Council Study Session

November 20, 2023

Agenda Item	Water Management and Conservation Plan Update	
From	Scott Fleury PE	Public Works Director
Contact	Scott.fleury@ashland.or.us	
Item Type	Requested by Council ☐ Update ☐ Request for Direction ☐ Presentation ☒	

SUMMARY

Before the Council is an update on development of the required Water Management and Conservation Plan (WMCP) document. This is a regulatory document overseen by the Oregon Water Resources Department (OWRD). The critical component of this WMCP is documenting the need for full use of the City's Lost Creek Reservoir municipal water permit.

POLICIES, PLANS & GOALS SUPPORTED

VISION STATEMENTS for Success:

- *Ashland is a resilient, sustainable community that maintains the distinctive quality of place for which it is known*
- *We will continue to be a unique and caring city that stresses environmental conservation, fosters artistic expression, and is open to new ideas and innovation*
- *We will plan and direct our efforts to fulfill this Vision for the long term with a constant view toward being an open, welcoming community for all with a positive economic future*

CEAP Goals:

Natural Systems: Air, water, and ecosystem health, including opportunities to reduce emissions and prepare for climate change through improved resource conservation and ecosystem management.

- Strategy NS-2: Manage and conserve community water resources
- Strategy NS-3: Conserve water use within City operations

Department Goals:

- Maintain existing infrastructure to meet regulatory requirements and minimize life-cycle costs
- Deliver timely life cycle capital improvement projects
- Maintain and improve infrastructure that enhances the economic vitality of the community
- Evaluate all city infrastructure regarding planning management and financial resources

PREVIOUS COUNCIL ACTION

The Council previously awarded GSI Water Solutions a Professional Services Contract to develop the WMCP.
December 6, 2022 Business Meeting Staff Report (WMCP)
December 6, 2022 Business Meeting Minutes

BACKGROUND AND ADDITIONAL INFORMATION

A municipal WMCP provides a description of a water supplier's use, management, and conservation of its water resources. Preparation of a WMCP is intended to represent a pro-active evaluation of the management

and conservation measures that suppliers can undertake. The planning program requires municipal water suppliers to consider water that can be saved through conservation practices as a source of supply to meet growing demands if the saved water is less expensive than developing new or existing supplies. As such, a WMCP represents an integrated resource management approach to securing a community's long-term water supply.

Effective water management requires an evaluation of the adequacy and reliability of water supplies to meet current and future needs, identification of planned modifications in water systems, and development of new or existing water supplies. WMCPs provide information important for long-term water resources planning and management. The plans may also provide support for applications for new water use permits, water right transfers and permit amendments, claims of beneficial use necessary to certificate existing permits, requests for permit extensions of time, and approvals of water exchanges and reservations of water.

A WMCP is broken into sections covering the following topics:

1. Water Supplier Description
2. Water Conservation
3. Water Curtailment
4. Water Supply

The WMCP is a requirement of the Oregon Water Resources Department (OWRD) and is to be updated every ten years followed by submission of five-year progress reports. This WMCP is an update to the City's first WMCP approved by OWRD in 2014. The City's 2014 WMCP is in effect until spring of 2024 and the updated WMCP that is presented to the Council must be approved by OWRD by that time. Staff will submit this WMCP to OWRD by the end of 2023.

Plan Development Process

GSI Water Solutions, Inc. (GSI) was the lead consulting agency for plan development. Plan development included not only meeting the Oregon Administrative Rule (OAR) requirements for a WMCP (OAR 690-086), but also included a climate impact analysis on the City's water supplies as part of the supply and demand analysis. Public Works staff also incorporated a Management Advisory Committee (MAC) to oversee the plan development. Medford Water Commission staff, Julie Smitherman and Cody Scroggins also participated in the plan development as they have a robust knowledge of the City's current conservation program. The MAC and MWC input were invaluable to development of the conservation section and plan overall.

MAC members who participated in plan development were previous members of the Ashland Water Advisory Committee during the 2012 and 2020 Water Master Planning process and are extremely familiar with water issues faced by the City. Staff would like to thank the members of the MAC who provided a robust dialogue and feedback loop over the course of four (4) meetings with the consultants.

MAC Members:

John Williams
Pat Aklin
Joseph Graf
Kate Jackson

Larry Cooper

Council Liaison
Bob Kaplan

WATER MANAGMEENT AND CONSERVATION PLAN OVERVIEW

Water Supplier Description

This section provides a description of the water supplier, water system supplies, demands, populations, water rights, and water users.

Ashland had 9,413 water service connections in 2022, which provided water to a population of approximately 21,642 people. The City's service area includes the area within the City's municipal boundary. The City's primary water source is Ashland Creek and water impounded in Reeder Reservoir sourced from East and West Ashland Creeks. Stored water from Reeder Reservoir and Ashland Creek natural streamflow is gravity fed to the City's water treatment plant (WTP). Following treatment, water is conveyed from the plant to the City's water distribution system.

Water Conservation

This section provides a description of water conservation program elements and compares previous conservation measures in a benchmark breakdown found in the 2014 WMCP.

GSI, staff and the MAC spent a majority of two meetings discussing the current conservation program and additional conservation program measures the City should consider as part of the WMCP update. The elements of the discussion and associated outcomes are referenced in a GSI memorandum to the City titled "City of Ashland Water Conservation Program Expansion and Enhancements" provided in Appendix C of the WMCP.

Water Curtailment

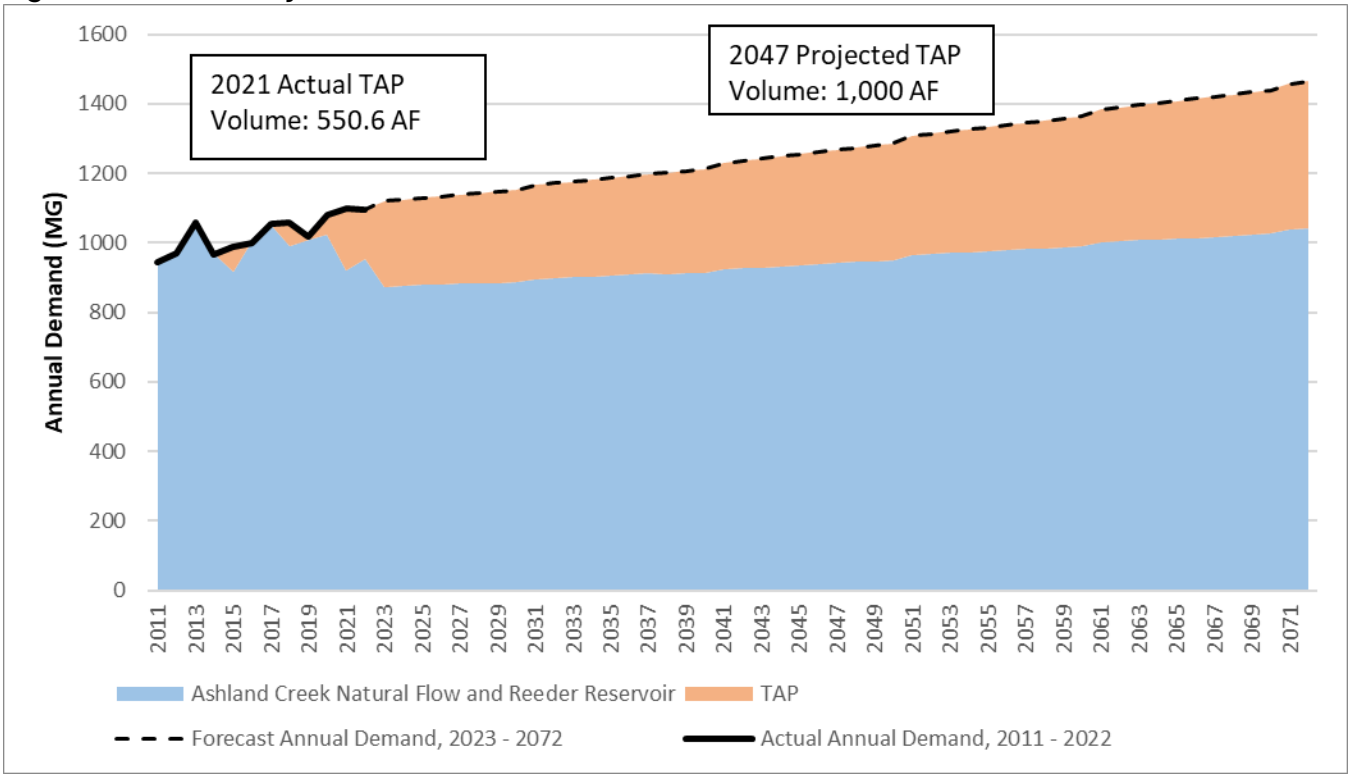
This section provides a description and overview of the City's water curtailment program. Curtailment planning is the development of proactive measures to reduce water demand during periods of temporary shortages of supply. The goal of the WMCP is to define objective criteria and actions to prepare the City for management of water supplies in these types of events. The WMCP addresses the need to maintain essential public health and safety while applying curtailment measures in an equitable manner that minimizes impacts on economic activity and lifestyle to the greatest degree possible. This may include more restrictions on uses deemed less essential.

Water Supply

This section provides forecasted water supply and associated demand in conjunction with population growth and climate change impacts from 2023 to 2073. Two different climate scenarios were modeled for the Ashland Creek watershed as part of the climate analysis and they both show expanded irrigation seasons with more water being used in the shoulder months of April/May and September/October because of increased temperatures.

A critical component of the supply/demand analysis is to show when and how the City intends to use the City's 1,000 acre-feet Lost Creek Reservoir storage right. Currently 546 acre-feet of the 1,000 acre-feet is certificated and the supply/demand analysis shows the City using the remaining water as part of the overall demand projection by 2047, as referenced in Figure 1 below. The City uses the Talent-Ashland-Phoenix pipeline (TAP) to convey this water to the City.

Figure 1: Demand Projection 2023-2073



Climate and Environmental Policy Advisory Committee (CEPAC)

The plan was referred to CEPAC by the MAC and CEPAC commented on the plan and associated climate analysis at the October 11th, 2023 meeting. Both the MAC and CEPAC support the plan, climate analysis and conservation related components. The CEPAC also supports moving forward with the hiring of a climate analyst position to further the conservation program.

The CEPAC provided the following upon review and discussion of the WMCP:

- CEPAC endorsed the plan in general
- CEPAC feels that there should be more detailed and explicit and aggressive conservation measures as part of the plan, but that developing a full conservation plan to encompass these aspects would unduly delay the presentation of the plan to the state of Oregon, and that this delay should not happen. CEPAC recommends that a group of interested and concerned citizens from the CEPAC, and the Water Action Team of the Ashland Climate Collaborative and other interested and concerned citizens, along with the City's climate analyst should study and make specific recommendations about further water conservation measures, and

that these recommendations could be added to the plan in the future as an amendment to the plan after passage of the specific conservation recommendations by Council.

- CEPAC, and the members of the MAC strongly recommend that the City resume funding for a water conservation director position and post the position and perform an appropriate search for a qualified candidate.
- Lastly, the CEPAC endorses the City's tiered pricing for water, with the summer time additional tier, and CEPAC recommends consideration be given to increasing rates in in the highest tiers to encourage conservation among the highest water volume users.

FISCAL IMPACTS

The original contract amount awarded to GSI Water Solutions was $100,700 and to date $90,960 has been spent on project development. The remainder of the contract amount will be spent towards participation in the Council meeting, preparing and submitting the WMCP for affected local government review, and revising and finalizing the WMCP based on comments from OWRD during OWRD's review process, as needed.

DISCUSSION QUESTIONS

Does the Council have any questions about the final draft of the WMCP?

SUGGESTED NEXT STEPS

Next steps include submittal of the WMCP to OWRD for review and approval. This will start a new cycle and the City will be required to submit a five (5) year progress report to OWRD and then perform a formal plan update in ten (10) years (2034).

Following the presentation to Council, staff will send a copy to local jurisdictions for review as required and outlined in Appendix A.

REFERENCES & ATTACHMENTS

Attachment #1: Water Management and Conservation Plan

Draft

Water Management and Conservation Plan

City of Ashland

October 2023

Prepared by:

GSI Water Solutions, Inc.
1600 SW Western Boulevard, Suite 240
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541.753.0745
www.gsiws.com

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Executive Summary

This is an update of the City of Ashland's (City's or Ashland's) 2013 Water Management and Conservation Plan (WMCP) and the City's second WMCP. This WMCP satisfies the final order issued by the Oregon Department of Water Resources (OWRD or Department) approving the City's 2014 WMCP that required the City to submit an updated WMCP to OWRD within 10 years. This WMCP also meets a condition in the final order approving an extension of time for Permit S-54337 issued by OWRD that requires submittal of an updated WMCP to OWRD within 3 years of issuance (August 26, 2025). In addition to meeting these requirements, the purposes of this WMCP is to: (1) guide the development, financing, and implementation of water management and conservation policies, programs, and practices that ensure long-term sustainable water use by the City and its customers and (2) assess the City's water supply and document a plan to meet the City's future water needs.

This WMCP is submitted in compliance with the requirements of the Oregon Administrative Rules (OAR) for WMCPs adopted by the Water Resources Commission in 2018 (OAR Chapter 690, Division 86).

Description of Municipal Water Supplier

Ashland had 9,413 water service connections in 2022, which provided water to a population of approximately 21,642 people. The City's service area includes the area within the City's municipal boundary.

The City's primary water source is Ashland Creek and water impounded in Reeder Reservoir sourced from East and West Ashland Creeks. Stored water from Reeder Reservoir and Ashland Creek natural streamflow is gravity fed to the City's water treatment plant (WTP). Following treatment, water is conveyed from the plant to the City's water distribution system.

Water right Certificate 10843 authorizes storage of up to 800 acre-feet (AF) of water from Ashland Creek in Reeder Reservoir for municipal purposes, and Certificate 10856 authorizes the use of this stored water and Ashland Creek natural streamflows for municipal use at a rate of up to 15 cubic feet per second (cfs). The City holds Certificate 15998, which authorizes the use of up to 12.43 cfs from Ashland Creek, as well as an additional 22 certificated water rights authorizing diversions from Ashland Creek for municipal purposes. The City holds three other water rights for non-municipal purposes.

The City supplements these supplies with water stored in Lost Creek Reservoir located on the mainstem Rogue River. Combined, Certificate 96166 and Permit S-54337 authorize Ashland's use of up to 1,000 acre-feet per year of stored water. Water released from the reservoir is rediverted and treated by Medford Water (MW) for the City under a contract with MW and conveyed to the City via the Cities of Talent-Ashland-Phoenix (TAP) intertie. These sources of supply (Reeder Reservoir/Ashland Creek and Lost Creek Reservoir) have been adequate and reliable to meet the City's system demands.

The City also has a contract with the U.S. Bureau of Reclamation (BOR) to receive water from the Howard Prairie Reservoir owned and operated by the BOR. This water is conveyed via a canal system to Ashland by the Talent Irrigation District (TID). This source of supply can be unavailable in low-water years; as a result, the City does not consider this a reliable source of supply for planning purposes in this WMCP.

Water system demand has decreased from 2005 to 2022 despite population growth in the service area. This trend is observed in the calculated per capita daily demand, which was 160 gallons per person per day (gpcd) in 2005 and 139 gpcd by 2022.

Water system demand is composed primarily of water used (metered consumption) by the City's customers. Of the City's seven customer categories, the single-family customer category accounted for 78.7 percent of all accounts and consumed approximately 49 percent of all water consumed by the City's customers in 2022. The commercial, multifamily, and irrigation customer classes made up the bulk of the remainder of consumption at 43.1 percent in that year.

Water loss is also another component of demand, and the City has consistently observed water losses below 10 percent since at least 2003, except for in 2022. In 2022, the City learned of a major leak that was subsequently located and repaired in 2023.

Water Conservation

The City has an extensive and robust water conservation program designed to provide ways for all its customers to use water more efficiently both indoors and outdoors. For example, the City employs financial incentives; offers on-site services, such as in-home water audits; and maintains an education outreach program, among other program measures that encourage water efficiency. The results of the City's efforts are borne out in ongoing decreases in per capita water use and reductions in peak day demands over time.

Over the next 5 years and beyond, the City intends to expand and enhance its conservation program measures through implementation of conservation benchmarks, as described in Exhibit ES-1. To ensure the City's conservation program continues to meet the needs of its customers, the City convened a Management Advisory Committee (MAC) composed of Ashland water customers and a representative from the Ashland City Council. The MAC identified and prioritized 30 conservation measures and reviewed nine reuse projects, some of which are benchmarks identified in this WMCP. The City is also in discussions with other water providers in the area to coordinate regional water conservation programming and messaging.

