CITY OF ASHLAND
WATER MASTER PLAN UPDATE




PREPARED BY RH2 ENGINEERING, INC.

WITH ASSISTANCE FROM

HANSFORD ECONOMIC CONSULTING

SPRING 2019

RH2

CITY OF ASHLAND

DRAFT

| TABLE OF CONTENTS

City of Ashland Water Master Plan Update

DRAFT

| TABLE OF CONTENTS

City of Ashland Water Master Plan Update

DRAFT

| TABLE OF CONTENTS

City of Ashland Water Master Plan Update

DRAFT

| TABLE OF CONTENTS

City of Ashland Water Master Plan Update

DRAFT

1 INTRODUCTION

DRAFT

DRAFT

1 | INTRODUCTION

Water System Ownership and Management

The City of Ashland (City) is a municipal corporation that owns and operates a public water system that covers its corporate boundaries. A summary of water system data is shown in **Table 1-1**.

Table 1-1
Water System Ownership Information

Information Type	Description
System Classification	Community
System Name	Ashland Water Department
County	Jackson County
System ID Number	00047
Address	90 N. Mountain Avenue, Ashland OR 97520
Contact	Mr. Greg Hunter, Water Treatment Plant Supervisor
Contact Phone Number	(541)488-5346

Overview of Existing System

In 2016, the City provided water service to an average of approximately 8,796 customer connections, or 16,461 equivalent residential units (ERUs), within the City's water service area. The City limits comprise an area of approximately 6.58 square miles, which also represents the water service area. The 2016 population served by the water system was approximately 20,620.

The City's water supply is currently provided by the Reeder Reservoir and the Talent-Ashland-Phoenix (TAP) "Emergency" Intertie that conveys water supply from the Medford Water Commission (MWC). Supplemental raw water supply may also be provided by the Talent Irrigation District (TID). Water supply from Reeder Reservoir and TID is treated at the City's Water Treatment Plant. Water supply from MWC is rechlorinated at the TAP booster pump station (BPS).

Water storage is provided by four treated water storage/distribution reservoirs that have a total capacity of approximately 6.8 million gallons (MG). In addition, the City's water system has 14 pressure zones with 31 pressure reducing stations. The system also has 4 booster pump stations and approximately 119 miles of water main. A tabular summary of the 2016 water system data is shown in **Table 1-2**.

DRAFT

Table 1-2
2016 Water System Data

Description	Data
Water Service Population	20,620
Existing Water Service Area	6.50 Square Miles
Total Connections	8,796
Total ERUs	16,461
Demand per ERU	177 Gallons Per Day
Annual Consumption	1,065,011,589 Gallons
Average Day Demand (ADD)	2.91 MGD
Maximum Day/Average Day Demand Factor	2.04
Peak Hour/Peak Day Demand Factor	2.38
Number of Pressure zones	14
Number of Sources and Total Capacity[1]	3 (10.0 MGD)
Number of Storage Tanks and Total Capacity	4 (6.8 MG)
Number of Pump Stations	4
Number of Pressure Reducing Valve Stations	31
Total Length of Water Main	119 Miles
[1]Does not include TID emergency supply.	

Authorization and Purpose

In accordance with Oregon Administrative Rules (OAR 333-61-060), this Water Master Plan (WMP) was developed to satisfy the City's requirements for planning by the Oregon Health Authority. The previous WMP was completed in 2012. The purpose of this updated WMP is as follows:

- To evaluate existing water demand data and project future water demands;
- To analyze the existing water system to determine if it meets minimum requirements and the City's own policies, level of service goals and design criteria;
- To identify water system improvements that resolve existing system deficiencies and accommodate the system's future needs for at least 20 years into the future;
- To prepare a schedule of improvements that meets the goals of the City's financial program;
- To document the City's existing water rights, their current status, and future requirements;
- To evaluate past water quality and identify water quality improvements, as necessary; and
- To document the City's operations and maintenance program including personnel requirements.

DRAFT

Summary of WMP Contents

A brief summary of the content of the chapters in the WMP is as follows:

- The **Executive Summary** provides a brief summary of the key elements of this WMP.
- **Chapter 1** introduces the reader to the City's water system, the objectives of the WMP, and its organization.
- **Chapter 2** presents the water service area and describes the existing water system.
- **Chapter 3** presents related plans, land use, and population characteristics.
- **Chapter 4** identifies existing water demands and projected future demands.
- **Chapter 5** discusses the water system analyses and existing system deficiencies.
- **Chapter 6** presents the proposed water system improvements, and their estimated costs and implementation schedule in a Capital Improvement Plan.
- **Chapter 7** summarizes the financial status of the water system and presents a plan for funding the water system improvements.
- The **Appendices** contain additional information and plans that supplement the main chapters of the WMP.

Definition of Terms

The following terms are used throughout this WMP.

Consumption: The true volume of water used by the water system's customers. The volume is measured at each customer's connection to the distribution system.

Cross Connection: A physical arrangement that connects a public water system, directly or indirectly, with facilities that could present the potential for contaminating the public water system.

Demand: The quantity of water required from a water supply source over a period of time to meet the needs of domestic, irrigation, commercial, industrial, and public uses, and provide enough water to supply firefighting, system losses, and miscellaneous water uses such as hydrant flushing and non-revenue water uses. Demands are normally discussed in terms of flow rate, such as million gallons per day (MGD) or gallons per minute (gpm) and are described in terms of a volume of water delivered during a certain time period. Flow rates pertinent to the analysis and design of water systems are as follows:

- **Average Day Demand (ADD)**: The total amount of water delivered to the system in a year divided by the number of days in the year.
- **Maximum Day Demand (PDD)**: The maximum amount of water delivered to the system during a 24-hour time period of a given year.
- **Peak Hour Demand (PHD)**: The maximum amount of water delivered to the system, excluding fire flow, during a 1-hour time period of a given year. A system's peak hour demand usually occurs during the same day as the MDD.

Equivalent Residential Units (ERUs): One ERU represents the amount of water used by one single-family residence for a specific water system. The demand of other customer classes can be expressed in terms of ERUs by dividing the demand of each of the other customer classes by the demand represented by one ERU.

Fire Flow: The rate of flow of water required during firefighting, which is usually expressed in terms of gpm.

Head: A measure of pressure or force exerted by water. Head is measured in feet and can be converted to pounds per square inch (psi) by dividing feet by 2.31.

Headloss: Pressure reduction resulting from pipeline wall friction, bends, physical restrictions, or obstructions.

Hydraulic Elevation: The height of a free water surface above a defined datum; the height above the ground to which water in a pressure pipeline would rise in a vertical open-end pipe.

Maximum Contaminant Level (MCL): The maximum permissible level of contaminant in the water that the purveyor delivers to any public water system user.

Pressure Zone: A portion of the water system that operates from sources at a common hydraulic elevation. For example, the 2170 Granite Zone 1 refers to one of the City's primary pressure zones, which has a reservoir with an overflow elevation of 2,170 feet.

Purveyor: An agency, subdivision of the state, municipal corporation, firm, company, mutual or cooperative association, institution, partnership, or persons or other entity owning or operating a public water system. Purveyor also means the authorized agents of such entities.

Supply: Water that is delivered to a water system by one or more supply facilities, which may consist of supply stations, booster pump stations, interties, springs, and wells.

Storage: Water that is "stored" in a reservoir to supplement the supply facilities of a system and provide water supply for emergency conditions. Storage is broken down into the following three components, which are defined and discussed in more detail in **Chapter 5**: operational storage, emergency storage and fire flow storage.

Water Loss: Water that is measured as going into the distribution system but not metered as going out of the system.

DRAFT

List of Abbreviations

The abbreviations listed in **Table 1-3** are used throughout this WMP.

Table 1-3
Abbreviations

Abbreviation	Description
ACS	American Community Survey
ADD	Average Day Demand
AWWA	American Water Works Association
BPS	Booster Pump Station
CCR	Consumer Confidence Report
CIP	Capital Improvement Program
City	City of Ashland
County	Jackson County
DBP	Disinfection Byproduct
DLCD	Department of Land Conservation and Development
EPA	U.S. Environmental Protection Agency
ERU	Equivalent Residential Unit
fps	Feet per second
gpd	Gallons per day
gpm	Gallons per minute
HDPE	High Density Polyethylene
hp	Horsepower
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDD	Maximum Day Demand
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MWC	Medford Water Commission
OAR	Oregon Administrative Rules
OHD	Oregon Health Division
PHD	Peak Hour Demand

Abbreviation	Description
PRV	Pressure Reducing Valve
PRV	Pressure Relief Valve
psi	Pounds per square inch
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SOC	Synthetic Organic Chemical
SWTR	Surface Water Treatment Rule
TAP	Talent-Ashland-Phoenix Partnership
TID	Talent Irrigation District
UGB	Urban Growth Boundary
USGS	United States Geological Survey
VOC	Volatile Organic Chemical
WMP	Water Master Plan
WTP	Water Treatment Plant
WUE	Water Use Efficiency

DRAFT

2 | WATER SYSTEM DESCRIPTION

DRAFT

DRAFT

2 | WATER SYSTEM DESCRIPTION

Introduction

This chapter describes the City's existing and future water service areas and water service agreements and provides a thorough description of the water system and its individual components. The results of the evaluation and analyses of the existing water system are presented in **Chapter 5.**

Water Service Area

History

The City's primary source of raw water is the Ashland Creek watershed. In 1887 through 1890, the City installed its first water works and pipe network to serve the City's early settlers. In 1909, piping was installed to deliver water to town from the East and West Forks of Ashland Creek. In 1928, the City constructed Hosler Dam at the confluence of the West and East Forks of Ashland Creek. Reeder Reservoir, the resulting impoundment, provides 280 MG of storage for the City's water supply. Water from the reservoir is conveyed to the City's WTP located along Ashland Creek, approximately 1 mile below Reeder Reservoir. The City has an agreement with the TID to provide additional raw water supply in drought years. When needed, TID water is pumped from Ashland Canal by the City's Terrace Street Pump Station up to the WTP, where it is treated with the Ashland Creek Supply. In 2016, construction of permanent facilities was completed to enable supply from the MWC to be conveyed to the City via a partnership with the cities of Talent and Phoenix; otherwise known as the TAP Supply System or TAP Intertie.

Existing Water Service Area

The City's existing water service area is equivalent to its City limits, which covers an area of approximately 6.58 square miles with an Urban Growth Boundary of 7.40 square miles. The existing water service area is shown on **Figure 2-1**. The existing service area is approximately bordered by Interstate 5 (I-5) to the north, by the topography of the Siskiyou Mountain Range to the south and the west, Highway 66 to the east, with Highway 99 cutting through the middle of the City. Along the north-south axis of the system, the existing retail water service area is approximately 2.6 miles long. Along the east-west axis, the existing retail water service area varies from 1.9 to 3.8 miles wide.

Along with the water service area, Ashland's city limits and urban growth boundary (UGB) are shown in **Figure 2-1**.

Future Water Service Area

The City's UGB includes most areas of the existing water service area, as well as additional area to the northwest near the TAP Booster Pump Station (BPS) and areas to the southwest to Tolman and Neil Creeks. In order for customers or properties to be provided water, their property must be

DRAFT

annexed into the City (although the City does have a resolution to allow water service to customers with failed wells). The UGB is approximately 7.40 square miles and is shown on **Figure 2-1.**

Topography

The topography of the existing service area is generally rising in elevation from the northwest corners to the southern side of the city, with the highest elevations being the hillsides southwest of the Granite Reservoir. Service area elevations range from approximately 1,700 feet above sea level in the northwest to approximately 2,800 above sea level feet in the southwest portion of the service area. The City's system is located within the Rogue River watershed.

Inventory of Existing Water Facilities

This section provides a detailed description of the existing water system and the current operation of the facilities. The analysis of the existing water facilities is presented in **Chapter 6**.

Pressure Zones

The City's highest and lowest elevation customers are separated by approximately 1,100 feet. The wide elevation range requires the water pressure be increased or reduced to maintain pressures that are safe and sufficient to meet the flow requirements of the system. The City achieves this by dividing the water system into four major service areas (named after the storage facilities that serve them), each of which contains several pressure zones as shown in **Figure 2-1**. The hydraulic grade in each pressure zone is regulated by reservoir levels, pressure reducing station settings, pump station settings, or a combination of these, as illustrated in the hydraulic profile (**Figure 2-2)**.

The Granite service area is comprised of three different pressure zones: 2170 Granite Zone 1; 1980 Granite Zone 2; and 2060 Granite Zone 3. The 2170 Granite Zone 1 is supplied in the southwest from the Granite Reservoir and the TAP BPS. The 2170 Granite Zone 1 serves customers within an elevation range of approximately 1,800 feet to 2,600 feet, and is situated between the northwest portion of the City to Clay Street at its most eastern point. The 2170 Granite Zone 1 has six pressure reducing valves (PRVs) supplying water to the two lower 1980 and 2060 Granite Zones.

The 1980 Granite Zone 2 is supplied by five PRVs from the 2170 Granite Zone 1 and three other PRVs from the 2060 Granite Zone 3. The 1980 Granite Zone 2 serves customers within an elevation range of approximately 1,700 feet to 1,840 feet, and is the most northerly pressure zone. The 1980 Granite Zone 2 is predominantly located between the railroad to the west and Patton Lane to the east.

The 2060 Granite Zone 3 is located just east of the 1980 Granite Zone 2 on Patton Lane and north of the 2170 Granite Zone 1 on Clear Creek Drive. The 2060 Granite Zone 3 is supplied by two PRVs from the 2170 Granite Zone 1, which establish pressures in the zone. The 2060 Granite Zone 3 currently serves customers within an elevation range of approximately 1,740 feet to 1,840 feet.

The large Crowson service area is comprised of 8 separate pressure zones: the 2425 Crowson Zone 1; 2200 Crowson Zone 2; 2270 Crowson Zone 3; 2640 Crowson Zone 4; 2270 Crowson Zone 5; 2290 Crowson Zone 6; 2570 Crowson Zone 7; and 2610 Crowson Zone 8.

DRAFT

The 2425 Crowson Zone 1 has two separate sections divided by a small sliver of the 2170 Granite Zone 1. The westerly section of the zone is directly supplied by the WTP, while the other section of the pressure zone is indirectly supplied by the WTP via the Crowson Reservoir. The 2425 Crowson Zone 1 serves customers within an elevation range of approximately 2,080 feet to 2,440 feet. The 2425 Crowson Zone 1 has 12 PRVs supplying water to lower zones: 4 PRVs provide water to the 2170 Granite Zone 1, 1 PRV provides water to the 2270 Crowson Zone 5, 2 PRVs provide water to the 2270 Crowson Zone 3, 4 PRVs provide water to the 2290 Crowson Zone 6; and 1 PRV provides water to the 2200 Crowson Zone 2. Two PRVs can supply the 2425 Granite Zone 1 from the 2559 Alsing Zone 1.

The 2200 Crowson Zone 2 is supplied with water from two PRVs; one from the 2425 Crowson Zone 1 and one from the 2290 Crowson Zone 6. The 2200 Crowson Zone 2 is the eastern most pressure zone, located between I-5 and Hidden Lane. The 2200 Crowson Zone 2 serves customers within elevations between approximately 1,800 feet and 2,120 feet.

The 2270 Crowson Zone 3 is supplied by two PRVs from the 2425 Crowson Zone 1, which establish pressures in the zone. The 2270 Crowson Zone 3 serves customers in an elevation range between approximately 1,960 feet and 2,160 feet. The 2270 Crowson Zone 3 is located just east of Ashland Creek, between Iowa Street to the south and Hargadine Street to the north.

The 2640 Crowson Zone 4 is a small zone supplied with water from the South Mountain Booster Pump Station. The 2640 Crowson Zone 4 serves customers within an elevation range of approximately 2,340 feet and 2,480 feet, just south of Emma Street and north of Pinecrest Terrace.

The 2270 Crowson Zone 5 is a very small pressure zone consisting of one small section of Harmony Lane, serving customers between Siskiyou Boulevard and Lit Way. The 2270 Crowson Zone 5 is supplied water from one PRV from the 2425 Crowson Zone 1 and serves customers within an elevation range of approximately 2,040 feet and 2,060 feet.

The 2290 Crowson Zone 6 is provided water through the 2425 Crowson Zone 1 by four pressure reducing valves. The pressures in this zone are established by these four PRVs. The 2290 Crowson Zone 6 currently serves customers between the elevations of approximately 1,880 feet to 2,080 feet.

The 2570 Crowson Zone 7 is located just east of 2610 Crowson Zone 8, which supplies the zone from a single PRV. The 2570 Crowson Zone 7 serves customers between an elevation range of approximately 2,240 feet and 2,340 feet.

The 2610 Crowson Zone 8 is located towards the southwest corner of the City. The 2610 Crowson Zone 8 is provided water directly from the Park Estates Booster Pump Station and the Crowson Reservoir. This zone serves customers in an elevation range of approximately 2,320 feet to 2,600 feet. The 2610 Crowson Zone 8 serves customers predominantly along Ashland Loop Road and Morton Street.

The Fallon service area consists of only two smaller pressure zones on the west side of the City: the 2586 Fallon Zone 1 and the 2470 Fallon Zone 2. The 2586 Fallon Zone 1 is located between Creekside Road and Strawberry Lane. The Fallon Reservoir serves the 2586 Fallon Zone 1, which is supplied from the Strawberry Booster Pump Station. This zone serves customers at an elevation range of approximately 2,280 feet to 2,580 feet.

The last Fallon pressure zone is the 2470 Fallon Zone 2, which is located between the 2425 Crowson Zone 1 and the 2586 Fallon Zone 1. The 2470 Crowson Zone 2 serves customers in an elevation range of approximately 2,200 feet to 2,470 feet and is supplied water from the 2586 Fallon Zone 1 by one PRV.

The Alsing service area also consists of only one pressure zone. The 2559 Alsing Zone 1 is located at the south end of the City between Leonard Street and Tolman Creek Road. The Alsing Reservoir serves the 2559 Alsing Zone 1, which is supplied by the Hillview Booster Pump Station. This zone serves customers within an elevation range of approximately 2,160 feet and 2,560 feet.

Supply Facilities

Introduction

The City's primary source of raw water is the Ashland Creek watershed. In 1928, the City constructed Hosler Dam at the confluence of the West and East Forks of Ashland Creek. Reeder Reservoir, the resulting impoundment, provides 280 MG of storage for the City's water supply. Water from the reservoir is conveyed to the City's WTP through a 24-inch diameter raw water transmission line. Treated water is conveyed to the City in a 30-inch diameter transmission line.

The City also has an agreement with the Talent Irrigation District (TID) to provide additional supply. The TID supply is typically used only in drought years. When needed, TID water is pumped from the Ashland Canal by the City's Terrace Street Pump Station to the WTP, where it is treated.

A third supply is the City's TAP Intertie. The TAP Supply System delivers treated water from the Medford Water Commission to the City's TAP BPS. At this location, the water is chlorinated and boosted to the 2170 Granite Zone 1 through 16-inch piping in Highway 99.

A summary of the City's sources of supply is shown in **Table 2-1**.

DRAFT

Table 2-1
Supply Facilities Summary

Facility	Pressure Zone	Use	Existing Pumping Capacity (gpm)	Water Treatment
Reeder Reservoir	2425 Crowson Zone 1	Active	N/A	Flocculation, Filtration, Disinfection
TID Intertie	2425 Crowson Zone 1	Active	2,250	Flocculation, Filtration, Disinfection
TAP Intertie	2170 Granite Zone 1	Active	1,730	Booster Chlorine System

Water Treatment

Water Treatment Plant

The City's WTP is located along Ashland Creek, approximately 1 mile below Reeder Reservoir. The WTP has a capacity of approximately 7.5 MGD, based on the plant's historical performance and input from operations staff. Prior to 1948, screening and chlorination were the only treatment given to Ashland Creek water. In 1948, a rapid sand filtration plant was built adjacent to the power generating facility, utilizing alum as a coagulant and lime for pH control. The WTP was converted to a high rate filtration plant in the mid-1960s.

Ashland Creek WTP

The treatment process now consists of flocculation, filtration, and disinfection. Water flows into the treatment plant from a combination of three sources: 1) diversion water from the power generator; 2) direct flows from Ashland Creek; and, 3) flows from the TID intertie. The water flows through a flash mixing process, then to the flocculation basins. The high rate filtration plant continues utilizing alum as a coagulant to aid particle agglomeration and soda ash for alkalinity adjustment and pH control. A chlorine solution is fed immediately ahead of the flocculation tanks. The chlorine feed is adjusted in response to the water temperature. Following flocculation, the water flows through the filter beds and then into a 168,000-gallon clear well where the water is chlorinated and distributed to the system.

Alum, sodium hypochlorite, soda ash, and activated carbon can be mixed with the raw water in the flash mixing tank as part of the treatment process to aid in the removal of solid particles and other contaminates. The activated carbon is used only when TID water is included in the system and the color is high. The activated carbon absorbs the organic material in the raw TID water, which improves color, taste, and odor.

DRAFT

Mechanical flocculators are installed in the flocculation basins. Sediment from the flocculation chamber and the filter backwash waste is piped to a sludge lagoon. The six filters contain a dual media filter material of sand and anthracite coal. These filters remove the remaining particles in the water before it enters the clear well. Backwash water for the filters is pumped from the clear well.

Water Supply

Reeder Reservoir

Reeder Reservoir, created by Hosler Dam, is located approximately one mile upstream of the WTP at the confluence of the West and East Forks of Ashland Creek. The reservoir has a resulting impoundment of 280 MG of storage for the City's raw water supply. Water from the reservoir is conveyed to the City's WTP through a 24-inch diameter raw water transmission line.

Reeder Reservoir

TID Intertie/Ashland Canal

The City has an agreement with TID to provide additional supply. The TID supply is typically used only in drought years. When needed, TID water is pumped from the Ashland Canal by the City's Terrace Street Pump Station up to the WTP, where it is treated with the Ashland Creek supply. To date, use of the Ashland Canal at the WTP has been for short periods only and has been accomplished with the CIty's current staffing level. However, in future years, the Ashland Canal may be used more frequently and for longer durations.

Terrace Street Pump Station

TAP Intertie

A partnership was created in 1997 between the cities of Talent, Ashland, and Phoenix to supply water to these jurisdictions from the MWC. MWC water is purchased by the partnership and delivered to Phoenix and Talent via the Regional Booster Pump Station, located north of Phoenix. A 24-inch transmission main conveys water supply from Phoenix to Talent. Supply to Ashland is conveyed through Talent's distribution system, then through a 16-inch transmission main and the TAP BPS to Ashland's 2170 Granite Zone 1.

The TAP BPS was completed in 2016 and is located at 2073 W. Jackson Road near the northwesterly boundary of the City. The TAP BPS consist of two vertical turbine centrifugal pumps with a nominal installed capacity of 3.2 MGD (2,250 gpm) and a firm capacity of 2.0 MGD (1,400 gpm). There are provisions for a third pump to provide an ultimate firm capacity of 3.2 MGD (2,250 gpm). The station is equipped with a booster chlorine system. The pump station and booster chlorination facility are controlled by an onsite programmable logic controller PLC. Operation, status, and set points can be viewed and adjusted at the station. The station can also be monitored and controlled by the City's supervisory control and data acquisition (SCADA) control system.

TAP BPS

Pump Station Facilities

The City's water system has four booster pump station facilities that provide supply to the 2559 Alsing Zone 1, 2640 Crowson Zone 4, 2586 Fallon Zone 1, and 2610 Crowson Zone 8. A summary of the pumping facilities is shown in **Table 2-2**, and a detailed description of each facility is provided in the following sections.

DRAFT

Table 2-2
Booster Pump Facilities Summary

Pump Station	Year Constructed	Suction Pressure Zone	Discharge Pressure Zone	Pump No.	Capacity (gpm)	HP
Hillview BPS	1984	2425 Crowson Zone 1	2559 Alsing Zone 1	1	650	30
				2	650	30
South Mountain BPS	Unknown	2425 Crowson Zone 1	2640 Crowson Zone 4	1	145	15
				2	600	40
Strawberry BPS	1994	2425 Crowson Zone 1	2586 Fallon Zone 1	1	200	40
				2	200	40
Park Estates BPS	2019	2425 Crowson Zone 1	2610 Crowson Zone 1	1	50	5
				2	152	15
				3	152	15
				4	2000	136
				5	2000	136

Hillview Booster Pump Station

The Hillview BPS was originally constructed in 1984 to supply water to the Alsing Reservoir and maintain pressure in the 2559 Alsing Zone 1. The booster station is located at the northeast corner of Peachey Road and Hillview Drive. The two pumps have a maximum flow rate of 650 gallons per minute (gpm) and are powered by 30 horsepower (hp) motors. The booster pump station has a power receptacle to enable connection of a portable generator.

Hillview BPS

South Mountain Booster Pump Station

South Mountain BPS

The South Mountain BPS is located on the corner of Ivy Lane and South Mountain Avenue. The South Mountain BPS contains two differently sized pumps. The smaller pump has a designed flow range of 100 gpm to 145 gpm with a 15 hp motor. The larger pump has a designed flow range of 400 gpm to 600 gpm with a 40 hp motor. The booster pump station has an automatic transfer switch to enable use of an adjacent generator.

Strawberry Booster Pump Station

The Strawberry BPS was built in 1994 and is located near the intersection of Nutley Street and Alnut Street. The booster station was designed to convey water to the 2586 Fallon Zone 1 and the Fallon Reservoir in the hilly northwest area of the City. The two identical pumps supply water at a flow rate of 200 gpm and are powered by 40 hp motors. The booster pump station has a power receptacle to enable connection of a portable generator.

Strawberry BPS

DRAFT

Park Estates Booster Pump Station

The Park Estates BPS is located next to the Crowson Reservoir at the crossing of Ashland Loop Road and Terrace Street. The Park Estates BPS was just recently replaced to meet future demands and provide fire protection to customers at the City's highest elevations. The new pump station includes one small 5 hp duty pump on a variable frequency drive motor, two 15 hp pumps on variable frequency drive motors to meet peak hour demands, and two 136 hp fire pumps to provide fire protection at the City's forest interface. The new Park Estates BPS includes a backup generator and automatic transfer switch.

Original Park Estates BPS

Storage Facilities

The City's water system has four storage facilities that provide storage to various zones in the system. A summary of the storage facilities is shown in **Table 2-3**, and a detailed description of each facility is provided in the following sections.

Table 2-3
Storage Facilities Summary

Reservoir	Approximate Location	Pressure zone	Year Built	Capacity (MG)	Diameter (feet)	Base Elev. (feet)	Overflow Elev. (feet)
Crowson	Ashland Loop Rd. & Terrace St.	2420 Crowson Zone 1	1928	2.1	132.62	2,406	2,425
Alsing	Morninglight Dr. & Greenmeadow Way	2559 Alsing Zone 1	1984	2.1	107.0	2,530	2,559
Fallon	Hitt Rd.	2586 Fallon Zone 1	1994	0.5	58.0	2,560	2,586
Granite	Granite St.	2170 Granite Zone 1	1948	2.1	134.0	2,145	2,173

Crowson Reservoir

The Crowson Reservoir is located at the southwest corner of Ashland Loop Road and Terrace Street and provides storage capacity to the eight different Crowson pressure zones. The reservoir is supplied by the WTP and was originally constructed in 1928.

Crowson Reservoir

DRAFT

The Crowson Reservoir is a buried concrete storage facility that is 19.9 feet deep with an oval shaped cross-sectional area of approximately 13,813 square feet (SF), and a capacity of 2.1 MG. The reservoir is surrounded by a gated, 6-foot-tall fence with no barbed wire. The reservoir has a ground elevation of 2,406 feet and an overflow elevation of 2,425 feet; however, the storage volume provided by the reservoir varies by depth.

Alsing Reservoir

Built in 1984, Alsing Reservoir is an above ground-storage tank with the with a capacity of 2.1 MG that stores water for the Alsing pressure zones. This reservoir is supplied water through the Hillview Booster Pump Station. The Alsing Reservoir is located at the end of Alsing Reservoir Road between Morninglight Drive and Green Meadows Way. The 107-foot-diameter reservoir has a base elevation of 2,530 feet and an overflow elevation of 2,559 feet. The Alsing Reservoir is a concrete storage facility that is gated off at the road but is not surrounded by a fence.

Alsing Reservoir

Fallon Reservoir

The Fallon Reservoir was brought online in 1994 and is located at 183 Hitt Road, about 0.3 miles south of Strawberry Lane. This reservoir provides storage for both the 2586 Fallon Zone 1 and the 2470 Fallon Zone 2. The Fallon Reservoir is an above-ground tank that has the capacity to store approximately 0.5 MG. The Fallon Reservoir stands 25.5 feet tall, has a diameter of 58 feet, a base elevation of 2,561 feet, and an overflow elevation of 2,586 feet.

Water is supplied to the reservoir by the Strawberry Booster Pump Station just off the intersection of Nutley Street and Alnut Street.

Fallon Reservoir

DRAFT

Granite Reservoir

Granite Reservoir

The Granite Reservoir is located adjacent to Ashland Creek on Granite Street, between Ashland Creek Drive and Glenview Drive. The reservoir is an above-ground tank with a storage capacity of 2.1 MG for all three Granite pressure zones and was constructed in 1948.

The Granite Reservoir stands 28 feet tall, has a diameter of 134 feet, a base elevation of 2,145 feet and an overflow elevation of 2,173 feet. The reservoir is supplied by a control valve that conveys water from the 2425 Crowson Zone 1. The reservoir can also be supplied by the TAP BPS when the intertie is operating.

Distribution and Transmission System

The City's water system contains approximately 119 miles of water main ranging in size from 2 inches to 30 inches. As shown in **Table 2-4**, most of the water main (approximately 80 percent) within the system is 8 inches in diameter or smaller. The remaining 20 percent of the water main is 10 inches in diameter or larger.

Table 2-4
Water Main Diameter Inventory

Diameter (inches)	Length (feet)	Percent of Total
4 or smaller	106,911	17.0%
6	213,163	33.9%
8	182,368	29.0%
10	16,195	2.7%
12	58,940	9.4%
14	2,055	0.3%
16	27,294	4.3%
18	88	0.0%
20	3,419	0.5%
24	12,217	1.9%
30	4,662	0.7%
Total	**628,032**	**100%**

DRAFT

The water main in the City's system is constructed of either asbestos cement, cast iron, ductile iron, galvanized iron, HDPE, PVC, or steel, with approximately 56 percent of the system constructed of ductile iron pipe. All new water main installations are required to use ductile iron pipe in accordance with the City's development and construction standards. **Table 2-5** shows the City's existing water main inventory by material.

