport NW 49th PRV
Airport Road	1,515	Airport NW C PRV
Airport NW 47th	1,475	Airport NW 47th PRV
Cemetery	1,471	Cemetery & SE 7th Street Pump Stations
Gravity	1,326	Wells 1-5, 8 & 14, South Hill, North Hill & Southwest Reservoirs
Jr. High	1,380	Jr. High Pump Station
Mt. Hebron	1,500	Mt. Hebron Pump Station
Murietta	1,200	Murietta PRV
North	1,415	North-South PRV
Royal Ridge	1,420	Royal Ridge Pump Station
SE 20th	1,360	SE 20th Pump Station
Skyline	1,478	Skyline Reservoir, 12th Street & North Hill Pump Stations

Distribution Storage Reservoirs

The water system contains eight storage facilities, which are summarized in Table 2-3.

Table 2-3
Water Distribution Storage Facilities

Reservoir	Year Built	Construction	Volume (MG)	Pressure Zone Served	Floor Elevation (ft)	Overflow Elevation (ft)
Airport 1	1965	welded steel	0.5	Pump to Airport	1,478	1,512
Airport 2	1991	welded steel	0.5	Pump to Airport	1,478	1,512
North Hill	Unk	below-ground concrete	1.0	Gravity	1,304.8	1,325.8
Skyline	Unk	partially buried concrete w/ dome	0.25	Skyline	1,451.7	1,481[1]
South Hill (2 reservoirs)	1912	below-ground concrete	1.0 each	Gravity	1,307.3	1,326.9
Southwest	1991	welded steel	1.1	Gravity	1,290.5	1,330
WFP Clearwell	2002	welded steel	1.8[2]	Gravity	1,318.9	1,340.9
Stillman[3]	2011	bolted steel	0.08	Pump to Gravity	-	-

[1] *To avoid issues with the tank dome leaking, the Skyline Reservoir is only filled to an elevation of 1,477.5 feet.*
[2] *Available storage capacity at the WFP Clearwell is equal to 10 feet of the 24-foot total depth of the clearwell, approximately 0.75 MG.*
[3] *The Stillman Reservoir is used to mitigate air entrainment issues for supply pumped from Well 5.*

Booster Pump Stations

There are currently 13 booster pump stations within the water system; nine of these pump to create higher pressure zones, and four add intermediate pressure boosts within zones. The 5th & Horn and High Level Pump Stations each provide an additional boost when needed to fill reservoirs in the Gravity Zone from the distribution system and WFP respectively. The Stillman Pump Station pumps from the Stillman Reservoir at Well 5 into the Gravity Zone. The Gilliam Canyon Pump Station does not serve customers directly, but boosts water from the Gravity Zone to fill the Airport Reservoirs. The remaining nine pump stations either provide constant pressure to a smaller zone without storage, or supply to a water storage facility serving a higher pressure zone by gravity.

Backup Power

The City recently installed backup power at Mt. Hebron Pump Station and is currently installing backup power at the Airport Pump Station. None of the other booster pumps currently have backup power. The largest pump at the Cemetery Pump Station is driven by a natural gas engine to provide an alternate energy source in case of an electrical power outage. Table 2-4 presents a list of the City's booster pump stations and their relevant attributes.

Table 2-4
Pump Stations

Pump Station	Number of Pumps	HP	Total Capacity (gpm)	Suction Zone	Discharge Zone	Pump Elev. (ft)
12th Street	2	25, 40	800	Gravity	Skyline	1,255.5
5th & Horn	1	10	600	Gravity	North Hill Reservoir (Gravity)	1,287.5
Airport	3	30, 30, 50	3,300	Airport Reservoirs	Airport	1,473.5
Cemetery	4	25, 30, 50, 100	3,200	Gravity	Cemetery	1,147.7
Gilliam Canyon	2	30, 30	800	Gravity	Airport Reservoirs	1,204.2
High Level	2	20, 50	3,550	WFP	South Hill Reservoir (Gravity)	1,327.3
Jr. High	2	30, 30	2,200	Gravity	Jr. High	1,194.7
Mt. Hebron	2	7.5, 15	600	Gravity	Mt. Hebron	1,117.7
North Hill	1	25	800	Gravity	Skyline	1,319.2
Royal Ridge	3	20, 20, 40	1,050	Gravity	Royal Ridge	1,212.2
SE 20th	1	1.5	150	Gravity	SE 20th	1,186.8
SE 7th	2	30, 60	800	Gravity	Cemetery	1,305
Stillman	1	250	2,800	Stillman Reservoir	Gravity	1,073.2

Pressure Reducing Valves

Nine PRV vaults regulate pressure and flow to small zones throughout the system. While most of the PRV vaults have just one valve, three of the facilities contain a bypass valve for typical operations and a larger, main valve for fire flow conditions. These include the Hospital, Murietta Road and North-South PRV vaults. Table 2-5 presents a list of PRVs in the City's water system including pressure zones served, diameter and pressure setting for each valve.

Table 2-5
Pressure Reducing Valves

PRV	Pressure Zone Flow Direction (High to Low HGL)	Diameter (in)	Setting (psi)	Elevation (ft)
Airport NW 47th	Airport NW 49th to Airport NW 47th	6	50	1,360
Airport NW 49th	Airport to Airport NW 49th	6	80	1,415
Airport NW C	Airport to Airport Road	8	30	1,446
Airport Road	Airport NW 47th to Gravity	6	35	1,236
Hospital Main	Cemetery to Gravity	8	40	1,184
Hospital Bypass	Cemetery to Gravity	2	45	1,184
Murietta Road Main	Gravity to Murietta	8	75	1,013
Murietta Road Bypass	Gravity to Murietta	2	80	1,013
North-South Main	Cemetery to North	14	45	1,300
North-South Bypass	Cemetery to North	8	50	1,300
Sunridge	Jr. High to Gravity	8	55	1,185
Tutuilla Road	Cemetery to Gravity	12	105	1,075

Distribution Pipe

The City's water distribution piping includes over 100 miles of pipe. These pipes vary from 3/4 to 30 inches in diameter and are composed primarily of cast iron and ductile iron, with some polyvinyl chloride (PVC), galvanized iron and concrete. A very small portion of system piping is constructed from other materials, such as, steel and copper. New water mains are typically constructed using ductile iron or C900/905 PVC, which are allowed with City approval. Table 2-6 summarizes existing pipes by material and diameter.

Table 2-6
Pipe Materials by Diameter

Material - Length (1,000 ft)								
Diameter (in)	**Cast Iron**	**Concrete**	**Ductile Iron**	**Galvanized Iron**	**PVC**	**Other**	**Total**	**Percent**
Unknown	1.6	0.1	1.0	0.0	0.0	0.1	**2.8**	**0.5%**
3/4-3	12.0	0.0	1.6	5.4	0.0	1.1	**20.1**	**3.6%**
4-8	242.5	0.0	71.3	2.8	7.7	0.3	**324.6**	**57.7%**
10-16	87.7	1.1	73.7	0.0	0.9	0.8	**164.2**	**29.2%**
20-30	3.9	36.0	10.4	0.0	0.0	0.3	**50.6**	**9.0%**
Total	**347.7**	**37.2**	**158.0**	**8.2**	**8.6**	**2.6**	**562.3**	**100%**
Percent	**61.8%**	**6.6%**	**28.1%**	**1.5%**	**1.5%**	**0.5%**		

The physical characteristics of the water system are summarized based on information in the City's Geographic Information System (GIS), which has been developed as part of this overall planning effort. The creation of the GIS was based on a conversion of historical computer aided drafting (CAD) layers, hard copy mapping, operator input and augmented with field data collection. Pipe installation year is based on input from City staff, who reviewed existing information where it was available. In many cases the pipe installation information is incomplete. The majority of the distribution piping is greater than 60 years old with 63 percent of the piping installed prior to 1950. Table 2-7 summarizes the distribution system piping by age and material.

Table 2-7
Pipe Age and Material

Material – Age by Length (1,000 ft)								
Installation Year	**Cast Iron**	**Concrete**	**Ductile Iron**	**Galv. Iron**	**PVC**	**Other**	**Total**	**Percent**
Before 1950	249.8	37.2	54.9	7.8	0.0	1.6	**351.3**	**62.5%**
1950-1959	15.1	0.0	4.7	0.4	0.0	0.0	**20.2**	**3.6%**
1960-1969	66.7	0.0	17.7	0.0	0.0	0.0	**84.4**	**15.0%**
1970-1979	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0%**
1980-1989	0.0	0.0	8.0	0.0	0.0	0.0	**8.0**	**1.4%**
1990-1999	0.0	0.0	4.9	0.0	0.0	0.0	**4.9**	**0.9%**
2000-2013	0.0	0.0	32.9	0.0	7.1	0.0	**40.0**	**7.1%**
Unknown	16.1	0.0	34.9	0.0	1.5	1.0	**53.4**	**9.5%**
Total	**347.7**	**37.2**	**158.0**	**8.2**	**8.6**	**2.6**	**562.3**	**100%**
Percent	**61.8%**	**6.6%**	**28.1%**	**1.5%**	**1.5%**	**0.5%**		

SCADA System

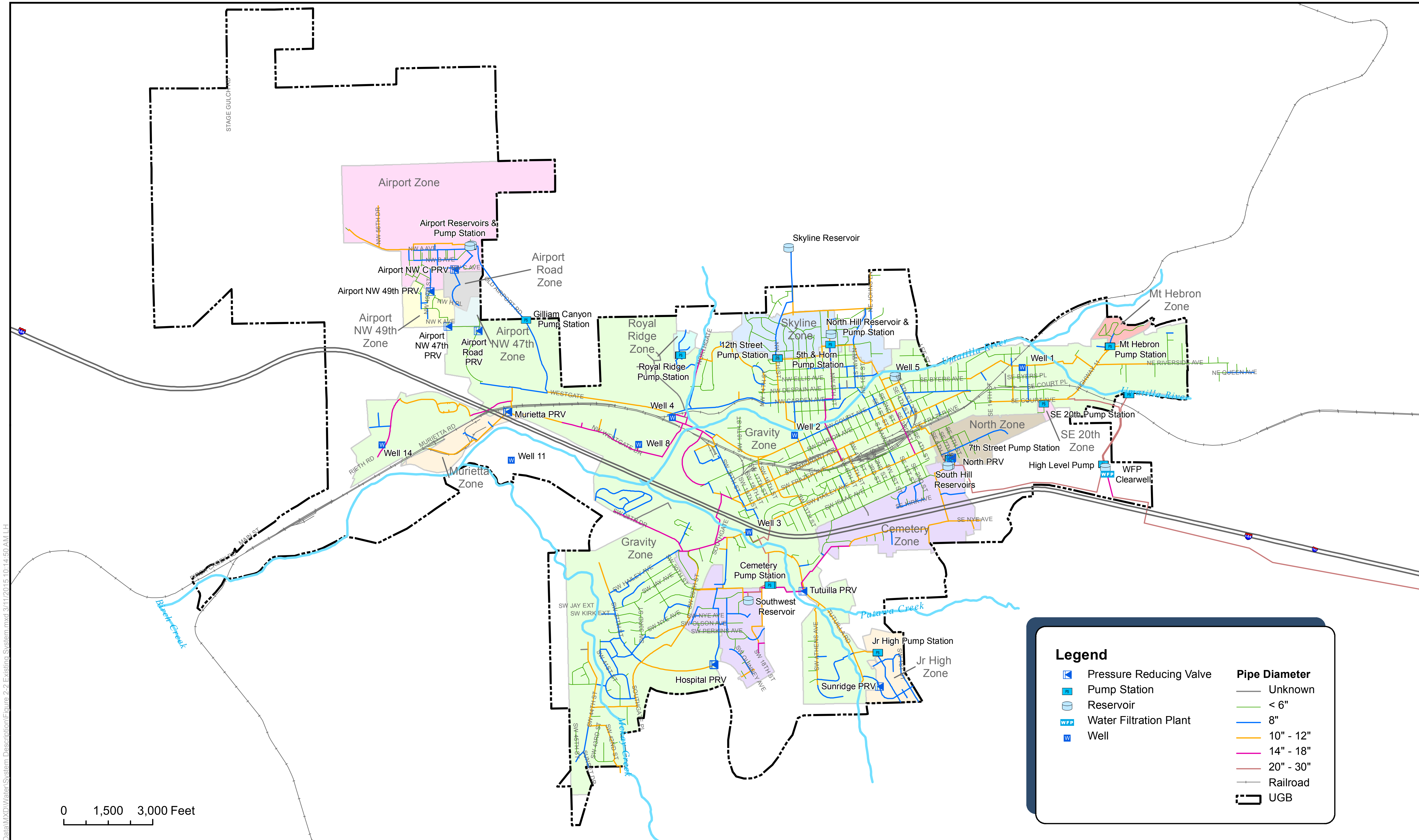
The status of the water system is monitored and controlled through a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system continuously monitors conditions and various parameters at each well and booster station and displays the information on the operator workstations. The SCADA system also monitors levels at the reservoirs. The system sounds an alarm if conditions are not meeting standards, with approximately 330 alarm conditions throughout the distribution system and 200 at the WFP.

Summary

Pendleton's existing water service area covers approximately 11.3 square miles within the current city limits. Elevations within the water service area range between 950 And 1,570 feet. The water system is divided into 13 pressure zones serving approximately 17,700 people through 5,800 residential, commercial and industrial service connections.

Pendleton's water supply is taken from both the Umatilla River and eight groundwater wells located throughout the City. Water from the river and Well 7 is treated at the Water Filtration Plant (WFP) using ultra-filtration membrane technology. Five of the City's wells are configured for ASR.

The distribution system consists of approximately 107 miles of pipeline and includes 13 booster pump stations (nine establish pressure zones and four are 4 within zones), nine pressure-reducing valves (PRV) and eight distribution storage reservoirs.



City of Pendleton
Water System Master Plan

Figure 2-3
Existing Water System

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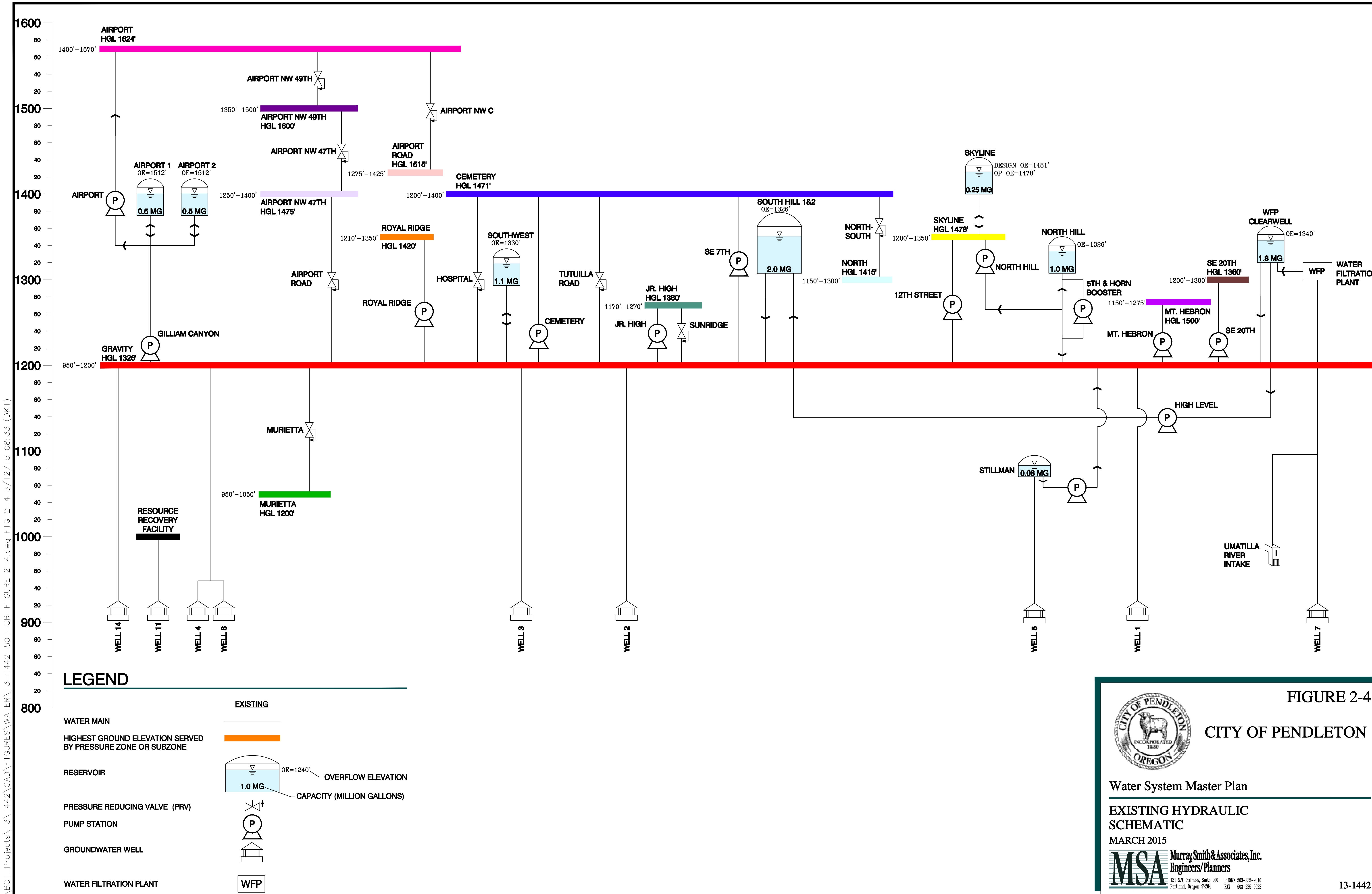


FIGURE 2-4

CITY OF PENDLETON

Water System Master Plan

EXISTING HYDRAULIC SCHEMATIC

MARCH 2015

MSA Murray, Smith & Associates, Inc. Engineers/Planners
121 S.W. Salmon, Suite 900 Portland, Oregon 97204 PHONE 503-225-9010 FAX 503-225-9022

13-1442

Murray, Smith & Associates, Inc.
Engineers/Planners

SECTION 3
Population & Demand Projections

SECTION 3
POPULATION AND DEMAND PROJECTIONS

Introduction

This section presents a summary of existing and projected population, associated water use and service area characteristics. Water demand forecasts were developed from current land use and zoning designations, and historical consumption and production records. Land use and population assumptions reflect the analysis and findings documented in the City of Pendleton's (City) 2011 Comprehensive Plan Update.

Service Area

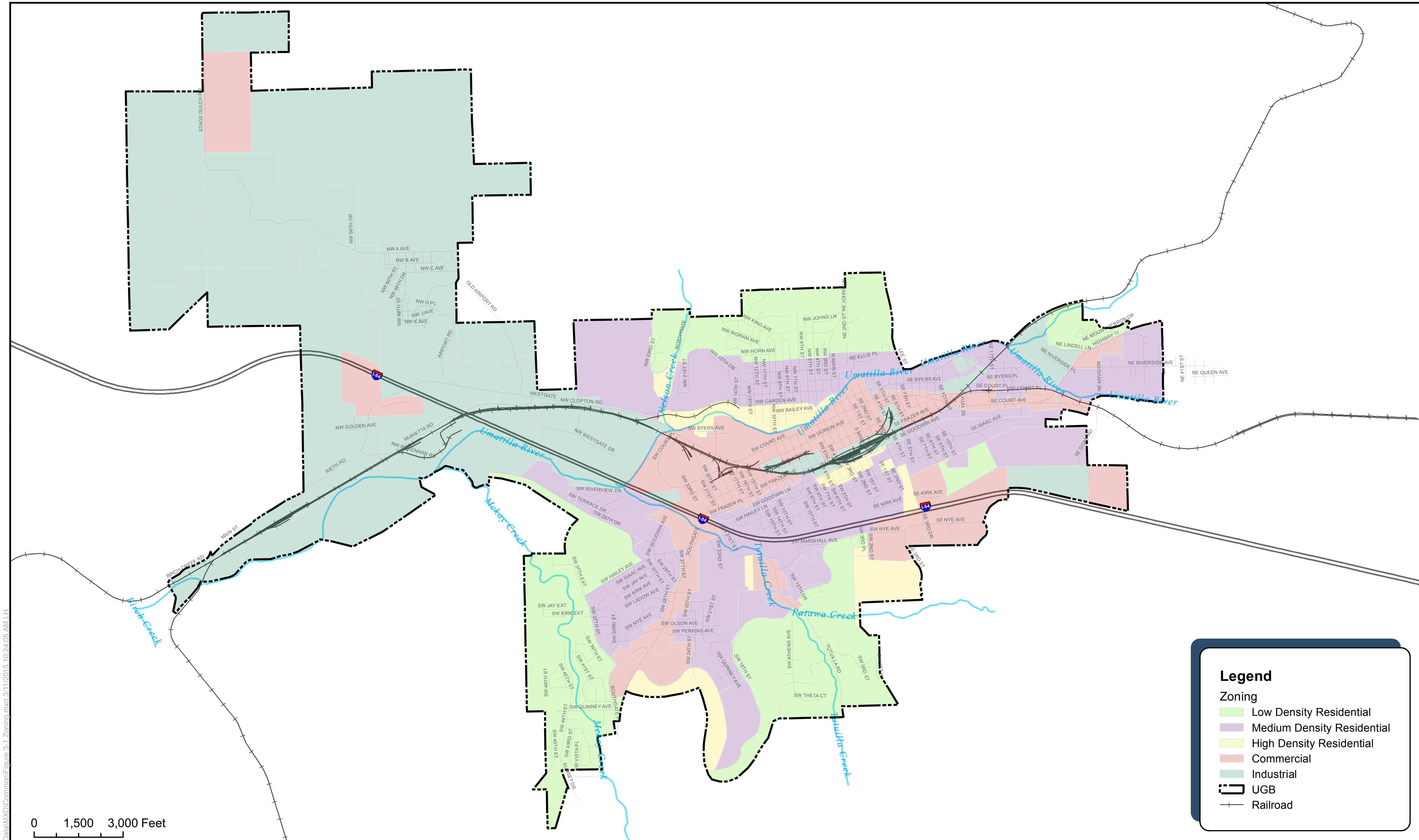
As described in Section 2—System Description, current customers reside within the City's Urban Growth Boundary (UGB). The UGB represents the current limit to where the City may expand service and was used as the boundary for all planning horizons in the Water System Master Plan (WSMP). Projections for population growth and water demand were based upon zoning criteria in the UGB. The current zoning within the UGB is shown in Figure 3-1.

Planning Period

The planning period for the WSMP is 20 years. Specific population and growth projections were identified for 5-, 10-, and 20-year intervals, along with a more general build-out projection. Build-out occurs when all available land has been developed to the target density anticipated for each land use or zoning designation. Build-out projections were included primarily to allow the City to plan for water supply needs beyond 20 years. New system piping is also expected to last well beyond 20 years and a build-out analysis provides an understanding of long-term infrastructure sizing requirements. If substantial improvements are required beyond the 20-year horizon, staging facilities through incremental expansion is recommended where feasible and practical. However, where possible and unless otherwise noted, recommended improvements identified in this plan were sized to accommodate build-out development.

Population & Land Use

The WSMP utilized information provided in the 2011 amendments to the City's Comprehensive Plan contained in technical memos produced by Winterbrook Planning. The amendments outline the basis for growth and development within the City. Information regarding current and future population, land use, density, vacancy rate and other assumptions used in the WSMP are consistent with the 2011 Comprehensive Plan amendments. The assumptions used to project growth for existing and future water service area populations in the City's UGB are provided in Table 3-1.



Murray, Smith & Associates, Inc.

City of Pendleton
Water System Master Plan

Figure 3-1
UGB Land Use

I:\BOI_Projects\13\1442\GIS Data\MXD\Common\Figure 3-1 Zoning.mxd 3/11/2015 10:24:05 AM LH
March 2015 13-1442

Table 3-1
Comprehensive Plan Population Data

Attribute	Value
2010 UGB Population	17,611 people
2033 UGB Population Estimate	23,970 people
Household size	2.34 people/household

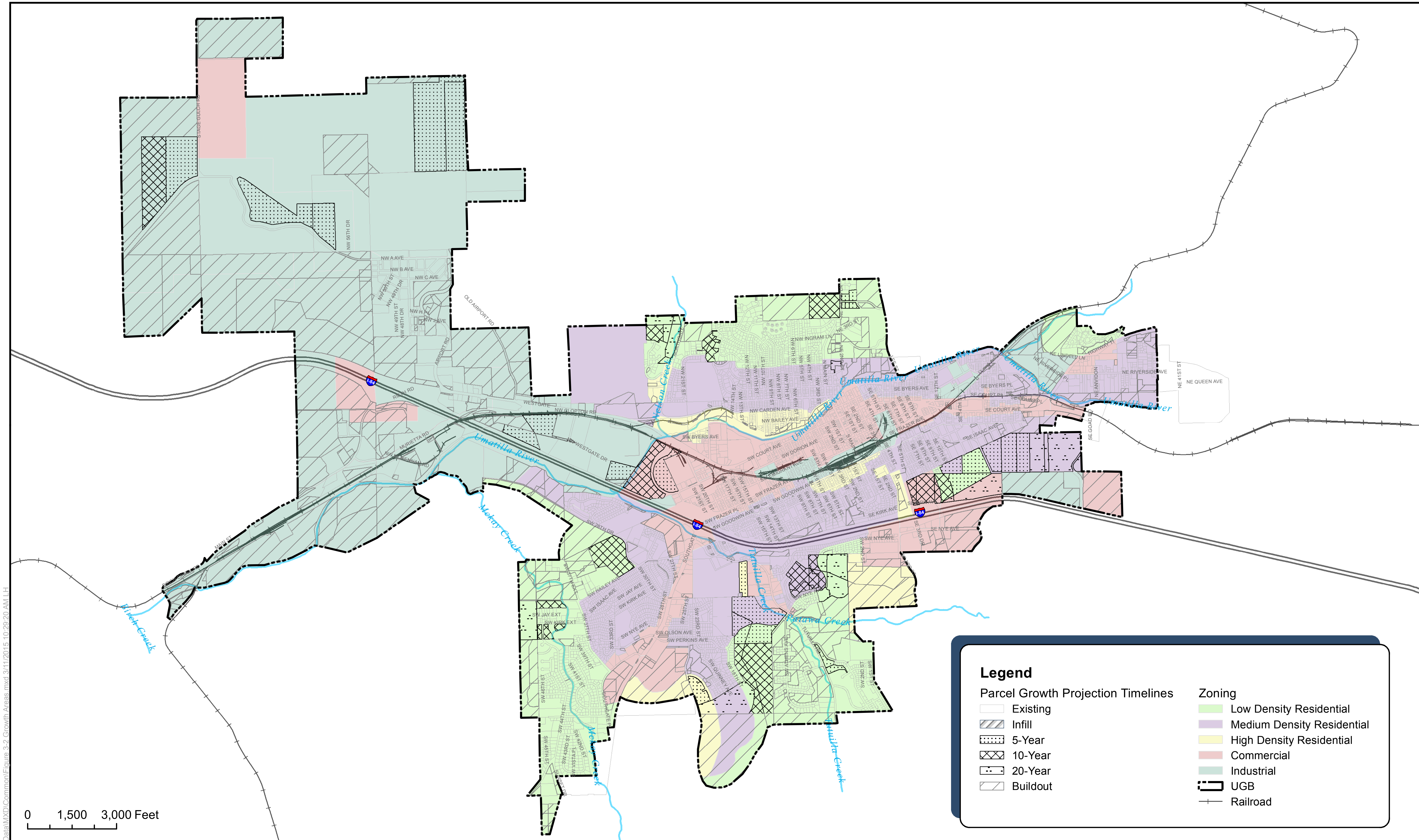
In addition to forecasting the anticipated population growth, the 2011 Comprehensive Plan provides parameters for how this growth will occur within the UGB as shown by land use designations in Figure 3-1. Table 3-2 provides density categories for future residential land development within the UGB by land use designation.

Table 3-2
Comprehensive Plan Residential Density Ranges

Land Use	Density Range (dwellings/acre)
Low-Density Residential	4-9
Medium-Density Residential	6-18
High-Density Residential	12-35
Overall-Average Residential	7

The residential development densities are intended to apply to future development. Existing developed parcels are not necessarily expected to meet the lower densities outlined in Table 3-2. For the purpose of this analysis, all infill parcels were assumed to develop at the average existing density within the area, which was approximately 3.5 dwellings per acre. The 2011 Comprehensive Plan amendments also assume an 11% vacancy rate for residential development and an average of 20% of developable land being required for utility and road right-of-way (ROW).

Using these land use and development assumptions from the 2011 Comprehensive Plan amendments and input from City staff, areas within the UGB that are likely to develop to accommodate the projected population increase of 6,359 people by 2033 were identified. These areas, illustrated in Figure 3-2, are targeted for growth in the 5-, 10-, and 20-year planning horizons. Growth will occur primarily in these new development areas, with some infill within already developed areas. Infill growth was generally distributed evenly over the distinct planning periods, with around 40 acres of infill occurring during each period. The population growth associated with the residential areas was calculated using an average density of seven dwellings per acre, along with the 11% vacancy and 20% ROW assumptions described previously. The forecasted residential development and corresponding population at each benchmark year appears in Table 3-3.



City of Pendleton
Water System Master Plan

Figure 3-2
Projected Growth Areas

Table 3-3
20-Year Population Projections

Planning Horizon	Growth Type	Gross Area[1] (Acres)	Net Area[2] (Acres)	Occupied New Dwellings[3]	Population Increase	Total Population[4]
0-5 Year	Infill	47	47	146	343	
	New Development	151	121	753	1,762	
	Total	**198**	**168**	**899**	**2,105**	**19,716**
6-10 Year	Infill	42	42	131	306	
	New Development	161	129	801	1,875	
	Total	**203**	**171**	**932**	**2,181**	**21,897**
11-20 Year	Infill	40	40	125	292	
	New Development	153	122	761	1,781	
	Total	**193**	**162**	**886**	**2,073**	**23,970**
	Overall Total	**594**	**501**	**2,717**	**6,359**	**23,970**

[1] *Gross Area = total residential area.*
[2] *Net Area = total contributing area from residential parcels (does not include utility corridors or ROW).*
[3] *Assumes 11% vacancy rate per 2011 Comprehensive Plan.*
[4] *Includes existing population of 17,611.*

Currently undeveloped residential areas, not identified for development in the 20-year planning horizon, were assumed to develop by build-out. The lowest anticipated density for each residential land use type was used to calculate the build-out population projections. All other assumptions remained the same as for the 20-year projections. The resulting build-out population projections are summarized in Table 3-4.

Table 3-4
Build-Out Population Projections

Residential Land Use Type	Gross Area[1] (Acres)	Net Area[2] (Acres)	Occupied New Dwellings[3]	Population Increase	Total Population[4]
Low Density	400	320	1,139	2,665	
Medium Density	272	218	1,163	2,721	
High Density	98	79	841	1,968	
Total	**770**	**617**	**3,143**	**7,354**	**31,324**

[1] *Gross Area = total residential area.*
[2] *Net Area = total contributing area from residential parcels (does not include utility corridors or ROW).*
[3] *Assumes 11% vacancy rate per 2011 Comprehensive Plan.*
[4] *Includes existing population of 17,611.*

Associated with the anticipated residential growth will be commercial and other non-residential growth. Water demand for the non-residential development was estimated based on the total developable non-residential acreage. Table 3-5 summarizes the anticipated acreage of non-residential development associated with the areas illustrated in Figure 3-2.

Table 3-5
Non-Residential Growth Projections

Planning Horizon	Gross Area[1] (Acres)	Net Area[2] (Acres)
0-5 Year	279	224
6-10 Year	103	83
11-20 Year	21	17
Build-Out	1,902	1,522
Total	**2,305**	**1,846**

[1] *Gross Area = total non-residential area.*
[2] *Net Area = total contributing area (does not include utility corridors or ROW)*

Water Production

The Pendleton water system is supplied from both groundwater wells and surface water from the Umatilla River, which is filtered at the Water Filtration Plant (WFP). A number of the City's groundwater wells are operated as Aquifer Storage and Recovery (ASR) facilities. ASR wells are used by water providers to increase available water supply during the peak demand season by injecting excess surface water supply into the wells during the winter and spring months and "storing" it in the aquifer until it is needed during the summer. The water used within the distribution system is the difference between total production and the volume injected into the wells for ASR storage. A summary of monthly water production records in million gallons (MG) for the water years 2009 through 2013 is presented in Table 3-6.

Table 3-6
Historical Water Production (MG)

Month	2009				2010				2011				2012				2013			
	Wells	River	ASR	Net Water for Use	Wells	River	ASR	Net Water for Use	Wells	River	ASR	Net Water for Use	Wells	River	ASR	Net Water for Use	Wells	River	ASR	Net Water for Use
Oct	37.5	54.3	0.4	91.4	52.4	47.9	0.0	100.3	44.6	44.6	0.0	89.2	18.6	58.2	0.0	76.8	30.3	49.3	0.1	79.5
Nov	7.8	46.6	3.9	50.5	20.2	45.7	0.0	65.8	20.0	46.0	0.0	66.0	3.7	49.7	0.0	53.4	8.8	108.3	71.7	45.5
Dec	15.6	61.0	33.4	43.2	23.7	67.3	13.3	77.6	1.7	129.7	61.3	70.1	15.1	55.0	0.0	70.1	2.3	202.0	121.1	83.3
Jan	0.0	147.5	77.5	70.0	2.0	128.9	69.3	61.6	1.6	130.0	56.3	75.2	5.5	115.9	57.2	64.2	4.1	105.5	54.2	55.4
Feb	0.0	151.2	91.5	59.7	0.0	159.4	102.7	56.6	0.3	159.7	100.4	59.6	0.0	196.7	129.0	67.8	3.8	220.2	204.9	19.1
Mar	0.0	188.7	87.8	100.9	0.0	179.0	110.1	68.9	0.0	142.8	83.4	59.5	0.0	211.4	155.4	56.0	0.2	241.4	196.4	45.1
Apr	0.0	179.6	70.1	109.5	0.0	174.3	100.7	73.7	0.0	173.2	101.5	71.7	0.0	193.4	117.9	75.5	0.0	222.6	165.1	57.5
May	32.0	191.1	38.2	184.9	0.0	179.2	80.5	98.7	0.0	168.5	82.1	86.4	5.3	203.0	80.1	128.3	49.5	197.7	70.3	177.0
June	164.6	73.2	2.2	235.6	35.2	146.6	42.0	139.8	6.1	168.0	48.5	125.6	88.6	82.7	0.0	171.3	124.2	44.5	0.0	168.7
July	235.5	42.9	0.0	278.3	194.4	48.9	0.0	243.3	181.2	41.7	0.0	222.9	216.9	28.5	7.1	238.3	214.2	48.1	0.0	262.3
Aug	157.2	44.8	0.0	202.1	182.5	48.5	0.0	231.0	173.0	39.8	0.0	212.8	217.2	49.6	0.0	266.8	188.5	44.7	0.0	233.3
Sept	145.5	41.1	0.0	186.7	91.4	47.9	0.0	139.3	143.6	38.4	0.0	182.1	119.3	43.8	0.0	163.1	74.8	46.4	0.0	121.2
Total	**795.8**	**1,222.1**	**405.0**	**1,612.9**	**601.8**	**1,273.6**	**518.6**	**1,356.7**	**572.3**	**1,282.4**	**533.6**	**1,321.1**	**690.1**	**1,288.0**	**546.6**	**1,431.5**	**700.9**	**1,530.8**	**883.8**	**1,347.9**

The average day demand (ADD), was calculated by finding the daily average of the difference in total volume of water produced and the volume produced for ASR over the year. The maximum day demand (MDD) and peak hour demand (PHD) were provided by the City for each year. The MDD represents the maximum 24-hour period of demand during the year and PHD represents the peak hour; both exclude water for ASR storage. The ADD, MDD, PHD, and the associated peaking factors for each year are shown in Table 3-7. The average peaking factors for the five-year period were used in the report to calculate future MDD and PHD from projected ADD values.

Table 3-7
System-Wide Historical Average and Maximum Demands

Year	ADD (mgd)	MDD (mgd)	PHD (mgd)	MDD Peaking Factor (MDD/ADD)	PHD Peaking Factor (PHD/MDD)
2009	4.4	11.0	17.1	2.5	1.6
2010	3.7	9.1	16.9	2.5	1.9
2011	3.6	9.2	15.7	2.5	1.7
2012	3.9	9.4	16.0	2.4	1.7
2013	3.7	9.4	14.3	2.5	1.5
5-Year Average	3.9	9.6	16.0	2.5	1.7

Water Use

The majority of the City’s water customers are residential, with approximately 5,040 of the 5,800 accounts classified as single- or multi-family residential. These customers account for approximately 57% of total billed water usage. The remaining 750 non-residential accounts are a mix of City, commercial and industrial users.

The largest water user in the City, the Eastern Oregon Correctional Institution (EOCI), is a hybrid residential/non-residential account. The EOCI uses 10% of all water billed within the City, and although it is classified as a commercial account, the prisoners housed there are included in the City population. The EOCI is also a large employer and inmates engage in manufacturing activities, such as denim clothing production and commercial laundry services. Due to its unique characteristics and no significant anticipated growth, the EOCI water use and inmate population (approximately 1,600) were not included in the residential per capita demand or non-residential per acre use for future water demand projections.

The City holds 75 water accounts, including the cemetery, parks and other facilities, which represent 9% of billed water use. The remaining accounts are commercial and industrial, representing 24% of billed use. Figure 3-3 shows the number of accounts and average water use over the past three years for EOCI, residential and non-residential customers. Excluding the prison and City uses, residential demand represents approximately 70% of billed use, and other non-residential accounts represent 30% of billed water use as shown in Figure 3-4.

Figure 3-3
2010-2013 Water Accounts and Billing Data

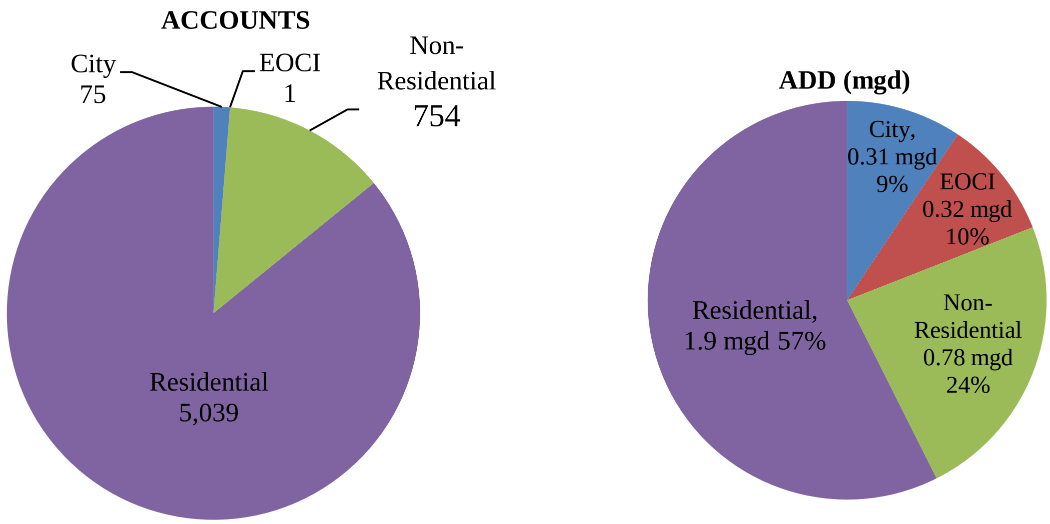
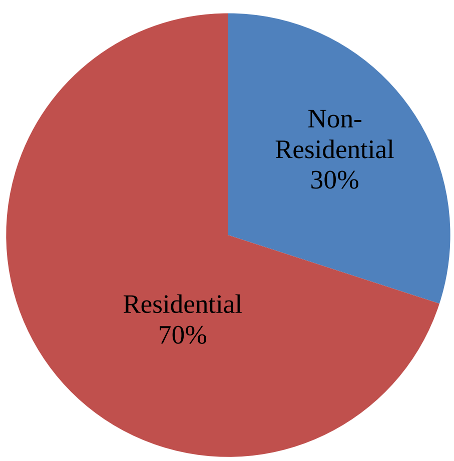


Figure 3-4
Residential to Non-Residential Billing Ratio



Non-Revenue Water

The difference between the yearly water production records, shown in Table 3-7, and the yearly billing record totals, shown in Table 3-8, is referred to as non-revenue water. Non-revenue water may be attributed to things such as unauthorized connections to the system, leaks, reporting errors, or unmetered water uses such as flushing and fighting fires. Over the past five years, non-revenue water has averaged less than 10% in annual comparisons between production and billing data. This level of non-revenue water is considered low and does not warrant major investment by the City to make further reductions. As such, projections of water demands in this plan reflect the current level of non-revenue water. Existing water use by customer class is an important tool for predicting future water use by land-use type, system-wide water demand. For the purposes of the analyses presented in this plan, water demands were scaled based on total water production (minus ASR storage) in order to include non-revenue water. Since demand projections were used to determine infrastructure needs, it was important to include the total amount of water that enters into and is conveyed through the system, as well as billable water use.

Use by Pressure Zone

Based on the location of each customer account, the billing records were grouped and scaled to match water production (excluding ASR) to determine the average and maximum day demand within each pressure zone. Existing demands by pressure zone are presented in Table 3-8.

Table 3-8
Existing Demand by Pressure Zone

Pressure Zone	ADD (mgd)	MDD (mgd)
Airport	0.065	0.159
Airport NW 49th	0.009	0.022
Airport Road	0.0006	0.001
Airport NW 47th	0.004	0.010
Cemetery	0.463	1.134
Gravity	2.947	7.220
Jr. High	0.047	0.115
Mt. Hebron	0.025	0.061
Murietta	0.003	0.007
North	0.056	0.137
Royal Ridge	0.007	0.017
SE 20th	0.003	0.007
Skyline	0.269	0.659
Total	**3.9**	**9.6**

Future Demand Projections

The existing service area population is approximately 17,611, with 1,600 being inmates housed in the EOCI. The non-prison average per capita water use is approximately 224 gallons per capita, per day (gpcd). It was assumed that after excluding EOCI and City use, the ratio of future customer water use will remain relatively consistent with current water use. So, for this analysis, it was assumed that 70% of water produced is for residential use and 30% will be used by non-residential customers.

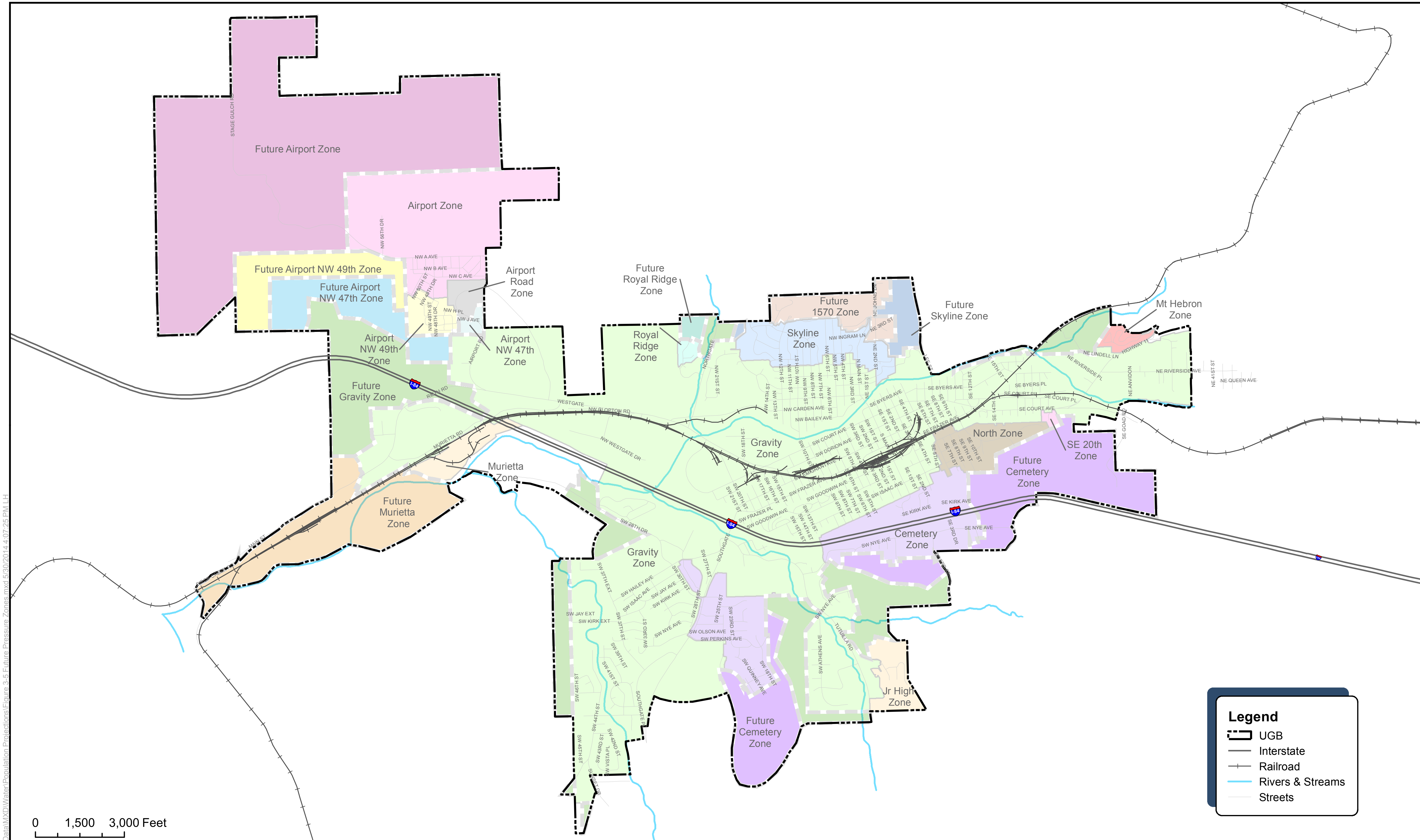
Based on the estimated 20-year population increase of 6,359 shown in Table 3-3, residential demand would increase by about 1.0 mgd and non-residential demand would increase approximately 0.4 mgd by 2033. From the information shown in Table 3-3 and Table 3-5, total developed residential area is expected to grow by 594 acres and non-residential by 403 acres by 2033. This results in an average future non-residential demand of 1,000 gallons per total acre per day (gpad) or 1,300 gpad when ROW is excluded. By build-out, approximately 7,300 additional people and 1,900 non-residential acres are projected to be added to the system. The projected growth in residential population and non-residential area, along with water demand, are presented in Table 3-9. The areas associated with this growth are illustrated in Figure 3-2.

Table 3-9
Additional Demand Projections[1]

Planning Horizon	Residential		Non-Residential		Total Increase in Demand	
	Population	ADD (mgd)	Net Area (acres)	ADD (mgd)	ADD (mgd)	MDD (mgd)
5-Year	2,105	0.33	**224**	0.29	0.62	1.52
10-Year	2,181	0.34	**83**	0.11	0.45	1.10
20-Year	2,073	0.33	**17**	0.02	0.35	0.85
20-Year Total Increase	**6,359**	**1.00**	**324**	**0.42**	**1.42**	**3.47**
Build-Out	7,354	1.15	1,522	1.98	3.13	7.67
Total Increase	**13,713**	**2.15**	**1,846**	**2.40**	**4.55**	**11.14**

[1] *Table does not include existing population or demand.*

Based on topography, most of the future demand falls within areas that can be served by the current pressure zones, which will be expanded as the system grows and service elevations allow. However, there are two small areas that, due to changes in topography, cannot receive adequate service pressure from the adjacent existing pressure zone. As a result, two new pressure zones would need to be established when these areas are developed. The future pressure zone areas are shown in Figure 3-5, and the corresponding demand for each zone is presented in Table 3-10.