Exhibit ES-1. Water Conservation Benchmarks

Conservation Topic	Benchmark(s)
Annual Water Audit	• Continue to conduct annual water audits. • Within the next 5 years, resume facilities water audits as resources allow and, upon completion, seek to modify practices to reduce water use based on the audit results.
System-wide Metering	• Continue to require existing water system connections remain metered and new customer water connections are metered.
Meter Testing and Maintenance	• Establish a 5-year testing program for master meters by 2025 and begin testing these meters in 2026. Master meters will be recalibrated, repaired, or replaced as needed. • Continue to repair or replace service meters upon failure.
Water Rate Structure	• Continue to bill customers based, in part, on the volume of water consumed and on a monthly basis.
Water Loss Analysis	• If losses continue to exceed 10% in 2024, the City will perform a water loss analysis and inform OWRD of the results within 2 years of issuance of a final order approving this WMCP.
Public Education	• Maintain the existing level of public education programming as described, with modifications to the program over time to accommodate shifts in priorities and available resources. • Re-instate or expand the City's public education program over the next 5 years as described.
Technical and Financial Assistance Programs	• Maintain existing technical and financial assistance measures as described. • Within 2 years, begin performing irrigation system evaluations at City parks. • Within 2 years, establish and implement a program to provide financial incentives for irrigation contractors to install water-wise landscapes.
Supplier-Financed Retrofit or Replacement of Fixtures	• Maintain supplier-financed retrofit and replacement measures. • Within 2 years, develop and implement a grant program eligible to low-income residents focused on the installation of water efficient fixtures.
Rate Structure and Billing Practices	• Continue billing customers monthly for the amount of water used, at least in part. • Over the next 2 years, consider revising the commodity charges to make them more progressive.
Water Reuse, Recycling, and Non-potable Opportunities	• Continue promoting graywater and rain catchment systems. • Within the next 5 years, using the list of large-scale reclaimed water use projects (Exhibit 2 of Appendix C); consider further study of one or more of the most feasible projects.

Water Curtailment

Ashland has developed a curtailment plan that describes its response to specific water-shortage events. The curtailment plan presented in this WMCP has five distinct stages that increase in order of severity. Each stage is triggered by one or more initiating conditions. The curtailment stages and initiating conditions are summarized in Exhibit ES-2. Initiating conditions and curtailment measures are described in detail in Section 4 of this WMCP.

Exhibit ES-2. Curtailment Plan Stages and Triggers

Curtailment Stages (Curtailment Response)	Initiating Conditions
Stage 1 (Internal Planning)	A series of indicators suggest that a future shortage is possible; these may include drought-related conditions or foreseeable operational factors that prevent the City from meeting demand in whole or part.
Stage 2 (Voluntary)	Continued and/or further indicators raise concerns about the ability to meet supply needs unless demand levels are reduced, or Sustained demand reaches or is anticipated to reach 90% of supply or delivery capacity.
Stage 3 (Mandatory)	Indicators show that supply and/or delivery capacities are strained to meet current demand levels; these may include: Sustained demand reaches or is anticipated to reach 95% of supply or delivery capacities, or Water storage facilities are not routinely refilling, and City Manager determines that continuation could result in inability to meet fire protection or other essential needs.
Stage 4 (Mandatory)	Series of indicators show that water consumption levels must be immediately reduced; indicators may include: Sustained demand is exceeding normal supply or delivery capacities, or Water storage facility(ies) is/are only 2/3 full, and City Manager determines that ability to meet fire protection or other essential needs is jeopardized. Supply or delivery capacities have been reduced or are anticipated to be reduced by up to 35%.
Stage 5 (Mandatory)	Major water use reductions are deemed necessary to avoid system failure, inadequate fire protection capability and/or to assure protection of water quality; indicators may include: Sustained demand continues to exceed supply or delivery capacities, or Water storage facility(ies) is/are only 1/3 full. Supply source or major facility is lost, reducing supply or delivery capabilities to less than 65% of normal capacities.

Water Supply

Ashland anticipates that its future water service area will expand beyond its current service area during the planning horizon of this WMCP and into its Urban Growth Boundary (UGB).

To project future populations to be served, the City relied on the population forecast conducted by Portland State University's Population Research Center. This forecast was conducted for the City's UGB. The results are shown in Exhibit ES-3 through 2073.

Exhibit ES-3. UGB Population Projections

Year	Population
2023	22,651
2033	23,611
2043	24,710
2053	25,942
2063	27,164
2073	28,379

Water demand projections through 2073 were developed assuming that water demands would grow at the same rate as Ashland's water service population, with additional increases in demand caused by projected temperature increases over time due to climate change. A climate change analysis was conducted for this WMCP to evaluate the impacts of climate change on demand and the City's primary water supplies, Reeder Reservoir, and Ashland Creek. The results of the analysis suggest demands will increase, particularly earlier and later than the City's historically observed peak season of May through October. For example, demand may increase by as much as 14 percent above historical demands in October by the 2070s because of climate change. Exhibit ES-4 shows projected demand for the City considering projected temperature increases due to climate change.

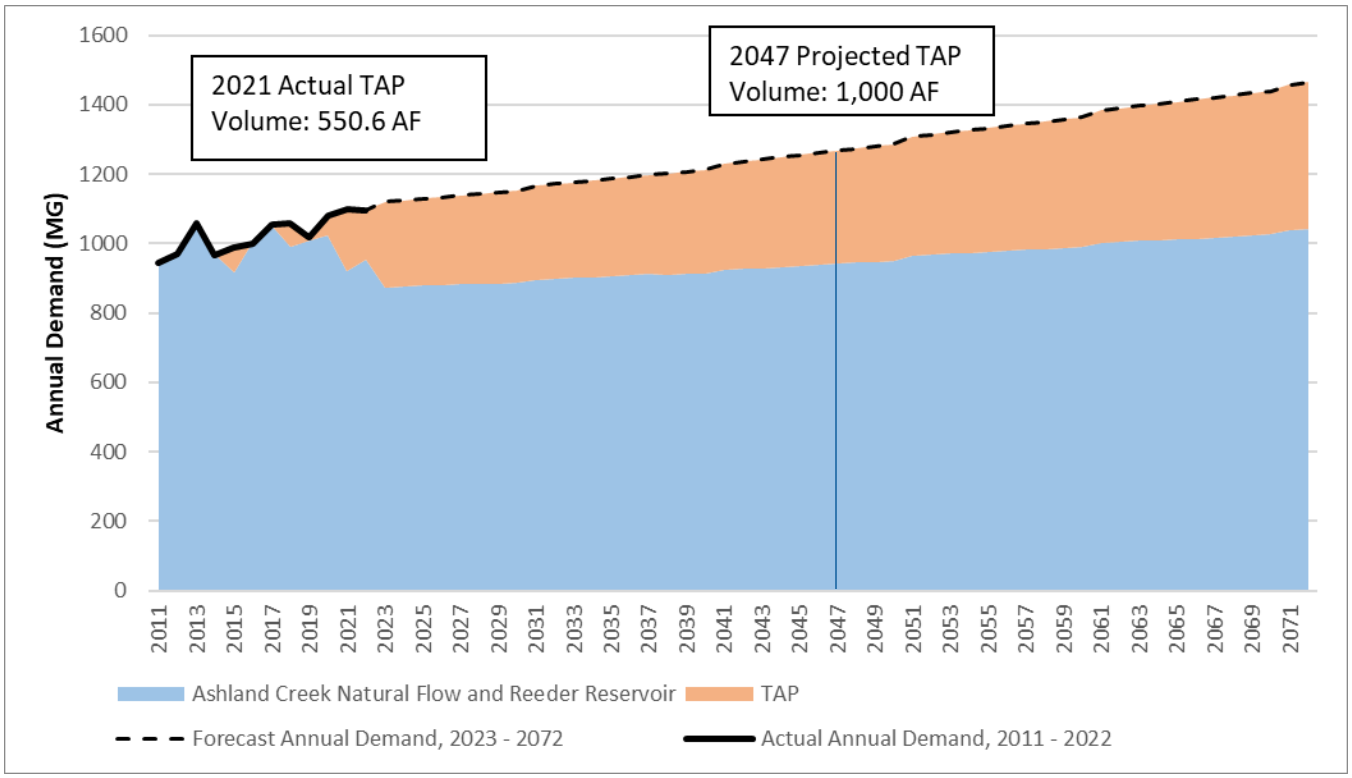
Exhibit ES-4. Ashland's Projected Annual Demand

Year	Annual Demand (million gallons [MG])
2021 (Actual)	1,100
2023	1,073
2033	1,127
2043	1,187
2053	1,256
2063	1,322
2073	1,384

The City's conservation program has led to significant water savings. Though the City anticipates that additional water savings will result from the City's future enhanced and expanded conservation program measures, the City anticipates that these will be more difficult to realize. Thus, the demand forecast for this WMCP takes a conservative approach to forecasting by only considering the City's past conservation efforts by virtue of using historical demand to project future demand.

Climate change impacts to streamflows of Ashland Creek were also analyzed. The models for this analysis project little change in the annual amount of precipitation, but predict shifts in precipitation leading to increases in winter flows and reductions in spring and summer flows. These changes are expected due to more precipitation falling as rain and reduced snowpack melt earlier in the year. These impacts could reduce the availability of water from Reeder Reservoir, requiring additional reliance on the City's Lost Creek Reservoir supply via the TAP intertie, as shown in Exhibit ES-5.

Exhibit ES-5. Comparison of Demand and Supply through 2073



The City projects that by 2047, it will require full use of its Lost Creek Reservoir water rights of 1,000 AF under Certificate 96166 and Permit S-54337. In addition to serving as an additional source of supply, the City considers stored water in Lost Creek Reservoir a redundant source of supply for use when the City's primary sources of supply, Ashland Creek and Reeder Reservoir, are not available. Several feasible scenarios would render these sources unavailable, requiring the City's full reliance on its Lost Creek Reservoir water rights within the 20-year planning period of this WMCP. Thus, the City is requesting access to the entirety of Permit S-54337 (449.4 AF) in order to be able to continue to meet projected demand scenarios.

1. Municipal Water Supplier Plan Elements

This section satisfies the requirements of OAR 690-086-0125.

This rule requires a list of affected local government to whom the plan was made available, and a proposed date for submittal of an updated plan.

1.1 Introduction

The City of Ashland (City or Ashland) sits in Jackson County in southwest Oregon along the Interstate 5 corridor and 16 miles north of the Oregon-California border. The climate of the area is mild year-round, with little snowfall and summer temperatures ranging between 65 and 85 degrees Fahrenheit (°F) on average. The City has over 21,500 residents of which approximately a quarter are students at Southern Oregon University. The City boasts the Oregon Shakespeare Festival that draws in thousands of visitors each year.

The purpose of this Water Management and Conservation Plan (WMCP or Plan) is to: (1) guide development, financing, and implementation of water management and conservation policies, programs, and practices that ensure long-term sustainable water use by the City and its customers and (2) serve as a water supply evaluation and assess the City's water supply and document a plan to meet the City's future water needs. This WMCP addresses a 20-year planning period from 2023 to 2043.

1.2 Plan Requirement

This is the City's second WMCP. The first WMCP was developed in 2013 and was required under a condition in Permit S-54337, which the City received in 2006. This 2023 WMCP is intended to meet two conditions associated with the City's water rights. First, the final order issued by the Oregon Department of Water Resources (OWRD or Department) approving the City's 2014 WMCP included a condition requiring the City to update its plan and submit the updated plan by March 3, 2023. Second, a permit extension for Permit S-54337 issued on August 26, 2022, required submittal of an updated WMCP to OWRD within 3 years of issuance. This WMCP is submitted in compliance with the requirements of the Oregon Administrative Rules (OAR) for WMCPs adopted by the Water Resources Commission in 2018 (OAR Chapter 690, Division 86).

1.3 Plan Organization

The WMCP is organized into the following sections, each addressing specific sections of OAR Chapter 690, Division 86. Section 2 is an evaluation of the City's water supply, water use, water rights and water system. The information developed for Section 2 is the foundation for the sections that follow. The later sections use this information to help guide key elements of this Plan, including the City's future conservation efforts, curtailment measures in the event of a water shortage, and future use and management of the City's supplies.

Section	Requirement
Section 1 – Municipal Water Supplier Plan Elements	*OAR 690-086-0125*
Section 2 – Municipal Water Supplier Descriptions	*OAR 690-086-0140*
Section 3 – Municipal Water Conservation Element	*OAR 690-086-0150*
Section 4 – Municipal Water Curtailment Element	*OAR 690-086-0160*
Section 5 – Municipal Water Supply Element	*OAR 690-086-0170*

1.4 Affected Local Governments

OAR 690-086-0125(5)

The following governmental agencies may be affected by this WMCP:

- City of Medford
- City of Talent (Talent)
- City of Phoenix (Phoenix)
- Jackson County (County)

In addition, the City provided Medford Water (MW) and the Talent Irrigation District (TID) and the Cities of Eagle Point and Central Point with a draft plan as a courtesy.

Thirty days before submitting this WMCP to OWRD, the City made the draft WMCP available for review by each affected local government listed above along with a request for comments relating to consistency with the local government's comprehensive land use plan. The letters requesting comment and any comments received are provided in Appendix A.

1.5 Plan Update Schedule

OAR 690-086-1025(6)

The City anticipates submitting an update of this WMCP within 10 years of the final order approving this WMCP. As required by OAR Chapter 690, Division 86, a progress report will be submitted within 5 years of the final order.

1.6 Time Extension

OAR 690-086-0125(7)

The City is not requesting additional time to implement metering or a previous benchmark.

2. Municipal Water Supplier Description

This section satisfies the requirements of OAR 690-086-0140.

This rule requires descriptions of the water supplier's water sources, service area and population, water rights, and adequacy and reliability of the existing water supply. The rule also requires descriptions of the water supplier's customers and their water use, the water system, interconnections with other water suppliers, and quantification of water loss.

2.1 Terminology

The following terminology is used in this WMCP.

Demand and *system demand* refers to the quantity of water delivered to the City's distribution system from its water treatment plant (WTP) plus water treated at the MW WTP and delivered via the Talent, Ashland, Phoenix (TAP) pipeline.

Consumption is equal to the volume of metered water use and unmetered, authorized water uses. Metered consumption includes water use by residential, commercial, industrial, public, and irrigation customers, for example, and unmetered, authorized uses can include firefighting and hydrant flushing, among other uses.

Generally, demand and consumption in municipal and quasi-municipal systems are expressed in rate of usage using million gallons per day (mgd), but also may be expressed in cubic feet per second (cfs) or gallons per minute (gpm). One mgd is equivalent to 1.55 cfs or 694 gpm. For water measured by volume, million gallons (MG) or acre-feet (AF) are used; an acre-foot is 325,850 gallons.

The following terms are used to describe specific values of system demands in this WMCP:

- Average day demand (ADD) equals the total annual production divided by 365 days.
- Maximum day demand (MDD) equals the highest system demand that occurs on any single day during a calendar year. It is also called the peak day demand.
- Monthly demand equals the total volume of water produced in a month divided by 30.
- Maximum monthly demand (MMD) equals the highest demand in one of the 12 months of a calendar year.
- Peaking factors are the ratios of one demand value to another. The most common and important peaking factor used in this WMCP is the ratio of the MDD to the ADD.