Table 2-5
Water Main Material Inventory

Diameter (inches)	Length (feet)	Percent of Total
Asbestos Cement	8,826	1.4%
Cast Iron	244,482	38.9%
Ductile Iron	351,766	56.0%
Galvanized Iron	2,708	0.4%
HDPE	1,086	0.2%
PVC	2,260	0.4%
Steel	16,904	2.7%
Total	**628,032**	**100%**

Approximately 41 percent of the water main within the system was constructed in the 1970s or before and is reaching or has reached its projected life expectancy. The majority of this older water main is asbestos cement or cast iron pipe. The remainder of the water main in the City's water system (discounting water main of unknown installation year) was constructed in the 1980s or later and is generally in good condition. A detailed breakdown of the City's water main installation year inventory is shown in **Table 2-6.**

DRAFT

Table 2-6
Water Main Installation Year Inventory

Year Installed	Length (feet)	Percent of Total
Before 1910	2,589	0.4%
1910s	4,071	0.6%
1920s	10,351	1.6%
1930s	26,217	4.2%
1940s	33,985	5.4%
1950s	36,595	5.8%
1960s	70,979	11.3%
1970s	71,925	11.5%
1980s	81,693	13.0%
1990s	88,955	14.2%
2000s	100,104	15.9%
2010s	5,325	0.8%
Unknown	95,243	15.2%
Total	**628,032**	**100%**

Pressure Reducing and Control Valve Stations

Pressure reducing stations are connections between adjacent pressure zones that allow water to flow from the higher pressure zone to the lower pressure zone while reducing the pressure of the water to maintain a safe range of operating pressures in the lower zone. A pressure reducing station is essentially a below-grade vault (typically concrete) that normally contains two PRVs, sometimes a pressure relief valve, piping, and other appurtenances. The PRV hydraulically varies the flow rate through the valve (up to the flow capacity of the valve) to maintain a constant set pressure on the downstream side of the valve for water flowing into the lower pressure zone.

Pressure reducing stations can serve multiple purposes. First, they can function as an active supply facility by maintaining a continuous supply of water into a lower zone that has no other source of supply. Pressure reducing stations can also function as standby supply facilities that are normally inactive (no water flowing through them). The operation of this type of station is typically triggered by a drop in water pressure near the downstream side of the station. A typical application of this function is a station that is only needed to supply additional water to a lower zone during a fire flow situation. The pressure setting of the control valve within the station allows it to remain closed during normal system operation and open only during high-demand conditions, like fire flows, to provide the additional supply needed.

Pressure relief valves are control valves that are activated by higher than normal pressures and flow water out of the system to relieve the pressure and protect the system from

DRAFT

overpressurization. Pressure sustaining valves are control valves between adjacent pressure zones that allow water to flow from the higher pressure zone to the lower pressure zone, provided the pressure in the higher zone remains above a certain threshold. Flow control stations allow water to flow from a higher pressure zone to a lower pressure zone at a regulated flow rate.

The City's water system has one pressure relief valve station and 31 pressure reducing valve stations, as shown in plan view in **Figure 2-1** and in profile view on **Figure 2-2**. A list of the control valve stations and related data is contained in **Table 2-7**.

Table 2-7
Water Main Installation Year Inventory

Control Valve Station Name (Pressure Reducing Valve)	Upper Pressure Zone	Lower Pressure Zone
PRV-1[1]	2170 Granite Zone 1	2170 Granite Zone 1
PRV-2	2170 Granite Zone 1	1980 Granite Zone 2
PRV-3	2170 Granite Zone 1	1980 Granite Zone 2
PRV-4	2170 Granite Zone 1	1980 Granite Zone 2
PRV-5	2170 Granite Zone 1	1980 Granite Zone 2
PRV-6	2060 Granite Zone 3	1980 Granite Zone 2
PRV-7	2170 Granite Zone 1	1980 Granite Zone 2
PRV-8	2425 Crowson Zone 1	2170 Granite Zone 1
PRV-9	2425Crowson Zone 1	2170 Granite Zone 1
PRV-10	2586 Fallon Zone 1	2425 Crowson Zone 1
PRV-11	2586 Fallon Zone 1	2470 Fallon Zone 2
PRV-12	2610 Crowson Zone 8	2270 Crowson Zone 7
PRV-13	2425 Crowson Zone 1	2270 Crowson Zone 3
PRV-14	2270 Crowson Zone 3	2170 Granite Zone 1
PRV-15	2270 Crowson Zone 3	2170 Granite Zone 1
PRV-16	2425 Crowson Zone 1	2170 Granite Zone 1
PRV-17	2425 Crowson Zone 1	2290 Crowson Zone 6
PRV-18	2290 Crowson Zone 6	2170 Granite Zone 1
PRV-19	2570 Crowson Zone 5	2425 Crowson Zone 1
PRV-20	2425 Crowson Zone 1	2170 Granite Zone 1
PRV-21	2559 Alsing Zone 1	2425 Crowson Zone 1
PRV-22	2559 Alsing Zone 1	2425 Crowson Zone 1
PRV-23	2425 Crowson Zone 1	2290 Crowson Zone 6
PRV-24	2425 Crowson Zone 1	2200 Crowson Zone 2

DRAFT

Control Valve Station Name (Pressure Reducing Valve)	Upper Pressure Zone	Lower Pressure Zone
PRV-25	2290 Crowson Zone 6	2200 Crowson Zone 2
PRV-26	2425 Crowson Zone 1	2290 Crowson Zone 6
PRV-27	2425 Crowson Zone 1	2290 Crowson Zone 6
PRV-28	2425 Crowson Zone 1	2270 Crowson Zone 3
PRV-29	2170 Granite Zone 1	2060 Granite Zone 3
PRV-30	2170 Granite Zone 1	2060 Granite Zone 3
PRV-31	2060 Granite Zone 3	1980 Granite Zone 2
PRV-32	2060 Granite Zone 3	1980 Granite Zone 2

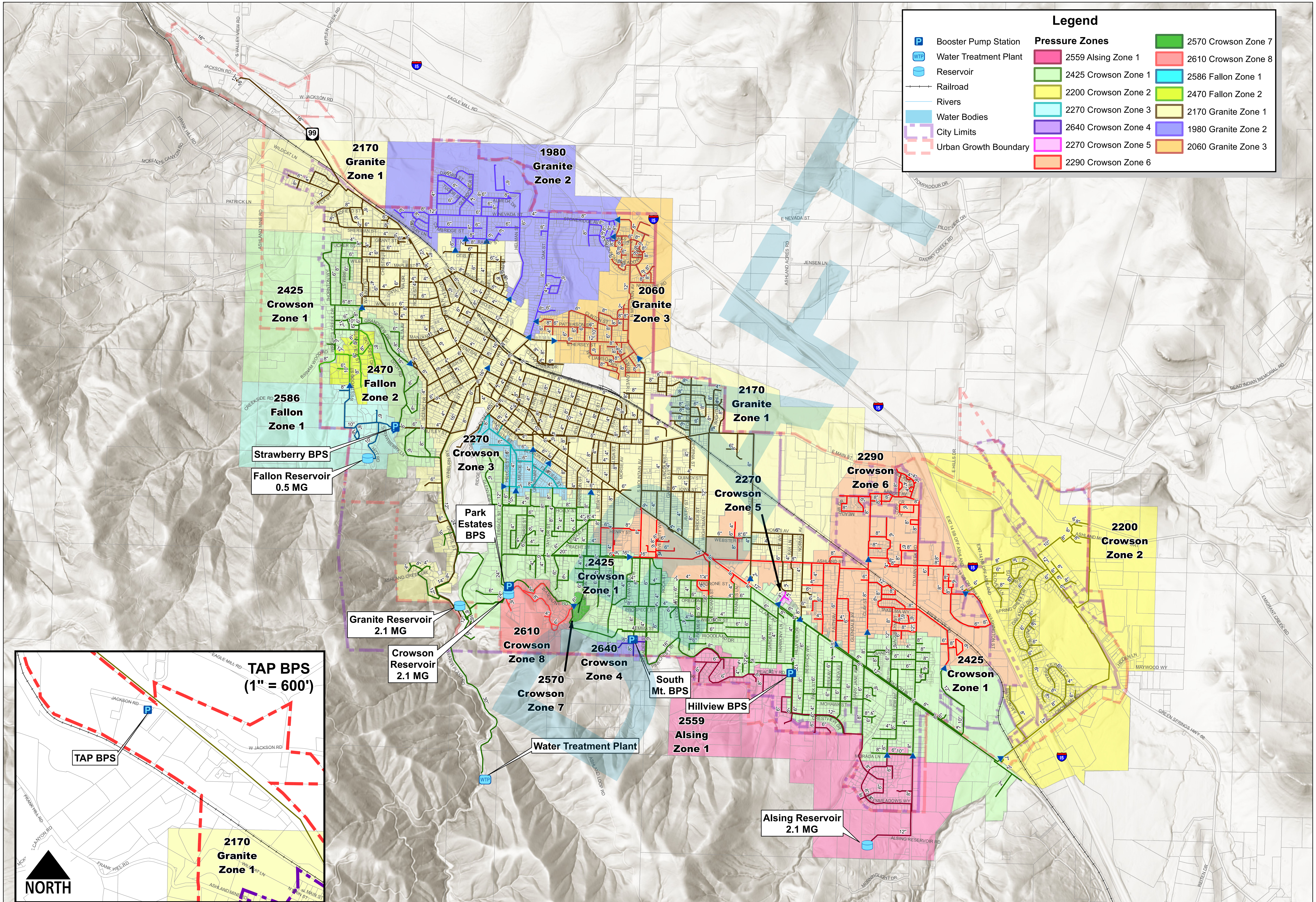
[1]Pressure Relief Valve

Water System Operation and Control/Telemetry and Supervisory Control System

A telemetry and supervisory control system gathers information and can efficiently control a system by automatically optimizing facility operations. A telemetry and supervisory control system also provides instant alarm notification to operations personnel in the event of equipment failures, operational problems, fire, or other emergency situations.

The master telemetry unit for the SCADA system is located at the WTP. The computerized system controls and monitors the entire water system, including levels in the storage facilities and pump station operations. All remote sites utilize radio transmitters and receivers that communicate with a signal repeater at Ashland Acres, which then sends the signal to the WTP. Some programming and logic control features are only accessible locally at the facility.

DRAFT



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County

Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Figure 2-1
Existing Water System

PRELIMINARY

City of Ashland Water Master Plan

Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet

By: hfarris

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 2-1 Existing System.mxd

CITY OF ASHLAND

1 inch = 1,200 feet

0 600 1,200 2,400 Feet

Plot Date: 5/8/2019

RH2

NORTH

Figure 2-2: Existing System

Hydraulic Profile
City of Ashland
Water Master Plan

Date: April 11, 2018 Filename: COA\1016-096\CAD\TAP-HPX.DWG

Legend

- 2559 Alsing Zone 1
- 2425 Crowson Zone 1
- 2200 Crowson Zone 2
- 2270 Crowson Zone 3
- 2640 Crowson Zone 4
- 2270 Crowson Zone 5
- 2290 Crowson Zone 6
- 2570 Crowson Zone 7
- 2610 Crowson Zone 8
- 2586 Fallon Zone 1
- 2470 Fallon Zone 2
- 2170 Granite Zone 1
- 1980 Granite Zone 2
- 2060 Granite Zone 3
- Booster Pump Station
- Pressure Reducing Station

RH2 ENGINEERS PLANNERS SCIENTISTS

CITY OF ASHLAND

3 | LAND USE AND POPULATION

DRAFT

DRAFT

3 | LAND USE AND POPULATION

Introduction

The City of Ashland's Water Master Plan was last updated in 2012. The plan was developed to satisfy the Oregon Health Division (OHD) water master plan requirements as outlined in Oregon Administrative Rules (OAR) 333-61-060. The OAR requires, among other things, consistency between land use and utility plans and their implementation. This chapter demonstrates the compatibility of the City's WMP with other plans, identifies the designated land uses within the existing and future service area, and presents population projections within the City's planning area.

Compatibility with Other Plans

Introduction

To ensure that the WMP is consistent with the land use policies that guide it and other related plans, the following planning documents were examined.

- *Oregon Statewide Planning Goals & Guidelines - Goal 14 Urbanization - OAR 660-015-000(14)*
- *City of Ashland Comprehensive Plan*
- *Jackson County Comprehensive Plan*

Oregon Statewide Planning Goal 14

The State of Oregon's Statewide Planning Goal 14 addresses urbanization, with the goal "To provide for an orderly and efficient transition from rural to urban land use, to accommodate urban population and urban employment inside urban growth boundaries, to ensure efficient use of the land, and to provide for livable communities." As it pertains to water systems, Goal 14 also states that "The type, location and phasing of public facilities and services are factors which should be utilized to direct urban expansion."

Urban Growth Boundary

Goal 14 requires that Jackson County and the City cooperate in designating a UGB adjacent to the City's existing corporate limits. The UGB is based on a demonstrated need to accommodate long range urban population and associated housing, employment opportunities, and other uses. The current UGB is shown in **Figure 3-1**.

Consistency

Goal 14 requires that the UGB "be adopted by all cities within the boundary and by the county or counties within which the boundary is located, consistent with intergovernmental agreements." Consistency with population forecasting and plans for the provision of urban facilities and services are also required.

DRAFT

Concurrency

Concurrency means that adequate public facilities and services be provided at the time growth occurs. For example, growth should not occur where schools, roads, and other public facilities are overloaded. To achieve this objective, growth should be directed to areas already served or readily served by public facilities and services. When public facilities and services cannot be maintained at an acceptable level of service, the new development should be prohibited.

City of Ashland Comprehensive Plan

The City's *Comprehensive Plan*, most recently updated in August 2016, describes the City's vision of how growth and development should occur over a 20-year horizon. The *Comprehensive Plan* considers the general location of land uses, as well as the appropriate intensity and density of land uses given the current development and economic trends. The public services and transportation elements ensure that new development will be adequately serviced without compromising adopted levels of service.

Jackson County Comprehensive Plan

The County adopted its first *Comprehensive Plan* in 1972. Subsequent revisions resulted from the County's first periodic review approved by the Department of Land Conservation and Development (DLCD) on April 11, 1994. Since then, further revisions occur as Jackson County continues the on-going process of inventorying and analyzing data, reviewing alternative solutions, and responding to changes in local, regional, and state conditions to ensure that the plans and regulations remain in compliance with the statewide planning goals and local needs. The current version of the plan was adopted in 2015.

The County's *Comprehensive Plan* guides development in both urban and rural, unincorporated Jackson County and designates land use in the unincorporated UGB. Similar to the City's *Comprehensive Plan*, the County's plan contains planning for transportation and public facilities and services in unincorporated Jackson County.

Land Use

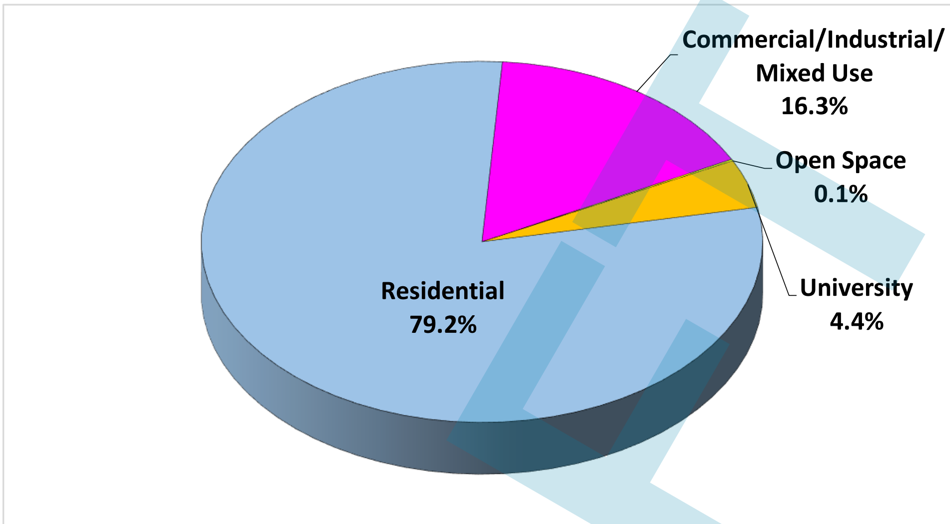
The City limits currently encompass an area of approximately 4,240 acres, or 6.6 square miles. The City's UGB encompasses approximately 714 acres outside of the current City limits, for a total area of 4,954 acres, or 7.7 square miles. The existing retail water service area includes customers within the City limits as well as some customers outside of City limits, with areas in the UGB requiring annexation into the City limits for water service to be provided. The City's zoning, shown in **Figure 3-1**, guides development within the City. Zoning in the UGB but outside of the City limits is designated by the County, as shown in **Figure 3-1**.

Approximately 79.2 percent of the area within the current City Limits or Water Service Area is designated for residential use, as indicated in **Chart 3-1**. Approximately 16.3 percent is designated for commercial, industrial, and mixed use, 4.4 percent is designated for Southern Oregon University, and 0.1 percent for open space.

DRAFT

Chart 3-1

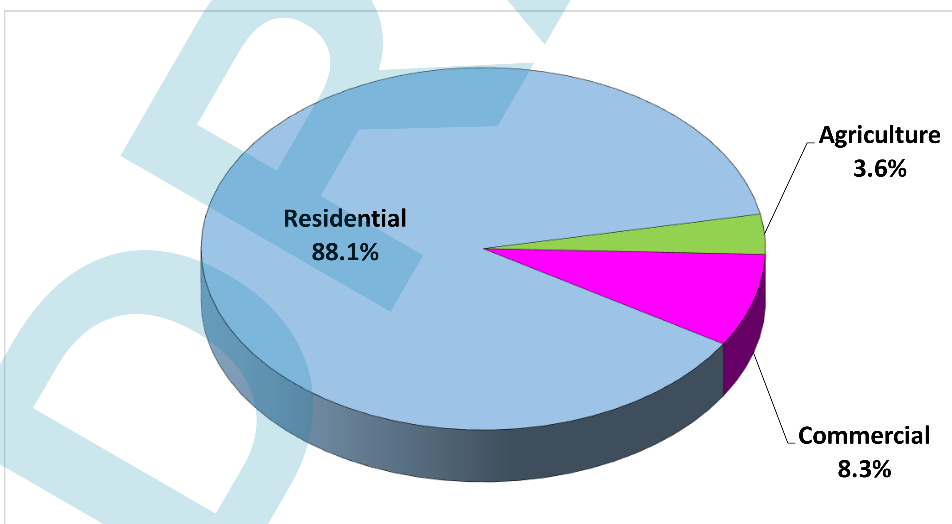
Zoning Inside City Limits



Within the City's unincorporated UGB and outside of the City limits, approximately 88.1 percent of the land area is designated for residential use, as shown in **Chart 3-2**. Approximately 8.3 percent of the land area is designated for commercial use, and the remaining 3.6 percent is designated for agricultural use.

Chart 3-2

Zoning Inside UGB (Outside City Limits)



Population

Household Trends

The City's residential areas are comprised largely of single-family residences. The Census Bureau's 2015 American Community Survey (ACS) estimated a total of 10,372 housing units in the City, with 9,446 occupied and 926 vacant. The ACS-estimated average household size for 2015 was 2.10 persons.

Existing and Future City Population

The County has experience rapid population growth and extensive physical developments since 2000. The population of the County increased by approximately 18 percent from 2000 to 2016, based on Portland State University's Population Research Center (PRC) estimates. In contrast, the population of the City increased by only approximately 5 percent during the same period. **Table 3-1** illustrates the historical population growth since 2000, with years 1995, 2000, and 2005 included for refence.

Table 3-1
Population Trends within the City Limits

Historical	
Year	Population
1995	17,985
2000	19,610
2005	20,880
2010	20,095
2011	20,225
2012	20,325
2013	20,295
2014	20,340
2015	20,405
2016	20,620

Projected future growth for the City limits and unincorporated UGB is shown in **Table 3-2**. Estimated UGB and City limits population projections were provided on 5-year intervals by the PRC. Projected population for intermediate years was calculated by assuming a uniform population growth rate between the available PRC estimates for 2015, 2020, 2025, 2030, 2035, and 2040. Therefore, the projected 2037 population was calculated by interpolating between the PRC's 2035 and 2040 estimates.

DRAFT

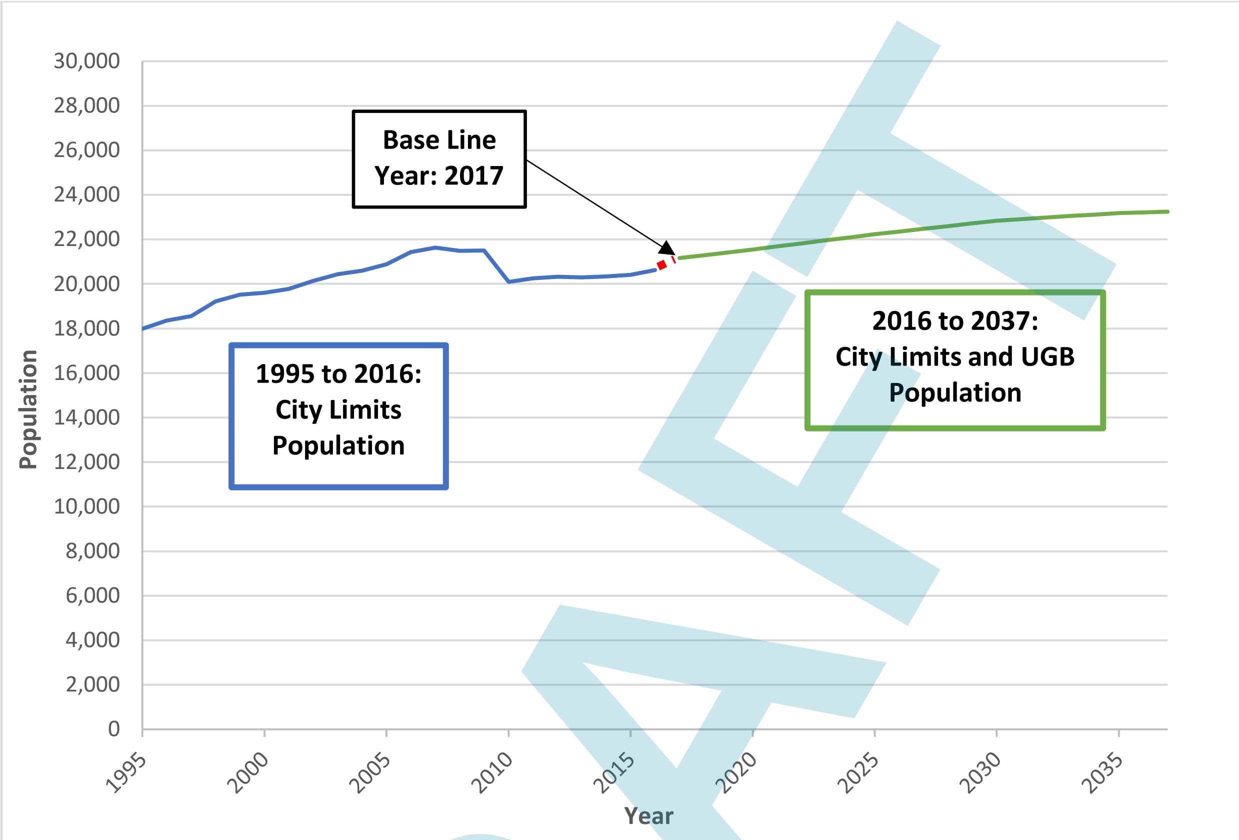
Table 3-2
Population Trends within the City Limits

Year	City Limits + UGB Population
2017	21,162
2018	21,290
2019	21,419
2020	21,547
2021	21,684
2022	21,821
2023 (+6 years)	**21,957**
2024	22,094
2025	22,231
2026	21,252
2027 (+10 years)	**22,474**
2028	22,596
2029	22,718
2030	22,839
2031	22,908
2032	22,977
2033	23,045
2034	23,114
2035	23,183
2036	23,213
2037 (+20 years)	**23,224**

Historic and projected population are shown in **Chart 3-3**. The population of the City limits is shown for years 1995 to 2016, and the population of the City limits and UGB are shown for 2016 to 2037. It is assumed that the entire UGB will be annexed into the City by the end of the 20-year planning period as described in the City's *Comprehensive Plan*.

DRAFT

Chart 3-3
Population Projections



Water System Population

Because the City requires properties to either annex into the City or experience failure with their existing private water system before water service is provided (unless unique circumstances exist), the population inside the City limits is roughly equivalent to the total water system population. For the purposes of estimating demands, the population projections in **Table 3-2** will be used, with the understanding that the entire UGB is not anticipated to annex in to the City until the end of the City's 20-year planning period. The system is expected to provide service to approximately 23,244 customers by 2037.

DRAFT


Legend
City Limits
Urban Growth Boundary
Railroad
Rivers
Water Bodies
City Zoning
Commercial (C-1)
Downtown Commercial (C-1-D)
Croman Mill - Compatible Industrial (CM-CI)
Croman Mill - Mixed Use (CM-MU)
Croman Mill - Neighborhood Commercial (CM-NC)
Croman Mill - Office Employment (CM-OE)
Croman Mill - Open Space (CM-OS)
Employment (E-1)
Health Care Services (HC)
Industrial (M-1)
North Mountain Neighborhood (NM)
Single Family Residential High (R-1-10)
Suburban Residential (R-1-3.5)
Single Family Residential Low (R-1-5)
Single Family Residential Medium (R-1-7.5)
Low Density Multiple Family Residential (R-2)
High Density Multiple Family Residential (R-3)
Rural Residential Low (RR-.5)
Rural Residential High (RR-1)
South Oregon University (SO)
Woodland Residential (WR)
Woodland Residential (WR-20)
DRAFT
This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.
Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.
This material is owned and copyrighted by the City of Ashland.
Vicinity Map
Oregon
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community
Figure 3-1
City Land Use
PRELIMINARY
City of Ashland
Water Master Plan
Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet
By:hfarris
Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 3-1 Land Use.mxd
CITY OF ASHLAND
1 inch = 1,200 feet
0 600 1,200 2,400 Feet
Plot Date: 5/8/2019
RH2
NORTH

DRAFT

4 WATER DEMANDS

DRAFT

DRAFT

4 | WATER DEMANDS

Introduction

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy the water system's future growth and continue to meet federal and state laws.

The magnitude of water demands is typically based on three main factors: 1) population; 2) weather; and 3) water use classification. Population and weather have the two largest impacts on water system demands. Population growth has a tendency to increase the annual demand, whereas high temperatures have a tendency to increase the demand over a short period of time. Population does not solely determine demand because different user types use varying amounts of water. The use varies based on the number of users in each customer class, land use density, and irrigation practices. Water use efficiency efforts also impact demands and can be used to accommodate a portion of the system's growth without increasing a system's supply capacity.

Demands on the water system determine the size of storage reservoirs, supply facilities, water mains, and treatment facilities. Several different types of demands were analyzed and are addressed in this chapter, including average day demand, maximum day demand, peak hour demand, fire flow demand, future demands, and a demand reduction forecast based on the Water Use Efficiency program.

Current Population and Service Connections

Water Use Classifications

The City has divided water customers into eight different classes for billing purposes. These classes are: 1) Single-family; 2) Multi-family; 3) Commercial/Residential; 4) Commercial; 5) Industrial; 6) Municipal; 7) Governmental; and 8) Irrigation. The demand analysis that follows will report on the water use patterns of these eight user groups.

Residential Population Served

The population within the City limits was 20,620 in 2016, based on estimates from the Portland State University PRC. **Chapter 3** contains a more detailed discussion of the City's population and household trends.

As shown in **Table 4-1,** the City provided water service to an average of 8,796 connections in 2016. Approximately 7,826 connections (89 percent) were residential or mixed commercial/residential customers, 593 connections (7 percent) were commercial customers, 111 connections (1 percent) were municipal or governmental customers, and the remaining 265 connections (3 percent) were irrigation connections. Multiple multi-family residential units (units represent individual

DRAFT

apartments, condominiums, or other components of a multi-family dwelling) are served by each multi-family connection, as shown in **Table 4-2**.

Table 4-1
Average Annual Metered Consumption and Service Connections

Average Number of Connections by Customer Class							
Year	2010	2011	2012	2013	2014	2015	2016
Single-family	6,957	6,964	7,000	7,022	7,068	7,105	7,127
Multi-family	589	597	599	603	604	603	619
Commercial/Residential	58	62	62	65	72	76	80
Commercial	579	581	588	586	590	590	593
Industrial	3	2	2	0	0	0	0
Municipal	16	16	15	15	29	63	65
Government	96	101	106	98	101	63	46
Irrigation	372	376	339	208	201	201	265
Totals	8,671	8,699	8,711	8,597	8,665	8,701	8,796

Average Annual Consumption (gallons) by Customer Class							
Year	2010	2011	2012	2013	2014	2015	2016
Single-family	488,100,190	474,070,759	506,821,036	533,363,462	481,966,672	455,536,334	461,125,696
Multi-family	152,611,315	146,276,774	158,560,229	163,659,886	159,044,218	152,323,802	146,529,929
Commercial/Residential	8,909,187	9,172988	9,743,138	10,980,461	10,542,835	10,951,526	11,010,907
Commercial	136,133,308	137,649,340	141,214,766	140,110,401	134,557,956	136,443,256	136,245,374
Industrial	1,022	409	275	0	0	0	0
Municipal	6,784,577	7,155,087	6,676,933	7,091,256	7,818,924	61,121,481	72,916,421
Government	41,042,636	41,719,040	44,964,433	49,158,394	72,990,366	55,681,857	33,083,654
Irrigation	132,325,776	115,967,240	139,613,067	137,913,590	186,928,216	177,344,959	204,099,607
Totals	965,908,12	932,011,636	1,007,593,876	1,042,277,451	1,053,849,187	1,049,403,215	1,065,011,589

Average Daily Consumption Per Connections (gal/day/connection) by Customer Class								
Year	2010	2011	2012	2013	2014	2015	2016	Avg
Single-family	192	187	198	208	187	176	177	189
Multi-family	709	671	723	743	722	693	647	701
Commercial/Residential	418	409	426	466	401	395	375	413
Commercial	644	649	657	656	625	633	627	642
Industrial	1	0	0	N/A	N/A	N/A	N/A	1
Municipal	1,150	1,225	1,190	1,295	734	2,662	3,045	1,614
Government	1,168	1,128	1,164	1,371	1,978	2,412	1,958	1,597
Irrigation	974	844	1,124	1,815	2,545	2,418	2,106	1,690
Totals	305	294	317	332	333	330	331	320

Table 4-2
Multi-family Units

Year	Approximate Total Multi-family Units	Approximate Average Daily Consumption per Unit (gal/day/unit)
2010	4,571	91
2011	4,629	87
2012	4,649	93
2013	4,678	96
2014	4,681	93
2015	4,673	89
2016	4,802	83
Average	4,669	90

Existing Water Demands

Water Consumption

Water consumption is the amount of water used by all customers of the system, as measured by the customer's meters. **Table 4-1** shows the historical average number of connections, average annual consumption, and average daily consumption per connection of each customer class for the City from 2010 through 2016.