City of Pendleton
Water System Master Plan

Figure 3-5
Future Pressure Zones

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Table 3-10
Total Demand Projections by Pressure Zone

Pressure Zone	Existing (2013)		5-Year		10-Year		20-Year		Build-Out	
	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)	ADD (mgd)	MDD (mgd)
Airport	0.065	0.159	0.301	0.738	0.353	0.865	0.353	0.865	0.894	2.189
Airport NW 49th	0.009	0.021	0.009	0.022	0.009	0.022	0.031	0.076	0.196	0.479
Airport Road	0.0006	0.001	0.001	0.001	0.0006	0.001	0.0006	0.001	0.027	0.066
Airport NW 47th	0.004	0.010	0.004	0.010	0.004	0.010	0.004	0.010	0.208	0.510
Cemetery	0.463	1.139	0.623	1.525	0.708	1.736	0.912	2.233	1.369	3.355
Future 1420	-	-	-	-	-	-	-	-	0.006	0.014
Future 1570	-	-	-	-	0.035	0.085	0.035	0.085	0.067	0.164
Gravity	2.947	7.249	3.130	7.667	3.370	8.257	3.467	8.494	4.798	11.756
Jr. High	0.047	0.115	0.047	0.115	0.047	0.115	0.079	0.194	0.079	0.195
Mt. Hebron	0.025	0.061	0.025	0.061	0.025	0.061	0.025	0.061	0.030	0.073
Murietta	0.003	0.007	0.003	0.007	0.003	0.007	0.003	0.007	0.271	0.665
North	0.056	0.137	0.073	0.178	0.088	0.216	0.088	0.216	0.095	0.234
Royal Ridge	0.007	0.017	0.016	0.040	0.029	0.071	0.046	0.113	0.046	0.113
SE 20th	0.003	0.007	0.005	0.012	0.005	0.012	0.005	0.012	0.005	0.013
Skyline	0.269	0.662	0.291	0.712	0.305	0.748	0.309	0.756	0.364	0.892
Total	**3.9**	**9.6**	**4.5**	**11.1**	**5.0**	**12.2**	**5.4**	**13.1**	**8.5**	**20.7**

Summary

Population growth and water demand projections were developed for; existing (2013), 5-year, 10-year, 20-year, and build-out planning horizons. Current water demands were estimated from historical billing records and production data. Future demand projections were based on current water use characteristics, population projections, and household size from the City's 2011 Comprehensive Plan Update. The location and rate of anticipated development was based on a review of developable land and City input.

The projected future water demands are used in Section 4—Water System Analysis, to assess the capacity of existing water system facilities and develop recommended water system improvements to serve anticipated growth. Approximate timing for growth in the system has been provided for the 5-, 10- and 20-year horizons. The timing of system improvements should be scrutinized based on actual growth at the time the improvement is to be constructed. The City might also consider using demand as a trigger to determine when projects are required.

SECTION 4
System Analysis

SECTION 4
SYSTEM ANALYSIS

Introduction

This section presents performance criteria used to analyze the City of Pendleton's (City's) water distribution system and findings of this analysis. The water demand forecasts summarized in Section 3—Population and Demand Projections were used in conjunction with performance criteria to assess water system characteristics, including supply capacity, service pressures, distribution system storage, and pumping capacity, and emergency fire flow availability. This section provides the basis for recommended distribution system improvements presented in Section 6—Capital Improvement Program.

Performance Criteria

The water distribution system should be capable of operating within certain performance limits under varying customer demand and operational conditions. The recommendations of this plan are based on the performance criteria summarized in Table 4-1. These criteria have been developed through a review of federal Safe Drinking Water Act requirements, Oregon Health Authority Drinking Water Services requirements, American Water Works Association (AWWA) acceptable practice guidelines, Ten States Standards and the Washington State *Water System Design Manual*.

In addition, a review of anticipated impacts on future water quality or regulatory requirements was conducted to identify any future increases in performance criteria to be considered. The only potential consideration identified through this review, that is expected to impact the City's water system and the analysis presented herein, is future regulation related to demonstration of planning to address aging infrastructure. Section 5—Operations and Maintenance of this Water System Master (WSMP) includes an analysis of infrastructure renewal and replacement as the City is working to proactively address this issue in advance of passage of any regulatory mandate.

Table 4-1
Performance Criteria

System Attribute	Evaluation Criterion	Value
Water Supply	Firm Supply Capacity[1]	MDD[2]
Water Quality	Safe Drinking Water Act Requirements	Contaminant concentrations below the Maximum Contaminant Level (MCL)
Distribution Storage	Maximum Water Level Variation	30 ft
	Total Distribution Storage Capacity	Sum of operational, equalization, fire & emergency storage, see Table 4-4
Pump Stations	Minimum No. of Pumps	2
	Closed Zone Capacity[3]	PHD[4] + Fire Flow
	Open Zone Capacity[5]	MDD
	Emergency Power	At least two independent sources
Service Pressure	Minimum during MDD + Fire Flow	20 psi
	Minimum, during PHD	40 psi
	Standard Range	40-80 psi
	Maximum	100 psi, 80 psi preferred[6]
Distribution Piping	Maximum Velocity during MDD	5 ft/second (fps)
	Velocity during PHD or Fire Flow	Not to Exceed 10 fps
	Maximum Headloss	6 ft per 1,000 ft of pipe
	Minimum Pipe Diameter	8-in, except 6-in for short, dead-end mains without fire service
	Isolation Valve Spacing	500 to 1,000 ft for developed Up to 1 mile for undeveloped
Fire Suppression	Minimum Hydrant Spacing	300 to 500 ft
	Available Fire Flow Requirements	Residential: 1,500 gpm for 2 hours Commercial/Industrial: 3,000 gpm for 2 hours Airport Industrial: 4,000 gpm for 4 hours

[1] *Firm capacity: the total production capacity with the largest capacity well, Well 5, out of service.*
[2] *MDD = Maximum day demand: the maximum volume of water delivered to the system during any single day.*
[3] *Closed zone: a pressure zone supplied constant pressure from a booster pump station without the benefit of distribution storage.*
[4] *PHD = Peak hour demand: the maximum volume of water delivered to the system during any single hour of the maximum demand day.*
[5] *Open zone: a pressure zone supplied by gravity from a distribution storage reservoir.*
[6] *Pressures greater than 80 psi require installation of individual pressure reducing valves (PRVs).*

Supply Analysis

Supply Criteria

To adequately meet system demands, supply facilities must be capable of providing MDD with the largest pump out of service.

Supply Findings

As described in Section 2—Existing System Description, the City produces potable water from both surface and groundwater sources. Throughout the year, the Umatilla River supplies the majority of City water; however, intake capacity is significantly limited during the summer months due to lower river levels. To remain conservative for this analysis, it is assumed that the City's currently available year-round surface water supply is approximately 1.6 million gallons per day (mgd), based on the minimum available flow during the summer season. The City maintains eight groundwater wells. One well, Well 7, pumps to the Water Filtration Plant (WFP) and the other seven supply the Gravity Zone after on-site disinfection. Five Gravity Zone wells, Wells 1, 4, 5, 8 and 14, are also used for Aquifer Storage and Recovery (ASR). Long term pumping of wells may reduce groundwater levels in the aquifer. ASR reduces this impact on the groundwater aquifer by storing filtered surplus Umatilla River water available during the winter and spring.

In addition to these eight City wells, Well 11 currently serves the Resource Recovery Facility (RRF) through a small, private system. This well may connect to the rest of the City system in the future. The City has three planned wells permitted under existing water rights (Wells 9, 10, and 12) that have not been developed.

Based on current water system operations and supply redundancy, the City should plan for adequate capacity to provide MDD with the largest capacity well (Well 5) in the system out of service.

Long Term ASR Impact on Supply Capacity

Prior to initiation of the ASR injection program in 2004, Pendleton's aquifer experienced an approximate 3.4-foot water level decline annually. Figure 4-1 illustrates the long term decline in aquifer water level had this annual trend continued.

Between 2004 and 2012, the City injected (stored) an average of 441 MG annually which reduced the average aquifer decline to approximately 1.4 feet. In 2013, Pendleton doubled its annual ASR injection rate to 884 MG which resulted in a 0.5-foot increase in aquifer water levels. The City intends to continue injecting at this rate and anticipates a long term trend of increasing aquifer water levels at a rate of approximately 0.5 feet annually. This projected aquifer level increase is illustrated on Figure 4-1.

A long-term increase in aquifer water levels will result in lower total dynamic head (TDH) at each well, which will allow an increase in water production (recovery) from the City's wells. Based on existing pump curves for City Wells 1, 2, 3, 4, 5, 8 and 14 and the estimated decrease in TDH due to rising aquifer levels, groundwater capacity from these 7 wells is expected to increase approximately 0.21 mgd (146 gpm) by 2023 and approximately 0.41 mgd (285 gpm) by 2033.

Figure 4-1
ASR Impact to Aquifer Levels

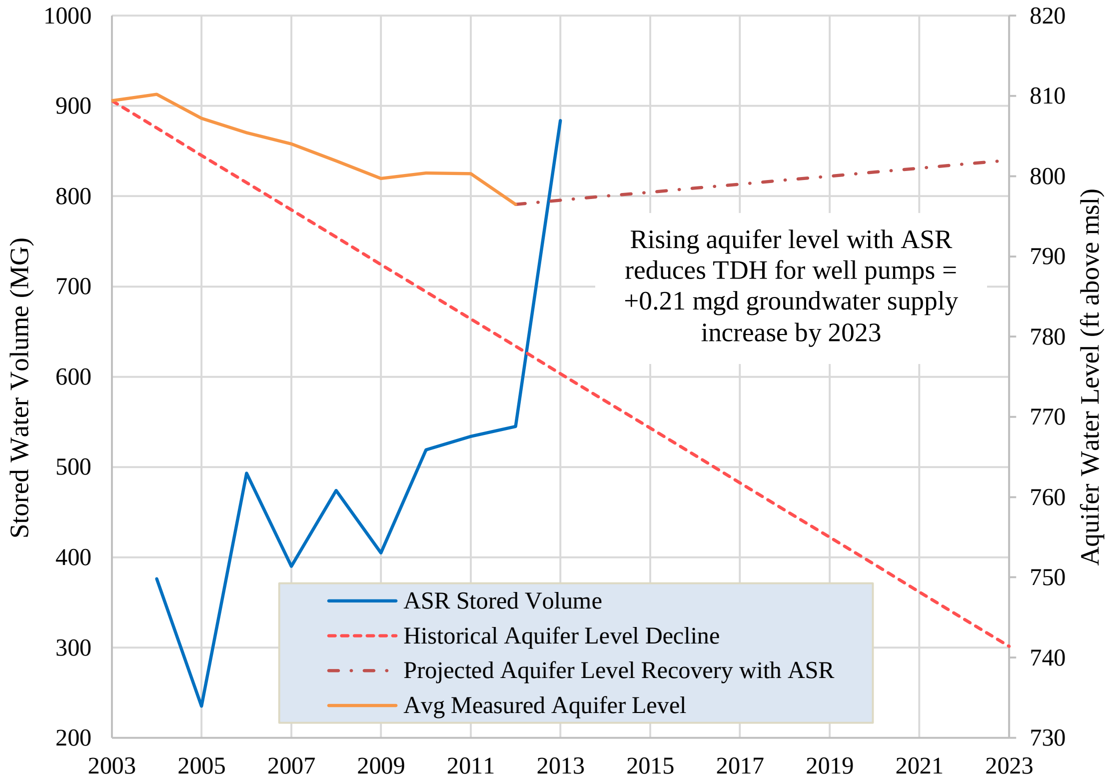


Table 4-2
Existing Supply Capacity

Supply Source	Existing Capacity (mgd)	Capacity (mgd) with ASR Aquifer Level Rise of 0.5 ft Annually		
		5-Year	10-Year	20-Year
Sources Directly to the Distribution System				
Wells 1-5, 8 & 14	11.52	11.65	11.73	11.93
Water Filtration Plant Sources				
Umatilla River[1]	1.60	1.60	1.60	1.60
Well 7	0.43	0.43	0.43	0.43
System-Wide Sources				
Total Capacity	**13.55**	**13.68**	**13.76**	**13.96**
Firm Capacity[2]	10.89	10.98	11.02	11.13

[1] *Currently available minimum year-round capacity.*
[2] *Assuming largest source, Well 5, out of service.*

Table 4-3 shows that the City has adequate supply to meet existing demands. An additional 0.12 mgd of supply will be required within the 5-year timeframe, an additional 1.18 mgd of supply will be required within the 10-year horizon, and an additional 1.97 mgd of supply will be needed within 20 years. The City holds existing water rights with available undeveloped capacity to support the expanded 20-year water supply need.

Table 4-3
Supply Analysis

Timeframe	Existing	5-Year	10-Year	20-Year	Build-Out
Existing Firm Supply Capacity	10.89	10.98	11.02	11.13	11.13
MDD	9.60	11.10	12.20	13.10	20.70
Surplus/Deficiency	1.29	(0.12)	(1.18)	(1.97)	(9.57)

Water Quality

The City strives to deliver consistent water quality to its customers and to comply with all Safe Drinking Water Act requirements. The City provides an annual water quality report to customers that indicates consistent, high quality water and full compliance with all Safe Drinking Water Act requirements.

Pressure Zone Analysis

Water distribution systems are typically separated into pressure zones to provide service pressures within an acceptable range to all customers due to varying surface elevations. Pressure zones are defined by ground topography and designated by either a distribution storage facility's overflow elevation, or the discharge pressure of PRVs or pump stations supplying the pressure zone. The City has 13 pressure zones. Two zones, Gravity and Skyline, are supplied directly from distribution storage reservoirs, six are supplied by constant pressure pumping, and five are PRV-controlled zones served from the Gravity and Airport Zones.

Pressure Zone Criteria

The City's pressure zones are designed to serve the majority of customers within the desired pressure criteria presented in Table 4-1. However, given the varying topography within the City's service area, some customers do receive service at pressures outside the desirable limits.

Pressure Zone Findings

Pendleton's 13 existing pressure zones provide adequate service pressures between 40 and 80 psi to most water system customers. Due to varying topography within the City limits, main line pressures in the Gravity Zone near the center of the City are near 100 psi. A small number of customers in the Skyline Zone along SW Skyline Drive on the northern boundary of the water system and just north of I-84 along SW Isaac Avenue between SW 10th and 12th Streets have service pressures below 40 psi, due to dramatic elevation changes relative to the surrounding pressure zone.

As discussed in Section 3, future development within the City's urban growth boundary (UGB) is anticipated to be served primarily by expansion of existing pressure zones. Properties north of the existing Skyline Zone with future development potential are too high in elevation to be adequately served from existing pressure zones. A new 1570 Zone is proposed to serve customers at high elevations north of the existing Skyline Zone, as well as some existing high-elevation Skyline customers with low service pressures. Future pressure zone boundaries are illustrated in Figure 3-5.

Distribution Storage Capacity Analysis

Distribution Storage Criteria

Water storage facilities serve four purposes: operational storage, equalization storage, fire storage, and standby or emergency storage. The total distribution storage required is the sum of these four components.

Required storage volumes in million gallons (MG) were calculated according to the following criteria:

- *Operational Storage* – assumed to be 5% of the total volume required for other storage components.

- *Equalization Storage* – the amount of peak hour demand (PHD) exceeding supply to the pressure zone, provided for 150 minutes.
- *Fire Storage* – largest fire flow demand within the pressure zone, multiplied by the duration of that flow (see Table 4-1 for fire flow requirements).
- *Emergency Storage* – two times the average day demand (ADD), minus the volume of water generated in 24 hours by all but the largest capacity supply to the pressure zone.

Distribution Storage Findings

Existing distribution storage reservoirs serve customers in the Gravity and Skyline zones by gravity. The City's other existing pressure zones are supplied either through pump stations or PRVs. There must be adequate reservoir volume to meet customer demands in the zone served directly from the reservoir, as well as any smaller zones served through PRVs from the higher level zone with storage. For instance, Gravity Zone reservoirs must have adequate capacity to provide for demands in both the Gravity Zone and the lower level PRV-controlled Murietta Zone.

Ideally, the Cemetery Zone, which supplies a relatively large geographic area with potential for future expansion, would also have gravity distribution storage. However, due to the City's topography, sites with adequate elevation for a future Cemetery Reservoir are too far away from existing Cemetery Zone customers to be practical or cost effective.

The Skyline Reservoir is currently operated below its design overflow, due to condition issues with the reservoir dome. For customers at the highest elevations in this pressure zone, this results in lower than desirable service pressures and requires individual booster pumps for some service connections. Recommended Skyline Zone storage improvements described in Section 6, along with the proposed development of the future 1570 Zone, will address both the storage deficiency and pressure concerns in the Skyline Zone.

The existing Airport Reservoirs do not serve customers by gravity flow, as they are below the hydraulic grade of the Airport Zone. These reservoirs provide suction supply to the Airport Pump Station, which serves customers by constant pressure pumping. The existing Airport Zone supplies customers around the Pendleton Regional Airport, which sits atop the ridge above the City.

In order to serve this high-elevation area by gravity flow from a distribution storage reservoir, the City would need to install an elevated reservoir; however, this is not a viable solution due to facility height restrictions adjacent to the airport runway. It is recommended that the City continue to serve the Airport Zone through constant pressure pumping. The capacity of the Airport Reservoirs is evaluated based on operational, fire and emergency storage components only. Because the Airport Reservoirs do not serve customers by gravity flow, operational storage in these reservoirs is unnecessary.

A summary of required distribution storage capacities under existing and future conditions for the Airport, Gravity and Skyline zones are in Table 4-4. Additional storage of less than 200,000 gallons each will be required in both the Skyline and Airport zones within the 20-year planning horizon. Another 750,000 gallons of storage is required system-wide to serve build-out demands.

Table 4-4
Distribution Storage Analysis

Pressure Zone	Existing Distribution Storage			Demand (mgd)						Recommended Distribution Storage (MG)																	
				Existing		20-Year		Build-Out		Existing						20-Year						Build-Out					
	Reservoir	Capacity (MG)	Zone Total (MG)	ADD	PHD[1]	ADD	PHD[1]	ADD	PHD[1]	Operational	Equalization	Emergency	Fire	Total	Deficiency	Operational	Equalization	Emergency	Fire	Total	Deficiency	Operational	Equalization	Emergency	Fire	Total	Deficiency
Airport[2]	Airport 1	0.5	1.0	0.08	0.32	0.39	1.62	1.33	5.51	N/A	0.00	0.05	0.96	1.01	(0.01)	N/A	0.00	0.21	0.96	1.17	(0.17)	N/A	0.00	0.93	0.96	1.89	(0.89)
	Airport 2	0.5																									
Gravity[3]	South Hill 1	1.0	4.85	2.95	12.34	3.47	14.45	5.07	21.12	0.11	0.00	1.58	0.54	2.23	0.00	0.12	0.01	1.86	0.54	2.53	0.00	0.22	0.70	3.11	0.54	4.57	0.00
	South Hill 2	1.0																									
	North Hill	1.0																									
	Southwest	1.1																									
	WFP Clearwell	0.75[4]																									
Skyline[5]	Skyline	0.25	0.25	0.27	1.13	0.31	1.29	0.37	1.54	0.01	0.00	0.00	0.18	0.19	0.00	0.02	0.00	0.17	0.18	0.37	(0.12)	0.02	0.00	0.20	0.18	0.40	(0.15)

General note: Numbers showing deficiencies appear inside parentheses.
[1] *PHD is calculated as 1.7 times the MDD based of historical averages presented in Section 3.*
[2] *Airport Zone demands include customer demands in PRV-controlled sub-zones Airport NW 49th, Airport Road, and Airport NW 47th.*
[3] *Gravity Zone demands include customer demands in Murietta PRV-controlled sub-zone.*
[4] *Available storage capacity at the WFP Clearwell is equal to 10 feet of the 24-foot total depth of the clearwell.*
[5] *Future demands in the Skyline Zone include customer demands for the proposed 1570 Zone.*

Pumping Analysis

Pump Station Criteria

Closed Zones

Most booster pump stations in the Pendleton water system supply constant pressure to customers in zones without water storage facilities, also referred to as closed zones. Booster stations serving these closed zones are the only means of supplying domestic water demands and fire flow to the zone. Pump stations serving closed zones should have sufficient firm capacity to supply PHD and the highest required fire flow in the primary zone and any PRV-controlled sub-zones.

Open Zones (Supplied by Gravity Distribution Storage)

The 12th Street and North Hill pump stations supply the Skyline Reservoir, which serves customers in the Skyline Zone by gravity and through privately owned booster pumps. Pressure zones with the benefit of gravity distribution storage are also referred to as open zones. Operational and fire storage provided by open zone reservoirs such as the Skyline Reservoir make it unnecessary to plan for fire flow or peak hour capacity from pump stations or other supplies (assuming adequate storage is available). Open zone pump stations such as the 12th Street and North Hill Pump Stations must have sufficient firm capacity to meet the MDD for all customers in the zone.

Backup Power

At least two independent power sources are recommended for the City's pump stations that serve closed zones through constant pressure pumping. The City recently installed backup power at Mt. Hebron Pump Station and is currently installing backup power at the Airport Pump Station. None of the other booster pumps currently have backup power. The largest pump at the Cemetery Pump Station is driven only by a natural gas engine to provide an alternate power source in case of an electrical power outage.

Pump Station Findings

Table 4-5 summarizes the analysis of the City's existing and future pumping requirements. Significant capacity and standby power improvements are recommended under existing and future conditions. Capacities for the High Level pumps at the WFP and Stillman Pump Station at Well 5 are included in the supply analysis. The Gilliam Canyon Pump Station will be abandoned as part of a reconfiguration of Airport Zone facilities so this station is not evaluated in Table 4-5. The 5th & Horn Pump Station is used only to boost pressure when filling the North Hill Reservoir. This station's operation is not significantly impacted by system growth and expansion so it is not evaluated in Table 4-5.

Table 4-5
Pump Station Capacity Analysis[1]

Pressure Zone	Existing Supply Facilities				Zone Fire Flow (gpm)	Zone Pumping Capacity Criteria	Firm Capacity (gpm)									Standby Power Need to be Added
	Pump Station	Capacity (gpm)					Existing			2033			Build-Out			
		Total	Firm	Zone Firm			Required	Existing	Surplus or Deficit	Required	Existing	Surplus or Deficit	Required	Existing	Surplus or Deficit	
Airport	Airport	3,300	1,200	1,200	4,000	PHD + FF	4,225	1,200	(3,025)	5,252	1,200	(4,052)	7,830	1,200	(6,630)	Yes
Airport NW 49th	Served through PRVs from Airport Zone															
Airport Road																
Airport NW 47th																
Cemetery	Cemetery	3,200	975	1,635	3,000	PHD + FF	4,345	1,635	(2,710)	5,636	1,635	(4,001)	6,961	1,635	(5,326)	Yes
	SE 7th	1,660	660													
North	Served through PRV from Cemetery Zone															
Gravity	See Supply Analysis				3,000	MDD	See Supply Analysis			See Supply Analysis			See Supply Analysis			No[2]
Murietta	Served through PRV from Gravity Zone															
Jr. High	Jr. High	2,200	1,100	1,100	1,500	PHD + FF	1,636	1,100	(536)	1,729	1,100	(629)	1,730	1,100	(630)	Yes
Mt. Hebron	Mt. Hebron	600	220	220	1,500	PHD + FF	1,572	220	(1,352)	1,572	220	(1,352)	1,586	220	(1,366)	No
Royal Ridge	Royal Ridge	1,050	550	550	1,500	PHD + FF	1,520	550	(970)	1,633	550	(1,083)	1,633	550	(1,083)	Yes
SE 20th	SE 20th	150	-	-	1,500	PHD + FF	1,508	-	(1,508)	1,514	-	(1,514)	1,515	-	(1,515)	Yes
Skyline	12th Street	800	400	800	1,500	MDD	460	800	340	525	800	275	2,553	800	(1,753)	No[2]
	North Hill	800	-		1,500											
Future 1570	-	-	-	-	1,500	PHD + FF	1,500	-	(1,500)	1,600	-	(1,600)	1,694	-	(1,694)	Yes

General note: Figures showing deficits appear inside parentheses.
[1] *The High Level and Stillman Pump Stations are part of the supply analysis. Gilliam Canyon Pump Station is to be abandoned as part of other system modifications. 5th & Horn Pump Station is used only to boost pressure and is not included in this capacity analysis.*
[2] *The Gravity and Skyline Zones use distribution storage to supply the zone in an emergency.*

Distribution System Analysis

Distribution System Criteria

Service Pressure

Distribution system performance was assessed based on the following service pressure criteria discussed earlier and summarized in Table 4-1. A distribution system must:

- Provide approximately 40 to 80 psi at service connections under ADD, MDD or PHD conditions.
- Maintain minimum pressure of 40 psi at service connections under PHD conditions.
- Maintain a minimum service pressure of 20 psi under MDD plus fire flow conditions.
- Keep static pressure within the distribution system below 100 psi and, where possible, below 80 psi.

Pipe Flow Velocity and Headloss

Pipe flow velocity and headloss criteria were also used during distribution system analysis to indicate areas of undersized piping. These criteria alone did not dictate system improvements, but helped guide system analysis and the prioritization of system improvements. Distribution piping was assessed based on the following criteria:

- Velocity below 5 fps under MDD conditions.
- Velocity below 10 fps under PHD or fire flow conditions.
- Maximum headloss of 6 feet per 1,000 feet of pipe.

Hydraulic Model

A steady-state hydraulic network analysis model was used to evaluate the performance of the existing distribution system and identify proposed piping improvements. The purpose of the model is to determine pressure and flow relationships throughout the distribution system for a variety of demand, supply and emergency conditions. The model was developed using InfoWater software, which incorporates geographic information system (GIS) water piping and facility data developed for the City as part of this planning effort.

The model was calibrated to match field data to ensure it could accurately predict "real world" conditions. The existing system was then analyzed to identify hydraulic deficiencies under current and future demand conditions. Where necessary, the model was expanded to include proposed improvements required to correct existing deficiencies and provide for future development.

Model Calibration

Model calibration typically involves adjusting the model parameters to improve the accuracy in matching field data, such as pressure and flow measurements recorded at system fire hydrants. The required level of model accuracy can vary according to the intended use of the model, the type and size of water system, the available data, and the way the system is controlled and operated.

The model's accuracy depends on the accuracy of the data, particularly the input data that describes the pipe system. Accurate system modeling assumes correct pipe connectivity, diameter, internal roughness and length. Knowing the status of system facilities, including pumps, reservoirs and valves, referred to as "boundary conditions" is also critically important during calibration. As part of this master planning effort the City is working to combine information from pre-existing baseline, utility and valve location maps. Conflicting information on these 3 map sets created some accuracy challenges during model construction and calibration.

Fire Flow Testing

The first step in calibrating any system is to match field-measured pressures and fire hydrant flows with model-simulated system pressures and flows. This calibration process tests the accuracy of model pipeline friction factors, demand distribution, valve status, network configuration, and facility parameters such as tank elevations, PRV settings and pump controls and curves.

Fire flow testing consists of recording static pressure at a hydrant and then "stressing" the system by flowing an adjacent hydrant. While the adjacent hydrant is flowing, residual pressure is measured at the first hydrant to determine the pressure drop that occurs when the system is "stressed". Boundary condition data, such as reservoir levels and pump on/off status, must also be known to accurately model the system conditions during the time of the flow test. The recorded time of each fire hydrant flow test was used to collect boundary condition information from the City's system supervisory control and data acquisition (SCADA) system.

Steady-State Calibration Results

For any system, a portion of the data describing the distribution system will be missing or inaccurate, and assumptions will be required. This does not necessarily mean that the accuracy of the hydraulic model will be compromised. Depending on the accuracy and completeness of the available information, some pressure zones may achieve a higher degree of calibration than others. Models that do not meet the highest degree of calibration can still be useful for planning purposes.

The initial model facilities were set up based on information developed for the City's water system GIS from existing AutoCAD as-built drawings and system maps. Operational setting information continued to evolve during the calibration process.

Hydrant flow tests were conducted on September 3, 2013. Many of the City’s pressure zones are closed zones served through constant pressure pump stations with variable frequency drives (VFDs) on one or more pumps. VFD operating points were not available at the time of the tests, making it difficult to predict how much flow was being produced by the pump.

Pump VFD settings during hydrant flow testing were approximated based on pump discharge pressure recorded by the SCADA system and pressure set points reported by the City. No flow tests were conducted in the PRV-controlled Airport NW 47th Zone or in the SE 20th Zone.

Both zones serve a small number of customers with little or no potential for future expansion; thus, the absence of flow testing data in these zones is not expected to impact the overall accuracy of the hydraulic model. The calibration’s confidence level was evaluated using the criteria shown in Table 4-6.

Table 4-6
Calibration Confidence

Confidence Level	Static Pressure Difference	Residual Fire Flow Pressure Difference
High	±5 psi	≤10 psi
Medium	± 5-10 psi	10-20 psi
Low	>10 psi	>20 psi

Each zone’s overall confidence level was determined by the number of low-, medium-, and high-confidence results, as summarized in Table 4-7. Overall system calibration confidence is considered moderate to high.

Table 4-7
Calibration Confidence Results

Pressure Zone	Overall Confidence
Airport	High
Airport NW 49th	Low
Airport Road	High
Airport NW 47th	No Data
Cemetery	Medium
Gravity	Medium
Jr High	High
Mt Hebron	Medium
Murietta	High
North	Medium
Royal Ridge	High
SE 20th	No Data
Skyline	Medium

Modeling Conditions

System analysis was performed under existing, 5-year and 20-year MDD, plus fire flow conditions. Fire flow scenarios test the distribution system's ability to provide required fire flows at a given location while simultaneously supplying MDD and maintaining a minimum residual pressure of 20 psi at all services. Where the pressure criteria could not be met, deficiencies were identified and used to develop the improvement projects outlined in Section 6. Distribution system pressures were evaluated under PHD conditions to confirm piping improvements identified during fire flow analysis and to evaluate piping velocities.

To assess pressure fluctuations observed by City staff at the west end of the Gravity Zone, system pressures under existing ADD conditions were evaluated with and without ASR injection.

Demand

Existing customer demand was allocated throughout the system by linking customer billing records to the surveyed meter locations, which were then linked to the nearest demand node within the model. The billing records were then scaled to match production records to account for non-revenue water use within the system. As described in Section 3, future water demands were estimated based on developable land within the UGB and anticipated development densities from the City's Comprehensive Plan. Projected 5- and 20-year demands are allocated by spatially joining each parcel's estimated future water demand growth with the nearest eligible demand node within the model.

Fire Flow

Fire flows are assigned based on the general zoning classifications illustrated on Figure 3-2. The general classifications and assigned fire flow are summarized in Table 4-8.

Table 4-8
Model Fire Flow Assignments

General Zoning Class	Zoning Designations	Fire Flow Requirement (gpm)
Residential	LDR, MDR, HDR, FRC	1,500
Commercial & Industrial	BP, FC, GC, SC, TC, FI, HI, LI, RD	3,000
Airport Industrial	AI	4,000

Facilities

For distribution system modeling, all City wells are assumed to be off. Distribution storage reservoirs are modeled at their operational minimum level, as provided by the City. This is approximately 86% full for all reservoirs including the WFP Clearwell. The Airport Reservoirs operate approximately 55% full.

Distribution System Findings

A detailed system analysis was performed to assess the ability of the City's existing distribution system to provide water for existing and projected future demands and emergency fire suppression.

Existing Fire Flow Analyses

As illustrated in Figure 4-2, some areas of the existing distribution system have pressures below 20 psi under MDD plus fire flow conditions. Piping improvements, presented in Section 6 are recommended to mitigate these deficiencies.

- *Airport Zone* — Existing available fire flow in this area is between approximately 1,600 and 2,900 gpm, well under the required 4,000 gpm for the Airport industrial area. A number of Airport facility improvements are recommended to address fire flow deficiencies and provide for anticipated development in the Airport Zone within the next 5 years and beyond. Capital Improvement Program (CIP) projects for the Airport Zone are summarized in Table 6-7.
- *Southgate Commercial Area* – Available fire flow at 20 psi near the intersection of Southgate/US 395 and SW Hailey Avenue is approximately 1,200 gpm. Fire flow

availability may be improved by transferring hydrants FH-52 and FH-692 from Cemetery Zone mains to parallel 16-inch Gravity Zone mains in SW Hailey Ave or installing additional hydrants on the north side of SW Hailey Avenue connected to the Gravity Zone 16-inch main.

- *Ellis Place* – Existing available fire flow in Gravity Zone residential areas northwest of the 8th Street Bridge are under 1,000 gpm, due to undersized piping and limited looping in the area. In order to mitigate fire flow deficiencies, a 12-inch loop is recommended from Byers Avenue over the 8th Street Bridge and along Ellis Place to 2nd Street. This CIP project (CIP M-6) is illustrated on Figure 6-1 and described in Table 6-5. Proposed improvements should be coordinated with the planned 8th Street Bridge replacement.
- *Skyline Drive* – As previously described, due to high elevations along Skyline Drive, customers experience low static service pressures that also result in extremely low fire flow availability. In order to mitigate low service pressures and fire flow deficiencies, it is recommended that existing Skyline Zone mains along Skyline Drive be transferred to the proposed 1570 Zone as illustrated on Figure 6-1 and a portion of existing 6-inch mains on Skyline Drive be replaced with 8-inch pipe (CIP M-21).
- *SE Court Avenue* –Piping improvements (CIP M-11) are recommended to improve looping and fire flow availability near the intersection of SE Court Avenue/US 30 and SE 10th Street/OR 11.
- *NE Riverside Avenue* – Available fire flows in the residential area along NE Riverside Avenue east of OR 11 are under 1,000 gpm. Upsizing of existing 6-inch mains (CIP M-5A, 5B, 5C) is recommended to mitigate fire flow deficiencies in this area.

Future System Analysis

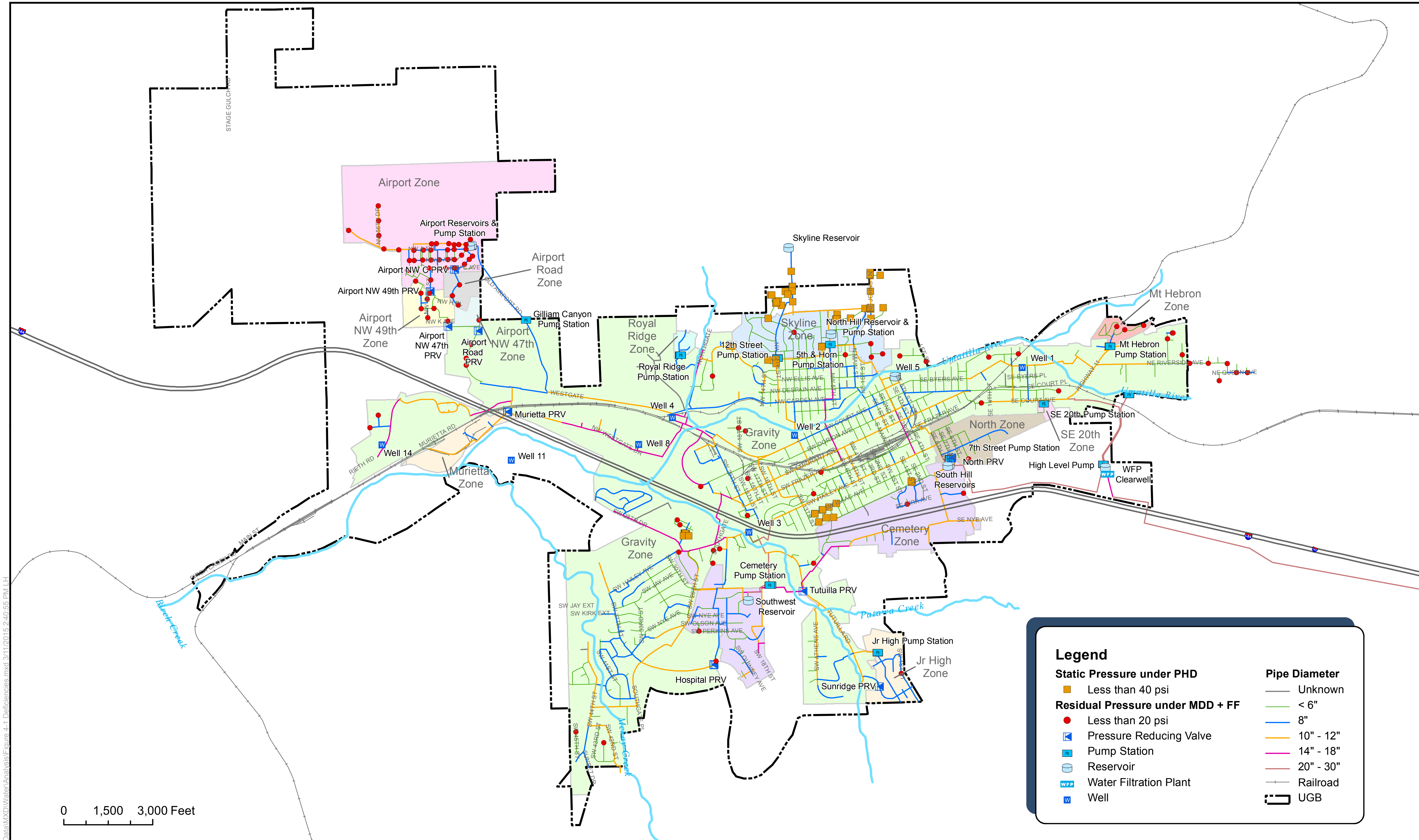
Distribution system modeling under future demand conditions focused on expanding the existing pressure zones to serve potential growth and improving system looping and redundancy. System improvements described in Section 6 provide for:

- a large-diameter Gravity Zone loop north of Westgate.
- creation of a 1570 Zone to serve high-elevation customers on the Skyline Zone's northern boundary.
- looping for potential development in the Cemetery and Airport Zones south and east of St. Anthony Hospital.
- looping for potential Skyline Zone growth east to Lee Street.

ASR Injection Modeling

Modeling revealed a service pressure reduction of 9 to 12 psi in the west end of the City's Gravity Zone during ASR injection, from Northgate (Hwy 37) near the Rudy Rada Skate Park west to Pendleton Sanitary Services. The water system grid is limited in this area, with only two parallel, large-diameter mains running east to west along Westgate and NW 36th

Street, respectively. North-south connections and looping between these pipes is limited due to the location of the Eastern Oregon Correctional Institution between them. Although service pressures do not drop below minimum criteria, the City would like to reduce service pressure fluctuations during ASR injection. A water main improvement project to reduce service pressure fluctuations during ASR injection is presented in Section 6 (CIP M-1).



MSA Murray, Smith & Associates, Inc.

City of Pendleton Incorporated 1880 Oregon

City of Pendleton
Water System Master Plan

Figure 4-2
Pressure Deficiencies

March 2015 13-1442

Summary

This section presents the water system analysis and identifies deficiencies based on performance criteria summarized in Table 4-1. The analysis identifies supply, storage, pumping and distribution system deficiencies under existing and future conditions as presented below. Key existing deficiencies include distribution system piping improvements to provide fire suppression capacity, adequate pumping capacity and backup power at most of the existing booster pump stations.

Supply Analysis Summary

- The City has adequate total and firm capacity (Well 5 out of service) to meet existing demands.
- ASR injection of approximately 885 MG into the City's aquifer in 2013 resulted in a 0.5 ft water level increase. This annual water level increase is projected to continue with the ASR program. This projected increase in aquifer water level will increase pumping capacity in the City's wells by approximately 0.21 mgd in 10 years and 0.41 mgd with the 20-year timeframe.
- An additional 0.12 mgd of firm supply capacity will be required within 5 years, 1.18 mgd of firm supply capacity will be required within the 10-year horizon, 1.97 mgd will be required within the 20-year horizon, and 9.57 mgd of additional firm supply capacity is forecasted at build-out conditions.

Water Quality Summary

The City provides an annual water quality report to customers that indicates consistent, high quality water and full compliance with all Safe Drinking Water Act requirements.

Pressure Zone Analysis Summary

- The City's 13 existing pressure zones provide adequate service pressures between 40 and 80 psi to most water system customers.
- A new 1570 Zone is proposed to serve customers at high elevations north of the existing Skyline Zone, as well as some existing high-elevation Skyline customers with low service pressures.

Distribution Storage Analysis Summary

- The City has adequate distribution storage for existing conditions.
- The City has a system-wide future distribution storage deficit of 0.29 MG by the 20-year horizon and 1.04 MG at build-out.

- The Airport Pressure Zone has a projected 20-year distribution storage deficit of 0.17 MG and build-out deficit of 0.89 MG. This assumes that the zone will continue to be served from a constant pressure pump station.
- The Skyline Pressure Zone has a projected 20-year distribution storage deficit of 0.12 MG and build-out deficit of 0.15 MG.

Pumping Analysis Summary

- Backup power is recommended for all pump stations serving zones without gravity storage. The City recently added backup power to Mt. Hebron Pump Station and is in the process of adding backup power at the Airport Pump Station. None of the other booster pump stations have backup power.
- Of the existing booster pump stations, six have existing capacity deficiencies. These deficiencies increase over the 20-year planning horizon.

Distribution System Analysis Summary

- Six areas within the existing distribution system exhibit pressures below 20 psi under existing MDD plus fire flow conditions. Piping improvements are recommended to mitigate these deficiencies.
- Model results indicate that during ASR injection a reduction in service pressures of 9 to 12 psi occurs in the west end of the City's Gravity Zone from Northgate (Hwy 37) near the Rudy Rada Skate Park west to Pendleton Sanitary Services. The water system grid is limited in this area. A water main improvement to reduce service pressure fluctuations during ASR injection is recommended as described in the CIP (M-1).
- Proposed system looping is recommended to provide service to identified distribution system expansion areas consistent with anticipated development timeframes presented in Figure 3-2.

Murray, Smith & Associates, Inc.
Engineers/Planners

SECTION 5
Operations and Maintenance

SECTION 5
OPERATIONS AND MAINTENANCE

Introduction

This section assesses the City of Pendleton's (City's) Operations and Maintenance (O&M) program for its water system. The assessment is based on information from City staff, comparison to the O&M practices of similarly sized utilities, and pertinent regulatory requirements. Improvement recommendations for the City's O&M program are detailed at the end of this section, and are based on the results of this assessment, state and federal requirements, City code, and benchmarking with similar utilities.

O&M Regulations and Guidelines

Oregon Administrative Rules (OAR) 333-061-0065 governs O&M and OAR 333-061-0200 defines requirements of the Operator Certification Program. The OAR requires all water systems to maintain a current, detailed operations manual that includes guidelines to assure a continuous supply of drinking water. Personnel in charge of operations for all community and non-transient, non-community water systems are required to be certified through the Oregon Water System Operator's Certification Program. (See OAR 333-061-0205 through 333-061-0295 for specific certification rules.)

OAR Section 333-061-0220, Classification of Water Treatment Plants and Water Distribution Systems, defines water systems based on system complexity, population served, and type of source water. Population-based classifications follow:

- Small Water System – Fewer than 150 connections that
    - use only groundwater for supply; or
    - purchase water from a community or non-transient non-community public water system without further treatment.
- Water Distribution 1 – 1 to 1,500.
- Water Distribution 2 – 1,501 to 15,000.
- Water Distribution 3 – 15,001 to 50,000.
- Water Distribution 4 – 50,001 or higher.

A point system assigns ratings based upon the complexity of treatment present at the water treatment plant; higher numbers reflect more complex systems. (See OAR 333-061-0220(3) for further details.) Point-based classifications follow:

- Water Treatment 1 – 1 to 30.
- Water Treatment 2 – 31 to 55.
- Water Treatment 3 – 56 to 75.
- Water Treatment 4 – 76 or higher.

Water distribution and water treatment operators must receive certification in accordance with the classification of the system they operate. The City's classifications are Water Distribution 3 and Water Treatment 2.

In addition to the OAR regulations summarized above, the American Public Works Association (APWA) provides the following guidance in the *Public Works Management Practices Manual*, 6th edition:

> Maintenance practices should be developed for the water distribution system to include installation, testing and preventative maintenance activities for all elements of the system. The level and frequency of maintenance provided for the various elements of the water distribution system should be preplanned so that the overall system is properly and adequately managed. Maintenance practices should include installation, testing, and preventative maintenance for water meters, fire hydrants, valves and pipes, as well as a program for leak detection and elimination.

The Ten States Standards *Recommended Standards for Water Works*, 2012 edition, recommends the following regarding water system O&M:

> An operation and maintenance manual including a parts list and parts order form, operator safety procedures and an operational trouble-shooting section shall be supplied to the water works as part of any proprietary unit installed in the facility.

The City has established ordinances regarding connection to the water system, charges, cross-connection, leak detection and repair, and water curtailment. (See City Ordinance Nos. 3236 and 3514 for further details.)

System Overview, O&M Staff, and Certification Status

The following list provides an overview of the City's water distribution system:

- System serves approximately 17,600 people.
- Service Area: 13.4 square miles.
- Volume of water produced (approximate 2013 values).
  - Average Daily Demand (ADD): 3.7 mgd.
  - Maximum Daily Demand (MDD): 9.4 mgd.
  - Peak Hourly Demand (PHD): 14.3 mgd.
- Non-revenue water: approximately 7%.
- Total length of water line: 106 miles.
- Number of wells: 8.
- Number of booster pumping stations: 13.
- Number of finished water tanks: 8.

- Number of pressure zones: 13.
- Number of pressure reducing valve (PRV) stations: 9.
- Average residential customer consumption: 224 gallons per capita, per day (gpcd).
- Size of most residential connections: 3/4 inch.
- Water treatment: Water Filtration Plan, ultra-filtration membrane facility with 9.8 mgd capacity and expansion capacity of up to 15 mgd.

The City's Water Utility staff are responsible for the maintenance and operation of the distribution and treatment systems. Based on the system size, the state requires a Water Treatment Level 2 and Water Distribution Level 3 operator certification for the individual in direct charge of the system. The Water Utility is structured and currently operated with five and half (5.5) full-time equivalent employees (FTEs).

Table 5-1 lists current City personnel and their State of Oregon certification level. The City encourages certification of operations personnel, and sponsors attendance of personnel at appropriate work-related safety and technical training courses. As defined in Ordinance No. 3236, Section 16, the City maintains three certificated cross connection control staff for inspection and testing of backflow prevention devices.

Table 5-1
Certification Status of Personnel

Certification Number	Name	Job Title	Certification
D-7052, T-7052	Tim Smith	Water Superintendent	WD-3, WT-2
D-8119	Steve Quinn	Utility Worker	WD-1
D-8330, 5000	Brian Pickard	Utility Worker	WD-2, Backflow Tester
D-8331	Scott Roe	Utility Worker	WD-1
	Bobby Smith	Utility Worker	In Process
D-6654, T-6654	Bob Patterson[1]	Public Works Director	WD-3, WT-2
D-8949	Sean Tarter[2]	Utility Worker	WD-1
6069	Klaus Hoehna[3]	Regulatory Specialist	Cross Connection
6001	Heaven Doherty[3]	Cross Connection Specialist	Cross Connection
D-6431	Jeff Brown[4]	Construction & Repair/Utility Worker	WD-1
D-8501	Kevin Van Dorn[4]	Construction & Repair/Utility Worker	WD-2

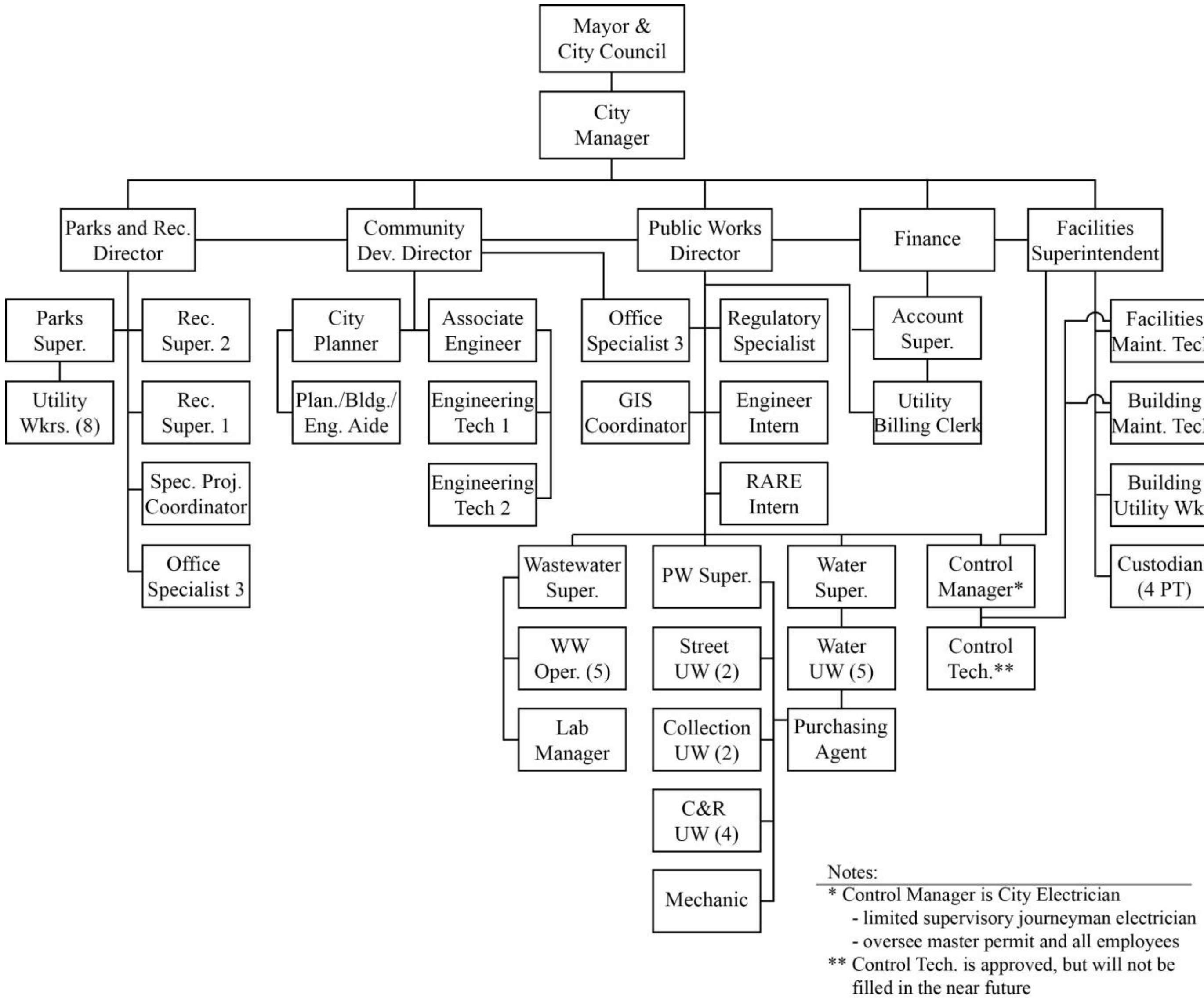
[1] *Operation support for water filtration plant.*
[2] *Utility locator, shared with sewer / storm system locates.*
[3] *Cross connection program.*
[4] *Construction & repair crew focused on replacement.*

The water system O&M is managed by the Water Superintendent, who reports to the Public Works Director. There are currently five employees, supervised by the Water Superintendent, who operate or maintain the system in some capacity. Figure 5-1 shows the Water Utility's organizational structure.