2.2 Water Sources

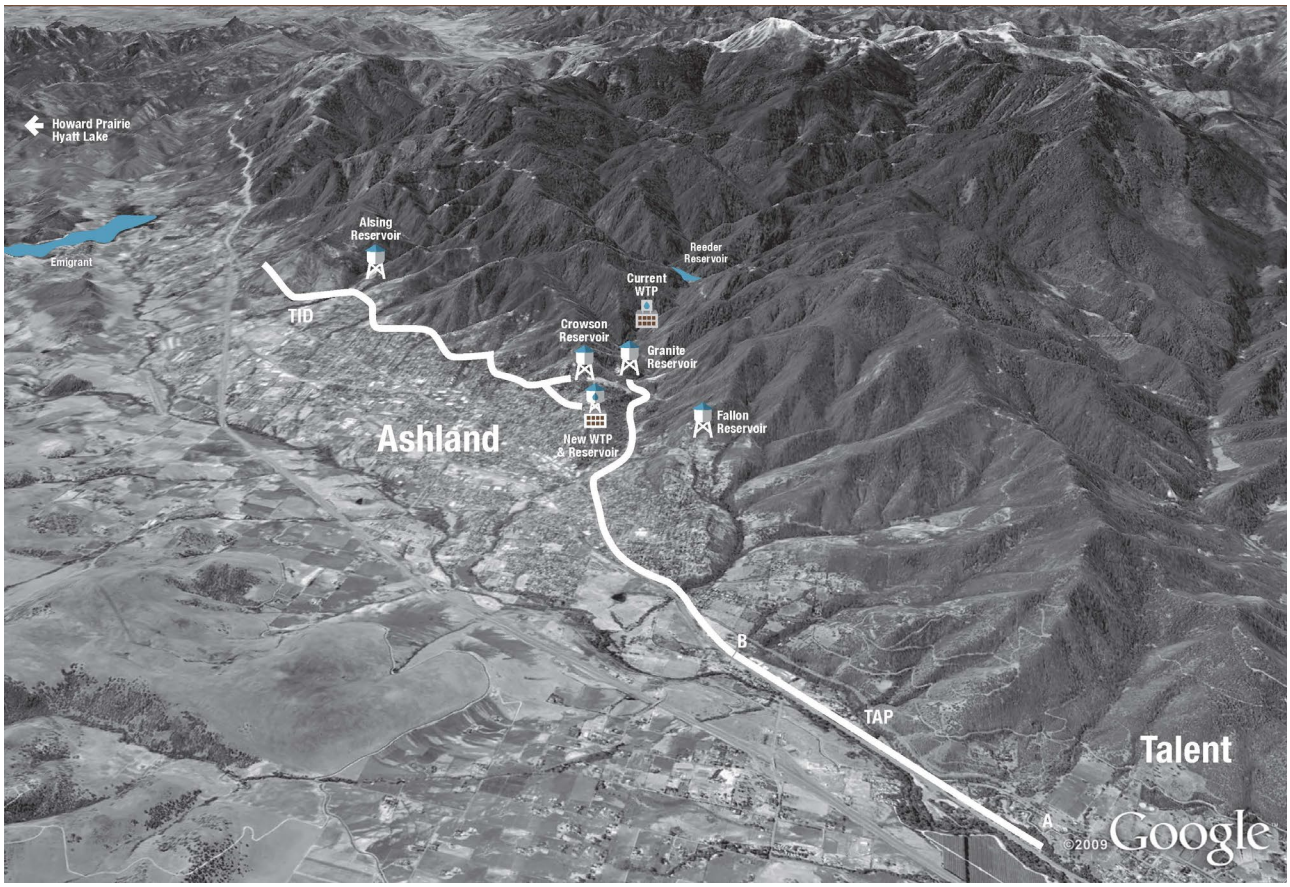
OAR 690-086-0140(1)

The City's primary source of supply is the Ashland Creek watershed. In 1928, the City constructed Hosler Dam, which impounds water from the West and East Forks of Ashland Creek. This impounded water is stored in Reeder Reservoir, which is capable of storing 280 MG (860 AF). Water from the reservoir is conveyed in a transmission pipeline along Ashland Creek to the City's WTP located approximately 1 mile below the reservoir as shown in Exhibit 2-1. A second source of supply includes Lost Creek Reservoir authorized by the City's Permit S-54337and Certificate 96116. When needed, water from this source is diverted at the Lost Creek Dam and re-diverted at MW's Duff WTP where it is treated by MW and conveyed to Ashland via the TAP intertie, also shown in Exhibit 2-1. Ashland may also receive *surplus* water from MW (diverted under MW's water rights) as a source of supply.

Ashland has numerous water rights that authorized diversions from Ashland Creek. The points of diversion for these rights are located at the City's WTP.

The City may also receive water from Hyatt and Howard Prairie Reservoirs under contract with the U.S. Bureau of Reclamation (BOR), conveyed in TIDs canals to the City (labeled "TID" in Exhibit 2-1). TID can supply untreated water to the City via the Ashland canal in years when water is available. Historically, at least a portion of the total volume of water authorized for use by the City has been available annually during peak season. However, in 2021 and 2022, severe drought conditions prevented TID from providing Ashland water. When available, TID water is pumped from Ashland canal to the City's WTP where it is blended and treated with water from Ashland Creek. The City provides some Ashland customers with non-potable water from Ashland canal for irrigation and other non-potable purposes when available. Some of Ashland's customers receive water directly from TID as non-potable water, which is used primarily for irrigation. This arrangement is not managed by the City; thus, it is not considered a source of supply for the City. There are approximately 180 City customers that receive non-potable water in the Ashland canal provided by the City.

Exhibit 2-1. Sources of Supply



2.3 Current Service Area Description and Population

OAR 690-086-0140(2)

The City's existing water service area includes the area within the City limits as shown in the City's schematic, Exhibit 2-2. Exhibits 2-1 and 2-2 also show major components of the City's distribution system and boundaries of the City and the City's Urban Growth Boundary (UGB).

The population of the City was 21,642 in 2022 according to Portland State University Population Research Center.

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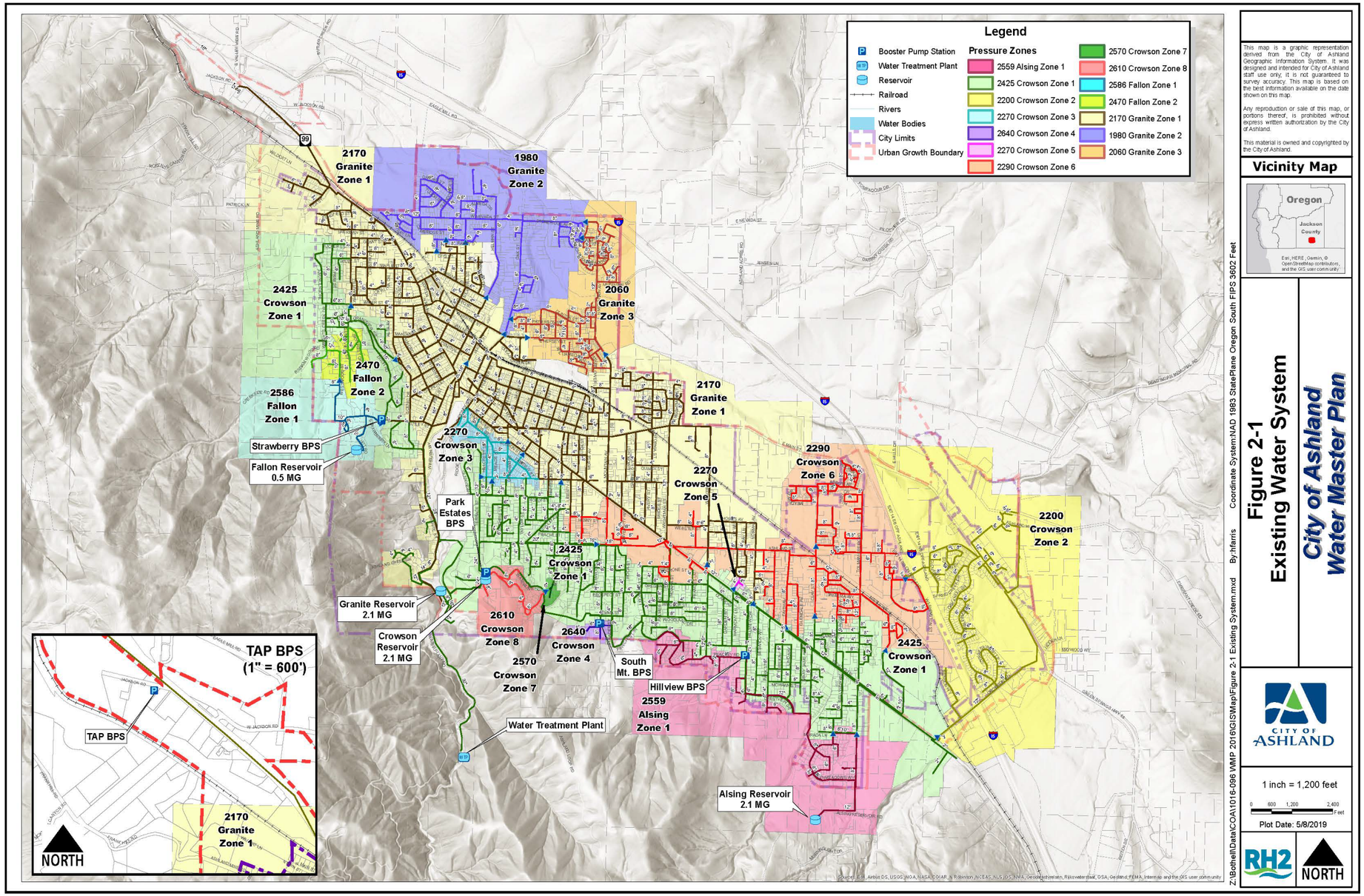
Exhibit 2-2. Ashland's Service Area and Distribution System Schematic



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2.4 Interconnections with Other Systems

OAR 690-086-0140(7)

The City's water system has two interconnections. The TID interconnection allows the City to receive water from TID via the Ashland canal sourced from Hyatt and Howard Prairie Reservoirs. When available, water from TID can be treated at the City's WTP and used to augment the City's supply during peak season or water from the canal (non-potable) can be used by City customers for irrigation purposes. The City also has an interconnection on the TAP intertie, which conveys water from MW, identified as "TAP" in Exhibit 2-1.

2.5 Intergovernmental Agreements and Contracts for Water Supply

OAR 690-086-0140(1)

Ashland has multiple intergovernmental agreements (IGAs) and contracts for water supply related to the following entities: (1) the BOR, (2) the Partner Cities; (3) City of Medford; (4) TID; and (5) Talent and Phoenix.

2.5.1 Partner Cities

In September 2022, Ashland joined the six other Partner Cities (Cities of Jacksonville, Central Point, Eagle Point, Phoenix, and Talent) and MW in signing an IGA called the Coordinated Water Management and Water Sharing Agreement (Partner Cities' IGA) that establishes a coordinated approach to water rights management and describes a mechanism for sharing water among the Partner Cities. Under the Partner Cities' IGA, Partner's will coordinate certificating water rights in permit or transfer status with a point of diversion at MW's Robert A. Duff Water Treatment Plant (Duff WTP) as the Duff WTP capacity is expanded over time. In addition, the IGA establishes a framework that promotes long-term regional water supply. In summary, if Partner Cities have supply in excess of demand, that excess can be shared with other Partner Cities with a deficit of supply. The IGA is effective through October 1, 2027 and may be renewed in 5-year increments.

2.5.2 City of Medford

Through Ashland's agreement with the City of Medford, MW can provide up to 1,480 gallons per minute (gpm) of surplus water from October through April and surplus facilities capacity to treat and transport up to 1,480 gpm (2.13 mgd) from May through September. From May through September, the City's reliance on the MW facilities is associated with its use of stored water from Lost Creek Reservoir of 1,000 AF authorized by Certificate 96166 and Permit S-54337. Ashland has an option to receive up to 3 mgd of surplus water. In addition, this agreement allows for the provision of water to Ashland in the event of an emergency.

2.5.3 Bureau of Reclamation

The City annually contracts with the BOR for the use of stored water from the Howard Prairie Reservoir. The volume of water available to the City may change from year to year. For example, in 2020, the City

contracted for the use of up to 173 AF. Water is conveyed from the reservoir to Ashland via TID's canal system. This contract does not guarantee the availability of water to Ashland.

2.5.4 Talent Irrigation District

In a 1924 agreement and subsequent agreement in 1926 with TID, the City obtained 800 AF in perpetuity of water from the TID, sourced from water impounded in Hyatt Reservoir and delivered via TID's canal system, for use by the City during the irrigation season. In 1935, the City relinquished 33 AF feet of this volume to TID, resulting in a total supply of up to 768 AF available to the City. The City is entitled only to a pro-rata share in the event of shortages in TID's system. As noted in the City's 2014 WMCP, TID measures the water that it provides to the City at the Starlite measuring station. According to TID, the district does not have contracts with any water users on the City's side of that measuring station.

2.5.5 Talent and Phoenix

Ashland has several agreements with the Cities of Talent and Phoenix regarding the management and construction of the TAP facilities through which water from MW is conveyed. Based on these agreements, Ashland currently has access to 2.13 mgd via the pipeline. The most relevant of these are listed below per the TAP Master Plan (2020):[1]

- 2000 TAP IGA – October 27, 2000
- 2000 TAP IGA Amendment No. 1 – March 20, 2002
- 2000 TAP IGA Amendment No. 2 – Unsigned 2004
- 2000 TAP IGA Addendum No. 1 – May 15, 2007
- 2006 Talent Ashland IGA for Emergency Water Service – April 19, 2006
- MW Commission IGA TAP Regional Pump Station Maintenance Agreement (October 2000) and Amendment No.1 (May 7, 2002)
- TAP Cost Allocation Recommendations – 2017
- 2023 TAP IGA (for intended approval by the City in August, 2023)

2.6 Demand

OAR 690-086-0140(4)

2.6.1 Annual Demand

Over time, the City has observed a general trend of decreasing annual demands. This trend is highlighted by comparing the average demands from 2005 to 2007 to the average demand from 2020 to 2022—resulting in a decrease in demand by approximately 11 percent—and comparing the volume of water used on a per capita basis in 2005 of 160 gallons per capita per day (gpcd) to per capita water use in 2022 of 139 gpcd. This trend also was observed in the City's peaking factor; these values slightly

[1] RH2 et al. 2020. *TAP Water Master Plan*. Prepared for the Cities of Talent, Ashland, and Phoenix. Summer, 2020

decreased from a factor of over 2 from 2005 to 2007 (reaching a high of 2.14 in 2005) to consistently being below a factor of 2 since 2016 (1.86 in 2019). This decrease in the peaking factor suggests that customers, and in particular residential customers, have adopted more efficient water use practices during peak seasons since the mid-2000s. (Changes to residential customer consumption are more thoroughly explored in Section 2.7.) Exhibit 2-3 highlights these and other historical changes.

Exhibit 2-3. Water Demand, 2005 to 2022

	Annual Demand (MG)	ADD (mgd)	MDD (mgd)	Date of MDD	Peaking Factor	Population	Per Capita Daily Demand (gpcd)
2005	1,220	3.34	7.17	Aug-05	2.14	20,880	160
2006	1,261	3.46	7.04	Jul-06	2.04	21,430	161
2007	1,218	3.34	6.96	Jul-07	2.09	21,630	154
2008	1,196	3.27	6.50	Jul-08	1.99	21,485	153
2009	1,073	2.94	6.74	Aug-09	2.29	21,505	137
2010	950	2.60	5.88	Aug-10	2.26	21,460	121
2011	943	2.58	5.36	Aug-11	2.08	20,255	128
2012	969	2.65	5.14	Aug-12	1.94	20,324	131
2013	1,059	2.90	5.95	Jul-13	2.05	20,295	143
2014	967	2.65	4.80	Jul-14	1.81	20,340	130
2015	989	2.71	5.43	Jul-15	2.01	20,405	133
2016	1,000	2.73	5.25	Aug-16	1.92	20,620	133
2017	1,055	2.89	5.72	Aug-17	1.98	20,700	140
2018	1,057	2.90	5.55	Aug-18	1.92	20,815	139
2019	1,016	2.78	5.19	Jul-19	1.86	20,960	133
2020	1,082	2.96	5.84	Sep-20	1.98	21,474	138
2021	1,100	3.01	6.01	Jun-21	1.99	21,554	140
2022	1,096	3.00	5.93	Aug-22	1.97	21,642	139

Exhibits 2-4 and 2-5 graphically depict annual demand and average and maximum day demands from 2005 through 2022, respectively.