The number of multi-family connections is less than the number of units served since one connection typically serves several units. **Table 4-2** shows the historical approximate total of multi-family units, and the approximate average daily consumption per multi-family unit within the City's water service area from 2010 through 2016. Total multi-family units are based on the ratio between multi-family units and multi-family connections, current as of June 21, 2017.

As shown in **Chart 4-1**, the Single Family class represents approximately 81 percent of all connections, but only 43 percent of total system consumption, as shown in **Chart 4-2**. This is due to the lower consumption per connection of single-family residential customers as compared to other customer types. As shown in **Table 4-1**, single-family residential customers use an average of approximately 189 gpd per connection, compared to multi-family customers that use an average of approximately 701 gpd per connection, and commercial customers that use an average of approximately 642 gpd per connection. Since multiple units are typically served by one multi-family connection, **Table 4-2** includes the average daily consumption per unit for the multi-family class, which historically has been approximately 90 gpd per unit. The lower consumption of multi-family customers is expected since the average household size of multi-family units is usually less than the average household size of single-family units, and multi-family units consume considerably less water for lawn and garden maintenance. Additionally, the higher consumption of commercial customers is expected since these customers include the system's highest individual water users.

DRAFT

Chart 4-1
2016 Water Connections by Customer Class

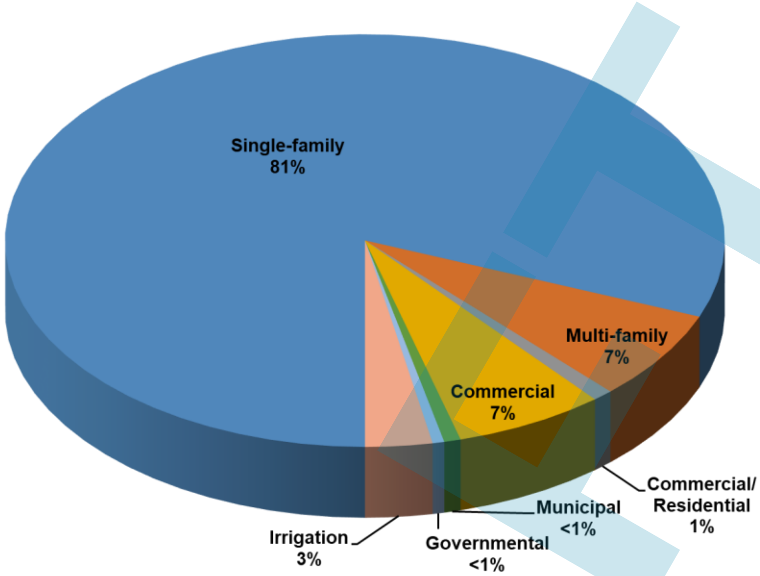


Chart 4-2
2016 Water Consumption by Customer Class

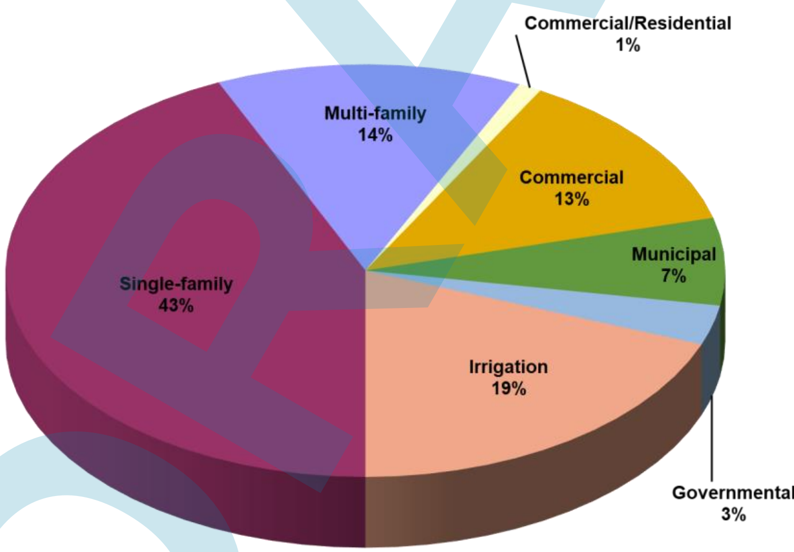


Table 4-3 shows the largest water users of the system in 2016 and their total amount of metered consumption for the year. The total water consumption of these 20 water accounts represented approximately 17 percent of the system's total metered consumption in 2016.

DRAFT

Table 4-3
2016 Largest Water Users

Name	Address	Annual Consumption (gals)
City of Ashland, Water Department, Tracking	2071 N. Hwy 99	55,471,845
Ashland Parks Department	551 Clay Street	11,424,503
Ashland Parks Department	526 N. Mountain Avenue	9,906,512
City of Ashland Mountain View Cemetery	440 Normal Avenue	9,519,796
CPM Real Estate Services, Inc.	321 Clay Street	8,940,844
Southern Oregon University	1361 Quincy Street	8,168,908
SOU/Physical Plant Department	1165 Ashland Street	8,146,468
Ashland Community Health Care System	280 Maple Street	8,108,619
Ashland Springs Hotel	2525 Ashland Street	6,294,420
Southern Oregon University	438 Wightman Street	5,483,408
Ashlander Apartments	2234 Siskiyou Boulevard	5,426,740
Ashland Parks Department	1699 Homes Avenue	5,262,030
Ashland Public Schools	1070 Tolman Creek Road	4,957,894
Ashland Assisted Living LLC	950 Skylark Place	4,921,167
Ashland Springs Hotel	212 E. Main Street	3,964,400
Oregon State Hwy	2488 Ashland Street	3,912,414
Windsor Inn	2520 Ashland Street	3,721,300
Ashland Parks Department	2 Winburn Way	3,698,860
Ashland Springs Hotel	2525 Ashland Street	3,640,067
2016 Largest Water Users Total	176,674,443	
2016 Water System Total	1,065,011,589	
Percent of Total	17%	

Residential demand varies throughout the year, typically peaking in the hot summer months. Other customer types often peak at different times or have different peaking factors because their uses differ. The demand of single-family residential customers in the City generally peaks in the summer, as shown in **Chart 4-3**. Multi-family residential, commercial/residential, and commercial consumption also typically peak in the summer, as shown in **Chart 4-4**, **Chart 4-5**, and **Chart 4-6** (note that the scales vary for each chart for clarity). Industrial consumption, shown in **Chart 4-7**, is very low during the 2010 to 2016 timeframe, and includes an unexplained peak in September of 2010 that is likely an error or anomaly. Municipal and governmental consumption, shown in **Chart 4-8** and **Chart 4-9**, do not follow consistent patterns of use from year to year. Irrigation consumption, shown in **Chart 4-10**, is close to zero in the winter and peaks during the hot summer

DRAFT

months. The City reads most meters every month as shown in **Chart 4-3**, **Chart 4-4**, **Chart 4-5**, **Chart 4-6**, **Chart 4-7**, **Chart 4-8**, **Chart 4-9**, and **Chart 4-10**.

Chart 4-3
Historical Monthly Single-Family Consumption

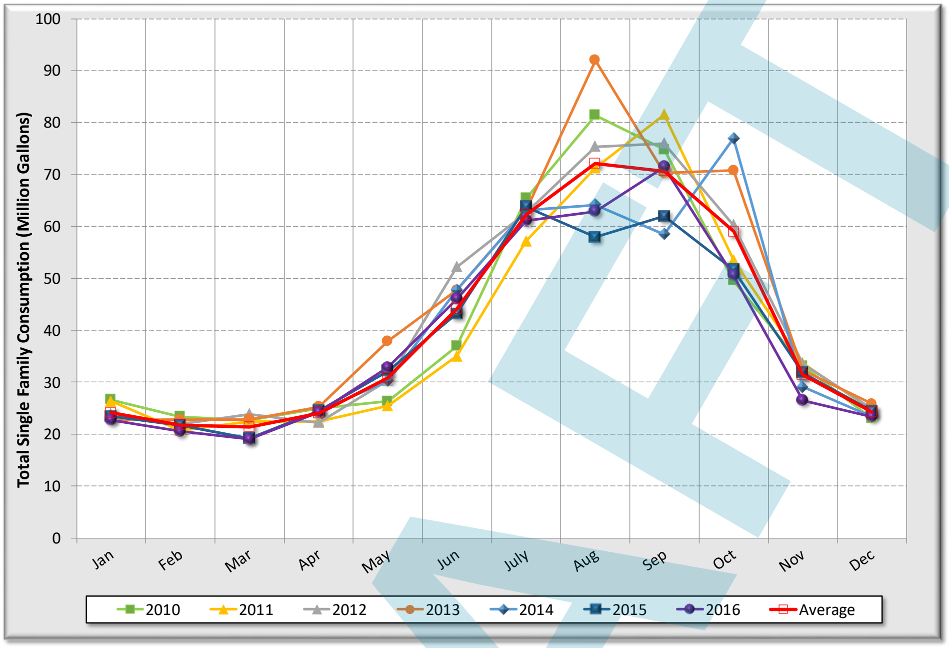
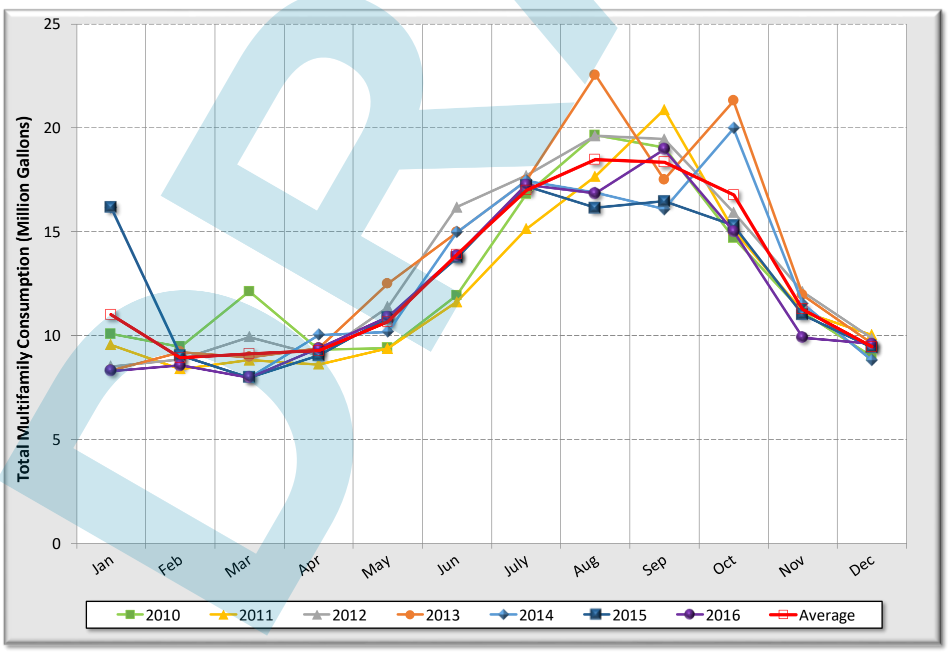


Chart 4-4
Historical Monthly Multi-Family Consumption



DRAFT

Chart 4-5
Historical Monthly Commercial/Residential Consumption

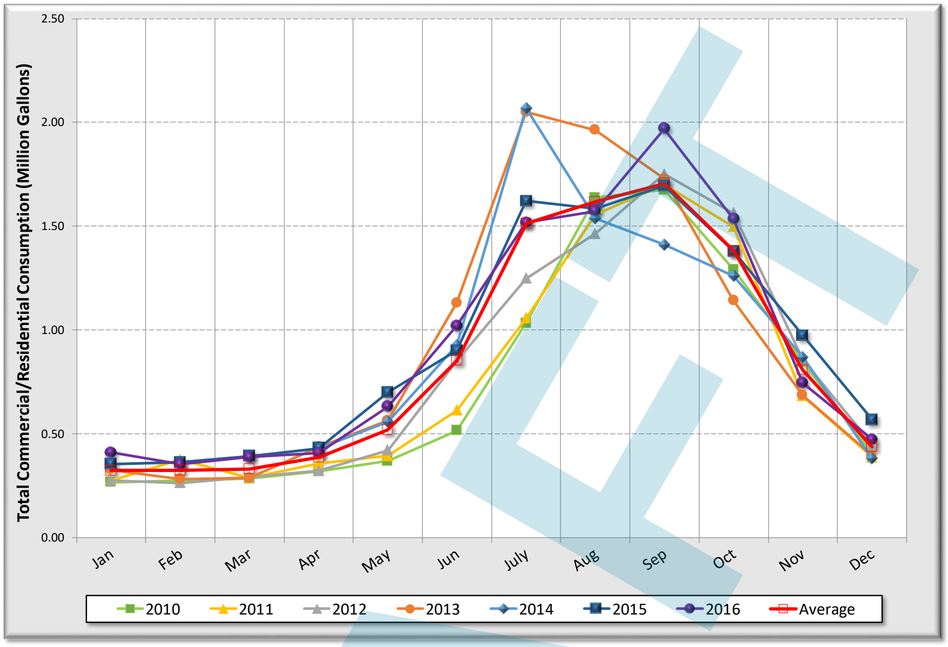


Chart 4-6
Historical Monthly Commercial Consumption

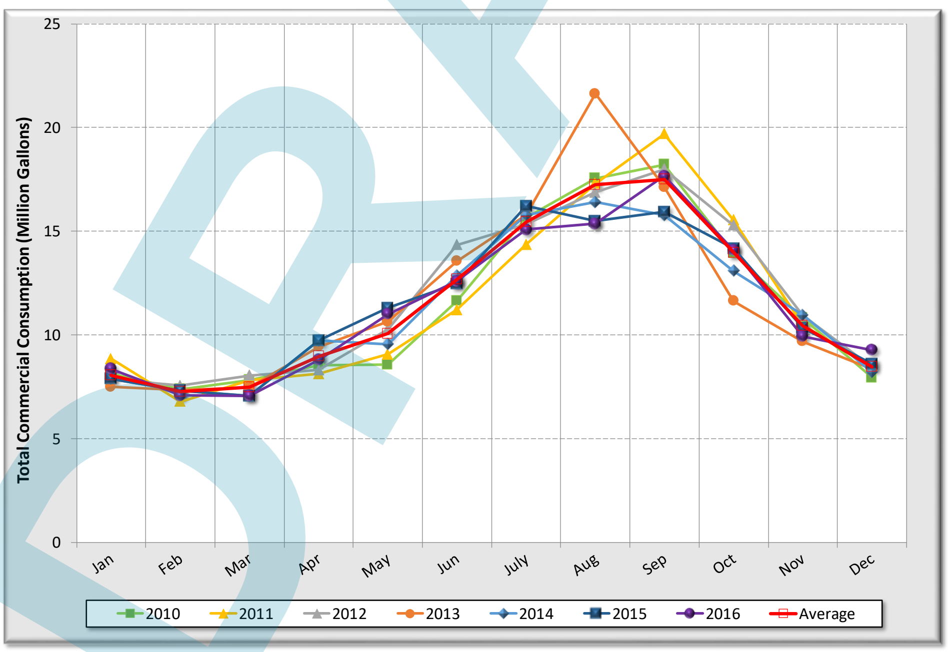


Chart 4-7
Historical Monthly Industrial Consumption

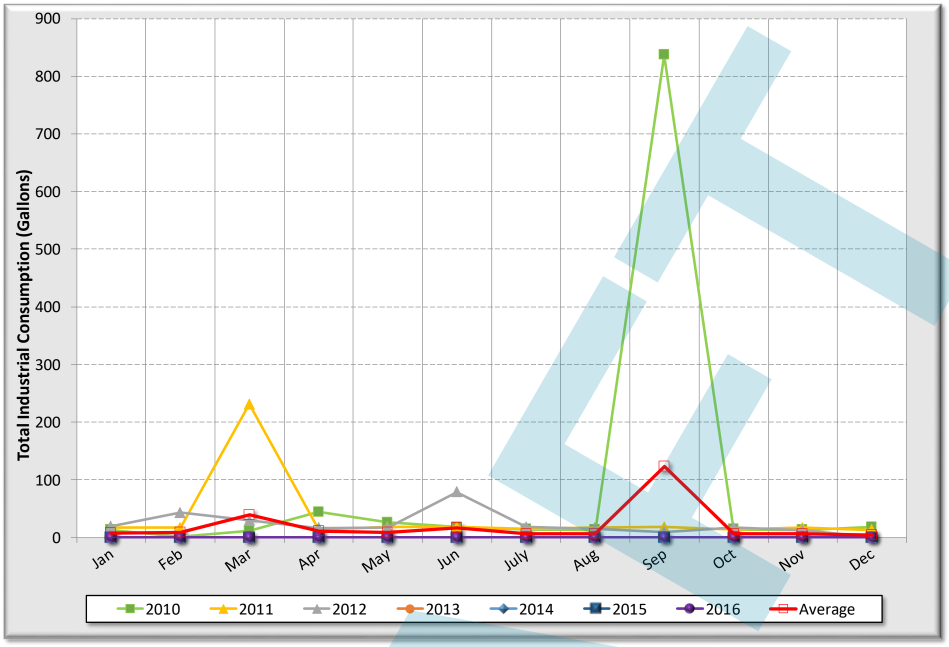


Chart 4-8
Historical Monthly Municipal Consumption

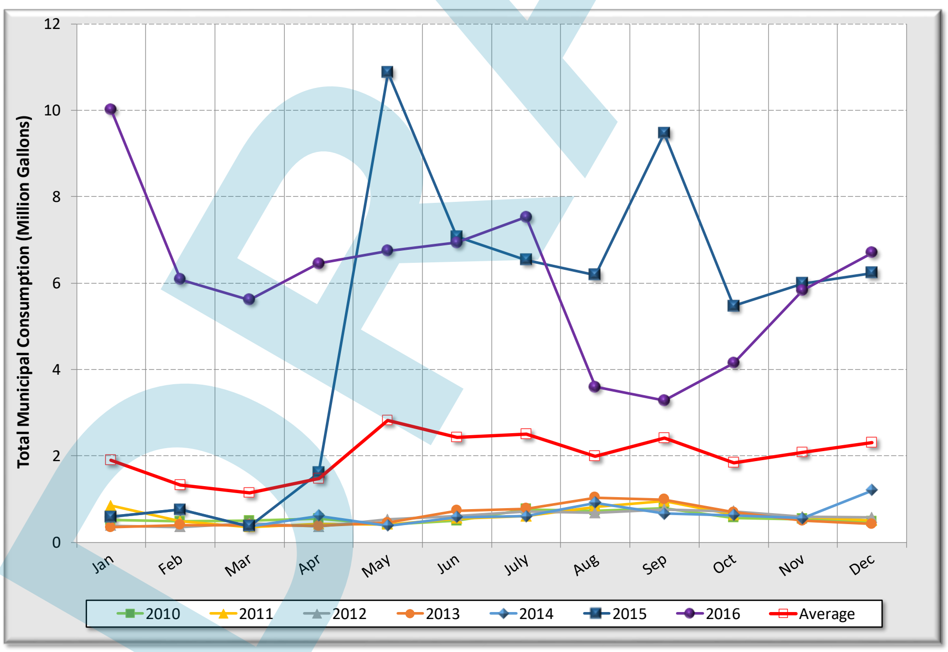


Chart 4-9
Historical Monthly Governmental Consumption

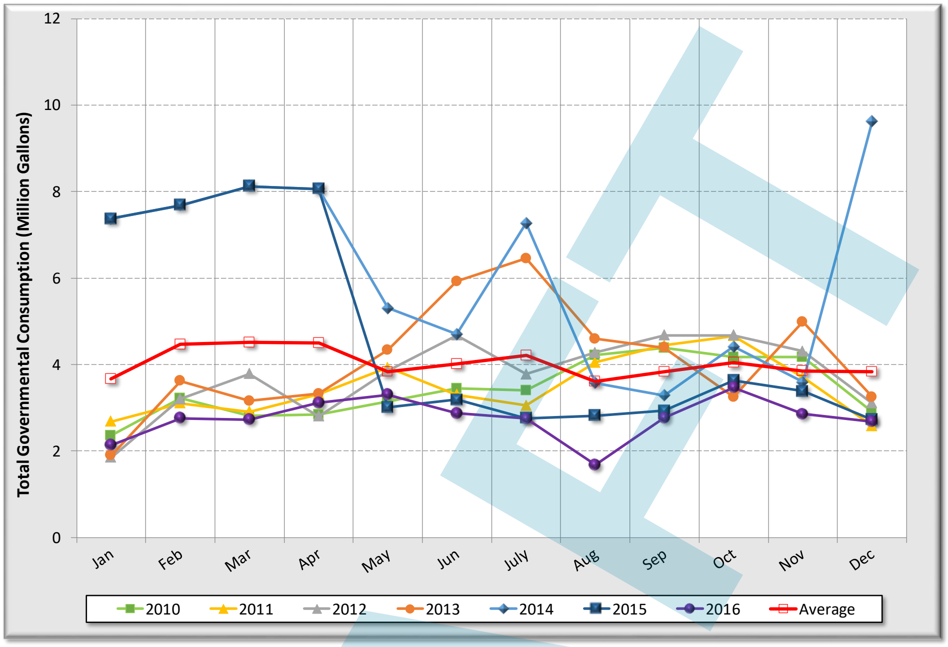


Chart 4-10
Historical Monthly Irrigation Consumption

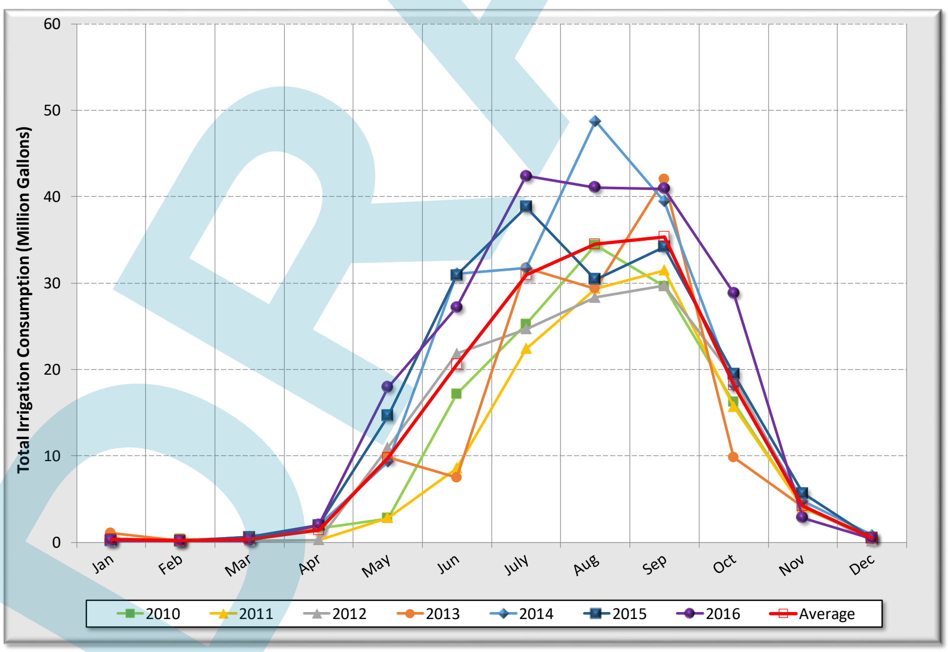
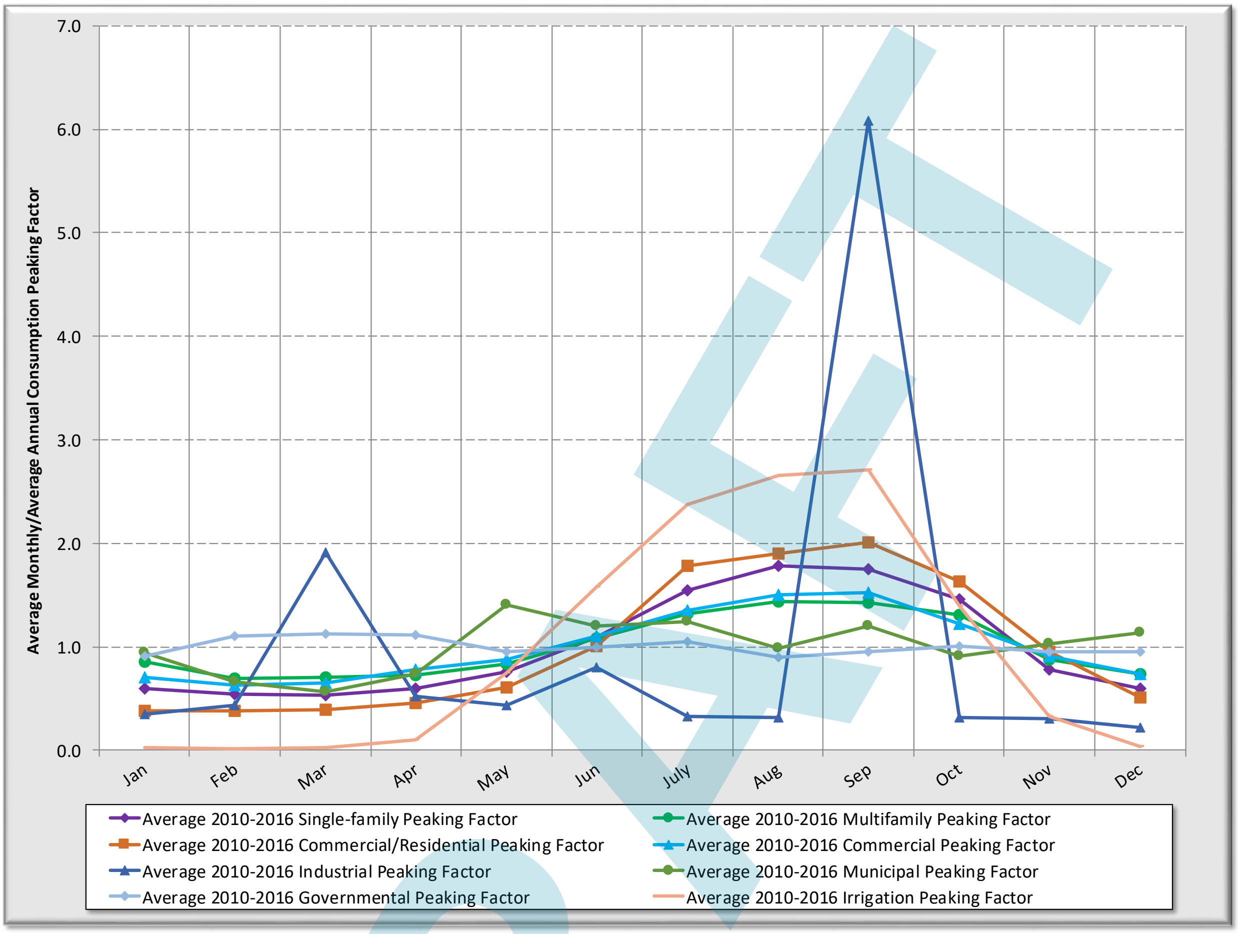


Chart 4-11 shows the ratio of monthly consumption to average annual consumption for each of the eight customer classes. The relatively high summer peaking factors of the City's residential and irrigation customers are illustrated clearly in **Chart 4-11**. The extremely low consumption of the City's industrial customers during the 2010 to 2016 analysis period results in exaggerated peaking factors for this customer class, which is presented for reference only.

DRAFT

Chart 4-11
Average Monthly Peaking Factors by Customer Class



Water Supply

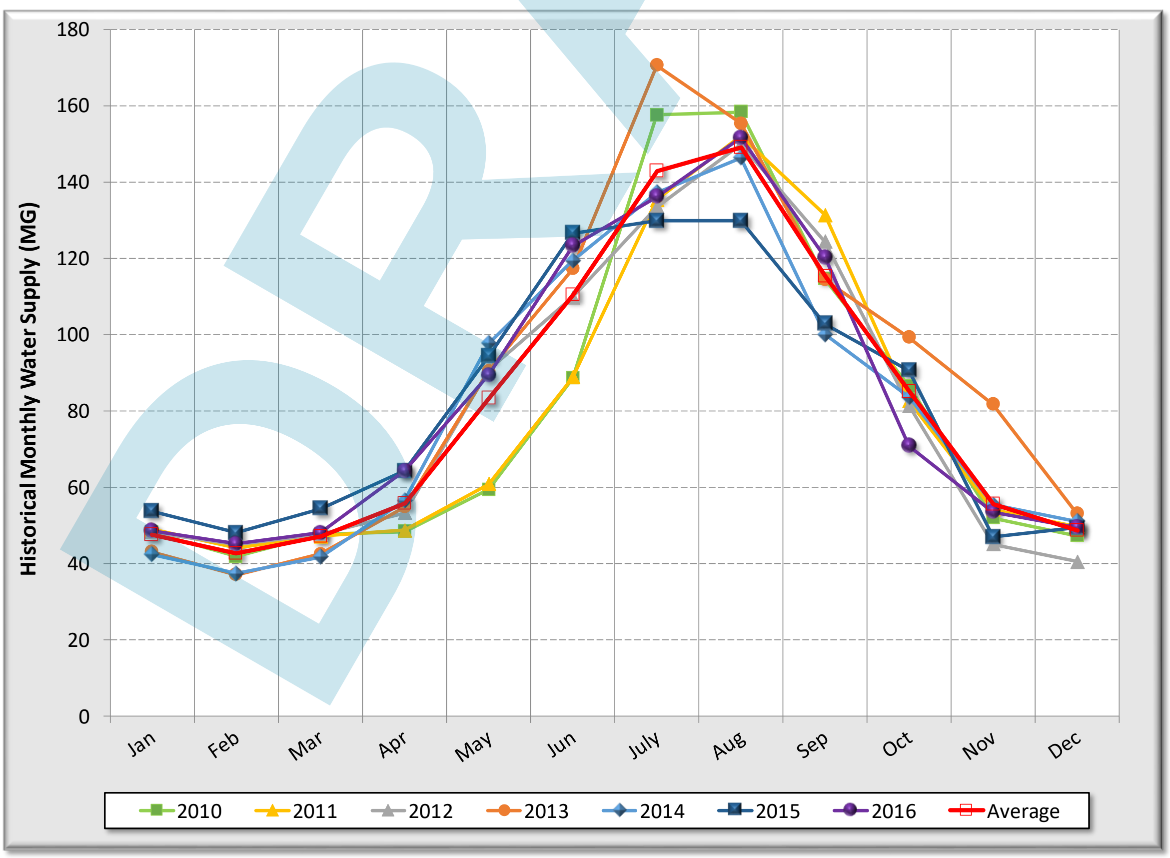
Water supply, or production, is the total amount of water supplied to the system, as measured by the meters at source of supply facilities. Water supply is different than water consumption in that water supply is the recorded amount of water put into the system and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply of any system is typically larger than the measured amount of water consumption, due to non-metered water use and water loss, which will be described more in the **Water Loss** section. **Table 4-4** summarizes the total amount of water supplied to the system from 2010 through 2018.Production data for the years 2017 and 2018 were provided in early 2019 during completion of this Plan and are included herein. In general, the amount of water consumed by the City's customers has grown slightly from 2010 to 2018. This slight increase can likely be attributed to development and the small population increase the City has undergone during this time period.