The City also maintains a construction and replacement (C&R) crew, consisting of four FTEs managed by the Public Works Superintendent. This crew handles C&R for in-house water lines, as well as sewer and storm pipes, but are not dedicated to the Water Utility. The City estimates that if this crew were fully dedicated to water and sewer pipe replacement, 3,500 linear feet of water distribution pipe could be replaced per year. Based on this the associated annual in-house labor and equipment costs would total about $242,000 and the water pipe material costs would total about $363,000. Currently, however, the C&R crew is assigned to work outside of the Water and Sewer Utility. Additionally, the City follows Oregon Revised Statues, §279C.305, which requires that before a utility constructs a public improvement with a value of $125,000 or greater with its own equipment or personnel, it shall prepare adequate plans and specifications and the estimated unit cost of each classification of work.

In June 2014, the City received the results of the most recent Water System Survey from the Oregon Health Authority – Drinking Water Services. In August 2014, the City provided responses to all identified deficiencies and potential rule violations. The City is currently in compliance with all regulatory standards and OARs.

Figure 5-1
Organizational Chart



Current O&M Practices and Procedures

Routine operations identify and implement procedures to ensure that the facilities within the water system function efficiently and meet level-of-service requirements (e.g., quality and pressure). Ongoing procedures include making daily rounds to visually inspect system facilities, monitoring flow- and reservoir-level recording, and responding to customer inquiries and complaints.

The City is working to update their O&M program through pursuing Public Works Accreditation, which implements best practices of the American Public Works Association's *Public Works Management Practices Manual – 8th Edition* (PWMP Manual). The following lists the best O&M practices for the potable water distribution system as they are described in the PWMP Manual:

- Potable Water Source and Use: A directive establishes the source of potable water and any limitations on usage.
- Water Quality or Quantity Changes: A plan establishes operating procedures used during a change in quality or quantity of available raw water and identifies procedures to minimize treatment problems.
- Infrastructure Inventory: An inventory of the potable water infrastructure is maintained and updated.
- Infrastructure Condition: A record of the potable water infrastructure condition is maintained and updated.
- Infrastructure Management: A system is used to guide the development and maintenance of potable water infrastructure assets.
- Potable Water Treatment: A water quality treatment program outlines treatment methods, facility maintenance, staffing requirements, and the quality and quantity of potable water to be produced.
- Energy Consumption Review: Energy consumption reviews of the entire system are performed.
- Fire-Flow Requirements: A policy establishes fire-flow requirements and provides for testing and maintenance of fire-flow volumes and pressures for the various zones within the service area.
- Operation and Use of Water Resources: A program establishes the operation and use of reservoirs, wells, surface potable water sources, and pump stations to enable efficient delivery of treated water, including drought contingency plans.
- Water Source Protection: Protection and testing measures are established for raw water to prevent contamination.
- Vulnerability Assessment: A vulnerability assessment of the water system is conducted to ensure optimum security is provided for the water supply.

- Water Distribution System Operations and Maintenance: Maintenance practices are developed for the water distribution system to include installation, testing, and preventative maintenance activities for all elements of the system.
- Cross-Connection Control: A program is established to protect the potable water supply from possible contaminants, pollutants, or entry of other waters from an unapproved source.
- Inspection Schedule: An inspection schedule establishes the time and frequency of equipment inspection for all elements of the water treatment and distribution system.
- Meter Reading: Meter reader responsibilities are developed and include a meter-reading schedule.
- Pumping Operation: A schedule is established for inspection activities and preventive maintenance of pumping operations.
- Disinfection Procedures: Disinfection procedures are developed to provide measures for dealing with water main breaks, installation of new services, and additions to the distribution system.
- Public Notification Procedures: Public notification procedures are established which detail water contamination conditions.
- Sampling and Testing: A program is established for the sampling and testing of water quality in the system.
- Public Education Program: A program is established to educate the public on water resource issues.
- Long-Range Water Resource Plan: A long-range water resource plan is developed.
- Incentives for Water Conservation: A program to encourage the conservation of water should be developed and incentives put in place where needed.
- Alarm Testing: A schedule is developed to determine the frequency of alarm system testing. A log or record of the test results are maintained.

The City will be implementing these best management practices in development of a comprehensive water system O&M program. System O&M procedures are discussed below.

System Operation

Field personnel monitor the water system's performance every day. The City maintains and operates all facilities and appurtenances within the system, including customer meters. The customer is responsible for maintaining the water service line beyond the meter, typically located at the curb or near the property line. City staff handles the majority of the O&M duties; however, tasks such as major water main or facility repairs are sourced to outside contractors.

Each facility is typically inspected monthly to ensure proper operation. Critical facilities are visited more frequently.

Supervisory Control and Data Acquisition (SCADA) equipment at the City's Water Filtration Plant (WFP) records the water pressure at all wells and booster pump sites, and the water levels in the water reservoirs. Flow meter data at each well is transmitted to the City's WFP through the SCADA system and is then recorded. Data includes flow rate in gallons per minute (gpm) and run time of the pumps. A totalizer records the gallons produced. High and low temperatures are also recorded each day.

Water Department personnel utilize this data to detect any major abnormalities in the water system. Daily records store the gallons produced from each source, the water level in each reservoir, and total water produced at each well and the WFP.

Quarterly measurements of the static and/or pumping water level in each well are compiled into a yearly report. When the City switches to aquifer storage and recovery (ASR) operation at the well stations, it checks the valves and equipment, recording the necessary water level and flow information required by the state.

Water customer meter reading is currently being transitioned from a contracted outside service to City crews. The City has created a meter reader position to perform monthly meter reads. This position also covers the meter reads that City staff currently perform, which include Route 37 for the water vaults and as required for re-reads and shutoffs. The City is also considering automated meter reading (AMR); this is described further in Appendix B.

The City is currently developing a Geographic Information System (GIS) geodatabase to maintain detailed information about the system. This geodatabase will have extensive information about facilities, pipelines, and appurtenances throughout the system. It spatially locates each component of the system and includes attributes relevant to each feature, such as material, diameter, pressure settings, elevations, and other relevant characteristics. Currently, the GIS data can be leveraged for in-office use or by City crews in the field using a laptop.

System Preventive Maintenance

Preventive maintenance consists of regularly servicing pumps and motors, exercising valves, cleaning and painting reservoirs, and flushing dead-end pipelines.

The following is a list of preventive maintenance activities regularly performed by City Operations staff:

- Change equipment oil once a year at each of the facilities.
- Inspect and repair, as necessary, all equipment in the pump house.
- As applicable, check the oil level of the motor bearings, the water-cooling bearing, and the packing gland on the pump.
- Check for damaged valves or meter boxes and repair or replace as necessary.
- Repair reported leaks daily to minimize damage to streets and the surrounding area.

- Operate valves and flush hydrants in areas where the City has observed the need, and make repairs to valves or valve boxes. (The City currently does not have an established flushing or valve exercise program.)
- Maintain grounds around City facilities, water meter reads, utility locates, customer complaints, and water quality sampling.
- Operate Water Filtration Plant.

Water Quality Monitoring

The City follows federal and state requirements for water quality monitoring. The following lists the water quality parameters that the City monitors:

- Coliform.
- Turbidity.
- Inorganics.
- Radionuclides.
- Disinfection byproducts.
- Disinfection residuals.
- Lead and copper at water taps.
- Synthetic Organic Compounds (SOCs)/ Volatile Organic Compounds (VOCs).

Water quality monitoring over the last 5 years indicates that the City's water meets federal and state requirements. The Consumer Confidence Report (CCR) are published every May/June for the prior calendar year, which includes the most current water quality information. The current reports are available on the City's website.

Emergency Response Plan

The City's Water System Emergency Response Plan (ERP) provides the Water Utility with a standardized response and recovery protocol to prevent, minimize, and mitigate injury and damage resulting from emergencies or disasters of man-made or natural origin.

The ERP also describes how the Water Utility will respond to potential threats or actual terrorist scenarios identified in the vulnerability assessment, as well as additional emergency response situations. Included in the ERP are action plans that will be utilized to respond to specific events.

Safety Procedures

The City's Safety Manual provides the Water Utility with a standardized approach for the establishment, implementation, administration, and governance of a comprehensive safety program. The City is accountable for the safety of employees working under their supervision and is expected to conduct operations safely at all times.

Customer Complaints

Customer complaints are currently received by to the utility billing clerk and as required are routed to the Water Utility to be addressed. The City is developing and preparing to implement a Water and Waste Water System Customer Complaints and Inquiries Standard Operating Procedure (SOP).

Automated Meter Reading

As mentioned previously, the City is considering implementing an AMR system; see Appendix B for additional information on the options that the City is reviewing.

Benchmark Comparisons

Four other regional utilities, comparable in size and climate to the City, were surveyed to compare their O&M practices to the City's current program. These utilities and the populations they serve are listed below:

1. Asotin County Public Utility District (Asotin PUD), Washington = 19,750.
2. City of Lewiston, Idaho = 16,000.
3. City of Redmond, Oregon (Redmond) = 27,000.
4. City of Walla Walla, Washington (Walla Walla) = 35,000.

Because each utility has unique attributes, a number of performance indicators were calculated on a unit basis for a means of comparison, and the results are summarized in Table 5-2. Tables 5-3 to 5-14 highlight responses to specific survey questions.

The City ranks fourth in population served and fifth in average flow rates when compared to the other four utilities. The City is ranked fifth in the length of lines maintained and first in terms of number of well and booster pump stations maintained. The City is fifth in the number of water system O&M staff and third in O&M budget. Although the City is one of the smaller utilities in terms of customers and distribution main, it has the most facilities, increasing the complexity of the system for its size. It is operating with more facilities and fewer staff than all other surveyed utilities. The City is in the middle of the group when comparing the annual budget to population served, annual average daily flow, total distribution system length, and total number of FTEs on staff.

The performance indicators show that each FTE in the City is responsible for more water supplied (daily average) and total length of the distribution system piping than the other utilities. This shows that the City operates with fewer staff than the rest of the survey group. Additionally, based on the *2012 Benchmarking Performance Indicators for Water and*

Wastewater Utilities: Survey Data and Analyses Report, the national median is 210,000 gpd per FTE which, compared to the City's 616,700 gpd per FTE, indicates that the City is understaffed.

Similar to the other utilities, the City receives almost all of its funding from water rates, with a small percentage of funds coming from connection fees. The City's connection fee and monthly water rates are comparable to the other four utilities surveyed.

Table 5-2
Benchmarking – Performance Indicators

Utility Name	Number of FTEs	Annual Budget/ Average Day Flow ($/mgd)	Annual Budget/ System Pipe Length ($/lf)	Annual Budget/ Population Served ($/person)	Average Day Flow/ FTEs (gal/FTE)	Feet of Pipe/ FTEs (lf/FTE)	Annual Budget/ FTEs ($/FTE)
Asotin PUD	10	541,900	3.5	111	507,500	79,200	275,000
Lewiston	8	878,000	5.9	225	293,000	43,800	257,000
Pendleton	5.5	675,700	4.4	142	672,700	102,700	455,000
Redmond	6	956,000	5.6	178	500,000	86,100	478,000
Walla Walla	16	413,400	4.1	112	591,900	60,400	245,000

General note: Large numbers have been rounded to the nearest hundred for ease of comparison.

Table 5-3
Benchmarking – Service Areas

Rank (population served)	Utility Name	Population Served	Number of Service Connections	Service Area (square miles)
1	Walla Walla	34,858	10,900	13
2	Redmond	26,924	9,989	10.2
3	Asotin PUD	19,750	7,050	20
4	Pendleton	17,611	6,184	13.4
5	Lewiston	16,000	5,980	17

Table 5-4
Benchmarking – Flow Rates

Rank (ADD)	Utility Name	Volume of Water Produced (mgd)			Non-Revenue Water
		ADD	MDD	PHD	(%)
1	Walla Walla	9.5	20.0	26.8	31
2	Redmond	5.0	13.2	NA	2.0
3	Lewiston	4.1	10.5	2.6	5.9
4	Asotin PUD	4.1	12.1	19.2	5.0
5	Pendleton	3.7	9.4	14.3	7.0

Table 5-5
Benchmarking – Distribution Pipe

Rank (length of distribution pipe)	Utility Name	Total Length of Distribution Pipe (miles)	Number of Hydrants
1	Walla Walla	183	2,300
2	Redmond	163	1,700
3	Asotin PUD	120	1,010
4	Lewiston	116	864
5	Pendleton	107	700

Table 5-6
Benchmarking – PRVs

Rank (number of PRVs)	Utility Name	Number of PRVs	Number of Pressure Zones
1	Lewiston	28	8
2	Asotin PUD	25	9
3	Walla Walla	25	4
4	Pendleton	9	13
5	Redmond	4	4

Table 5-7
Benchmarking – Wells

Rank (number of wells)	Utility Name	Number of Wells	Largest Well Pump (hp)	Smallest Well Pump (hp)	Number of Wells with Backup Power
1	Pendleton	8	450	100	0
2	Asotin PUD	7	900	200	1
3	Redmond	7	600	150	6
4	Walla Walla	7	500	200	0
5	Lewiston	6	350	75	0

Table 5-8
Benchmarking – Booster Stations

Rank (number of booster stations)	Utility Name	Number of Booster Stations	Largest Pump (hp)	Smallest Pump (hp)	Number of Booster Stations with Backup Power
1	Pendleton	13	100	1.5	1
2	Lewiston	9	400	1.5	6
3	Redmond	4	150	15	4
4	Asotin PUD	3	500	50	2
5	Walla Walla	1	25	15	0

Table 5-9
Benchmarking – Surface Water Supply and ASR

Utility Name	Surface Water Supply	ASR
Asotin PUD	No	No
Lewiston	Yes	No
Pendleton	Yes	Yes
Redmond	No	No
Walla Walla	Yes	Yes

Table 5-10
Benchmarking – Reservoirs

Rank (number of reservoirs)	Utility Name	Total Number	Tank Types				
			Pre-stressed Concrete	Cast In Place Concrete	Welded Steel	Bolted Steel	Other
1	Pendleton	8		x	x		x
2	Redmond	8	x		x		
3	Lewiston	7		x	x		x
4	Asotin PUD	5	x		x	x	
5	Walla Walla	3	x		x		

Table 5-11
Benchmarking – Staff

Rank	Utility Name	Number of FTEs on Staff	Number of Certified Distribution Operators			
			Class I	Class II	Class III	Class IV
1	Walla Walla	16	0	4	1	0
2	Lewiston	14	2	3	2	1
3	Redmond	10	0	3	6	0
4	Asotin PUD	8	1	5	2	0
5	Pendleton	5.5	2.5	2	2[1]	0

[1] *Public Works Director also certified.*

Table 5-12
Benchmarking – Budget

Rank	Utility Name	Total O&M Budget
1	Redmond	$4,780,000
2	Lewiston	$3,600,000
3	Pendleton	$2,500,000
4	Asotin PUD	$2,200,000
5	Walla Walla	$3,915,000

Table 5-13
Benchmarking – Financing

Utility Name	Residential Water Fees		Source of Budget (%)			
	Connection Fee	Average Monthly Water Rate	Connection Fee	Water Rates	General Fund	Loans
Asotin PUD	$1,650	$30.00	1	99	0	0
Lewiston	$1,500	$70.00	5	95	0	0
Pendleton	$2,300	$30.00	2	98	0	0
Redmond	$400	$35.00	14	86	0	0
Walla Walla	$2,408	$54.00	3	97	0	0

Table 5-14
Benchmarking – Budget Allocation

Budget Allocation (%)							
Utility Name	Chemicals	Wages	Equipment and Materials	Contracted Services	Staff Training	Energy	Other
Asotin PUD	1	40	20	3	1	15	20
Lewiston	NA	NA	NA	NA	NA	NA	NA
Pendleton	2	9	49	1	0	14	25
Redmond	10	10	45	10	5	15	5
Walla Walla	3	22	2	8	3	15	47

The following list summarizes responses to other survey questions. (Not all questions were answered by every utility.)

- System Age: The majority of the City's system is over 50 years old, which is relatively older than the other systems.
- Surface Water Sources: Three utilities have a surface water source.
- Budget Allocation: The City's spending is comparable, with two exceptions: The City spent the least on wages and the most on equipment and materials.
- System Flushing: The City is the only utility without a flushing program in place.
- Valve Exercising: The City and one other utility are the only utilities surveyed that did not have a valve exercising program.
- In-House Construction: The City maintains a C&R crew for repair and replacement of water system infrastructure, however, currently the C&R crew is assigned to work outside of the Water and Sewer Utility. Other utilities surveyed indicated that they do not have a dedicated crew for in-house construction. Only repairs and maintenance

projects are performed in-house by operations staff. These utilities use their small works roster or bid out construction of new pipelines and major repair/replacement projects.

- Cathodic Protection: The City is one of two utilities responding that reported employing cathodic protection.
- Cross-Connection Program: All utilities reported having a cross-connection program.
- Leak Detection: The City was one of two utilities without a leak detection program.
- Well Head Protection Plan: The majority of utilities, including the City, have a wellhead protection plan.
- Specific Capacity Tests: The city measures specific capacity every year to monitor ASR and well production.

Conclusions and Recommendations

The following conclusions and recommendations are based on a review of the City's O&M practices and benchmarking of other water system O&M programs:

General

An effective O&M program addresses issues with customer interaction, water quality and infrastructure operations and maintenance. This requires timely and relevant information on operations and maintenance activities. This information is used for planning, implementing, reviewing, evaluating, and taking appropriate operations or maintenance actions in response to water system infrastructure needs.

The key to these best practices is the ability to get pertinent information from field staff to managers. This is best achieved through improving record-keeping practices. However, few of these procedures are formally documented. To become compliant with state and industry recommendations, O&M water system procedures should be documented, and these recommendations followed:

- Develop a comprehensive water system O&M program based on incorporation of the PWMP Manual best management practices, which includes the water infrastructure programs defined below, to provide for consistent long-term operations and maintenance.
- Expand existing record keeping and document each maintenance activity performed. This form should track each piece of equipment, maintenance records, and man-hours required for this activity.
- Invest in ongoing training for staff related to record-keeping and encourage a disciplined documentation program.
- Track and compare annual costs of maintenance for each piece of equipment to determine whether to repair or replace it.

- Maintain a log of customer complaints and issues that includes date, time, location, cause of the issue, and corrective measures taken. Consider linking the complaints database to GIS.
- Develop a utility succession plan, a program that ensures continuity in leadership by building internal personnel talent and strategies for knowledge management development.

Distribution System

Water distribution system O&M programs typically include the following maintenance programs:

- Water meter calibration and replacement.
- Dead-end main and hydrant flushing.
- Valve exercising.
- Leak detection.

It is difficult for water providers to address each item listed above. Consequently, it is important to prioritize maintenance of the critical infrastructures necessary to maintain effective service during an emergency. To accomplish this, the City should ensure adequate resources.

To maintain a high level of service, the City should assess and identify critical components of the distribution system. To improve water distribution system O&M, it is recommended that the City develop the following programs:

A pipe replacement program based on a 100-year cycle. The prioritization should be:

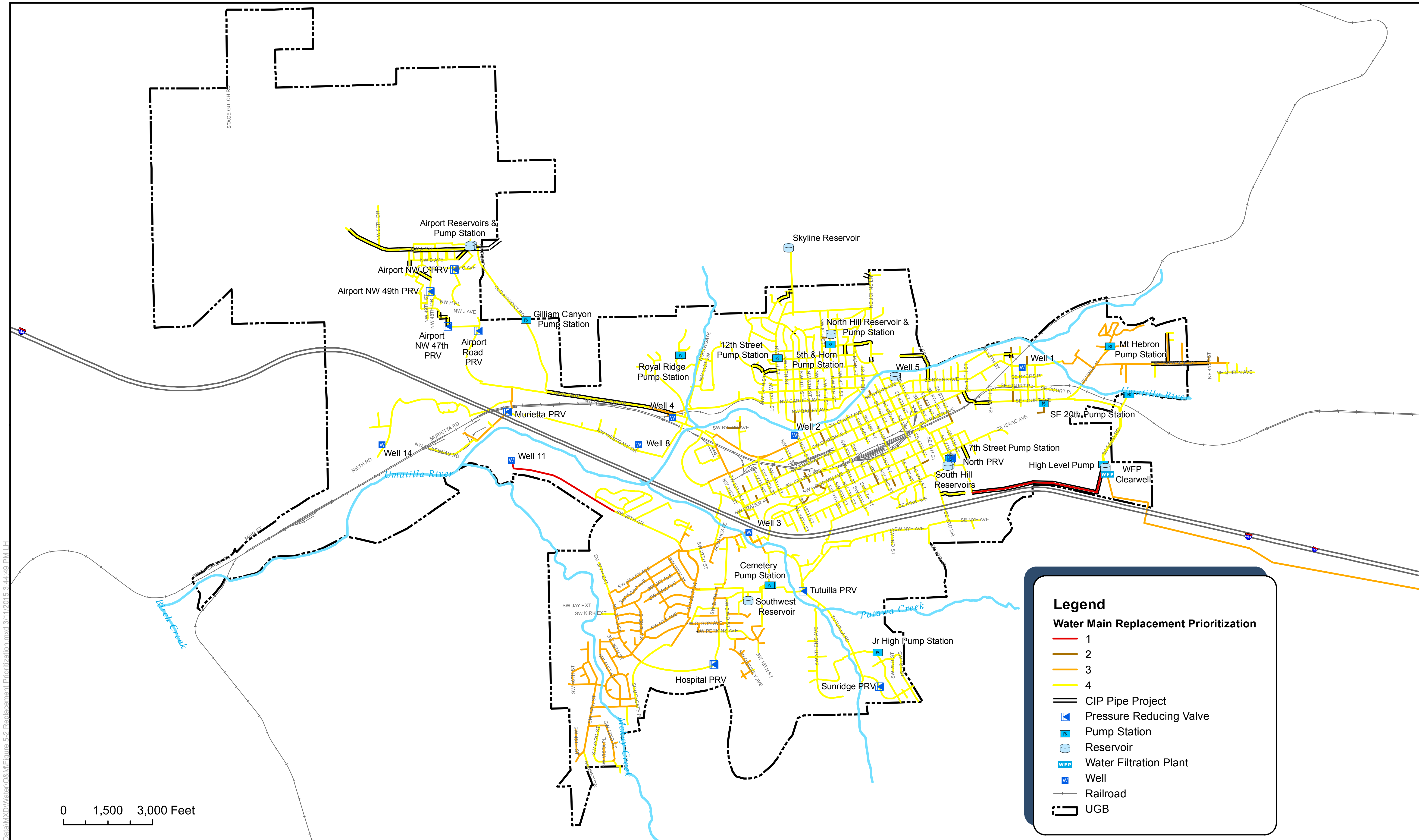
1. Known capacity and condition issues – Targeted replacements.
2. Pipe material – Based on record of issues (pipe material and era of manufacture).
3. Pipe age – Coordinate replacement of pipes 50 years or older with other City pipe utilities and street (City, County, State) projects.

Table 5-15 highlights the priority based on material and age. See Figure 5-2 for the distribution system pipe replacement prioritization. Based on 562,000 feet of water pipe and a 100-year replacement cycle, the City should spend $970,000 a year replacing water pipes within its system.

Table 5-15
Pipe Replacement Prioritization

Priority	Type of Pipe
1 – High	Identified Condition and Capacity Issues
2 – Medium	Galvanize Iron Pipe All Ages Post-1950 Cast Iron Pre-1950 Unknown Material Pipe
3 –Medium	Pre-1950 Cast Iron Pipe Post-1950 Unknown Material Pipe
4 – Low	Ductile Iron Pipe and PVC Pipe All Ages

- A customer meter replacement program independently or in association with implementing AMR.
- A flushing program that addresses dead-ends and other areas within the City with water quality concerns.
- A valve exercise program that exercises or operates all distribution valves on a 5-year basis to maintain the reliability of their service. If properly operated, most valves require less maintenance and will last a long time. Focus should be on critical isolation valves within the distribution system.
- A leak-detection program. (Although the City's non-revenue water is about 7%, and developing a leak-detection program is not a top priority, the City should consider implementing such a program in the future.)



City of Pendleton
Water System Master Plan

Figure 5-2
Water Main
Replacement Prioritization

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Wells and Booster Pumps

Well and booster pump station maintenance programs should follow the manufacturers' recommendations for maintenance procedures such as lubricating bearings, changing oil and replacing parts, particularly when the equipment is still under warranty.

Specific requirements for each pump station should be followed, including operation manuals from each manufacturer of proprietary units installed. Specific requirements for each pump station should be developed by the operator, based on their observations of the pump station and knowledge of local conditions.

Basic pump station inspection should include verifying proper operation of alarm systems, ensuring all indicator lights, voltage readings, and suction and discharge pressures are within acceptable limits, and confirming that pumps are properly lubricated and running without excessive heat or vibration.

Source and production meters should be inspected to be sure they are accurately measuring flows and treatment equipment examined for proper operation. Additionally, water quality information should be measured and recorded.

Properly maintained pump station equipment has a typical of life of 30 years or longer if substantiated by historical information before it needs to be replaced. Currently the City is planning to update and/or replace 6 of the pump station facilities over the next 25 years, providing a starting point for a pump station equipment replacement program. Information on specific pump station updates is found in Section 6—Capital Improvement Program.

A typical pump station inspection should include the following:

Each week, check:

- Pump motor for unusual conditions.
- Any warning lights or alarms for low pressure, pump failure, intrusion, power outage, etc.
- Pump house interior and grounds for general cleanliness and condition.
- Pumps for leaks (Pumps that are not water-lubricated should be checked for seepage).
- Pump cycle rate – troubleshoot excessive pump cycling (over 6 cycles per hour).
- Start and Stop pressure settings and operability of water pressure gauges – (reference O&M manual).
- Bearing temperatures (if a temperature gauge is available). Caution must be used when checking how hot temperature may be.
- Pump run hours (if this information is available).
- Condition of the pump house and booster pump stations for damage and deterioration.

- Area around the pump house and booster station for security concerns, vandalism or unauthorized access.

Each month:

- Check oil or grease lubricant reservoirs for proper levels and any leakage or unusual conditions.
- Measure the pump capacity, compare with the expected output from performance records or design parameter.
- Perform routine operation of emergency generator (diesel, gas or propane) per manufacturer's instructions.
- Check condition of emergency generator batteries, fuel levels, oil levels, instruments and controls.
- Check that existing pressure gauges, pump run meters and flow meters are functioning properly.
- Check that pump controls are functioning properly (per O&M manual instructions).
- Check pump house lighting, ventilation, heating.
- Animal-proof facilities (bats, birds, rodents, etc.).

The City can expand its water system maintenance program and improve its pump station operations and maintenance program by following these recommendations:

- Continue to develop O&M manuals for each well and booster pump station to provide consistent maintenance practices for each station. This will encourage the transfer of the City field crew's knowledge and experience to new staff. The O&M manual should include a recommended inventory of critical components, supplier and manufacturer's contact information, and a list of local contractors for emergency repairs, including after-hours contacts.
- Upgrade pump station sites by installing permanent generators.
- Develop a pump station equipment replacement program based on an expected life of 30 years or longer if substantiated by historical information. Currently, Section 4—System Analysis recommends the City to update and/or replace 6 of the existing pump stations over the next 25 years, providing a starting point for a pump station equipment replacement program. Information on specific pump station updates is found in Section 6.

Water Storage Tanks

To ensure a long tank life and good water quality, water storage tanks must be periodically inspected and maintained at least every five years, depending on the structure. Routine inspections aid in assessing the coating system and potential required repairs.

The following recommendations will allow the City to expand its water system maintenance program and improve its water storage tank operations and maintenance program:

- Implement a water storage tank inspection and cleaning program to assess every storage tank within the system every 5 years. The City could consider contracting with an independent certified inspection company.

Staffing

As noted earlier in this section, the water system has 4.5 FTEs, not including the Water Superintendent. The staff is assigned to operate and maintain the water supply and distribution facilities. To assess the City's staffing requirements, the benchmarking survey was used to compare current staffing levels at comparable utilities.

As shown in Table 5-2, the City is operating with fewer staff to maintain the water system than comparable cities and national averages, indicating that current staffing is inadequate to meet the requirements of operating and maintaining the system. Additionally, the need for additional staff will grow as the system expands, water flows increase, and regulatory requirements change and typically become more stringent through the planning horizon.

Based on the staffing review above, the City should have more staff to implement the defined operations and maintenance programs. The following staffing recommendations are for the City to consider, with exact staffing levels to be determined by the City:

- To implement the flushing and valve exercising programs and for leak detection, the City would require three additional FTEs.
- To implement the O&M program and associated record keeping, the City may need up to 0.5 FTEs in a utility worker role. These FTEs could potentially be shared with other departments.

Staffing evaluation related to the C&R crew is based on the City's preference to cost effectively implement the pipe replacement program. A comparison between the production cost per foot of the City's C&R crew and the developed capital improvement costs, which include engineering, administration and surface restoration was completed. The comparison indicates that historically, the City can install pipe at a cost of $173 per lf on average compared to $275 per lf for outsourced work, which is based on the individual CIP project budgets in Section 6.

If the City had a second crew exclusively focused on water line replacement, it could install 5,600 lf per year of pipe required for a 100-year replacement program. The second City C&R crew could install the 5,600 lf of pipe per year at an estimated cost of $970,000 compared to $1,540,000 if it was outsourced.

The following recommendation is for the City to review and consider the need to add an additional four full time staff for a second C&R crew. This would provide the City with two

C&R crews to focus on water and collection system pipe replacement. Note that some water system piping will still need to be out sourced due to the size and complexity of the project.

- If the City is going to implement an ongoing pipe replacement program on a 100-year cycle, it would be cost effective to hire two additional FTEs, which will be part of a second crew of four full time staff with dedicated equipment to perform this work compared to contracting it out. The other two FTEs on the crew would be shared and funded with the Sewer and Storm Utilities.

Summary

The assessment of the City's water system operations and maintenance (O&M) program, included review of information from City staff and comparison to the O&M practices of similarly sized utilities and regulatory requirements. Staff from the City's Water Utility are responsible for the maintenance and operation of the distribution and treatment systems. Based on the system size, the state requires a Water Treatment Level 2 and Water Distribution Level 3 operator certification for the individual in direct charge of the system. The Water Utility is structured and currently operated with six full-time equivalent employees (FTEs).

Routine operations implement procedures to ensure that the facilities within the water system function efficiently and meet regulations. Ongoing procedures include inspecting system facilities, monitoring flow- and reservoir-level recording, and responding to customer inquiries and complaints.

For a benchmark comparison, four other utilities in the region were surveyed in order to compare their O&M practices to the City's current program.

The performance indicators show that each FTE in the City is responsible for more water supplied (daily average) and total length of the distribution system piping than the other utilities. In general, the City operates with fewer staff than the rest of the survey group.

The following conclusions and recommendations are based on a review of the City's O&M practices and benchmarking of other water systems:

- Develop a comprehensive water system O&M program based on incorporation of the PWMP Manual best management practices, which includes the water infrastructure programs defined below, to provide for consistent long-term operations and maintenance.
- Expand existing record keeping and document each maintenance activity performed.
- Invest in ongoing training for staff related to record keeping and encourage a disciplined documentation program.
- Track and compare annual costs of maintenance for each piece of equipment to determine whether to repair or replace it.

- Continue to maintain a log of customer complaints and issues. Consider linking the complaints database to GIS.
- Develop a program for pipe replacement based on a 100-year cycle.
- Develop a program for customer meter replacement independently or in association with implementing AMR.
- Develop a flushing program that addresses dead-ends and other areas within the City with water quality concerns.
- Develop a valve exercise program that exercises or operates all distribution valves on a 5-year basis to maintain the reliability of their service.
- Develop a leak-detection program.
- Continue development of O&M manuals for each well and booster pump station to provide consistent maintenance practices.
- Install backup power at booster stations per the CIP.
- Develop a pump station equipment replacement program based on an expected life of 30 years or longer if substantiated by historical information.
- Implement a water storage tank inspection and cleaning program to assess every storage tank within the system every 5 years. The City could consider contracting with an independent certified inspection company.
- Hire three FTEs to implement the flushing and valve exercising programs and for leak detection.
- Hire up to 0.5 FTEs in a utility worker role to implement the comprehensive water system O&M program and associated record keeping. These FTEs could potentially be shared with other departments.
- Hire two FTEs if the City is going to implement an ongoing pipe replacement program on a 100-year cycle; this would be more cost effective than contracting it out, because these two additional FTEs will be part of a second crew of four full-time staff with equipment dedicated to perform this work. The other two FTEs on the crew would be shared with and funded by the Sewer and Storm utilities.

Murray, Smith & Associates, Inc.
Engineers/Planners

SECTION 6
Capital Improvement Program

SECTION 6
CAPITAL IMPROVEMENT PROGRAM

Introduction

This section presents the Capital Improvement Program (CIP) for the City of Pendleton's (City's) water system. It summarizes the recommended system improvement projects to correct deficiencies identified in Section 4—System Analysis and ongoing replacement and maintenance requirements identified in Section 5—Operations and Maintenance. The recommended improvements in this CIP prioritize projects and assign suggested planning-level costs for each project. It also acts as a blueprint for forecasting capital expenditures and preparing the City to meet its water infrastructure needs for existing and future customers.

For the projects identified in this CIP, the recommended facility sizes and designated locations are schematic. A Preliminary Engineering Report (PER) should be completed for each improvement project to identify the final sizing and location. A PER looks at a specific project in more detail than the analysis conducted within this WSMP.

During final design of each project, it will be necessary to confirm design flows, pipe and facility sizes, and pressure zone configurations based upon the current land use plan, proposed development, detailed soil surveys, soil investigations, utility conflicts, physical constraints and other relevant field conditions.

Project Cost Estimates

An estimate of project cost for each identified improvement was developed in conjunction with this WSMP. These rough cost estimates adhere to the definitions and dictates in OAR 660-011-0005(2) and 660-011-035 for public facilities planning. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors.

Each cost estimate contained herein represents a Class 5 budget estimate, as established by AACE International. This preliminary estimate class is used for conceptual screening. The expected accuracy range of Class 5 estimates is -30% to +50%. As the project is better defined, the accuracy level of the estimates can be narrowed.

Project cost estimates are used as guidance in establishing funding requirements based on information available at the time of the estimate. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) 20-City Average Construction Cost Index (CCI) is commonly used for this purpose. CIP project costs were developed in December 2013 dollars based on the ENR 20-City Average CCI of 9668. CIP cost estimates should be reevaluated periodically to account for inflation.

Appendix C presents a detailed description of the methodology used for estimating these costs. This description explains the procedures used in determining project costs and describes the assumptions made for encountering bedrock, commonly occurring construction activities (such as erosion control), contingency factors, and other project costs.

Capital Improvement Program

The CIP was developed based on the analysis presented in Section 4. The City has also identified CIP projects in which existing infrastructure has exceeded the design life of the initial construction or has other condition issues based on operations and maintenance staff feedback and to address ongoing replacement and maintenance of the system in accordance with recommendations in Section 5. CIP projects are described in the following pages, summarized in Table 6-6 and illustrated in Figures 6-1 and 6-3 at the end of this section.

This CIP, which addresses existing deficiencies and system expansion, is not anticipated to result in environmental impacts. Individual projects, such as pipe crossing of the Umatilla River, may result in temporary impacts during construction. The City is required to comply with environmental permitting requirements and provide mitigation measures in compliance with all local, state, and federal environmental regulations.

Prioritization

Identified piping CIP projects are prioritized based on the following criteria, the timing of anticipated development in the area, and coordination of related projects such as distribution storage reservoirs and upgraded supply mains.

Piping Criteria

Piping improvements for hydraulic deficiencies are most often related to fire flow availability. These piping improvements are prioritized by the following general criteria.

1. Commercial and industrial fire flow improvements:
   Due to their high flow requirements, these are often large pipes running through busy commercial centers and along highway corridors where inadequate fire flow may create a higher potential for both financial losses and injury.

2. Residential fire flow improvements:
   a. Loops impacting multiple customers or housing areas with greater density.
   b. Dead-ends impacting only a few properties.

Other factors that may influence a project's priority:

- Proximity of other hydrants with adequate fire flow.

    - For instance, a residential fire flow improvement serving properties on a dead-end main at the edge of the system with no other hydrant access will be prioritized higher than other similar density residential fire flow deficiencies where additional capacity may be available at another nearby hydrant.

- Pipe age
    - For instance, if there are three residential cul-de-sacs each containing undersized mains serving a hydrant, the oldest main would be replaced first.

- City input on planned development
    - Undersized mains in areas anticipating development within the next five years would have higher priority over those areas whose development timeframes are unknown.

Implementation Timeframe

Identified CIP projects are grouped into four implementation timeframes. General priorities for water system improvement projects and their associated timeframes are summarized in Table 6-1. Ongoing repair and replacement programs are included in all timeframes.

Table 6-1
Prioritization for Recommended Improvements

Implementation Timeframe	Priority Description
5-Year	• Fire flow deficiencies under existing and projected 5-year demand conditions. • Projects required to serve development anticipated within 1 to 5 years.
10-Year	• Fire flow deficiencies under projected 5-year demand conditions not previously funded. • Projects required to serve growth anticipated within 6 to 10 years.
20-Year	• Fire flow deficiencies under projected 20-year demand conditions. • Projects required to serve growth anticipated within 11 to 20 years.
Beyond 20 Years	• Fire flow deficiencies under projected build-out demand conditions. • Projects required to serve potential growth beyond 20 years, including developer-driven improvements.

Supply Projects

As presented in Section 4, the City's maximum day demand (MDD) is projected to exceed the existing year-round supply capacity within 5 years. It is recommended that the City construct additional wells to expand groundwater supply capacity. The City has completed preliminary investigations of the aquifer character and determined that three new groundwater wells near existing Well 8 and the Eastern Oregon Correctional Institution (EOCI), identified as future wells 9, 10 and 12, present the greatest opportunity for expanded supply. These proposed wells will be located close to existing supply and will have a distribution infrastructure adequate to deliver the expanded supply to customers.

The City's water rights permits allow it to support groundwater development at the proposed site. The total additional potential capacity projected for the site is between 3,750 gallons per minute (gpm) and 4,500 gpm (5.4 to 6.5 million gallons per day [mgd]). To meet supply deficiencies in the 5-, 10- and 20-year planning horizons, it is recommended that the City construct one 1,500 gpm (2.2 mgd)-well in the next 5 years at an estimated project cost of $1.5 million.

Long-term supply expansion beyond 20 years would include construction of two 1,500-gpm wells, 10 and 12, and connection of existing Well 11 (currently serving an isolated area near the Resource Recovery Facility (RRF), to the Gravity Zone (CIP ID T-56). In order to meet projected water demands at build-out, the City will need additional supply expansion beyond the estimated capacity of wells 10, 11 and 12. It is recommended that the City identify additional sites for future well construction as development warrants. Existing water rights held by the City are adequate to support this long-term water supply development. The City's 2012 Water Management and Conservation Plan (WMCP) documents the capacity and timeline for development of the City's water rights permits. Relevant excerpts from the WMCP are included in Appendix A.

Transmission Main

Supply from the Water Filtration Plant to the South Hills Reservoirs is pumped through a 1.3-mile long, 30- and 24-inch diameter transmission main. The 30-inch concrete portion of this main, constructed approximately 100 years ago to transmit the City's original spring water supply to the South Hills Reservoirs, has reached the end of its useful life. It is recommended that this transmission main be replaced with a new 24-inch diameter transmission main (CIP ID T-55) within the 10-year timeframe. As part of the preliminary design for this improvement, it is recommended the City investigate the feasibility and potential cost savings related to using trenchless construction techniques, such as sliplining or pipe bursting, to install the new transmission main within the existing main. For the purposes of this CIP, the project cost estimate for this improvement assumes traditional (trenched) construction methods and PVC pipe.

Pressure Zone Expansion

Skyline and 1570 Zone

The existing Skyline Zone serves primarily residential customers north of the City Center. The residential area anticipated to be developed north of the existing City limits is too high in elevation to receive adequate service pressure from the existing Skyline Zone. A new pressure zone, 1570 Zone, with a hydraulic grade line (HGL) of 1,570 feet is proposed to serve new development north of the existing city limits between NW 12th Street and Johns Lane.

Current Skyline customers along Skyline Drive and NW 12th Drive would also be transferred to the 1570 Zone to mitigate existing fire flow deficiencies and eliminate privately-owned booster pumps. These existing customers would be transferred from the Skyline Zone to the 1570 Zone by closing existing isolation valves as shown in Figure 6-1.

Distribution Storage Reservoir Projects

Recommended distribution storage reservoir projects are described in the following paragraphs and summarized in Table 6-2.

R-1: Airport Reservoirs Replacement

It is recommended that existing Airport Reservoirs 1 and 2 be replaced within the 10-year horizon due primarily to fire flow requirements resulting in an existing storage deficit in the Airport Zone. Significant near-term industrial expansion is planned in this zone. This project will provide long-term water system solutions to the Airport area, with immediate deficiencies and needs addressed by the interim improvements detailed at the end of this section and illustrated in Figure 6-2.

R-2: Skyline Reservoir Replacement

As presented in Section 4, condition issues with the existing Skyline Reservoir dome indicate that the reservoir has is reaching the end of its service life. A new 0.5-million gallon (MG) reservoir is recommended to address condition issues with the existing Skyline Reservoir and mitigate a projected future storage deficit. Additionally, the new reservoir would address pressure deficiencies at existing and future high-elevation areas in the Skyline and 1570 Zones. The new Skyline Reservoir is recommended for construction at a new site, on Johns Lane near Owen Court, as part of the Skyline and 1570 Zone reconfiguration. The new Skyline Reservoir would ultimately provide suction supply to the 1570 Zone Pump Station through a new parallel 12-inch main along Johns Lane north of NE 2nd Street. Although deficiencies exist in the 5-year horizon, the new Skyline Reservoir is recommended for construction beyond the 20-year planning horizon due to funding limitations and higher priority improvements elsewhere in the water system.

Table 6-2
Distribution Storage Reservoir Projects

CIP ID	Project Description	Pressure Zone Served	Capacity (MG)	Project Cost	Timeframe
R-1	**Airport Reservoir** - replaces existing Airport Reservoirs 1 & 2 at new location with lower overflow elevation, will provide suction supply to new Airport Pump Station (P-1) on same site	Gravity / Airport Pump Station	2.0	$3,625,000	10-Year
R-2	**Skyline Reservoir** - replaces existing Skyline Reservoir at new location, will provide long-term suction supply to new 1570 Pump Station (P-3)	Skyline / 1570 Zone Pump Station	0.5	$906,000	Beyond 20 Years

Pump Station Projects

As presented in Section 4, review of the City's existing pump stations reveals a current pumping capacity deficit in almost every pressure zone. Recommended pump station improvement projects are described as either capacity upgrades or new/replacement stations. Projects are described as capacity upgrades where existing pump stations appear to have adequate physical space to increase individual pump sizes or the number of pumps in each station. Projects are described as replacements where the capacity of an existing station could not be increased without a larger building or if the existing station has condition issues or needs to be relocated to a new site. Proposed pump station projects are described in terms of the firm capacity needed. Firm capacity is defined as a pump station's capacity with the largest pump out of service. Recommended pump station projects are described in the following paragraphs and summarized in Table 6-3.

As described in Section 5, the City should be aware of life cycle replacement costs associated with pump stations, anticipating a typical 30-year replacement cycle for electrical and mechanical equipment in particular. Due to the significant number of capacity related pump stations improvements that are recommended over the next 20 years, which will restart the life cycle of the stations, no costs are identified for annual replacement in this CIP, however, consistent with the recommendation in Section 5, a plan should be developed to consider these costs in future CIP development.

P-1: Airport Pump Station Replacement

The existing Airport Pump Station is recommended for replacement concurrently with the proposed Airport Reservoir (CIP ID R-1) due to an existing pumping capacity deficit in the Airport Zone and anticipated near-term industrial expansion in this zone. Based on City direction this project is being deferred in order to fund other higher priorities. This project will provide long-term solutions to the Airport area, with immediate deficiencies and needs addressed by the interim improvements discussed in more detail at the end of this section and illustrated in Figure 6-1.

Cemetery Zone Pumping Improvements

The existing Cemetery Zone serves two large areas that are geographically separated by a valley running roughly northwest to southeast along Tutuilla Road. These two areas are hydraulically connected across Tutuilla Road by a 16-inch diameter transmission main. The Cemetery Zone is served by constant pressure from the Cemetery Pump Station on the west side of Tutuilla Road and the SE 7th Street Pump Station on the east side of Tutuilla Road near the South Hill Reservoirs. Under existing conditions, there is a significant firm pumping capacity deficit in the Cemetery Zone. It is recommended that the existing SE 7th Street Pump Station be replaced before expanding capacity at the Cemetery Pump Station.

P-6: SE 7th Street Pump Station Replacement

A new SE 7th Street Pump Station is recommended to replace the existing station on, or near, the same site. It is recommended that the new station have a firm capacity of approximately 4,000 gpm and include a backup electrical generator. Based on City direction this project is being deferred to the 20-year timeframe in order to fund other higher priorities.

P-2: Cemetery Pump Station Upgrade

The existing Cemetery Pump Station building is assumed to have adequate space to accommodate additional pumping equipment and an electrical upgrade. It is recommended that the Cemetery Pump Station equipment be upgraded and the largest two pumps replaced to provide an additional 2,000 gpm of firm capacity. This project would include removal of the existing natural gas driven pump and installation of a backup electrical generator. It is recommended for construction beyond 20 years following replacement of the SE 7th Street Pump Station.

P-3: Future 1570 Zone Pump Station

A new pump station 1570 Zone Pump Station with a firm capacity of 1,700 gpm and backup power is proposed for construction within the next five years to serve anticipated development on the east side of Johns Lane between NE 2nd Street and Owen Court to create the 1570 Zone. Properties in this area are at too high in elevation to receive adequate service pressure from the existing Skyline Zone.

In the short term, this 1570 Pump Station will receive suction supply from Skyline Zone distribution piping near the intersection of Johns Lane and NE 2nd Street. Customers to the north along Johns Lane will receive service from the pump station through an existing 12-inch Skyline main that will be transferred to the 1570 Zone using existing isolation valves.

Additional development west of Johns Lane, anticipated within the next 10 years, will be served from the 1570 Pump Station through a new distribution loop between Johns Lane, the future Meacham Road and NW Johns Lane near NW 4th Street (M-19). Ultimately, the new Skyline Reservoir (CIP ID R-2) will provide suction supply to the pump station through a new 12-inch main on Johns Lane (CIP ID M-23).