Exhibit 2-4. Annual Demands, 2005 - 2022

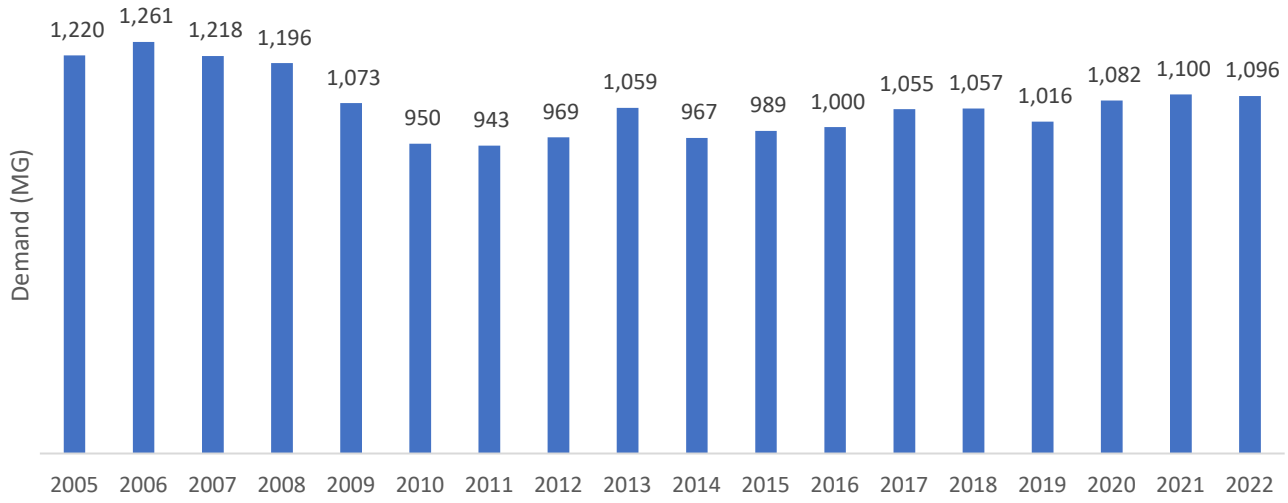
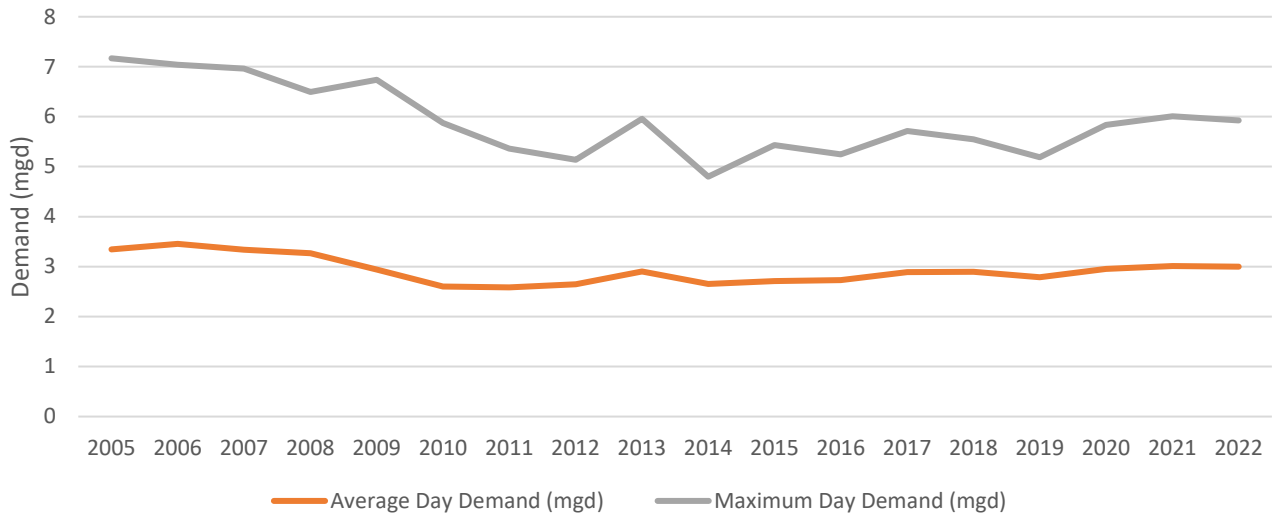


Exhibit 2-5. Average and Maximum Day Demands, 2005 - 2022



2.7 Customer Characteristics and Use Patterns

OAR 690-086-0140(6)

2.7.1 Categories of Accounts

The City organizes its water service accounts by seven customer categories: single family residential, multifamily, commercial, irrigation, government, municipal, and commercial/residential as shown in Exhibit 2-6. Multifamily residences are defined as dwellings with more than one unit sharing the same water meter. The Government category includes the schools served by the City, and the Municipal

category includes City accounts. The Commercial/Residential category includes customers with mixed uses, such as a multi-story building with both commercial space and residential dwellings.

Customers in the single-family category represented the largest group in 2022, with 78.7 percent of all accounts, followed by the Commercial (8.6 percent) and Multifamily (6.3 percent) categories. The combined categories of Irrigation, Municipal, Government, and Commercial/Residential made up 6.6 percent of all accounts.

Exhibit 2-6. Count of Accounts by Customer Category, 2022

Customer Category	Account Count	Percent of All Accounts
Single Family	7,406	78.7%
Commercial	807	8.6%
Multifamily	589	6.3%
Irrigation	325	3.5%
Municipal	187	2.0%
Government	66	0.7%
Commercial/Residential	33	0.4%
Total	9,413	100.0%

2.7.2 Total Consumption

Exhibit 2-7 shows the total annual metered consumption from 2014 to 2022 and Exhibit 2-8 graphically depicts this data. The consumption data prior to 2018 was drawn from the City's 2019 WMCP Progress Report. The City's 2019 WMCP Progress Report consumption value for 2018 is slightly higher (969.8 MG) than the volume shown below, likely due to the City moving to a new billing system in 2018.

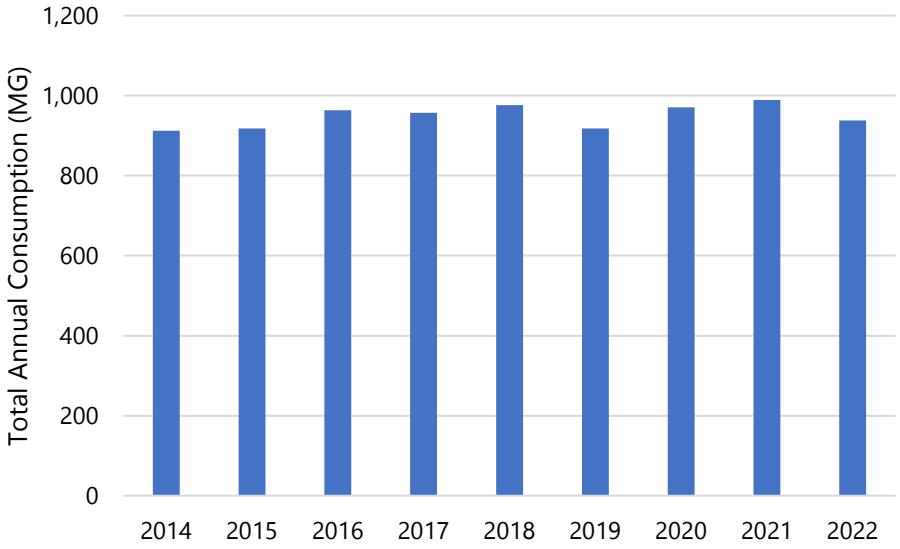
Annual consumption averaged 949.1 MG from 2014 through 2022. The highest consumption volume was 988.7 MG in 2021 and the lowest was 912.5 MG in 2014.

Exhibit 2-7. Annual Consumption (MG) Table, 2014-2022

Year	Consumption (MG)	Population
2014	912	20,340
2015	918	20,405
2016	963	20,620
2017	957	20,700
2018	976	20,815
2019	918	20,960
2020	970	21,474
2021	989	21,554
2022	938	21,642

Overall, total annual consumption has remained fairly consistent during this 9-year period, with a slight upward trend likely resulting from increases in the service area population.

Exhibit 2-8. Annual Consumption (MG) Chart, 2014-2022



2.7.3 Consumption by Account Category

Exhibit 2-9 provides the number of service connections in 2022 and the percentage of water consumed by each customer category in that year. Single-family residential consumption represents the largest proportion of use at 49 percent due to the large number of service meters, with Irrigation, Commercial, and Multifamily accounts consuming 43 percent. Combined, these four categories made up 92 percent of total water use.

Exhibit 2-9. Number of Service Connections and Percent Annual Water Use by Customer Category, 2022

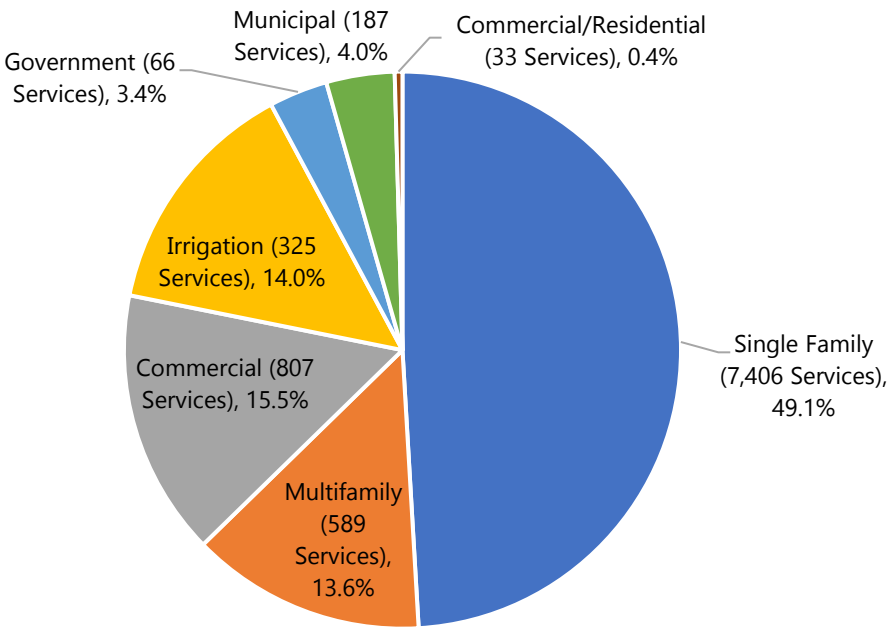


Exhibit 2-10 presents annual consumption by account category from 2014 through 2022. The City's previous 2014 WMCP does not have consumption by customer category data in a format that is directly comparable with data presented in this WMCP. However, consumption by customer category data from 2014 through 2017 was available from the 2019 WMCP Progress Report and is included in the exhibit for comparison purposes.

The most significant, observable trends include a general increase in consumption by the Single Family category, which is likely due to population increases over this 9-year period. The Irrigation category generally decreased in consumption, possibly due to the City's aggressive campaign to encourage efficient use of water used for irrigation. The Municipal and Commercial/Residential categories' volumes increased to its peak consumption in 2018, and then decreased in the following years, while the Government category consumption significantly decreased in 2021 and 2022. These decreases in Municipal and Government consumption were likely due to these users' responses to drought-like conditions, COVID impacts to municipal and government staff attendance at municipal and government facilities, and the City's requests for voluntary curtailment in 2021 and 2022.

Exhibit 2-10. Annual Consumption by Customer Category, 2014-2022

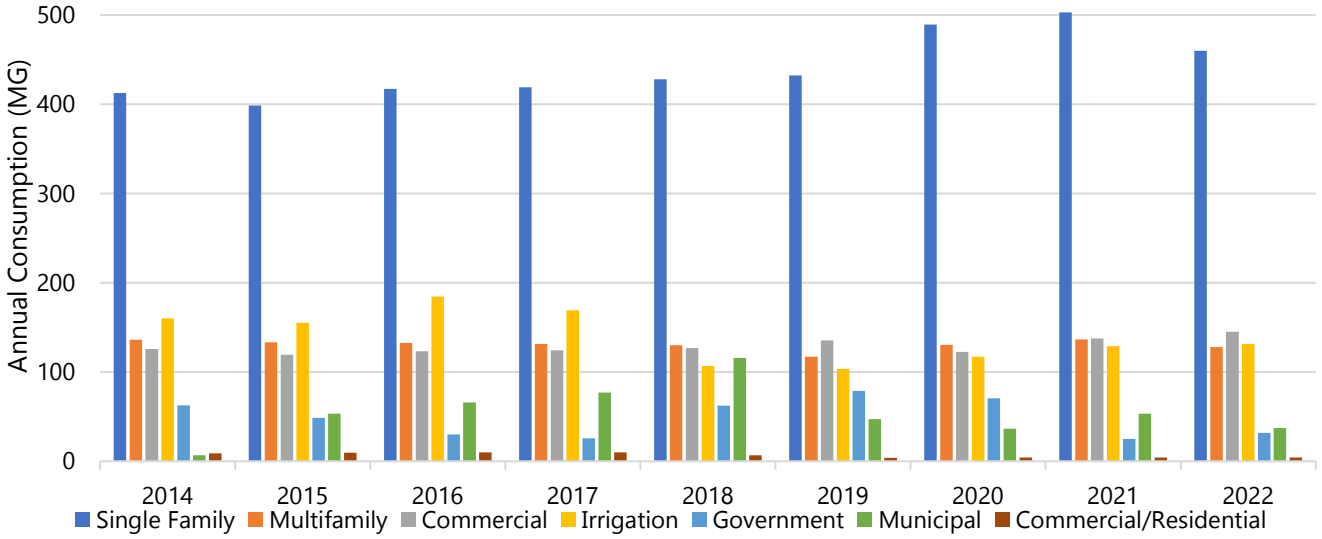
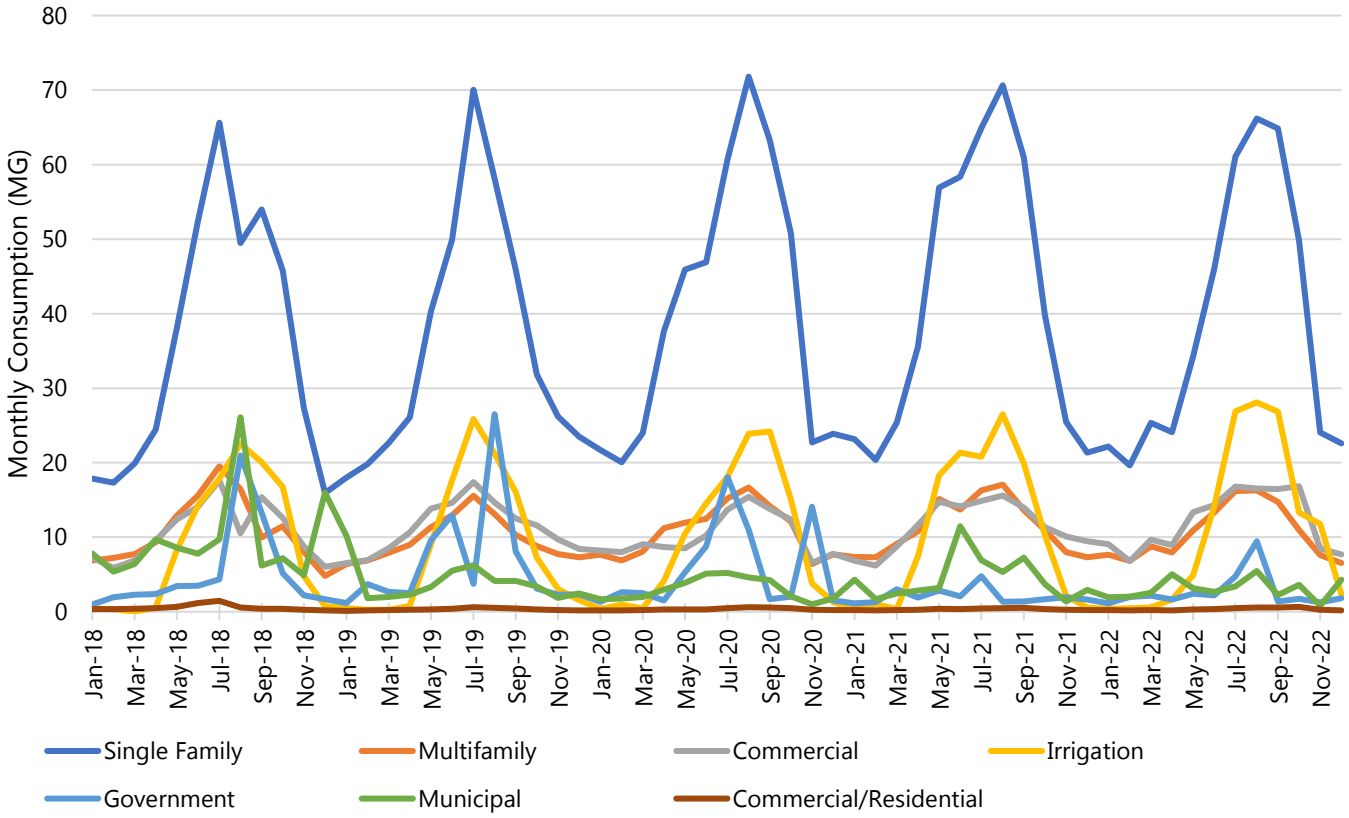


Exhibit 2-11 shows monthly consumption by customer category from 2018 through 2022. Consumption follows a seasonal pattern, with increases in the summer months for all categories except for Commercial/Residential and decreases in consumption during the winter months relative to summer. Seasonal increases are likely attributed to outdoor water use.

Exhibit 2-11. Monthly Consumption by Customer Category, 2018-2022



2.7.4 Residential Per Capita Demand

Ashland calculated a per capita single-family category demand of 104.2 gpcd by dividing the 2022 residential population estimate of 12,098 by the 2022 residential category's billed consumption volume of 460.1 MG. (The residential population estimate was calculated based on the owner-occupied housing percentage from 2017 to 2021 in Ashland according to the U.S. Census Bureau of 55.9 percent.) This per capita value is within the range of other single-family per capita water use rates of some surrounding communities. For example, the City of Medford's estimated single-family per capita demand was 187 gpcd per the Medford Water Commission's 2015 WMCP.[2] Ashland calculated the City of Talent's single-family per capita consumption for 2017 based on data provided in this city's WMCP[3] and U.S. Census Bureau's estimate of persons per household to arrive at a per capita water use of 91.8 gpcd.

2.7.5 Indoor and Outdoor Water Use

In recognition of the seasonal consumption patterns displayed by the City's customers, the City calculated and compared winter and summer consumption volumes to highlight these differences.

[2] CH2M. 2017. *Water Management and Conservation Plan*, Medford Water Commission. June 2017.

[3] RH2. 2020. *Water Management and Conservation Plan*, City of Talent. April 2020.