Table 4-4
Historic Water Supply

Year	Annual Supply (gallons)	Average Day Demand (gpm)	(MGD)
2010	949,561,700	1,807	2.60
2011	943,421,100	1,795	2.58
2012	968,775,300	1,843	2.65
2013	1,058,786,700	2,014	2.90
2014	967,335,304	1,840	2.65
2015	988,901,814	1,881	2.71
2016	1,000,034,998	1,903	2.74
2017	1,054,864,551	2,007	2.89
2018	1,057,499,874	2,012	2.90

Like most other water systems, the City's water use varies seasonally. **Chart 4-12** shows the historical amount of water supplied to the City's system for each month from 2010 to 2016.

Chart 4-12
Average Monthly Peaking Factors by Customer Class



As shown in **Chart 4-12**, water supply increases significantly during summer months, primarily due to irrigation. The City's highest water use typically occurs in July and August. On average, the amount of water supplied during these 2 months is approximately 30 percent of the total supply for the entire year.

Chart 4-13 shows the monthly water supply by source for 2015, a drought year when water was supplied from all three of the City's supply sources. Typically, water is supplied only from the Reeder Reservoir, but water is supplemented from TID and the TAP BPS during drought years to meet demand. **Chart 4-14** shows the monthly water supply for 2016, a non-drought year when water was supplied only from the Reeder Reservoir.

Chart 4-15 shows the annual water supply by source from 2010 to 2016. The years 2013 to 2015 reflect the City's supply data during years where due to drought or other conditions, TID and the TAP BPS were used to meet the required water demand.

Chart 4-13
2015 Monthly Water Supply Source

DRAFT

Chart 4-14
2016 Monthly Water Supply Source

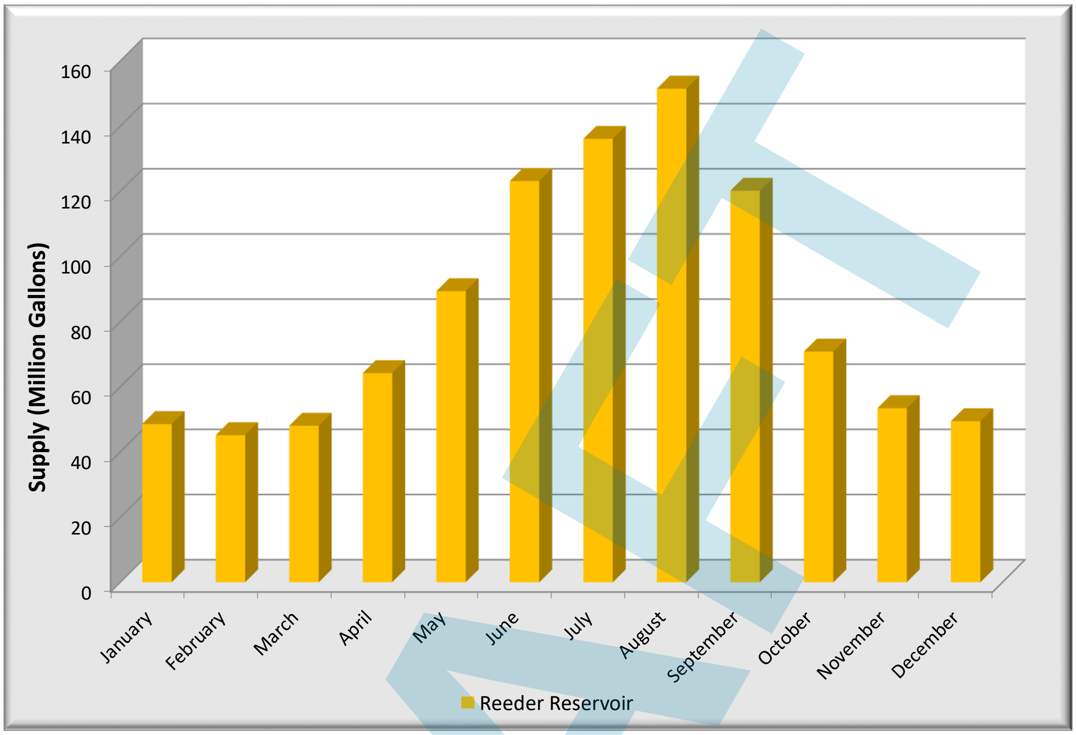
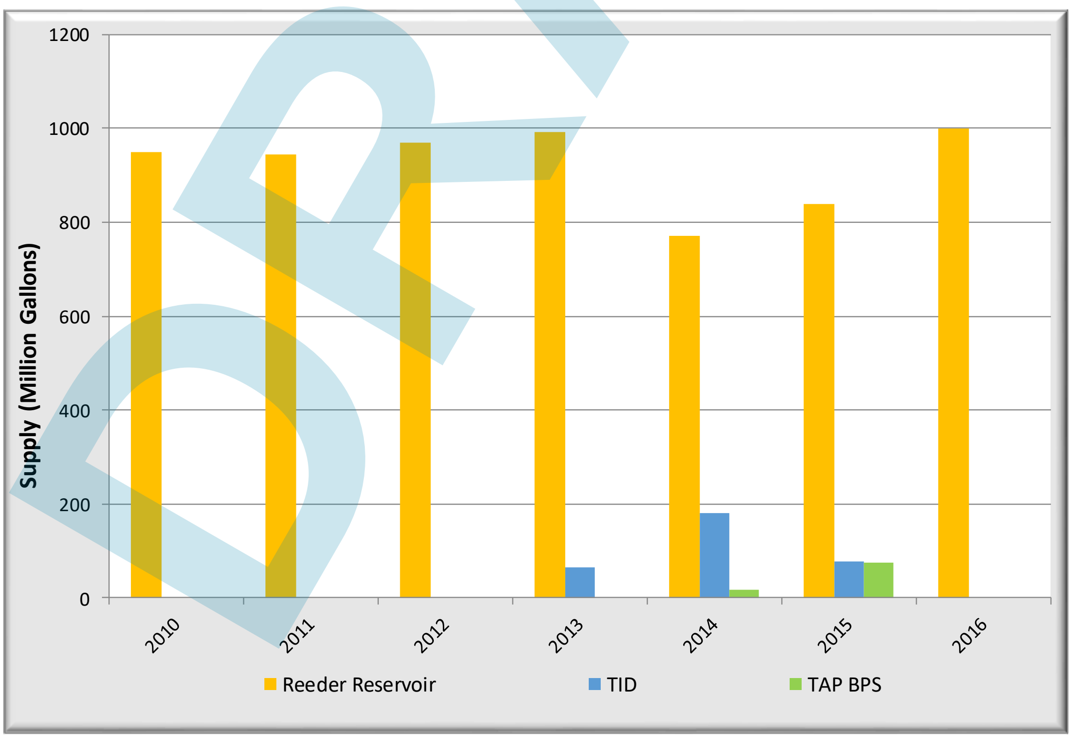


Chart 4-15
Annual Water Supply by Source



DRAFT

Water Loss

The difference between the amount of water supply and the amount of authorized water consumption is the amount of water loss. There are many sources of water loss in a typical water system, including water system leaks, inaccurate supply metering, inaccurate customer metering, illegal water system connections or water use, fire hydrant usage, water main flushing, and malfunctioning telemetry and control equipment resulting in reservoir overflows. Several of these types of usages, such as water main flushing and fire hydrant usage, may be considered authorized uses if they are tracked and estimated. Although real losses from the distribution system, such as reservoir overflows and leaking water mains, should be tracked for accounting purposes, these losses must be considered water loss.

A comparison of the City's water production/supply totals with consumption totals for the years 2012 through 2018 shows that for the year 2012, metered consumption exceeded metered production. This is likely due to incorrect accounting and results in the calculation of a negative water loss percentage for this year, as shown in **Table 4-5**. Data for the years 2010 and 2011 also appeared incorrect and are not included herein. The City updated its calculation method and provided updated data for the years 2014 through 2018 as shown in the table. For the last two years, which likely are more representative of the actual system, water loss is estimated at 7 percent.

Table 4-5
Water Loss

Description	2012	2013	2014	2015	2016	2017	2018
Authorized Consumption (AC)							
Metered Customers Use (gal)	1,007,593,876	1,042,277,451	903,194,843	921,575,446	961,052,470	951,348,523	962,416,066
Total Authorized Consumption (gal)	1,007,593,876	1,042,277,451	912,487,938	918,202,115	963,962,674	957,348,419	970,462,679
Total Production (TP)							
Total Production Supply (gal)	968,775,300	1,058,768,700	967,335,304	988,901,814	1,000,034,998	1,054,864,551	1,057,499,874
Water Loss (TP - AC)							
Total Water Loss (gal)	-38,818,576	16,509,249	54,847,366	70,699,699	36,072,324	97,516,132	87,037,295
Total Water Loss (%)	-4.0%	1.6%	5.7%	7.1%	-3.6%	9.2%	8.2%
Rolling 3-year Average Water Loss (%)	-2%	0%	1%	5%	5%	7%	7%

The City intends to continue to reduce the amount of water loss in the system through managing leaks and by ongoing pipe replacement. The City will also continue to improve the tracking and reporting of production, consumption, and other authorized water uses (such as hydrant flushing), including coordination with the fire department.

Per Capita Demands

Table 4-6 presents the computation of the existing system per capita demand based on 2016 data. As shown in the upper portion of the table, the total residential population served by the City's

DRAFT

water system in 2016 was approximately 20,620. This population served, and the City's total water consumption in 2016, were used to arrive at the existing per capita demand of 141 gpd.

Table 4-6
Historical Average Daily Demand

2016 Residential Population Served	
Calculated 2016 Residential Population Served	20,620
Total Annual Production	
2016 Total Annual Production (gal)	1,00,034,998
Existing Per Capita Demand (gpd/capita)	**133**

As shown in **Table 4-3**, in 2016, the Southern Oregon University and the City of Ashland Water Department accounted for approximately seven percent of the City's water consumption. Since these customers are not anticipated to annually increase their consumption in the future, the use of the existing system per capita demand of 133 gpd would not be accurate for projecting future demands. Therefore, an additional computation of per capita demand was performed to provide a more accurate estimate for use in forecasting future water demand. The computation of future per capita demand shown in **Table 4-7** is based on a reduced proportion of demand that is likely to be more representative of the future type of demand to occur in the City's system. Specifically, the demands for the City of Ashland Water Department and the Southern Oregon University were excluded from the total annual consumption, and an adjusted annual consumption was calculated. The estimated per capita demand of 123 gpd is used later in this chapter to forecast water demands in future years based on future population estimates.

Table 4-7
Future per Capita Demand Projection

2016 Residential Population Served	
Calculated 2016 Residential Population Served	20,620
Total Annual Consumption	
2016 Total Annual Consumption (gal)	1,000,034,998
Less Annual Demand of City of Ashland Water Department and Southern Oregon University not Representative of Future Users (gal)	74,828,409
2016 Net Annual Consumption Adjusted for Future Anticipated Users (gal)	925,206,589
Estimated Per Capita Demand for Future Demand Projections (gpd/capita)	**123**

Demands Per Pressure Zone

Table 4-8 shows the average demand of each of the City's 14 existing pressure zones. These data were developed using the City's hydraulic model estimated demand allocations. The City's two largest pressure zones, the 2425 Crowson Zone 1 and the 2170 Granite Zone 1, account for

DRAFT

approximately 60 percent of the total system demand. **Figure 2-1** in **Chapter 2** displays the City's pressure zones.

Table 4-8
2016 Demands by Pressure Zone

Pressure Zone	2016 Annual Supply (gallons)	Average Day Demand (gpm)	Percent of Total Demand (%)
2170 Granite Zone 1	425,333,455	809	42.5%
1980 Granite Zone 2	58,985,041	112	5.9%
2060 Granite Zone 3	56,084,301	107	5.6%
2425 Crowson Zone 1	201,886,479	384	20.2%
2200 Crowson Zone 2	55,164,066	105	5.5%
2270 Crowson Zone 3	17,074,354	32	1.7%
2640 Crowson Zone 4	2,170,553	4	0.2%
2270 Crowson Zone 5	1,860,474	4	0.2%
2290 Crowson Zone 6	145,957,217	278	14.6%
2570 Crowson Zone 7	60,015	0	0.0%
2610 Crowson Zone 8	3,971,013	8	0.4%
2586 Fallon Zone 1	3,085,787	6	0.3%
2470 Fallon Zone 2	5,186,322	10	0.5%
2559 Alsing Zone 1	23,215,920	44	2.3%
Total	1,000,034,998	1,903	100.0%

Equivalent Residential Units

The demand of each customer class can be expressed in terms of ERUs for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by a single-family residence. The number of ERUs represented by the demand of the other customer classes is determined from the total demand of the customer class and the unit demand per ERU from the single-family residential demand data.

Tables 4-9A, 4-9B, and 4-9C present the computed number of ERUs for each customer class from 2010 through 2016. The demands shown are based on the consumption totals of each customer class. Because the City revised its accounting methodology and provided updated total consumption data as shown in Table 4-4, the sum of the consumption data for each customer class shown in **Table 4-9C** does not match the total consumption data shown in **Table 4-4**. This does not significantly impact the ERU calculation. In years where there were active industrial connections, their use was minimal and represents less than 1 ERU for the given year. The average demand per ERU from 2010 through 2016 (7-year average) was 189 gpd.

DRAFT

Table 4-9A
Equivalent Residential Units

Year	Average Number of Connections	Average Annual Demand (gallons)	Demand per ERU (Gal/day/ERU)	Total ERUs
Single-family Residential				
2010	6,957	488,100,190	192	6,957
2011	6,964	474,070,759	187	6,964
2012	7,000	506,821,036	198	7,000
2013	7,022	533,363,462	208	7,022
2014	7,068	481,966,672	187	7,068
2015	7,105	455,536,334	176	7,105
2016	7,127	461,125,696	177	7,127
Multi-family Residential				
2010	58	8,909,187	192	127
2011	62	9,172,988	187	135
2012	62	9,743,138	198	135
2013	65	10,980,461	208	145
2014	72	10,542,835	187	155
2015	76	10,951,526	176	171
2016	80	11,010,907	177	170
Commercial/Residential				
2010	58	8,909,187	192	127
2011	62	9,172,988	187	135
2012	62	9,743,138	198	135
2013	65	10,980,461	208	145
2014	72	10,542,835	187	155
2015	76	10,951,526	176	171
2016	80	11,010,907	177	170

DRAFT

Table 4-9B
Equivalent Residential Units - Continued

Commercial				
2010	579	136,133,308	192	1,940
2011	581	137,649,340	187	2,017
2012	588	141,214,766	198	1,956
2013	586	140,110,401	208	1,845
2014	590	134,557,956	187	1,973
2015	590	136,443,256	176	2,126
2016	593	136,245,374	177	2,106
Industrial				
2010	3	1,022	192	0
2011	2	409	187	0
2012	2	275	198	0
2013	0	0	208	0
2014	0	0	187	0
2015	0	0	176	0
2016	0	0	177	0
Municipal				
2010	16	6,784,577	192	97
2011	16	7,155,087	187	105
2012	15	6,676,933	198	92
2013	15	7,091,256	208	93
2014	29	7,818,924	187	115
2015	63	61,121,481	176	953
2016	65	72,916,421	177	1,127

DRAFT

Table 4-9C
Equivalent Residential Units - Continued

Government				
2010	96	41,042,636	192	585
2011	101	41,719,040	187	613
2012	106	44,964,433	198	621
2013	98	49,158,394	208	647
2014	101	72,990,366	187	1,070
2015	63	55,681,857	176	868
2016	46	33,083,654	177	511
Irrigation				
2010	372	132,325,776	192	1,866
2011	376	115,967,240	187	1,704
2012	339	139,613,067	198	1,928
2013	208	137,913,590	208	1,816
2014	201	186,928,216	187	2,741
2015	201	177,344,959	176	2,766
2016	265	204,099,607	177	3,155
System-Wide Totals				
2010	8,671	965,908,012	192	13,767
2011	8,699	932,011,636	187	13,626
2012	8,711	1,007,593,876	198	13,921
2013	8,597	1,042,277,451	208	13,722
2014	8,665	1,053,849,187	187	15,455
2015	8,701	1,049,403,215	176	16,367
2016	8,796	1,065,011,589	177	16,461

The average demand per ERU from 2013 of 208 gpd will be used later in this chapter to forecast ERUs in future years based on estimated future demands. This demand per ERU value also will be used to determine the capacity (in terms of ERUs) of the existing system in **Chapter 5**.

DRAFT

Average Daily Demand

ADD is the total amount of water delivered to the system in a year divided by the number of days in the year. The ADD is determined from the historical water use patterns of the system and can be used to project future demands within the system. ADD data typically are used to determine standby storage requirements for water systems. Standby storage is the volume of a reservoir used to provide water supply under emergency conditions when supply facilities are out of service. Yearly water production records from the City's supply sources and customer water use records were reviewed to determine the system's ADD. The system's average day demand from 2010 through 2018 is shown in **Table 4-4**.

Maximum Day Demand

MDD is the maximum amount of water used throughout the system during a 24-hour time period of a given year. MDD typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with Oregon Department of Human Services design standards, the distribution system shall provide fire flow at a minimum pressure of 20 psi during MDD (i.e. maximum day demand) conditions. Supply facilities (e.g. wells, springs, pump stations, interties) are typically designed to supply water at a rate that is equal to or greater than the system's MDD.

Because water use restrictions have been in place for 2014 through 2016, 2013 data was used to determine typical peaking factors for the water system. Fifteen-minute interval water production and reservoir level records from 2013 were reviewed to determine the system's MDD. The City's MDD occurred on July 26, 2013, when temperatures reached approximately 100 degrees Fahrenheit and were in the 90s or over 100 the days before and after. As shown in **Table 4-10**, the demand of the system on July 26, 2013, or MDD, was 4,106 gpm.

Table 4-10
Maximum Day Demands and Peaking Factors

Maximum Day Demand Data		
Demand Type	**Date**	**Demand (gpm)**
Average Day Demand (ADD)	2013	2,014
Maximum Day Demand (MDD)	7/26/2013	4,106
Peak Hour Demand (PHD)	8/5/2013 6:00 AM – 7:00 AM	9,784
Peaking Factor		
Description		**Factor**
Maximum Day Demand/Average Day Demand (MDD/ADD)		2.04
Peak Hour Demand/Maximum Day Demand (PHD/MDD)		2.38
Peak Hour Demand/Average Day Demand (PHD/ADD)		4.86

DRAFT

Peak Hour Demand

PHD is the maximum amount of water used throughout the system, excluding fire flow, during a one-hour time period of a given year. The PHD, like the MDD, is typically determined from the combined flow of water into the system from all supply sources and reservoirs. Five-minute interval reservoir level and water production records were reviewed to evaluate the PHD. As shown in **Table 4-10**, the City's PHD for 2013 was 9,784 gpm, which occurred on August 5th from 6:00 AM to 7:00 AM.

Table 4-10 also shows the peaking factors of the water system based on the ADD, PDD, and the PHD data.

Fire Flow Demand

Fire flow demand is the amount of water required during firefighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a high rate of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply is useless if the transmission or distribution system cannot deliver water at the required rate and pressure necessary to extinguish a fire.

General planning-level fire flow requirements were established for the different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general planning-level fire flow requirement for each land use category is shown in **Table 4-11**. The water system analyses presented in **Chapter 5** are based on an evaluation of the water system for providing sufficient fire flow in accordance with these general planning-level fire flow requirements. The fire flow requirements shown in **Table 4-11** do not necessarily equate to actual existing or future fire flow requirements for all buildings, since this is typically based on building size, construction type, and fire suppression systems provided. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown in **Table 4-11** shall be the responsibility of the developer.

Table 4-11
General Planning-Level Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (Hours)
Single-family Residential	1,500	2
Multi-family Residential	2,500	3
Commercial/Industrial	4,000	4

Future Water Demands

Basis for Projecting Demands

Future demands were calculated from the results of the future per capita demand computation shown in **Table 4-7** and the projected population data from **Chapter 3**. Future demand projections were computed with and without water savings expected from implementing conservation measures. The City's conservation program presents a goal to reduce the system-wide average daily demand from projected non-conservation demand by 5 percent by 2020, 15 percent by 2030, and 20 percent by 2050.

Demand Forecasts and Conservation

Table 4-12 presents the projected water demand forecast for the City's water system. The actual average daily demand data from 2016 also is shown for comparison purposes. The future ADDs were projected based on population estimates for the given years and the estimated demand per capita value of 123 gpcd. Historical average demands for SOU and the Ashland Water Department were added to other customer demands. The 123 gpcd value already assumes any potential water loss, so water loss is not added in separately. The MDDs and PHDs shown were computed from the projected ADDs and the existing system peaking factors shown in **Table 4-10** and **Chart 4-16**. The future demand projections are shown with and without estimated reductions in water use from achieving conservation goals.

Table 4-12
Future Demand Projections

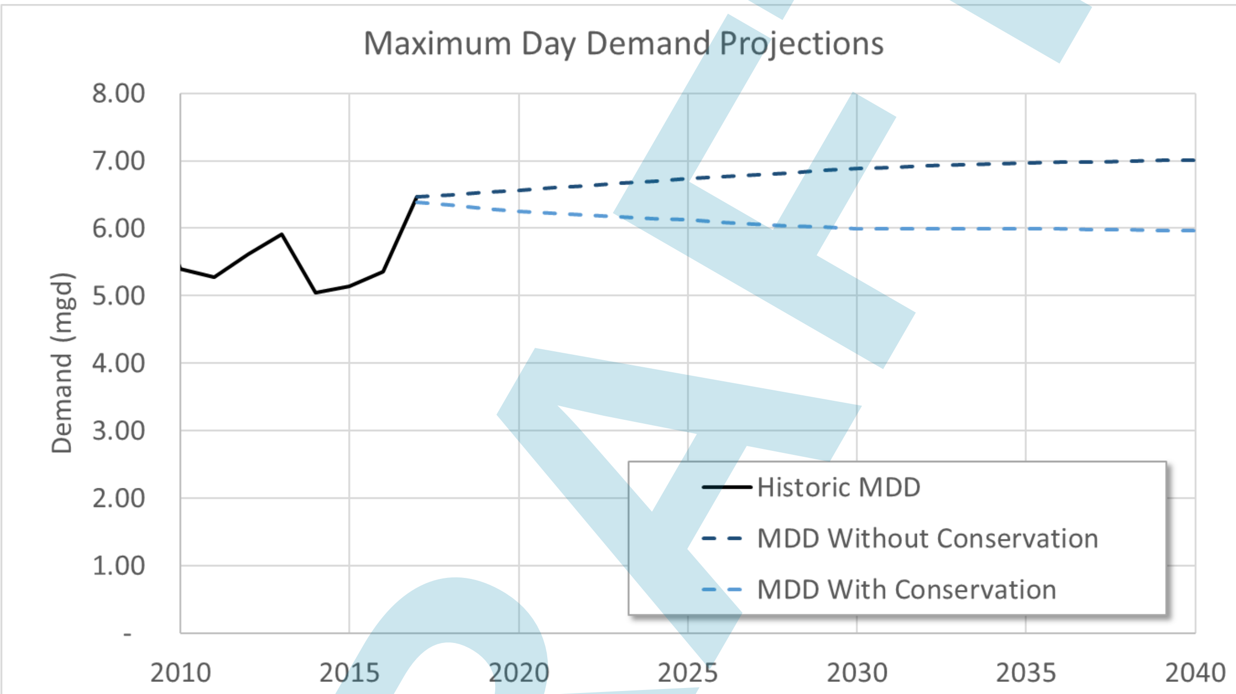
Description	Actual[1]	Projected[2]								
	2016	2017	2018	2019	2020	2021	2022	2023 (+6 yrs)	2027 (+10 yrs)	2037 (+20 yrs)
Population Data										
Population in Water Service Area	20,620	21,162	21,290	21,419	21,547	21,684	21,182	21,957	22,474	23,244
Average Day Demand (gpm)										
Demand without Conservation	1,823	2,203	2,214	2,225	2,236	2,247	2,259	2,271	2,315	2,380
Demand with Conservation		2,176	2,160	2,144	2,129	2,120	2,111	2,102	2,067	2,039
Maximum Day Demand (gpm)										
Demand without Conservation	4,106	4,491	4,513	4,535	4,558	4,581	4,605	4,629	4,718	4,852
Demand with Conservation		4,435	4,403	4,371	4,340	4,322	4,304	4,286	4,213	4,156
Peak Hour Demand (gpm)										
Demand without Conservation	9,784	10,699	10,752	10,805	10,858	10,915	10,972	11,028	11,242	11,560
Demand with Conservation		10,567	10,490	10,415	10,341	10,297	10,254	10,211	10,037	9,901

[1] 2016 Maximum Day Demand and Peak Hour Demand values are based on actual average day demand amounts for the given year and typical peaking factors, and do not necessarily represent actual peak demands for 2016.
[2] Projected population data beyond 2016 is based on projected UGB population plus City limits population, as shown in Table 3-2.

DRAFT

The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 2** and **5**, is based on the 2037 projected demand data without conservation reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use reductions are achieved. However, the City will continue to pursue reductions in water use by implementing the current conservation program.

Chart 4-16
Maximum Day Demand Projections



DRAFT

Future ERUs

Table 4-13 presents the existing and projected ERUs of the system. The ERU forecasts are based on the projected water demands from **Table 4-12** and the average demand per ERU that was computed from actual 2013 data.

Table 4-13
Future ERU Projections

Description	Actual[1] 2016	Projected 2017	2018	2019	2020	2021	2022	2023 (+6 yrs)	2027 (+10 yrs)	2037 (+20 yrs)
Demand Data (gpm)[1]										
ADD without Conservation	1,823	2,203	2,214	2,225	2,236	2,247	2,259	2,271	2,315	2,380
ADD with Conservation		2,176	2,160	2,144	2,129	2,120	2,111	2,102	2,067	2,039
ERU Basis Data (gpd/ERU)										
Demand per ERU without Conservation	177	208	208	208	208	208	208	208	208	208
Demand per ERU with Conservation		206	203	201	198	196	194	193	186	178
Equivalent Residential Units (ERUs)										
Total System ERUs	16,461	15,244	15,319	15,395	15,471	15,551	15,632	15,712	16,017	16,470

[1] Demand data calculated as in Table 4-12.

5 | WATER SYSTEM ANALYSIS

DRAFT

DRAFT

5 | WATER SYSTEM ANALYSIS

Introduction

This chapter presents the capacity analysis of the City's water system. Individual water system components were analyzed to determine the ability to meet policies and design criteria under existing and future water demand conditions (presented in **Chapter 4**). The analyses below cover supply, storage, pumping, pressure zones, and distribution piping. The policies and criteria are summarized below for each analysis. Recommendations are discussed in this chapter and captured in the recommended Capital Improvement Plan (CIP) in **Chapter 6**.

Changes Since Last Water Master Plan

Since completion of the City's last Water Master Plan, several improvements have been decided upon and implemented that influence the system analysis. These include the following:

- **Construction of the TAP Emergency Supply System**. This new emergency supply provides MWC water to the City and makes use of the City's Lost Creek Reservoir water rights purchased for this purpose.
- **Construction of the New Park Estates Booster Pump Station.** This pump station upgrade provides a much higher level of reliability and fire protection for customers at the highest elevations in the City.
- **Construction of the New Terrace Street Booster Pump Station**. This pump station upgrade improves the City's ability to boost TID supply in the Ashland Canal to the WTP and new WTP.
- **New Water Treatment Plant Decision on Capacity and Location**. The new WTP is planned to be a 7.5 MGD capacity plant (expandable to 10 MGD). The location of the plant is at the granite quarry southwest of the Granite Reservoir.
- **Pipe Improvement Projects**. Several pipe improvements have been made related to new development and improving distribution system capacity.

General System Challenges

The following summarizes the overall challenges to the water system. Goals for addressing these challenges are also listed and the analyses throughout this report reflect these goals.

Challenge 1: Moving from a Gravity System to a Partial Gravity System

The majority of the City's customers are currently served entirely through a gravity supply system. With construction of the new WTP, located lower in elevation than the existing plant, approximately half of the City's supply will need to be boosted through a new booster pump station. The size of this pump station and ongoing pumping costs can be reduced by reducing demands in the high-pressure zones. This can be accomplished by reducing the use of PRVs that supply water from higher zones to lower zones and by improving the ability of the lower zones to serve low elevation customers (see *Supply Analysis* below for further detail).

DRAFT

Goal: Reduce pumping to Crowson Zones:

- Improve Granite Zone transmission capacity;
  - Extend piping to serve low elevation customers in Crowson Zone 6;
- Reduce/eliminate PRVs supplying from Crowson or Alsing Zones to Granite Zones.

Challenge 2: Granite Reservoir is Aging and in a Poor Location

The Granite Reservoir is in poor condition and requires major improvements to remain functional and safe. In addition, the reservoir is located in Ashland Creek, which places the reservoir at risk of flood damage and ongoing deterioration. With construction of one or two new clearwells at the new WTP site, the storage volume requirements for the Granite Zones are replaced so that the City could take this reservoir offline. However, the reservoir at its current location is important to the operation of the TAP Emergency Supply into Granite Zone 1. See *Storage Analysis* below for further details.

Goal: Abandon the existing Granite Reservoir without compromising system hydraulics:

- Confirm ability of TAP system to function without a terminal reservoir;
- Confirm if WTP clearwells can replace the Granite tank functionality;
- Consider a new Granite Zone Reservoir.

Challenge 3: Oversized Alsing Reservoir

For many years the City has dealt with water quality challenges in the Alsing Reservoir, which is oversized for the current service area that it serves. The low demands on the reservoir result in poor water turnover and lead to water quality issues. The City has adjusted the Hillview Pump Station setpoints to temporarily alleviate the water quality issue by keeping the reservoir partially full. However, this is not a long-term solution and the City's total stored volume is less than it could be to support an emergency. See *Storage Analysis* below for further details.

Goal: Expand Alsing Reservoir service area to achieve reservoir turnover.