P-4: North Hill Pump Station Replacement

The existing North Hill Pump Station consists of a single pump housed in an underground vault adjacent to the North Hill Reservoir. Although North Hill is one of two pump stations serving the Skyline Reservoir, the lack of redundant pumps and access challenges associated with its current vault installation make pump station replacement a priority within 10 years. It is recommended that the new North Hill Pump Station have a firm capacity of 1,800 gpm.

P-5: Mt. Hebron Pump Station Replacement

The existing Mt. Hebron Pump Station has inadequate capacity to provide the required 1,500 gpm residential fire flow to customers in this small hilltop zone. It is recommended that the existing Mt. Hebron Pump Station be replaced with a new 1,600-gpm firm capacity pump station. Based on City staff accounts, a fire event within the Mt. Hebron Zone was successfully extinguished in the last year with no negative feedback from the fire department regarding water availability during the event. Thus, the new Mt. Hebron Pump Station construction may be deferred until the 10-year timeframe to allow CIP funding to be allocated to other higher priority projects.

P-7: Royal Ridge Pump Station Upgrade

The existing Royal Ridge Pump Station has inadequate capacity to provide the required 1,500-gpm residential fire flow to customers in this small hillside zone. It is recommended that the existing Royal Ridge Pump Station pumps and electrical system be upgraded to a firm capacity of 1,700 gpm. Additional development anticipated within the Royal Ridge Zone at slightly higher elevations may require pumping to a higher hydraulic grade than the existing pump station is capable of achieving. Thus, the Royal Ridge Pump Station upgrade should be considered based on development within the zone and may be deferred beyond 20 years.

Table 6-3
Pump Station Projects

CIP ID	Project Description	Pressure Zone Served	Firm Capacity (gpm)	Approx. HP	Project Cost	Timeframe
P-1	Airport Pump Station replacement[1]	Airport	8,000	900	$8,900,000	10-Year
P-2	Cemetery Pump Station capacity upgrade	Cemetery	2,000	125	$1,192,000	Beyond 20 Years
P-3	New 1570 Pump Station	Future 1570 Zone	1,700	75	$1,760,000	5-Year
P-4	North Hill Pump Station replacement	Skyline	1,800	100	$2,080,000	10-Year
P-5	Mt Hebron Pump Station replacement	Mt Hebron	1,600	100	$1,760,000	10-Year
P-6	SE 7th Street Pump Station replacement	Cemetery	4,000	200	$3,520,000	20-Year
P-7	Royal Ridge Pump Station capacity upgrade	Royal Ridge	1,700	125	$1,080,000	Beyond 20 Years

[1] *At the new location adjacent to new Airport Reservoir (R-1). Station is designed to provide 4,000 gpm fire flow and replace interim pumps.*

Backup Power

The City recently added backup power to Mt. Hebron Pump Station and is in the process of adding backup power at the Airport Pump Station. None of the other booster pump stations have backup electrical power generators. Backup power is needed for stations serving closed zones by constant pressure pumping as the pump station is the only water source for customers in these zones. The largest pump at the Cemetery Pump Station is driven only by a natural gas engine to provide an alternate power source in case of an electrical power outage. As part of the new 1570 Pump Station, SE 7th Street Pump Station replacement and Cemetery Pump Station capacity upgrade, it is recommended that a backup electrical power generator be provided at each station. It is also recommended that the City provide backup power within 10 years to the remaining three constant pressure pumps stations; Royal Ridge, Jr High and SE 20th.

Pressure Reducing Valve (PRV) Projects

Several PRV projects are recommended to eliminate dead-end mains at pressure zone boundaries in future development areas. PRVs are recommended to increase fire flow capacity, provide redundant supply under emergency conditions, and provide a means of circulating water between zones if needed to mitigate potential water quality issues associated with phased development. Proposed PRVs are summarized in Table 6-4.

Table 6-4
PRV Projects

CIP ID	Project Description	Pressure Zone		Project Cost	Timeframe
		From	To		
V-1	53rd Avenue	Airport	Airport 49th Zone	$150,000	Beyond 20 Years
V-2	53rd & H	Airport 49th Zone	Airport 47th Zone	$150,000	Beyond 20 Years
V-3	12th Drive	Future 1570 Zone	Skyline	$150,000	20-Year
V-4	2nd & Furnish	Skyline	Gravity	$150,000	Beyond 20 Years
V-5	Lee	Skyline	Gravity	$150,000	Beyond 20 Years
V-6	Perkins-Nye	Cemetery	Gravity	$150,000	5-Year
V-7	Southern Loop	Cemetery	Gravity	$150,000	Beyond 20 Years

Water Main Projects

Water main capacity projects identified based on water system modeling described in Section 4 were divided into one of five timeframes, based on the general criteria outlined in Table 6-1. Piping projects are described in Table 6-5. In addition to capacity projects, the City should plan for replacement of pipes based on a 100-year life cycle and the prioritization of the pipes replaced each year should be determined in accordance with the recommendations in Section 5. An annual cost for replacement is provided in Table 6-6.

Table 6-5
Water Main Projects

CIP ID	Project Description	Project Purpose	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-1	New main under the Umatilla River from NW 36th Street (EOCI) east to SW Court Avenue	Reduce pressure fluctuation during ASR injection	16	786	Ductile Iron	Unpaved	N	Y	River	$430,000	10-Year
M-2	New main along Northgate/OR37 from 16-inch stub at Westgate/US30 north to existing Northgate 16-inch near NW Despain Avenue alignment	Complete large diameter loop in Gravity Zone	16	1,111	Ductile Iron	Arterial Road	N	Y		$490,000	5-Year
M-3	New main along the D&B Supply northern driveway connecting the Southgate/US395 Gravity Zone main with Gravity Zone main through Olney Cemetery	Address existing commercial fire flow deficiency	8	527	Ductile Iron	Local Road	N	N		$134,000	20-Year
M-4	New main along SE Court Place from 4-inch dead end south of railroad and east of SE 20th Street through Tire Factory driveway to OR11	Address existing commercial fire flow deficiency	8	481	Ductile Iron	Unpaved	N	Y		$110,000	5-Year
M-5A	Upgrade existing 6-inch main along NE 35th Street from NE Riverside Avenue north to NE Riverside School Road	Address existing fire flow deficiency in residential area with limited looping and no adjacent hydrants	8	978	Ductile Iron	Local Road	N	Y		$282,000	20-Year
M-5B	Upgrade existing 6-inch main along NE Riverside Avenue from west of NE 33rd Place east to NE 41st Street	Address existing fire flow deficiency in residential area with limited looping and no adjacent hydrants	10	1,933	Ductile Iron	Local Road	N	Y		$647,000	20-Year
M-5C	Upgrade existing 6-inch main along NE 41st Street from NE Riverside Avenue south to NE Queen Avenue then east along Queen Ave to NE 42nd Street	Address existing fire flow deficiency in residential area with limited looping and no adjacent hydrants	8	660	Ductile Iron	Local Road and Unpaved	N	Y		$163,000	20-Year
M-6	Upgrade existing 4-inch along SE 8th Street from SE Byers Avenue north over the 8th Street Bridge to Lee Street and NE Ellis Place then west on Ellis Place to meet existing Gravity Zone piping crossing the Umatilla River in the SE 3rd Street alignment	Address existing residential fire flow deficiency, coordinate with 8th Street Bridge Replacement	12	2,800	Ductile Iron	Arterial and Local Road and Unpaved	N	Y	River (Bridge)	$1,064,000	5-Year
M-7	New main to connect SW 45th Street dead end to SW 44th Street near SW Sheridan Avenue	Address existing fire flow deficiency in residential area with limited looping and no adjacent hydrants	8	743	Ductile Iron	Local Road and Unpaved	N	N		$183,000	20-Year
M-9	Upgrade existing 4-inch Gravity Zone main along NW 3rd Street from NW Horn Avenue south to hydrant at NW Gilliam Avenue	Address existing residential fire flow deficiency and replace 4-inch pipe	8	311	Ductile Iron	Local Road	N	N		$89,000	20-Year
M-10	Upgrade existing 4-inch main along SE 9th Street southeast of SE Isaac Avenue	Address existing residential fire flow deficiency and replace 4-inch pipe	8	493	Ductile Iron	Local Road	N	N		$141,000	20-Year

CIP ID	Project Description	Project Purpose	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-11	Upgrade existing 4-inch along SE 12th Street from SE Court Place under US30/OR11 bridge and railroad to SE Frazer Place then along Frazer Place and SE Court Ave/US30/OR11 to SE 14th Street	Address fire flow deficiency, improve system looping and replace 4-inch pipe	8	1,140	Ductile Iron	Arterial and Local Road	N	Y	Railroad	$395,000	20-Year
M-12	Upgrade existing 8-inch along SE Kirk Avenue from OR11 east to existing dead end	Address future fire flow deficiency when development occurs	12	832	Ductile Iron	Local Road	N	N		$313,000	Beyond 20 Years
M-13	Upgrade small section of existing 2-inch at 2439 SW Perkins Avenue	Address existing commercial fire flow deficiency and replace 2-inch pipe	8	22	Ductile Iron	Local Road	N	N		$7,000	5-Year
M-14	Upgrade small section of existing 2-inch along NW 10th Avenue from NW King Avenue northeast to fire hydrant	Address existing residential fire flow deficiency and replace 2-inch pipe	8	38	Ductile Iron	Local Road	N	N		$11,000	5-Year
M-15A	New main along SW Runnion Drive alignment from SW Runnion Place west to SW 24th Street alignment	Future system expansion	8	564	Ductile Iron	Unpaved	N	N		$127,000	20-Year
M-15B	New main along SW 24th Street alignment south from Hospital PRV to SW Runnion Drive alignment	Future system expansion	12	853	Ductile Iron	Unpaved	N	N		$262,000	20-Year
M-16	Extend SW Perkins Avenue main east of SW 18th Street across undeveloped area to existing main on SW Nye Avenue at SW Athens Avenue	Future system expansion	8	1,946	Ductile Iron	Unpaved	N	N		$435,000	20-Year
M-17	Extend existing main along NW Horn Avenue from NW 12th Street to existing dead end west of NW 11th Street	Complete system loop in Skyline Zone	8	113	Ductile Iron	Local Road	N	N		$29,000	5-Year
M-18	Upgrade existing main along NW 14th Street from NW 15th Drive to easement adjacent to 514 NW 14th Street then along NW Furnish Avenue to NW 12th Street	Complete large diameter loop in Gravity Zone	12	972	Ductile Iron	Local Road	N	N		$365,000	10-Year
M-19	New main along NW 4th Street alignment from north of NW Johns Lane through undeveloped area to future Meacham Road alignment then along Meacham Road alignment east to Johns Lane	Create future 1570 Zone to serve new development, must coordinate with proposed 1570 Zone Pump Station (P-3)	8	2,291	Ductile Iron	Unpaved	N	N		$513,000	10-Year
M-20	Extend existing NW 12th Drive main northeast across undeveloped area along future Meacham Road alignment to M-19	Expand future 1570 Zone west to serve new development and facilitate transfer of Skyline Drive customers to 1570 Zone for improved service pressure and fire flow, must occur after M-19	8	2,031	Ductile Iron	Unpaved	N	N		$454,000	20-Year
M-21	Upgrade existing 6-inch main along NW Skyline Drive from Skyline Lane northeast to Skyline Reservoir access road	Address residential fire flow deficiency, must coordinate with M-20	8	674	Ductile Iron	Local Road	N	N		$192,000	20-Year

CIP ID	Project Description	Project Purpose	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-22	Extend SW 24th Street main (M-15B) south and west of SW Runnion Drive through undeveloped area along proposed Southern Loop Road alignment to Tutuilla Road, then north along Tutuilla Road to existing main at SW Tahoe Avenue	Future system expansion	12	9,058	Ductile Iron	Unpaved	N	N		$2,774,000	Beyond 20 Years
M-23	New main along Johns Lane from new Skyline Reservoir at NE Owen Court south to new 1570 Pump Station at NE 2nd Street	Provide suction supply to proposed 1570 Zone Pump Station (P-3) from proposed Skyline Reservoir (R-2), must coordinate with R-2	12	1,051	Ductile Iron	Local Road	N	N		$357,000	Beyond 20 Years
M-24	New main along future Meacham Road alignment from Johns Lane east to Lee Street	Future system expansion	12	1,564	Ductile Iron	Unpaved	N	N		$479,000	Beyond 20 Years
M-25	New main along Lee Street from future Meacham Road alignment (M-24) north to UGB boundary	Future system expansion	8	1,031	Ductile Iron	Local Road	N	N		$262,000	Beyond 20 Years
M-26	New main along Lee Street from future Meacham Road alignment (M-24) south to proposed Lee Street PRV	Future system expansion	12	1,374	Ductile Iron	Local Road	N	N		$466,000	Beyond 20 Years
M-27	New main along Lee Street from proposed Lee Street PRV south to new NE Ellis Place main (M-6)	Future system expansion	12	569	Ductile Iron	Local Road	N	N		$193,000	Beyond 20 Years
M-28	New main extension along NW King Avenue alignment west of NW Horn Avenue	Future system expansion	8	516	Ductile Iron	Unpaved	N	N		$116,000	Beyond 20 Years
M-30	Upgrade existing 6-inch main along NE Horn Avenue alignment from N Main Street east to hydrant at NE 2nd Street	Address existing residential fire flow deficiency	8	624	Ductile Iron	Unpaved	N	N		$159,000	10-Year
M-32	New main along Old Airport Road from Westgate through Gilliam Canyon to proposed Airport Reservoir and Pump Station site northwest of existing Gilliam Canyon Pump Station	Provide adequate capacity to fill proposed Airport Reservoir (R-1) from Gravity Zone distribution, must coordinate with M-47 and R-1	18	3,775	PVC	Unpaved	Y	N		$1,019,000	10-Year
M-33A	New main along Old Airport Road from new Airport Reservoir and Pump Station site to Airport Road	Provide adequate capacity to supply future Airport Zone distribution from proposed Airport Pump Station (P-1), must coordinate with P-1	24	1,087	PVC	Unpaved	Y	N		$440,000	10-Year
M-33B	New main along Airport Road from Old Airport Road to NW A Avenue	Provide adequate capacity to supply future Airport Zone distribution from proposed Airport Pump Station (P-1), must coordinate with P-1	24	1,000	PVC	Local Road	Y	N		$439,000	10-Year

CIP ID	Project Description	Project Purpose	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-34	New main along existing access road southeast of airport runway continuing north under runway to south end of UAS Phase 4 - provide industrial fire flow from interim non-potable pond as development warrants, long term fire and industrial service	Provide long term domestic and fire flow capacity as Airport Zone development warrants, must coordinate with M-33A and M-33B	18	6,542	PVC	Unpaved	N	N	Airport Runway	$963,000	10-Year
M-35A	New main along Airport Road from west interim non-potable pump station (IP-1) to industrial development west of Stage Gulch Road	Provides short term industrial fire flow as part of an interim non-potable system and long term domestic supply and fire flow as development warrants, must coordinate with IP-1	18	1,527	PVC	Unpaved	N	N		$304,000	5-Year
M-35B	New main along Airport Road from west interim non-potable pump station (IP-1) to existing 12-inch dead end west of 56th	Provide short term industrial fire flow as part of an interim non-potable system and long term domestic supply and fire flow as development warrants, must coordinate with IP-1	18	4,743	PVC	Unpaved	N	N		$944,000	5-Year
M-36	New main west of airport boundary from new Airport Road 18-inch (M-35) north to new road alignment south of Daniel Road and west of Stage Gulch Road	Provide long term domestic and fire flow capacity as Airport Zone development warrants, must coordinate with M-35A	18	2,725	PVC	Unpaved	N	N		$542,000	10-Year
M-37	New main along future road alignment south of Daniel Road parallel to northern airport boundary from near Stage Gulch Road (M-36) to UAS Phase 4 industrial development (M-48)	Provide long term domestic and fire flow capacity as Airport Zone development warrants, must coordinate with M-36 and M-48	18	10,002	PVC	Unpaved	N	N		$1,989,000	Beyond 20 Years
M-38	Upgrade existing 6, 8 and 12-inch mains along NW A Avenue from new Airport Road 24-inch (M-33B) to new 18-inch on Airport Road west of 56th Drive (M-35)	Provide adequate fire flow capacity to future Airport Zone development west of 56th Drive, must coordinate with M-33A, M-33B and P-1	18	4,593	PVC	Local Road	N	N		$1,124,000	Beyond 20 Years
M-39	Upgrade existing 6-inch main along NW 52nd Street alignment from NW B Avenue south across NW C Avenue to existing fire hydrant	Address existing industrial fire flow deficiencies	8	351	Ductile Iron	Local Road	N	N		$100,000	20-Year
M-40	Upgrade existing 2-inch along NW D Avenue from NW 50th Drive to NW 49th Street	Address existing industrial fire flow deficiencies	8	566	Ductile Iron	Local Road	N	N		$162,000	20-Year
M-41	Upgrade existing 6-inch along NW C Avenue from hydrant at NW 49th Street to hydrant at NW 48th Street	Address existing industrial fire flow deficiencies	8	361	Ductile Iron	Local Road	N	N		$103,000	20-Year
M-42	Upgrade existing 2-inch along NW B Avenue from NW B Place to NW A Avenue	Address existing industrial fire flow deficiencies	8	433	Ductile Iron	Local Road	N	N		$124,000	20-Year

CIP ID	Project Description	Project Purpose	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-43	New main along NW 53rd Street alignment from Airport Road south to NW F Avenue then southeast along NW F Ave to existing main east of NW 50th Drive	Future system expansion	8	1,647	Ductile Iron	Local Road and Unpaved	N	N		$399,000	Beyond 20 Years
M-44	New main along NW 53rd Street alignment from NW F Avenue south to NW L Avenue alignment then east along NW L Ave to NW 47th Street	Future system expansion	8	3,013	Ductile Iron	Unpaved	N	N		$674,000	Beyond 20 Years
M-45	Upgrade existing 6-inch main along NW 48th Street from near NW H Avenue (M-46) south to NW J Avenue then east along NW J Ave to NW 47th Street and south along NW 47th Street to existing Airport NW 47th PRV at NW L Avenue alignment	Future system expansion	8	793	Ductile Iron	Local Road	N	N		$212,000	Beyond 20 Years
M-46	New main along NW 48th Street from NW H Place south to NW H Avenue (M-45)	Future system expansion	8	303	Ductile Iron	Local Road	N	N		$77,000	Beyond 20 Years
M-47	Upgrade existing 10-inch main along Westgate/US30 from Old Airport Road (M-32) east to existing 16-inch pipe at Northgate near Well 4	Provide adequate capacity to fill proposed Airport Reservoir (R-1) from Gravity Zone distribution, coordinate with M-32 and R-1	18	4,400	PVC	Arterial Road	N	N		$1,142,000	10-Year
M-48	New main – Airport East interim non-potable pump station (IP-2) to UAS Phase 4 north	Provide short term industrial fire flow as part of an interim non-potable system and long term domestic supply and fire flow as development warrants, must coordinate with IP-2.	18	1,029	PVC	Unpaved	N	N		$205,000	5-Year
M-49	UAS Phase 4 non-potable loop from - M-48 south then east to M-34 - extend as needed for Phase 4 development	Provide short term industrial fire flow as part of an interim non-potable system and long term domestic supply and fire flow as development warrants, must coordinate with IP-2.	16	3,129	PVC	Unpaved	N	N		$539,000	Beyond 20 Years
M-52	UAS Phase 4 industrial main loop - IM-51 south and east through UAS Phase 4 development	Provide short term domestic supply as development warrants, must coordinate with IM-51	8	2,966	PVC	Unpaved	N	N		$300,000	Beyond 20 Years
M-53	New main – Airport East interim non-potable pump station (IP-2) to UAS Phase 4 South	Provide short term industrial fire flow as part of an interim non-potable system and long term domestic supply and fire flow as development warrants, must coordinate with IP-2.	18	2,250	PVC	Unpaved	N	N		$448,000	5-Year
Total Cost										**$23,891,000**	

Table 6-6
CIP Summary

Project Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				
			5-Year	10-Year	20-Year	Beyond 20 Years	Total
Supply and Transmission		First additional well	$1,500,000				$1,500,000
		Additional groundwater capacity beyond 20 years				$3,000,000	$3,000,000
	T-56	Connect Well 11 to Gravity Zone distribution system				$1,850,000	$1,850,000
	T-55	WFP High Level transmission main to South Hill Reservoirs		$1,552,000			$1,552,000
Supply and Transmission Projects Subtotal			**$1,500,000**	**$1,552,000**		**$4,850,000**	**$7,902,000**
Distribution Storage	R-1	2 MG Airport Reservoir replacement		$3,625,000			$3,625,000
	R-2	0.5 MG Skyline Reservoir replacement				$906,000	$906,000
Distribution Storage Projects Subtotal				**$3,625,000**		**$ 906,000**	**$ 4,531,000**
Pump Station	P-1	Airport PS replacement		$8,900,000			$8,900,000
	P-2	Cemetery PS capacity upgrade				$1,192,000	$1,192,000
	P-3	Future 1570 Zone PS	$1,760,000				$1,760,000
	P-4	North Hill PS replacement		$2,080,000			$1,600,000
	P-5	Mt Hebron PS replacement		$1,760,000			$1,760,000
	P-6	SE 7th Street PS replacement			$3,520,000		$3,520,000
	P-7	Royal Ridge PS capacity upgrade				$1,080,000	$1,080,000
		Backup power	$200,000	$400,000			$600,000
Pump Station Projects Subtotal			**$1,960,000**	**$13,140,000**	**$3,520,000**	**$2,272,000**	**$20,892,000**
Water Mains	M-2, 4, 6, 13, 14, 17, 35B	5-Year	$2,655,000				$2,655,000
	M-1, 18, 19, 30, 32-34, 36, 47	10-Year		$6,012,000			$6,012,000
	M-3, 5, 7, 9-11, 15, 16, 20, 21, 39-42	20-Year			$3,993,000		$3,993,000

Project Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				
			5-Year	10-Year	20-Year	Beyond 20 Years	Total
Water Mains	M-12, 22-28, 37, 38, 43-46, 49, 52	Beyond 20 Years				$10,274,000	$10,274,000
	M-35A	Airport West interim non-potable main, permanent distribution main	$304,000				$304,000
	M-48	Airport East interim non-potable main, permanent distribution mains	$205,000				$205,000
	M-53		$448,000				$448,000
		Pipe Replacement Program	$1,250,000	$4,850,000	$9,700,000	$81,200,000	$97,000,000
Water Main Projects Subtotal			**$4,862,000**	**$10,862,000**	**$13,693,000**	**$91,474,000**	**$120,891,000**
PRV	V-1	53rd Ave - Airport 49th Zone				$150,000	$150,000
	V-2	53rd & H - Airport 47th Zone				$150,000	$150,000
	V-3	12th Dr - Skyline Zone			$150,000		$150,000
	V-4	2nd & Furnish - Gravity Zone				$150,000	$150,000
	V-5	Lee - Gravity Zone				$150,000	$150,000
	V-6	Perkins-Nye - Gravity Zone	$150,000				$150,000
	V-7	Southern Loop- Gravity Zone				$150,000	$150,000
PRV Projects Subtotal			**$150,000**		**$150,000**	**$ 750,000**	**$1,050,000**
Other	IR-2, IP-2, IM-50, IM-51	Airport East interim non-potable system – pond, supply main and pump station	$2,841,000				$2,841,000
	IR-1, IP-1, IM-54	Airport West interim non-potable system – pond, supply main and pump station	$2,520,000				$2,520,000
		Existing Airport Pump Station & Reservoir Demolition			$200,000		$200,000
		Update Water Master Plan	$150,000	$150,000	$300,000		$600,000
		Update Water Management & Conservation Plan	$50,000	$50,000	$100,000		$200,000
Other Projects Subtotal			**$5,561,000**	**$200,000**	**$600,000**		**$6,361,000**
Total			**$14,033,000**	**$29,379,000**	**$17,963,000**	**$100,252,000**	**$161,627,000**

Airport Industrial Area (AIA) CIP

The City plans to expand the existing Airport Zone water facilities to serve proposed industrial development at the western end of Airport Road near Stage Gulch Road and the proposed UAS development east and north of the existing airport runway. Development of UAS Phase 1 is expected to begin within one to two years with UAS Phases 3 and 4 and west Airport Road developments to follow within the next five years.

Average, non-emergency demands for each area are anticipated to be no more than 60 gpm within the next five years, with an AIA fire flow requirement of 4,000 gpm. Due to the long runs of large diameter pipe required to complete this water system expansion and provide economic development opportunities in the area, PVC pipe will be used to reduce material costs only for water main projects in the AIA. Proposed improvements to serve the AIA are summarized in Tables 6-7 and 6-8 and illustrated in Figure 6-2.

The existing Airport Pump Station is capable of providing the estimated 1,500-gpm fire flow required to serve UAS Phase 1. It is recommended that an interim 10-inch diameter main (CIP ID IM-50) be constructed from the existing Airport Pump Station, east along NW A Avenue then continuing east and north along an existing gravel access road to serve UAS Phase 1. This water main project is recommended for completion in the 5-year timeframe.

The existing Airport Pump Station does not have adequate capacity to provide a 4,000-gpm fire flow to either UAS Phase 4 or the west Airport Road developments anticipated for construction in the next five years. In order to provide fire service to these customers, it is recommended that the City construct two interim non-potable supply systems, east and west. The interim systems, described in further detail below, allow the City to make incremental investments in the AIA water system infrastructure required to serve industrial and fire suppression demands as development occurs.

Construction of potable water system facilities to serve both immediate small industrial demands and large industrial fire flows would result in water age and water quality concerns in the transmission mains. Development of the interim non-potable systems allows for construction of smaller diameter potable drinking water supply mains in parallel with short segments of large diameter, non-potable water mains for fire suppression supply, thereby reducing water quality concerns and spreading the cost of water system development over multiple years as growth in the AIA occurs.

Interim Airport Non-Potable Systems

The proposed interim Airport non-potable systems will consist of two water storage ponds supplied with potable water from the City's distribution system and two non-potable pump stations that boost water from the pond into non-potable, large-diameter mains in an emergency. As development occurs and industrial water demands increase, the large-diameter mains will be transferred to the potable system and used to supply both industrial and fire suppression demands. Smaller diameter interim mains constructed to fill the ponds

(CIP IDs IM-50, 51, and 54) will be abandoned along with the ponds (CIP ID IR-1, 2) and the non-potable pump stations (CIP IDs IP-1 and 2). This transition must occur after construction of the new Airport Pump Station (CIP ID P-1) and Reservoir (CIP ID R-1), which will provide adequate fire flow to the AIA.

Airport West Non-Potable System

A lined and covered non-potable water storage pond (CIP ID IR-1) is proposed for construction near the northeast corner of Airport Road and Stage Gulch Road. It is assumed that the pond will have a water height of approximately 8 feet with a berm height not to exceed 10 feet. The pond will be filled from an interim 8-inch diameter PVC main (CIP ID IM-54) constructed parallel to Airport Road running from existing distribution piping near NW 56th Drive west to the pond and proposed west Airport Road industrial development.

In addition to filling the pond, this 8-inch diameter main (CIP ID IM-54) will also provide potable drinking water demand within the west Airport Road development. Stored water from the pond will be boosted through an interim 4,000-gpm non-potable pump station (CIP ID IP-1) and 18-inch diameter non-potable main parallel to Airport Road (CI PID M-35A) to supply industrial demand and fire suppression flow to the west Airport Road industrial development. The 18-inch diameter main may be extended parallel to Airport Road east from the interim pump station as development warrants (CIP ID M-35B).

Airport East Non-Potable System

A lined and covered non-potable water storage pond (CIP ID IR-2) is proposed for construction at the northeast corner of the Pendleton Regional Airport near the existing National Guard training area. It is assumed that the pond will have a water height of approximately 8 feet with a berm height not to exceed 10 feet. The pond will be filled from interim 10 and 8-inch diameter PVC mains (CIP ID IM-50, 51) constructed along an existing access road running north-south on the east side of the airport. These mains will also provide potable drinking water demand to UAS Phase 4.

A portion of these proposed water mains will cross the existing east-west runway. It is assumed that this crossing will be constructed using trenchless methods. Stored water from the pond will be boosted through an interim 4,000-gpm non-potable pump station (CIP ID IP-2) and 18-inch diameter non-potable mains (CIP ID M-48, 53) to supply industrial demand and fire suppression flow to UAS Phase 4.

The 18-inch diameter main along the existing north-south access road may be extended south to NW A Avenue (CIP ID M-34) as development warrants. Parallel 8-inch diameter (CIP ID M-52) and 16-inch diameter (CIP ID M-49) loops are proposed for phased construction to serve incremental development within UAS Phase 4. These loops will connect with 8-inch diameter potable mains (CIP ID IM-51) and 18-inch diameter non-potable mains (CIP IDs M-48 and 53), respectively.

Airport Reservoir and Pump Station Replacement

The existing Airport Reservoirs 1 and 2 are limited to providing suction supply to the Airport Pump Station. In order to fill the existing Airport Reservoirs water must be pumped up from the Gravity Zone through the Gilliam Canyon Pump Station. This double pumping, from the Gravity Zone through Gilliam Canyon Pump Station to Airport Reservoirs then through the Airport Pump Station to customers, introduces additional pumping cost and operational vulnerability should one of the pump stations or transmission mains fail. Where possible, it is desirable to reconfigure water system facilities such that this double pumping to reach system customers is unnecessary.

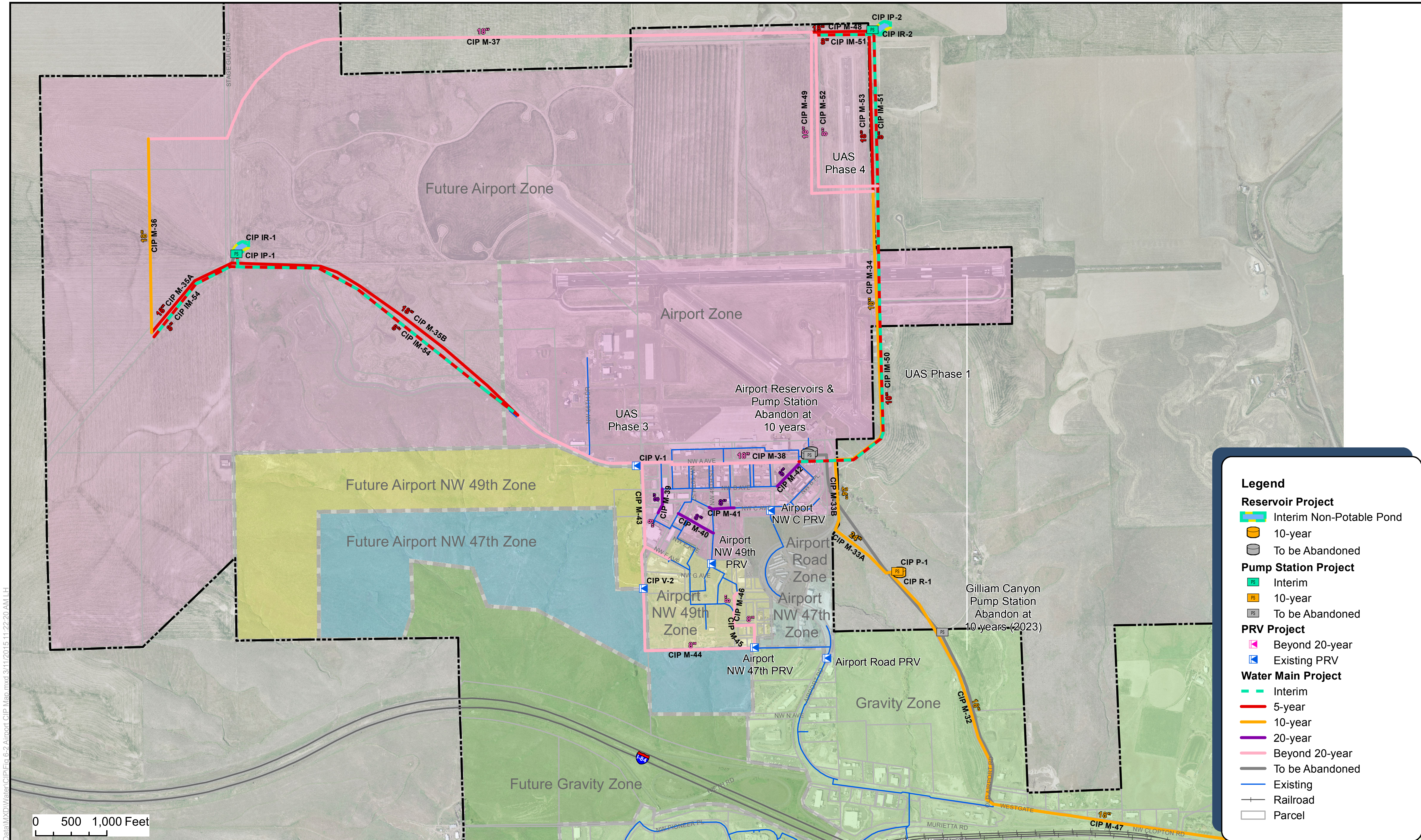
It is recommended that the existing Airport Reservoirs be replaced with a single, larger reservoir at a new site along Old Airport Road north of the existing Gilliam Canyon Pump Station. The new Airport Reservoir (R-1) would be filled by gravity at the same HGL as the Gravity Zone thereby allowing the Gilliam Canyon Pump Station to be abandoned. The new reservoir should have adequate capacity to mitigate projected future storage deficiencies, as presented earlier in this section.

A new Airport Pump Station is proposed on the same site as the new Airport Reservoir. The proposed pump station should have a firm capacity of 8,000 gpm in order to provide adequate capacity for ultimate industrial demands within the Airport Zone and PRV-controlled sub-zones as well as required 4,000-gpm fire flows.

Large diameter water main improvements are also required in order to efficiently supply water from the Gravity Zone to the new Airport Reservoir (CIP IDs M-47 and 32) and to supply AIA customers from the new Airport Pump Station (CIP IDs M33A, 33B, and 38).

Airport Zone Long Term Growth

With continued growth in the Airport Zone, it is anticipated that the interim non-potable ponds, non-potable pump stations, and smaller diameter pond supply mains will be abandoned following construction of the new Airport Reservoir and Pump Station. At that time, both industrial and fire suppression demands will be served from parallel 18-inch diameter mains which will be transitioned from non-potable mains to potable distribution mains. Completion of a large diameter loop around the north side of the existing airport (CIP ID M-37) is proposed for construction as development warrants. This main, connecting west Airport Road with UAS Phase 4, follows an approximate future roadway alignment identified by City staff.



MSA Murray, Smith & Associates, Inc.

City of Pendleton
Water System Master Plan

Figure 6-2
Airport CIP Map

March 2015 13-1442

Table 6-7
AIA Water Main Projects

CIP ID	Project Description	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-32	New main along Old Airport Road from Westgate through Gilliam Canyon to proposed Airport Reservoir and Pump Station site northwest of existing Gilliam Canyon Pump Station	18	3,775	PVC	Unpaved	Y	N		$1,019,000	10-Year
M-33A	New main along Old Airport Road from new Airport Reservoir and Pump Station site to Airport Road	24	1,087	PVC	Unpaved	Y	N		$440,000	10-Year
M-33B	New main along Airport Road from Old Airport Road to NW A Avenue	24	1,000	PVC	Local Road	Y	N		$439,000	10-Year
M-34	New main along existing access road southeast of airport runway continuing north under runway to south end of UAS Phase 4 - provide industrial non-potable flow from temp pond as development warrants, long term fire and industrial service	18	4,205	PVC	Unpaved	N	N	Airport Runway	$963,000	10-Year
M-35A	New main - Airport Road from west interim non-potable pump station (IP-1) to industrial development west of Stage Gulch Road	18	1,527	PVC	Unpaved	N	N		$304,000	5-Year
M-35B	Airport Road from west interim non-potable pump station (IP-1) to existing 12-inch dead end west of 56th	18	4,743	PVC	Unpaved	N	N		$944,000	5-Year
M-36	New main west of airport boundary from new Airport Road 18-inch (M-35) north to new road alignment south of Daniel Road and west of Stage Gulch Road	18	2,725	PVC	Unpaved	N	N		$542,000	10-Year
M-37	New main along future road alignment south of Daniel Road parallel to northern airport boundary from near Stage Gulch Road (M-36) to UAS Phase 4 industrial development (M-48)	18	10,002	PVC	Unpaved	N	N		$1,989,000	Beyond 20 Years
M-38	Upgrade existing 6, 8 and 12-inch mains along NW A Avenue from new Airport Road 24-inch (M-33B) to new 18-inch on Airport Road west of 56th Drive (M-35)	18	4,593	PVC	Local Road	N	N		$ 1,124,000	10-Year
M-39	Upgrade existing 6-inch main along NW 52nd Street alignment from NW B Avenue south across NW C Avenue to existing fire hydrant	8	351	Ductile Iron	Local Road	N	N		$100,000	20-Year
M-40	Upgrade existing 2-inch along NW D Avenue from NW 50th Drive to NW 49th Street	8	566	Ductile Iron	Local Road	N	N		$162,000	20-Year
M-41	Upgrade existing 6-inch along NW C Avenue from hydrant at NW 49th Street to hydrant at NW 48th Street	8	361	Ductile Iron	Local Road	N	N		$103,000	20-Year
M-42	Upgrade existing 2-inch along NW B Avenue from NW B Place to NW A Avenue	8	433	Ductile Iron	Local Road	N	N		$124,000	20-Year

CIP ID	Project Description	Diameter (in)	Total Project Length (ft)	Material	Surface Restoration Type	Rock Excavation	Dewatering	Crossings	Total Cost	Timeframe
M-43	New main along NW 53rd Street alignment from Airport Road south to NW F Avenue then southeast along NW F Ave to existing main east of NW 50th Drive	8	1,647	Ductile Iron	Local Road and Unpaved	N	N		$399,000	Beyond 20 Years
M-44	New main along NW 53rd Street alignment from NW F Avenue south to NW L Avenue alignment then east along NW L Ave to NW 47th Street	8	3,013	Ductile Iron	Unpaved	N	N		$674,000	Beyond 20 Years
M-45	Upgrade existing 6-inch main along NW 48th Street from near NW H Avenue (M-46) south to NW J Avenue then east along NW J Ave to NW 47th Street and south along NW 47th Street to existing Airport NW 47th PRV at NW L Avenue alignment	8	793	Ductile Iron	Local Road	N	N		$212,000	Beyond 20 Years
M-46	New main along NW 48th Street from NW H Place south to NW H Avenue (M-45)	8	303	Ductile Iron	Local Road	N	N		$77,000	Beyond 20 Years
M-47	Upgrade existing 10-inch main along Westgate/US30 from Old Airport Road (M-32) east to existing 16-inch pipe at Northgate near Well 4	18	4,400	PVC	Arterial Road	N	N		$1,142,000	10-Year
M-48	New main - Airport East interim non-potable pump station (IP-2) to UAS Phase 4 north	18	1,029	PVC	Unpaved	N	N		$205,000	5-Year
M-49	UAS Phase 4 non-potable line loop from - M-48 south then east to M-34 - extend as needed for Phase 4 development	16	3,129	PVC	Unpaved	N	N		$539,000	Beyond 20 Years
IM-50	Interim main - existing Airport Pump Station to UAS Phase 1 for industrial demand & 1,500 gpm fire flow	10	3,526	PVC	Unpaved	N	N		$450,000	5-Year
IM-51	Interim main - UAS Phase 1 10-inch interim main (IM-50) to temp non-potable storage pond continuing west to UAS Phase 4 for industrial demand & pond supply	8	4,837	PVC	Unpaved	N	N	Airport Runway	$547,000	5-Year
M-52	UAS Phase 4 industrial main loop - IM-51 south and east through UAS Phase 4 development	8	2,966	PVC	Unpaved	N	N		$300,000	Beyond 20 Years
M-53	New main - Airport East interim non-potable pump station (IP-2) to UAS Phase 4 south	18	2,250	PVC	Unpaved	N	N		$448,000	5-Year
IM-54	Interim main - Airport Road from existing 12-inch dead end west of 56th to west of Stage Gulch for industrial demand & pond supply	8	6,214	PVC	Unpaved	N	N		$627,000	5-Year
Total									**$13,873,000**	

Table 6-8
AIA CIP Summary

Project Category	Project ID	Project Description	Diameter (in)	Length (ft)	Project Schedule and Cost Summary			
					5-Year	10-Year	20-Year	Beyond 20 Years
AIA - Interim Projects	IR-2	Lined and covered interim non-potable storage pond			$275,000			
	IP-2	Non-Potable 4,000 gpm interim pump station approx. 125 hp			$1,569,000			
	IM-50	Interim main – existing Airport Pump Station to UAS Phase 1 for industrial demand & 1,500 gpm fire flow	10	3,526	$450,000			
	IM-51	Interim main – UAS Phase 1 10-inch interim main (IM-50) to temp pond continuing west to UAS Phase 4 for industrial demand & pond supply	8	4,837	$547,000			
Airport East Interim Non-Potable System[1] Subtotal					**$2,841,000**			
AIA - Interim Projects	IR-1	Lined and covered interim non-potable pond			$275,000			
	IP-1	Non-Potable 4,000 gpm interim pump station approx. 150 hp			$1,618,000			
	IM-54	Interim main – Airport Road from existing 12-inch dead end west of 56th to west of Stage Gulch Road	8	6,214	$627,000			

Project Category	Project ID	Project Description	Diameter (in)	Length (ft)	Project Schedule and Cost Summary			
					5-Year	10-Year	20-Year	Beyond 20 Years
Airport West Interim Non-Potable System[1] Subtotal					**$2,520,000**			
Airport Expansion Interim Water Facilities Subtotal					**$5,361,000**			
Airport Expansion - Permanent Projects	R-1	2 MG Airport Reservoir replacement				$3,625,000		
	P-1	Airport Pump Station replacement (8,000 gpm firm capacity)				$8,900,000		
		Existing Airport Pump Station & Reservoir Demolition				$200,000		
	M-32	Old Airport Road (through Gilliam Canyon) - Westgate/US30 to new Airport Reservoir	18	3,775		$1,019,000		
	M-33A	Old Airport Road - new Airport Reservoir site to Airport Road	24	1,087		$440,000		
	M-33B	Airport Road - Old Airport Road to NW A Avenue	24	1,000		$439,000		
	M-34	UAS Phase 4 south fire line (M-53) to Airport Road	18	4,205		$963,000		
	M-35A	New main - Airport Road from west interim non-potable pump station (IP-1) to industrial development west of Stage Gulch Road	18	1,527	$304,000			

Project Category	Project ID	Project Description	Diameter (in)	Length (ft)	Project Schedule and Cost Summary			
					5-Year	10-Year	20-Year	Beyond 20 Years
Airport Expansion - Permanent Projects	M-35B	Airport Road from west interim non-potable pump station (IP-1) to existing 12-inch dead end west of 56th Street	18	4,743	$944,000			
	M-36	West end of M-35 north to new road alignment along airfield northern boundary	18	2,725		$542,000		
	M-37	Airport North Loop - M-36 to M-34 along new road alignment parallel to northern airfield boundary	18	10,002				$1,989,000
	M-38	NW A Avenue - M-33B to M-35	18	4,593				$1,124,000
	M-47	Westgate/US 30 - Old Airport Road to Northgate/OR 37	18	4,400		$1,142,000		
	M-48	New main - Airport East interim non-potable pump station (IP-2) to UAS Phase 4 north	18	1,029	$205,000			
	M-49	UAS Phase 4 non-potable line loop from - M-48 south then east to hangars M-34	16	3,129				$539,000
	M-52	UAS Phase 4 industrial main loop- IM-51 south and east	8	2,966				$300,000

Project Category	Project ID	Project Description	Diameter (in)	Length (ft)	Project Schedule and Cost Summary			
					5-Year	10-Year	20-Year	Beyond 20 Years
Airport Expansion - Permanent Projects	M-53	New main - Airport East interim non-potable pump station (IP-2) to UAS Phase 4 south	18	2,250	$448,000			
Airport Expansion Permanent Water Facilities Subtotal					**$1,901,000**	**$17,270,000**		**$3,952,000**
Existing Airport Area Projects	M-39, 40, 41, 42	Existing Airport Zone - fire flow improvements	8	1,711			$489,000	
	M-43, 44, 45, 46	Airport PRV Zones - fire flow and future zone expansion	8	5,756				$1,362,000
	V-1	53rd Ave - Airport 49th Zone						$150,000
	V-2	53rd & H - Airport 47th Zone						$150,000
Existing Airport Water Service Area Projects Subtotal							$489,000	$1,662,000
AIA CIP Total by Timeframe					$7,262,000	$17,270,000	$489,000	$5,614,000
AIA CIP Total					**$30,635,000**			

[1] Interim projects to be abandoned with construction of Airport Reservoir (R-1), Pump Station (P-1), and parallel 18-inch main.

Summary

This section presents a CIP comprised of water system projects recommended to correct deficiencies identified in Section 4 and estimated costs for each project. Identified CIP projects are grouped into four implementation timeframes: 5-year, 10-year, 20-year, and beyond 20 years. CIP projects are summarized in Table 6-6 and illustrated in Figures 6-1 and 6-3.

The CIP includes $14 million in improvement projects over the 5-year horizon and $61.4 million over the 20-year horizon. Through build-out, $161.6 million in improvements are identified.

Supply and Transmission Projects Summary

- To meet supply deficiencies in the 5-, 10- and 20-year planning horizons, it is recommended that the City construct one 1,500 gpm (2.2 mgd)-well in the next 5 years at an estimated project cost of $1.5 million.
- The 30-inch diameter concrete transmission main from the Water Filtration Plant to the South Hills Reservoirs has reached the end of its useful life and should be replaced with a new 24-inch diameter transmission main (CIP ID T-55) within the 10-year timeframe at an estimated project cost of $1.6 million.

Distribution Storage Reservoir Projects Summary

- Due to an existing storage deficit in the Airport Zone and anticipated near-term industrial expansion in this zone, it is recommended that existing Airport Reservoirs 1 and 2 be replaced by a single 2 MG reservoir (CIP ID R-1) within 10 years at an estimated project cost of $3.6 million.
- A new 0.5 MG Skyline Reservoir (CIP ID R-2) is recommended beyond the 20-year planning horizon to address condition issues with the existing reservoir and mitigate a projected future storage deficit at an estimated project cost of $906,000. The new Skyline Reservoir is recommended for construction at a new site as part of the Skyline and 1570 Zone reconfiguration.
- Inspect and clean all City reservoirs on a regular basis.

Pump Station Projects Summary

- Review of the City's existing pump stations reveals a current pumping capacity deficit in almost every pressure zone. Recommended pump station improvement projects include both capacity upgrades when space for additional pumps is available and replacements when a new facility is required to provide adequate capacity. Pump station upgrades and improvements, including the new Airport Pump Station, have a total estimated project cost of $15.1 million over the 10-year horizon.

- Develop a plan to address pump life cycle replacement costs in future CIPs, after addressing capacity upgrades identified in current CIP.
- In addition to installing the generator the City currently has at the Airport, backup power generators are recommended in the next 10 years at three constant pressure pumps stations: Royal Ridge, Jr High and SE 20th at an estimated total project cost of $600,000.

PRV Projects Summary

- Several PRV projects are recommended to eliminate dead-end mains through future development areas and provide fire flow, emergency redundancy and a means of circulating water between zones to mitigate potential water quality issues.

Water Main Projects Summary

Water main projects are recommended to:

- Mitigate fire flow deficiencies identified in Section 4.
- Reduce pressure fluctuations at the western edge of the system during ASR injection.
- Create a new 1570 Zone to improve service pressure and fire flow for existing high-elevation Skyline Zone customers.
- Provide water service and system looping through future development areas.
- Provide ongoing repair or replacement of water mains consistent with a 100-year life cycle.

AIA CIP Summary

- In order to provide adequate industrial and fire suppression capacity to anticipated development in the AIA, it is recommended that the City construct two interim non-potable supply systems over the 5-year planning horizon at an estimated project cost of $5.3 million. The interim non-potable systems allow the City to make incremental investments in the water system infrastructure and serve significant fire suppression demands for near term development.
- A new Airport Reservoir and Pump Station are recommended to serve anticipated future development within 10 years at an estimated project cost of $12.7 million, including costs for demolition of the existing facilities.

General Planning Projects

- Plan to update the City Water Master Plan approximately every 5 years.
- Update the City's Water Conservation and Management Plan as required by the State of Oregon.