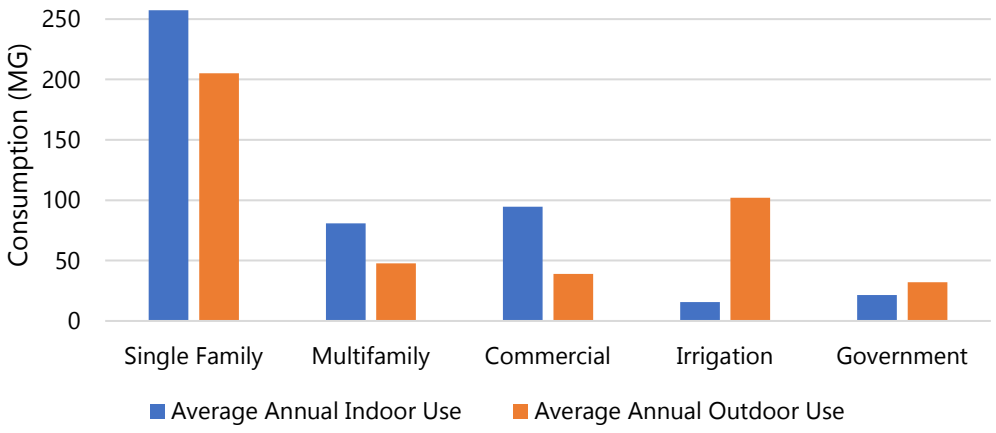
Estimates of indoor and outdoor water use by customers may provide information that helps the City target its water conservation efforts.

The annual indoor use was calculated by multiplying the average use for the month of December for each customer category from 2018 to 2022 by 12 months. This calculation assumes that December consumption is representative of the monthly volume of water used indoors for every month of the year. The average annual outdoor use was calculated by subtracting annual indoor use from total average annual use for each category for 2018 to 2022. This calculation was performed for each customer category and is presented in Exhibit 2-12.

Based on these calculations, estimated indoor water use for all customer categories (not shown in Exhibit 2-12) represented approximately 56 percent of total water use and estimated outdoor water use represented approximately 44 percent of total water use. The Municipal category is not shown on Exhibit 2-12 because there was unusually high consumption in this category in 2018, which skewed the data and produced unreliable estimates. The Commercial/Residential category is also not shown on the chart because the consumption in that category is too low to discern a difference between outdoor and indoor use.

Almost all categories had higher estimated indoor use than outdoor use except for the Irrigation and Government categories. Outdoor water use represented 44 percent of annual use among Single Family users, and 37 percent among Multifamily users. The previous 2014 WMCP reported a total annual outdoor use figure of 592 MG for 2008, and the current estimate for total average annual outdoor use for 2018 through 2022 is 420 MG, which indicates that outdoor use has decreased since 2008. This decrease may be due to successful water conservation programs targeting outdoor use, the addition of a peak season tier to the City's water rate structure, or the City's curtailment measures during recent drought and water shortages.

Exhibit 2-12. Annual Indoor and Outdoor Water Consumption by Customer Category, 2018-2022



2.7.6 Largest Water Users

Exhibit 2-13 lists the City's top 10 water customers. These customers were responsible for the use of 220 MG from March 2021 through February 2022, or 11.1 percent of all consumption.

Exhibit 2-13. Consumption of Top 10 Water Users, March 2021 through February 2022

User	Annual Volume Used (MG)	Percent of Annual Volume (%)
Municipal	60.91	3.1%
Municipal	31.57	1.6%
Commercial	30.33	1.5%
Multifamily	25.43	1.3%
Government	23.55	1.2%
Commercial	13.23	0.7%
Multifamily	13.10	0.7%
Commercial	7.72	0.4%
Multifamily	6.90	0.3%
Multifamily	6.90	0.3%
Totals	**220**	11.1%

2.8 Water Loss

OAR 690-086-0140(9)

Water loss is defined in the rule as a comparison of all water that enters into the water supplier's system and the total Authorized Consumption. Total water demand includes water supply from Reeder Reservoir/Ashland Creek, Lost Creek Reservoir, TID, and MW. Authorized consumption includes metered consumption by customers and metered bulk water use and unmetered, authorized uses such as system flushing, street sweeping, jet-rodding, and fire department use. (The City used an average of 2019 through 2022 to estimate the "Other Consumption" volume for 2018 because this data was not available for this WMCP.) Water loss includes apparent losses (i.e., unauthorized consumption, meter inaccuracies, and data handling errors) and real losses (i.e., system leakage). System leakage, as the name implies, is water loss from deteriorating or compromised pipes, pipe joints, service connections, and valves, among other sources. The City is unaware of any unauthorized uses.

Exhibit 2-14 shows the City's water loss estimates for 2018 through 2022. During this period, the City's water loss ranged from 7.2 percent to 14.1 percent, averaging 10.0 percent. Loss in 2022 is largely due to a major leak discovered and promptly repaired in 2023.

Exhibit 2-14. Water Audit, 2018-2022

Year	Total Demand (MG)	Metered Consumption (MG)	Other Consumption[1] (MG)	Total Consumption	Water Loss (MG)	Water Loss Percentage
2018	1,057.5	976.3	5.3	981.6	75.9	7.2%
2019	1,016.4	918.0	4.0	922.0	94.4	9.3%
2020	1,081.6	970.4	4.6	975.0	106.6	9.9%
2021	1,100.3	988.7	8.9	997.5	102.8	9.3%
2022	1,095.6	937.6	3.9	941.5	154.2	14.1%[2]
					5-Year Average	**10.0%**

[1] Other consumption includes metered bulk water sales and unmetered system flushing, street sweeping, jet-rodding, and fire department use.
[2] The City observed significant system losses in 2022 resulting from a leak that was discovered and repaired in 2023.

2.9 Water Rights

OAR 690-086-0140(5)

2.9.1 Summary of Municipal Water Rights

Ashland Creek (and Reeder Reservoir) provide the primary source for the City's municipal water supply. The City holds a water right authorizing the storage of water from Ashland Creek in a reservoir (Reeder Reservoir) and a secondary right authorizing the use of the stored water from Reeder Reservoir, as well as natural flow from Ashland Creek for municipal use. The City also holds Certificate 15998, which authorizes the use of up to 12.43 cfs from Ashland Creek, as well as an additional 22 other water rights for the use of water from Ashland Creek for municipal purposes. All these water rights are in certificate status. The 22 rights, which previously authorized the use of water for irrigation purposes, were acquired by the City and transferred (modified) to authorize municipal use of water.

In addition to its Ashland Creek water rights, the City also holds municipal water rights for the use of stored water from Lost Creek Reservoir and a water right authorizing the use of water from Sulphur Spring, which is a tributary of Neil Creek. The City holds a water use permit and certificate authorizing the use of stored water from Lost Creek Reservoir. (The City recently obtained the certificate through a partial perfection of the permit.) The City currently does not use water under its water right certificate for the use of water from Sulphur Spring.

These rights are described in more detail below, and in the City's water rights table, which is provided in Exhibit 2-15.

Ashland Creek Water Rights

Certificate 10843

Priority date: May 20, 1927
Source: Ashland Creek
Volume: 800 AF
Purpose: Storage in Reeder Reservoir for municipal use

In May 1927, the City applied for a permit to store water in Reeder Reservoir for municipal water supply. In July 1927, the State Engineer issued Permit R-596 authorizing the storage of up to 800 AF of water in the reservoir from Ashland Creek for municipal use. The City fully developed this water right and in September 1934 received Certificate 10843.

Certificate 10856

Priority date: May 31, 1927
Source: Ashland Creek and Reeder Reservoir
Rate: 15 cfs
Purpose: Municipal Use

In July 1927, the State Engineer issued Permit S-7985 to the City, which authorized the use of up to 15 cfs from Ashland Creek and Reeder Reservoir for municipal use. The City fully developed this water right and received Certificate 10856. The water right has a priority date of May 31, 1927.

Certificate 15998

Priority date: 1854 – 1882 (for municipal use)[4]
Source: Ashland Creek
Rate: 12.43 cfs (for municipal use)
Purpose: Municipal Use

In September 1949, the State Engineer issued Certificate 15998, based on the right decreed during the Rogue River basin adjudication. The water right authorizes the use of water from Ashland Creek for municipal, domestic, stock, irrigation and hydropower purposes. Water can be diverted at a rate of up to 12.43 cfs for municipal, domestic, stock, and irrigation purposes within the corporate limits of the City of Ashland.

Additional 22 Ashland Creek Certificates

Priority date: December 31, 1854 to December 31, 1885
Source: Ashland Creek
Combined Maximum Rate: 1.633 cubic feet per second
Purpose: Municipal Use

In addition to the water rights described above, the City has acquired 22 additional water rights that authorize the use of water from Ashland Creek. These rights are described in more detail in the Municipal Water Right Table in Exhibit 2-15. The combined maximum authorized rate for these rights is 1.633 cfs. The maximum authorized rates for the individual rights range from 0.011 cfs to 0.315 cfs. The priority dates for these water rights range from 1854 to 1885, which pre-date Oregon's 1909 water code. Consequently, the rights originally were granted through the Rogue River adjudication and decree. The rights originally authorized the use of water for irrigation purposes. After acquiring the rights, the City filed transfer applications to change the authorized use to municipal purposes. The transfers also changed the place of use to within the corporate limits of the City of Ashland or identified sections within Township 39 South, Range 1 East W.M. The transfers also changed the point of diversion

[4] Certificate 15998 also authorizes the use of up to 29 cfs for hydropower purposes. This portion of the water right is described in the water rights table, but is not considered as part of the evaluation of the City's municipal water supply.

for these rights to the SE SE, Section 20, Township 39 South, Range 1 East W.M, which is also the point of diversion for the City's Certificate 10856. Eleven of these water rights allow the use of water year round and the remaining allow use only during the irrigation season (April 1 to November 1).

Lost Creek Reservoir Water Rights

Permit S-54337 and Certificate 96166

Priority date: August 11, 2003
Source: Lost Creek Reservoir
Volume: 1,000 AF (449.4 AF in certificate status)
Purpose: Municipal Use

In August 2003, the City applied for a permit to use stored water from Lost Creek Reservoir for municipal use. In September 2006, the OWRD issued to the City Permit S-54337 authorizing the use of up to 1,000 AF of stored water from Lost Creek Reservoir for municipal use. (The use of stored water is also subject to the contract between the U.S. Army Corps of Engineers and the City.) The water right does not include a rate limitation. The stored water is diverted at MW's Duff WTP. On April 12, 2022, OWRD issued Certificate 96166 through a partial perfection of the permit. Certificate 96166 confirms the use of up to 550.6 AF of stored water. The remaining 449.4 AF portion of Permit S-54337 continues to be in permit status. On August 26, 2022, OWRD issued a final order extending the development deadline for the permit to October 1, 2061.

Sulphur Spring Water Right

Certificate 11090

Priority date: April 25, 1934
Source: Sulphur Spring
Rate: 0.035 cfs
Purpose: Municipal Use

In April 1934, the City applied for a permit to use water from Sulphur Spring for drinking purposes or irrigation of City-owned land. In May 1934, the State Engineer issued the City Permit S-11243 authorizing the diversion of up to 0.035 cfs from Sulphur Spring for municipal use. The City developed this water use and in January 1935 received a certificate (Certificate 11090) confirming the right to divert up to 0.035 cfs from Sulphur Spring for municipal use. The place of use for the certificate is described as Sections 3, 4, 9, 10, and 15 Township 39 South, Range 1 East W.M. or on any other land owned by the city, whether within or without the limits of the city.

The City does not currently divert water under Certificate 11090 for its municipal water supply, but retains the water right as a potential source of future water supply.

2.9.2 Summary of Non-Municipal Water Rights

The City also holds water rights that authorize the use of water for purposes other than municipal water supply, including two water rights that authorize the use of water for hydropower, and one water right that authorizes the use of water for irrigation and domestic use. These rights are further described in the City's water rights table, which is provided in Exhibit 2-15. Since the City does not use these water rights to provide municipal water supply, they are not considered in the remainder of this WMCP.

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Exhibit 2-15. Water Rights Table

Application	Permit	Certificate	Transfer	Claim, Decree	Priority Date	Source	Type of Beneficial Use	Rate (cfs)	Annual Volume (AF)	Period of Use	Authorized Date for Completion	Maximum Withdrawal To Date		Water Year 2022 Average Withdrawal(1)		Water Years 2018-2022 Average Withdrawal(1)	
												cfs	Annually (AF)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)
Municipal Rights																	
R-11489	R-596	10843	-	-	5/20/1927	Ashland Crk.	Storage for Municipal in Reeder Gulch Reservoir	-	800	-	-	-	800	70.8	2.4	70.1	2.3
S-11518	S-7985	10856	-	-	5/31/1927	Ashland Crk. and Reeder Gulch Reservoir	Municipal	15	-	Year-round	-	15	-	188.8	6.3	273.4	9.1
S-15342	S-11243	11090	-	-	4/25/1934	Sulphur Spring, trib. of Neil Crk.	Municipal	0.035	-	Year-round	-	0.035	-	0	0	0	0
S-85733	S-54337	-	-	-	8/11/2003	Lost Creek Reservoir, trib. of Rogue R.	Municipal	-	449.4(2)	Year-round	10/1/20161	-	0.00	30.4	1.0	19.1	0.6
		96166	-	-				-	550.6		-	-	550.6				
-	-	15998	-	Rogue River Decree	Tract No. 1: 1854 - 0.18 cfs; 1861 - 5 cfs; 1864 - 3.75 cfs; 1872- 2.5 cfs; 1882- 1 cfs. (Tract No. 2: 1854 - 7 cfs; 1868 - 14.5 cfs; 1889 - 7.5 cfs.)	Ashland Crk., trib. of Bear Crk.	Municipal, Domestic, Stock, and Irrigation in Tract No. 1; (600 Hp of Hydropower in Tract 2)	12.43 cfs in Tract No. 1 (and 29 cfs for hydropower)	-	Year-round	-	12.43 cfs in Tract No. 1; (29 cfs in Tract No. 2 for hydropower)	-	242.6	8.1	446.8	14.9
-	-	16024	P-21	'Rogue River Decree	1856		Municipal	0.315	-	Year-round	-	0.315	-				
-	-	~~16014~~ 35922	A-30		1858		Municipal	0.08	-	Year-round	-	0.08	-				
-	-	~~16013~~ 35923	A-30		1858		Municipal	0.08	-	Year-round	-	0.08	-				
-	-	~~16023~~ ~~35906~~ 39241	A-49		1856		Municipal	0.045	-	Year-round	-	0.045	-				
-	-	~~16031~~ 39242	T-2338		1864		Municipal	0.042	-	Year-round	-	0.042	-				
-	-	~~35084~~ 39243	T-2390	16033	1864		Municipal	0.16	-	Year-round	-	0.16	-				
-	-	~~16018~~ 41651	T-2701	'Rogue River Decree	1858		Municipal	0.022	-	Year-round	-	0.022	-				

Exhibit 2-15. Water Rights Table (continued)

Application	Permit	Certificate	Transfer	Claim, Decree	Priority Date	Source	Type of Beneficial Use	Rate (cfs)	Annual Volume (AF)	Period of Use	Authorized Date for Completion	Maximum Withdrawal To Date		Water Year 2022 Average Withdrawal(1)		Water Years 2018-2022 Average Withdrawal(1)	
												cfs	Annually (AF)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)
Municipal Rights																	
-	-	~~16031~~ ~~34780~~ ~~37660~~ 41652	T-2338 T-2595		1864		Municipal	0.073	-	Year-round	-	0.073	-				
-	-	~~16002~~ 41772	T-2775		1858		Municipal	0.04	-	Year-round	-	0.04	-				
-	-	~~16003~~ 44474	A-39		1858		Municipal	0.08	-	Year-round	-	0.08	-				
-	-	~~16019~~ 44475	A-46		1885		Municipal	0.03	-	Year-round	-	0.03	-				
-	-	~~16027~~ 44573	A-39		1854		Municipal	0.19	-	Year-round	-	0.19	-				
-	-	~~16023~~ ~~35906~~ ~~36818~~ 67618	A-49 T-3856		1856		Municipal	0.04	-	Irrigation season	-	0.04	-				
-	-	~~16034~~ 67619	T-3935		1864		Municipal	0.08	-	Irrigation season	-	0.08	-				
-	-	~~16031~~ ~~34780~~ ~~37660~~ ~~38770~~ 67620	T-2595 T-3965	'Rogue River Decree	1864	Ashland Crk., trib. of Bear Crk.	Municipal	0.09	-	Irrigation season	-	0.09	-	See above	See above	See above	See above
-	-	~~16023~~ ~~35906~~ ~~36818~~ ~~45508~~ 67621	A-49 T-3856 T-5580		1856		Municipal	0.034	-	Irrigation season	-	0.034	-				
-	-	~~16011~~ 67623	T-5656		1858		Municipal	0.034	-	Irrigation season	-	0.034	-				
-	-	~~16011~~ 67624	T-5581		1858		Municipal	0.011	-	Irrigation season	-	0.011	-				
-	-	~~16031~~ ~~37480~~ ~~43561~~ 67625	T-2338 T-2341 T-5861		1864		Municipal	0.09	-	Irrigation season	-	0.09	-				
-	-	~~16026~~ 72371	T-6147		1858		Municipal	0.032	-	Irrigation season	-	0.032	-				
-	-	~~46398~~	T-11364		1864		Municipal	0.02	5.9	Apr. 1 - Oct. 31	10/1/2017	0.02	5.9				
-	-	~~86353~~	T-11364		1864		Municipal	0.045	10	Apr. 1 - Oct. 31	10/1/2017	0.045	10				

Exhibit 2-15. Water Rights Table (continued)

Application	Permit	Certificate	Transfer	Claim, Decree	Priority Date	Source	Type of Beneficial Use	Rate (cfs)	Annual Volume (AF)	Period of Use	Authorized Date for Completion	Maximum Withdrawal To Date		Water Year 2022		Water Years 2018-	
												cfs	Annually (AF)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)
Non-Municipal Rights																	
S-61057	S-47628	-	-	PC-871	12/8/1980	East & West Forks of Ashland Crk. & Reeder Gulch Reservoir	Hydropower	30 cfs, 14.66 cfs from East Fork & 15.34 cfs from West Fork	-	Year-round	10/1/1986	30 cfs	7076 MG	(3)	(3)	(3)	(3)
-	-	15999	-	'Rogue River Decree	1860	Ashland Crk., trib. of Bear Crk.	Hydropower	25	-	Year-round	-	25	-	1,323.9	44.1	1,645.3	54.8
-	-	16033	-	'Rogue River Decree	1881 for Tract 1; and 1880 for Tract 2	Ashland Crk., trib. of Bear Crk.	Irrigation of 13 acres and domestic on Tract 1; irrigation of 10 acres and domestic on Tract 2	Total of 0.34 cfs: 0.19 for Tract 1; 0.15 cfs for Tract 2	-	Year-round	-	0.34	-	0	0	0	0

Notes

(1) Combined volumes used for hydropower per Certificates 15999, 15998, PC-871 as follows:
- 2022 Average Monthly/Daily (MG/mgd): 242.6/8.1
- 2018-2022 Average Monthly/Daily (MG/mgd): 446.8/14.9

(2) Development restriction of 0 AF.