Challenge 4: Fire Flow Deficiencies at Highest Customers (Park Estates and South Mountain)

Despite construction of the new Park Estates BPS, the water system cannot provide the anticipated fire flows of 2,000 gpm to hydrants in the boosted pressure zone (Crowson Zone 8). This is because the 8-inch pipes serving the area are undersized for this amount of flow. Additionally, high elevation customers at the top of South Mountain Street have very low pressures during fire flows and could be better served by the boosted zone (currently served by Crowson Zone 1).

Goal: Increase pipe sizes upstream of the Park Estates BPS:

- Expand Crowson Zone 8 to connect to Crowson Zone 4;
- Reconnect piping for high Crowson Zone 1 customers to Crowson Zone 4.

Challenge 5: TAP Emergency Supply Cannot Reach Crowson Zone

The TAP Booster Pump Station can supply water during an emergency to customers in the Granite Zones, which comprise approximately half of all system demands, but cannot boost water as high as the Crowson Zones. In the case of a WTP outage for more than one day, the water system needs

DRAFT

a way to boost water to meet the demands of all customers, including those in the higher pressure zones. See *Pump Station Analysis* for further details.

Goal: Identify the location for permanent pump station.

- Because the City has a location for a temporary pump to boost water from the Granite Zone to the Crowson Zone, this project could be delayed as needed.

Challenge 6: Pressure Extremes in Many Locations

Due to the large variation in elevations within each pressure zone, the water system has many locations of low and very high pressures. See *Pressure Zone Analysis* below for further details.

Goal: Rezone where feasible.

Challenge 7: Inability to Meet Higher Fire Flow Standards

Many neighborhoods in the water system were originally built for lower fire flow rates; such as those with 4-inch diameter pipes. These areas are unable to meet the City's updated criteria to provide 1,500 gpm in residential areas and 4,000 gpm for non-residential customers. See *Fire Flow Analysis* below for further details.

Goal: Build in distribution capacity, concurrent with road improvement projects to reduce costs.

Challenge 8: Potential Storage Deficiency

Storage volume evaluations in the past have identified storage deficiencies in the Crowson and Granite Zones. However, these deficiencies are highly dependent on the emergency scenario for which the City is planning. See *Storage Analysis* below for further details.

Goal: Revise criteria to account for new redundant, reliable supply sources.

Challenge 9: Many Aging, Undersized Pipes

Despite the City's ongoing pipe replacements, many pipes in the water system are aging and are undersized for current day pressure criteria. See *Pressure Analysis* below for further details.

Goal: Replace aging pipes as budget allows, and concurrent with road improvement projects to reduce costs.

Supply Evaluation

This section evaluates the City's water supplies for meeting existing and future demands of the water service area.

Supply Criteria

Table 5-1 presents the City's Supply Level of Service Goals. These goals are continued from the City's last master planning efforts.

Table 5-1
Supply Level of Service Goals

Goal Element	Goal
Water System Capacity	Have sufficient supply to meet projected demands that have reduced based on achieving 5 percent additional conservation from base year 2009. However, City will have a goal of achieving 15 percent conservation.
Water System Reliability	Community will accept curtailments of 45 percent during a severe drought. The City will prioritize source water available during drought conditions.
Water System Redundancy	Implement redundant supply projects to restore fire protection and supply for indoor water use shortly after a treatment plant outage. Supply ADD with redundant supply.
Regulatory Requirements	Meet or exceed all current and anticipated regulatory requirements, including cross-connection program improvements.

Supply Analysis

Each supply level of service goal is evaluated for the City's water system as follows.

Water System Capacity

The planned capacity of the new WTP is more than adequate to supply the projected 2040 Maximum Day Demands (MDD) and beyond (**Figure 5-1**); thus, the City amply meets the water system capacity level of service goal.

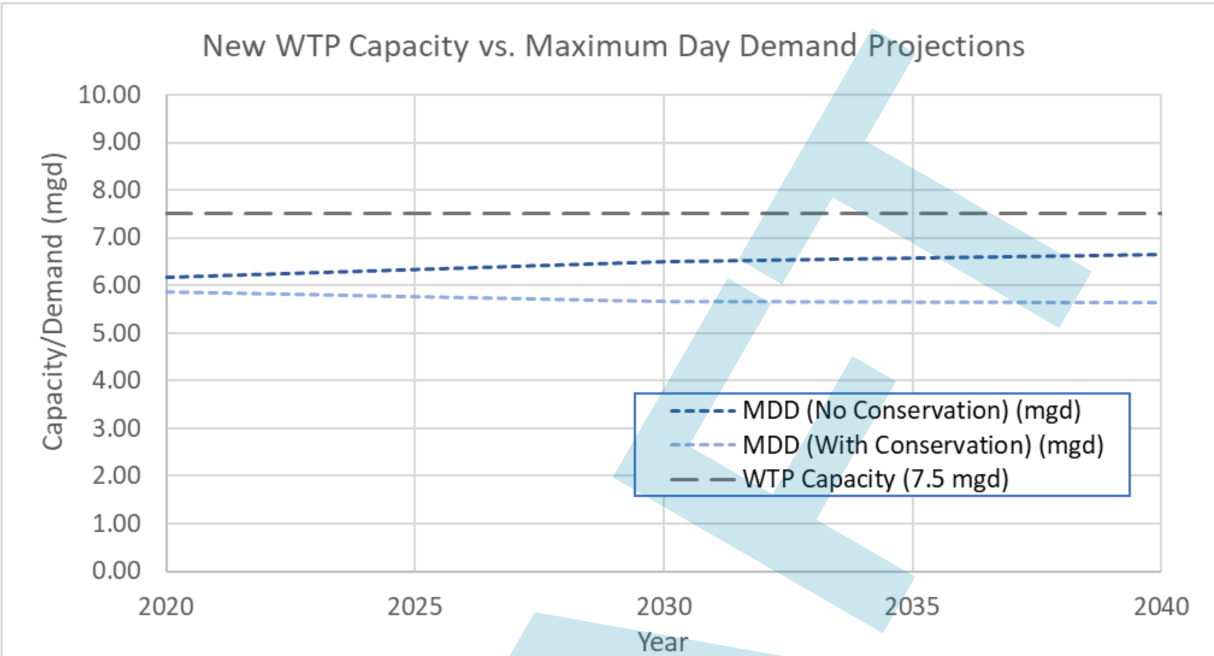
Water System Reliability

During water supply disruption or drought conditions the City's supply strategy is as follows in order of priority:

1. Supply East/West Fork Ashland Creek water as available to the new WTP (stored in Reeder Reservoir and soon to be able to bypass Reeder Reservoir).
2. Supplement Ashland Creek water with TID water to the new WTP.
3. Use the TAP Supply System to supply water from MWC.
4. Curtail supply according to the City's Water Curtailment Plan.

DRAFT

Figure 5-1
New WTP Capacity vs. Maximum Day Demand Projections



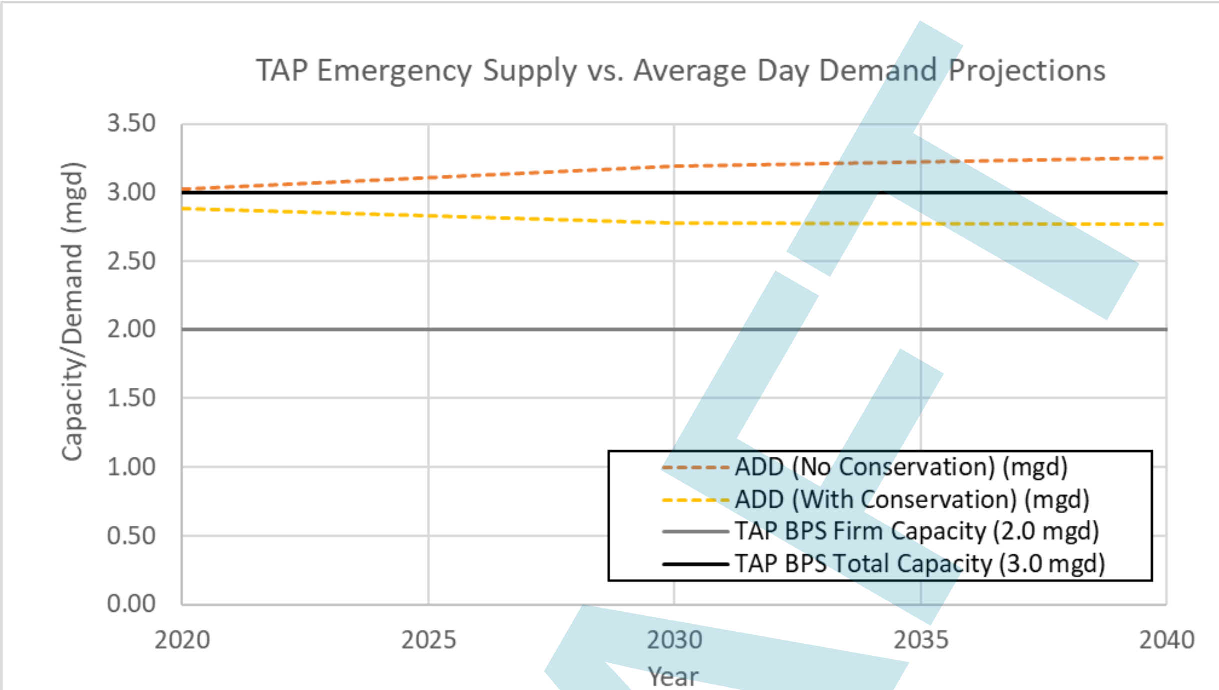
Water System Redundancy

With construction of the TAP Supply System, the City meets the first part of the water system redundancy level of service goal. However, neither the firm nor total capacity of the TAP BPS is able to meet ADD without conservation in the case of a WTP outage (see **Figure 5-2**). **Figure 5-2** presents the projected ADD with and without the planned conservation goals as presented in **Chapter 2**. To meet the water system redundancy goal, the City plans to expand the TAP Emergency Supply system to a firm capacity of 3.0 MGD (firm capacity is the total capacity with the largest. This capacity exceeds the projected ADD with conservation and is slightly less than ADD without conservation.

Expansion of the TAP supply system entails adding an additional pump in the TAP Pump Station, adding a backup generator that is able to power the firm capacity of 3.0 MGD of supply, pipeline transmission improvements, and likely other improvements in the TAP Emergency Supply system upstream of the City's TAP Pump Station. Expansion of the TAP Regional Booster Pump Station and Talent Booster Pump Station will be evaluated in the TAP Water Master Plan to be completed in the next year with the Cities of Phoenix and Talent. These recommended projects to meet the supply redundancy level of service goal are included in **Chapter 6**.

DRAFT

Figure 5-2
TAP Supply vs. Average Day Demand Projections



Regulatory Requirements

The City is meeting all regulatory requirements including those for cross-connection control. However, City staff think it would be prudent to implement the cross-connection control program more aggressively; this is discussed further in the City's *2019 Operations and Maintenance Plan*.

New WTP Integration with Existing System

Integration of the new WTP into the City's existing system was evaluated as part of this WMP. Assumptions for the location and assumed infrastructure are based on the recommendations in *Ashland Water Treatment Plant Technologies Alternatives Report* (HDR, March 20, 2019) (Report). The storage components of the new WTP currently include two 0.85-MG clearwells. To save upfront costs, the City is planning to only construct one clearwell at first, and then implement the second as budget allows. Combined, the 1.7-MG capacity of the two clearwells replaces the storage requirements supplied by the Granite Reservoir (see **Storage Analysis** below). After reviewing alternatives with City staff, it is recommended that the City not construct a second clearwell at the new WTP, but instead construct a new Granite Zone Reservoir elsewhere in the system.

As discussed in **General System Challenges** above, the site of the new WTP is at an elevation that results in approximately half of the City's demands located higher than the new WTP, and half located below the new WTP (**Figure 5-3**).

Supply to the zones above the WTP require water to be boosted to these customers with a new "WTP to Crowson" Booster Pump Station. This pump station is planned to be constructed with the new WTP. Assuming an elevation of the new pump station of 2255 ft (as provided in the Report), the pump station static head should be approximately 170 ft to meet Crowson Reservoir overflow elevation (2425 ft). A total head of 200 feet was assumed for hydraulic modeling. The capacity of the new pump station depends on continued reliance of the PRVs from the Crowson Zones to the Granite Zones.

Based on discussions with City staff and the output of the City's hydraulic model, the City's current water system operates to supplement the Granite Zone 1 demands through several PRVs coming from the Crowson Zone. As seen in **Figure 5-3**, these are PRVs 8, 9, 14, 15, 16, 18, and 20. During PHD, the supply through these PRVs can be as much as 1,400 gpm according to the hydraulic model. This indicates that the Granite Zone is relying on the Crowson Reservoir to provide PHD, which should ideally come from the Granite Reservoir where peak hour demands for the zone are stored. To minimize the size and ongoing pumping costs of the WTP to Crowson pump station, the City could implement changes to reduce the water that drains from the Crowson Zones to zones that can be supplied by gravity from the new WTP.

To reduce water draining through the Crowson to Granite PRVs, the Granite Zone 1 piping requires better transmission capacity in order to maintain the hydraulic grade across the zone and thereby use the PRVs less often. The City's hydraulic model was used to simulate pipe size changes to achieve this result.

Granite Street Pipe and Valving

The first pipe identified for improvement is the main transmission supply pipe in Granite Street that supplies water from the Granite Reservoir to the Granite Zone customers. The existing Granite Street pipe is a combination of old 12-inch, 14-inch, and newer 16-inch steel pipe. The model predicts a significant drop in the hydraulic grade in this pipe during PHD. By increasing the size of this pipe, the hydraulic grade in the zone is maintained much closer to the 2170 ft gradient provided by Granite Reservoir (when full).

The following options are recommended dependent on how the Granite Reservoir is addressed:

- As long as the Granite Reservoir remains in its current location, or if the City abandons the Granite Reservoir and constructs two clearwells at the new WTP to serve the Granite Zone:
  - The Granite Street pipe is recommended to be a 24-inch diameter pipe from Granite Reservoir to Strawberry Lane to provide PHD to the Granite Zones.
  - The existing 16-inch (Granite Zone 1) and 24-inch (Crowson Zone 1) pipes in Granite Street should be reconnected in Strawberry Lane and Nutley Street to allow the 24-inch pipe to supply the Granite Zone.
- If the Granite Reservoir is abandoned and a new Granite Reservoir is constructed elsewhere in Granite Zone 1:
  - The Granite Street pipe is recommended to be a 16-inch diameter pipe from the current Granite Reservoir site to Nutley Street to provide MDD to the Granite Zones.
  - A new flow control valve would be required along the pipe to provide maximum day demands to the Granite Zones.

DRAFT

- Piping from the new WTP to the current Granite Reservoir location is recommended to be replaced with a 16-inch diameter pipe and located in Granite Street. This replaces an aging steel pipe, improves reliability of a major transmission line, abandons two aging creek crossings, and improves the hydraulic grade of the zone.

Scenic Drive and Nutley Street Pipe

To reduce reliance on PRVs 8 and 9 on the west side of the Granite Zone, the pipes in Nutley Street (from Granite Street to Scenic Drive) and Scenic Drive (from Nutley Street to Wimer Street) are recommended for increasing in size to a 12-inch pipe. These projects replace aging 4- and 6-inch pipes in these streets and greatly improve transmission of gravity supplied water. This project is included in **Chapter 6**.

Crowson Zones 2 and 6 Rezoning

An additional long-term recommendation for reducing the pumping capacity required of the WTP to Crowson BPS is to rezone low elevation customers on the far northeast end of the City's system in Crowson Zones 2 and 6. Customers south of Ashland Street and between Clay Street and Tolman Creek Road, as well as customers in the vicinity of the Ashland Municipal Airport could all be served by Granite Zone 1 with more than adequate pressure. This will require extending the Granite Zone 1 piping to connect these areas; much of which is anticipated to be required as new development occurs along East Main Street. This recommendation is described further in the *Pressure Zone Analysis* discussed below.

New WTP Integration Recommendation Summary

Until the City can fund the above transmission projects, it is recommended that the City plan for the WTP to Crowson Booster Pump Station to have adequate capacity to meet the demands of the Crowson and Alsing Zones and provide adequate supply to the Crowson to Granite Zone PRVs under current demands. This capacity equates to approximately 3,200 gpm (see *Pump Station Analysis* below). (If and when the City is able to reduce all supply through the PRVs, this capacity could be reduced to approximately 1,650 gpm.)

It is also recommended that the City reduce the pressure settings in the Crowson to Granite PRVs once the new WTP is constructed, according to **Table 5-2** below.

A second 0.85-MG clearwell is not recommended at this time, but a new 0.85-MG Granite Zone Reservoir is recommended instead – see *Storage Analysis* below. The Granite Street and Nutley/Scenic Drive pipe improvements are included in the recommended capital improvement plan (CIP), presented in **Chapter 6**. Due to the decision to construct a new Granite Zone Reservoir elsewhere in Granite Zone 1, the Granite Street pipe is recommended to be a 16-inch pipe from the WTP to Strawberry Lane. Future rezoning of Crowson Zones 2 and 6 is also included in the CIP in **Chapter 6**.

DRAFT

Table 5-2
Recommended PRV Settings to Reduce Crowson to Granite PRVs

PRV Station	Current Setting	Revised Setting
8	45/38.5	40/35
9	45/38.5	40/35
14	70	60
15	79	60
16	71	60

Supply Recommendations

The following summarizes the recommended supply improvements:

- Construct new WTP and associated projects:
  - 7.5-MGD WTP (expandable to 10.0 MGD);
  - One (1) 0.85-MG clearwell for storage;
  - Pump station to boost water from the new WTP to the Crowson Reservoir;
  - 16-inch Granite Street Piping from the new WTP to piping that supplies Granite Reservoir (required until Granite Reservoir is abandoned);
  - Emergency Ashland Creek intake;
  - SCADA system upgrades.
- Expand the TAP Supply System to 3.0 MGD:
  - Additional pump at Ashland TAP BPS to achieve firm capacity of 3.0 MGD;
  - Emergency Back-up Generator at Ashland TAP BPS;
  - Expansion of the Talent TAP BPS;
  - Potential expansion of the Regional TAP BPS;
  - TAP System Transmission Capacity Improvements.
- Install transmission piping improvements and rezoning to minimize pumping to Crowson Zone 1:
  - Reduce PRV settings as shown in **Table 5-2**;
  - 16-inch piping in Granite Street from Granite Reservoir to Nutley Street;
  - 12-inch piping in Scenic Drive and Nutley Street;
  - Rezone portions of Crowson Zones 2 and 6 to be supplied by Granite Zone 1.

Storage Facilities

This section evaluates the capacity of the City's existing water storage tanks to meet the existing and future storage requirements of the system.

Storage Criteria

Water storage is typically made up of the following components: operational storage, emergency storage, and fire flow storage. Each storage component serves a different purpose and will vary from system to system. A definition of each storage component and the criteria used to evaluate the capacity of the City's storage tanks is provided below and summarized in **Table 5-3**.

Operational Storage – Volume of the reservoir used to supply the water system under peak demand conditions when the system demand exceeds the total rate of supply of the sources. In the past, the City has calculated operational storage as 25 percent of MDD for the zone it serves. Another criterion is to calculate the volume needed to meet PHD that supplies to the zone are unable to meet. Also called "Equalization Storage."

Emergency Storage – Volume of the reservoir used to supply the water system under emergency conditions when supply facilities are out of service due to equipment failures, power outages, loss of supply, transmission main breaks, and any other situation that disrupts the supply source. Common emergency criteria in the state of Oregon is to assume emergency storage as two times ADD (approximately equivalent to one times MDD). The City's previous criteria assumed 25 percent of MDD for emergency storage. This lower criteria correlates to the City constructing a new reliable WTP.

Fire Flow Storage – Volume of the reservoir used to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement in the zone. The magnitude of the fire flow storage is the product of the fire flow rate and duration of the operating area's highest fire flow needs. These fire flow planning goals were presented in **Chapter 4**.

Nesting of Storage – Some water systems allow for "nesting" of fire flow and emergency storage, meaning that it is assumed that a fire and a supply disruption would not happen at the same time and therefore only the greater of the two storage volumes is used in the storage analysis.

DRAFT

Table 5-3
Storage Criteria

Parameter	Criterion
Operational Storage	0.25 times MDD of the area served by each reservoir
Fire Flow Storage	Provide volume for single most severe required fire flow and duration for each reservoir service area. Systemwide, provide volume for two largest fires.
Emergency Storage	0.5 times MDD of the area served by each reservoir *Or* ES = (MDD – Firm Supply Capacity) (1 day)

Storage Analysis

The total combined storage capacity of the City's reservoirs is 6.7 million gallons. The City's original criteria for storage requirements for operational, emergency, and fire flow are compared to the existing storage to determine storage adequacy for the planning periods, as summarized in **Table 5-4.** The table includes the storage surplus/deficiency. As seen at the end of the table, under the City's original criteria, the City would have an existing storage deficit of 0.37 MG and a 2040 deficit of 1.34 MG given all current storage facilities.

Table 5-4
Existing Storage Evaluation

CROWSON RESERVOIR	2020	2030	2040
Maximum Day Demand (no conservation) (MGD)	2.29	2.59	2.81
Required Storage (MG)			
Operational	0.57	0.65	0.70
Fire Flow	0.96	0.96	0.96
Emergency	1.15	1.30	1.40
Total Crowson Required Storage	**2.68**	**2.90**	**3.06**
Total Crowson Existing Storage (MG)	2.10	2.10	2.10
Crowson Storage **Excess**/(Deficit) (MG)	(0.58)	(0.80)	(0.96)
GRANITE RESERVOIR	**2020**	**2030**	**2040**
Maximum Day Demand (no conservation) (MGD)	2.89	3.32	3.63
Required Storage (MG			
Operational	0.72	0.83	0.91
Fire Flow	0.96	0.96	0.96
Emergency	1.45	1.66	1.81
Total Granite Required Storage	**3.13**	**3.45**	**3.68**
Total Granite Existing Storage (MG)	2.00	2.00	2.00
Granite Storage **Excess**/(Deficit) (MG)	(1.13)	(1.45)	(1.68)
ALSING RESERVOIR	**2020**	**2030**	**2040**
Maximum Day Demand (no conservation) (MGD)	0.12	0.14	0.15
Required Storage (MG			
Operational	0.03	0.03	0.04
Fire Flow	0.96	0.96	0.96
Emergency	0.06	0.07	0.07
Total Alsing Required Storage	**1.05**	**1.06**	**1.07**
Total Alsing Existing Storage (MG)	2.10	2.10	2.10
Alsing Storage **Excess**/(Deficit) (MG)	**1.05**	**1.04**	**1.03**

DRAFT

FALLON RESERVOIR	2020	2030	2040
Maximum Day Demand (no conservation) (MGD)	0.04	0.05	0.06
Required Storage (MG)			
Operational	0.01	0.01	0.01
Fire Flow	0.18	0.18	0.18
Emergency	0.02	0.03	0.03
Total Fallon Required Storage	0.21	0.22	0.22
Total Fallon Existing Storage (MG)	0.50	0.50	0.50
Fallon Storage **Excess**/(Deficit) (MG)	**0.29**	**0.28**	**0.28**
TOTAL SYSTEM	**2020**	**2030**	**2040**
STORAGE OPERATING AREA	Storage **Excess**/(**Deficit**) (MG)		
CROWSON	(0.58)	(0.80)	(0.96)
GRANITE	(1.13)	(1.45)	(1.68)
ALSING	1.05	1.04	1.68
FALLON	0.29	0.28	0.28
TOTAL SYSTEM	(0.37)	(0.93)	(1.34)

Storage Requirements

It is recommended that the City revise its storage criteria to account for the planned and implemented system changes in the last few years. With a new emergency TAP supply connection and an upcoming robust WTP, it is recommended that the City's criteria be adjusted to reduce emergency storage. Using the second option for emergency storage noted in **Table 5-3,** where emergency storage volume is discounted by the capacity of redundant supply, the City would be revising its storage criteria to plan for an emergency in which the new WTP is offline and the TAP supply is online. This particular emergency is consistent with the City's supply analysis goals evaluated in this chapter.

Additionally, several studies have identified options to expand the Alsing Reservoir service area thereby shifting the storage burden from the Crowson Reservoir to the Alsing Reservoir which has excess capacity and needs additional demands to improve water quality. This system change was reviewed again as part of this WMP and is further described in *Alsing Reservoir Service Area Expansion* below.

Lastly, the City is actively promoting water conservation and the estimated reduction in overall demands should be considered.

Table 5-5 presents the revised storage analysis using the adjusted criteria, the expanded Alsing Reservoir service area, and reduced demands reflecting the City's conservation goals shown in **Chapter 4**.

DRAFT

Table 5-5
Storage Evaluation – Criteria Adjustment, Alsing Expansion, Conservation Goals

STORAGE OPERATING AREA	Storage **Excess**/(Deficit) (MG)		
	2020	**2030**	**2040**
CROWSON	0.37	0.42	0.38
GRANITE	0.54	0.67	0.57
ALSING	0.43	0.51	0.48
FALLON	0.29	0.29	0.29
TOTAL SYSTEM	**1.63**	**1.89**	**1.72**

Granite Reservoir Replacement

Granite Reservoir is in major need of replacement or removal. A recent estimate for improvements was $560,000, but even this investment would not improve the reservoir to current day seismic standards. In discussions with City staff, it is recommended that the Granite Reservoir be eventually abandoned, and a new Granite Zone Reservoir constructed elsewhere in the system. This recommendation is largely due to the importance of the reservoir to the operation of the TAP supply system into Granite Zone 1.

The recommended location of a new Granite Zone Reservoir is in the northwest of the City above Schofield Street and Lakota Way and in the vicinity of Ashland Mine Road. It is recommended that the City pursue purchasing property in this area. This location is ideal for the TAP supply discharge and could take advantage of new piping required for serving new development in this area. An 0.85-MG Reservoir with an overflow of 2170 ft was assumed in all future hydraulic modeling. The reservoir and recommended pipe connections are included in the CIP in **Chapter 6**.

As discussed earlier, the design for the new WTP includes one 0.85-MG clearwell initially that will serve as system storage and the second 0.85-MG clearwell is no longer recommended. **Table 5-6** presents the final storage evaluation considering replacement of the Granite Reservoir and addition of the 0.85-MG clearwell at the new WTP.

Table 5-6
Storage Evaluation – Removal of Granite Reservoir

STORAGE OPERATING AREA	Storage **Excess**/(Deficit) (MG)		
	2020	**2030**	**2040**
CROWSON	0.37	0.42	0.38
GRANITE	0.14	0.27	0.17
ALSING	0.43	0.51	0.48
FALLON	0.29	0.29	0.29
TOTAL SYSTEM	**1.23**	**1.49**	**1.32**

DRAFT

Alsing Reservoir Service Area Expansion

The City has evaluated options for expanding the Alsing Reservoir Service Area over many years. These recommendations were re-evaluated herein. To improve water quality in the Alsing Reservoir, it is recommended that the service area be expanded to serve customers south of Siskiyou Boulevard and all of Crowson Zones 2 and 6. **Figure 5-4** shows the recommended Alsing Reservoir Service Area Expansion with required infrastructure and recommended valve closures. Specific locations of valve reconnections should be confirmed with City staff. As seen in the **Figure 5-4**, the recommendation includes one new PRV station, pipe improvements, and several valve operational changes. These recommendations are described as follows:

- **Tolman Creek Road/Siskiyou Boulevard PRV** – This PRV station serves to maintain pressures in the Alsing Zones in the upper Tolman Creek Road area, while allowing the Alsing Reservoir water to drain to portions of Crowson Zone 1, which connects to Crowson Zones 2 and 6. In the hydraulic model, the proposed Tolman Creek Road PRV was set to 60 psi, resulting in a hydraulic grade line of 2270 ft (just slightly less than Crowson Zone 6 at 2290 ft).
- **Tolman Creek Road Pipe** – To supply the commercial fire flows (4,000 gpm) in the Crowson Zones 2 and 6, the piping in Tolman Creek Road above the new PRV is recommended for upsizing to a 12-inch pipe.
- **Valve Modifications** – The Alsing expansion recommendation takes advantage of existing parallel pipes in Siskiyou Boulevard while keeping the south pipe for Crowson Zone 1 and the north pipe used for the expanded Crowson Zone 6. To do this, the following valve modifications are recommended:
  - Deactivate PRVs 18, 23, 26, 27;
  - Open valves in Tolman Creek Road and Jacquelyn Street isolating Crowson 1 from Crowson 6 as shown in **Figure 5-4**;
  - Close valves along Siskiyou Blvd to isolate the expanded Crowson Zone 6 from Crowson Zone 1 as shown in **Figure 5-4**;
  - PRVs 17 and 19 are still assumed active PRVs to Crowson Zones 5/6.

By implementing the above changes, the Crowson Zone 6 is adjusted to include all pipes shown as blue lines in **Figure 5-4**. Rezoning the northern section of Crowson Zone 6 and the airport area in Crowson Zone 2 is also recommended (see *Pressure Zone Analysis* below) but is not required as part of the Alsing zone expansion.

Storage Recommendations Summary

The following summarizes the recommended supply improvements:

- Revise storage criteria to account for redundant system supplies.
- Expand the Alsing Reservoir Service Area as recommended.
- Construct one 0.85-MG clearwell at the New WTP to serve the Granite and Crowson Zones.
  - As long as PRVs from Crowson to Granite are set to provide fire protection pressures, fire volume for Granite can be stored in the Crowson Reservoir.

DRAFT

- Abandon Granite Reservoir and plan for construction of a new reservoir in the vicinity of Ashland Mine Road and Lakota Way.
  - Pursue property acquisition in this area.
- Continue water conservation efforts.

Pump Station Capacity Analysis

Pump Station Analysis Criteria

Table 5-7
Pump Station Evaluation Criteria

Parameter	Criterion
Capacity for Service Levels with Storage Facilities	Supply Maximum Day Demand to service zone assuming the single largest capacity pump is offline (i.e., firm capacity)
Capacity for Service Levels with No Storage Facilities	Supply Peak Hour Demand and fire flow assuming the single largest capacity pump is offline (i.e., firm capacity).
Power Supply	New pump stations require a main power source and an emergency source. Secondary power source for new pumps stations to be sized to meet full pump station demands. City will plan and design facilities to optimize energy efficiency.

Pump Station Analysis

Table 5-8 presents the required pumping capacity for each pump station considering the demands in its service area. **Table 5-9** compares the required pumping capacities to the firm capacity of the existing pump stations to identify any deficiencies. The results for each pump station are described below.