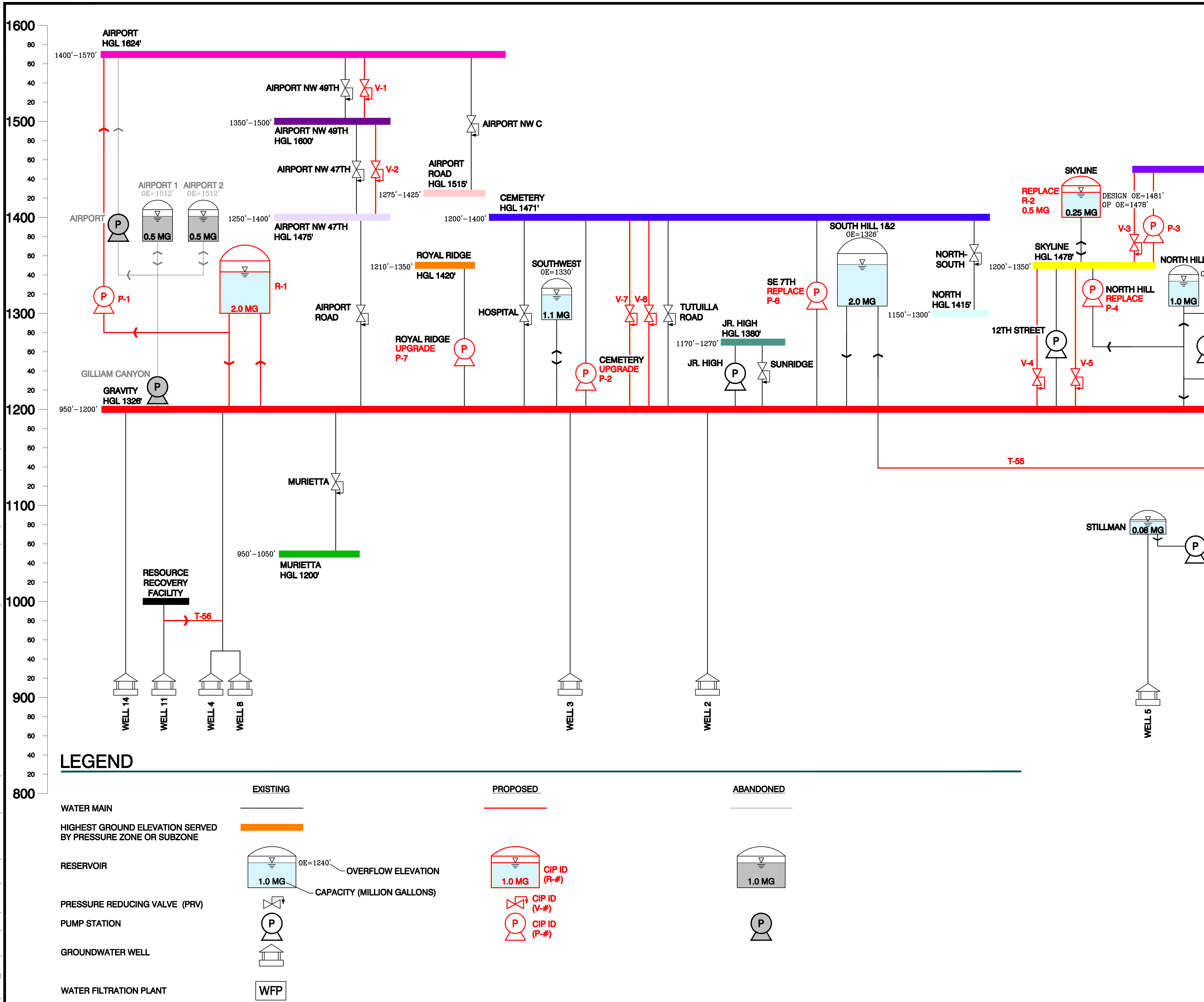


FIGURE 6-3

CITY OF PENDLETON

Water System Master Plan

PROPOSED HYDRAULIC SCHEMATIC

MARCH 2015

MSA Murray, Smith & Associates, Inc. Engineers/Planners

121 S.W. Salmon, Suite 900 Portland, Oregon 97204 PHONE 503-225-9010 FAX 503-225-9022

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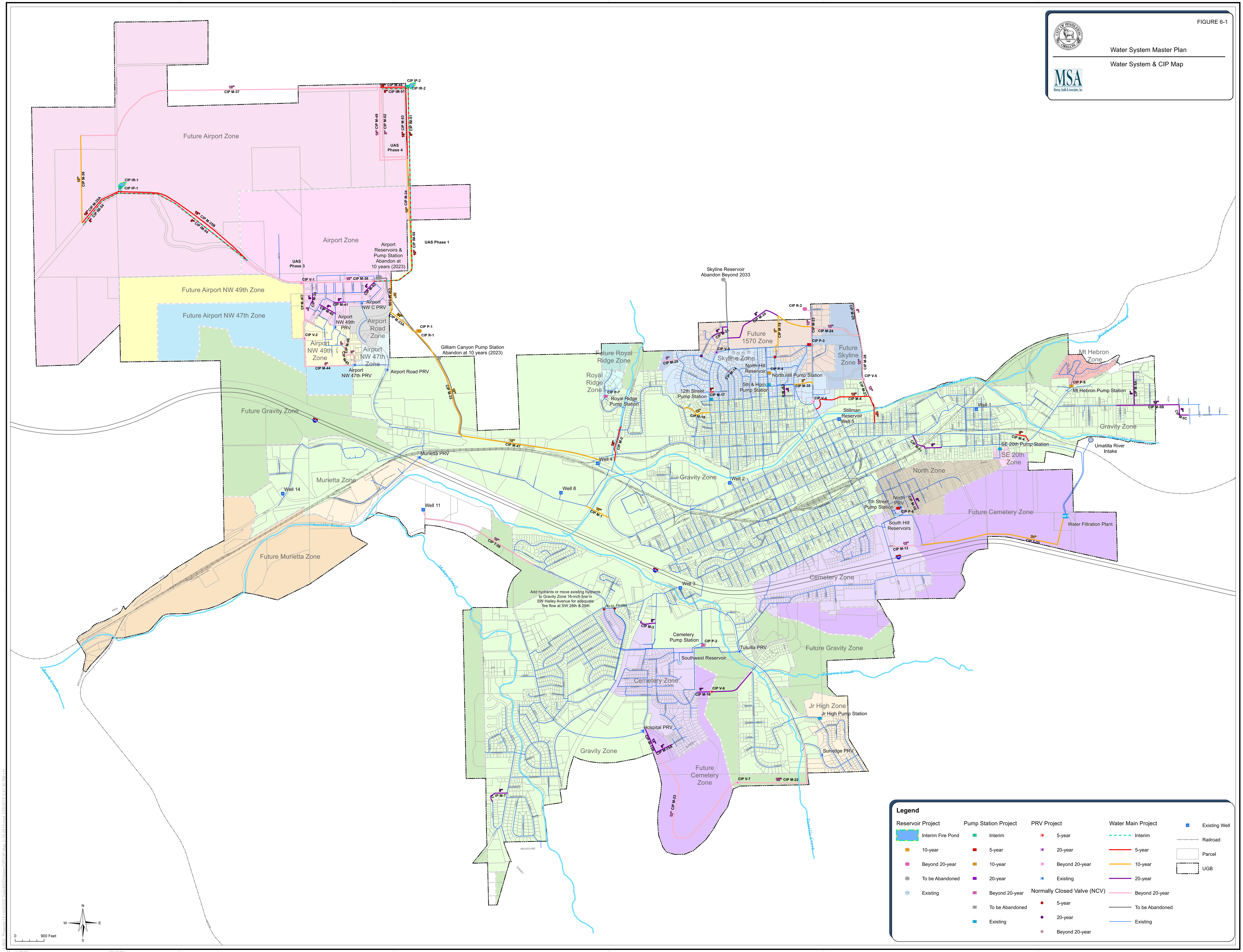
FIGURE 6-1
Water System Master Plan
Water System & CIP Map
MSA
Future Airport Zone
Airport Zone
Airport Reservoirs & Pump Station Abandon at 10 years (2023)
UAS Phase 1
UAS Phase 3
UAS Phase 4
Future Airport NW 49th Zone
Future Airport NW 47th Zone
Airport NW C PRV
Airport NW 49th PRV
Airport Road Zone
Airport NW 49th Zone
Airport NW 47th Zone
Airport NW 47th PRV
Airport Road PRV
Gilliam Canyon Pump Station Abandon at 10 years (2023)
Future Gravity Zone
Murietta PRV
Murietta Zone
Well 14
Well 11
Well 8
Well 4
Well 2
Well 3
Well 1
Future Murietta Zone
Umatilla River
Future Royal Ridge Zone
Royal Ridge Zone
Royal Ridge Pump Station
Skyline Reservoir Abandon Beyond 2033
Future 1570 Zone
Skyline Zone
Future Skyline Zone
North Hill Reservoir
North Hill Pump Station
12th Street Pump Station
5th & Horn Pump Station
Stillman Reservoir Well 5
Gravity Zone
Mt Hebron Zone
Mt Hebron Pump Station
Umatilla River Intake
SE 20th Pump Station
SE 20th Zone
North Zone
North PRV
7th Street Pump Station
South Hill Reservoirs
Future Cemetery Zone
Water Filtration Plant
Cemetery Zone
Add hydrants or move existing hydrants to Gravity Zone 16-inch line in SW Hailey Avenue for adequate fire flow at SW 28th & 29th
Cemetery Pump Station
Southwest Reservoir
Tutuilla PRV
Future Gravity Zone
Jr High Zone
Jr High Pump Station
Sunridge PRV
Hospital PRV
Future Cemetery Zone
Legend
Reservoir Project
Interim Fire Pond
10-year
Beyond 20-year
To be Abandoned
Existing
Pump Station Project
Interim
5-year
10-year
20-year
Beyond 20-year
To be Abandoned
Existing
PRV Project
5-year
20-year
Beyond 20-year
Existing
Normally Closed Valve (NCV)
5-year
20-year
Beyond 20-year
Water Main Project
Interim
5-year
10-year
20-year
Beyond 20-year
To be Abandoned
Existing
Existing Well
Railroad
Parcel
UGB
0 900 Feet
N
W E
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March 2015
13-1442

Murray, Smith & Associates, Inc.
Engineers/Planners

SECTION 7
Financial Plan

SECTION 7
FINANCIAL PLAN

Introduction

This section analyzes the overall impact that the 5- and 10-year capital improvements and staffing additions recommended in this Water System Master Plan (WSMP) will have on water rates. Although a transfer from the water fund to a fund intended for improvements at the Water Filtration Plant (WFP) is included in the financial analysis, no evaluation of the improvements needed or adequacy of this funding amount for the WFP are included in this WSMP.

For the purposes of this financial plan, annual projections of costs and revenues are provided for fiscal year (FY) 2014-15 through FY 2019-20, so that the City can develop 5- and 10-year implementation plans, including annual revenue adjustments. Summarized information associated with the 10-year financial forecast is also presented to give the City some indication of potential additional rate adjustments beyond the 5-year window. Finally, a water system financial forecast model allows the City to monitor and update financial projections over a 20-year period.

Background

The water system is an enterprise fund of the City, and is supported by water system fees and charges, rather than general City revenues. The system's primary funding source is monthly water rates charged to customers inside and outside the City.

Existing Water Rates

Existing water rates include a base monthly charge that varies depending on the type of customer or meter size (for most commercial and industrial customers), plus an additional volume rate per 100 cubic feet (ccf) or 748 gallons of water consumed. The City has three volume tiers: the first 19 units, 20 to 149 units, and 150 units or more.

The current monthly water bill (excluding sewer charges) of a typical residential customer with monthly water use of 15 ccf is $37.40 for a customer inside the City, and $56.15 for a customer outside the City. The *2013 Washington/Oregon Water Rate Survey* by Raftelis Financial Consultants, Inc., found the City's residential water bill to be the eleventh lowest out of the 41 utilities surveyed. The median monthly bill for surveyed utilities was $42.01 per month, compared to the City's bill at the time, $32.60 per month (not including the sewer portion of the utility bill).

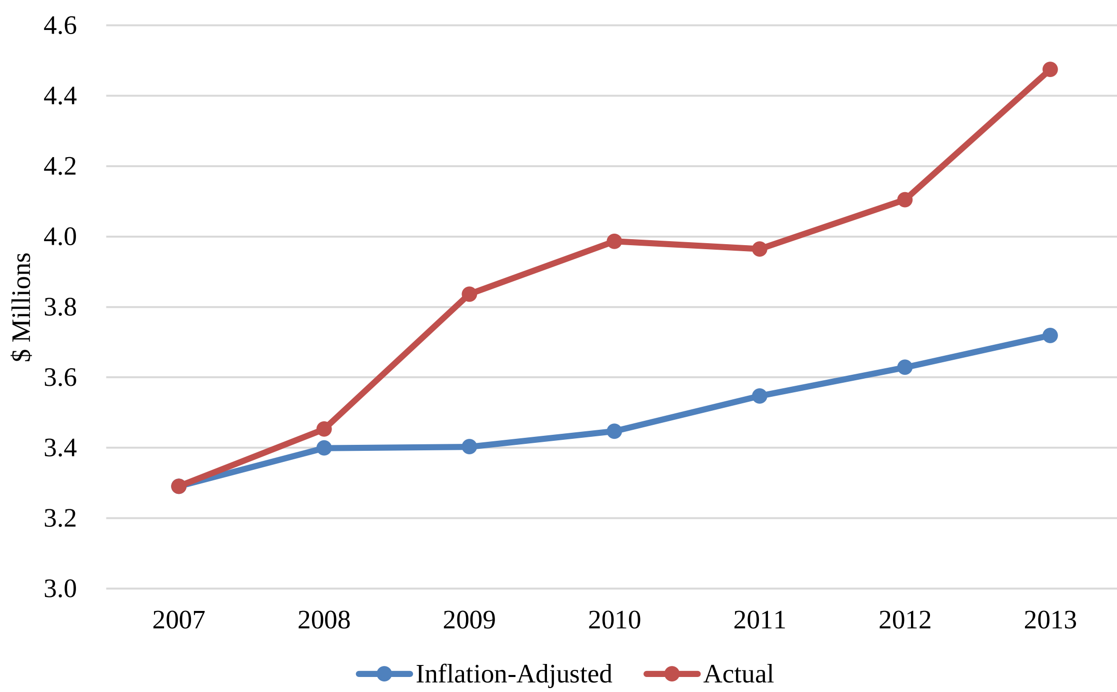
Rate Increase History

The City established an annual inflationary adjustment to its water and sewer rates in 2006. Each April, rates are adjusted by an amount equal to the lesser of 3.5%, or the year-to-year percentage change in the Portland-Salem Consumer Price Index, Urban Consumers (CPI-U). Rate increases beyond inflationary adjustments have been limited to regulatory-driven cost increases. Non-inflationary rate increases over the last 10 years include the following:

- 2005 – 12%
- 2013 – 5%
- 2014 – 7%

Since its implementation in 2006, the inflationary adjustment has not kept pace with the rising costs for water and sewer system operations. Figure 7-1 shows a comparison of inflation-adjusted operating expenses for the water and sewer systems combined, compared to actual historical expenses. The CPI-U (used to adjust rates annually) has increased at an average annual rate of 2.3% since 2007, compared to an average increase in operating costs of about 5.3%. This disparity is due to a number of factors, including higher cost escalation for electricity and chemicals (a large part of the system operating costs), franchise fees (related to non-inflationary rate increases), and City-allocated services costs (primarily personnel costs).

Figure 7-1
Historical Operating Expense Comparison (Combined Water & Sewer)



The current rates do not provide sufficient financial capacity to address the future projected system needs, given that the historical rate increases have not kept pace with operating cost inflation. Also, the City has had only one small rate increase for non-CPI cost increases (such as funding capital improvements related to rehabilitation and repair, and capacity expansion) since 2005; the 2014 rate increase was specifically targeted for membrane replacement at the WFP.

Financial Plan

Overview

This financial plan projects the City's costs or revenue requirements during the planning period, and the revenues, under existing rates, the City expects to generate during that period.

To develop adequate revenues from water rates, the system's annual revenue requirements must be determined. Basic revenue requirements include the following:

- Operations and maintenance (O&M) costs.
- Annual capital improvement projects funded by rates and reserves (cash outlays or pay-as-you-go capital).
- Debt service expenditures (principal and interest on loans and bonds).
- Transfers to the City's other funds for indirect and direct services provided to the utility.

Key Forecast Assumptions

This financial plan is based on a set of overall assumptions related to customer growth, inflation, and other factors, as well as the phasing of the Capital Improvement Program (CIP). The following is a list of key assumptions used in the forecast:

- The average annual customer growth rate is estimated to be 0.5% per year throughout the 5-year period, reflecting recent trends. (This financial plan uses a more conservative customer growth estimate than Section 3—Population and Demand Projections, which is based on the City's 2011 Comprehensive Plan. It is appropriate for this plan to base customer growth assumptions on more recent growth trends in order to more accurately project revenue in the short term).
- An elasticity of demand factor equal to -1.00 is assumed for all rate increases, and is applied to the volume (usage) portion of the water rate revenue (i.e., for every 10% increase in usage rates, consumption will decrease by 1.0%).
- Billed rate revenues are reduced by 0.8% annually to account for bad debts.
- Non-rate revenues are escalated at 3.2% annually (reflecting inflation and customer growth).

- Interest earnings on fund balances and reserves are estimated to accrue at a rate of 0.75% annually.
- O&M costs are based on the current (FY 2014-15) budget, adjusted for one-time expenses, changes in operation and staffing levels, and cost escalation. Specific escalation factors used are:
  - Personnel costs – Salaries, 3.0%; Benefits, 5.0%.
  - Material and service costs – 3.0%.
  - Energy costs – 4%.
  - General cost escalation rate (for non-specified categories) – 2.7% (reflecting a historical trend in cost inflation as measured by the Engineering News-Record 20-city average *Construction Cost Index*).
  - Franchise fees – 7% of annual water sales revenues.

  In addition, labor costs are adjusted for additional personnel as recommended in Section 5—Operations and Maintenance. Specifically, additional full time equivalent (FTE) positions are assumed to be phased as follows:

  - Clerical (0.15 FTE) – FY 2015-16.
  - Shared Utility Worker (0.5 FTE) – FY 2016-17.
  - Dedicated Utility Worker (1 FTE) – FY 2017-18.
  - Dedicated Utility Worker (1 FTE) – FY 2018-19.
  - Dedicated Utility Worker (1 FTE) – FY 2019-20.
  - Pipe Replacement Crew (2 FTE) – FY 2019-20.

  Annual labor costs for utility workers are assumed to average $65,000 per year in current dollars.
- Future capital costs are increased at an annual rate of 2.7%.
- The FY 2014-15 budget includes $250,000 for membrane replacement; the annual transfer for WFP rehabilitation and replacement is assumed to increase to $350,000 by the end of the 5-year improvement plan period.
- The City will target to maintain a minimum operating fund balance of at least 30 days of operating expenses (the minimum industry standard) by the end of the 5-year planning period.

This financial plan includes development of a new water System Development Charge (SDC). The SDC methodology is documented in a separate report, but following industry standards and Oregon statutory requirements, the Capital Improvement Program (CIP) supports an SDC of approximately $3,770 per equivalent residential unit. Revenues from new system developments are projected to average, based on the projected number of new customers and the updated SDC, about $100,000 per year during the 5-year period.

Each component of the baseline financial projection is discussed in more detail below.

Operations and Maintenance Costs

Table 7-1 summarizes projected water system O&M costs for FY 2014-15 through FY 2019-20. Total water O&M costs are currently about $2.6 million, excluding a budgeted contingency; future O&M costs are projected to increase to almost $3.7 million in FY 2019-20. As shown in Table 7-1, almost half of the projected increase in O&M costs is related to new staffing expenses (estimated to be $0.5 million in FY 2019-20.)

Table 7-1
Summary of Forecast O&M Costs

O&M Item	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Personnel Services	$443,030	$459,342	$476,293	$493,912	$512,226	$531,265
Materials & Services	$2,086,980	$2,173,744	$2,272,699	$2,377,168	$2,487,544	$2,604,249
Capital Outlay	$5,000	$5,150	$5,305	$5,464	$5,628	$5,796
Transfers	$11,170	$11,617	$12,081	$12,565	$13,067	$13,590
Additional Staffing	$0	$69,250	$105,820	$180,357	$260,687	$499,237
Total	**$2,546,180**	**$2,719,103**	**$2,872,198**	**$3,069,466**	**$3,279,152**	**$3,654,137**

Capital Improvements

Future capital expenditures for the water system are based on the CIP, which identifies $14.8 million (inflation adjusted) in system improvements for the period FY 2014-15 to FY 2019-20, as shown in Table 7-2. The CIP projects are necessary to repair and maintain existing system facilities, and to meet the needs of projected growth, particularly in the Airport Industrial Area (AIA). Capital expenditure estimates are allocated to 5-year time increments. As shown in Table 7-2, in the next 5-year increment (FY 2020-21 to FY 2024-25) CIP costs are almost $35 million. A detailed list of the projects is provided in Section 6—Capital Improvement Program. The average annual CIP cost is estimated to be almost $2.5 million in the first period, and nearly $7 million in the second period.

Table 7-2
Summary of Forecast CIP Costs

CIP Item	FY 2014-2015 to FY 2019-20	FY 2020-21 to FY 2024-25
5-Year Total Cost		
Airport Improvements	$6,108,611	$15,103,550
Pipe Replacement	$1,319,347	$5,848,481
Other Facilities	$7,427,101	$13,896,472
Total	**$14,855,058**	**$34,848,503**
Average Annual Cost		
Airport Improvements	$1,018,102	$3,020,710
Pipe Replacement	$219,891	$1,169,696
Other Facilities	$1,237,850	$2,779,294
Total	**$2,475,843**	**$6,969,700**

General note: Costs have been adjusted for inflation.

As shown in Table 7-3, a combination of projected annual revenue from rates and SDCs, and debt proceeds from state loans are assumed to fund the 5-year CIP. In order to mitigate the short-term impact on rates, debt financing is assumed for about 75% of the 5-year CIP. Debt financing is assumed specifically for the AIA projects and the majority of other facility improvement costs. Cash funding from rates and SDCs is assumed to fund pipe replacement and non-capacity costs.

Table 7-3
Summary of CIP Funding Sources

Source	Amount Generated
Rates	$2,968,058
SDCs	$587,000
Debt Proceeds	$11,300,000
Total	**$14,855,058**

General note: Values have been adjusted for inflation.

Revenues

As mentioned previously, rate revenues are the main source of funding for water system revenue requirements. Under state law, SDCs may not be used to fund O&M costs, and the portion of capital costs eligible for SDC funding is limited to growth-related capital expenditures. Other revenue sources available to fund a portion of annual requirements for the water system include water connection fees, new service fees, land rental interest income, and miscellaneous revenue. Estimated total revenues from these sources average about $150,000 per year during the 5-year planning period, and user fees are projected to total $3.7 million in FY 2014-15.

Revenue Requirements from Rates

Table 7-4 shows how current revenue from rates is distributed across major expense categories. Current O&M costs represent 65% of existing requirements. Of the remaining $1.3 million available for capital expenses, more than $0.5 million (15%) is for existing debt service, and $250,000 (7%) is for membrane replacement. The remaining $0.45 million of rate revenue is available for CIP costs in FY 2014-15.

Table 7-4 shows annually projected rate requirements through the 5-year planning period, and for the last year of the 10-year period. Significant additional capital funding (both debt and cash, or pay-as-you-go funding) is needed in the 5- and 10-year periods to finance the CIP costs shown in Table 7-2. Debt is assumed to fund interim AIA improvements ($5.5 million) during these periods. Additional debt is anticipated for other capacity and AIA improvements through FY 2019-20. At the end of the 5-year forecast period, total debt service may exceed $1.3 million per year. Debt service more than doubles in the 10-year planning period, reflective of the increase in the CIP shown in Table 7-2.

As shown in Table 7-4, the annual increase in revenue requirements (inclusive of inflation) is about 10% through FY 2019-20, with a cumulative increase of 60%. The City may choose to implement smooth annual rate increases over the planning period to meet the annual requirements, or have fewer but larger increases at the beginning of the period.

The cumulative 10-year increase is also shown in Table 7-4. Inclusive of inflation, requirements from rates are projected to grow 149%, based on the CIP and the current projections of debt versus cash funding. The City will revisit the capital priorities and staging at the end of the 5-year period to refine this estimate. Furthermore, the City will need to evaluate available financing options as it implements specific CIP projects, and update the rate revenue requirements accordingly, as financing commitments are secured.

Table 7-4
Current and Projected Revenue Requirements from Rates

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2024-25
Operations and Maintenance Expenses	$2,546,180	$2,719,102	$2,872,198	$3,069,466	$3,279,152	$3,654,137	$4,547,376
Capital Expenses							
Transfer to WFP Fund	$250,000	$250,000	$250,000	$250,000	$250,000	$350,000	$400,000
Debt Service	$572,724	$732,005	$875,654	$1,025,893	$1,178,798	$1,362,109	$3,319,768
Pay As You Go	$450,000	$274,000	$672,842	$718,294	$493,887	$1,321,035	$795,930
Subtotal Capital Expenses	$1,272,724	$1,256,005	$1,798,496	$1,994,188	$1,922,685	$3,033,144	$4,515,699
Total Expense Requirements	**$3,818,904**	**$3,975,107**	**$4,670,694**	**$5,063,654**	**$5,201,837**	**$6,687,281**	**$9,063,074**
Non-rate Revenue							
Operating	$148,000	$140,023	$148,104	$155,777	$165,575	$173,950	$220,185
SDC-supported Capital	$0	$100,000	$100,000	$100,000	$125,000	$162,000	$200,000
Total Non-rate Revenue	**$148,000**	**$240,023**	**$248,104**	**$255,777**	**$290,575**	**$335,950**	**$420,185**
Addition to Operating Fund Balance	$35,146	$337,422	$53,082	$111,391	$496,139	$0	$602,598
Use of Operating Fund Balance	$0	$0	$0	$0	$0	$406,731	$0
Requirements from Rates	**$3,706,050**	**$4,072,507**	**$4,475,671**	**$4,919,268**	**$5,407,401**	**$5,944,599**	**$9,245,487**
Annual % Revenue Increase[1]	-	10%	10%	10%	10%	10%	
Cumulative % Increase	-	-	-	-	-	60%	149%

[1] A 10.5% rate increase is projected to provide approximately a 10% revenue increase due to slight reductions in water use at higher rates.

Financial Performance Targets

Table 7-5 presents the expected revenues, expense, debt service coverage, and changes in fund balance for the City's operating fund for the 5-year period ending June 30, 2020.

Fund Balances

As shown in Table 7-5, the City's beginning operating fund balance in FY 2014-15 was only $74,000, less than 3% of operating expenses. The industry standard minimum contingency for small systems is 30 to 90 days (or 8% to 25%) of O&M expenses. The forecasted revenue requirements include a minimum contingency of 30 days, which is projected to be met in most years of the forecast. Some fluctuations in fund balance are needed to smooth rate increases over the forecast period.

Debt Service Coverage

Lending agencies such as Business Oregon generally require a minimum debt service coverage ratio of 1.2 times annual average debt. Net revenues available to meet this requirement are calculated as operating revenues minus operating expenses. As shown in Table 7-5, the City's subordinate debt service coverage is expected to exceed the minimum requirements during the study period.

Table 7-5
Projected Operating Results

	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Beginning Balance of Operating Fund	**$74,000**	**$109,146**	**$446,568**	**$499,650**	**$611,041**	**$1,107,180**
Projected Water Rate Increases[1]	0.00%	10.50%	10.50%	10.50%	10.50%	10.50%
Revenue						
Water Service Revenue	$3,706,050	$4,072,507	$4,475,671	$4,919,268	$5,407,401	$5,944,599
Non-rate Revenue	$147,500	$137,946	$144,569	$151,627	$159,156	$167,197
SDC Revenue	$0	$100,000	$100,000	$100,000	$125,000	$162,000
Operating Fund Interest	$500	$2,076	$3,535	$4,150	$6,419	$6,753
Total Operating Revenue	**$3,854,050**	**$4,312,529**	**$4,723,776**	**$5,175,044**	**$5,697,977**	**$6,280,550**
Operating Expenses						
Operations and Maintenance	$2,535,010	$2,707,486	$2,860,117	$3,056,901	$3,266,085	$3,640,547
Transfers	$11,170	$11,617	$12,081	$12,565	$13,067	$13,590
Total Operating Expenses	**$2,546,180**	**$2,719,102**	**$2,872,198**	**$3,069,466**	**$3,279,152**	**$3,654,137**
Net Revenue Available for Debt Service	$1,307,870	$1,593,427	$1,851,578	$2,105,578	$2,418,824	$2,626,413
Debt						
Senior Lien Debt Service	$0	$0	$0	$70,629	$225,130	$410,531
Existing Subordinate Debt	$449,495	$449,178	$449,458	$449,288	$449,668	$449,553
New Subordinate Debt	$54,504	$172,597	$317,942	$399,699	$399,699	$399,699
Total Debt Service	**$503,999**	**$621,775**	**$767,400**	**$919,616**	**$1,074,497**	**$1,259,783**
Sr. Lien Debt Service Coverage	NA	NA	NA	30.20	10.78	6.34
Subordinate Debt Service Coverage	2.59	2.56	2.41	2.39	2.58	2.60
All Debt Service Coverage	2.60	2.59	2.44	2.32	2.26	2.07
Other Financial Sources/Uses						
Debt Proceeds	$1,500,000	$1,750,000	$2,250,000	$1,600,000	$1,900,000	$2,300,000
Loan Payments to Sewer Fund	$68,725	$110,230	$108,254	$106,278	$104,302	$102,326
Transfer to WFP Fund	$250,000	$250,000	$250,000	$250,000	$250,000	$350,000
Transfer to Capital Improvement Fund	$1,950,000	$2,024,000	$2,922,842	$2,318,294	$2,393,887	$3,621,035
Net Other Sources/Uses	**$768,725**	**$634,230**	**$1,031,096**	**$1,074,572**	**$848,189**	**$1,773,361**
Ending Balance of Operating Fund	**$109,146**	**$446,568**	**$499,650**	**$611,041**	**$1,107,180**	**$700,499**
Portion of Balance for Debt Service Reserve	$54,504	$172,597	$317,942	$399,699	$399,699	$399,699
Available Balance for Operating Expenses	$54,642	$273,971	$181,708	$211,342	$707,481	$300,750
Minimum Operating Balance Requirement[2]	$208,864	$223,065	$235,635	$251,836	$269,057	$299,864

[1] A 10.5% rate increase is projected to provide approximately a 10% revenue increase due to slight reductions in water use at higher rates.
[2] Based on 30 days of operating expenses.

Recommendations

As indicated in Table 7-2, the average annual CIP cost for the 5-year planning period is almost $2.5 million, compared to current CIP funding capacity of less than $0.5 million. Significant rate increases will be necessary to generate the revenues required to support the recommended CIP and to fund O&M costs, including additional staffing.

The following recommendations are offered for the City's consideration related to funding the additional staffing and CIP.

Rate and Revenue Increases

In FY 2014-15, revenue from existing (July 2014) rates is estimated to be $3.7 million; rate revenue requirements are projected to increase by about 60% by FY 2019-20 to almost $6.0 million. The growth in revenue requirements is attributed to ongoing increases in O&M expenses, as well as increases in cash outlays and debt service to fund the CIP.

To meet the needed revenue increases, the City should continue adjusting rates annually for inflation; however, the index should be changed from the CPI to the Engineering News Record (ENR) 20-city average *Construction Cost Index*. The current CPI index has not kept pace with utility cost increases since it was adopted in 2006. The average annual increase in the ENR has been about 2.7%, compared to 2.3% for the CPI.

In addition to the inflationary increases, the City will need to implement other rate increases to fund the projected revenue requirements and to maintain cash reserves consistent with industry standards. Based on current projections of customer growth and water use, additional annual rate increases of 7.8% are needed through FY 2019-20.

Assuming a combined annual increase of 10.5% (2.7% inflation, plus 7.8% additional), applied uniformly to the City's existing rate structure, monthly bills for typical residential customers using 15 ccf, would increase approximately $4.00 to $6.00 each year, as shown in Table 7-6.

Table 7-6
Projected Residential Bills (at 15 ccf)

Year	Monthly Bill	Annual Increase ($)
FY 2014-15	$37.40	-
FY 2015-16	$41.39	$3.99
FY 2016-17	$45.75	$4.36
FY 2017-18	$50.64	$4.89
FY 2018-19	$56.09	$5.45
FY 2019-20	$62.13	$6.04

Even with the initial FY 2015-16 increase, a City customer's typical monthly water bill would fall below the $42.01 median bill for Oregon communities ($42.01) indicated in the 2013 rate survey. The rates in other communities will also continue to increase, most in excess of inflation; so it is likely that the City's water rates will continue to compare favorably with those of other communities.

Financial Plan Updating

This financial plan is based on available information on revenue and expenditures as of March 2015. There will likely be differences between assumed and actual conditions, because events and circumstances frequently do not occur as expected; these differences may be significant. Therefore, it is important that the City continue to monitor its financial plan annually and make adjustments as needed.

Among the variables that could impact future rate increases are changes in customer growth, and water consumption patterns. Over the past several years, the City has observed fluctuating water use per account. This financial plan assumes new customer growth averaging 0.5% per year over the forecast period, and reductions in water use per account due to water conservation and price elasticity (i.e., reductions in use in response to rate increases).

Other key assumptions related to capital financing that could impact future rate increases are:

1. The City will secure favorable borrowing terms for the State's Infrastructure Finance Authority for approximately $5.5 million to fund near-term improvements in the AIA.
2. Additional debt funding of almost $6 million will be used to fund other projects in the 5-year planning period.
3. The City will implement a new SDC to fund growth-related costs of the CIP.

System Development Charges

The SDCs calculated as part of this study result in an equitable distribution of capital costs to future development. The revised SDC per EDU is $3,770, which is within the range of SDCs charged in Oregon. Based on 2014 data, water SDCs generally range from $500 to $15,000 for an EDU. Furthermore, the City should adjust the SDCs annually for inflation based on the ENR *Construction Cost Index*, and complete comprehensive updates as necessary to incorporate significant changes to the CIP, including additional source improvements.

Murray, Smith & Associates, Inc.
Engineers/Planners

APPENDIX A

2012 Water Management and Conservation Plan Excerpts

CITY OF PENDLETON

WATER MANAGEMENT & CONSERVATION PLAN

2012

City of Pendleton (City) submitted a Water Management and Conservation Plan (WMCP) in 1999, which was approved by the Department in a letter dated November 16, 1999. City submitted a revised WMCP which was approved by the Department in a letter dated September 26, 2003. In 2008, the City submitted a five-year progress report. As a condition of extension of two water permits, the City was required to submit a new WMCP in 2012. This WMCP has been prepared to meet that requirement.

690-086-0030 Municipal Water Supplier

City of Pendleton (City) meets the definition of a "municipal water supplier." City has a publicly owned water treatment and distribution system that delivers potable water for community needs to residential, commercial and industrial customers.

690-086-120 General Provisions

This draft plan has been made available to the following affected local governments: City of Pendleton Planning Department; Umatilla County Planning Department; CTUIR Planning Department; and CTUIR Water Resources Program. The comments received from the affected local governments are included in Attachment A, Comments from Affected Local Governments.

An updated Water Management and Conservation Plan will be submitted ten years from the date this WMCP is approved. We hope to complete an updated Water System Master Plan by June, 2013. The City will use the historic growth rate of 1.4% in developing the projections for this plan.

690-086-0140 Municipal Water Supplier Description

1. <u>Description of the supplier's source of water</u>. City utilizes both surface water and groundwater supplies. The surface water source is the Umatilla River. City withdraws water from the Umatilla River at the Umatilla River Intake, located just east of the City, and filters it through the membrane filtration Water Treatment Plant (WTP) before distributing it to customers. The groundwater source consists of seven deep basalt wells located throughout the City and another deep basalt well located six miles east of the City near Mission.

The wells located within the City are: Byers Well #1, Round-Up Well #2, SW 21st St Well #3, Hospital Well #4, Stillman Well #5, Prison Well #8, and Well #14. The well east of town is Mission Well #7. See Figure 1, City of Pendleton Water System.

There are eight reservoirs in the City: Airport Reservoir has two tanks, each with 500,000 gallon capacity; Clearwell Reservoir, located at the Water Treatment Plant site, has a 1.8 Million Gallon (MG) capacity; North Hill Reservoir has a 1 MG capacity; South Hill Reservoir has 2 tanks, each with 1 MG capacity; Southwest Reservoir has a 1.1 MG capacity; and Skyline Reservoir has a 250,000 gallon capacity. Total storage capacity for the City is 7.15 MG.

2. A delineation of the current service areas and estimate of population served.

   The current service area is the area within the City's Urban Growth Boundary (UGB). See Figure 2, City of Pendleton Zoning Map. The 2010 US Census population within the Pendleton city limits was 16,625. The 2010 urban area population, i.e. the area within the UGB, was estimated at 16,687.

3. An assessment of the adequacy and reliability of the existing water supply considering potential limitations on continued or expanded use.

   Because the City is located on the dry side of the state, we have long been aware of the need to plan for potential draught conditions. The City determined that Aquifer Storage and Recovery (ASR) was one way to address water supply issues. In 2003, the City completed construction on a membrane filtration Water Treatment Plant (WTP). The WTP produces high quality drinking water, allowing the City to begin an ASR pilot study in late 2003/early 2004 under ASR Limited License # 006. Since that time, the City has successfully completed ten ASR cycles of storage and recovery with three ASR wells.

   The ASR project allows the City to maximize the effectiveness of the membrane filtration WTP by operating at full capacity during the winter and spring months when water rights allow, when flow is high in the Umatilla River, and when demand from customers is low. The stored water is recovered during the summer months when demand is high.

   Prior to the ASR program, the City derived about 62% of its supply from native groundwater and about 38% from the City's old "Springs" source. Since the ASR program began, the City has been able to reverse this trend of groundwater and surface water usage and now relies primarily on surface water. In fact, during 2011 and ASR Cycle 9, City obtained 97% of its drinking water supply from surface water and only 3% from native groundwater.

   The nine years of the ASR project have demonstrated aquifer recharge, storage, and recovery as a viable method for Pendleton to store and recover treated water and assist with reducing native groundwater declines. Historically, groundwater declines averaged 3.4 ft per year. Since the ASR program began, we have seen declines of from 0.4 to 2.0 ft per year at City wells.

The City recently added more membranes to the Water Treatment Plant, increasing the capacity from 6.0 MGD to 9.8 MGD. This will allow the City to add two more wells to the ASR program utilizing existing surface water rights. ASR allows the City to have a very sustainable water supply which is probably the most draught-tolerant drinking water supply system in the state of Oregon.

In addition to the ASR project, the City has water rights to allow current growth through 2100, as demonstrated in Section 690-086-0160.

4. <u>A quantification of the water delivered by the water supplier.</u>

Table 1, City of Pendleton Annual Water Usage, attached, shows the annual water use from 2005 through 2011. The City has been operating under the ASR test program during those years, so it is indicative of the way the water system is operating now and will operate in the future. Total water usage increased from 1,408 MG in 2005 to 1,644 MG in 2007 and then dropped off to 1,321 MG in 2011. Average annual water usage during this period was 1,495 MG.

Table 1 also shows the peak month and peak day information. The peak month was July or August, which follows the normal weather patterns in eastern Oregon where July and August are hot, dry months when lawns and gardens require more water. The average water usage for the peak month was 250.291 MG. The peak day was July 23, 2009, with usage of nearly 11 MG. Peak day usage for 2011 was 8.228 MG.

City is in the process of re-prioritizing our well level monitoring, so we should be able to have more accurate readings for peak day usage in the future.

5. <u>A tabular list of water rights.</u>

See Table 2, City of Pendleton Water Rights, attached, for a tabular list of the City of Pendleton's water rights. **The type of beneficial use for all of these rights is municipal.** As you can see, most of the water rights are certificated. The exceptions are ORS 538.450, which is a legislative surface water right to all waters of the North Fork Umatilla River, and two groundwater rights: Permit No. G-2410 and Permit No. G-3225. The City has until 2076 to fully develop G-2410 and G-3225. The only water used under Permit G-2410 during this period was from Well # 14. Under Permit G-3225, both Wells #7 and #11 are used; Well # 11 is used for domestic use only, supplying water to the City's Wastewater Treatment Plant and two residences.

Table 2 also includes Historic Maximum Rate of Diversion for each water right, both when pumping native groundwater (Native GW) and when pumping stored water through Aquifer Storage & Recovery (ASR). Stillman Well #5 can currently produce more water than allowed by the water right. It will be operated at the higher rate when pumping stored water from the well. Once all the stored water has been pumped from the well, the pump rate will be returned to the normal native groundwater pump rate.

The average monthly diversions in million gallons (MG) for each right for the previous five years is shown in Table 3, Average and Maximum Diversions Under Each Water Right, attached. It should be noted that the monthly average gives an inaccurate impression of usage because the City's wells are only operated for a few months each year, primarily during the summer. During most of the year, the City relies on the surface water source and does not operate the wells. For example, during 2011, Byers Well # 1 only operated for 5 months and was not utilized for the other 7 months of the year.

The average daily diversions in million gallons (MG) for each right for the previous five years is also shown in Table 3. As with the monthly averages, the values shown give an inaccurate impression of usage because the City's wells are only operated for a few months each year, primarily during the summer.

The maximum annual diversion in MG for the years 2005 through 2011 is also shown in Table 3. Both groundwater and surface water rights are exercised in order of priority date, so the table shows the total diversion at each well or at the Umatilla River intake. There are currently two wells under Permit G-3225, Well #7 and Well #11. Water is withdrawn from Well #11 for domestic use only, and the amount withdrawn is relatively small. During the 2011 water year, 13,464 gallons were withdrawn from Well #11.

City's groundwater sources (i.e. wells) are not located within the designated boundary of any critical groundwater area.

<u>Streamflow-dependent species and water quality parameters.</u>

According to Bill Duke, Fish Biologist with Oregon Fish and Wildlife Department, MCR Steelhead and Bull Trout are the only two federally listed threatened and endangered species on the mainstem Umatilla River; both are listed as threatened. The following species are listed on Oregon's streamflow dependent species list as sensitive, threatened, or endangered:

Steelhead----------------------------------Sensitive-Critical
Bull Trout-----------------------------------Sensitive-Critical
Inland Columbia Redband Trout---Sensitive-Vulnerable
Pacific Lamprey-------------------------Sensitive-Vulnerable
Western Brook Lamprey---------------Sensitive-Vulnerable

While Western Brook Lamprey are state-listed as *Sensitive-Vulnerable* in the Umatilla Hydrologic Unit on ODFW's Sensitive Species List, Bill Duke (ODFW fish biologist) indicated that he has not seen any evidence of Western Brook Lamprey in the Umatilla and North Fork Umatilla Rivers.

The following is a list of water quality limited parameters for the mainstem Umatilla River above and through the City of Pendleton:

- Aquatic weeds or algae
- Flow modification
- Habitat modification
- Iron
- pH
- Sedimentation
- Temperature

Of these parameters on the 303(d) list, only iron does not have a TMDL developed for it. This information was provided by Don Butcher, Oregon Department of Environmental Quality.

6. <u>A description of the customers served</u>.

As of March, 2012, the City had 5733 service connections. Usage is broken down into the following categories: Commercial; City; Residential; Multi-Family, Motel/Hotel, and Other. Table 4, Classification of Water Customers, shows the Classification of Water Customers for WY 2002 (as reported in the 2003 WMCP); WY 2007 (as reported in the 2008 WMCP Progress Report); and WYs 2008, 2009, 2010, and 2011. The percentage of commercial meters, which includes compound meters, and residential meters has remained essentially the same over this time period. Some of the other categories have gone up and down over the years, but there are no significant changes.

7. <u>Identification of interconnections with other municipal supply systems.</u>

The City does not have any exchange agreements or water supply or delivery contracts. However, the City does have an historic agreement with the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to provide them with 750,000 gallons of water per month at no charge from the "spring" line. The City abandoned the "spring" line in 2005 and removed the chlorination facility, but there is still an intertie between CTUIR water system and City's Mission Well #7, which is located on the reservation. City only uses Mission Well #7 for six months a year and has notified CTUIR that if they wish to use the water, they will need to chlorinate it. To date, CTUIR has not utilized the water or the intertie.

City is a member of the Oregon Water/Wastewater Agency Response Network (ORWARN) and has a staff member on the ORWARN board. City considers this to be an extremely important organization to belong to and to be involved with for emergency response preparation. City has hosted and participated in several emergency response exercises with ORWARN. City would, of course, assist other municipalities, agencies, or businesses with emergencies, including providing potable water should the need arise.

8. A schematic of the system.

   Figure 1, City of Pendleton Water Distribution System, shows a schematic of the City's water distribution system. It shows the sources of water, including both surface water and groundwater wells, the Water Treatment Plant, storage reservoirs, and booster pump stations. Figure 3, City of Pendleton Water Distribution System, shows a schematic of the major transmission and distribution lines. City just completed updating our map of major transmission and distribution lines as part of the master planning effort scheduled for 2012/2013.

9. A quantification and description of system leakage.

   City continues to conduct an Annual Water Audit. The results reported in the 2008 progress report as well as the results for water years 2008 through 2011 are shown below in Table 5, Water Loss. The audits demonstrate continued improvement in methodology, metering, and reduced leakage. For the period WY 2002 through WY 2007, the average water loss was 7.37%. For the period WY 2008 through 2011, the average water loss was 4.75%.

   The City continues to tighten leaks throughout the distribution system and replace older valves and meters as funds allow. We believe these are the main sources of system leakage and are, therefore, our top priority when allocating funds to water conservation measures.

   Estimates of un-metered water use have greatly improved. The following uses are included in the un-metered water use: 1) fire hydrant flushing & training; 2) well flushing; 3) by-pass flow at wells to address problems such as air entrainment; 4) contractor usage; 5) water breaks; 6) pre-lube water at wells; 7) valve leaks, reservoir leaks, and meter leaks; 8) flow to prevent freezing at bridge crossings; 9) fires; 10) Water Treatment Plant water for irrigation; 11) street flushing, dust control, and street sweeping; and 12) reservoir overflows.

690-086-0150 Municipal Water Conservation Element

In order to address the items in this section efficiently, we have created a table that includes benchmarks from previous conservation plans, progress on those benchmarks, and five-year benchmarks for the future. See Table 6, Water Conservation Measures and Benchmarks, for this information. However, in addition to the table, we would like to highlight some of the conservation measures that we are particularly proud of.

- The City's Aquifer Storage & Recovery (ASR) project continues to make the City one of the most drought-tolerant cities in the state. During the winter months when there is excess water in the Umatilla River and water rights permit, the City pumps water from the Umatilla River, treats it at the membrane filtration Water Treatment Plant, and stores it in the underground aquifer. The water is withdrawn (recovered) from the aquifer when demand is high. ASR itself is a water conservation program. In 2007, the City won the OWRD Stewardship and Conservation Award for this project. (see below)

City of Pendleton (May 2007) Stewardship & Conservation Award

Faced with continuing declines in their water supply wells, the City of Pendleton developed, in coordination with the Department, an aquifer storage and recovery (ASR) program. The City injects and stores treated Umatilla River water in basalt wells during the winter and spring months when water is available in the river. When the City can no longer use water from the Umatilla River during the summer and fall months for injection purposes, the stored treated water is pumped back out of the wells and served to the community. With the use of ASR, the City has been able to shore up its water supplies while reducing reliance on critical ground water supplies by using surface water collected during wet months.

- The ASR project started in the winter of 2003 and recently successfully completed nine cycles of storage and recovery. To date, we have stored over 12,173 MG in the underground aquifer. Prior to the ASR program, the groundwater level was observed to be dropping at a rate of over 3-feet per year, and the City derived about 62% of its supply from native groundwater and about 38% from the City's old "Springs" source (a series of collector galleries located in the alluvium next to the Umatilla River). Since the ASR program began in 2004, the City has been able to reverse this trend of groundwater and surface water usage and now relies primarily on surface water. In addition, the City has been able to decrease the decline in static water levels. Prior to ASR, the decline in static level measurements was 3.4 ft per year. After nine cycles of ASR, the decline in static level measurements averaged 1 ft per year. Currently, the City stores water at three ASR wells. We are in the process of adding two more wells to the ASR pilot project, which will greatly expand the amount of water the City can store.