(3) Volumes used for hydropower per PC-871
- East Fork Ashland Creek--2022 Average Monthly/Daily (MG/mgd): 240.8/8.0
- East Fork Ashland Creek--2018-2022 Average Monthly/Daily (MG/mgd): 240.6/8.0
- West Fork Ashland Creek--2022 Average Monthly/Daily (MG/mgd): 244.5/8.1
- West Fork Ashland Creek--2018-2022 Average Monthly/Daily (MG/mgd): 250.2/8.3

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2.10 Aquatic Resource Concerns

OAR 690-086-140(5) requires the City to identify the following for this source: (1) any listing of the source as water quality limited (and the water quality parameters for which the source was listed); (2) any streamflow-dependent species listed by a state or federal agency as sensitive, threatened or endangered that are present in the source; and (3) any designation of a source as being in a critical groundwater area.

The City relies on surface water from Ashland Creek, a tributary of Bear Creek, and the water impounded in Lost Creek Reservoir, a tributary of the Rogue River to meet demands. Water from Lost Creek Reservoir is diverted at the Lost Creek Dam and re-diverted at MW's Duff WTP at approximately River Mile 131.5.

As part of a federal and state effort to protect Oregon streams from pollutants, every 2 years the Clean Water Act requires Oregon Department of Environmental Quality's (DEQ) to assess or re-assess water quality and report to the U.S. Environmental Protection Agency (EPA) on the condition of Oregon's waters. The Clean Water Act Section 303(d) requires the DEQ to identify waters that do not meet water quality standards and where a Total Maximum Daily Load (TMDL) pollutant load limit needs to be developed for additional regulation. Both Ashland Creek and Rogue River were placed on DEQ's 303(d) list as impaired water bodies for some water quality parameters.

Ashland Creek is classified by DEQ as Assessment Unit OR SR 1710030801 02 105548. In DEQ's 2022 Integrated Report, DEQ categorized this creek, from Reeder Reservoir to the confluence of Bear Creek (approximately 2 miles in length), as a Category 5 water quality limited stream due temperature during the fish spawning season.[5] The reach of the Rogue River from which water is diverted for Ashland use is classified as Assessment Unit OR_SR_1710030802_04_105816 and was placed on DEQ's 303(d) list as a Category 5 water quality limited stream due to year-round temperature, temperature during spawning season, biocriteria, and methylmercury.[6]

The City's wastewater treatment plant National Pollution Discharge and Elimination System permit requires the City to reduce the thermal loads on Bear Creek resulting from the City's discharge of wastewater into this creek. The City is currently performing a flow augmentation study in order to identify solutions to address this requirement. The City is also addressing thermal loads through a water quality trading program approved by DEQ.

Exhibit 2-16 shows the listed fish species potentially located in Ashland Creek and within the reach from Lost Creek Dam to MW's Duff WTP point of re-diversion on the Rogue River.

[5] DEQ's Assessment Database from the 2022 Integrated Report.

[6] Ibid.

Exhibit 2-16. Listed Fish Species Potentially Located in Ashland Creek

Fish Species	Common Name	Geography	Federal Listing	State Listing
Oncorhynchus kisutch	Coho	Rogue SMU	Threatened	Sensitive
Oncorhynchus mykiss	Steelhead	Rogue SMU	—	Sensitive (Summer)
Oncorhynchus tshawytscha	Chinook Salmon	Rogue SMU	—	Sensitive (Spring)
Oregonichthys kalawatseti	Umpqua Chub	Range-wide	—	Sensitive-Critical
Lampetra tridentate (*Entosphenus tridentata*)	Pacific Lamprey	Range-wide	—	Sensitive
Thaleichthys pacificus	Eulachon	Southern distinct population segment	Threatened	—
Acipenser medirostris	Green sturgeon	Southern distinct population segment	Threatened	Sensitive-Critical

SMU = Species Management Unit; — = not applicable

References:

- Oregon Sensitive Species List: https://www.dfw.state.or.us/wildlife/diversity/species/docs/Sensitive_Species_List.pdf
- Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon: https://www.dfw.state.or.us/wildlife/diversity/species/docs/Threatened_and_Endangered_Species.pdf
- Status of Endangered Species Act Listings and Critical Habitat Designations for West Coast Salmon and Steelhead https://www.fisheries.noaa.gov/resource/document/status-esa-listings-and-critical-habitat-designations-west-coast-salmon-and
- Endangered Species Act, Threatened and Endangered Species Directory: https://www.fisheries.noaa.gov/species-directory/threatened-endangered?species_title=&field_species_categories_vocab_target_id=1000000031&field_species_status_value=All&field_region_vocab_target_id=1000001126

The City's sources of supply are not located within a critical groundwater area.

2.11 Assessment of Water Supply

OAR 690-086-0140(3)

As previously described, the City currently obtains its water supply from Ashland Creek, Lost Creek Reservoir, and from TID during some years. The following discussion describes the adequacy and reliability of the City's existing water supply sources, which are primarily limited by source capacity, the relative priority of its water rights, water system capacity, and water supply agreements/contracts.

Ashland Creek and Reeder Reservoir

The City's primary source of supply is Ashland Creek and Reeder Reservoir, and its municipal water rights authorize a combined maximum rate of diversion of up to 29.063 cfs from these sources.

The City's ability to use these rights, however, is limited by its water system capacity, and by the streamflow in Ashland Creek and the relative priority of its water rights compared to other water rights on Ashland Creek. The City's WTP has a current capacity of 7.5 mgd or 11.6 cfs. Additionally, the natural streamflow in Ashland Creek during periods of low flow and peak demand further limits the City's use of water from that source because there is insufficient streamflow to meet the needs of all the water right holders. Although the City holds the majority of the water rights with priority dates of 1895 or earlier,[7] there are water rights with authorized points of diversion downstream from the City's intake on Ashland Creek that are senior in priority to Certificate 10856, which authorizes the use of up to 15 cfs and has a priority date of May 31, 1927. These senior water right holders are entitled to receive the full rate to which they are authorized before the City diverts water under Certificate 10856. Additionally, the natural streamflow during peak demand periods is typically insufficient to allow use of the City's more senior water rights.

The natural streamflow in Ashland Creek is estimated by adding together the flows reported by the gages on the East Fork and West Fork of Ashland Creek. The 80 percent exceedance of the natural streamflow reported at the gages during low-flow season of July through September from 2003 through 2022 is 3.99 cfs. Based on information provided by OWRD's local watermaster (see Appendix B) at this flow, the City must bypass a 1.244 cfs portion of this streamflow to meet the demands of downstream water rights. Thus, the City would be expected to have access to approximately 2.75 cfs of Ashland Creek natural streamflow at least 80 percent of the time during this period (3.99 – 1.244 = 2.746). (This assessment considers streamflows under current conditions. See Section 5 for a discussion of streamflows under future conditions.)

The City augments this natural streamflow with releases of stored water from Reeder Reservoir. Storage in the reservoir is authorized by the City's Certificate 10843, which authorizes storage of up to 800 AF. The City is typically able to fill the reservoir each year. Although the City considers this water right to be secure and the supply of stored water to be reliable, the amount of water stored under this water right is not sufficient to consistently meet all of the City's water demands. As a result, the City must also use water from its other supply sources.

Lost Creek Reservoir

The City holds two water rights that authorize use of up to a total of 1,000 AF of stored water from Lost Creek Reservoir. Certificate 96166 authorizes the use of up to 550.6 AF, and Permit S-54337 authorizes the use of up to 449.4 AF. Based on the final order approving an extension of time for Permit S-54337 to October 1, 2061, the City does not currently have access to water under the permit until OWRD approves an updated WMCP demonstrating the need for additional supply. The City has a contract with the U.S. Army Corps of Engineers for this storage space in the reservoir, which can create some uncertainty due to associated federal regulatory processes. Nonetheless, the stored water in Lost Creek Reservoir historically has been sufficient to meet the needs of water users with rights to use the stored water and has not been curtailed. Accordingly, for planning purposes, the City considers Lost Creek Reservoir to provide a reliable source of supply.

[7] The City's rights authorize the use of a total of 14.063 cfs, while the other downstream water rights authorize use of a total of 3.305 cfs.

The released stored water is diverted at the Lost Creek Dam, rediverted and treated at MW's WTP, and conveyed to the City via the TAP intertie. The City's portion of the TAP intertie capacity is 2.13 mgd, which allows the City to use 1,000 AF associated with Certificate 96166 and Permit S-54337 within the period of May through September (peak season).

In addition to relying on Lost Creek Reservoir to serve as an additional source of supply, Ashland also relies on Lost Creek Reservoir to serve as a redundant source of supply for use during events in which water from Reeder Reservoir and Ashland Creek is not available. Depending upon the timing of such events, such as during peak season, the City would require use of all 1,000 AF over the year.

Talent Irrigation District

The City has contracts with TID to receive 768 AF of water for domestic purposes. (This water use is authorized by TID's Certificate 79212.) The water provided under these contracts is delivered by TID to the City via the Ashland Canal. In addition, the City has a contract with the BOR to receive 600 AF of stored water from Howard Prairie Reservoir, which is delivered to the City by TID via the Ashland Canal. (This water use is authorized by BOR's Certificate 80462.) Historically, water from TID was available annually during peak season for the City's use. However, TID did not have enough supply to provide to Ashland in 2021 and 2022. For this reason, for planning purposes, the City will consider the water supply from TID to not provide a reliable source of water supply.

2.12 System Description

OAR 690-086-0140(8)

From Reeder Reservoir, Ashland relies on a 30-inch transmission pipeline to convey impounded water to the City's WTP. This pipeline was replaced in 2007. The WTP has a treatment capacity of 7.5 MG, which is adequate to meet the City's current needs; however, the City is in the planning stages of constructing a new, expandable WTP capable of meeting the City's future capacity needs and future regulatory requirements. Water is conveyed from the WTP to Crowson Reservoir, the initial point of distribution to the south end of the City's distribution system. This transmission line was also replaced in 2007.

According to the City's 2020 Water Master Plan (WMP)[8], the distribution system is composed of four reservoirs that provide 7.1 MG of treated water storage and 14 pressure zones served by four pump stations, 32 pressure-reducing valve (PRV) stations, and over 126 miles of distribution piping. Exhibit 2-2 shows a schematic of the major water system infrastructure of the City's system.

[8] RH2 Engineering. 2020. *Water Master Plan Update*.

3. Municipal Water Conservation Element

This section addresses the requirements of OAR 690-086-0150(1) – (6). This rule requires a report on progress toward meeting previous benchmarks, descriptions of specific required conservation measures and benchmarks, and additional conservation measures implemented by the City.

3.1 Introduction

The City's conservation program offers a wide array of services and incentives and performs extensive outreach and promotion in order to encourage customers to use water efficiently. Since one of the City's primary objectives is to motivate customers to reduce peak season use, Ashland provides numerous outdoor-focused measures, such as performing free water use evaluations at customers' sites. As an added incentive to manage peak season use, the City adopted a unique progressive seasonal water rate structure that adds a peak season tier on top of non-peak season tiers. Customers seeking ways to use water more efficiently indoors will find a variety of indoor-related services and incentives available, for example rebates on water efficient appliances. Ashland's comprehensive conservation program caters to all of the City's major customer types, with offerings for residential, multifamily, commercial, and institutional customers. The following Conservation Element describes the City's conservation program in detail.

As part of the development of the Conservation Element, the City convened and sought input from a Management Advisory Committee (MAC) composed of Ashland water customers and a representative from the Ashland City Council. The purpose of the MAC was to offer ways that the City could expand or enhance the City's existing customer-focused conservation program and identify and evaluate potential reclaimed water opportunities that the City could implement. The results of the MAC's work is described in a technical memorandum found in Appendix C. In summary, the MAC identified and prioritized 30 conservation measures and reviewed nine reuse projects, many of which are described herein.

In addition to customer-focused conservation measures, this Conservation Element describes the operational practices of the City. These practices, such as Ashland's water loss control program, promote the City's efficient use of water under its control.

This conservation plan was informed by several plans previously developed by the City, including the Water Conservation and Reuse Study[9], the Water Savings and Cost Effectiveness Analysis[10], and the Climate and Energy Action Plan[11]. Conducted in 2011, the Water Conservation and Reuse Study established water conservation measures and targets and served as the basis for the City's conservation efforts in the 2010s. The Water Savings and Cost Effectiveness Analysis conducted in 2018 evaluated the water savings impacts of various conservation measures. Many of the recommended measures were implemented by the City following this study and comprise the basis of the City's current conservation program. The Climate and Energy Action Plan, published in 2017, described opportunities for the City to

[9] Carollo Engineers. 2011. *City of Ashland Water Conservation and Reuse Study.* June 2011.

[10] Maddaus Water Management, Inc. 2018. *Water Savings and Cost-effectiveness Analysis.*

[11] City of Ashland. 2017. *Ashland Climate and Energy Action Plan.* March 2017.

reduce its carbon emissions in part through water conservation measures, including an expansion of conservation education and outreach, use of greywater and rainwater collection systems, and implementation of recommendations from the City's facility water audit. These measures continue to be important elements of the City's current conservation program and will be in the future, as described in this conservation plan, resulting in increased efficiency of water use.

3.2 Progress Report

OAR 690-086-0150(1)

The City's 2014 WMCP described the City's extensive water conservation program and set benchmarks for the water conservation measures required by the rule. The City's 2018 WMCP Progress Report provided an update on the City's progress toward meeting those benchmarks. In Exhibit 3-1, the City provides an update of progress since publication of its 2014 WMCP.