New WTP to Crowson BPS

The 2020 required capacity of the new WTP to Crowson BPS is estimated to 3,200 gpm to meet current day demands of the Crowson, Alsing, and Fallon Zones and approximately 1,400 gpm of demand estimated through the Crowson to Granite PRVs. This capacity could increase to as much as 4,219 gpm by 2040 (the model predicts increased supply through the Crowson to Granite PRVs as overall system demands increase). Depending on if and when the City is able to reduce the need for the Crowson to Granite PRVs, and if the City rezones lower portions of Crowson Zones 2 and 6 to be served by the Granite Zone (discussed in *Pressure Zone Analysis* below), the pump station's 2040 capacity could be reduced from 4,219 gpm to 1,624 gpm.

To be conservative and to reflect that the City may be unable to modify the use of the Crowson to Granite PRVs for many years, it is recommended that the New WTP to Crowson BPS be sized for the ability to meet 2030 demands and a reduced Crowson to Granite PRV supply that reflects the adjusted PRV settings noted in **Table 5-2**. This capacity equates to approximately 3,200 gpm (which is similar to the 2020 required capacity with no system changes). It is also recommended that the pump station be designed to have a reduced future capacity of approximately 1,650 gpm to reflect future rezoning and the reduction in use of the PRVs.

Hillview BPS

The Hillview Pump Station is aging (almost 40 years old) and warrants replacement in the next 10 years. As seen in **Table 5-8**, the Hillview Pump Station capacity requirements greatly increase (from 89 gpm to 859 gpm) with the recommended Alsing Reservoir Service Area Expansion. The existing pump station meets the City's criteria through 2040 without expansion of the zone but will be deficient in meeting MDD if the Alsing Reservoir Service Area expands as seen in **Table 5-9**. With the planned expansion (recommended in the next ten years), the pump station capacity should be sized to provide approximately 860 gpm of MDD to the Alsing Reservoir. When the City rezones portions of Crowson Zones 2 and 6 (assumed to be beyond ten years), the pump station required capacity is estimated to be 677 gpm.

South Mountain BPS

The South Mountain BPS is aging and does not currently meet the City's criteria for providing fire flow to its customers in Crowson Zone 4. Part of planning for the Park Estates BPS included extending piping from Crowson Zone 8 to supply Crowson Zone 4, thereby allowing the City to abandon this pump station. The City is currently in the design process of constructing a pipe connecting Morton Street piping to Ivy Lane piping. This pipe is included in the CIP and this pump station is recommended for abandonment in the short-term.

Both the Park Estates and Strawberry BPS meet the City's capacity criteria through 2040, and both have backup generators. No modifications are recommended for these pump stations.

DRAFT

Table 5-8
Booster Pump Station Capacity Requirements

Pump Station	Zone Served	MDD (gpm) 2020	MDD (gpm) 2040	PHD (gpm) 2020	PHD (gpm) 2040	Largest Fire Flow (gpm)	Total 2020 Required Supply (gpm)	Total 2040 Required Supply (gpm)
Pumping Zones with Storage (Criteria = MDD)								
New WTP to Crowson	Crowson Zones 1-8, Alsing Zones	3,172	4,219	N/A	N/A	N/A	3,172	4,219
	Crowson Zones 1-8, Alsing Zones Rezoning of Crowson 2 & 6, PRV Reduction[1]	3,172	1,624	N/A	N/A	N/A	3,172	1,624
Hillview	Alsing Zone 1	89	102	N/A	N/A	N/A	89	102
	Alsing Zone 1, Crowson Zones 2 & 6	859	677[2]	N/A	N/A	N/A	859	677
Strawberry	Fallon Zone 1 &2	32	38	N/A	N/A	N/A	32	38
Pumping Zones without Storage (Criteria = PHD + FF)								
South Mountain	Crowson Zone 4	8	9	20	23	1,500	1,520	1,523
Park Estates	Crowson Zone 7 & 8	16	18	37	43	1,500	1,537	1,543
	Crowson Zones 4, 7, & 8	16	18	37	43	1,500	1,537	1,543

1) Note reduction in required 2040 demands reflect recommended rezoning of lower sections of Crowson Zones 2 & 6, and recommended Granite Zone 1 transmission projects to reduce supply through the Crowson to Granite Zone PRVs.
2) Reflects reduction in demands due to rezoning lower sections of Crowson Zones 2 & 6 to Granite Zone 1.

DRAFT

Table 5-9
Pump Station Capacity Evaluation

Pump Station	Zone Served	Required Supply (gpm)		Firm Capacity		
		Total 2020	Total 2040	Pump Capacity (gpm)	2020 Excess Capacity/ (Deficiency) (gpm)	2040 Excess Capacity/ (Deficiency) (gpm)
Pumping Zones with Storage (Criteria = MDD)						
Hillview	Alsing Zone 1	89	102	350	261	248
Hillview	Alsing Zone 1, Crowson Zones 2 & 6	551	677	350	(201)	(327)
Strawberry	Fallon Zone 1 & 2	32	38	200	168	162
Pumping Zones without Storage (Criteria = PHD + FF)						
South Mountain	Crowson Zone 4	1,520	1,523	145	(1,375)	(1,378)
Park Estates	Crowson Zone 7 & 8	1,537	1,543	2,350	813	807
Park Estates	Crowson Zones 4, 7, & 8	1,537	1,543	2,350	813	807

New Granite to WTP BPS

To address the need for the emergency TAP supply to be boosted to the City's highest pressure zones during a WTP outage, a new pump station is needed to boost water from Granite Zone 1 to the clearwell at new WTP. This pump station is herein called the "Granite to WTP BPS". The new WTP to Crowson BPS could then boost water to the Crowson Reservoir that serves all of the highest pressure zones. An ideal location for the pump station would be in the Granite Street pipe and in parallel with a new flow control valve from the WTP to the Granite Zone.

The Granite to WTP BPS requires a static head of 95 ft (assuming a clearwell overflow elevation of 2,255 ft and a Granite Zone 1 hydraulic grade of 2,160 ft). Capacity of the pump station should meet the projected ADD of the Crowson, Alsing, and Fallon Zones; this is estimated at 1,000 gpm. This project is included in the CIP in **Chapter 6**.

Pump Station Recommendations

- The new WTP to Crowson BPS should have a firm capacity of approximately 3,200 gpm to supply the Crowson and Alsing Zones. The pump station should be designed for a future reduced capacity of approximately 1,650 gpm.
- Replace the Hillview BPS to bring this pump station to current design standards and meet demand requirements of the Alsing Reservoir Service Area expansion.
    - Recommended capacity: 680 to 860 gpm
- Abandon the South Mountain BPS concurrent with pipe installation that connects Crowson Zones 4 and 8.
- Install the Granite to WTP BPS as part of a flow control and pumping structure in Granite Street.

DRAFT

Pressure Zones

Pressure Zone Criteria

The ideal static pressure of water supplied to customers is between 40 and 80 psi. Pressures within a water distribution system are commonly as high as 120 psi, requiring pressure regulators on individual service lines to reduce the pressure to 80 psi or less. It is difficult for the City's water system (and most others) to maintain distribution pressures between 40 and 80 psi, primarily due to the topography of the water service area.

The City has adopted the following service pressure criteria, which are consistent with industry standards:

- Minimum Pressure (during Peak Hour Demand): 30 psi
- Minimum Pressure (during Fire Flow): 20 psi
- Maximum Pressure: 120 psi

Pressure Zone Analysis

Table 5-10 lists each of the City's pressure zones, the highest and lowest elevation served in each zone, and the minimum and maximum distribution system pressures within each zone based on maximum static water conditions (full reservoirs with no demand). While this table presents the results of the pressure evaluations based on the adequacy of the pressure zones under static conditions, the hydraulic analysis section later in this chapter presents the results of the pressure evaluations based on the adequacy of the water mains under dynamic conditions.

As seen in the table, many pressure zones exceed the maximum pressure to customers. This is due to the complex topography and pipe networking within the City.

Table 5-10
Minimum and Maximum Distribution System Static Pressures

	Highest Elevation Served		Lowest Elevation Served	
Pressure Zone	Elevation (ft)	Static Pressure (psi)	Elevation (ft)	Static Pressure (psi)
2170 Granite Zone 1	2024	63	1788	165
2060 Granite Zone 2	1846	58	1724	110
1980 Granite Zone 3	1852	90	1757	131
2420 Crowson Zone 1	2359	26	1967	196
2200 Crowson Zone 2	2138	35	1884	145
2270 Crowson Zone 3	2153	51	1955	136
2640 Crowson Zone 4	2476	71	2341	130
2270 Crowson Zone 5	2058	92	2043	98
2290 Crowson Zone 6	210	82	1911	164

DRAFT

Pressure Zone	Highest Elevation Served: Elevation (ft)	Highest Elevation Served: Static Pressure (psi)	Lowest Elevation Served: Elevation (ft)	Lowest Elevation Served: Static Pressure (psi)
2570 Crowson Zone 7	2371	86	2370	86
2610 Crowson Zone 8	2578	14[1]	2382	98
2586 Fallon Zone 1	2431	67	2248	146
2470 Fallon Zone 2	2396	32	2224	107
2552 Alsing Zone 1	2396	94	2165	168

[1] This customer represents a few homes at the end of a pipe. If the hydraulic grade line of this zone is actually higher than 2610, then this pressure would be higher as well. The new Park Estates BPS can provide adequate pressures to this customer.

Pressure Zone Recommendations

The following actions are recommended for each pressure zone to meet the pressure criteria.

2170 Granite Zone 1

- Perform a rezoning study to lower pressures to low elevation customers in the northwest end of the zone.
- Rezone customers in Normal Avenue, Ray Lane, and Lit Lane between Ashland Street and Siskiyou Blvd to be served by Crowson Zone 6. This can be done by closing valves in Lit Way and Ray Lane north of Ashland Street and opening the closed valve above these customers (see **Figure 5-4**).
- Other transmission projects described earlier to reduce reliance on Crowson to Granite PRVs (Granite Street pipe improvement, Scenic/Nutley Street pipe improvement).

1980 Granite Zone 2

- Reduce PRV settings to lower overall zone pressures as listed in **Table 5-11**. City staff will need to confirm if PRV 31 is able to achieve the significantly lower pressure settings recommended without replacing the valves.

DRAFT

Table 5-11
Recommended PRV Settings for Granite Zone 2

PRV Station	Current Setting	Revised Setting
2	83/76	78/70
3	87/80	82/74
4	74	68
5	67/60	58/50
6	60/55	63/55
28	92/87	83/75
31	135/120	74/66
32	85/82	81/74

2060 Granite Zone 3

- No recommendations.

2420 Crowson Zone 1

- Perform a rezoning study to lower pressures to low elevation customers, particularly if PRVs from Crowson to Granite Zones are no longer used (they currently alleviate high pressures in low elevation areas of Crowson Zone 1).
- For high elevation customers on Emma Street and South Mountain St, reconnect piping to supply customers from the 2420 Crowson Zone 4.
- Rezone customers north of Siskiyou Blvd from Normal Ave to Crowson Road to be Crowson Zone 6. (This is assumed as part of the Alsing Reservoir Service Area expansion).

2200 Crowson Zone 2

- Extend 2170 Granite Zone 1 piping to supply lower elevation customers in this zone around the airport. This recommendation also reduces the required pumping from the WTP to the Crowson Reservoir.
    - New Transmission Pipe in East Main Street**.** Install a new 12-inch transmission supply pipe from Walker Road across I-5 to connect to 2200 Crowson Zone 2.
        - This project could be implemented as part of development of undeveloped lands in the northeast areas of the City.
        - This project will also serve lower elevation customers in 2290 Crowson Zone 6.
    - Rezone 2200 Crowson Zone 2: Identify the correct valve locations to isolate the lower elevation customers in 2200 Crowson Zone 2 and supply them from the 2170 Granite Zone 1.

DRAFT

- Install piping along Greensprings Highway to isolate the airport area from the Oak Knoll neighborhood.
- Allow the Alsing Reservoir to supply emergency supply to the zone by installing/setting PRVs to meet reduced pressures for fire flow only.

2270 Crowson Zone 3

- Reduce PRV settings by 10 psi each to lower overall zone pressures.

2640 Crowson Zone 4

- Extend supply from 2570 Crowson Zone 8 (supplied by the new Park Estates Pump Station) to supply customers in 2640 Crowson Zone 4.
  - Install piping from Morton Street to Ivy Lane.
  - Abandon South Mountain Pump Station.
  - Modify piping to supply high elevation customers in 2640 Crowson Zone 1.

2270 Crowson Zone 5

- Reconnect piping in Siskiyou Blvd and Ray Lane to rezone pipes in Ray Lane and Lit Way to connect to 2290 Crowson Zone 6. This will alleviate low pressures in Ray Lane and Lit Way.

2290 Crowson Zone 6

- Rezone customers north of the railroad tracks between Clay Street and Interstate 5 as shown in **Figure 5-4** to reduce high pressure customers in these areas. The rezoning would rezone these customers from Crowson Zone 6 to Granite Zone 1.
  - Install a PRV station in Clay Street just north of Ashland Street, close to where a previous PRV station existed.
  - Install a PRV station in Tolman Creek Road just north of the railroad tracks.
- Extend 2170 Granite Zone 1 to supply lower elevation customers in these zones. This recommendation also reduces the required pumping from the WTP to the Crowson Reservoir.
  - Install a new 12-inch transmission pipe in East Main Street from Walker Road across I-5 to Crocker Street.
  - Reduce settings on Clay Street and Tolman Creek Road PRVs to only supply fire flow.

2570 Crowson Zone 7

- No recommendations.

2610 Crowson Zone 8

- No recommendations.

DRAFT

Distribution and Transmission System

This section evaluates the City's existing distribution and transmission system (i.e., water mains) to determine if they are adequately sized and looped to provide the necessary flow rates and pressures to meet the existing and future requirements of the system.

Distribution System Analysis Criteria

Distribution and transmission mains must be capable of adequately and reliably conveying water throughout the system at acceptable flow rates and pressures. Hydraulic analyses of the existing system were performed under PHD conditions to evaluate its pressure capabilities and identify system deficiencies. The existing system was also analyzed under MDD conditions with fire flow demands to evaluate the fire flow capabilities. Additional hydraulic analyses were then performed with the same hydraulic model under future PHD and MDD conditions and with the proposed improvements to demonstrate that the identified improvements will eliminate the deficiencies and meet the requirements far into the future. The following is a description of the hydraulic model, the operational conditions, and facility settings used in the analyses.

As discussed in the **Pressure Zone Analysis** section of this chapter, ideal water pressures delivered to customers are in the range of 40 to 80 psi, and the City's criteria is to deliver pressures between 30 and 120 psi.

Hydraulic Model

Description

A computer-based hydraulic model of the existing water system was updated to version 8i of the WaterGEMS® program (developed by Bentley Systems, Inc.) with the City's most recent GIS shapefile, to reflect the best-known information on distribution system geometry and pipe characteristics, including diameter, material, and installation year. This was further refined to include the latest construction projects and changes to the system.

Hydraulic model pipe roughness coefficients were initialized with computed estimates based on the water main material and age information from the City's water main GIS shapefile. Based on the premise that the internal surface of water mains becomes rougher with age, older water mains were assigned higher roughness coefficients than newer water mains.

Demand Data

The hydraulic model of the existing system contains demands based on 2014 individual customer meter water demand data provided by the City. Demand data for each parcel was distributed to the closest representative junction node of the model based on the recorded usage. These demands were increased to represent 2020 demands. The peaking factors shown in **Chapter 4** were used to analyze the system under PHD and MDD conditions.

DRAFT

Facilities

The hydraulic model of the existing system contains all active existing system facilities. The facility settings for the pressure analyses corresponded to a PHD event in the water system. All sources of supply were set to operate at constant rates (i.e. MDD). Reservoir levels were modeled to reflect full utilization of operational storage.

The hydraulic model for the fire flow analyses contained settings that correspond to MDD events. All sources of supply were set to operate at constant MDD rates, and the reservoir levels were modeled to reflect full utilization of operational, emergency, and fire flow storage based on the maximum planning-level fire flow requirement.

Calibration

The model was calibrated as part of this WMP. Calibration is achieved by adjusting the roughness coefficients of the water mains in the model so the resulting pressures and flows from the hydraulic analyses closely match the pressures and flows from actual field tests under similar demand and operating conditions. Initial Darcy-Weisbach roughness coefficients were entered in the model based on computed estimates of the coefficients from available pipe age and material data. For example, older water mains were assigned higher roughness coefficients than new water mains; thereby assuming that the internal surface of water pipe becomes rougher as it gets older.

The model was calibrated using 25 hydrant flow tests performed in the system in the spring of 2016. The model is considered calibrated when model results are within 10 percent of the field results. After identifying a few closed/partially closed valves in the system and adjusting roughness coefficients, the modeled results closely match (within 10 percent) the field results for all 25 tests; therefore, the model is considered adequately calibrated for use in the following system analyses.

Hydraulic Analysis

Pressure and fire flow analysis of the existing system were performed using the model for 2020, 2030, and 2040.

Pressure Analysis

Figure 5-5 presents a map of system pressures color coded by pressure range during PHD. As seen in the map, low pressures exist at several high elevation customers. City staff indicate that some customers at high elevations have their own booster pump stations to achieve water pressure. Additionally, the model predicts many locations of high pressures exceeding 120 psi at low elevation customers. The recommendations described above in **Pressure Zone Analysis** should alleviate several of these high-pressure areas.

Fire Flow Analysis

Fire flow demands were assigned to the water system based on land use and the City's fire criteria presented in **Chapter 4** and are shown in **Figure 5-6**. Maps of fire flow results are shown in **Figure 5-7**. The maps are color coded to show if each junction in the system satisfies, does not satisfy, or is within 10 percent of delivering assigned fire flows (10 percent is within the error of the model).

DRAFT

The map shows many deficiencies in meeting the City's fire flow criteria. This is due to a few factors:

- High elevation customers within a zone are unable to maintain 20 psi during a fire flow elsewhere in the zone. This can be solved by rezoning high elevation customers.
- Many pipes were built before more stringent fire codes were adopted. Fire districts commonly classify buildings in these areas as "existing non-conforming," and since they met previous fire code requirements when they were constructed, improvements to these areas are considered a low priority. Resolving these deficiencies will require implementing larger diameter pipes over time as budget allows.

The modeling predicts several locations where the available fire flow is below 750 gpm, which has been used in the past by other water utilities as a minimum fire flow for residential areas. Pipe improvements to address fire flows that were significantly below the City's new fire flow criteria were prioritized in the recommendations presented in **Chapter 6**.

It is important to note that this Water Master Plan predicts several more deficiencies than the previous WMP because fire flows were assigned at every hydrant in the system, whereas they were previously only assigned in some locations.

Distribution System Recommendations

Recommended pipe improvements to address the pressure and fire flow deficiencies are presented in **Chapter 6** (**Table 6-3**). The general recommendations are as follows:

- Implement recommendations as described in the **Pressure Zone Recommendations** section.
- Upsize local pipes from 4- and 6-inch pipes to 8-inch pipes and larger.
- Increase transmission capacity in the 2170 Granite Zone 1.
    - Replace the upper section of 2170 Granite Zone 1 transmission main (from new WTP to connection to Strawberry Lane).
    - Extend transmission capacity of 2170 Granite Zone 1 in East Main Street to serve low elevation customers and new growth to the east of the system.
    - Other Granite Zone transmission improvements.

Other recommendations include the following:

- Set PRVs from Crowson and Alsing Zones to Granite Zones to only supply fire flow.
- To reduce reliance on PRV 20 (Siskiyou Blvd and Normal Ave), which appears to provide needed supply to the zone during fire flows according to the City's model, extending Granite Zone piping in East Main Street from Siskiyou Blvd to Walker Road is recommended. Additionally, increasing the transmission pipe in Siskiyou Blvd from 8-inch to 12-inch is recommended to improve fire flow to SOU and apartment complexes in the Wightman and Iowa Street areas.

Maintenance Recommendations

- Annual Pipe Replacement
  - Replace aging and undersized pipes throughout system.
- Hydrant Replacement
  - Replace hydrants that do not meet current standards for hydrants.

Telemetry and Supervisory Control System

This section evaluates the City's existing telemetry and supervisory control system to identify deficiencies related to its condition and current operational capability.

Evaluation and Recommendations

The City's SCADA system is headquartered at the WTP. System facilities, including source, storage, and pumping, can be controlled with the telemetry system. At the WTP and on remote computers, City staff can monitor and control supplies, reservoir levels, and pump station flows. The system communicates to all facilities using radio towers. SCADA system hardware and software require regular maintenance and occasional replacement.

There are no significant deficiencies with the existing telemetry/SCADA system; however, some minor changes would improve operations and management. As part of the new WTP updates, the City is reviewing alternatives to the current SCADA software system, which requires several third-party applications to achieve the functionality desired by City staff. As a result, the City may be required to replace the radio towers throughout the system. Further details are discussed in **Chapter 6**.

DRAFT

DRAFT

Legend

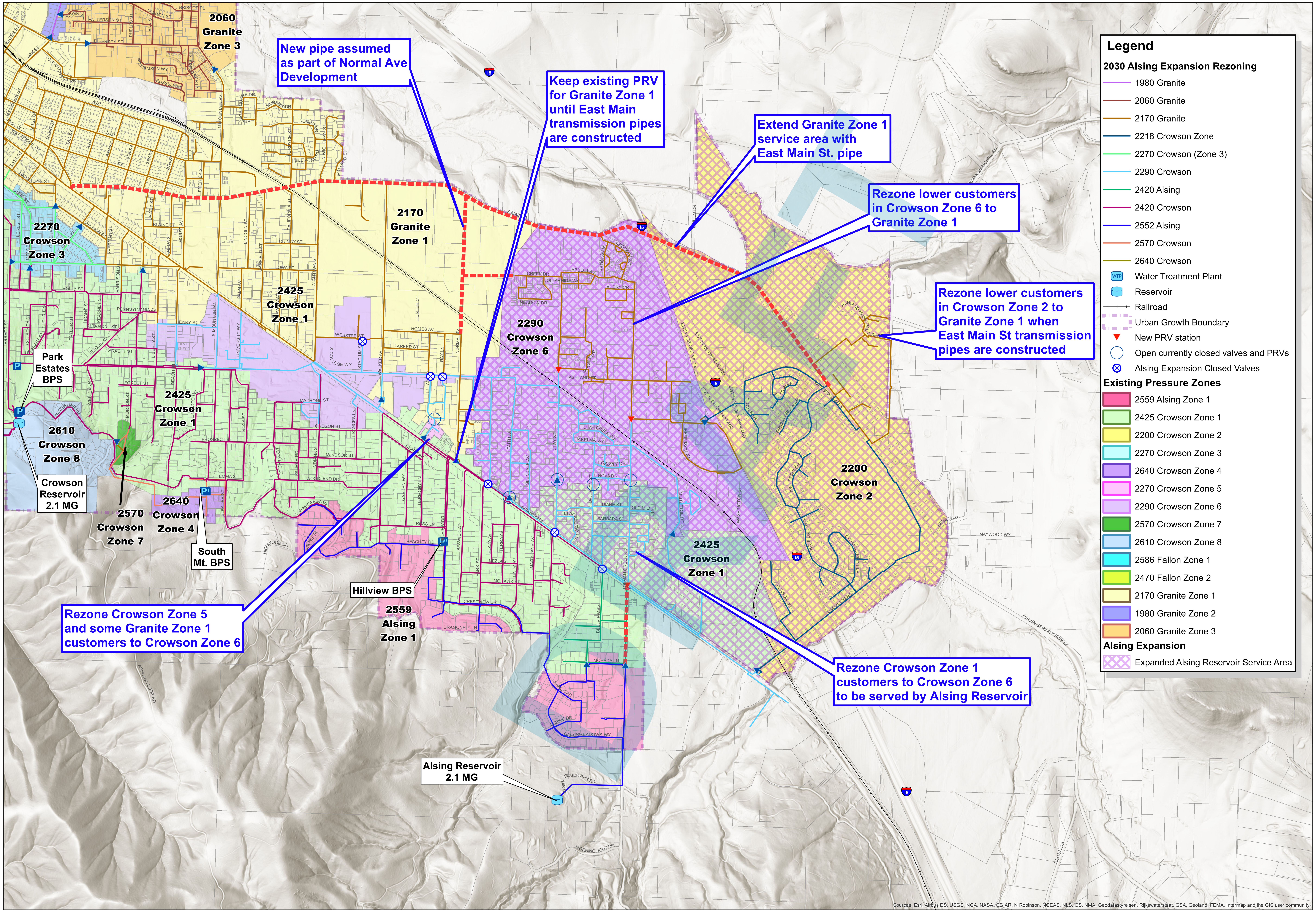
- 2559 Alsing Zone 1
- 2425 Crowson Zone 1
- 2200 Crowson Zone 2
- 2270 Crowson Zone 3
- 2640 Crowson Zone 4
- 2270 Crowson Zone 5
- 2290 Crowson Zone 6
- 2570 Crowson Zone 7
- 2610 Crowson Zone 8
- 2586 Fallon Zone 1
- 2470 Fallon Zone 2
- 2170 Granite Zone 1
- 1980 Granite Zone 2
- 2060 Granite Zone 3
- Booster Pump Station
- Pressure Reducing Station
- Facilities at Same Site

Figure 5-3

Hydraulic Profile with New WTP
City of Ashland
Water Master Plan

Date: June 18, 2019 Filename: COA\1016-096\CAD\COA-HPX.DWG

Figure 5-4 Alsing Zone Expansion and Rezoning Concepts



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

By:hfarris

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 5-4 Alsing Zone Expansion and Rezoning Concepts.mxd

PRELIMINARY

City of Ashland Water Master Plan

CITY OF ASHLAND

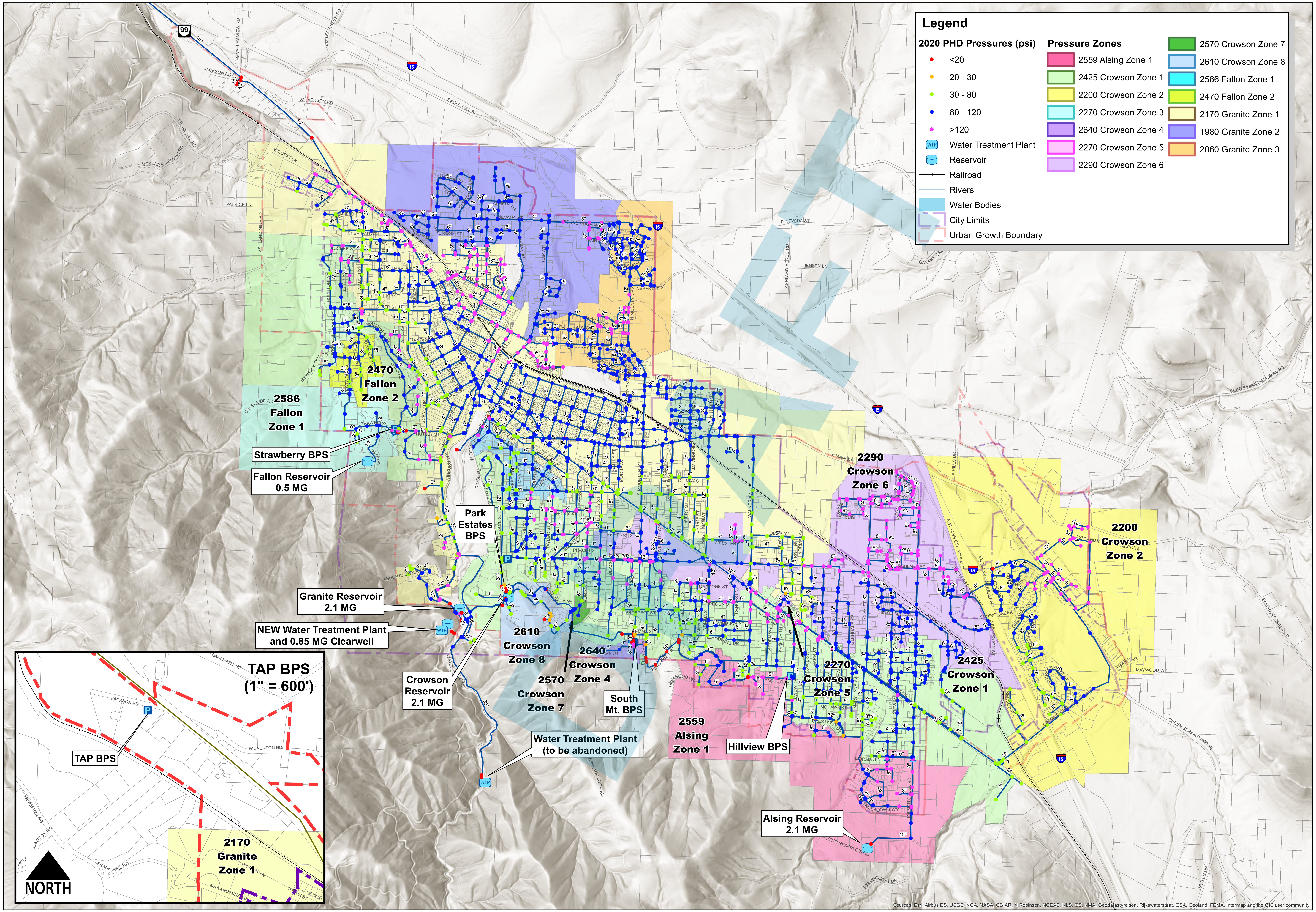
1 inch = 800 feet

0 405 810 1,620 Feet

Plot Date: 6/18/2019

RH2

NORTH



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

By:hfarris

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 5-5 2020 Existing System Pressures.mxd