- Beginning in 2008, Public Works Dept. and Parks Dept. began a program to install a computerized irrigation system and weather station. The system allows the Parks Dept. to control the sprinkler system at the parks from a computer or I-Pad. The system reduces waste by: a) allowing the Parks to turn off irrigation quickly when it is raining; b) alerting the Parks to leaks in the system; and c) giving Parks better control of the amount of water applied to each individual park. Currently, 17 parks are on the system. Initial cost was approximately $14,000 plus an additional $3000 for each park on the system. There are 11 more parks that will be added to the system as funding allows.
- The Water Division has been installing fill stations throughout town for contractor use. Currently, 5 stations have been installed located at: Cemetery Booster, Mt. Hebron Booster, Hospital Well #4, Well #14, and First Station #2. Another fill station will be installed at the Airport in the future. These stations will allow contractors to input a usage code and obtain water for their various projects. It allows the City to accurately meter and bill for the usage, and each station has backflow protection, so we are assured that there are no contaminants introduced into the system. The fill stations should be on line in late 2012.
- The City's webpage, *Water Efficiency Facts and Tips,* was recognized in 2011 by Ronald Brew, OWRD staff, who asked us to share with OWRD's webpage. Brew said the City's webpage was, "one of the best I've seen in its coverage of many aspects of water conservation and answers to questions most consumers would have in order to understand the importance of the issue."
- The City has a dynamic solar program. Solar panels have been installed at both the Water Treatment Plant and the Wastewater Treatment Plant. In addition, the City promotes both residential and commercial solar programs by offering no-interest loans to qualifying residents and businesses. To date, 67 homeowners have participated in the program, and 4 businesses have participated.
- The City is embarking on an Energy Recovery Technology (ERT) Project in conjunction with the ASR Project. The proposed ERT Project will utilize energy generated during the Aquifer Storage part of ASR, when the water flows down the well column, by utilizing regenerative drives and a micro-turbine. Water, the driving force, will travel down the well column, turning the well bowls and motor. The system will utilize braking technology to slow the speed of the bowls with the motor acting as the brake. This type of technology, referred to as regenerative drive technology, is commonly used in hybrid cars. The City will install a variable frequency drive (VFD) and regenerative drive which will allow us to capture the energy produced by the braking motion and convert it to electricity. In addition to the regenerative drives at the three wells, Well # 5 will also utilize a micro-turbine. Projections for the ERT Project at 5 wells are 1,242,037 kWh produced annually.
- The City of Pendleton water system is 100% metered.

- The City has been in the process of replacing older meters with touch-read meters. In 2011, the City contracted to have a meter study done by an independent party. The goal was to address the age and accuracy of the older meters in the system. They looked at 12 of the oldest meters in the system (dating to 1982 and 1983) and compared them with newer meters through bench tests. Interestingly, the results showed no noticeable loss in performance for the older meters. Based on this information, City decided to dedicate limited funds to a new mesh wireless meter-reading system instead of continuing to replace the older meters with touch-read meters. City plans to have the older meters replaced and the new mesh wireless meter-reading system in operation by 2014 if funding can be secured.
- The meters in the new mesh wireless system will be tested and replaced based on the manufacturer's recommended schedule. Having accurate meter readings is an advantage for the City, so, of course, City will continue to test meters for accuracy.
- City bills customers monthly. A copy of the current water and wastewater (sewer) rates is included as Attachment C.
- City complies with water measurement and reporting standards in OAR Chapter 690, Division 85. City currently probes wells manually on a quarterly basis in addition to trending well levels via the SCADA system.

Table 6 shows the rest of the City's water conservation programs and benchmarks. It includes information about water reuse in the City.

690-086-0160 Municipal Water Curtailment Element

1. <u>Description of the type, frequency and magnitude of supply deficiencies within the past 10 years and current capacity limitation.</u>

   The last time the City requested voluntary curtailment, i.e. the first stage of curtailment, from all our customers was in 2002.

   Major maintenance issues are the main reason we have to utilize our water shortage plan. If the City has a major maintenance issue, we first request voluntary curtailment from the City Parks and the Pendleton School District. For example, there was one instance when the motor for one of our two main production wells failed in the summer. We requested that the City Parks Department stop irrigating the parks, and they complied. The restrictions were in effect for approximately one week.

2. <u>A list of three or more stages of alert for potential shortage or water service difficulties.</u>

   City Ordinance No. 3514, Attachment B, which has been provided to OWRD in past WMCPs, is an ordinance establishing regulations for the allocation of water resources to be effective whenever the Pendleton City Council finds there is a water shortage emergency. It lists several levels of curtailment should the City suffer a water shortage and provides penalties for violation thereof.

Initially, the City would cut back watering of City facilities, such as parks, would request voluntary cooperation from the school district and other large water users, and would advise customers (via the media and monthly bills) of the water situation and projected deficiencies and request voluntary curtailment (Section 9). If the demands and requirements of water consumers could still not be satisfied and water levels fell to below 90% of system capacity, the City would impose the First Level of Curtailment (Section 11) which would prohibit nonessential residential, commercial, institutional, or industrial uses. If the water shortage still continued and water levels continued to fall to below 90% of system capacity, the City could impose the Second Level of Curtailment (Section 12) which includes further restrictions and daily usage allotments, including prohibiting new private wells (which is non-enforceable according to OWRD) and enforcing daily usage allotments.

3. A description of pre-determined levels of severity of shortage or water service difficulties.

   Refer again to Ordinance No. 3514 and Section 2, above. Voluntary Water Use Curtailment (Section 9) would occur if demands were at or above 90% of system capacity. If customer demands could still not be satisfied "without depleting the water supply of the City to the extent that there would be insufficient water for human consumption, sanitation, and fire protection," the City Council could impose First and Second Levels of Curtailment as deemed necessary.

4. A list of specific standby water use curtailment actions for each stage of alert.

   Refer again to Ordinance No. 3514, Sections 9, 11, and 12 for specific actions and Section 2, above.

690-86-170 Municipal Water Supply Element

1. Delineation of the current and future service areas.

   According to the City Planner, the 2011 periodic review process did not demonstrate justification for expanding the City's existing urban growth boundary (UGB) at this time. Our future service area is still the existing UGB and the industrial reserve near the airport, as shown in Figure 2.

   City chose to use the 1997 ***Pendleton Urban Fringe land Use Study***, Phase II, by the Benkendorf Associates Corporation for population projections. This study was formally adopted by City Ordinance Number 3612 on September 21, 1999. It delineated three options for projected population growth: 1) a low range of 0.88% growth per year (Demand Option A); 2) a high range of 1.6% growth per year (Demand Option B); and 3) the historic growth rate of 1.4% growth per year (Demand Option C). A more recent, 20-year projection by Winterbrook Planning was used for the 2011 periodic review process, and it utilized the "safe harbor" population projection method and calculated an annual growth rate of 1.05% (Safe Harbor). All these population projections are shown on Figure 4, Pendleton Population Projections.

These population projections vary widely for the year 2100, but twenty years from now (2032) they are not that diverse, ranging from 20,159 to 23,269.

The City will begin working on a revised Water System Master Plan in late 2012/early 2013.

2. <u>Estimated schedule to exercise each water right and water permit.</u>

Figure 5, Pendleton Water Right Projections, shows the estimated water demand through 2100 and the City's water rights. These values are based on a peak daily demand of 12.0 MGD and assume water demand increases at the same rate as the population grows. (NOTE: Peak demand in 2009 was approximately 11.0 MGD.) Under Demand Option C, the historic growth rate of 1.4%, the City's currently certificated water rights (26.42 cfs) should accommodate the City's needs through about 2065. At that time, the City would need to perfect Permit G-2463 (20 cfs, priority date 1962) and, eventually, Permit G-3443 (8.7 cfs, priority date 1966). Under Demand Option C, the City would not fully exercise all its water rights until sometime after 2100. However, the City plans to incrementally perfect Permits G-2463 and G-3443 to provide redundancy within the system as soon as it is feasible to do so. A critical issue is the OWRD requirement of developing water rights in 25% increments. It is incredible that municipalities cannot partially perfect water rights based on actual incremental development of permits.

3. <u>Estimate of the water supplier's water demand projections for 10 and 20 years.</u>

Figure 6, Summer Water Demand Projections, shows the estimated summer demand projections through 2100.These are based on the peak daily usage of 12.0 MGD and assumes water demand increases at the same rate as the population grows. These projections also do not take into account the City's Aquifer Storage and Recovery (ASR) program. The ASR program allows the City to rely on surface water for much of its usage and not utilize the surface water rights for five to seven months of the year.

4. <u>Comparison of the projected water needs and the sources of water currently available.</u>

Figures 5 and 6 clearly show the City's projected water needs and the sources of water currently available under the peak summer demand scenario. As noted earlier, this does not take into account the City's ASR program. The City was able to store 500 MG of water in the underground aquifer during 2011, and projections are that we will store 700 MG this year. This water is available to meet summer demand needs. The City's ASR program is clearly our best means of addressing future water needs.

5. Expansion or initial diversion of water allocated under existing permits.

The City needs to begin development of water allocated under Permit G-2410 and Permit G-3225 within the next five to ten years. This will allow the City to build redundancy into its water system, which is especially important if the City is to develop a contingency plan to provide adequate water supplies during the summer months or times of drought. One of the main concerns is the loss of one of more of the wells due to equipment failure or other problems.

Figure 7, Current Capacity with Summer Use Scenarios & Loss of 2 Major Wells, demonstrates the need for further development to provide system redundancy. The current total system capacity, i.e. the total amount of water the wells are able to produce at this time, is 20.93 cfs. The current average peak usage, which is the average of peak days from 2005 to 2011, is 15.13 cfs (9.782 MGD). The various peak usage growth projections, based on the same population growth projections used in Figures 4 – 6, are shown in Figure 7. Notice that the City would be able to provide adequate supplies through 2017 if one major production well is lost. However, if two production wells are lost, the City would not be able to provide adequate water even currently, and if two of the major projection wells are lost, the current water supply would be totally inadequate. The latter, loss of two major production wells, is the scenario the City is basing its contingency planning on; i.e., the City plans to incrementally develop Permits G-2410 and G-3225 over the next 5 – 20 years to provide system redundancy.

In addition, if the surface water supply is lost for any length of time, which could occur due to equipment failure or problems at the Water Treatment Plant (WTP), an additional 2.5 cfs summer flow would be lost. Loss of the WTP during the winter months could also cause additional concerns about adequate supplies.

Therefore, the City needs to begin incrementally developing Permits G-2410 and G-3225.

(a) The City will continue to implement water conservation measures identified under OAR 690-086-0150. We estimate that all the conservation measures could reduce demand by approximately 10%. However, conservation measures alone will not be adequate to meet the City's projected needs.
(b) Due to the long distances between municipalities in eastern Oregon, interconnections with other municipal systems are not cost effective. The City

and the Confederated tribes of the Umatilla Indian Reservation (CTUIR) have discussed a possible interconnection, but there are a number of political hurdles that would have to be met to make that possible, and there is no indication at this time that either the City or CTUIR are ready to enter into an agreement.

(c) At this time, there are no additional water conservation measures that would provide water at a cost that is equal to or lower than the cost of incrementally developing Permits G-2410 and G-3225 to provide adequate redundancy for the City's water system.

6. Quantification of the maximum rate and monthly volume of water to be diverted.

Table 7, Water Requirements to Allow for System Redundancy (2013—2033), shows the daily maximum water needed to provide adequate system redundancy under the different population growth projections. Currently, the City needs to develop an additional 2.79 cfs daily (86.5 cfs monthly) to provide adequate system redundancy. By 2021, the City will need between 4 and 5.5 cfs daily (124 and 155 cfs monthly), and by 2033, the City will need between 5.5 and 8.5 cfs daily (180 and 264 cfs monthly).

In order to meet this need, the City plans to incrementally develop and perfect Permits G-2410 and G-3225. Partial perfection of these permits will be based on OWRD's incremental perfection requirements. Initially, the City plans to upgrade the pumping equipment in Mission Well # 7 (Permit G-3225) and develop it to its full capacity of 2.0 cfs. Mission Well # 7 provides a daily average of 0.74 cfs during the summer; the daily maximum it has produced in the last five years was 0.93 cfs. Improving this well will add approximately 1 – 1.25 cfs capacity.

Next, City plans to add Hospital Well #4 as an additional point of appropriation to Permit G-2410. The well was recently reconditioned and is currently capable of pumping 2.67 cfs, but the water right only allows 1.47 cfs. With these two additions, the City will still fall short of its redundancy needs.

There are several other options open for meeting the redundancy demand. City will consider developing Well #11 (Permit G-3225) which currently serves only the City's Wastewater Treatment Plant and two other residential customers. Well #11 could be reconditioned and added to the City's well field. This would also allow partial perfection of Permit G-3225. City will also consider adding the current Aquifer Storage & Recovery (ASR) wells to Permit G-2410 as additional points of appropriation and re-conditioning these wells to allow them to pump more water. These options will be more fully considered during the Water System Master Planning process, which is currently scheduled for 2013.

7. Description of mitigation actions taken to comply with legal requirements.

   The City will continue to comply with all legal requirements under the Endangered Species Act (ESA) and Clean Water Act (CWA) by maintaining the screens at the Umatilla River Intake to meet Oregon Department of Fish and Wildlife and US Fish and Wildlife standards. City will continue to work diligently with the Oregon Health Authority—Drinking Water Program to ensure compliance with all Safety Drinking Water Act (SDWA) requirements.

   Because the City's Aquifer Storage and Recovery (ASR) Program is an important component of our water conservation strategy, the City will continue to meet OWRD, DEQ and OHA—DWP requirements under Limited License #006.

   City will continue to promote water conservation measures and to maintain equipment in the water system so that there is no need for the additional water herein requested. However, City must plan for all possible scenarios.

8. Acquisition of new water rights.

   Acquisition of new water rights for the next 20 years will not be necessary.

690-086-0130 Approval Criteria for Access to Water under an Extended Permit

7. The Final Order Incorporating Settlement Agreement Extension of Time for Permit Number G-2410, "extends the time to complete construction to October 1, 2076, and the time to fully apply water to beneficial use to October 1, 2076." It further states, "Diversion of water beyond 2.56 cfs under Permit G-2410 shall only be authorized upon issuance of a final order approving a Water Management and Conservation Plan under OAR Chapter 690, Division 86."

   The Final Order did not place further restrictions on diversion of water under G-2410. Therefore, City requests the final order approving the WMCP contain language that allows the City to develop Permit G-2410 as it deems necessary.

   The Final Order Incorporating Settlement Agreement Extension of Time for Permit Number G-3225, "extends the time to complete construction to October 1, 2076, and the time to fully apply water to beneficial use to October 1, 2076." It further states, "Diversion of water beyond 1.07 cfs under Permit G-3225 shall only be authorized upon issuance of a final order approving a Water Management and Conservation Plan under OAR Chapter 690, Division 86."

   The Final Order did not place further restrictions on diversion of water under G-3225. Therefore, City requests the final order approving the

WMCP contain language that allows the City to develop Permit G-3225 as it deems necessary.

(a) The City's schedule for development of conservation measures is described in 690-0186-0150 and Table 6. We estimate that all the conservation measures could reduce demand by approximately 10%. However, conservation measures alone will not be adequate to meet the City's projected needs.
(b) Increased development of the City's Aquifer Storage and Recovery (ASR) system and increased use from the already developed wells are the City's most feasible means of providing adequate water supplies for the next 20 years.
(c) Mitigation issues are discussed in 690-086-0170 (7).

TABLE 2 CITY OF PENDLETON WATER RIGHTS

Source	Application No.	Cert. No. (*Certificated Water Rights*)	Permit No.	Transfer No.	Rate (cfs)	Priority Date	Description/ Source	Location	Comments	Pump	Max. Pump Rate to System	Max. Annual Quantity Allowed	Historic Max. Rate Instantaneous: Native GW	Historic Max. Rate Instantaneous: ASR
SURFACE WATER	Decree (D-2604)	85849	Decree (D-2604)	T-8640	2.0	November 11, 1885	Uma. R.	Uma. R. Intake			898 gpm (1.29 MGD)	472 MG	898 gpm (1.29 MGD)	N/A
	Decree (D-2582)	85846	Decree (D-2582)	T-8721	0.5	1890	Uma. R.	Uma. R. Intake			224.4 gpm (0.32 MGD)	118 MG	224.4 gpm (0.32 MGD)	N/A
	S-1069	86028	458	T-8704	7.2	November 12, 1910	N. Fork Umatilla R.	Uma. R. Intake			3231 gpm (4.65 MGD)	1699 MG	3231 gpm (4.65 MGD)	N/A
	S-1100	85850	S 472	T-8761	3.8 total	April 22, 1929	Springs near Thorn Hollow	Uma. R. Intake 73400 Mytinger Lane T-8761 transferred the POD to the mainstem Umatilla R.	See (1) below		1705 gpm (2.46 MGD)	897 MG	1705 gpm (2.46 MGD)	N/A
	S-2310	85851	S 1197	T-8761			Shaplish Springs		See (2) below					
	S-12679	85853	S 9007	T-8761			Three Simons Springs		See (3) below					
	S-12678	85852	S 9006	T-8761			Long Hair Spring & Squaw Creek Spring		See (4) below					
			ORS 538.450		All Waters	March 8, 1941	Umatilla River	Uma. R. Intake 73400 Mytinger Lane	POD allowed at surface water intake as per SB 869		1514 gpm (2.18 MGD) See (7) below	Max. TBD by OWRD & MOA w/ CTUIR	5139 gpm (7.4 MGD) See (7) below	N/A
		MAXIMUM	SURFACE		23.3 cfs									
GROUNDWATER	U-158	20838	U 152		3.1	February 23, 1944	Well # 1	Byers Well @ 112 SE 18th		250 hp	1250 gpm (1.80 MGD)	944 MG	1796 gpm (2.59 MGD)	1250 gpm (1.80 MGD)
	G-2386	46096	G 2204		0.9	July 16, 1962								
	G-629	20840	U 579		2.51	September 16, 1953	Well # 2	Round-Up Well @ 1105 SW Court Ave.		450 hp	1950 gpm (2.81 MGD)	1324 MG	2519 gpm (3.63 MGD)	N/A
	G-2385	46094	G 2203		3.1	July 16, 1962								
	U-455	20839	U 418		1.11	December 31, 1951	Well # 3	SW 21st St. Well @ 708 SW 21st St.		100 hp	490 gpm (0.71 MGD)	309 MG	588 gpm (0.84 MGD)	N/A
	G-2384	46095	G 2202		0.2	July 16, 1962								
	U-755	86482	U 670	T-5604	1.47	October 18, 1954	Well # 4	Hospital Well @ 2420 Westgate		250 hp	660 gpm (0.95 MGD)	347 MG	660 gpm (0.95 MGD)	N/A
	G-1273	29147	G 1160		5.3	October 3, 1958	Well # 5	Stillman Well @ 27 SE 5th		400 hp	1900 gpm (2.74 MGD)	1250 MG	2380 gpm (3.43 MGD)	2800 gpm (4.03 MGD)
	G-11326	82840	G-10508		3.01	December 5, 1984	Well # 8	Prison Well @ 2580 NW Westgate Dr.		200 hp	1000 gpm (1.44 MGD)	1069 MG	2034 gpm (2.93 MGD)	N/A
	G-7338	86483	G 6773	T-5605	1.52	April 16, 1976								
	G-532	85847	G-465	T-8434	1.7 cfs total	March 5, 1957	Well # 14	5400 Rieth Rd	See (5) below	100 hp	540 gpm (0.78 MGD)	401 MG	763 gpm (1.10 MGD)	540 gpm (0.78 MGD)
	G-3241	85848	G-3044	T-8434		September 27, 1965			See (6) below					

NOTE: The type of beneficial use for all of the City's water rights is municipal.

(1) Certificate No. 85850: Source: Springs near Thorn Hollow, a tributary of the Umatilla River. The amount of water to which the right is entitled shall not exceed 3.8 cfs. This right, in combination with Certificates 85851, 85852 & 85853, is limited to a total diversion of not to exceed 3.8 cfs.

(2) Certificate No. 85851: Source: Shaplish Springs, a tributary of the Umatilla River. The amount of water to which the right is entitled shall not exceed 3.0 cfs. This right, in combination with Certificates 85850, 85852 & 85853, is limited to a total diversion of not to exceed 3.8 cfs.

(3) Certificate No. 85852: Source: Long Hair Spring & Squaw Creek Spring, tributaries of the Umatilla River. The amount of water to which the right is entitled shall not exceed 2.0 cfs. This right, in combination with Certificates 85850, 85851 & 85853, is limited to a total diversion of not to exceed 3.8 cfs.

(4) Certificate No. 85853: Source: Three Simons Springs, tributaries of the Umatilla River. The amount of water to which the right is entitled shall not exceed 2.7 cfs. This right, in combination with Certificates 85850, 85851 & 85852, is limited to a total diversion of not to exceed 3.8 cfs.

(5) Certificate No. 85847: The amount of water to which the right is entitled shall not exceed 1.21 cfs. This right, in combination with Certificate 85848, is limited to a total diversion of not to exceed 1.7 cfs, and shall be further limited to a diversion of not to exceed 607.2 acre feet for year round use.

(6) Certificate No. 85848: The amount of water to which the right is entitled shall not exceed 1.33 cfs. This right, in combination with Certificate 85847, is limited to a total diversion of not to exceed 1.7 cfs, and shall be further limited to a diversion of not to exceed 607.2 acre feet for year round use.

(7) Legislative Right ORS 538.450: This right was exercised exclusively while waiting for transfers for the other surface water rights; hence the historic instantaneous rate of 5139 gpm (7.4 MGD). More recently, maximum withdrawal under this right was 1514 gpm (2.18 MGD).

TABLE 2 cont. CITY OF PENDLETON WATER RIGHTS

Water Right Permits not currently certificated

Source	Application No.	Cert. No.	Permit No.	Transfer No.	Rate (cfs)	Priority Date	Description/ Source	Location	Comments	Pump	Max. Pump Rate to Dist. System	Max. Annual Quantity Allowed	Historic Max. Rate Instantaneous: Normal Ops	Historic Max. Rate Instantaneous: Flow Test
GROUNDWATER	G-2463	N/A	G-2410	T-8159	6.7	October 10, 1962	Well # 6	Sherwood Well			undeveloped	4719 MG	NA	
					6.7		Well # 9	South Hill Well	Extension of Time to		undeveloped			
					6.7		Well # 10	Crispin Well	Develop granted; have		undeveloped			
					6.7		Well # 12	McCormack Well	until October 1, 2076		undeveloped			
					(Total not to exceed 20 cfs)		Well # 14	5400 Rieth Rd.	POA added to G 2410					
	G-3443	N/A	G-3225		2.0	April 4, 1966	Well # 7	Mission Well @ 73740 Reservoir Ln	Extension of Time to Develop granted; have until October 1, 2076	60 hp	475 gpm (0.68 MGD)	472 MG	898 gpm (1.29 MGD)	
					6.7	April 4, 1966	Well # 11	McKay Creek Well @ 4255 SW 28th Dr		5 hp	28 gpm (0.04 MGD)	1581 MG	3007 gpm (4.33 MGD)	500 gpm (0.72 MGD)

NOTE: The type of beneficial use for all of the City's water rights is municipal.

Murray, Smith & Associates, Inc.
Engineers/Planners

APPENDIX B
AMI Technical Memorandum

Murray, Smith & Associates, Inc.
Engineers/Planners
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TECHNICAL MEMORANDUM

DATE: February 28, 2014

PROJECT: Financial Evaluation for Advanced Metering Infrastructure

TO: City of Pendleton, Oregon

FROM: Shawn A. Kohtz
Murray, Smith & Associates, Inc.

RE: Summary of Advanced Metering Infrastructure Financial Analysis

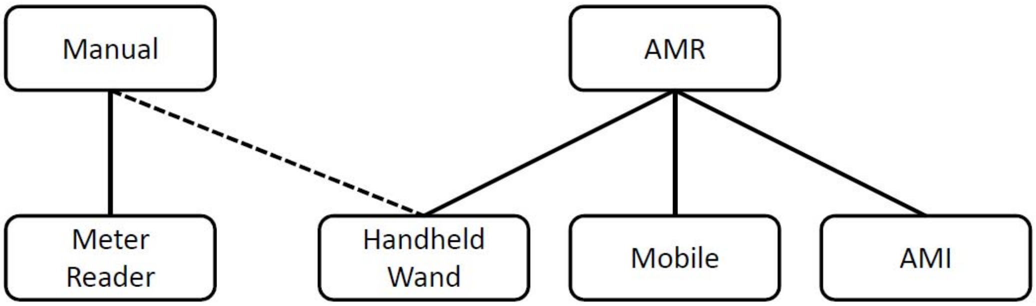
Purpose

This technical memorandum is written to summarize the financial analysis of a fixed base automated meter reading (AMR) system also known as advanced metering infrastructure (AMI) specific to the City of Pendleton's (City) potable water system. This analysis is intended to assist the City in making the decision between continuing its current meter reading operations or changing to an AMI system for meter reading.

Meter Reading Technology

There are two primary categories for meter reading technology: manual and AMR. Manual meter reading is accomplished by removing the lid on a meter pit and manually reading the register of a water meter. AMR refers to collection of consumption data without having to directly access a meter. This is generally accomplished by radio frequency transmission of data to a collector from a data transmitter, called an endpoint, connected to the register of a water meter. AMR may be further classified into touch read (handheld wand), mobile read and AMI (fixed base systems), depending on the type of data collector used. Each AMR system type has a unique data collector. A schematic of meter reading technology is provided in

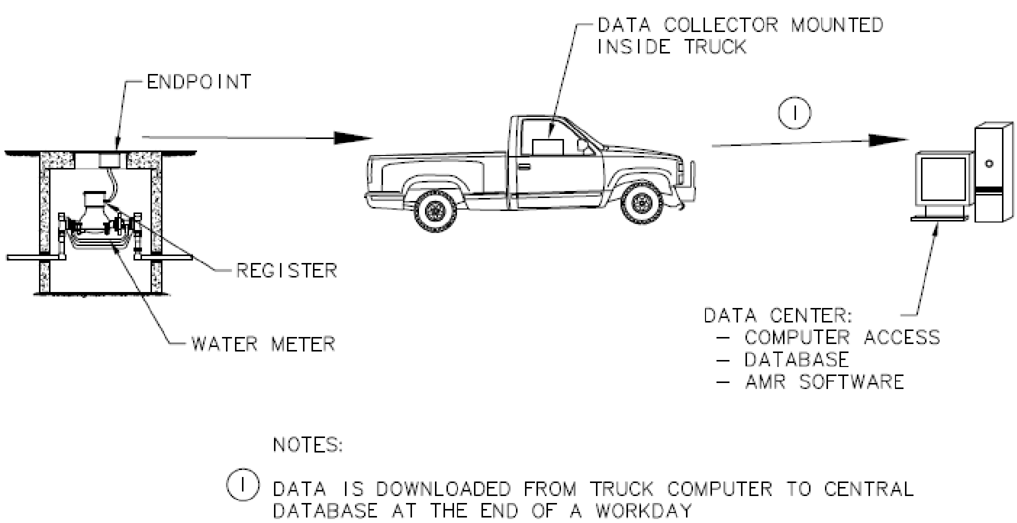
Figure 1
Automated Meter Reading Technology Schematic



A touch read system, similar to what the City currently has for a majority of its meters, also referred to as handheld or walk-by meter reading, consists of a meter reader waving a wand or probe over a meter pit. When a button is pressed on the handheld unit of the probe, this activates a radio transmission from an endpoint in the meter pit. The probe will accept a radio transmission from the endpoint, which is encoded with a serial number that matches the meter read with an address. A meter reader will download that information to a database at the end of a workday. Meter reads are then imported into billing software.

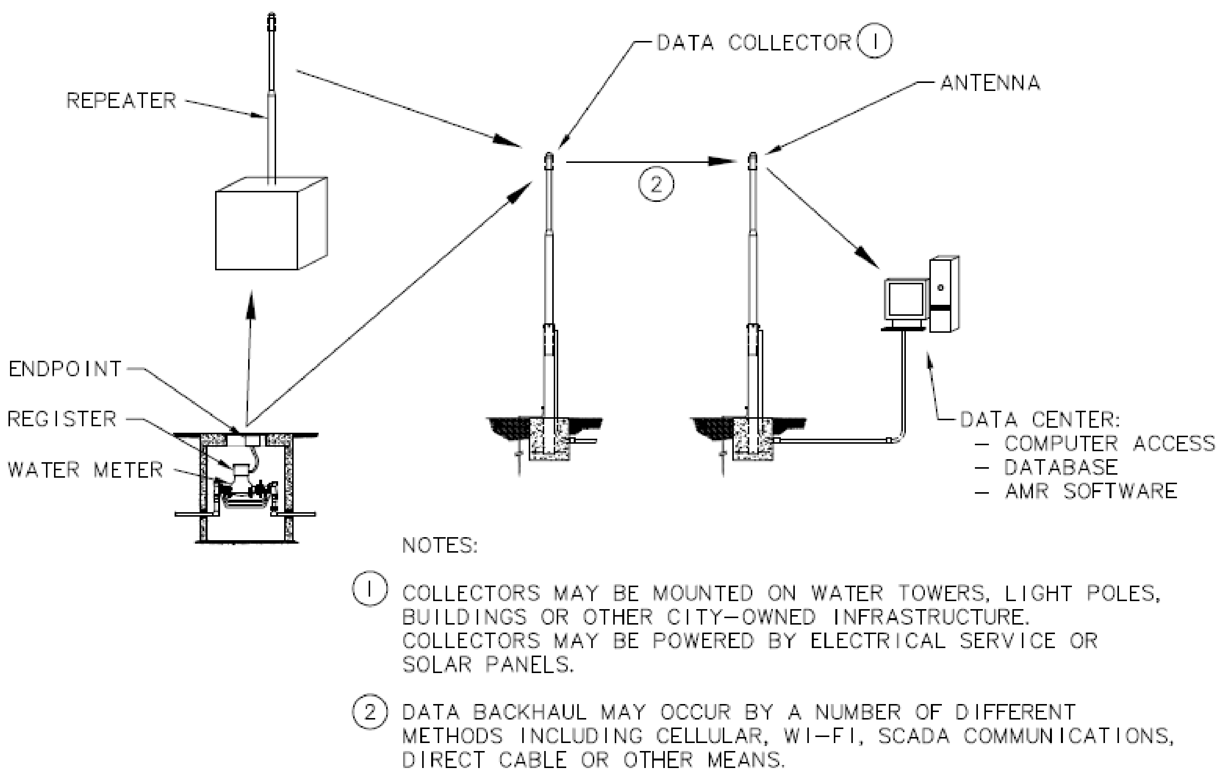
Mobile meter reading, also called a drive-by system, consists of placing a data collector in a vehicle. A technician drives the vehicle within the vicinity of water meters that have an endpoint. The data collector receives a radio frequency from the endpoints, which store the meter readings. An endpoint may store and transmit multiple reads since the last time it was read. Typically, a GPS device is mounted in a vehicle directing the meter reader on a specific route. Mobile meter reading generally includes a laptop with the associated meter read software. A meter reader drives a service area until all meter data is collected for a billing period. Data is then downloaded to a server and imported into billing software. A summary of the components of mobile meter read technology is provided in Figure 2.

Figure 2
Mobile Meter Read Components



AMI refers to a network of data collector infrastructure placed throughout a service area that automatically receives signals from meter endpoints. Data collectors then transmit data to a central server by cell phone, Wi-Fi, SCADA, or other data backhaul system. AMI systems typically read all meters in the system every day without the need to send field personnel to read meters. AMI data collectors are generally mounted on municipal infrastructure, such as water towers or utility poles. Data collectors range in size from approximately the size of a laptop to a 3-foot by 4-foot enclosure. Collectors require a power source from a direct service line or a solar panel and battery. Components of an AMI system are shown in Figure 3.

Figure 3
AMI Meter Read Components



AMR technology has changed rapidly over the past several years, particularly with respect to AMI systems. Communication between an endpoint and a data collector has become more reliable. Also, manufacturers have designed batteries for endpoints with a service life of 20 years based on radio transmissions within their design parameters. The standard warranty for batteries is a 10-year full warranty and an additional 10-year prorated warranty.

AMI systems now have the capability for two-way communication between a data collector and an endpoint. The primary function of two-way communication is to synchronize the endpoint time-stamp with a standard clock. This corrects a time shift error that can occur in the endpoints and allows the data to be correlated with other real-time water system data from SCADA. Two-way communication also allows a level of programming to be sent from a central computer to endpoints without an operator field visit.

Meter register technology has also recently improved to provide low resolution flow metering to one-tenth of a gallon. Low resolution flow metering makes leak detection and backflow detection through individual meters reliable.

Based on City input, the financial analysis was limited to a comparison of AMI technology to the City's current operations.

Advantages of AMI

The primary advantage of AMI over mobile AMR and manual meter reading is the availability of high resolution, real-time data and the quantity of data available for operations troubleshooting, engineering analysis, and customer support applications. In addition to these advantages, manpower requirements are reduced for meter reading and customer service. Data from AMI systems is primarily being used in the following ways:

- Customer service support.
- Leak detection.
- Backflow detection.
- Enhanced water system security.
- Eliminate interim physical meter reading for customer service termination or initiation.
- Limit or eliminate re-read trips by field personnel.
- Support of water conservation efforts through rate structures.
- Water demand management.
- Engineering design support.
- Water department operations troubleshooting.
- Water modeling and master planning data support.
- Sewer modeling and master planning data support.

Customer service can be vastly improved due to the data capabilities available from an AMI system. This will result in significantly less time required from field personnel and office staff to answer customer complaints.

Although most City residents irrigate through the City water system, for any non-potable irrigation connections, the backflow detection capabilities of an AMI system are valuable to protect the potable water system, primarily from bacterial contamination in a cross-connection backflow event. In many observed backflow events, potable and irrigation water systems are physically connected. In some cases, a potable water supply is used to backup an irrigation water supply when irrigation water is not available. Water system operators would be able to quickly identify backflow locations and correct the associated issue.

AMI systems can also offer many water conservation and demand management benefits, such as time-of-use rate capabilities.

Other utilities in the region have implemented AMI or pilot AMI projects, including the City of Bend, City of Redmond and United Water Idaho (UWI) in Boise. The City can leverage these other utility's experiences.

United Water Idaho Pilot Experience

- ***Enhanced Customer Service:*** UWI indicated that the most valuable aspect of its AMI technology is enhanced customer service, primarily due to data that is immediately available to customers and customer service personnel. With AMI technology, customer service inquiries can generally be handled by phone calls and email instead of a field inspection by a meter technician. AMI and the associated software allow customer service personnel to describe an issue from the data that is available in near real-time. Data can also be emailed to a customer or made accessible via a secure website, so customers can review the data.
- ***Reduced Field Visits:*** Field inspections are substantially reduced or skipped, interim and re-reads eliminated when manual reads are replaced with AMI technology. With AMI, an inactive customer account will immediately register water usage if someone has not set up an account but is using water, so a field visit is no longer necessary to obtain a new read to open or close an account. A meter reading may be obtained at the hour that a customer moves into or out of, a new residence.
- ***Leak Detection:*** Leaks can be rapidly detected by evaluating predefined reports that are auto generated by the equipment software. If detected early, they can be eliminated before significant damage to a structure is realized. Early leak detection can also reduce high bill complaints and the customer service time to review such complaints. UWI discovered that high bills due to leaks averaged nearly $200 per leaking service with bills as high as $8,000 to a customer due to major leaks. Often, there is substantial customer service time associated with high bill complaints and correcting leak issues without the detection capabilities of AMI.
- ***Backflow Detection:*** Backflow detection may be achieved by observance of a reverse-flow condition through a meter. This is particularly true of municipalities that have separate irrigation systems. UWI indicated a number of examples where they observed bacterial contamination in their water distribution system. In those cases, a substantial field investigation was employed to narrow and identify the source of backflow and eliminate it. Backflow detection is vastly simplified with AMI, and subsequently protection of the drinking water supply for human health is significantly improved.

- ***Low Flow Resolution Meter Registers:*** An important consideration is that low flow resolution meter registers must be installed to obtain adequate leak detection and backflow detection capabilities of an AMI system. An option to obtain this function is to replace the meter registers and leave the existing meter in place.
- ***Hourly Data:*** Hourly data gathering was considered vital for leak detection, backflow detection, customer service support, and other informational benefits. The endpoint radio frequency is very important for data transmission to and from data collectors. Lower radio frequency transmission produced better communication reliability. Two-way communication between the endpoints and data collectors was also considered critical. This was due to time synchronization between endpoints and data collectors as well as the ability to send programming instructions to endpoints without having to send a field technician and physically touch the endpoints.
- ***Battery Life:*** 20-year battery life of the endpoints is critical to realizing the value of an AMR system. However, due to the newness of the technology, consistent 20-year battery life is still unproven.

City of Bend and City of Redmond Experience

- ***Number of Meter Readers Reduced:*** Though both utilities had contracted out meter reading services, similar to Pendleton's, when switching from manual reading to AMI, the number of meter readers was reduced. Although some employees partially transitioned from meter readers to information technology personnel.
- ***Seamless Data Inputs to Billing:*** During a transition to AMI, data inputs to billing must be seamless for billing purposes. It is critical not to miss a billing cycle.
- ***Utility Department Customer Service:*** Customer service should be deployed through the utility department instead of the finance department due to the ability to identify issues from customer descriptions.
- ***Data Collector Overlap:*** Multiple data collector overlap should be used to provide redundancy for data transmission. Additionally, meter lids can substantially impact data transmission from a data collector to an endpoint when using 2-way communication. This is generally not a consideration for the City of Pendleton, because antennas have already been placed through most of the meter pit lids. The City of Bend, however, uses ductile iron lids and installed data collectors prior to installing new meters and endpoints, so that data transmission could be checked by the installer prior to leaving a meter site. Ductile iron lids were only replaced in the field if data transmission was shown to be limiting.
- ***Solar Powered Data Collectors:*** Data collectors were powered by solar cells, eliminating the need for a direct power service. Data collectors were in many cases mounted on light poles owned by the municipality. Some mounts were on other City infrastructure, such as water towers and buildings. If mounting on infrastructure owned by other utilities, the mounting locations should be discussed early in the project due to time required for negotiations.

- ***Prequalifying Contractors and Vendors:*** A number of recommendations were made for the prequalification of contractors and vendors during the selection of AMI systems. It was strongly recommended to prequalify equipment vendors to help ensure a positive and supportive experience when building a new AMI system.
- ***Water Conservation Support:*** The AMI systems are being used to support water conservation efforts and to maximize water supply. This is a critical issue for the City of Redmond and the City of Bend. An AMI system can support water rate structures and conservation efforts.
- ***Reduced Injuries and Accidents:*** Worker injuries and vehicle accidents are reduced due to the reduction in field operations. Access to private property is no longer necessary to obtain meter reads.
- ***Transition to AMI:*** It is essential to have a project manager that works for the City and who is from the City's IT Department when installing the system and transitioning from the current meter reading data system to a new AMI system. Without this project manager, there may be severe consequences when programming endpoints, entering installation data into the AMI system software, and subsequent integration with the City's billing software. The AMI vendor should also provide a project manager that interfaces with the City's IT project manager to ensure the above items are completed properly.
- ***Mesh Network vs. Star Network AMI:*** Several companies have attempted to provide a product with a "mesh network" AMI system. Those companies have had problems demonstrating long-term viability of the product due to demands placed on batteries. Until the mesh network technology is proven, it is suggested to use "star network" technologies for AMI, such as the Sensus, Neptune, Aclara, and Itron vendor systems.
- ***Installation Protocols:*** Ensure that the City obtains a standard protocol and training for installation of new meters, endpoints, and data collector infrastructure from the equipment vendor. Additionally, the equipment vendor's project manager should develop a protocol and training to demonstrate the process to incorporate new meter accounts into the data management system for both the AMI software and the City's billing software.

Existing City Meter and AMR System

The City owns and maintains meters that are used to measure water usage by residential, commercial, public, and industrial customers. Subsequently, water customers are billed for quantities of water used. To obtain data for billing, the City currently employs two different meter reading technologies. A majority of the City's meters are read using a touch read AMR system. The remaining meters are read manually. A summary of existing meter reading technology is provided in Table 1.

Table 1
Existing Meter Reading Technology

Meter Type	Number in System
Touch Read Meters	4,408
Manual Read Meters	1,776
Total	**6,184**

When upgrading to an AMI system, the City has two options to connect to AMI endpoints. The first option is to replace meters and registers throughout the system to create compatibility with the new endpoints. The second option is to retrofit existing meters with new registers to obtain endpoint compatibility. Bench testing of older meters throughout the City indicated that meter accuracy is still reasonably good. Additionally, Staff determined that water loss through the distribution system is less than 5%, indicating that the current water meter replacement program is adequate. This allows the City to replace meter registers rather than the full meter and register when upgrading to an AMI system. A register that is compatible with AMI endpoints would be retrofitted to existing meters thereby reducing costs associated with replacing an entire meter and register. Since meter accuracy is reasonably good, there isn't a driver to simultaneously replace meters and registers as part of an AMI project. The primary meter types are Sensus and Neptune meters, which are two of the largest meter and AMR manufacturers. In most cases, meters from both manufacturers may be upgraded with new meter registers to connect to an AMI endpoint.

Analysis and Financial Model Summary

A financial model was developed to account for changes in costs and savings relative to current operation if an AMI system is implemented in place of the current touch read and manual read system. Two financial model scenarios were analyzed including:

- Comparison relative to current 9-month contract meter reading operations.
- Comparison relative to year-round City staff meter reading.

Model Inputs

Financial Assumptions

All scenarios include a base assumption that the project is funded by a loan with an interest rate of 3.5% over a 20-year loan period. The population growth rate over that period is assumed to be 1.18% per year based on historical census data. Lastly, costs are assumed to increase at annual rate of inflation of 3%.

A contractor will install the AMI system, so contractor overhead and profit, as well as contingency are included at 15% and 5% of the equipment and installation costs, respectively. It is assumed that the system will be installed and become functional within a one-year time frame.

Meter Register Replacement

One-year implementation would require retrofit replacement of the existing meter registers to connect to an AMI endpoint. Alternatively, the full meter and register may be replaced at a higher cost to obtain compatibility. As the City's water meters are reporting accurately, only register replacement is recommended. The assumption of this analysis is that all meters will require a register replacement to obtain AMI compatibility.

AMI Data Collectors

In conjunction with Sensus, Ferguson Waterworks prepared a signal propagation study to determine the number of Sensus data collectors that would be required to provide signal coverage for an AMI network in the City service area. The propagation study indicated that three Sensus data collectors should be placed at the Airport, on Goad Road, and the South Hill Reservoir as shown on the map presented in Appendix A1. The financial analysis includes costs for data collectors to provide coverage of the entire City based on the Sensus propagation study. A new propagation study should be completed if another vendor is used; however, costs for data collector infrastructure across the major AMI suppliers tend to be competitive.

Endpoints

A new AMI endpoint must be connected to each meter register in the system, after replacement of endpoint compatible registers, to transmit meter reads to data collectors. Endpoints represent the single greatest capital expense of an AMI system. The endpoint vendor must be the same as the data collector vendor. However, most AMI vendors have developed compatibility with the major water meter vendors. Once selected, the City will be committed to the AMI vendor's equipment. However, the City will retain options for meter replacement vendors in the future.

Meter Pit Lids

Transmission of data from an endpoint to a data collector requires that the signal must be able to be sent outside the meter pit. This may be accommodated by drilling a hole in existing meter pit lids and mounting an antenna on the pit lid. Alternatively, radio-friendly lids may be placed on the pits. Because the City currently operates a touch read system, data transmission is already accommodated from most meter pits through the City. Therefore, $34,000 is allotted to retrofit or replace pit lids as necessary to implement an AMI system.

Meter Pits

It is assumed that all meter pits are accessible and in reasonable condition for a contractor to install registers and endpoints. In some cases, meter pits may be in poor condition or inaccessible. It is assumed that these pits would be addressed by City staff prior to installation of an AMI system and no cost for this is included in the analysis.

Additional Financial Model Cost and Benefit Assumptions

- The number of field personnel required to read meters is assumed to be reduced from the current contract meter reader costs and staff time represented by a combined full-time staff equivalent (FTE) of 0.83 FTE to 0 FTE upon full AMI system implementation.
- Additional staff time will be required to maintain data collectors and provide additional endpoint maintenance at an annual cost of $7,200.
- Staff will continue to perform meter turn-on and turn-offs for delinquent accounts and audit meter reads.
- For basic data tracking, 0.125 FTE is assumed to be added.
- For contract database services and software licensing associated with the AMI system, $12,000 per year is assumed.
- The number of vehicles used by City staff associated with meter reading and read verification activities is assumed to be reduced from 50% of one vehicle per year to 10% of one vehicle per year at a cost of $0.565 per mile and an annual average mileage per one vehicle of 20,000 miles.
- Customer calls and re-bills are assumed to be reduced by 62% and 50%, respectively, upon construction of an AMI system. The savings per customer call is estimated at $2.52 per call and the savings per re-bill is $20/bill.
- The number of special reads, turn-on and turn-off activities, is assumed to be reduced by 56% after implementation of an AMI system. The cost per activity is estimated at $27 per field visit.
- All personnel, O&M and system component costs and savings are assumed to grow at the annual population growth rate.
- Hardware pricing is provided from vendor budgetary quotes.
- All meters are located in meter pits or vaults.
- Data input clerk time associated with entering meter read data into the billing system and verifying accuracy of meter reads is assumed to be reduced by 0.12 FTEs based on an annual salary of a full FTE including overhead of $63,000.
- Data backhaul costs to transfer data from three data collectors to a central server are assumed to be $2,880 per year.

Model Results

Results of the financial model are summarized in Tables 2 and 3 comparing the costs and benefits for implementation of a new AMI system (details of the model and results are provided in Appendix A2). Table 2 shows a summary of financial analyses comparing the costs and benefits for implementation of a new AMI system relative to current, contract meter reading system costs. Table 3 shows the comparison of a new AMI system relative to the City staff assuming meter reading duties.

If the model shows a net gain (black net present value), the system will pay for itself within the payback period listed. If the model shows a net loss (red net present value), the proposed AMI system is not as cost effective as current operations. The financial analysis was completed over a 20-year time period, which is the life of AMI components according to industry standards.

Two financial scenarios were analyzed. The first scenario assumes that the contract meter reader continues to provide meter reading services for the next 20 years with a 3% rate of cost inflation. The second scenario assumes City staff read meters at a similar rate to other communities that have comparable meter reading methods. The result is 5,500 meters read per month per City full time employee equivalent (FTE), requiring 1.1 FTEs each month to read all 6,184 meters within the City. The Public Works Department provided meter reader salary, benefits and overhead data for this analysis and a 3% rate of cost inflation was also applied to a City employed meter technician.

Each scenario assumes that the City would finance a new AMI system with an interest rate of 3.5% over a 20-year loan period. Benefit and cost analysis also accounts for the City's historic growth rate over the past several decades equal to 1.18%. Scenarios 1 and 2 are not an identical comparison to one another because the contract meter reader does not read meters every month. Currently the contract meter reader does not read water meters during three winter months. Scenario 2 assumes that City staff read water meters every month.

The financial analysis indicates that current contract meter reading services are less expensive than a new AMI system. After 20 years, the AMI system would incur an additional cost of $229,000 relative to current operations.

Scenario 2 indicates that a new AMI system would be more cost effective than a City employee that reads meters every month of the year. Under scenario 2, the savings from an AMI system would be approximately $329,000 at the end of 20 years.

Under Scenario 1 it should be noted that, if the contract meter reader read meters every month (including winter), the cost/benefit analysis would be nearly equal to Scenario 2 for a City employed meter reader.

The financial analysis accounts for quantifiable costs and benefits, such as savings in meter reader salary; however, some benefits are not directly quantifiable, such as the value of data for operator troubleshooting, and are not included in the analysis. Current meter reading operations provide one meter read per month, except during three winter months, per water customer. An AMI system would provide one meter read per hour per water customer year round. The data from an AMI system may be used for other beneficial purposes that are unquantifiable, such as operations troubleshooting, real-time tracking of water use by customers, leak detection (preventing flooding damage in homes or businesses), backflow detection (protection of the potable water supply and public health), water theft tamper detection, engineering analysis, as well as other uses. If a value of $14,350 per year is assigned to the data for unquantifiable benefits of an AMI system, the financial analysis would favor implementation of an AMI system in place of the existing contract meter reader over the 20-year analysis period.

Based on the net present value and payback period, the cost/benefit ratio to convert to AMI meter reading technology is approximately 1.0. From a financial standpoint, the City is justified to either continue its current meter reading operations or transition to AMI meter reading. The additional unquantifiable benefits of an AMI system may drive a transition to AMI.