Exhibit 3-1. Progress Meeting 2013 Conservation Benchmarks

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Water Audit		
The City documents water production and consumption on a monthly basis to monitor the City's water demands. The City conducts an annual year water audit, comparing monthly system demand to plant production, as well as streamflow and reservoir storage. The City uses billings-based spreadsheet to estimate system leakage by comparing billed usage to plant production. The City of Ashland will improve its audit system to increase report accuracy. The City is developing procedures to account for valid unbilled water uses, to further reduce unaccounted for water rates, and better identify actual water losses due to leakage, as outlined in the American Water Works Association (AWWA) manual titled Water Audits and Leak Detection (M-36, AWWA 1990).	The City continues to document water production and consumption on a monthly basis to monitor the City's water demands. The City conducts an annual year water audit, comparing monthly system demand to plant production. The City had historically used billings-based spreadsheet to estimate system leakage by comparing billed usage to plant production. The City continues to work on improving the water audit process to increase report accuracy.	Continues to perform water audits annually and monthly. In 2019, the City updated its audit methodology to improve the accuracy of monthly water loss calculations. Now, the City adjusts monthly volumes of consumption to account for the delay in use at customers' sites and the dates when meters are read.
Metering		
The City is fully metered.	The City is fully metered.	The City is fully metered.
Meter Testing & Replacement		
The City's water meter maintenance and replacement program is focused on replacing mechanical meters with radio read meters. This approach yields the greatest conservation cost/benefit ratio. Water meters not recording within the manufacturer's specifications are repaired in the field or replaced as needed. For smaller meters, the City replaces meters that are determined to be inoperable by inspection as part of the meter reading process. Out of a total of 9,100 meters, about 1,200 radio read meters have been installed, and approximately $50,000 per year has budgeted for meter replacement. The City also maintains a number of source production meters to monitor treatment plant flows, as well as to verify TID supply and demand. At the water treatment plant, multiple redundant meters are installed and cross-checked to verify reasonable accuracy. Measurements are routinely compared to verify flows. TID flows are manually measured as weir structure readings made separately by City Staff and TID staff.	The City of Ashland continues to test and replace water meters that are deficient in order to minimize water loss. In addition, the City is planning to calibrate some of the larger meters within the system to ensure better demand accuracy. Radio read meters are installed to replace older analog meters when necessary.	Note: Identify if large meter calibration occurred per Column B. Continues to identify, test, and replace or replace water meters that are deficient in order to minimize water loss. Ceased installing meters fitted with radio read capabilities in response to community input.
Rate Structure		
The City's rate structure is based on the quantity of water consumed through metered connections and, therefore, encourages conservation. In addition, the rates are scheduled to be increased by 10% in 2014, and significant increases will continue annually until 2018. The City plans to conduct a cost of service rate study in the next couple of years.	The City's four-tier rate structure is based on the quantity of water consumed through metered connections and, therefore, encourages conservation. Additionally, there is a fifth tier that is implemented in the summer months, which encourages conservation as well as decreases peak usage. Rate increases have occurred each year since 2014. The City also completed a cost of service study in 2016 resulting in a higher base rate/customer charge for services to help cover fixed system costs.	Water rates continue to be based, in part, on the quantity of water consumed and include a four tier rate structure, with a fifth tier activated during the summer. Rates continue to be periodically increased based on cost-of-service studies.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Leak Detection Program		
The City monitors water audit results based on a 5-year running average. City policy is to begin leak detection measures if the average exceeds 10%. Based on the most recent Water Audit Report (February 2008), the current 5-year average is 8.4%. Visual leaks reported by the public or public works personnel are investigated. Leaks are repaired immediately.	Visual leaks reported by the public or public works personnel are investigated immediately and repaired. The City is currently below the state requirement of 10% or less water loss. If City water losses ever exceed the 10% or less requirement, then the City will take steps to create an additional leak detection program.	Visual leaks reported by the public or public works personnel are investigated immediately and repaired. The City is currently below the state requirement of 10% or less water loss. If City water losses ever exceed the 10% or less requirement, then the City will take steps to create an additional leak detection program.
Leak Repair		
Despite the fact that its system unaccounted-for (or nonrevenue) water percentage is less than 10%, the City currently is conducting various programs to reduce unaccounted-for water within the distribution system. These programs include small pipe replacement and meter assembly replacement. Numerous leaks have been identified and corrected through this program, which has been effective in reducing system water losses. Ashland also has a policy to adjust the leak portion of a customer's bill if the customer repairs the leak within 10 days after being notified of the leak. The program is designed to encourage customers to identify and repair leaks in a timely manner.	Current programs to minimize water loss include small pipe replacement and water meter assembly replacement when needed. Customers in the Ashland community are very aware of water issues and notify the city whenever there is the possibility of a leak within the system. The City of Ashland also continues the policy to adjust the leak portion of a customer's bill if the customer repairs the leak within 10 days after being notified of the leak. The program is designed to encourage customers to identify and repair leaks in a timely manner.	Current programs to minimize water loss include small pipe replacement and water meter assembly replacement when needed. Customers in the Ashland community are very aware of water issues and notify the city whenever there is the possibility of a leak within the system. The City of Ashland also continues the policy to adjust the leak portion of a customer's bill if the customer repairs the leak within 10 days after being notified of the leak. The program is designed to encourage customers to identify and repair leaks in a timely manner.
Pipe Replacement		
The City currently is conducting various programs to reduce unaccounted-for water within the distribution system. These programs include small pipe replacement and meter assembly replacement.	Pipe replacement is outlined in the City's Capital Improvement Projects and includes tracking the location and year of replacement. The Capital Improvement Projects are adopted as part of the budget process and approved by Council.	Pipe replacement is outlined in the City's Capital Improvement Projects and includes tracking the location and year of replacement. The Capital Improvement Projects are adopted as part of the budget process and approved by Council.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Public Education		
The City's conservation program includes a significant public education element. The Conservation Division spearheads a program that includes North Mountain Park Nature Center in its outreach. The center provides a wide variety of activities, including in-class presentations, videos, interactive games, and booths at various festivals to promote water conservation and water quality. The City's conservation analyst provides a display of conservation information and/or a related activity as well as program promotions. The conservation program will provide staff and materials as needed for events in general. The City's website contains seasonal conservation articles, indoor and outdoor conservation tips, instructions on how to water lawns 1 inch per week, a frequently asked questions (FAQ) section, a downloadable application for the reimbursement programs, and an information request form for materials regarding water conservation and water quality.Water conservation displays are set up at the Ashland Library and Public Works Building. These seasonal displays provide informational brochures depending on the time of the year. During peak water use periods, brochures on the reimbursement program and outdoor water conservation tips are available. During the wetter months, the conservation calendar and indoor conservation information are available. The conservation program has produced a utility bill insert to inform customers about the importance of water conservation throughout the summer.	The City's water conservation program continues to include a large public outreach and education component, which includes but is not limited to the following: • Water Wise Landscaping Website and Water Conservation Webpage• Online Watering Calculator and Watering Hotline• Articles written for the City Source newsletter and are delivered in monthly utility bills. Those listed on website are dated 2016 and 2017• Provide presentations to local schools, civic groups, and homeowners associations.• Regularly participate in community events, in particular staffing booths at Science Works on Earth Day and the Salmon Festival in the fall at North Mountain Park.• Handouts and brochures have been created and include the following: example watering schedules, indoor water use guide, tips for using water indoors and outdoors, how to read your water meter, graywater, rainwater catchment, drought, how to water trees, etc. Water conservation materials are available in displays at the Public Works & Community Development building as well as in City Hall and North Mountain Park. In the past 5 years, the City has advertised its programs in local newspapers, during television interviews, on the radio, multiple public presentations, K-12 and college-level school presentations. For the past 3 years, the City has also advertised its programs and resources before each movie that plays at two local movie theaters during the summer months.	Continue to lead a robust public education campaign that exceeds rule requirements. Since 2019, minor changes in the program reflect the impacts of COVID (e.g. fewer in-person opportunities), such as shifts in education program priorities. Examples of campaign offerings include the following: • Water Wise Landscaping Website and Water Conservation Webpage• Online Watering Calculator• Articles written for the City Source newsletter and are delivered in monthly utility bills and published online• Provide presentations to local schools, civic groups, trade associations, and homeowners associations.• Participated in community events, in particular staffing booths at Science Works on Earth Day and the Salmon Festival in the fall at North Mountain Park.• Handouts and brochures have been created and include the following: example watering schedules, indoor water use guide, tips for using water indoors and outdoors, how to read your water meter, graywater, rainwater catchment, drought, how to water trees etc. • Water conservation materials were made available in displays at the Public Works & Community Development building as well as in City Hall and North Mountain Park. • Program offerings advertised in local newspapers, before movies, during television interviews, on the radio, multiple public presentations, K-12 and college-level school presentations.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Technical and Financial Assistance		
The City provides technical assistance to residential and multi-family residential customers in a variety of ways to encourage and assist with implementing water conservation measures. This technical assistance is advertised in multiple ways and includes the following services: Indoor Water Analysis - to evaluate plumbing fixtures and giveaway showerheads, aerators and toilet leak tablets. Irrigation Analysis - Evaluations are offered during the summer months and consist of an assessment of the design, operation/management of sprinkler systems. Assistance with sprinkler controllers and watering schedules will also be provided. Landscape and irrigation plan reviews - for new commercial industrial and residential developments. The City's Water Conservation Analyst reviews and provides comments on landscape and irrigation plans submitted to the Planning Division. Direction for meeting water efficiency standards is provided through the plan review process and also directly to landscape designers.	The City will continue to provide technical assistance to residential and multi-residential customers, which comprise the majority of the City's water use. In the last 5 years, expanded technical assistance to commercial and institutional customers as well. Currently all customer categories are eligible for free evaluations, rebates and/or giveaways. Continue to work with trade allies to encourage production and installation of water efficient fixtures and products in accordance with Oregon's plumbing code regulations and the Oregon Landscape Contractors Board.• Irrigation Evaluations & Indoor Evaluations: Every year water conservation staff offer free irrigation system evaluations and indoor water use evaluations for all Ashland customers. Evaluations are offered during the summer months and consist of an assessment of the design, operation/management of sprinkler systems. Assistance with programming sprinkler controllers and developing watering schedules is also provided.• Indoor Water Evaluation - evaluate water use on indoor plumbing fixtures; look for leaks and giveaway showerheads, aerators and toilet leak tablets.	Continue to provide technical assistance to residential and multi-residential customers, which comprise the majority of the City's water use. In the last 5 years, expanded the program to include providing technical assistance to commercial and institutional customers as well. Currently, all customer categories are eligible for free evaluations, rebates and/or giveaways. Continue to work with trade allies to encourage production and installation of water efficient fixtures and products in accordance with Oregon's plumbing code regulations and the Oregon Landscape Contractors Board.• Irrigation Evaluations & Indoor Evaluations: Every year water conservation staff offer free irrigation system evaluations and indoor water use evaluations for all Ashland customers. Evaluations are offered during the summer months and consist of an assessment of the design, operation/management of sprinkler systems. Assistance with programming sprinkler controllers and developing watering schedules is also provided.• Indoor Water Evaluation - evaluate water use on indoor plumbing fixtures; look for leaks and giveaway showerheads, aerators and toilet leak tablets.
Additional Programs		
Additional Programs: • Water Wise Landscaping Website • Watering Hotline • Water Conservation Web Page • Landscaping and Irrigation Plan Review • Earth Advantage Home Review • Brochures on selecting a landscape and/or irrigation systems • Articles are written for the City's newsletter, and the annual Water Quality Report	Giveaways - Regularly give away low-flow aerators for bathroom and kitchen sinks, low-flow shower heads and soil moisture meters. Water Wise Landscaping Website - www.ashlandsaveswater.org The Water Wise Landscaping website is designed to inspire the creation of landscapes that incorporate native species and other water wise plants that are not only attractive, but are capable of using less water than traditional lawns. It serves as a virtual demonstration garden that showcases examples from local residents as well as provides useful information and resources on water efficient gardening concepts.	Giveaways - Regularly give away low-flow aerators for bathroom and kitchen sinks, low-flow shower heads and soil moisture meters. Water Wise Landscaping Website - www.ashlandsaveswater.org. The Water Wise Landscaping website is designed to inspire the creation of landscapes that incorporate native species and other water wise plants that are not only attractive, but are capable of using less water than traditional lawns. It serves as a virtual demonstration garden that showcases examples from local residents as well as provides useful information and resources on water efficient gardening concepts.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
The City will provide other technical and financial assistance programs in the future • Continue irrigation and indoor water audit program, expand to commercial and industrial • Add live weather data transmitted from a nearby weather station to the City website • Enhance the Water-Wise Landscaping website by adding more features • Develop a water use calculator for customers to evaluate their own water use. • Implement a "Smart" irrigation controller incentive program • Add the weekly watering hotline to the City's Conservation Division webpage. • Add a sample water schedule, water savings tips for outdoors and indoors	**The City has added the following technical and financial assistance programs** • Expanded the indoor and outdoor water evaluations to commercial and institutional • Added live weather data transmitted from a nearby weather station to the City website • Enhanced the Water-Wise Landscaping website by adding more features • Developed a water use calculator for customers to evaluate their own water use. • Added the weekly watering hotline - phone recording • Added a sample water schedule, water savings tips for outdoors and indoors • Created a Facebook page for Water Conservation	**Added the following technical and financial assistance programs** • Expanded the indoor and outdoor water evaluations to commercial and institutional • Added live weather data transmitted from a nearby weather station to the City website • Enhanced the Water-Wise Landscaping website by adding more features • Developed a water use calculator for customers to evaluate their own water use. • Added a sample water schedule, water savings tips for outdoors and indoors • Created a Facebook page for Water Conservation
	Landscape and irrigation plan reviews - for new commercial industrial and residential developments. The City's Water Conservation Analyst reviews and provides comments on landscape and irrigation plans submitted to the Planning Division. Direction for meeting water efficiency standards is provided through the plan review process and also directly to landscape designers.	Landscape and irrigation plan reviews - for new commercial industrial and residential developments. The City's Water Conservation Analyst reviews and provides comments on landscape and irrigation plans submitted to the Planning Division. Direction for meeting water efficiency standards is provided through the plan review process and also directly to landscape designers.
	Additional Technical Resources: • Water conservation website www.ashland.or.us/conserve • Provide information and resources for customers on efficient landscape practices, local landscape contractors information, and guidance on plant watering needs and installing irrigation systems. Present this material at local garden clubs, landscape associations and master gardener conferences.	Additional Technical Resources: • Water conservation website www.ashland.or.us/conserve • Provide information and resources for customers on efficient landscape practices, local landscape contractors information, and guidance on plant watering needs and installing irrigation systems. Present this material at local garden clubs, landscape associations and master gardener conferences.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Rebates for Replacement of Inefficient Fixtures		
Washing Machine Rebates are given to customers who purchase ENERGY STAR labeled clothes washers. These machines use up to 40% less water and up to 50% less energy. Clothes washers qualify for up to $80 City rebate if the home has an electric water heater and $50 if the home has a gas water heater. Dishwasher RebatesRebates of $25 are given to customers who purchase an ENERGY STAR labeled dishwashers. These models use up to 30% less water than standard models.Toilet Rebates are given to customers who replace existing (3.0 gallons per flush or greater) with Water Sense labeled, 1.28 gallons per flush or less: $75 for the first toilet, $60 for the second and $50 for the third all located in the same house or business. Rebates are also given to customers who replace existing (1.6 gallons per flush) with Water Sense labeled, 1.28 gallons per flush or less: $35 for the first toilet, $25 for the second and $15 for the third all located in the same house or business. These rebates can even apply to new construction. The City may implement or consider the following for future programs: • A turf replacement program or incentives for new water-efficient landscapes• A weather based irrigation controller incentive program is currently being reviewed• Hotel and motel incentives on toilets, showerheads and bathroom aerators.• Restaurant incentives for commercial kitchen appliances such as air-cooled ice machines.	The City of Ashland will continue with the current appliance rebates for replacement of inefficient toilets and washing machines provided a cost benefit analysis confirms the effectiveness of the program. The dishwasher rebate was discontinued to free up the budget for other more cost effective programs. Additionally, retailers are almost exclusively selling Energy Star Dishwashers. **Toilet Rebates** -Continue to offer rebates for replacing older toilets with more efficientWaterSense labeled toilets. **Washing Machines** - Offer rebates for replacing older washing machines with more efficient Energy Star washers. **Lawn Replacement Program Rebate** - for new water-efficient landscapes - Customers can apply for a rebate for the removal of live, maintained and irrigated lawn that is replaced with climate appropriate, low-water use landscape and efficient irrigation systems. Incentive Amounts: $1.25 per square foot (sq. ft.) for the first 1,000 sq. ft., $1.00 per sq. ft. up to 2,000 sq. ft. and $0.75 per sq. ft. up to 3,000 sq. ft. Projects of more than 3,000 sq. ft. will be considered on a case-by-case basis. www.ashland.or.us/lrp **Giveaways** - Regularly give away 1.0 gpm low-flow aerators for bathroom and kitchen sinks, low flow showerheads (1.5 gpm) and soil moisture meters at home evaluations. Customers are also able to pick these items up at the City's office. City has advertised in the monthly newsletter and many customers take advantage of these free devices and fixtures. The City has expanded its programs to include commercial customers including schools and businesses. The City has also expanded its programs to include restaurant incentives for commercial kitchen appliances such as air-cooled ice machines and pre-rinse spray valves. The City is currently exploring a commercial washing machine rebate, a smart controller rebate and a pressure reducing valve rebate as well.	Continue with the current appliance rebates for replacement of inefficient toilets and washing machines provided a cost benefit analysis confirms the effectiveness of the program. The dishwasher rebate was discontinued to free up the budget for other more cost effective programs. Additionally, retailers are almost exclusively selling Energy Star Dishwashers. **Toilet Rebates** -Continues to offer rebates for replacing older toilets with more efficientWaterSense labeled toilets. **Washing Machines** - Offers rebates for replacing older washing machines with more efficient Energy Star washers. **Lawn Replacement Program Rebate** - for new water-efficient landscapes - Customers can apply for a rebate for the removal of live, maintained and irrigated lawn that is replaced with climate appropriate, low-water use landscape and efficient irrigation systems. Incentive Amounts: $1.25 per sq. ft. for the first 1,000 sq. ft., $1.00 per sq. ft. up to 2,000 sq. ft. and $0.75 per sq. ft. up to 3,000 sq. ft. Projects of more than 3,000 sq. ft. will be considered on a case-by-case basis. www.ashland.or.us/lrp **Smart Irrigation Controller Rebate--**The City offers a smart irrigation controller rebate of up to $250. **Giveaways** - Regularly giveaway 1.0 gpm low-flow aerators for bathroom and kitchen sinks, low-flow showerheads (1.5 gpm) and soil moisture meters during home evaluations. Customers are also able to pick these items up at the City office. Advertise in the monthly newsletter and many customers take advantage of these free devices and fixtures. The City has expanded its programs to include commercial customers including schools and businesses. the City has also expanded its programs to include restaurant incentives for commercial kitchen appliances such as air-cooled ice machines and pre-rinse spray valves. Exploring a commercial washing machine rebate, a smart controller rebate and a pressure-reducing valve rebate as well.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Reuse, Recycling, and Non-potable Water Opportunities		
The City uses reclaimed water for landscape irrigation at the wastewater treatment plant. The City has extensively investigated using reclaimed water for other uses, but DEQ has been resistant to permit this use of reclaimed water because of its need to meet in-streamflows during the peak irrigation season. The availability of TID has been limited by proximity to the canal, as well as water availability, but the City has embarked on a program to pipe its portion of the TID canal, which will reduce evaporation and seepage losses as well as allow for more efficient means of piping TID water greater distances. Capital Improvements Projects planned for the next 5 years include piping TID canals to serve irrigation water to more residents within the City. In response to public interest, the City has also developed information about grey-water and rainwater catchment systems. A water use evaluation guide will be offered to help customers determine how much graywater they produce using plumbing fixtures such as showers and washing machines.	Irrigation Water - "Right Water Right Use" The City will continue to replace potable water irrigation with TID irrigation water, where feasible. The City is also considering piping a 2-mile portion of the TID canal, which will reduce evaporation and seepage losses as well as improve water quality. The project is currently in the public input process and a report to council is scheduled in April 2019. Graywater System Education - In response to public interest, the City has also developed information about graywater and rainwater catchment systems. A water use evaluation guide is now offered to help customers determine how much graywater they produce using plumbing fixtures such as showers and washing machines. The City has offered four workshops in the past 2 years on graywater and rainwater catchment. The City plans to continue to offer workshops in the future. More information can be found at www.ashland.or.us/graywater.	•Continue to provide non-potable water from TID to customers when available for irrigation use, though the City no longer promotes the replacement of potable water with TID irrigation water due to the unavailability of TID water in some years. •Canal piping is no longer being considered by the City for the reason noted above. •Additional workshops on the topic of graywater and rainwater catchment have not been held.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Other Measures		
1) Shave Peak Period Consumption Target: Residential Turf Watering-Utilize Incentive-based Water Rates: Provide an economic incentive to reduce water consumption. Current water rates are based on the costs of treatment and maintenance of the system. These rates do not reflect the cost of new supplies. When water demand begins to approach the available supply for an agency, modifying water rates closer to the cost of new water supplies is indicated. Higher rates, and rates that provide signals to decrease certain types of peak usage can be very effective in providing conservation rates in the summer season, when water consumption is high due to landscape irrigation encourages conservation. The program recommends rate modifications for all sectors.	A Lawn Replacement Program- for new water-efficient landscapes - Customers can apply for a rebate for the removal of live, maintained and irrigated lawn that is replaced with climate appropriate, low-water use landscape and efficient irrigation systems. Incentive Amounts: $1.25 per sq. ft. for the first 1,000 sq. ft., $1.00 per sq. ft. up to 2,000 sq. ft. and $0.75 per sq. ft. up to 3,000 sq. ft. Projects of more than 3,000 sq. ft. will be considered on a case-by-case basis. www.ashland.or.us/lrp Irrigation Evaluations - Every year water conservation staff offer free irrigation system evaluations for all Ashland customers. Evaluations are offered during the summer months and consist of an assessment of the design, operation/management of sprinkler systems. Assistance with programming sprinkler controllers and developing watering schedules.	Retain text in Column B with this modification: •City now offers a smart irrigation controller rebate of up to $250.
Public Information and Education: The City will continue sponsoring events and will explore opportunities to provide additional customer services, both among customers and in schools, to encourage water conservation. **The City may implement the following to educate the public on water efficiency:** • Continue to enhance the City's Conservation Division webpage.• Presenting to local schools to educate students• Future outreach efforts will also include internal education.• Send out high-use letters to highest water users.• Continue to participate in events such as Earth Day and the Spring Garden Fair.• Increase outreach to developers and builders to encourage water efficient development practices, particularly with landscape designs. **Target: Summer Water Use of Largest Non-residential Consumers** The target audience is the City's largest customers. Depending on the intensity of the audit, either City staff volunteer or an engineering consultant would conduct the audits. Large Customer Audit: Provide water audits to provide suggested measure for more efficient water usage among the largest customers. These large customers are all non-residential and include the City itself, Southern Oregon University, and several large hotels and apartments. A consumer visit and brief audit, or an extensive inspection and analysis of water using processes, can determine process or operational changes that may be more water efficient, or suggest implementation of measures that lead to more efficient use of water. Irrigation audits can provide landscape managers with information for more effective water usage.	Website: Continue to enhance the website by adding more information and resources including a watering schedule based on type of sprinklers being used, tips for saving water indoors and outdoors, a water use evaluation guide, a link to live weather data, graywater use and rainwater catchment as well as current program information. School Presentations: Offers presentations to local schools K-12 and college level to educate students about where the City of Ashland's water comes from and why it is important to use water resources wisely. Staff regularly partners with North Mountain Park to give classes, tours and presentations and provide educational materials to their volunteer instructors. Internal Outreach Efforts: Continue communication with staff and public officials within other departments to educate and encourage implementation of water-efficient guidelines within development standards. Specifically, conservation staff are working with the Parks Department on a sprinkler replacement pilot project for City owned irrigated properties. Outreach to developers and Builders: As a partner with EPA WaterSense program, the City of Ashland will promote WaterSense products, including improving awareness of these products through newsletters, the website, and working closely with developers and builders. Current landscape regulations require some water efficiency measures.High use customers: Offer indoor and outdoor water evaluations to high-use customers. Working closely with Southern Oregon University, the local School district, the hospital, several hotel and motels and Home Owners Associations. Provide rebate forms and other educational materials as needed and monitor water usage before and after implementing any changes to verify water savings.	Website: Continue to enhance the website by adding more information and resources, including a watering schedule based on type of sprinklers being used, tips for saving water indoors and outdoors, a water use evaluation guide, graywater use and rainwater catchment as well as current program information. School Presentations: Offering presentations to local schools K-12 and college level to educate students about where the City of Ashland's water comes from and why it is important to use water resources wisely. Staff regularly partners with North Mountain Park to give classes, tours and presentations and provide educational materials to their volunteer instructors. Internal Outreach Efforts: Continue communication with staff and public officials within other departments to educate and encourage implementation of water-efficient guidelines within development standards. Specifically, working with the Parks Department on a sprinkler replacement pilot project for City owned irrigated properties. Outreach to developers and Builders: As a partner with EPA WaterSense program, the City of Ashland will promote WaterSense products, including improving awareness of these products through newsletters, the website, and working closely with developers and builders. Current landscape regulations require some water efficiency measures. High use customers: offer indoor and outdoor water evaluations to high-use customers. Working closely with Southern Oregon University, the local School district, the hospital, several hotel and motels and Home Owners Associations. Provide rebate forms and other educational materials as needed and monitor water usage before and after implementing any changes to verify water savings.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Other Measures		
Target: Commercial and Residential Baseload Use Showerhead Kit Retrofit: Encourage conservation by providing households with an inexpensive set of measures that reduce leakage and usage in the home. In this program, the City provides door-to-door drop-off or optional audit and installation of a set of three conservation devices, including: (1) a toilet leak detection tablet; (2) 1.5-gallon per minute showerhead; and (3) 1.0 gpm faucet aerator. These measures are very cost effective and yield significant water conservation benefits. This program is targeted for the residential sector.	Giveaways - Regularly giveaway 1.0 gpm low-flow aerators for bathroom and kitchen sinks, low- flow showerheads (1.5 gpm) and soil moisture meters at home evaluations. Customers are also able to pick these items up at the City office. Advertise in the monthly newsletter and many customers take advantage of these free devices and fixtures. Giveaway toilet dye tablets for customers to check their toilets for leaks, sponges, stickers and other water conservation related materials.	Giveaways - Regularly giveaway 1.0 gpm low-flow aerators for bathroom and kitchen sinks, low- flow showerheads (1.5 gpm) and soil moisture meters at home evaluations. Customers are also able to pick these items up at the City office. Advertise in the monthly newsletter and many customers take advantage of these free devices and fixtures. Also, giveaway toilet dye tablets for customers to check their toilets for leaks, sponges, stickers and other water conservation related materials.
Landscape Regulation: Revise Ashland's current landscaping regulations to significantly reduce the water use of most landscapes.Landscaping plans are required for new apartment, commercial, and industrial developments. While the City encourages saving water, current regulations do not require water efficiency in plant selection or irrigation systems. Significant reductions in water usage can nevertheless be achieved through voluntary utilization of principles such as good landscape planning and design; limiting turf areas; use of low-water use plants to reduce transpiration; efficient irrigation systems and scheduling; soil improvement where necessary; use of mulches to reduce evaporation; and appropriate maintenance.	Landscape Regulation: Continue to work with the Planning Department to develop landscaping regulations that will reduce water use on most landscapes. Currently, provide helpful resources and information to customers and developers on water efficient irrigation system practices and climate appropriate plantings. Landscape and irrigation plan review: for new commercial industrial and residential developments. The City's Water Conservation Specialist reviews and provides comments on landscape and irrigation plans submitted to the Planning Division. Direction for meeting water efficiency standards is provided through the plan review process and also directly to landscape designers.	Landscape Regulation: Provide helpful resources and information to customers and developers on water efficient irrigation system practices and climate appropriate plantings.Landscape and irrigation plan review: for new commercial industrial and residential developments. The City's Water Conservation Specialist reviews and provides comments on landscape and irrigation plans submitted to the Planning Division. Direction for meeting water efficiency standards is provided through the plan review process and also directly to landscape designers.
Acquisition of Water Rights: Investigate extending the City's access to TID water to relieve the municipal water system's summertime residential irrigation load. The City currently has water rights for 1,400 AF of water per year from the TID. Ashland has over 2,000 households that irrigate with TID water delivered through a series of ditches. However, new subdivisions have not been permitted to extend this system. This source could provide significant relief from City resources during the summertime residential irrigation loads. The City can lobby for extending access to this water for subdivisions; purchasing land with existing TID allocations before the land is subdivided; or investigates the possibility of purchasing TID allotments alone without the land. In addition, this water may be able to be diverted to the water treatment plant when it is needed in severe droughts. This program will be targeted at residential and non-residential customers with TID allotments.	Acquisition of Water Rights: The City continues to acquire municipal water rights. In addition to the TID water rights, the City has also acquired several water right transfers along Ashland Creek. Irrigation Water - "Right Water Right Use" The City will continue to replace potable water irrigation with TID irrigation water where feasible. The City is also considering piping a 2-mile portion of the TID canal, which will reduce evaporation and seepage losses as well as improve water quality. The project is currently in the public input process and a report to council is scheduled in April 2019.	Acquisition of Water Rights: No additional water rights were acquired since the 2019 WMCP progress report. Irrigation Water--Canal piping is no longer being considered by the City and no longer promotes the replacement of potable water with TID irrigation water due to the unavailability of TID water in some years.
Density Bonus: Ashland's current density bonus allows additional houses or apartments if the design meets water and energy efficiency criteria to allow additional units only if the design meets both energy and water conservation criteria. Since 1980, Ashland has included a density bonus for energy efficient housing. This program offers a 15% increase in the number of houses or apartments permitted by the zoning code if the housing is designed to exceed building code minimums. Under this program, the City would tie the density bonus to both energy and water efficiency. System Development Charge rebates would also be available to new buildings meeting water efficiency standards. The new housing constructed would be required to exceed state code in energy and water efficiency, and install low-water use landscaping.	Density Bonus: Continue to offer the density bonus where applicable - Ashland's current density bonus that allows additional houses or apartments if the design meets water and energy efficiency criteria to allow additional units only if the design meets both energy and water conservation criteria. Since 1980, Ashland has included a density bonus for energy efficient housing. This program offers a 15% increase in the number of houses or apartments permitted by the zoning code if the housing is designed to exceed building code minimums. Under this program, the City would tie the density bonus to both energy and water efficiency.	Density Bonus: Continue to offer the density bonus where applicable - Ashland's current density bonus that allows additional houses or apartments if the design meets water and energy efficiency criteria to allow additional units only if the design meets both energy and water conservation criteria. Since 1980, Ashland has included a density bonus for energy efficient housing. This program offers a 15% increase in the number of houses or apartments permitted by the zoning code if the housing is designed to exceed building code minimums. Under this program, the City would tie the density bonus to both energy and water efficiency.