Figure 5-5
2020 Existing System Pressures

PRELIMINARY

City of Ashland Water Master Plan

CITY OF ASHLAND

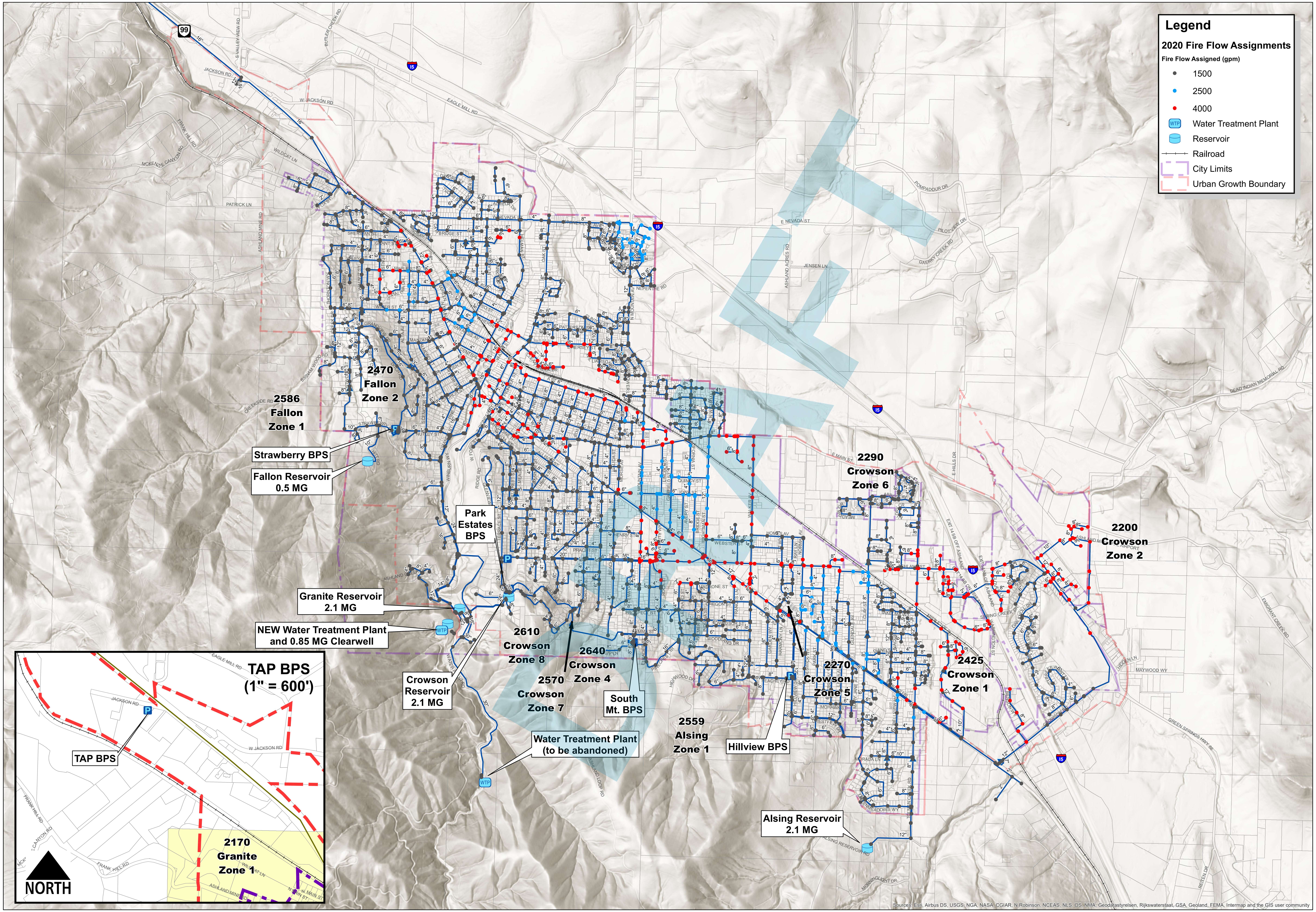
1 inch = 1,200 feet

0 600 1,200 2,400 Feet

Plot Date: 5/22/2019

RH2

NORTH



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

By:hfarris

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 5-6 Fire Flow Requirements.mxd

Figure 5-6
Fire Flow Requirements

PRELIMINARY

City of Ashland
Water Master Plan

CITY OF ASHLAND

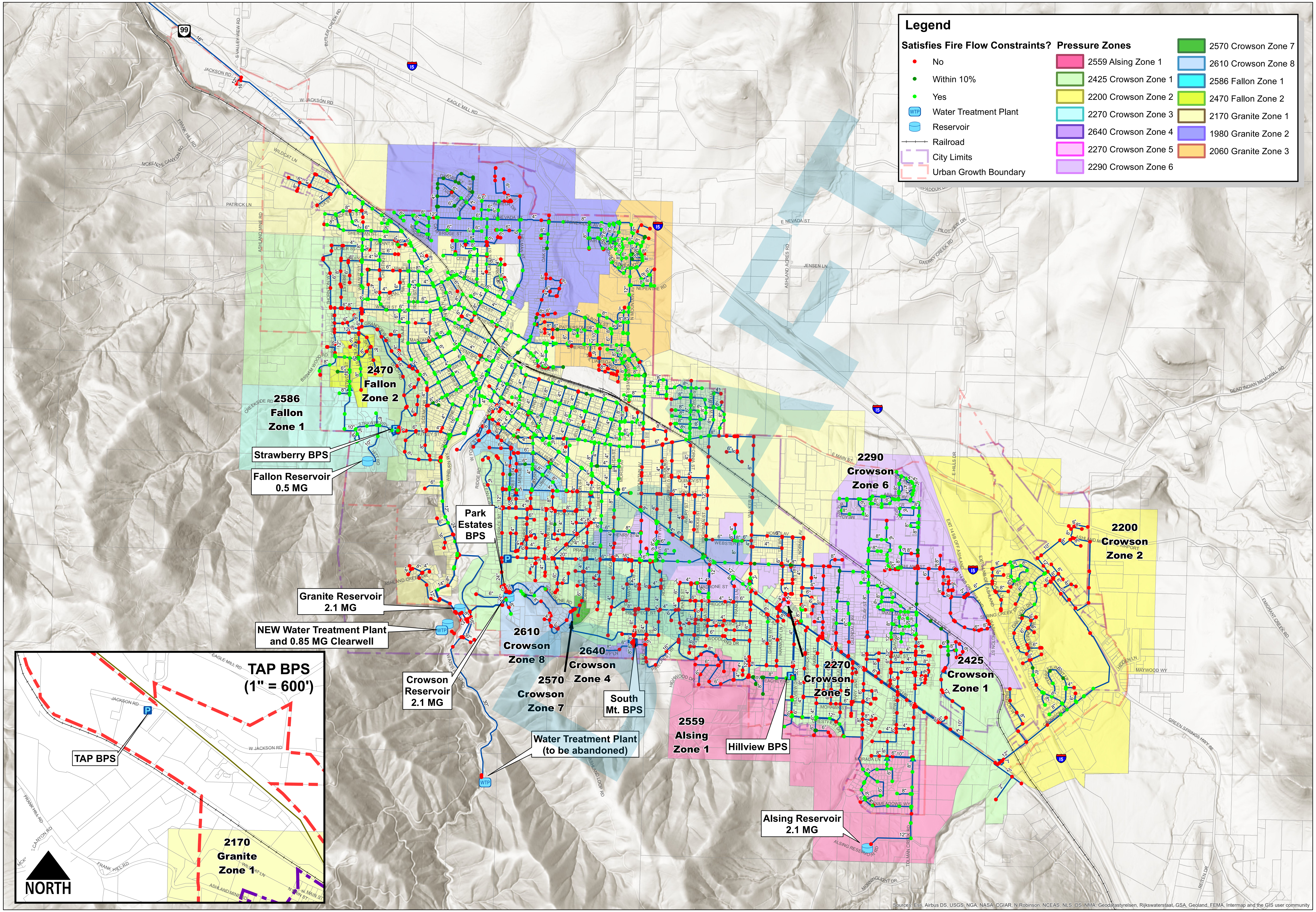
1 inch = 1,200 feet

0 600 1,200 2,400 Feet

Plot Date: 5/22/2019

RH2

NORTH



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Figure 5-7
2020 Existing System Fire Flow Deficiencies

City of Ashland
Water Master Plan

CITY OF ASHLAND

1 inch = 1,200 feet

0 600 1,200 2,400 Feet

Plot Date: 5/21/2019

RH2

NORTH

Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet   By:hfarris   Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 5-7 2020 Existing System Fire Flow Deficiencies.mxd

DRAFT

6 | CAPITAL IMPROVEMENT PLAN

DRAFT

DRAFT

6 | CAPITAL IMPROVEMENT PLAN

INTRODUCTION

This chapter presents the recommended Capital Improvement Plan (CIP) for meeting the City's level of service goals of continuing to provide safe, reliable water to current and future customers. The improvements described below were developed from the system analysis described in **Chapter 5**, as well as interviews with City staff, to address current and future water demand conditions and to sustain system reliability. It is important to note that this plan represents the latest decision-making given current conditions and may likely change in the future as conditions change.

The capital improvement projects are categorized as follows:

- Supply Improvements
- Storage Improvements
- Pump Station Improvements
- Pipe Improvements
- Operational Improvements
- Recommended Studies

A summary of the City CIP is developed and presented in **Table 6-2**. This summary provides total probable costs, a brief description, and prioritizes each capital improvement based on recommended year of implementation. Project priorities should be considered flexible in order to accommodate concurrent construction during other street opening projects, budgetary constraints, specific development projects, and other factors that may affect project implementation.

The following sections include the basis for the cost estimates, a brief description of each improvement, and the recommended prioritization and schedule for implementation.

Cost Estimate

Planning level cost estimates were prepared for the recommended projects following the American Association of Cost Estimators (AACE) Class 5 estimates, which assume 0 to 2 percent of project definition as appropriate for master planning. This level of opinions of cost are assumed to be within the range of plus 50 percent to minus 30 percent of the average of contractors' bids. The estimated costs of the facilities should be expected to change along with the accuracy of the estimate as a project proceeds into preliminary and final design. These opinions of probable cost are based on year 2019 dollars and no allowance has been made for inflation in future years.

Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. The CCI used for this study is 11230, the May 2019 20-Cities Average. For comparison the last Water Master Plan CCI for September 2011 was 9030. Thus, costs are assumed to be approximately 25 percent higher than estimated in the previous Water Master Plan.

DRAFT

Estimated total project costs for each project are comprised of multiple components: directly estimated construction costs, an allowance for contingencies, and an allowance for engineering, legal, and administrative costs. These components are described below.

Construction Costs

Planning-level construction costs were estimated assuming a traditional public works procurement process of design, bidding, award, and construction by a licensed contractor using commonly accepted means and methods. Property easements or land acquisition and maintenance costs are not included.

Error! Reference source not found. presents the unit construction cost assumptions for pipe improvements used in the CIP. These are based on recent, local projects and include mobilization, materials, labor, contractor overhead and profit, and all elements expected to be included in a contractor's bid. Pump station costs were estimated using previous projects and comparing building square footage, total motor power, ultimate capacity, and startup capacity.

Table 6-1
Pipe Installation Unit Costs

Diameter (Inches)	Unit Construction Cost (2017 $ / Linear Foot)
6	$180
8	$225
10	$235
12	$240
16	$250
18	$260
20	$280
24	$300

Contingencies

A contingency of 30 percent was added to estimated construction costs for all projects except small pipe improvement projects that require minimal traffic disruption. The allowance for contingencies covers items such as variations in the project configuration, which are developed during preliminary design and final design, unforeseen site conditions encountered during construction, and reasonable project changes during construction. The contingency allowance does not include major project scope additions or additional costs resulting from permit mitigation requirements (such as wetlands enhancement).

Engineering, Legal, Administration

Total construction costs were increased by 25 percent to achieve the total project cost. This markup accounts for engineering design, construction management, legal, and administrative project costs. Costs shown in the CIP are estimated total project costs.

DRAFT

SDC Allocation & Development Contributions

Projects that are required for meeting increased demands are eligible to be funded from System Development Charges (SDC) and will be used to estimate an updated SDC value for the City's water system in **Chapter 7**. Some projects are recommended for capacity upgrades and maintenance or other non-growth-related reasons. The portion eligible for SDC funding was calculated as the additional cost for increasing capacity. Chapter 4 presents the current and future estimated ERUs for the water system. New ERUs comprise approximately 10 percent of all total 2040 ERUs; thus, an SDC allocation of 10 percent was assigned to several projects where general infill is anticipated. In other projects, the SDC eligibility is greater due to the project specifically benefitting future growth.

A few pipe projects (P-20, P-28 through P-32) were identified to serve future development areas and are assumed to be installed by developers when development occurs. These projects are noted in **Table 6-3**.

Project Prioritization

As described in **Chapter 5**, the City's water system has several challenges to overcome that will take many years and significant funding to resolve. The following prioritization was assigned to the recommended projects:

1. Currently planned projects for the next two years and including the new WTP and its required associated facilities.
2. Projects that resolve significant fire flow deficiencies. (These are defined as fire flows that are approximately 50 percent below the fire flow criteria when in a non-residential area. These projects are labeled as "Fire Flow 1" in the notes in **Table 6-3** and are prioritized for the next twenty years.)
   a. Projects that correct low pressure conditions causing fire flow deficiencies elsewhere in a pressure zone.
3. Projects that reduce supply from the Crowson to Granite zones (thereby reducing pumping to Crowson).
4. Projects that correct high pressure conditions.

Schedule of Improvements

The recommended projects were added to an implementation schedule that can be used by the City for preparing its CIP and annual water budget. The implementation schedule for the proposed improvements is shown in **Table 6-2**. As seen in the table, projects are allocated into Short-Term, Mid-Term, and Long-Term schedules. The Short-Term shows projects allocated annually for the next ten years. The table also shows the calculated SDC eligibility.

Description of Improvements

This section provides a general description of the recommended improvements and an overview of the deficiencies they resolve. Most of the improvements are necessary to resolve existing system

DRAFT

deficiencies. Improvements have also been identified for serving future growth. Recommended infrastructure improvements for Short-Term, Mid-Term and Long-Term planning periods are shown in **Figures 6-1**, **6-2** and **6-3**, respectively.

Supply Improvements

The following improvements are recommended for the City's supply system. The City is already planning on the majority of these projects and City staff provided costs. Costs and timing of supply improvement projects are shown in **Table 6-2**.

S-1: Dam Safety Improvements

The City recently completed its Federal Energy Regulatory Commission (FERC) Part 12 inspection of Hosler Dam and associated appurtenances. The Part 12 inspection and associated Potential Failure Modes Analysis Update (PFMA) details areas of concern with the dam. This project covers the cost of developing a plan and schedule, and further evaluation and potential improvements of the spillway structures and dam piping penetrations. The City has determined that this project is 25 percent SDC eligible.

S-2: Ashland (TID) Canal Piping Project

The City has secured a $1.3M loan from the Department of Environmental Quality Clean Water State Revolving Fund Loan to improve creek health by piping the Ashland Canal. This project includes piping approximately 10,000 feet of canal for both water quality and conservation purposes. The City has determined that this project is 100 percent SDC eligible.

S-3: East and West Forks Transmission Line Rehabilitation

The East and West Forks transmission lines are critical for providing raw water supply to the City while dewatering the Reeder Reservoir for repairs or sediment removal. Several segments of these pipes are in need of repair, including two crossings of the reservoir. The City has determined that this project is 75 percent SDC eligible.

S-4: Reeder Reservoir Intake Repairs

Recent water quality studies identified the need to be able to draw water supply from different depth levels of Reeder Reservoir during different times of the year. This will allow the City to better manage raw water quality for treatment of potable water and temperature control for wastewater effluent. The City has determined that this project is not SDC eligible.

S-5: Reeder Reservoir Sediment Removal

To meet regulatory requirements for sediment in Reeder Reservoir, the City must manage ongoing sediment removal in the upper dams that flow into the reservoir every three to four years. The City has determined that this project is 75 percent SDC eligible.

DRAFT

S-6: 7.5 MGD Water Treatment Plant

The City is already under design of the new WTP that replaces the existing WTP that is in major need of replacement. This significant project will build in critical water supply reliability and resilience. The project includes a new WTP, clearwell, pump station, and associated piping to connect to the water system. The new WTP is planned for construction at a site southwest of the Granite Reservoir on City property. The City has determined that this project is 10 percent SDC eligible.

S-7: WTP Backwash Recovery System

A follow up project to the new WTP is additional mechanical and structural components at the plant to allow the City to reuse filter backwash water, thereby reducing water waste. This project is assumed to be delayed until funding is available. Similar to the new WTP, this project is assumed to be 10 percent SDC eligible.

S-8: TAP System Improvements

It is anticipated that the City will have some responsibility in the investment of improvements to the TAP Supply System from the connection at MWC to the City's TAP BPS. The City, along with the Cities of Phoenix and Talent, are preparing a TAP Water Master Plan in FY20 to review infrastructure capacity and maintenance needs. Costs for the resulting recommendations are unknown at this time. However, a cost of approximately $50,000 is anticipated in the short-term to support pipe relocation required by an ODOT project in Phoenix. This project is assumed to be 10 percent SDC eligible.

S-9: Deferred WTP Improvement Projects

To save upfront costs, the City anticipates deferring other ancillary WTP improvements that can be delayed until funding is available. No costs are associated with these improvements at this time.

Storage Improvements

The following water system storage improvement was identified from the results of the water system analyses in **Chapter 5**.

ST-1: New 0.85-MG Granite Zone Reservoir

As soon as budget allows, it is recommended that the City abandon the existing Granite Reservoir, which is in poor condition and in need of costly repairs and construct a new reservoir in the vicinity of Ashland Mine Road. A new 0.85-MG Granite Zone Reservoir in this location continues to serve as Granite Zone storage and provides terminal storage for the TAP supply into Granite Zone 1 so that the TAP BPS does not have to meet PHD of the Granite Zones. New development is anticipated to occur in the vicinity of the recommended location, thus cost savings could be achieved by combining new pipes for development with connections to the new reservoir. Pipe projects P-20 through P-22 are recommended to support the new Granite Street Reservoir. Additionally, pipe project AP-1 (Fox Street Pipe) is recommended to be a 16-inch (previously planned as an 8-inch pipe). **Figure 6-2** shows the approximate location for this reservoir and the associated piping.

DRAFT

Pump Station Improvements

The following pump station improvements were identified from the results of the water system analyses in **Chapter 5**. The improvements are primarily necessary to resolve existing system deficiencies, but also have been sized to accommodate projected growth. The project costs for pump stations in **Table 6-2** are for the pump stations only and do not include costs of new pipes.

PS-1: TAP BPS Backup Power

Provide backup power to TAP BPS by 2024. This project is assumed to be 10 percent SDC eligible.

PS-2: Hillview BPS Replacement

Replace this aging booster pump station and increase capacity to support the Alsing Reservoir Service Area expansion. The recommended capacity is 860 gpm, with the ability to be reduced to 680 gpm. This project is anticipated to be 8 percent SDC eligible, which reflects the additional growth in the expanded Alsing Reservoir Service Area.

PS-3: Granite to WTP BPS

Provide a new booster pump station to boost water from the Granite Zones to the new clearwell at the WTP. This project allows the emergency TAP supply to boosted to the upper pressure zones (in combination with the WTP to Crowson BPS). A 1,000 gpm pumping capacity with a static head of 95 feet is recommended. The project is recommended to be located in Granite Street in parallel with a flow control valve that supplies the Granite Zone from the WTP. This project is anticipated to be 10 percent SDC eligible.

Pipe Improvements

The following water main improvements were identified from the results of the distribution and transmission system analyses discussed in **Chapter 5**. All recommended improvements are assumed to be Ductile Iron Pipe Class 54 following the City's pipe construction standards. The improvements are sized to meet future demands; thus, many projects include an SDC allocation. The projects were prioritized according to the prioritization discussed above and were allocated in the planning years such that the total pipe project costs are approximately $1M per year. This is consistent with the City's latest budget planning.

It is important to note that the recommended pipe improvements do not resolve every pressure or fire flow deficiency in the water system as predicted by the hydraulic model. The number of pipe projects identified to address significant fire flow issues as well as other critical transmission projects require over $30M over the next 30 years. Thus, it was assumed that additional pipe projects to resolve every deficiency would require budgeting beyond the planning periods presented herein.

AP-1 through AP-25: Annual Pipe Replacement

Proposed CIP projects AP-1 through AP-25 are a group of pipe improvements which address aging, undersized pipes, many of which could be implemented by City staff. Several of these projects increase pipe size to accommodate infill and higher fire flow requirements due to the increased fire flow criteria. The City has adopted an annual pipe replacement budget of $300,000. The recommended projects are summarized in **Table 6-4** at the end of this chapter and into a single line-item on the CIP summary shown in **Table 6-2**. The projects were placed in priority of those that resolve significant fire flow deficiencies. The City may opt to adjust this recommended pipe replacement schedule to accommodate road improvement projects or other priority projects. These projects are assumed to be 10 percent SDC eligible.

P-1 through P-32: Distribution Pipe Projects

Distribution pipe projects P-1 through P-32 are 8- to 12-inch diameter pipe improvements necessary for meeting the City's pressure and fire flow criteria. The first five years include projects that the City recently adopted as part of its FY20/21 biannual CIP. However, some projects have been delayed to allow budget for newly identified projects. These include funding for Project P-3 (Morton Street to Ivy Street connection) and Project P-5 (Siskiyou Blvd pipe upsizing) that should be done concurrently with the street overlay project in FY24. Distribution pipe projects are spread out between short-term, mid-term and long-term planning periods and are listed in **Table 6-3.** These projects are assumed to be 10 percent SDC eligible.

T-1 through T-5: Transmission Pipe Projects

Transmission pipe projects are 12- to 16-inch diameter pipes that supply water into the system. These projects are assumed to be 80 percent SDC eligible as they resolve some fire flow issues but are mostly required to support new growth.

T-1: Walker Ave Pipe Replacement

New 12-inch pipe in Walker Avenue from Siskiyou Boulevard to Ashland Middle School. This project greatly improves the fire flow for Walker Elementary School and the Ashland Middle School and was included in the City's five-year CIP.

T-2: Granite St Pipe Replacement

New 16-inch pipe in Granite Street from the new Water Treatment Plant (WTP) to Strawberry Lane. This project may be done in phases (i.e. Granite Reservoir to Strawberry Lane, then WTP to Granite Reservoir) or could be a single project when the Granite Reservoir is taken offline. This project is identified to be completed in the mid-term; however, completing this project as soon as budget allows is recommended in order to reduce pumping from the WTP to Crowson Zone 1.

T-3 through T-5: E Main St Pipes

A series of pipe projects in E Main Street from Siskiyou Boulevard to the east side of Interstate 5 at Ashland Street / Oak Knoll Drive are recommended. T-3 and T-4 are 16-inch mains. T-3 provides needed transmission capacity within Granite Zone 1 to supply fire flows to SOU and the apartment complexes in the Wightman St and Iowa St vicinity. Project T-3 could also be used as a way to separate high pressure customers north of East Main Street as part of a rezone project. T-4 is recommended to provide a redundant supply to new development in the Normal Avenue area north of East Main Street. T-5 is a 12-inch main to supply areas of Crowson Zones 2 and 6 that are recommended for rezoning to the Granite Zone. This pipe could also be constructed to serve development east of I-5 and south of East Main St.

Operations and Maintenance

The following operations and maintenance improvements are recommended and are shown in **Table 6-2**.

OM-1: Tolman Creek Road PRV Station

This project is recommended for expansion of the Alsing Reservoir Service Area. The timing of the project is recommended to be concurrent with replacement of the Hillview BPS. This project is estimated to be 8 percent SDC eligible, which corresponds to projected growth in the expanded Alsing service area.

OM-2: Hydrant Replacement Program

City staff have identified the need for funding of a hydrant replacement program to bring hydrants throughout the City into improved, more reliable conditions for fighting fires. An annual budget of 10 hydrants per year is recommended for the first ten years (except for the first two years), and 20 per year beyond this. This program is not assumed to be SDC eligible.

OM-3: Telemetry Upgrades

As discussed in Chapter 5, the City's telemetry system will require infrastructure improvements to keep up with improved technologies and to match the system decided on for the new WTP. This project is assumed to be 10 percent SDC eligible.

OM-4: AMI/AMR Evaluation

The water system includes a combination of meter types, including typical manual read meters and some automatic meter read (AMR) meters. To simplify monthly meter reading and meter maintenance, have a consistent meter type is recommended. City staff need a plan for whether to continue to install and repair AMR meters or consider other technologies. Other meter technologies, such as advanced metering infrastructure (AMI) would need to be reviewed and approved with public input as the community is concerned with potential environmental impacts associated with these technologies. A study is recommended for evaluating and recommending a meter type for the City to move forward with meter management. This project is assumed to be 10 percent SDC eligible.

OM-5: Pipe Connection/PRV Adjustments from Rezone Studies

Pipe improvement or PRV projects are anticipated to result from the recommended rezone study (RS-3) for addressing low- and high-pressure areas in the system. Costs are unknown at this time, but a cost of $200,000 is a placeholder until the costs can be further refined. This project is assumed to be 10 percent SDC eligible.

DRAFT

OM-6: Clay Street and Tolman Creek Road PRV Stations

These two PRV stations are recommended for rezoning lower sections of the Crowson Zones 2 and 6 where significantly high pressures exist. This project could happen prior to extending Granite Zone 1 piping in East Main Street to these areas. Once the East Main piping is installed, these customers could be supplied mainly by the Granite Zone, and these PRV stations would be used for fire protection (supply fire from the Alsing Reservoir). This project is estimated to not be SDC eligible.

OM-7: Pressure Relief Valves

Due to high pressures at low elevations within pressure zones, City staff have identified the need for installing pressure relief valves at critical locations. The number of relief valves and their locations are unknown at this time. This project is assumed to not be SDC eligible.

Recommended Studies

RS-1: TAP Water Master Plan and Future Updates

As discussed above, the City, along with the Cities of Phoenix and Talent, is preparing a TAP Water Master Plan in FY20 to review infrastructure capacity, operations and maintenance needs of the TAP Supply System infrastructure. The Plan includes developing a cost-sharing methodology for future maintenance and improvements that will reflect each TAP partner city's original investment in the TAP system and future capacity needs. It is anticipated that an updated Intergovernmental Agreement will also result from the TAP Water Master Plan. Additionally, a revised TAP Water Master Plan is recommended every ten years. This project is assumed to be 10 percent SDC eligible.

RS-2: Risk and Resilience Assessment and Emergency Response

Recently adopted federal regulations under the Water Infrastructure Act require that the City perform a Risk and Resilience Assessment and Emergency Response Plan. This plan is required to identify all potential hazards to the City including natural hazards, human-caused threats, cyber-security threats, financial risks, etc. The plan also requires developing a mitigation plan to address all threats and develop an Emergency Response Plan. The regulations also include a short-time frame for completion of the Plan, and the City's plan will be due in FY21. This project is assumed to be 10 percent SDC eligible.

RS-3: Rezoning Study

A rezoning study is recommended to address the City's many locations experiencing significantly low and high pressures. The study may identify ways to use existing or planned pipe projects to create new sub-zones, identify potential new PRV stations, and evaluate the existing PRV settings in further detail than this WMP. This project is assumed to be 10 percent SDC eligible.

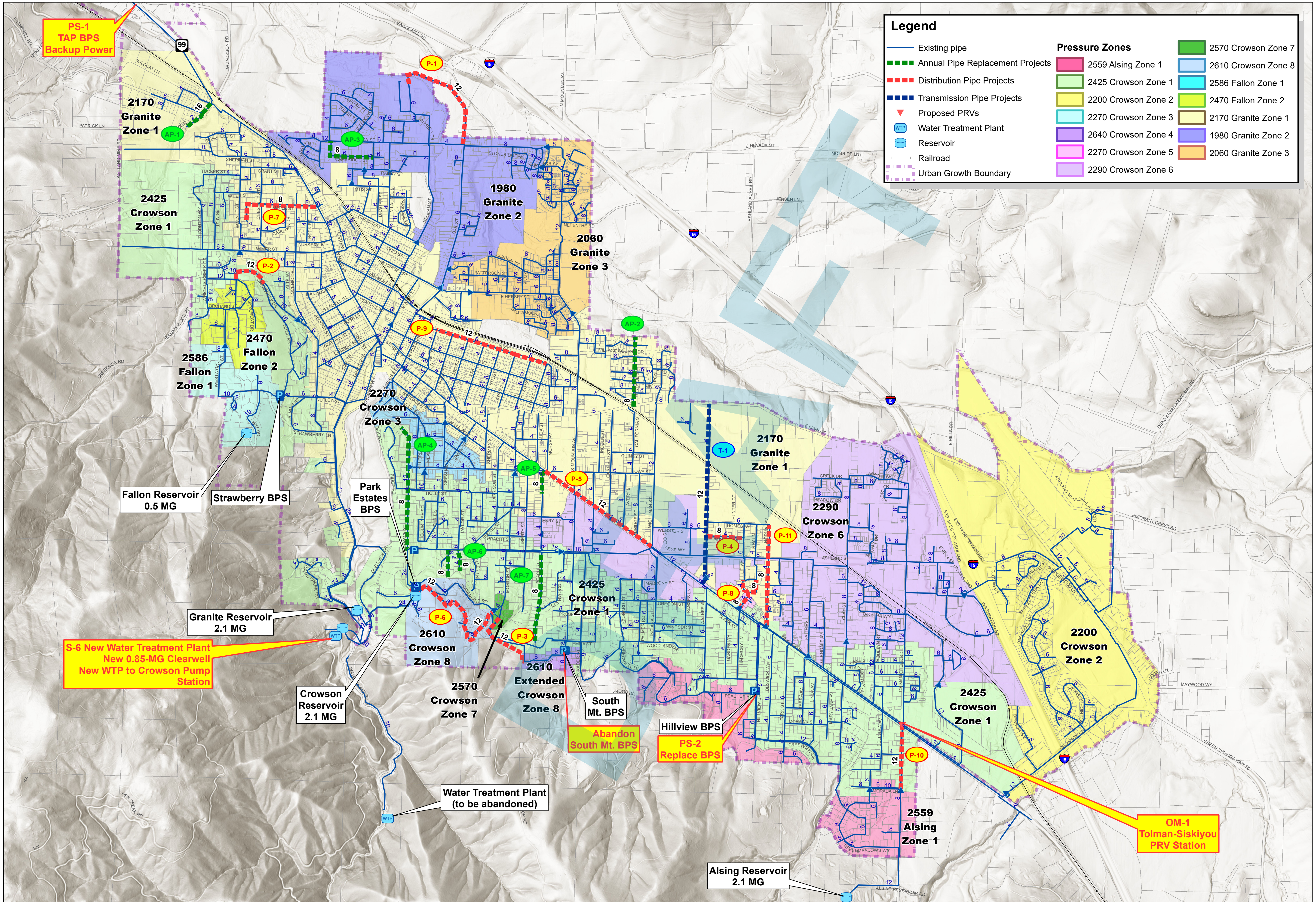
RS-4: Water Master Plan Updates

The Oregon Drinking Water Program (DWP) requires that each water system have a current water master plan. A revised master plan is recommended every ten years to capture changes in demands. However, the City may opt to prepare an abbreviated updated Plan once the new WTP is

DRAFT

completed; thus, a lower cost Plan is recommended in the first ten years of the CIP. This project is assumed to be 10 percent SDC eligible.