City Council requested information about the annual savings required to purchase and install an AMI system rather than fund the system through a loan. The probable capital cost to purchase and install the build-out system in January 2014 would be approximately $2,330,000. To save funds until an AMI system could be installed, a target date for installation must be selected. Then, annual savings may be calculated accounting for inflation and the time value of money. As shown in Tables 2 and 3, the annual debt service on a 20-year loan to fund the system would be approximately $164,000 per year. Therefore, the required annual savings to install the system would be near that value if the target installation date was 20 years.

Table 2
Comparison of AMI System to Current Contract Meter Reading Services

Year		Meter Reading and Associated Benefits		Field Work/ Services	Customer Service Impact	Total Benefits & Savings	Total Costs[5]	Net Costs & Benefits	Net Present Value	Cumulative Net Present Value	Payback Period (years)
		Savings Salaries & Benefits[1]	Savings Vehicles[2]	Field Services Special Reads[3]	Call Center & Customer Accounting[4]						
2013	1	$40,000	$5,000	$39,000	$17,000	$101,000	($164,000)	($63,000)	($60,870)	($60,870)	> 20
2014	2	$42,000	$5,000	$41,000	$18,000	$106,000	($164,000)	($58,000)	($54,144)	($115,013)	
2015	3	$44,000	$5,000	$43,000	$19,000	$111,000	($164,000)	($53,000)	($47,803)	($162,816)	
2016	4	$46,000	$5,000	$44,000	$20,000	$115,000	($164,000)	($49,000)	($42,701)	($205,517)	
2017	5	$48,000	$6,000	$46,000	$21,000	$121,000	($164,000)	($43,000)	($36,205)	($241,722)	
2018	6	$50,000	$6,000	$48,000	$22,000	$126,000	($164,000)	($38,000)	($30,913)	($272,635)	
2019	7	$52,000	$6,000	$50,000	$22,000	$130,000	($164,000)	($34,000)	($26,724)	($299,358)	
2020	8	$54,000	$6,000	$52,000	$23,000	$135,000	($164,000)	($29,000)	($22,023)	($321,381)	
2021	9	$56,000	$7,000	$54,000	$24,000	$141,000	($164,000)	($23,000)	($16,876)	($338,257)	
2022	10	$59,000	$7,000	$57,000	$25,000	$148,000	($164,000)	($16,000)	($11,343)	($349,600)	
2023	11	$61,000	$7,000	$59,000	$26,000	$153,000	($164,000)	($11,000)	($7,534)	($357,134)	
2024	12	$64,000	$7,000	$62,000	$28,000	$161,000	($164,000)	($3,000)	($1,985)	($359,120)	
2025	13	$67,000	$8,000	$64,000	$29,000	$168,000	($164,000)	$4,000	$2,558	($356,562)	
2026	14	$69,000	$8,000	$67,000	$30,000	$174,000	($164,000)	$10,000	$6,178	($350,384)	
2027	15	$72,000	$8,000	$70,000	$31,000	$181,000	($164,000)	$17,000	$10,147	($340,237)	
2028	16	$75,000	$9,000	$73,000	$32,000	$189,000	($164,000)	$25,000	$14,418	($325,819)	
2029	17	$79,000	$9,000	$76,000	$34,000	$198,000	($164,000)	$34,000	$18,945	($306,874)	
2030	18	$82,000	$9,000	$79,000	$35,000	$205,000	($164,000)	$41,000	$22,073	($284,802)	
2031	19	$85,000	$10,000	$82,000	$37,000	$214,000	($164,000)	$50,000	$26,008	($258,794)	
2032	20	$89,000	$10,000	$86,000	$38,000	$223,000	($164,000)	$59,000	$29,651	($229,142)	

[1] *Includes reduction in manual contract meter reading staff, addition of AMR system related staffing, and direct O&M costs on AMR system.*
[2] *The number of vehicles used by City staff associated with meter reading and read verification activities is assumed to be reduced from 50% of one vehicle per year to 10% of one vehicle per year at a cost of $0.565 per mile and an annual average mileage per one vehicle of 20,000 miles.*
[3] *Decrease in field services.*
[4] *Includes savings from reduction in number of customer calls and rebills.*
[5] *Total costs include fixed data collectors, software and data management system, registers, and endpoints.*

Table 3
Comparison of AMI System to City Staff Meter Reading Services

Year		Meter Reading and Associated Benefits		Field Work/ Services	Customer Service Impact	Total Benefits & Savings	Total Costs[5]	Net Costs & Benefits	Net Present Value	Cumulative Net Present Value	Payback Period (years)
		Savings Salaries & Benefits[1]	Savings Vehicles[2]	Field Services Special Reads[3]	Call Center & Customer Accounting[4]						
2013	1	$63,000	$9,000	$39,000	$17,000	$128,000	($164,000)	($36,000)	($34,783)	($34,783)	14
2014	2	$65,000	$10,000	$41,000	$18,000	$134,000	($164,000)	($30,000)	($28,005)	($62,788)	
2015	3	$68,000	$10,000	$43,000	$19,000	$140,000	($164,000)	($24,000)	($21,647)	($84,435)	
2016	4	$71,000	$11,000	$44,000	$20,000	$146,000	($164,000)	($18,000)	($15,686)	($100,121)	
2017	5	$74,000	$11,000	$46,000	$21,000	$152,000	($164,000)	($12,000)	($10,104)	($110,224)	
2018	6	$77,000	$12,000	$48,000	$22,000	$159,000	($164,000)	($5,000)	($4,068)	($114,292)	
2019	7	$80,000	$12,000	$50,000	$22,000	$164,000	($164,000)	$0	$0	($114,292)	
2020	8	$84,000	$13,000	$52,000	$23,000	$172,000	($164,000)	$8,000	$6,075	($108,216)	
2021	9	$87,000	$13,000	$54,000	$24,000	$178,000	($164,000)	$14,000	$10,272	($97,944)	
2022	10	$91,000	$14,000	$57,000	$25,000	$187,000	($164,000)	$23,000	$16,305	($81,639)	
2023	11	$95,000	$14,000	$59,000	$26,000	$194,000	($164,000)	$30,000	$20,548	($61,091)	
2024	12	$99,000	$15,000	$62,000	$28,000	$204,000	($164,000)	$40,000	$26,471	($34,619)	
2025	13	$103,000	$15,000	$64,000	$29,000	$211,000	($164,000)	$47,000	$30,052	($4,567)	
2026	14	$108,000	$16,000	$67,000	$30,000	$221,000	($164,000)	$57,000	$35,214	$30,646	
2027	15	$112,000	$17,000	$70,000	$31,000	$230,000	($164,000)	$66,000	$39,395	$70,041	
2028	16	$117,000	$17,000	$73,000	$32,000	$239,000	($164,000)	$75,000	$43,253	$113,294	
2029	17	$122,000	$18,000	$76,000	$34,000	$250,000	($164,000)	$86,000	$47,920	$161,213	
2030	18	$127,000	$19,000	$79,000	$35,000	$260,000	($164,000)	$96,000	$51,683	$212,896	
2031	19	$133,000	$20,000	$82,000	$37,000	$272,000	($164,000)	$108,000	$56,177	$269,073	
2032	20	$138,000	$21,000	$86,000	$38,000	$283,000	($164,000)	$119,000	$59,805	$328,878	

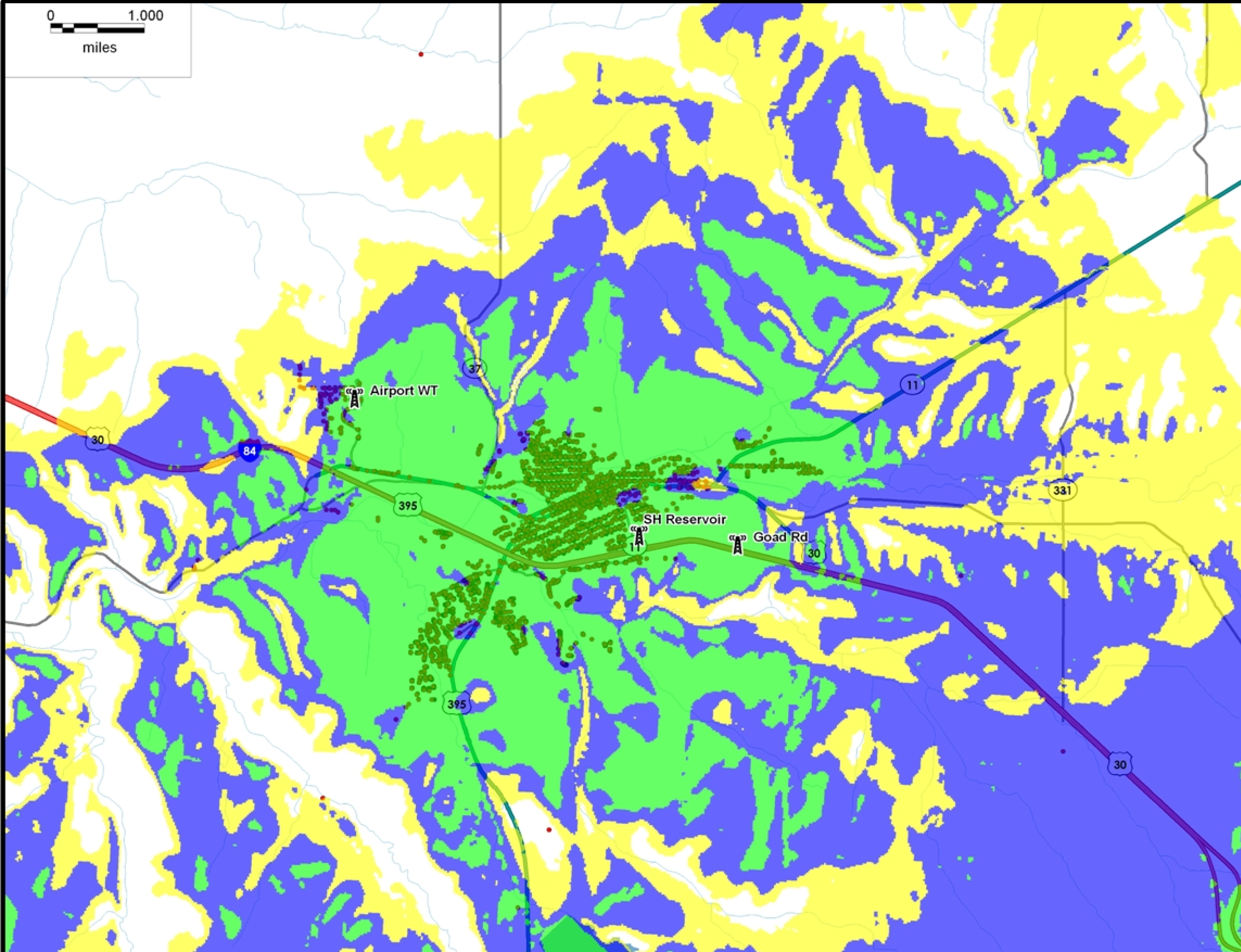
[1] *Includes reduction in manual City meter reading staff, addition of AMR system related staffing, and direct O&M costs on AMR system.*
[2] *The number of vehicles used by City staff associated with meter reading and read verification activities is assumed to be reduced from 50% of one vehicle per year to 10% of one vehicle per year at a cost of $0.565 per mile and an annual average mileage per one vehicle of 20,000 miles.*
[3] *Decrease in field services.*
[4] *Includes savings from reduction in number of customer calls and rebills.*
[5] *Total costs include fixed data collectors, software and data management system, registers, and endpoints.*

Additional Considerations & Recommendations

- Migrateable AMR technology may be installed over a period of time to implement an AMI system. For example, several vendors are producing endpoints that may transmit meter reads to a walk by, mobile, or AMI data collector. Those endpoints may be installed per the current meter replacement program, and when enough endpoints are installed, the meter reading system may be converted to AMI.
- If an AMI system is to be implemented, adjust the City's meter and AMR standards to accommodate the AMI system.
- Meter read routes must be considered while upgrading the system to AMI. During the transition to AMI, it is beneficial to manage both the existing and new systems if AMI is installed along existing meter routes. This will limit interruptions to staff procedures until the new AMI system is fully operational.
- Install AMI data collectors prior to other system components. This will allow a check of data transmission as endpoints are installed.
- The AMI system may be opened to the bid selection process. If the City proceeds with opening equipment selection to several manufacturers, equipment suppliers should be prequalified prior to bidding. Also, the City should review compatibility issues during the conversion process. After an AMI equipment manufacturer is selected, that manufacturer's AMI equipment must be used in future implementation. The City should negotiate a future price escalation clause prior to completing contract negotiations for AMI equipment.
- If the City elects to move forward with an AMI system by funding the system with cash flow, MSA recommends constructing the data collector infrastructure for coverage of the entire City as soon as funding allows and then adding AMI meters, registers, endpoints and data collectors to the City standard. The preliminary probable cost for data collector infrastructure to provide coverage for the current footprint of the City is approximately $340,000. Therefore, new development added to the system would install the required AMI components, and the City would not need to retrofit future growth that occurs prior to construction of the build-out AMI system. Additionally, as cash flow allows, old meters may be replaced with an upgraded meter, register and attached endpoint, which would allow meters to be read automatically as the system is upgraded over time. If the City elects to perform installation as funding allows, MSA also recommends replacement of meters along meter reading routes to maintain efficient meter reading operations until the AMI system is built out.

Murray, Smith & Associates, Inc.
Engineers/Planners

APPENDIX B1
Propagation Study



FlexNet Propagation Analysis

Pendleton, OR

BTS Best Server Coverage
Airport WT (Panel, 135°)
Goad Rd (Panel, 290°)
SH Reservoir

Signal Strength Ranges	Covered Meters	Percentage of Total Meters
-102 to MAX	5,565	93.09%
-112 to -102	304	5.09%
-122 to -112	47	0.79%
-200 to -122	62	1.04%
Total Meters	5,978	

LEGEND

- BTS
- Meters
- -102 dBm
- -112 dBm
- -122 dBm

This propagation study is based on actual information provided by the utility pertaining to meter type, meter location, potential antennae height on structure, structure height, and structure location. Any changes, deletions and/or additions that are not provided to the design engineers during the creation of this design may result in a study that does not correlate to actual field conditions.

For all tower mounted antennas, a minimum antenna standoff of 3' is required from the tower.

Murray, Smith & Associates, Inc.
Engineers/Planners

APPENDIX B2
Financial Model Results

AMI System Inputs

Date: 9/23/2013	

Utility Name	City of Pendleton, Oregon
Title for Scenario	20 Year Implementation Conservative Assumptions

Utility Contact	
Name	Shawn Kohtz - MSA (on behalf of the City of Pendleton)
Title	Civil Engineer
Phone #	208-947-9033

Notes:

Meter Information	**Water**
Existing Total Number of Meters in Service	6,184
Number of Radio Read units	-
Number of Mobile Read Units	-
Number of Touch Read Units	4,408
Number of Manual Read Units	1,776
% of Total Water Meters in Pit Boxes	100%
Quantity of meters, endpoint and register to be replaced	-
Quantity of meters to be replaced - Radio reads	-
Quantity of meters to be replaced - Mobile read	-
Quantity of meters to be replaced - Touch reads	-
Quantity of meters to be replaced - Manual reads	-
Quantity of registers, no new meters, to be replaced	6,184
Quantity of registers to be replaced - Radio reads	-
Quantity of registers to be replaced - Mobile reads	-
Quantity of registers to be replaced - Touch reads	4,408
Quantity of registers to be replaced - Manual reads	1,776
Total Quantity of endpoint to be retrofitted	6,184
Quantity of endpoints to be retrofitted - Radio reads	-
Quantity of endpoints to be retrofitted - Mobile reads	4,408
Quantity of endpoints to be retrofitted - Touch reads	1,776
Quantity of meter accounts to remain in place unchanged	-
Average age (years) of meters to remain in place unchanged	-
Total	6,184

Current Water Metering Replacement Program - Calculates a credit going forward if used	
Water Meter Replacement at Age in years	20
Endpoint Replacement at Age in Years	20

Population		
Number of meters per number of customers		0.374
Population at Year	15,126	1990
Population at Year	16,354	2000
Population at Year	16,612	2010

Implementation Program		
First Year AMI/AMR Capital Improvements	2013	
Second Year of AMR/AMI Capital Improvements (leave blank if no second round)		
End of Phase in	2013	
Meter Rollout Period	1	years
Register Rollout Period	1	years
Endpoint Rollout Period	1	years
Percent of meters requiring new lid	10%	

Meter Reading	
Original number of FTE Readers	0.83
Proposed number of full time field services (or equivalent)	-
Average meter reader salary	$ 75,000
Benefits as a % of salary (Incl FICA, workmen's comp, retirement, overhead)	0%

Original number of vehicles	0.50	
Proposed number of vehicles	0.10	
Federal mileage reimbursement	$ 0.565	
Annual Vehicle Mileage	20,000	
Annual cost per vehicle (Incl cost of vehicle, gas, maintenance)	$ 11,300	
Original Number of data input clerks	0.67	
Proposed number of data input clerks	0.55	
Average clerk salary	$ 63,000	
Benefits as a % of salary (Incl FICA, workmen's comp, retirement, overhead)	0%	
Hand-held Equipment Replacement price per unit	$ 7,200	
Accounting/Customer Services		
Original number of customer calls per year	9,500	
Annual number of calls per meter in system	1.536	
Cost per call	$ 2.52	
Assumed call % reduction with WSS	62%	
Original number of re-bills per year	190	
Annual number of re-bills per meter in system	0.031	
Cost per re-bill	$ 20.00	
Assumed re-bill % reduction with WSS	50%	
Field Service / Special Reads		
Number of Special Reads / Turn-on or Turn-offs per year	2,500	
Annual number of calls FS/SR per meter in system	0.404	
Reduction in the number of Special Reads / Turn-on or Turn-offs	56%	
Cost per a field visit activity	$ 27.04	
Revenue		
Total Water Expenditures	$ 3,550,000	
Total annual revenue	$ 3,550,000	
Revenue Gained from Flat Rate Service		
Service Connections to be metered per year	-	
Expected Revenue Increase from Metering	0%	
Current Average Annual Revenue per Un-metered Account	$ -	
Billing Cycle Efficiency		
Number of months saved	-	
Other System Benefits (Engineering, Conservation, Troubleshooting, Etc)		
Annual Benefit to Cash Flow		
Water Loss Management System Benefits		
Millions of Gallons Produced Annually - Assumed	3,205	MG
Millions of Gallons Sold Annually - Actual	3,045	MG
Percent of TOTAL unaccounted Water	5%	
Percent unaccounted for water non-meters:: Water lost in rest of system	2%	
Percent unaccounted for water meters: Water lost though inaccurate meters	3%	
Cost of water produced or purchased	$ 200.00	per mgd
Revenue of water sold	$ 1,165.85	per mgd
Original average revenue per account	$ 574.06	per year
Financial - General		
Loan Term in years	20	
Inflation rate	3.00%	
Discount rate or Weighted Average Cost of Capital	3.50%	
Annual Growth Rate for City	1.18%	
Financial - Contractor Install		
Contractor Overhead and Profit	15.00%	
Contingency	5.00%	
Construction Mob./Demob.	8.00%	
Construction Admin	5.00%	
Combined Federal and State tax rate	0.00%	
Financial - City Install		
City Install Beginning Year (year of contract, e.g. 3, zero if City to install all	1000	
Contingency	10.00%	
Construction Mob./Demob.	5.00%	
Construction Admin	5.00%	
Combined Federal and State tax rate	0.00%	

Annual Operational & Maintenance Preliminary and Probable Costs - Fixed Network and Endpoint

Cost per System:

Labor Computation

	Cost / Year	# of FTE	Ben	Overhead	Total	
Data Hosting by Vendor	54,000	0.05	35%	10%	4,000	Enter the Salary and Benefit (FICA, pension,
Data Analyst	75,000	0.125	0%	0%	9,400	medical) for each employee
Total Annual System Operation Employees					**$ 13,400**	

Software Licensing and Maintenance:

Software	$ 8,000	
	$ 8,000	Annual Cost

Collector Maintenance & Operation Costs:

Network Collectors Maintenance Cost - Utility Labor[1]	4	Hours/month	$ 100.00	per hour	**$ 4,800**	
Repeater Maintenance Cost - Utility Labor	0	Hours/month	$ 100.00	per hour	**$ -**	
GSM / Cellular Monthly Cost - estimated	$ 240.00	Unlimited data price/month			**$ 2,880**	
					$ 7,700	Annual Cost

Endpoint Maintenance:

On an annual basis	Est. Module Removal Rate	Est. Modules or Meters Needed	Average Price Per Endpoint	Est. Labor Cost for Endpoint	Total Cost Cost per Year		
Indoor Meter Endpoint	0.000%	-	$ 150.00		$ -		One technician and vehicle for 1.5 hours.
Pit Water Meter Endpoint	0.250%	16	$ 150.00		$ 2,400.00		One technician and vehicle for 1 hour.
MLOG / Leak Sensor Leak Detection Module	0.000%	-	$ 250.00		$ -		One technician and vehicle for 1 hour.
Total Endpoint Maintenance Per Year					**$ 2,400.00**	**$ 2,400**	

Meter Maintenance:

On an annual basis	Est. Meter Investigation Rate	Number of Activities	Est. Labor Cost for Invest.	Total Cost Cost per Year		
Indoor Water System	0.000%	-	$ 75.00	$ -		Assume meters replaced under warranty.
Pit Water System	0.000%	-	$ 50.00	$ -		Only technician cost for field visit.
Water Loss Management System	0.000%	-	$ 50.00	$ -		
Total Overall System Maintenance Per Year				**$ -**	**$ -**	

Total Operating Cost Per Year	**$ 31,500**
(first year pricing - determine inflation per year)	

Notes:
1. Network collectors maintenance may be completed by manufacturer if desired by City. Enter cost estimate for service here.

Preliminary, Probable Construction Cost: AMR System (Excluding New Water Meters)

	Est. Price	Qty	Ext	
Water Meters / Modules:				
New Water Meters and Registers:				Estimated Meter Cost
5/8" Meter	$ 47.00		$ -	RSM 22 11 19.38 2060
3/4" Meter	$ 86.00	-	$ -	RSM 22 11 19.38 2020
1" Meter	$ 131.00		$ -	RSM 22 11 19.38 2100
1 1/2" Meter	$ 320.00		$ -	RSM 22 11 19.38 2340
2" Meter	$ 430.00		$ -	RSM 22 11 19.38 2360
3" Meter	$ 2,925.00		$ -	RSM 22 11 19.38 2640
4" Meter	$ 4,700.00		$ -	RSM 22 11 19.38 2660
6" Meter	$ 7,500.00		$ -	RSM 22 11 19.38 2680
8" Meter	$ 11,800.00		$ -	RSM 22 11 19.38 2700
Meter, Register and Endpoint:				Average meter cost
Water Meter and Registers - Average Cost Per	$ 160.00			
Endpoint	$ 150.00			
Per each Metering Setup	**$ 310.00**			Note:
Cost for All Meter Setups		-	$ -	
Register:				Include only the cost of the register - module will be included below
Register Exchange	$ 60.00	6,184	$ 371,040.00	
Endpoint:				
Endpoint Exchange	$ 150.00	6,184	$ 927,600.00	Add $s for Remote Antenna if RF Friendly lids are not used.
Sub-total Water Meters & Modules			**$ 1,298,640.00**	

Installation:				
Water:				Estimated Meter Cost
Water Meter Installation - 5/8"	$ 28.00	-	$ -	RSM 22 11 19.38 2060
Water Meter Installation - 3/4"	$ 32.00	-	$ -	RSM 22 11 19.38 2020
Water Meter Installation - 1"	$ 37.00	-	$ -	RSM 22 11 19.38 2100
Water Meter Installation - 1 1/2"	$ 56.00	-	$ -	RSM 22 11 19.38 2340
Water Meter Installation - 2"	$ 74.50	-	$ -	RSM 22 11 19.38 2360
Water Meter Installation - 3"	$ 268.00	-	$ -	RSM 22 11 19.38 2640
Water Meter Installation - 4"	$ 535.00	-	$ -	RSM 22 11 19.38 2660
Water Meter Installation - 6"	$ 805.00	-	$ -	RSM 22 11 19.38 2680
Water Meter Installation - 8"	$ 1,000.00	-	$ -	RSM 22 11 19.38 2700
Per each Metering Setup		-	$ -	$ - Water Meter Install Average
Water Register Exchange	$ 9.01	6,184	$ 55,745.19	
Endpoint Exchange	$ 12.00	6,184	$ 74,185.70	
Sub-total Installation			**$ 129,930.89**	

Other:				
Pit Lid	$ 40.39	618	$ 24,977.18	Radio frieldy lid cost
Sub-total Other			**$ 24,977.18**	$ 4.04 Average Cost per Water Meter

First Year Infrastructure

System:			
Collectors / Antennas	$ 50,000.00	3	$ 150,000.00
Repeaters	$ 4,000.00	-	$ -
Software	$ 40,000.00	-	$ -
Drive-by Units	$ 30,000.00	-	$ -
Professional Services / Training / Travel	$ 37,500.00	1	$ 37,500.00
Leak Sensors	$ 250.00	-	$ -
Sub-total System			**$ 187,500.00**
System Installation			
Collectors / Antennas	$ 20,000.00	3	$ 60,000.00
Repeaters	$ 1,000.00	-	$ -
Software	$ 15,000.00	-	$ -
Drive-by Units	$ 5,000.00	-	$ -
Leak Sensors	$ 10.00	-	$ -
Sub-total System Installation			**$ 60,000.00**
First Year Total System			**$ 247,500.00**

Second Installation Phase

System:			
Collectors / Antennas	$ 50,000.00	-	$ -
Repeaters	$ 4,000.00	-	$ -
Software	$ -	-	$ -
Drive-by Units	$ 30,000.00	-	$ -
Professional Services / Training / Travel	$ 25,000.00	-	$ -
Leak Sensors	$ 250.00	-	$ -
Sub-total System			**$ -**
System Installation			
Collectors / Antennas	$ 20,000.00	-	$ -
Repeaters	$ 1,000.00	-	$ -
Software	$ 5,000.00	-	$ -
Drive-by Units	$ 5,000.00	-	$ -
Leak Sensors	$ 10.00	-	$ -
Sub-total System Installation			**$ -**
Second Installation Phase Total System			**$ -**

City of Pendleton Costs, page 1															
							AMI Infrastructure	Meters, Register and Endpoint - Contractor Install				Meters, Register and Endpoint - City Install			
Year	Rollout	Growth Rate	Inflation Rate	Tax Rate	Meters	Revenue	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost
2,012		1.18%	3%	0%	(#)										
2,013	1	1.012	1.030	0%	6,257	3,699,526	$ 339,050	1	Yes	0	$ -	1	Yes	0	$ -
2,014	2	1.024	1.061	0%	6,330	3,855,351	$ -	2	No	0	$ -	2	No	0	$ -
2,015	3	1.036	1.093	0%	6,405	4,017,739	$ -	3	No	0	$ -	3	No	0	$ -
2,016	4	1.048	1.126	0%	6,480	4,186,967	$ -	4	No	0	$ -	4	No	0	$ -
2,017	5	1.060	1.159	0%	6,557	4,363,322	$ -	5	No	0	$ -	5	No	0	$ -
2,018	6	1.073	1.194	0%	6,634	4,547,106	$ -	6	No	0	$ -	6	No	0	$ -
2,019	7	1.085	1.230	0%	6,712	4,738,631	$ -	7	No	0	$ -	7	No	0	$ -
2,020	8	1.098	1.267	0%	6,791	4,938,222	$ -	8	No	0	$ -	8	No	0	$ -
2,021	9	1.111	1.305	0%	6,871	5,146,221	$ -	9	No	0	$ -	9	No	0	$ -
2,022	10	1.124	1.344	0%	6,951	5,362,980	$ -	10	No	0	$ -	10	No	0	$ -
2,023	11	1.137	1.384	0%	7,033	5,588,870	$ -	11	No	0	$ -	11	No	0	$ -
2,024	12	1.151	1.426	0%	7,116	5,824,274	$ -	12	No	0	$ -	12	No	0	$ -
2,025	13	1.164	1.469	0%	7,200	6,069,593	$ -	13	No	0	$ -	13	No	0	$ -
2,026	14	1.178	1.513	0%	7,284	6,325,245	$ -	14	No	0	$ -	14	No	0	$ -
2,027	15	1.192	1.558	0%	7,370	6,591,665	$ -	15	No	0	$ -	15	No	0	$ -
2,028	16	1.206	1.605	0%	7,457	6,869,307	$ -	16	No	0	$ -	16	No	0	$ -
2,029	17	1.220	1.653	0%	7,545	7,158,643	$ -	17	No	0	$ -	17	No	0	$ -
2,030	18	1.234	1.702	0%	7,633	7,460,166	$ -	18	No	0	$ -	18	No	0	$ -
2,031	19	1.249	1.754	0%	7,723	7,774,389	$ -	19	No	0	$ -	19	No	0	$ -
2,032	20	1.264	1.806	0%	7,814	8,101,848	$ -	20	No	0	$ -	20	No	0	$ -

Register - Contractor Install				Registers - City Install				Endpoints - Contractor Install				Endpoints - City Install				Pit Lids - Contractor Install			
Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost
1	Yes	6184	$ 584,653	1	Yes	0	$ -	1	Yes	6184	$ 1,372,346	1	Yes	0	$ -	1	Yes	618	$ 34,216
2	No	0	$ -	2	No	0	$ -	2	No	0	$ -	2	No	0	$ -	2	No	0	$ -
3	No	0	$ -	3	No	0	$ -	3	No	0	$ -	3	No	0	$ -	3	No	0	$ -
4	No	0	$ -	4	No	0	$ -	4	No	0	$ -	4	No	0	$ -	4	No	0	$ -
5	No	0	$ -	5	No	0	$ -	5	No	0	$ -	5	No	0	$ -	5	No	0	$ -
6	No	0	$ -	6	No	0	$ -	6	No	0	$ -	6	No	0	$ -	6	No	0	$ -
7	No	0	$ -	7	No	0	$ -	7	No	0	$ -	7	No	0	$ -	7	No	0	$ -
8	No	0	$ -	8	No	0	$ -	8	No	0	$ -	8	No	0	$ -	8	No	0	$ -
9	No	0	$ -	9	No	0	$ -	9	No	0	$ -	9	No	0	$ -	9	No	0	$ -
10	No	0	$ -	10	No	0	$ -	10	No	0	$ -	10	No	0	$ -	10	No	0	$ -
11	No	0	$ -	11	No	0	$ -	11	No	0	$ -	11	No	0	$ -	11	No	0	$ -
12	No	0	$ -	12	No	0	$ -	12	No	0	$ -	12	No	0	$ -	12	No	0	$ -
13	No	0	$ -	13	No	0	$ -	13	No	0	$ -	13	No	0	$ -	13	No	0	$ -
14	No	0	$ -	14	No	0	$ -	14	No	0	$ -	14	No	0	$ -	14	No	0	$ -
15	No	0	$ -	15	No	0	$ -	15	No	0	$ -	15	No	0	$ -	15	No	0	$ -
16	No	0	$ -	16	No	0	$ -	16	No	0	$ -	16	No	0	$ -	16	No	0	$ -
17	No	0	$ -	17	No	0	$ -	17	No	0	$ -	17	No	0	$ -	17	No	0	$ -
18	No	0	$ -	18	No	0	$ -	18	No	0	$ -	18	No	0	$ -	18	No	0	$ -
19	No	0	$ -	19	No	0	$ -	19	No	0	$ -	19	No	0	$ -	19	No	0	$ -
20	No	0	$ -	20	No	0	$ -	20	No	0	$ -	20	No	0	$ -	20	No	0	$ -

City of Pendleton Costs, page 3

Pit Lids - City Install				AMR Extra O&M					Funding		
				AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	Loan to Fund Capital Costs		
Rollout Year	If replacing	# Replaced	Future Cost	Data Hosting by VendorData Analyst Future Cost	Software Licensing and Maintenance: Future Cost	Collector Maintenance & Operation Costs: Future Cost	Endpoint Maintenance: Future Cost	Meter Maintenance: Future Cost	Capital Req'd: Only Infrastructure (Data Collectors, Meter, Endpoints)	Total Req'd for Loan	Yearly Payment
1	Yes	0	$ -	$ 13,964	$ 8,337	$ 8,024	$ 2,472	$ -	2,330,266	2,330,266	$ 163,960
2	No	0	$ -	$ 14,553	$ 8,688	$ 8,362	$ 2,546	$ -	-		$ 163,960
3	No	0	$ -	$ 15,166	$ 9,054	$ 8,715	$ 2,623	$ -	-		$ 163,960
4	No	0	$ -	$ 15,804	$ 9,435	$ 9,082	$ 2,701	$ -	-		$ 163,960
5	No	0	$ -	$ 16,470	$ 9,833	$ 9,464	$ 2,782	$ -	-		$ 163,960
6	No	0	$ -	$ 17,164	$ 10,247	$ 9,863	$ 2,866	$ -	-		$ 163,960
7	No	0	$ -	$ 17,887	$ 10,679	$ 10,278	$ 2,952	$ -	-		$ 163,960
8	No	0	$ -	$ 18,640	$ 11,128	$ 10,711	$ 3,040	$ -	-		$ 163,960
9	No	0	$ -	$ 19,425	$ 11,597	$ 11,162	$ 3,131	$ -	-		$ 163,960
10	No	0	$ -	$ 20,243	$ 12,086	$ 11,632	$ 3,225	$ -	-		$ 163,960
11	No	0	$ -	$ 21,096	$ 12,595	$ 12,122	$ 3,322	$ -	-		$ 163,960
12	No	0	$ -	$ 21,985	$ 13,125	$ 12,633	$ 3,422	$ -	-		$ 163,960
13	No	0	$ -	$ 22,911	$ 13,678	$ 13,165	$ 3,524	$ -	-		$ 163,960
14	No	0	$ -	$ 23,876	$ 14,254	$ 13,720	$ 3,630	$ -	-		$ 163,960
15	No	0	$ -	$ 24,881	$ 14,854	$ 14,297	$ 3,739	$ -	-		$ 163,960
16	No	0	$ -	$ 25,929	$ 15,480	$ 14,900	$ 3,851	$ -	-		$ 163,960
17	No	0	$ -	$ 27,021	$ 16,132	$ 15,527	$ 3,967	$ -	-		$ 163,960
18	No	0	$ -	$ 28,159	$ 16,812	$ 16,181	$ 4,086	$ -	-		$ 163,960
19	No	0	$ -	$ 29,346	$ 17,520	$ 16,863	$ 4,208	$ -	-		$ 163,960
20	No	0	$ -	$ 30,582	$ 18,258	$ 17,573	$ 4,335	$ -	-		$ 163,960

City of Pendleton Benefits, page 1

						Readers					Vehicles				
						Original Readers		Proposed Readers			Original Vehicles		Proposed vehicles		
Year	Rollout	Growth Rate	Inflation Rate	Tax Rate	Meters	# of Readers	Meter FTE Readers	# of Readers	Meter FTE Readers	Savings/Costs	# Vehicles	Future Cost	# Vehicles	Future Cost	Savings/Costs
2,012	-	1.18%	3%	0%	(#)		Future Cost		Future Cost						
2,013	1	1.012	1.030	0%	6,257	0.84	$ 65,133	0.0	$ -	$ (65,133)	0.51	$ 5,888	0.10	$ 1,178	$ (4,710)
2,014	2	1.024	1.061	0%	6,330	0.85	$ 67,876	0.0	$ -	$ (67,876)	0.51	$ 6,136	0.10	$ 1,227	$ (4,909)
2,015	3	1.036	1.093	0%	6,405	0.86	$ 70,735	0.0	$ -	$ (70,735)	0.52	$ 6,394	0.10	$ 1,279	$ (5,116)
2,016	4	1.048	1.126	0%	6,480	0.87	$ 73,714	0.0	$ -	$ (73,714)	0.52	$ 6,664	0.10	$ 1,333	$ (5,331)
2,017	5	1.060	1.159	0%	6,557	0.88	$ 76,819	0.0	$ -	$ (76,819)	0.53	$ 6,944	0.11	$ 1,389	$ (5,556)
2,018	6	1.073	1.194	0%	6,634	0.89	$ 80,055	0.0	$ -	$ (80,055)	0.54	$ 7,237	0.11	$ 1,447	$ (5,790)
2,019	7	1.085	1.230	0%	6,712	0.90	$ 83,427	0.0	$ -	$ (83,427)	0.54	$ 7,542	0.11	$ 1,508	$ (6,033)
2,020	8	1.098	1.267	0%	6,791	0.92	$ 86,941	0.0	$ -	$ (86,941)	0.55	$ 7,859	0.11	$ 1,572	$ (6,288)
2,021	9	1.111	1.305	0%	6,871	0.93	$ 90,602	0.0	$ -	$ (90,602)	0.56	$ 8,190	0.11	$ 1,638	$ (6,552)
2,022	10	1.124	1.344	0%	6,951	0.94	$ 94,419	0.0	$ -	$ (94,419)	0.56	$ 8,535	0.11	$ 1,707	$ (6,828)
2,023	11	1.137	1.384	0%	7,033	0.95	$ 98,396	0.0	$ -	$ (98,396)	0.57	$ 8,895	0.11	$ 1,779	$ (7,116)
2,024	12	1.151	1.426	0%	7,116	0.96	$ 102,540	0.0	$ -	$ (102,540)	0.58	$ 9,270	0.12	$ 1,854	$ (7,416)
2,025	13	1.164	1.469	0%	7,200	0.97	$ 106,859	0.0	$ -	$ (106,859)	0.58	$ 9,660	0.12	$ 1,932	$ (7,728)
2,026	14	1.178	1.513	0%	7,284	0.98	$ 111,360	0.0	$ -	$ (111,360)	0.59	$ 10,067	0.12	$ 2,013	$ (8,054)
2,027	15	1.192	1.558	0%	7,370	0.99	$ 116,050	0.0	$ -	$ (116,050)	0.60	$ 10,491	0.12	$ 2,098	$ (8,393)
2,028	16	1.206	1.605	0%	7,457	1.00	$ 120,939	0.0	$ -	$ (120,939)	0.60	$ 10,933	0.12	$ 2,187	$ (8,746)
2,029	17	1.220	1.653	0%	7,545	1.02	$ 126,032	0.0	$ -	$ (126,032)	0.61	$ 11,393	0.12	$ 2,279	$ (9,115)
2,030	18	1.234	1.702	0%	7,633	1.03	$ 131,341	0.0	$ -	$ (131,341)	0.62	$ 11,873	0.12	$ 2,375	$ (9,499)
2,031	19	1.249	1.754	0%	7,723	1.04	$ 136,873	0.0	$ -	$ (136,873)	0.62	$ 12,373	0.12	$ 2,475	$ (9,899)
2,032	20	1.264	1.806	0%	7,814	1.05	$ 142,638	0.0	$ -	$ (142,638)	0.63	$ 12,894	0.13	$ 2,579	$ (10,316)

Data Input					Handhelds					Customer Calls						
Original Data Input		Proposed Data Input			Original Handhelds		Proposed Handhelds					Original Calls		Proposed Calls		
# Original FTE	Future Cost	Proposed # FTE	Future Cost	Savings/Costs	# Purchased	Future Cost	# Purchased	Future Cost	Savings/Costs	Number of Radio Ready Units - Calculation Step	No. Not Radio Ready - Calculation Step	# of Calls	Future Cost	# of Calls	Future Cost	Savings/Costs
0.7	$ 43,988	0.6	$ 36,109	$ (7,878)	1	$ 7,416	1	$ 7,416	$ -	6257	0	9612	$ 24,988	3642	$ 9,470	$ (15,519)
0.7	$ 45,841	0.6	$ 37,630	$ (8,210)	1	$ 7,638	1	$ 7,638	$ -	6331	0	9725	$ 26,041	3686	$ 9,869	$ (16,172)
0.7	$ 47,771	0.6	$ 39,215	$ (8,556)	0	$ -	0	$ -	$ -	6405	0	9839	$ 27,138	3729	$ 10,284	$ (16,854)
0.7	$ 49,784	0.6	$ 40,867	$ (8,916)	0	$ -	0	$ -	$ -	6481	0	9955	$ 28,281	3773	$ 10,718	$ (17,563)
0.7	$ 51,881	0.6	$ 42,588	$ (9,292)	0	$ -	0	$ -	$ -	6557	0	10072	$ 29,472	3817	$ 11,169	$ (18,303)
0.7	$ 54,066	0.6	$ 44,382	$ (9,683)	0	$ -	0	$ -	$ -	6634	0	10191	$ 30,713	3862	$ 11,639	$ (19,074)
0.7	$ 56,343	0.6	$ 46,252	$ (10,091)	1	$ 8,855	1	$ 8,855	$ -	6712	0	10311	$ 32,007	3907	$ 12,129	$ (19,877)
0.7	$ 58,716	0.6	$ 48,200	$ (10,516)	1	$ 9,121	1	$ 9,121	$ -	6791	0	10432	$ 33,355	3953	$ 12,640	$ (20,715)
0.7	$ 61,189	0.6	$ 50,230	$ (10,959)	0	$ -	0	$ -	$ -	6871	0	10555	$ 34,760	4000	$ 13,173	$ (21,587)
0.8	$ 63,767	0.6	$ 52,346	$ (11,421)	0	$ -	0	$ -	$ -	6952	0	10679	$ 36,224	4047	$ 13,728	$ (22,496)
0.8	$ 66,452	0.6	$ 54,551	$ (11,902)	0	$ -	0	$ -	$ -	7034	0	10805	$ 37,750	4095	$ 14,307	$ (23,443)
0.8	$ 69,251	0.6	$ 56,848	$ (12,403)	0	$ -	0	$ -	$ -	7117	0	10932	$ 39,340	4143	$ 14,910	$ (24,430)
0.8	$ 72,168	0.6	$ 59,243	$ (12,926)	1	$ 10,573	1	$ 10,573	$ -	7200	0	11060	$ 40,997	4191	$ 15,536	$ (25,461)
0.8	$ 75,208	0.6	$ 61,738	$ (13,470)	1	$ 10,891	1	$ 10,891	$ -	7285	0	11191	$ 42,724	4241	$ 16,191	$ (26,532)
0.8	$ 78,376	0.7	$ 64,338	$ (14,037)	0	$ -	0	$ -	$ -	7371	0	11322	$ 44,523	4291	$ 16,874	$ (27,649)
0.8	$ 81,677	0.7	$ 67,048	$ (14,629)	0	$ -	0	$ -	$ -	7457	0	11455	$ 46,399	4341	$ 17,583	$ (28,816)
0.8	$ 85,117	0.7	$ 69,872	$ (15,245)	0	$ -	0	$ -	$ -	7545	0	11590	$ 48,353	4392	$ 18,324	$ (30,029)
0.8	$ 88,702	0.7	$ 72,815	$ (15,887)	0	$ -	0	$ -	$ -	7634	0	11727	$ 50,389	4444	$ 19,096	$ (31,293)
0.8	$ 92,439	0.7	$ 75,882	$ (16,556)	1	$ 12,625	1	$ 12,625	$ -	7724	0	11865	$ 52,512	4497	$ 19,901	$ (32,611)
0.8	$ 96,332	0.7	$ 79,079	$ (17,254)	1	$ 13,004	1	$ 13,004	$ -	7815	0	12004	$ 54,724	4549	$ 20,740	$ (33,984)

Rebills					Field Service/Special Reads					Other System Benefits		
Original Rebills		Proposed Rebills			Original FS/SR		Proposed FS/SR			Flat Rate Service to be Metered		Misc. System Benefits
# of Rebills	Future Cost	# of Rebills	Future Cost	Savings	# of FS/SR	Future Cost	# of FS/SR	Future Cost	Savings/Costs	# Added	Future Added Rev.	Future Savings
192	$ 3,960	96	$ 1,980	$ (1,980)	2529	$ 70,456	1123	$ 31,284	$ (39,172)	0	$ -	$ -
194	$ 4,127	97	$ 2,064	$ (2,063)	2559	$ 73,423	1136	$ 32,603	$ (40,820)	0	$ -	$ -
197	$ 4,301	98	$ 2,150	$ (2,150)	2589	$ 76,516	1150	$ 33,974	$ (42,542)	0	$ -	$ -
199	$ 4,482	100	$ 2,241	$ (2,241)	2620	$ 79,739	1163	$ 35,408	$ (44,331)	0	$ -	$ -
201	$ 4,671	101	$ 2,335	$ (2,335)	2651	$ 83,098	1177	$ 36,898	$ (46,199)	0	$ -	$ -
204	$ 4,867	102	$ 2,434	$ (2,434)	2682	$ 86,598	1191	$ 38,451	$ (48,146)	0	$ -	$ -
206	$ 5,072	103	$ 2,536	$ (2,536)	2713	$ 90,245	1205	$ 40,071	$ (50,175)	0	$ -	$ -
209	$ 5,286	104	$ 2,643	$ (2,643)	2745	$ 94,046	1219	$ 41,758	$ (52,288)	0	$ -	$ -
211	$ 5,509	106	$ 2,754	$ (2,754)	2778	$ 98,007	1233	$ 43,518	$ (54,490)	0	$ -	$ -
214	$ 5,741	107	$ 2,871	$ (2,870)	2810	$ 102,136	1248	$ 45,352	$ (56,784)	0	$ -	$ -
216	$ 5,982	108	$ 2,992	$ (2,991)	2843	$ 106,438	1263	$ 47,263	$ (59,174)	0	$ -	$ -
219	$ 6,234	109	$ 3,118	$ (3,117)	2877	$ 110,921	1277	$ 49,256	$ (61,665)	0	$ -	$ -
221	$ 6,497	111	$ 3,249	$ (3,248)	2911	$ 115,593	1292	$ 51,325	$ (64,268)	0	$ -	$ -
224	$ 6,771	112	$ 3,386	$ (3,385)	2945	$ 120,461	1308	$ 53,489	$ (66,973)	0	$ -	$ -
226	$ 7,056	113	$ 3,528	$ (3,528)	2980	$ 125,535	1323	$ 55,744	$ (69,791)	0	$ -	$ -
229	$ 7,353	115	$ 3,677	$ (3,676)	3015	$ 130,823	1338	$ 58,086	$ (72,737)	0	$ -	$ -
232	$ 7,663	116	$ 3,832	$ (3,831)	3050	$ 136,333	1354	$ 60,535	$ (75,798)	0	$ -	$ -
235	$ 7,986	117	$ 3,993	$ (3,992)	3086	$ 142,076	1370	$ 63,086	$ (78,989)	0	$ -	$ -
237	$ 8,322	119	$ 4,161	$ (4,161)	3122	$ 148,060	1386	$ 65,745	$ (82,315)	0	$ -	$ -
240	$ 8,672	120	$ 4,337	$ (4,336)	3159	$ 154,296	1403	$ 68,515	$ (85,781)	0	$ -	$ -

Table 1
20 Year Implementation Conservative Assumptions

		METER READING AND ASSOCIATED BENEFITS			*FIELD WORK/SERVICES*	*CUSTOMER SERVICE IMPACT*	*MISC. SYSTEM BENEFITS*	TOTAL BENEFITS & SAVINGS	TOTAL COSTS (4)	Net Costs and Benefits	Net Present Value	Cumulative Net Present Value	Payback Period (years)
Year		Savings Salaries & Benefits (1)	Savings Vehicles	Savings Handheld	Field Service Special Reads (2)	Call Center and Customer Accounting (3)	Data Benefits						
2013	1	$40,000	$5,000	$0	$39,000	$17,000	$0	$101,000	($164,000)	($63,000)	($60,870)	($60,870)	> 20
2014	2	$42,000	$5,000	$0	$41,000	$18,000	$0	$106,000	($164,000)	($58,000)	($54,144)	($115,013)	
2015	3	$44,000	$5,000	$0	$43,000	$19,000	$0	$111,000	($164,000)	($53,000)	($47,803)	($162,816)	
2016	4	$46,000	$5,000	$0	$44,000	$20,000	$0	$115,000	($164,000)	($49,000)	($42,701)	($205,517)	
2017	5	$48,000	$6,000	$0	$46,000	$21,000	$0	$121,000	($164,000)	($43,000)	($36,205)	($241,722)	
2018	6	$50,000	$6,000	$0	$48,000	$22,000	$0	$126,000	($164,000)	($38,000)	($30,913)	($272,635)	
2019	7	$52,000	$6,000	$0	$50,000	$22,000	$0	$130,000	($164,000)	($34,000)	($26,724)	($299,358)	
2020	8	$54,000	$6,000	$0	$52,000	$23,000	$0	$135,000	($164,000)	($29,000)	($22,023)	($321,381)	
2021	9	$56,000	$7,000	$0	$54,000	$24,000	$0	$141,000	($164,000)	($23,000)	($16,876)	($338,257)	
2022	10	$59,000	$7,000	$0	$57,000	$25,000	$0	$148,000	($164,000)	($16,000)	($11,343)	($349,600)	
2023	11	$61,000	$7,000	$0	$59,000	$26,000	$0	$153,000	($164,000)	($11,000)	($7,534)	($357,134)	
2024	12	$64,000	$7,000	$0	$62,000	$28,000	$0	$161,000	($164,000)	($3,000)	($1,985)	($359,120)	
2025	13	$67,000	$8,000	$0	$64,000	$29,000	$0	$168,000	($164,000)	$4,000	$2,558	($356,562)	
2026	14	$69,000	$8,000	$0	$67,000	$30,000	$0	$174,000	($164,000)	$10,000	$6,178	($350,384)	
2027	15	$72,000	$8,000	$0	$70,000	$31,000	$0	$181,000	($164,000)	$17,000	$10,147	($340,237)	
2028	16	$75,000	$9,000	$0	$73,000	$32,000	$0	$189,000	($164,000)	$25,000	$14,418	($325,819)	
2029	17	$79,000	$9,000	$0	$76,000	$34,000	$0	$198,000	($164,000)	$34,000	$18,945	($306,874)	
2030	18	$82,000	$9,000	$0	$79,000	$35,000	$0	$205,000	($164,000)	$41,000	$22,073	($284,802)	
2031	19	$85,000	$10,000	$0	$82,000	$37,000	$0	$214,000	($164,000)	$50,000	$26,008	($258,794)	
2032	20	$89,000	$10,000	$0	$86,000	$38,000	$0	$223,000	($164,000)	$59,000	$29,651	($229,142)	

Notes:

1: Includes reduction in manual meter reading staff and addition of AMR system related staffing and direct O&M costs on AMR system.
2: Decrease in field services
3: Includes savings from reduction in number of customer calls and rebills
4: Total Costs include fixed data collectors, software and data management system, registers and endpoints.