DRAFT



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County

Figure 6-1
10-Year Proposed CIP Projects

PRELIMINARY

City of Ashland
Water Master Plan

CITY OF ASHLAND

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Plot Date: 6/18/2019

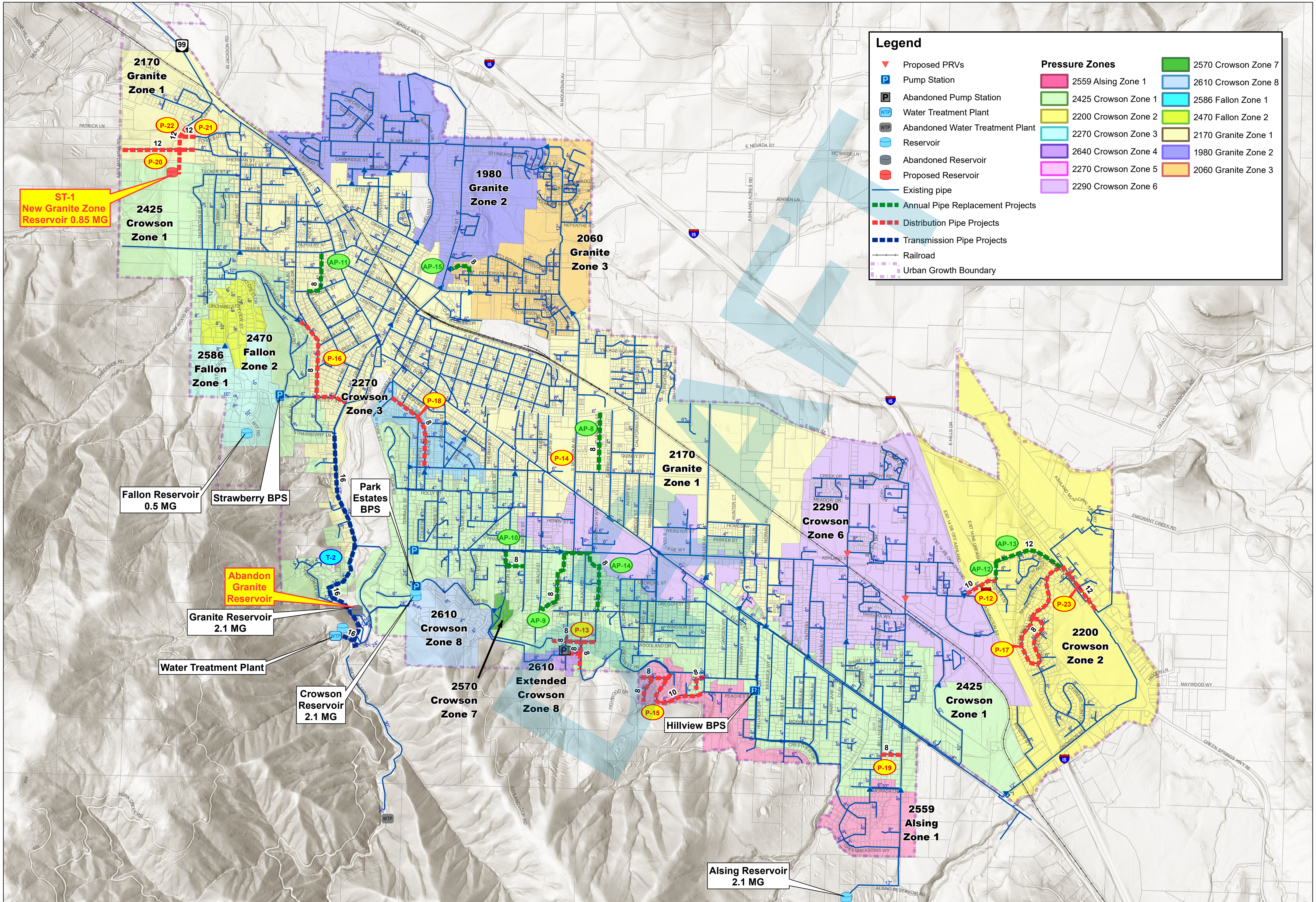
RH2

NORTH

Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

By:hfarris

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 6-1 10-Year Proposed CIP Projects.mxd



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon

Jackson County

Figure 6-2
20-Year Proposed CIP Projects

City of Ashland
Water Master Plan

PRELIMINARY

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 6-2 20-Year Proposed CIP Projects.mxd By:hfarris Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

CITY OF ASHLAND

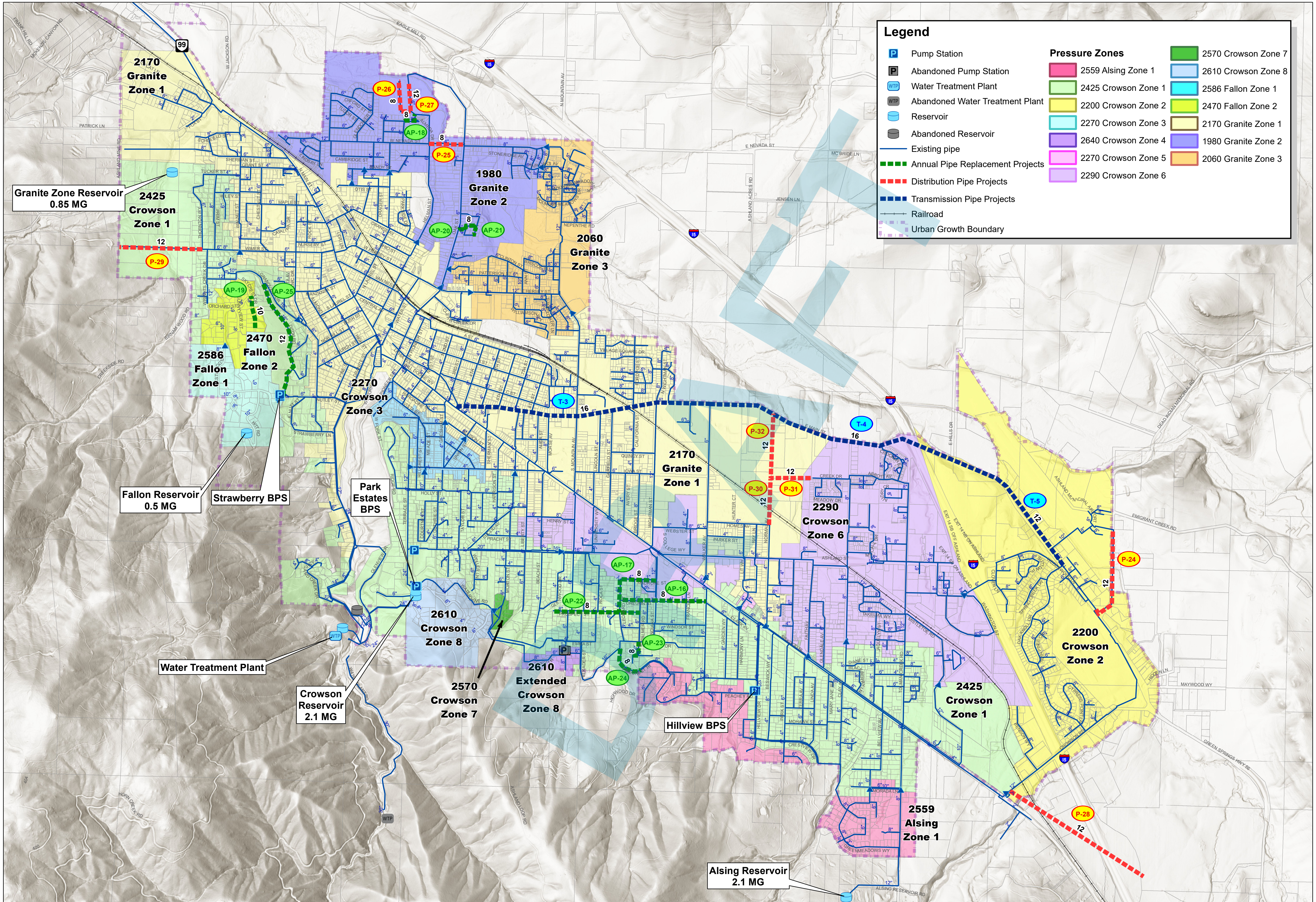
1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Plot Date: 6/18/2019

RH2

NORTH



This map is a graphic representation derived from the City of Ashland Geographic Information System. It was designed and intended for City of Ashland staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

Any reproduction or sale of this map, or portions thereof, is prohibited without express written authorization by the City of Ashland.

This material is owned and copyrighted by the City of Ashland.

Vicinity Map

Oregon
Jackson County

Figure 6-3
30-Year Proposed CIP Projects

PRELIMINARY

City of Ashland Water Master Plan

CITY OF ASHLAND

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Plot Date: 6/18/2019

RH2

NORTH

Z:\Bothell\Data\COA\1016-096 WMP 2016\GIS\Map\Figure 6-3 30-Year Proposed CIP Projects.mxd By:hfarris Coordinate System:NAD 1983 StatePlane Oregon South FIPS 3602 Feet

Table 6-2
Proposed Water System Capital Improvement Plan

CATEGORY	PROJECT NO.	DESCRIPTION	TOTAL PROJECT COST	SCHEDULE FOR WATER SYSTEM IMPROVEMENTS – PLANNING PERIOD (YEARS) – SHORT-TERM – FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	MID-TERM – FY30-40	LONG-TERM – FY41+	SDC ELIGIBILITY (%)	NOTES
Supply	S-1	Dam Safety Improvements	**$ 4,800,000**	$ 300,000	$ 500,000	$ 2,000,000	$ 2,000,000									13%	SDC Eligibility provided in City's approved CIP
	S-2	Ashland (TID) Canal Piping Project	**$ 3,500,000**	$ 500,000	$ 1,500,000	$ 1,500,000										66%	SDC Eligibility provided in City's approved CIP
	S-3	East and West Forks Transmission Line Rehabilitation	**$ 2,123,000**	$ 360,000	$ 1,763,000											0%	SDC Eligibility provided in City's approved CIP
	S-4	Reeder Reservoir Intake Repairs	**$ 131,500**	$ 24,490	$ 107,010											0%	SDC Eligibility provided in City's approved CIP
	S-5	Reeder Reservoir Sediment Removal	**$ 1,120,000**	$ 140,000			$ 140,000			$ 140,000			$ 140,000	$ 560,000	$ 560,000	75%	SDC Eligibility provided in City's approved CIP
	S-6	7.5 MGD Water Treatment Plant	**$ 30,700,000**	$ 3,900,000	$ 13,150,000	$ 13,650,000										10%	Additional ERUs represent 10% of all future ERUs
	S-7	WTP Backwash Recovery System	**$ 2,800,000**											$ 2,800,000		10%	Additional ERUs represent 10% of all future ERUs
	S-8	TAP System Improvements	**$ 50,000**	$ 50,000												10%	$50,000 is an estimated cost for the ODOT Bridge replacement project. Additional projects will be required beyond this project and estimated costs are unknown.
	S-9	Deferred WTP Improvement Projects	**NA**													10%	No cost known at this time.
		Total Supply Projects	**$ 45,224,500**	**$ 5,274,490**	**$ 17,020,010**	**$ 17,150,000**	**$ 2,140,000**	**$ -**	**$ -**	**$ 140,000**	**$ -**	**$ -**	**$ 140,000**	**$ 3,360,000**	**$ 560,000**		
Storage	ST-1	New 0.85-MG Granite Zone Reservoir	**$ 2,800,000**											$ 2,800,000		33%	Timing within 10 years so Granite Reservoir can be taken offline
		Total Storage Projects	**$ 2,800,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,800,000**	**$ -**		
Pump Stations	PS-1	TAP BPS Backup Power	**$ 410,000**				$ 60,000	$ 350,000								10%	
	PS-2	Hillview BPS Replacement	**$ 1,500,000**							$ 375,000	$ 1,125,000					8%	Replaces aging pump station and increases capacity to serve expanded Alsing Reservoir Service Area.
	PS-3	Granite to WTP BPS	**$ 569,000**											$ 569,000		10%	Provides the ability to boost the TAP Supply to the WTP where it can be boosted to serve all other Zones. City has the ability to use an emergency pump to boost between zones until this pump station is constructed.
		Total Pumping Projects	**$ 2,479,000**	**$ -**	**$ -**	**$ -**	**$ 60,000**	**$ 350,000**	**$ -**	**$ 375,000**	**$ 1,125,000**	**$ -**	**$ -**	**$ 569,000**	**$ -**		
Pipes	AP-1 to AP-25	Annual Pipe Replacement	**$ 9,000,000**	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 3,000,000	$ 3,000,000	10%	Annual pipe replacement for aging and/or undersized pipes.
	P-1 to P-32	Distribution Pipe Projects	**$ 15,500,500**	$ 472,000	$ 998,000	$ 194,000	$ 100,000	$ 467,000	$ 507,000	$ 1,418,000	$ 311,000	$ 1,386,000	$ 560,000	$ 7,066,500	$ 2,022,000	10%	Recommended distribution projects to meet the City's pressure and fire flow criteria.
	T1-T5	Transmission Pipe Projects	**$ 8,972,000**	$ -	$ -	$ -	$ -	$ 117,000	$ 467,000	$ -	$ -	$ -	$ -	$ 2,234,000	$ 6,154,000	80%	Recommended transmission projects for improving fire flow and for serving new
		Total Pipe Projects	**$ 33,472,500**	**$ 772,000**	**$ 1,298,000**	**$ 494,000**	**$ 400,000**	**$ 884,000**	**$ 1,274,000**	**$ 1,718,000**	**$ 611,000**	**$ 1,686,000**	**$ 860,000**	**$ 12,300,500**	**$ 11,176,000**		
Operations and Maintenance	OM-1	Tolman Creek Road PRV Station	**$ 75,000**								$ 75,000					8%	Recommended for Alsing Reservoir Service Area Expansion; to be done concurrently with Hillview BPS Replacement
	OM-2	Hydrant Replacement Program	**$ 2,240,000**	$ -	$ -	$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 1,600,000		0%	Assumes 10 hydrants for first 10 years; 20 hydrants per year after that.
	OM-3	Telemetry Upgrades	**$ 80,000**					$ 80,000								10%	
	OM-4	AMI/AMR Evaluation	**$ 60,000**						$ 60,000							10%	
	OM-5	Pipe Connection/PRV Adjustments from Rezone Studies	**$ 200,000**											$ 200,000		0%	
	OM-6	Clay St and Tolman Creek Road PRV Stations	**$ 150,000**											$ 150,000		10%	Recommended to reduce pressures in lower Crowson Zone 6.
	OM-7	Pressure Relief Valves	**TBD**				TBD									10%	Identify appropriate locations and install pressure relief valves to alleviate high pressure neighborhoods.
		Total O&M Projects	**$ 2,805,000**	**$ -**	**$ -**	**$ 80,000**	**$ 80,000**	**$ 160,000**	**$ 140,000**	**$ 80,000**	**$ 155,000**	**$ 80,000**	**$ 80,000**	**$ 1,950,000**	**$ -**		
Recommended Studies	RS-1	TAP Water Master Plan & Future Updates	**$ 100,000**	$ 50,000										$ 50,000	$ 50,000	10%	
	RS-2	Risk and Resilience Assessment and Emergency Response	**$ 150,000**		$ 150,000											10%	
	RS-3	Rezoning Study	**$ 50,000**										$ 50,000			10%	
	RS-4	Water Master Plan Updates	**$ 750,000**							$ 100,000				$ 250,000	$ 250,000	100%	
		Total Recommended Studies	**$ 1,050,000**	**$ 50,000**	**$ 150,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 100,000**	**$ -**	**$ -**	**$ 50,000**	**$ 300,000**	**$ 300,000**		

DRAFT

6/19/2019

Table 6-3
Proposed Water System Distribution and Transmission Pipe Projects

New Project No.	DESCRIPTION	Length (feet)	Diameter (inches)	TOTAL PROJECT COST	DEVELOPMENT COST SHARE ($)	CITY COST SHARE ($)	SCHEDULE FOR WATER SYSTEM IMPROVEMENTS – PLANNING PERIOD (YEARS) – SHORT-TERM FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	MID-TERM FY30-40	LONG-TERM FY41+	NOTES
P-1	Oak St Waterline (WWTP to E Nevada St)	3246	12	$ 400,000		$ 400,000	$ 400,000												Recommended for looping. 12-inch pipe is required to provide fire flow criteria at WWTP. City provided costs.
P-2	Grandview Drive Waterline (Ditch Road to Sunnyview St)	919	12	$ 358,000		$ 358,000	$ 72,000	$ 287,000											Replaces very old pipe. First 1/3 of project has 12-inch pipe in place.
P-3	Morton to Ivy Street New Pipe Connection	1700	12	$ 663,000		$ 663,000		$ 663,000											Fire Flow 1. Allows ability to disconnect South Mountain PS. Not in current City CIP.
P-4	Parker St Pipe Replacement (Walker Ave to Lit Way)	860	8	$ 242,000		$ 242,000		$ 48,000	$ 194,000										
P-5	Siskiyou Blvd (Beach St to Wightman St)	2950	12	$ 498,000		$ 498,000				$ 100,000	$ 398,000								Fire Flow 1; Timing concurrent with street overlay.
P-6	Ashland Loop Rd (Park Estates PS to Morton St) and Morton St (Ashland Loop Rd to Waterline Rd)	2982	12	$ 1,163,000		$ 1,163,000						$ 233,000	$ 930,000						Fire Flow 1; Required to provide 2,000 gpm to customers in these zones.
P-7	Maple St and Maple Way (N Main to end of Maple Way)	2031	8	$ 343,000		$ 343,000					$ 69,000	$ 274,000							Fire Flow 1; Extended City planned project to Maple Way; Concurrent with street overlay.
T-1	Walker Ave Pipe Replacement (Siskiyou Blvd to Ashland Middle School)	3246	12	$ 584,000		$ 584,000					$ 117,000	$ 467,000							Recommended for improving fire flow to Walker and Ashland Middle Schools. Concurrent with street overlay.
P-8	Harmony Lane, Lit Way, Ray Lane Line Upsizing	1735	8	$ 488,000		$ 488,000							$ 488,000						Fire Flow 1. Recommend reconnecting pipes for rezoning as described in Chapter 5. Delaying project to allow funding of P-3.
P-9	A St Pipe Replacement (1st St to 8th St)	2594	12	$ 1,012,000		$ 1,012,000								$ 202,000	$ 809,000				Fire Flow 1; Extended City planned project to 8th St
P-10	Tolman Creek Rd (Morada to Siskiyou Blvd)	1400	12	$ 546,000		$ 546,000								$ 109,000	$ 437,000				Recommended for Expanding Alsing Service Area; to be done concurrently with Tolman Creek Road PRV.
P-11	Normal Ave Pipe Replacement (400 north of Siskiyou Blvd to Homes Ave)	1913	8	$ 699,000		$ 699,000									$ 140,000	$ 560,000			Fire Flow 1. 8-inch pipe is adequate for future extension to serve Normal Avenue Development (assuming East Main Connection as well).
T-2	Granite Street Pipe Replacement (New WTP to Strawberry Ln)	5500	16	$ 2,234,000		$ 2,234,000											$ 2,234,000		Recommended to reduce Crowson supply to Granite Zone. Also improves ability to boost TAP supply to Crowson Zone.
P-12	Interstate 5 Crossing (Ashland St)	720	10	$ 500,000		$ 500,000											$ 500,000		Fire Flow 1. Needed for providing commercial fire flows to hotels and businesses across I-5 in this vicinity. Cost estimated for bridge crossing.
P-13	Rezoning Study, Reconnection of Pipes and Pipe Upsizing in Elkader St, Ivy Lane, Emma St, and South Mountain Avenue.			$ 540,000		$ 540,000											$ 540,000		Fire Flow 1; Resolves high and low pressures.
P-14	AHS Property Pipe Replacement (Fire hydrant in school property)	480	8	$ 176,000		$ 176,000											$ 176,000		Recommended for fire supply within school property.
P-15	Pinecrest Ter Pipe Replacement (Walker Ave to Starlight Pl)	1833	10	$ 700,000		$ 700,000											$ 700,000		Fire Flow 1
	Ponderosa Dr (Pinecrest Ter to west end)	645	8	$ 236,000		$ 236,000											$ 236,000		Fire Flow 1
	Timberline Ter (Ponderosa Dr to south end)	596	8	$ 218,000		$ 218,000											$ 218,000		Fire Flow 1
	Hiawatha Pl Pipe Replacement (Walker Ave to end of Hiawatha Pl)	300	8	$ 110,000		$ 110,000											$ 110,000		Fire Flow 1
P-16	Nutley and Scenic Dr (Granite St to Grandview St)	2351	8	$ 661,000		$ 661,000											$ 661,000		Recommended to reduce Crowson supply to Granite Zone. Also replaces an aging pipe and reduces need for PRV 9 so City can abandon steep pipe behind houses.
P-17	Oak Knoll Dr (Ashland St to Twin Pines Creek Drive and Loop)	4018	8	$ 1,469,000		$ 1,469,000											$ 1,469,000		Fire Flow 1; and replaces AC pipe from the 1960s
P-18	Vista St Pipe Replacement (Fork St to Hillcrest St)	740	8	$ 208,000		$ 208,000											$ 208,000		
	Vista St Pipe Replacement (Intersection of Vista St, Hillcrest St, and Glenview Dr)	22	8	$ 6,000		$ 6,000											$ 6,000		
	Meade St Pipe Replacement (Vista St/Hillcrest St to Iowa St)	1172	8	$ 330,000		$ 330,000											$ 330,000		
P-19	Black Oak Way Pipe Replacement (Tolman Creek Rd to Bellview Ave)	456	6	$ 103,000		$ 103,000											$ 103,000		Recommended for Alsing Zone Expansion
P-20	Lakota Way extension to Ashland Mine Rd; Extend piping to new Granite Reservoir	2672	12	$ 977,000	$ 488,500	$ 488,500											$ 488,500		Joint project for future expansion and to supply future Granite Zone Reservoir
P-21	Schofield St extension to Fox St	356	12	$ 139,000		$ 139,000											$ 139,000		Recommended for supplying future Granite Zone Reservoir
P-22	Fox St extension to Lakota Way	560	12	$ 218,000		$ 218,000											$ 218,000		Recommended for supplying future Granite Zone Reservoir
P-23	Highway 66 Pipe Replacement (Oak Knoll Dr to Dead Indian Memorial Rd)	2472	12	$ 964,000		$ 964,000											$ 964,000		Fire Flow 1; Two parallel pipes to serve two separate zones

DRAFT

Table 6-3
Proposed Water System Distribution and Transmission Pipe Projects

6/19/2019

New Project No.	DESCRIPTION	Length (feet)	Diameter (inches)	TOTAL PROJECT COST	DEVELOPMENT COST SHARE ($)	CITY COST SHARE ($)	SCHEDULE FOR WATER SYSTEM IMPROVEMENTS												NOTES
							PLANNING PERIOD (YEARS)												
							SHORT-TERM										MID-TERM	LONG-TERM	
							FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30-40	FY41+	
T-3	East Main Street (Siskiyou Blvd to Walker)	5768	16	$ 2,343,000		$ 2,343,000												$ 2,343,000	Recommended for rezoning Granite Zone 1 and for tranmission capacity to supply growth to east. Could delay until after 2030.
P-24	Dead Indian Mem Rd (Hwy 66 to Airport) and extended to Airport	2945	12	$ 1,149,000		$ 1,149,000												$ 1,149,000	Fire Flow 1
T-4	East Main Street (Walker Road to East of I-5)	6500	16	$ 2,641,000		$ 2,641,000												$ 2,641,000	Recommended for transmission capacity to supply growth to the east. Also recommended for rezoning lower customers in Crowson Zones 2 & 6.
P-25	E Nevada St (Helman St to Oak St)	770	8	$ 300,000		$ 300,000												$ 300,000	Fire Flow 2; Required to provide 4,000 gpm fire flow to WWTP
P-26	WWTP loop (part 1 of 2)	950	8	$ 347,000		$ 347,000												$ 347,000	Fire Flow 2; Required to provide 4,000 gpm fire flow to WWTP
P-27	WWTP loop (part 2 of 2)	618	12	$ 226,000		$ 226,000												$ 226,000	Fire Flow 2; Required to provide 4,000 gpm fire flow to WWTP
T-5	New Pipe East Main St to Ashland St	3000	12	$ 1,170,000		$ 1,170,000												$ 1,170,000	
P-28	Crowson Rd north of I-5 to serve new Welcome Center	3570	12	$ 1,305,000	$ 1,305,000	$ -												$ -	Private lateral for Welcome Center. 12-inch pipe is required for 2,000 gpm fire flow. Additional City pipe improvements would be required for additional fire flow.
P-29	Wimer St extension to Ashland Mine Rd	1870	12	$ 684,000	$ 684,000	$ -												$ -	Assumed for future expansion
P-30	Normal Ave (Homes St to Creek Dr to serve new development)	1055	12	$ 386,000	$ 386,000	$ -												$ -	Assumed pipe networking for future development in this area. Development driven and funded.
P-31	Creek Dr (west to Normal Ave between taxlots)	912	12	$ 356,000	$ 356,000	$ -												$ -	
P-32	Normal Ave (Creek Dr to E Main St to serve new development)	1460	12	$ 534,000	$ 534,000	$ -												$ -	
	TOTAL DISTRIBUTION PIPE PROJECTS			**$ 19,254,000**	**$ 3,753,500**	**$ 15,500,500**	**$ 472,000**	**$ 998,000**	**$ 194,000**	**$ 100,000**	**$ 467,000**	**$ 507,000**	**$ 1,418,000**	**$ 311,000**	**$ 1,386,000**	**$ 560,000**	**$ 7,066,500**	**$ 2,022,000**	
	TOTAL TRANSMISSION PIPE PROJECTS			**$ 8,972,000**	**$ -**	**$ 8,972,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 117,000**	**$ 467,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,234,000**	**$ 6,154,000**	
	TOTAL PIPE PROJECTS			**$ 37,226,000**	**$ 3,753,500**	**$ 33,472,500**	**$ 772,000**	**$ 1,298,000**	**$ 494,000**	**$ 400,000**	**$ 884,000**	**$ 1,274,000**	**$ 1,718,000**	**$ 611,000**	**$ 1,686,000**	**$ 860,000**	**$ 12,300,500**	**$ 11,176,000**	

DRAFT

Table 6-4
Proposed Water System Annual Pipe Replacement Projects

New Project No.	DESCRIPTION	Length (feet)	Diameter (inches)	TOTAL PROJECT COST	SCHEDULE FOR WATER SYSTEM IMPROVEMENTS			NOTES
					SHORT-TERM FY29	MID-TERM FY30-40	LONG-TERM FY41+	
AP-1	Fox St Pipe Replacement (Ashland Mine Rd to dead end)	472	16	**$ 148,000**	$ 148,000			Fire Flow 1; Increased size of pipe to support future supply connection to future Granite Reservoir in this area.
AP-2	Fordyce Pipe Replacement (E Main to dead end)	1576	8	**$ 443,000**	$ 443,000			Required to avoid continued maintenance costs
AP-3	Cambridge Pipe Replacement (Willow to W Nevada)	1316	8	**$ 370,000**	$ 370,000			Aging pipe.
AP-4	Terrace Pipe Replacement (527 Terrace north to end)	2809	8	**$ 963,000**	$ 963,000			Very old steel pipe requires replacement. Reducing size from 12-inch to 8-inch is adequate.
AP-5	Beach St Pipe Replacement (Larkin Ln to Iowa St)	488	8	**$ 137,000**	$ 137,000			Replaces aging, undersized pipe
AP-6	Taylor St (Ashland St to south end)	477	8	**$ 134,000**	$ 134,000			Fire Flow 1
	Long Way (Ashland St to south end)	611	8	**$ 172,000**	$ 172,000			Fire Flow 1
AP-7	Beach Street (Ashland Street to south end)	2038	8	**$ 573,000**	$ 573,000			Fire Flow 1
AP-8	Lincoln St (E Main St to Iowa St)	1346	8	**$ 379,000**		$ 379,000		Fire Flow 1
AP-9	Glenwood Drive (Ashland Street to Beach Street)	1629	8	**$ 458,000**		$ 458,000		Fire Flow 1
AP-10	Morton St (Ashland St to Forest St) and Forest St (Liberty St to end)	991	8	**$ 279,000**		$ 279,000		Fire Flow 1
AP-11	High St (Wimer Rd to Manzanita St) and Manzanita St (High St to Almond St)	1233	8	**$ 347,000**		$ 347,000		Fire Flow 1
AP-12	Clover Ln Pipe Replacement (Ashland St to hydrant)	500	12	**$ 195,000**		$ 195,000		Fire Flow 1
AP-13	Ashland St Pipe Replacement (Clover Ln to Oak Knoll Dr)	1500	12	**$ 585,000**		$ 585,000		Fire Flow 1
AP-14	Ashland St (Glenwood to Roca) and Roca St (Ashland St to Prospect St)	2041	8	**$ 574,000**		$ 574,000		Fire Flow 1
AP-15	Crispin St Pipe Replacement (Oak St to Patterson St)	650	8	**$ 183,000**		$ 183,000		Fire Flow 2
AP-16	Oregon St (Leonard St to Walker Ave)	1941	8	**$ 546,000**			$ 546,000	Fire Flow 2
AP-17	Leonard St (Madrone St to Woodland Terrace) and Woodland Terrace (Leonard St to Pinecrest Terrace)	1500	8	**$ 422,000**			$ 422,000	Fire Flow 2
AP-18	Almeda Dr New Pipe (west end of street to dog park)	180	8	**$ 51,000**			$ 51,000	Improves fire flow at WWTP; Fire Flow 2
AP-19	Skycrest Dr Pipe Replacement (Orchard St to south end Skycrest Dr)	748	10	**$ 220,000**			$ 220,000	Fire Flow 2

DRAFT

Table 6-4
Proposed Water System Annual Pipe Replacement Projects

New Project No.	DESCRIPTION	Length (feet)	Diameter (inches)	TOTAL PROJECT COST	SCHEDULE FOR WATER SYSTEM IMPROVEMENTS			NOTES
					SHORT-TERM FY29	MID-TERM FY30-40	LONG-TERM FY41+	
AP-20	Oak Lawn Ave Pipe Replacement (Oak St to Sylvia St)	150	8	**$ 42,000**			$ 42,000	Fire Flow 2
AP-21	Sylvia St Pipe Replacement (Oak Lawn Ave to hydrant)	330	8	**$ 93,000**			$ 93,000	Fire Flow 2
AP-22	Prospect St (Palmer Road to west end)	1625	8	**$ 594,000**			$ 594,000	Fire Flow 2; Creek Crossing
AP-23	Penny Dr Pipe Replacement (Woodland Dr to Weissenback Way)	413	8	**$ 116,000**			$ 116,000	Fire Flow 2
AP-24	Pinecrest Ter New Pipe (Penny Dr to Woodland Dr)	880	8	**$ 322,000**			$ 322,000	
AP-25	Ditch Road Waterline (Strawberry Ln to Grandview Dr)	1873	12	**$ 654,000**			$ 654,000	Replaces very old pipe. Reducing size. First 1/3 of project has 12-inch pipe in place.
	TOTAL ANNUAL PIPE REPLACEMENT			**$ 9,000,000**	**$ 2,940,000**	**$ 3,000,000**	**$ 3,060,000**	

DRAFT