AMI System Inputs

Date: 9/23/2013

Utility Name	City of Pendleton, Oregon
Title for Scenario	20 Year Implementation Conservative Assumptions

Utility Contact	
Name	Shawn Kohtz - MSA (on behalf of the City of Pendleton)
Title	Civil Engineer
Phone #	208-947-9033

Notes:

Meter Information	**Water**
Existing Total Number of Meters in Service	6,184
Number of Radio Read units	-
Number of Mobile Read Units	-
Number of Touch Read Units	4,408
Number of Manual Read Units	1,776
% of Total Water Meters in Pit Boxes	100%
Quantity of meters, endpoint and register to be replaced	-
Quantity of meters to be replaced - Radio reads	-
Quantity of meters to be replaced - Mobile read	-
Quantity of meters to be replaced - Touch reads	-
Quantity of meters to be replaced - Manual reads	-
Quantity of registers, no new meters, to be replaced	6,184
Quantity of registers to be replaced - Radio reads	-
Quantity of registers to be replaced - Mobile reads	-
Quantity of registers to be replaced - Touch reads	4,408
Quantity of registers to be replaced - Manual reads	1,776
Total Quantity of endpoint to be retrofitted	6,184
Quantity of endpoints to be retrofitted - Radio reads	-
Quantity of endpoints to be retrofitted - Mobile reads	4,408
Quantity of endpoints to be retrofitted - Touch reads	1,776
Quantity of meter accounts to remain in place unchanged	-
Average age (years) of meters to remain in place unchanged	-
Total	6,184

Current Water Metering Replacement Program - Calculates a credit going forward if used	
Water Meter Replacement at Age in years	20
Endpoint Replacement at Age in Years	20

Population		
Number of meters per number of customers		0.374
Population at Year	15,126	1990
Population at Year	16,354	2000
Population at Year	16,612	2010

Implementation Program		
First Year AMI/AMR Capital Improvements	2013	
Second Year of AMR/AMI Capital Improvements (leave blank if no second round)		
End of Phase in	2013	
Meter Rollout Period	1	years
Register Rollout Period	1	years
Endpoint Rollout Period	1	years
Percent of meters requiring new lid	10%	

Meter Reading	
Original number of FTE Readers	1.1
Proposed number of full time field services (or equivalent)	-
Average meter reader salary	$ 75,000
Benefits as a % of salary (Incl FICA, workmen's comp, retirement, overhead)	0%

Original number of vehicles		0.50
Proposed number of vehicles		0.10
Federal mileage reimbursement	$	0.565
Annual Vehicle Mileage		40,000
Annual cost per vehicle (Incl cost of vehicle, gas, maintenance)	$	22,600
Original Number of data input clerks		0.67
Proposed number of data input clerks		0.55
Average clerk salary	$	63,000
Benefits as a % of salary (Incl FICA, workmen's comp, retirement, overhead)		0%
Hand-held Equipment Replacement price per unit	$	7,200

Accounting/Customer Services		
Original number of customer calls per year		9,500
Annual number of calls per meter in system		1.536
Cost per call	$	2.52
Assumed call % reduction with WSS		62%
Original number of re-bills per year		190
Annual number of re-bills per meter in system		0.031
Cost per re-bill	$	20.00
Assumed re-bill % reduction with WSS		50%

Field Service / Special Reads		
Number of Special Reads / Turn-on or Turn-offs per year		2,500
Annual number of calls FS/SR per meter in system		0.404
Reduction in the number of Special Reads / Turn-on or Turn-offs		56%
Cost per a field visit activity	$	27.04

Revenue		
Total Water Expenditures	$	3,550,000
Total annual revenue	$	3,550,000

Revenue Gained from Flat Rate Service		
Service Connections to be metered per year		-
Expected Revenue Increase from Metering		0%
Current Average Annual Revenue per Un-metered Account	$	-

Billing Cycle Efficiency		
Number of months saved		-

Other System Benefits (Engineering, Conservation, Troubleshooting, Etc)		
Annual Benefit to Cash Flow		

Water Loss Management System Benefits			
Millions of Gallons Produced Annually - Assumed		3,205	MG
Millions of Gallons Sold Annually - Actual		3,045	MG
Percent of TOTAL unaccounted Water		5%	
Percent unaccounted for water non-meters:: Water lost in rest of system		2%	
Percent unaccounted for water meters: Water lost though inaccurate meters		3%	
Cost of water produced or purchased	$	200.00	per mgd
Revenue of water sold	$	1,165.85	per mgd
Original average revenue per account	$	574.06	per year

Financial - General	
Loan Term in years	20
Inflation rate	3.00%
Discount rate or Weighted Average Cost of Capital	3.50%
Annual Growth Rate for City	1.18%

Financial - Contractor Install	
Contractor Overhead and Profit	15.00%
Contingency	5.00%
Construction Mob./Demob.	8.00%
Construction Admin	5.00%
Combined Federal and State tax rate	0.00%

Financial - City Install	
City Install Beginning Year (year of contract, e.g. 3, zero if City to install all	1000
Contingency	10.00%
Construction Mob./Demob.	5.00%
Construction Admin	5.00%
Combined Federal and State tax rate	0.00%

Annual Operational & Maintenance Preliminary and Probable Costs - Fixed Network and Endpoint

Cost per System:

Labor Computation

	Cost / Year	# of FTE	Ben	Overhead	Total	
Data Hosting by Vendor	54,000	0.05	35%	10%	4,000	Enter the Salary and Benefit (FICA, pension,
Data Analyst	75,000	0.125	0%	0%	9,400	medical) for each employee
Total Annual System Operation Employees					**$ 13,400**	

Software Licensing and Maintenance:

Software	$ 8,000	
	$ 8,000	Annual Cost

Collector Maintenance & Operation Costs:

Network Collectors Maintenance Cost - Utility Labor[1]	4	Hours/month	$ 100.00	per hour	**$ 4,800**	
Repeater Maintenance Cost - Utility Labor	0	Hours/month	$ 100.00	per hour	**$ -**	
GSM / Cellular Monthly Cost - estimated	$ 240.00	Unlimited data price/month			**$ 2,880**	
					$ 7,700	Annual Cost

Endpoint Maintenance:

On an annual basis	Est. Module Removal Rate	Est. Modules or Meters Needed	Average Price Per Endpoint	Est. Labor Cost for Endpoint	Total Cost Cost per Year		
Indoor Meter Endpoint	0.000%	-	$ 150.00		$ -		One technician and vehicle for 1.5 hours.
Pit Water Meter Endpoint	0.250%	16	$ 150.00		$ 2,400.00		One technician and vehicle for 1 hour.
MLOG / Leak Sensor Leak Detection Module	0.000%	-	$ 250.00		$ -		One technician and vehicle for 1 hour.
Total Endpoint Maintenance Per Year					**$ 2,400.00**	**$ 2,400**	

Meter Maintenance:

On an annual basis	Est. Meter Investigation Rate	Number of Activities	Est. Labor Cost for Invest.	Total Cost Cost per Year		
Indoor Water System	0.000%	-	$ 75.00	$ -		Assume meters replaced under warranty.
Pit Water System	0.000%	-	$ 50.00	$ -		Only technician cost for field visit.
Water Loss Management System	0.000%	-	$ 50.00	$ -		
Total Overall System Maintenance Per Year				**$ -**	**$ -**	

Total Operating Cost Per Year	**$ 31,500**
(first year pricing - determine inflation per year)	

Notes:
1. Network collectors maintenance may be completed by manufacturer if desired by City. Enter cost estimate for service here.

Preliminary, Probable Construction Cost: AMR System (Excluding New Water Meters)

	Est. Price	Qty	Ext		
Water Meters / Modules:					
New Water Meters and Registers:					Estimated Meter Cost
5/8" Meter	$ 47.00		$ -		RSM 22 11 19.38 2060
3/4" Meter	$ 86.00	-	$ -		RSM 22 11 19.38 2020
1" Meter	$ 131.00		$ -		RSM 22 11 19.38 2100
1 1/2" Meter	$ 320.00		$ -		RSM 22 11 19.38 2340
2" Meter	$ 430.00		$ -		RSM 22 11 19.38 2360
3" Meter	$ 2,925.00		$ -		RSM 22 11 19.38 2640
4" Meter	$ 4,700.00		$ -		RSM 22 11 19.38 2660
6" Meter	$ 7,500.00		$ -		RSM 22 11 19.38 2680
8" Meter	$ 11,800.00		$ -		RSM 22 11 19.38 2700
Meter, Register and Endpoint:					Average meter cost
Water Meter and Registers - Average Cost Per	$ 160.00				
Endpoint	$ 150.00				
Per each Metering Setup	**$ 310.00**				Note:
Cost for All Meter Setups		-	$ -		
Register:					Include only the cost of the register - module will be included below
Register Exchange	$ 60.00	6,184	$ 371,040.00		
Endpoint:					
Endpoint Exchange	$ 150.00	6,184	$ 927,600.00		Add $s for Remote Antenna if RF Friendly lids are not used.
Sub-total Water Meters & Modules			**$ 1,298,640.00**		

	Est. Price	Qty	Ext		
Installation:					
Water:					Estimated Meter Cost
Water Meter Installation - 5/8"	$ 28.00	-	$ -		RSM 22 11 19.38 2060
Water Meter Installation - 3/4"	$ 32.00	-	$ -		RSM 22 11 19.38 2020
Water Meter Installation - 1"	$ 37.00	-	$ -		RSM 22 11 19.38 2100
Water Meter Installation - 1 1/2"	$ 56.00	-	$ -		RSM 22 11 19.38 2340
Water Meter Installation - 2"	$ 74.50	-	$ -		RSM 22 11 19.38 2360
Water Meter Installation - 3"	$ 268.00	-	$ -		RSM 22 11 19.38 2640
Water Meter Installation - 4"	$ 535.00	-	$ -		RSM 22 11 19.38 2660
Water Meter Installation - 6"	$ 805.00	-	$ -		RSM 22 11 19.38 2680
Water Meter Installation - 8"	$ 1,000.00	-	$ -		RSM 22 11 19.38 2700
Per each Metering Setup		-	$ -	$ -	Water Meter Install Average
Water Register Exchange	$ 9.01	6,184	$ 55,745.19		
Endpoint Exchange	$ 12.00	6,184	$ 74,185.70		
Sub-total Installation			**$ 129,930.89**		

	Est. Price	Qty	Ext		
Other:					
Pit Lid	$ 40.39	618	$ 24,977.18		Radio frieldy lid cost
Sub-total Other			**$ 24,977.18**	$ 4.04	Average Cost per Water Meter

First Year Infrastructure

	Est. Price	Qty	Ext
System:			
Collectors / Antennas	$ 50,000.00	3	$ 150,000.00
Repeaters	$ 4,000.00	-	$ -
Software	$ 40,000.00	-	$ -
Drive-by Units	$ 30,000.00	-	$ -
Professional Services / Training / Travel	$ 37,500.00	1	$ 37,500.00
Leak Sensors	$ 250.00	-	$ -
Sub-total System			**$ 187,500.00**
System Installation			
Collectors / Antennas	$ 20,000.00	3	$ 60,000.00
Repeaters	$ 1,000.00	-	$ -
Software	$ 15,000.00	-	$ -
Drive-by Units	$ 5,000.00	-	$ -
Leak Sensors	$ 10.00	-	$ -
Sub-total System Installation			**$ 60,000.00**
First Year Total System			**$ 247,500.00**

Second Installation Phase

	Est. Price	Qty	Ext
System:			
Collectors / Antennas	$ 50,000.00	-	$ -
Repeaters	$ 4,000.00	-	$ -
Software	$ -	-	$ -
Drive-by Units	$ 30,000.00	-	$ -
Professional Services / Training / Travel	$ 25,000.00	-	$ -
Leak Sensors	$ 250.00	-	$ -
Sub-total System			**$ -**
System Installation			
Collectors / Antennas	$ 20,000.00	-	$ -
Repeaters	$ 1,000.00	-	$ -
Software	$ 5,000.00	-	$ -
Drive-by Units	$ 5,000.00	-	$ -
Leak Sensors	$ 10.00	-	$ -
Sub-total System Installation			**$ -**
Second Installation Phase Total System			**$ -**

City of Pendleton Costs, page 1

							AMI Infrastructure	Meters, Register and Endpoint - Contractor Install				Meters, Register and Endpoint - City Install				Register - Contractor Install			
Year	Rollout	Growth Rate	Inflation Rate	Tax Rate	Meters (#)	Revenue	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost
2,012		1.18%	3%	0%															
2,013	1	1.012	1.030	0%	6,257	3,699,526	$ 339,050	1	Yes	0	$ -	1	Yes	0	$ -	1	Yes	6184	$ 584,653
2,014	2	1.024	1.061	0%	6,330	3,855,351	$ -	2	No	0	$ -	2	No	0	$ -	2	No	0	$ -
2,015	3	1.036	1.093	0%	6,405	4,017,739	$ -	3	No	0	$ -	3	No	0	$ -	3	No	0	$ -
2,016	4	1.048	1.126	0%	6,480	4,186,967	$ -	4	No	0	$ -	4	No	0	$ -	4	No	0	$ -
2,017	5	1.060	1.159	0%	6,557	4,363,322	$ -	5	No	0	$ -	5	No	0	$ -	5	No	0	$ -
2,018	6	1.073	1.194	0%	6,634	4,547,106	$ -	6	No	0	$ -	6	No	0	$ -	6	No	0	$ -
2,019	7	1.085	1.230	0%	6,712	4,738,631	$ -	7	No	0	$ -	7	No	0	$ -	7	No	0	$ -
2,020	8	1.098	1.267	0%	6,791	4,938,222	$ -	8	No	0	$ -	8	No	0	$ -	8	No	0	$ -
2,021	9	1.111	1.305	0%	6,871	5,146,221	$ -	9	No	0	$ -	9	No	0	$ -	9	No	0	$ -
2,022	10	1.124	1.344	0%	6,951	5,362,980	$ -	10	No	0	$ -	10	No	0	$ -	10	No	0	$ -
2,023	11	1.137	1.384	0%	7,033	5,588,870	$ -	11	No	0	$ -	11	No	0	$ -	11	No	0	$ -
2,024	12	1.151	1.426	0%	7,116	5,824,274	$ -	12	No	0	$ -	12	No	0	$ -	12	No	0	$ -
2,025	13	1.164	1.469	0%	7,200	6,069,593	$ -	13	No	0	$ -	13	No	0	$ -	13	No	0	$ -
2,026	14	1.178	1.513	0%	7,284	6,325,245	$ -	14	No	0	$ -	14	No	0	$ -	14	No	0	$ -
2,027	15	1.192	1.558	0%	7,370	6,591,665	$ -	15	No	0	$ -	15	No	0	$ -	15	No	0	$ -
2,028	16	1.206	1.605	0%	7,457	6,869,307	$ -	16	No	0	$ -	16	No	0	$ -	16	No	0	$ -
2,029	17	1.220	1.653	0%	7,545	7,158,643	$ -	17	No	0	$ -	17	No	0	$ -	17	No	0	$ -
2,030	18	1.234	1.702	0%	7,633	7,460,166	$ -	18	No	0	$ -	18	No	0	$ -	18	No	0	$ -
2,031	19	1.249	1.754	0%	7,723	7,774,389	$ -	19	No	0	$ -	19	No	0	$ -	19	No	0	$ -
2,032	20	1.264	1.806	0%	7,814	8,101,848	$ -	20	No	0	$ -	20	No	0	$ -	20	No	0	$ -

Registers - City Install				Endpoints - Contractor Install				Endpoints - City Install				Pit Lids - Contractor Install				Pit Lids - City Install			
Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost	Rollout Year	If replacing	# Replaced	Future Cost
1	Yes	0	$ -	1	Yes	6184	$ 1,372,346	1	Yes	0	$ -	1	Yes	618	$ 34,216	1	Yes	0	$ -
2	No	0	$ -	2	No	0	$ -	2	No	0	$ -	2	No	0	$ -	2	No	0	$ -
3	No	0	$ -	3	No	0	$ -	3	No	0	$ -	3	No	0	$ -	3	No	0	$ -
4	No	0	$ -	4	No	0	$ -	4	No	0	$ -	4	No	0	$ -	4	No	0	$ -
5	No	0	$ -	5	No	0	$ -	5	No	0	$ -	5	No	0	$ -	5	No	0	$ -
6	No	0	$ -	6	No	0	$ -	6	No	0	$ -	6	No	0	$ -	6	No	0	$ -
7	No	0	$ -	7	No	0	$ -	7	No	0	$ -	7	No	0	$ -	7	No	0	$ -
8	No	0	$ -	8	No	0	$ -	8	No	0	$ -	8	No	0	$ -	8	No	0	$ -
9	No	0	$ -	9	No	0	$ -	9	No	0	$ -	9	No	0	$ -	9	No	0	$ -
10	No	0	$ -	10	No	0	$ -	10	No	0	$ -	10	No	0	$ -	10	No	0	$ -
11	No	0	$ -	11	No	0	$ -	11	No	0	$ -	11	No	0	$ -	11	No	0	$ -
12	No	0	$ -	12	No	0	$ -	12	No	0	$ -	12	No	0	$ -	12	No	0	$ -
13	No	0	$ -	13	No	0	$ -	13	No	0	$ -	13	No	0	$ -	13	No	0	$ -
14	No	0	$ -	14	No	0	$ -	14	No	0	$ -	14	No	0	$ -	14	No	0	$ -
15	No	0	$ -	15	No	0	$ -	15	No	0	$ -	15	No	0	$ -	15	No	0	$ -
16	No	0	$ -	16	No	0	$ -	16	No	0	$ -	16	No	0	$ -	16	No	0	$ -
17	No	0	$ -	17	No	0	$ -	17	No	0	$ -	17	No	0	$ -	17	No	0	$ -
18	No	0	$ -	18	No	0	$ -	18	No	0	$ -	18	No	0	$ -	18	No	0	$ -
19	No	0	$ -	19	No	0	$ -	19	No	0	$ -	19	No	0	$ -	19	No	0	$ -
20	No	0	$ -	20	No	0	$ -	20	No	0	$ -	20	No	0	$ -	20	No	0	$ -

AMR Extra O&M					Funding		
AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	AMR Extra O&M	Loan to Fund Capital Costs		
Data Hosting by VendorData Analyst Future Cost	Software Licensing and Maintenance: Future Cost	Collector Maintenance & Operation Costs: Future Cost	Endpoint Maintenance: Future Cost	Meter Maintenance: Future Cost	Capital Req'd: Only Infrastructure (Data Collectors, Meter, Endpoints)	Total Req'd for Loan	Yearly Payment
$ 13,964	$ 8,337	$ 8,024	$ 2,472	$ -	2,330,266	2,330,266	$ 163,960
$ 14,553	$ 8,688	$ 8,362	$ 2,546	$ -	-		$ 163,960
$ 15,166	$ 9,054	$ 8,715	$ 2,623	$ -	-		$ 163,960
$ 15,804	$ 9,435	$ 9,082	$ 2,701	$ -	-		$ 163,960
$ 16,470	$ 9,833	$ 9,464	$ 2,782	$ -	-		$ 163,960
$ 17,164	$ 10,247	$ 9,863	$ 2,866	$ -	-		$ 163,960
$ 17,887	$ 10,679	$ 10,278	$ 2,952	$ -	-		$ 163,960
$ 18,640	$ 11,128	$ 10,711	$ 3,040	$ -	-		$ 163,960
$ 19,425	$ 11,597	$ 11,162	$ 3,131	$ -	-		$ 163,960
$ 20,243	$ 12,086	$ 11,632	$ 3,225	$ -	-		$ 163,960
$ 21,096	$ 12,595	$ 12,122	$ 3,322	$ -	-		$ 163,960
$ 21,985	$ 13,125	$ 12,633	$ 3,422	$ -	-		$ 163,960
$ 22,911	$ 13,678	$ 13,165	$ 3,524	$ -	-		$ 163,960
$ 23,876	$ 14,254	$ 13,720	$ 3,630	$ -	-		$ 163,960
$ 24,881	$ 14,854	$ 14,297	$ 3,739	$ -	-		$ 163,960
$ 25,929	$ 15,480	$ 14,900	$ 3,851	$ -	-		$ 163,960
$ 27,021	$ 16,132	$ 15,527	$ 3,967	$ -	-		$ 163,960
$ 28,159	$ 16,812	$ 16,181	$ 4,086	$ -	-		$ 163,960
$ 29,346	$ 17,520	$ 16,863	$ 4,208	$ -	-		$ 163,960
$ 30,582	$ 18,258	$ 17,573	$ 4,335	$ -	-		$ 163,960

City of Pendleton Benefits, page 1

						Readers					Vehicles				
						Original Readers		Proposed Readers			Original Vehicles		Proposed vehicles		
Year	Rollout	Growth Rate	Inflation Rate	Tax Rate	Meters	# of Readers	Meter FTE Readers	# of Readers	Meter FTE Readers	Savings/Costs	# Vehicles	Future Cost	# Vehicles	Future Cost	Savings/Costs
2,012	-	1.18%	3%	0%	(#)		Future Cost		Future Cost						
2,013	1	1.012	1.030	0%	6,257	1.13	$ 87,538	0.0	$ -	$ (87,538)	0.51	$ 11,776	0.10	$ 2,355	$ (9,421)
2,014	2	1.024	1.061	0%	6,330	1.15	$ 91,225	0.0	$ -	$ (91,225)	0.51	$ 12,272	0.10	$ 2,454	$ (9,818)
2,015	3	1.036	1.093	0%	6,405	1.16	$ 95,068	0.0	$ -	$ (95,068)	0.52	$ 12,789	0.10	$ 2,558	$ (10,231)
2,016	4	1.048	1.126	0%	6,480	1.17	$ 99,072	0.0	$ -	$ (99,072)	0.52	$ 13,328	0.10	$ 2,666	$ (10,662)
2,017	5	1.060	1.159	0%	6,557	1.19	$ 103,245	0.0	$ -	$ (103,245)	0.53	$ 13,889	0.11	$ 2,778	$ (11,111)
2,018	6	1.073	1.194	0%	6,634	1.20	$ 107,593	0.0	$ -	$ (107,593)	0.54	$ 14,474	0.11	$ 2,895	$ (11,579)
2,019	7	1.085	1.230	0%	6,712	1.22	$ 112,125	0.0	$ -	$ (112,125)	0.54	$ 15,084	0.11	$ 3,017	$ (12,067)
2,020	8	1.098	1.267	0%	6,791	1.23	$ 116,848	0.0	$ -	$ (116,848)	0.55	$ 15,719	0.11	$ 3,144	$ (12,575)
2,021	9	1.111	1.305	0%	6,871	1.24	$ 121,770	0.0	$ -	$ (121,770)	0.56	$ 16,381	0.11	$ 3,276	$ (13,105)
2,022	10	1.124	1.344	0%	6,951	1.26	$ 126,899	0.0	$ -	$ (126,899)	0.56	$ 17,071	0.11	$ 3,414	$ (13,657)
2,023	11	1.137	1.384	0%	7,033	1.27	$ 132,244	0.0	$ -	$ (132,244)	0.57	$ 17,790	0.11	$ 3,558	$ (14,232)
2,024	12	1.151	1.426	0%	7,116	1.29	$ 137,814	0.0	$ -	$ (137,814)	0.58	$ 18,539	0.12	$ 3,708	$ (14,831)
2,025	13	1.164	1.469	0%	7,200	1.30	$ 143,619	0.0	$ -	$ (143,619)	0.58	$ 19,320	0.12	$ 3,864	$ (15,456)
2,026	14	1.178	1.513	0%	7,284	1.32	$ 149,668	0.0	$ -	$ (149,668)	0.59	$ 20,134	0.12	$ 4,027	$ (16,107)
2,027	15	1.192	1.558	0%	7,370	1.33	$ 155,972	0.0	$ -	$ (155,972)	0.60	$ 20,982	0.12	$ 4,196	$ (16,786)
2,028	16	1.206	1.605	0%	7,457	1.35	$ 162,541	0.0	$ -	$ (162,541)	0.60	$ 21,866	0.12	$ 4,373	$ (17,493)
2,029	17	1.220	1.653	0%	7,545	1.37	$ 169,388	0.0	$ -	$ (169,388)	0.61	$ 22,787	0.12	$ 4,557	$ (18,229)
2,030	18	1.234	1.702	0%	7,633	1.38	$ 176,522	0.0	$ -	$ (176,522)	0.62	$ 23,746	0.12	$ 4,749	$ (18,997)
2,031	19	1.249	1.754	0%	7,723	1.40	$ 183,957	0.0	$ -	$ (183,957)	0.62	$ 24,747	0.12	$ 4,949	$ (19,797)
2,032	20	1.264	1.806	0%	7,814	1.42	$ 191,706	0.0	$ -	$ (191,706)	0.63	$ 25,789	0.13	$ 5,158	$ (20,631)

Data Input					Handhelds					Customer Calls							
Original Data Input		Proposed Data Input			Original Handhelds		Proposed Handhelds					Original Calls		Proposed Calls			
# Original FTE	Future Cost	Proposed # FTE	Future Cost	Savings/Costs	# Purchased	Future Cost	# Purchased	Future Cost	Savings/Costs	Number of Radio Ready Units - Calculation Step	No. Not Radio Ready - Calculation Step	# of Calls	Future Cost	# of Calls	Future Cost	Savings/Costs	
0.7	$ 43,988	0.6	$ 36,109	$ (7,878)	1	$ 7,416	1	$ 7,416	$ -	6257	0	9612	$ 24,988	3642	$ 9,470	$ (15,519)	
0.7	$ 45,841	0.6	$ 37,630	$ (8,210)	1	$ 7,638	1	$ 7,638	$ -	6331	0	9725	$ 26,041	3686	$ 9,869	$ (16,172)	
0.7	$ 47,771	0.6	$ 39,215	$ (8,556)	0	$ -	0	$ -	$ -	6405	0	9839	$ 27,138	3729	$ 10,284	$ (16,854)	
0.7	$ 49,784	0.6	$ 40,867	$ (8,916)	0	$ -	0	$ -	$ -	6481	0	9955	$ 28,281	3773	$ 10,718	$ (17,563)	
0.7	$ 51,881	0.6	$ 42,588	$ (9,292)	0	$ -	0	$ -	$ -	6557	0	10072	$ 29,472	3817	$ 11,169	$ (18,303)	
0.7	$ 54,066	0.6	$ 44,382	$ (9,683)	0	$ -	0	$ -	$ -	6634	0	10191	$ 30,713	3862	$ 11,639	$ (19,074)	
0.7	$ 56,343	0.6	$ 46,252	$ (10,091)	1	$ 8,855	1	$ 8,855	$ -	6712	0	10311	$ 32,007	3907	$ 12,129	$ (19,877)	
0.7	$ 58,716	0.6	$ 48,200	$ (10,516)	1	$ 9,121	1	$ 9,121	$ -	6791	0	10432	$ 33,355	3953	$ 12,640	$ (20,715)	
0.7	$ 61,189	0.6	$ 50,230	$ (10,959)	0	$ -	0	$ -	$ -	6871	0	10555	$ 34,760	4000	$ 13,173	$ (21,587)	
0.8	$ 63,767	0.6	$ 52,346	$ (11,421)	0	$ -	0	$ -	$ -	6952	0	10679	$ 36,224	4047	$ 13,728	$ (22,496)	
0.8	$ 66,452	0.6	$ 54,551	$ (11,902)	0	$ -	0	$ -	$ -	7034	0	10805	$ 37,750	4095	$ 14,307	$ (23,443)	
0.8	$ 69,251	0.6	$ 56,848	$ (12,403)	0	$ -	0	$ -	$ -	7117	0	10932	$ 39,340	4143	$ 14,910	$ (24,430)	
0.8	$ 72,168	0.6	$ 59,243	$ (12,926)	1	$ 10,573	1	$ 10,573	$ -	7200	0	11060	$ 40,997	4191	$ 15,536	$ (25,461)	
0.8	$ 75,208	0.6	$ 61,738	$ (13,470)	1	$ 10,891	1	$ 10,891	$ -	7285	0	11191	$ 42,724	4241	$ 16,191	$ (26,532)	
0.8	$ 78,376	0.7	$ 64,338	$ (14,037)	0	$ -	0	$ -	$ -	7371	0	11322	$ 44,523	4291	$ 16,874	$ (27,649)	
0.8	$ 81,677	0.7	$ 67,048	$ (14,629)	0	$ -	0	$ -	$ -	7457	0	11455	$ 46,399	4341	$ 17,583	$ (28,816)	
0.8	$ 85,117	0.7	$ 69,872	$ (15,245)	0	$ -	0	$ -	$ -	7545	0	11590	$ 48,353	4392	$ 18,324	$ (30,029)	
0.8	$ 88,702	0.7	$ 72,815	$ (15,887)	0	$ -	0	$ -	$ -	7634	0	11727	$ 50,389	4444	$ 19,096	$ (31,293)	
0.8	$ 92,439	0.7	$ 75,882	$ (16,556)	1	$ 12,625	1	$ 12,625	$ -	7724	0	11865	$ 52,512	4497	$ 19,901	$ (32,611)	
0.8	$ 96,332	0.7	$ 79,079	$ (17,254)	1	$ 13,004	1	$ 13,004	$ -	7815	0	12004	$ 54,724	4549	$ 20,740	$ (33,984)	

City of Pendleton Benefits, page 3

Rebills					Field Service/Special Reads					Other System Benefits		
Original Rebills		Proposed Rebills			Original FS/SR		Proposed FS/SR			Flat Rate Service to be Metered		Misc. System Benefits
# of Rebills	Future Cost	# of Rebills	Future Cost	Savings	# of FS/SR	Future Cost	# of FS/SR	Future Cost	Savings/Costs	# Added	Future Added Rev.	Future Savings
192	$ 3,960	96	$ 1,980	$ (1,980)	2529	$ 70,456	1123	$ 31,284	$ (39,172)	0	$ -	$ -
194	$ 4,127	97	$ 2,064	$ (2,063)	2559	$ 73,423	1136	$ 32,603	$ (40,820)	0	$ -	$ -
197	$ 4,301	98	$ 2,150	$ (2,150)	2589	$ 76,516	1150	$ 33,974	$ (42,542)	0	$ -	$ -
199	$ 4,482	100	$ 2,241	$ (2,241)	2620	$ 79,739	1163	$ 35,408	$ (44,331)	0	$ -	$ -
201	$ 4,671	101	$ 2,335	$ (2,335)	2651	$ 83,098	1177	$ 36,898	$ (46,199)	0	$ -	$ -
204	$ 4,867	102	$ 2,434	$ (2,434)	2682	$ 86,598	1191	$ 38,451	$ (48,146)	0	$ -	$ -
206	$ 5,072	103	$ 2,536	$ (2,536)	2713	$ 90,245	1205	$ 40,071	$ (50,175)	0	$ -	$ -
209	$ 5,286	104	$ 2,643	$ (2,643)	2745	$ 94,046	1219	$ 41,758	$ (52,288)	0	$ -	$ -
211	$ 5,509	106	$ 2,754	$ (2,754)	2778	$ 98,007	1233	$ 43,518	$ (54,490)	0	$ -	$ -
214	$ 5,741	107	$ 2,871	$ (2,870)	2810	$ 102,136	1248	$ 45,352	$ (56,784)	0	$ -	$ -
216	$ 5,982	108	$ 2,992	$ (2,991)	2843	$ 106,438	1263	$ 47,263	$ (59,174)	0	$ -	$ -
219	$ 6,234	109	$ 3,118	$ (3,117)	2877	$ 110,921	1277	$ 49,256	$ (61,665)	0	$ -	$ -
221	$ 6,497	111	$ 3,249	$ (3,248)	2911	$ 115,593	1292	$ 51,325	$ (64,268)	0	$ -	$ -
224	$ 6,771	112	$ 3,386	$ (3,385)	2945	$ 120,461	1308	$ 53,489	$ (66,973)	0	$ -	$ -
226	$ 7,056	113	$ 3,528	$ (3,528)	2980	$ 125,535	1323	$ 55,744	$ (69,791)	0	$ -	$ -
229	$ 7,353	115	$ 3,677	$ (3,676)	3015	$ 130,823	1338	$ 58,086	$ (72,737)	0	$ -	$ -
232	$ 7,663	116	$ 3,832	$ (3,831)	3050	$ 136,333	1354	$ 60,535	$ (75,798)	0	$ -	$ -
235	$ 7,986	117	$ 3,993	$ (3,992)	3086	$ 142,076	1370	$ 63,086	$ (78,989)	0	$ -	$ -
237	$ 8,322	119	$ 4,161	$ (4,161)	3122	$ 148,060	1386	$ 65,745	$ (82,315)	0	$ -	$ -
240	$ 8,672	120	$ 4,337	$ (4,336)	3159	$ 154,296	1403	$ 68,515	$ (85,781)	0	$ -	$ -

Table 2 - Comparison of Fixed Base AMR System to City Staff Meter Reading Services

		METER READING AND ASSOCIATED BENEFITS		*FIELD WORK/SERVICES*	*CUSTOMER SERVICE IMPACT*	TOTAL BENEFITS & SAVINGS	TOTAL COSTS (4)	Net Costs and Benefits	Net Present Value	Cumulative Net Present Value	Payback Period (years)
Year		Savings Salaries & Benefits (1)	Savings Vehicles	Field Service Special Reads (2)	Call Center and Customer Accounting (3)						
2013	1	$63,000	$9,000	$39,000	$17,000	$128,000	($164,000)	($36,000)	($34,783)	($34,783)	14
2014	2	$65,000	$10,000	$41,000	$18,000	$134,000	($164,000)	($30,000)	($28,005)	($62,788)	
2015	3	$68,000	$10,000	$43,000	$19,000	$140,000	($164,000)	($24,000)	($21,647)	($84,435)	
2016	4	$71,000	$11,000	$44,000	$20,000	$146,000	($164,000)	($18,000)	($15,686)	($100,121)	
2017	5	$74,000	$11,000	$46,000	$21,000	$152,000	($164,000)	($12,000)	($10,104)	($110,224)	
2018	6	$77,000	$12,000	$48,000	$22,000	$159,000	($164,000)	($5,000)	($4,068)	($114,292)	
2019	7	$80,000	$12,000	$50,000	$22,000	$164,000	($164,000)	$0	$0	($114,292)	
2020	8	$84,000	$13,000	$52,000	$23,000	$172,000	($164,000)	$8,000	$6,075	($108,216)	
2021	9	$87,000	$13,000	$54,000	$24,000	$178,000	($164,000)	$14,000	$10,272	($97,944)	
2022	10	$91,000	$14,000	$57,000	$25,000	$187,000	($164,000)	$23,000	$16,305	($81,639)	
2023	11	$95,000	$14,000	$59,000	$26,000	$194,000	($164,000)	$30,000	$20,548	($61,091)	
2024	12	$99,000	$15,000	$62,000	$28,000	$204,000	($164,000)	$40,000	$26,471	($34,619)	
2025	13	$103,000	$15,000	$64,000	$29,000	$211,000	($164,000)	$47,000	$30,052	($4,567)	
2026	14	$108,000	$16,000	$67,000	$30,000	$221,000	($164,000)	$57,000	$35,214	$30,646	
2027	15	$112,000	$17,000	$70,000	$31,000	$230,000	($164,000)	$66,000	$39,395	$70,041	
2028	16	$117,000	$17,000	$73,000	$32,000	$239,000	($164,000)	$75,000	$43,253	$113,294	
2029	17	$122,000	$18,000	$76,000	$34,000	$250,000	($164,000)	$86,000	$47,920	$161,213	
2030	18	$127,000	$19,000	$79,000	$35,000	$260,000	($164,000)	$96,000	$51,683	$212,896	
2031	19	$133,000	$20,000	$82,000	$37,000	$272,000	($164,000)	$108,000	$56,177	$269,073	
2032	20	$138,000	$21,000	$86,000	$38,000	$283,000	($164,000)	$119,000	$59,805	$328,878	

Notes:

1: Includes reduction in manual meter reading staff and addition of AMR system related staffing and direct O&M costs on AMR system.
2: Decrease in field services
3: Includes savings from reduction in number of customer calls and rebills
4: Total Costs include fixed data collectors, software and data management system, registers and endpoints.

Murray, Smith & Associates, Inc.
Engineers/Planners

APPENDIX C
Cost Estimating Methodology and Assumptions

APPENDIX C
COST ESTIMATING METHODOLOGY AND ASSUMPTIONS

Introduction

This appendix summarizes the approach used in development of unit costs and project costs used in the Capital Improvement Program (CIP) for the City of Pendleton's (City) Water System Master Plan (WSMP).

Cost Estimating

The probable costs estimated for each improvement are based on average costs from the 2013 RS Means Heavy Construction Cost Data (RSMeans), City input, construction costs for similar projects across the Northwest, and information provided by local suppliers. All costs identified in this section reference U.S. dollars. The *Engineering News Record Construction Cost Index* (ENR CCI) basis is 9668 (20-City Average, December 2013).

Project cost estimates were prepared in accordance with the guidelines of AACE International, formerly the Association for the Advancement of Cost Engineering International. (*AACE International Recommended Practice No. 56R-08 Cost Estimate Classification System - As Applied For The Building and General Construction Industries - TCM Framework: 7.3 - Cost Estimating and Budgeting Rev. December 31, 2011*). The project cost estimates in this WSMP are categorized Class 5, as defined by AACE International:

> *Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systemic manner.*
>
> *Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.*
>
> *Typical accuracy ranges for Class 5 estimates are -20% to -30% on the low side, and +30% to +50% on the high side, depending on the construction complexity of the project, appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks.*

All project descriptions and cost estimates in this WSMP represent planning-level accuracy and opinions of costs (+50%, -30%). During the design phase of each improvement project,

project definition, scope and specific information (e.g., pipe diameter and length) should be verified. The final cost of individual projects will depend on actual labor and material costs, site conditions, competitive market conditions, regulatory requirements, project schedule and other factors. Because of these factors, project feasibility and risks must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.

The project costs presented in this WSMP include estimated construction costs, and allowances for permitting, legal, administrative and engineering fees. A contingency factor is also added to each cost to help account for any unanticipated components of the project costs. Construction costs are based on the preliminary concepts and layouts of the system components developed during the system analysis.

Total estimated project costs were developed through a progression of steps and multiple methodologies. The steps included development of component unit costs, construction costs and, finally, project costs. The component unit cost includes the sum of materials, labor and equipment of a project's basic features. The construction cost is the sum of component costs and mark-ups to determine the probable cost of construction (i.e., the contractor bid price). The project cost is the sum of construction costs with additional cost allowances for engineering, legal and administrative fees as well as a contingency factor to determine the total project cost to the City.

The following costs are not included:

- Land or right-of-way acquisition, unless directed by the City.
- Required improvements or upgrades to the Water Filtration Plant to accommodate system expansion.
- Water System studies, planning or modeling.
- Borrowing or finance charges during the planning, design, or construction of assets.
- Improvements to distribution or filtration facilities in response to changes in regulatory standards or rules.
- Remediation or fines associated with system violations.

Component Unit Costs

Pipelines

The estimates for water system piping include the costs for pipe, fittings, valves and water service connections. The pipe material assumed for new waterlines was CL 52 Ductile Iron or C900 PVC for 4- to 12-inch pipe and CL 50 ductile iron or C905 PVC for 14- to 24-inch pipe. The cost of ductile iron pipe was obtained from a local vendor. The cost of the PVC was originally gathered from a local vendor. However, the costs for the pipe material ultimately came from the City because the local vendor costs were from 60% to 100% more expensive than RSMeans and City estimates.

For all pipeline installations including new and replacement projects, the cost is based on a cover depth of four feet and includes:

- Excavation.
- Waste of the material associated with the trenching (which includes haul, load and dump fees).
- Imported bedding and zone material.
- Native backfill (which includes minimal haul and compaction of material).
- Fittings and valves (30% of pipe costs).
- Testing and disinfection (as a percentage of total cost).

For replacement of existing waterlines additional costs include:

- Abandonment of the existing pipe.
- Replacement of water service lines (10% of pipe costs).

As the diameter of pipe and the trench width increase, the costs also increase. Therefore, a specific cost has been identified for each pipe diameter. See Table C-1 for costs for both new pipe and replacement of existing pipe.

Table C-1
Water Pipeline Costs per Linear Foot

Pipe Diameter (inch)	Ductile Iron Pipe ($/LF)		PVC Pipe ($/LF)	
	New	Replacement	New	Replacement
4	$55	$57	$22	$23
6	$60	$63	$28	$28
8	$80	$85	$34	$35
10	$96	$101	$42	$43
12	$111	$116	$51	$52
14	$124	$129	$52	$53
16	$143	$151	$60	$61
18	$165	$173	$70	$72
20	$167	$176	$73	$75
24	$190	$200	$106	$108

Bedrock

There is typically ripable rock in the project areas. For planning purposes, rock excavation will be applied to projects identified by the City. Excavation costs were calculated for each type of project. Due to the higher unit cost for ductile iron pipe, the increased cost of excavation in rock resulted in only a 25% increase in pipe unit cost for rock excavation. The lower PVC pipe cost relative to the increased rock excavation cost results in a 50% overall increase in unit pipe cost for PVC projects requiring rock excavation.

Special Pipe Crossings

Special pipe crossings are required for crossing rivers, canals, railroads and highways, or areas where traditional open cut construction is not possible. An additional 100% is applied to pipeline costs for any projects with these conditions.

Surface Restoration

Surface restoration of construction sites is required to complete every project. As with the pipe installation costs, the surface restoration costs increase with the size of pipe and depth of construction, due to the larger trench that will need to be excavated. Therefore, a unit surface restoration cost has been developed for each pipe diameter. Table C-2 tabulates costs for surface restoration. The tables are separated to define costs associated with local and arterial asphalt roadways and unpaved surfaces. The surface restoration is developed from local supplier and costs and RSMeans.

Table C-2
Surface Restoration Costs per Linear Foot

Pipe Diameter (inch)	Surface Condition Cost ($/LF)		
	Arterial[1]	Local[2]	Unpaved[3]
4	$20	$19	$5
6	$21	$19	$5
8	$22	$20	$5
10	$22	$20	$5
12	$23	$21	$5
14	$24	$22	$6
16	$24	$22	$6
18	$25	$23	$6
20	$25	$23	$7
24	$27	$24	$7

[1] *Road repair and replacement along trench. 4.5-inch asphalt and 4 inches of ¾-inch minus and 8 inches of 2-inch minus.*
[2] *Road repair and replacement along trench.3.5-inch asphalt and 4 inches of ¾-inch minus and 8 inches of 2-inch minus.*
[3] *Repair and replacement of trench using rock backfill to ground surface along trench cross-country..*

Pressure-Reducing Valve Facilities

Pressure-reducing Valve (PRV) project costs assume the stations contain the following major components for construction:

- 8-inch mainline Cla-Val PRV.
- 2-inch low flow Cla-Val bypass PRV.
- 8-inch mainline PRV piping.
- 2-inch bypass PRV piping.
- Concrete valve vault.

Booster Pump Station

Booster pump station project costs were developed for each individual pump station project. For new or replacement booster pump stations, the project cost includes basic site, civil, mechanical, electrical, and instrumentation and control facilities. Project cost estimates were developed based on cost curves that reflect similar booster pump station construction projects within the Pacific Northwest.

Upgraded booster pump station project cost estimates were developed individually for each facility to be upgraded. Estimated costs to upgrade specific components were established for each project based on the scope of improvements using data from similar projects. Component upgrades included: pumps and motors, mechanical piping and valves, general electrical, service electrical, site civil, and building structural.

Storage Facilities

Proposed storage facility project costs were compared for two different tank construction types, AWWA D110 – Type 1 pre-stressed concrete and AWWA D100 welded steel. It was assumed that proposed reservoirs will be circular, at grade structures with an exterior wall height of between 25 and 35 feet. Project cost estimates for pre-stressed concrete construction were based on a base cost of $2,000,000 per million gallons of storage volume. Project cost estimates for welded steel construction were based on a base cost of $1,250,000 per million gallons of storage volume. City staff recommended continuing reservoir project estimates with steel construction at a lower cost.

Construction Cost Allowances

The construction cost is the sum of materials, labor, equipment, mobilization, contractor's overhead and profit, and contingency for each project. Tables D-3 and D-4 present the additional allowances associated with the construction costs and project costs, respectively.

Traffic Control

Traffic control will be required for all projects that occur in roadways. The cost and level of effort for traffic control should be evaluated based on the scope and size of each project and as local conditions at the time of construction dictate. For planning purposes, the cost of traffic control is estimated at 0.5% for low traffic control areas or 2% for high traffic control areas depending on project location. Traffic control mark-up accounts for the cost of signage, flagging and temporary barriers, street widening, pavement markings, lane delineators and lighting at flagging locations.

Erosion Control

Erosion control will be required for all projects. For planning purposes, the erosion control is estimated at 1% of the construction costs. Erosion control mark-up accounts for materials and practices to protect adjacent property, storm water systems, and surface water in accordance with regulatory requirements. The level of effort and cost for erosion control depends on the size and scope of a project, and the local conditions at the time of construction.

Dewatering

Dewatering groundwater is expected to be necessary when construction is near the Umatilla River and other smaller water drainages as identified by the City. For planning purposes, dewatering is estimated at 1% of the construction costs for projects located in these areas.

Construction Contractor Overhead and Profit

A 10% mark-up accounts for the contractor's indirect project costs and anticipated profit.

Construction Mobilization

A 10% mobilization mark-up accounts for the cost of the contractor's administrative and direct expenses to mobilize equipment, materials and labor to the work site.

Construction Contingency

A 30% increase was added in each project's construction cost to account for a contingency factor to cover the uncertainties inherent to planning-level development. The contingency is provided to account for factors such as:

- Unanticipated utilities.
- Relocation and connection to existing infrastructure.
- Minor elements of work not addressed in component unit cost development.
- Details of construction.
- Changes in site conditions.
- Variability in construction bid climate.

The contingency excludes:

- Major scope changes such as end product specification, capacities and location of project.
- Extraordinary events such as strikes or natural disasters.
- Management reserves.
- Escalation and currency effects.

A summary of construction mark-ups is provided in Table C-3.

Table C-3
Additional Construction Costs

Additional Cost Factor	Percent
Low Traffic Control	0.5%
High Traffic Control	2%
Erosion Control	1%
Dewatering	1%
Contractor Overhead and Profit	10%
Mobilization	10%
Contingency	30%

Total Project Cost

The total project cost is the sum of construction cost with additional cost allowances for engineering, legal, and administrative fees. Table C-4, shown below, presents the cost allowances for each additional project cost. The engineering costs include design and surveying. Construction administration is the cost associated with managing the construction of the project. The administrative and legal costs are those associated with the City providing financial and legal oversight of the contract.

Table C-4
Summary of Additional Costs

Additional Cost Factor	Percent
Construction Administration	5%
Engineering	15%
Legal and Administrative	10%

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