2014 Benchmarks	Benchmark Progress 2014-2019	Benchmark Progress 2018-2023
Other Measures		
2.) Reduce Base load ConsumptionTarget Unaccounted-for- Water in City SystemSystem leak detection and repair: Reduce system losses through investigation and mitigation of system leaks and other measures.To reduce the amount of Unaccounted-for-Water and to make more efficient use of water production, the City can investigate the feasibility of undertaking a program to reduce system leaks. Recommended actions include: calibrating water treatment plant flow meter; continued monitoring of municipal uses of water (street washing and fire department uses); setting up a meter testing program for meters larger than one inch; monitoring Unaccounted-for-Water annually through a system audit; minimizing overflows at the Granite Street Reservoir, and documenting/metering the overflows; obtaining estimates for a leak detection survey prioritizing and implementing recommendations from the survey.	Target Unaccounted-for-Water in City System leak detection and repair: Continue to reduce system losses through investigation and mitigation of system leaks and other measures.Ongoing: To reduce the amount of Unaccounted-for-Water and to make more efficient use of water production, the City can investigate the feasibility of undertaking a program to reduce system leaks. Recommended actions include: calibrating water treatment plant flow meter; continued monitoring of municipal uses of water (street washing and fire department uses); setting up a meter testing program for meters larger than one inch; monitoring Unaccounted-for-Water annually through a system audit; minimizing overflows at the Granite Street Reservoir, and documenting/metering the overflows; obtaining estimates for a leak detection survey prioritizing and implementing recommendations from the survey.	Target Unaccounted-for-Water in City System leak detection and repair: continue to reduce system losses through investigation and mitigation of system leaks and other measures. Ongoing: To reduce the amount of Unaccounted-for- Water and to make more efficient use of water production, the City can investigate the feasibility of undertaking a program to reduce system leaks. Recommended actions include: calibrating water treatment plant flow meter; continued monitoring of municipal uses of water (street washing and fire department uses); setting up a meter testing program for meters larger than one inch; monitoring Unaccounted-for-Water annually through a system audit; minimizing overflows at the Granite Street Reservoir, and documenting/metering the overflows; obtaining estimates for a leak detection survey prioritizing and implementing recommendations from the survey.

3.3 Use and Reporting Program

OAR 690-086-0150(2)

The City's water measurement and reporting program complies with the measurement standards in OAR Chapter 690, Division 85. Source master meters are installed at the WTP and the TAP intertie and are owned and operated by the City. Volumes diverted from Rogue River under the City's storage rights are measured by meters owned and operated by MW at MW's WTP at the point of re-diversion. These master meters read and record the volumes of water produced every 24 hours. Based on these records, the City submits an annual water use report to the Department documenting the total amount of water produced from each source. These reports are submitted electronically to the Department by December 31 for the water year. The City's water use records can be found at http://apps2.wrd.state.or.us/apps/wr/wateruse_report/.

3.4 Required Conservation Measures

OAR 690-086-0150(4)(a-f)

OAR 690-086-150(4) requires that all water suppliers establish 5-year benchmarks for implementing the following water management and conservation measures:

- Annual water audit
- System-wide metering
- Meter testing and maintenance
- Water rate structure
- Water loss analysis
- Public education

During the next 5 years, the City plans to initiate, continue, or expand the following conservation measures that are required of all municipalities.

3.4.1 Annual Water Audit

A water audit is an analysis of the water system that includes a thorough accounting of all water entering and leaving the system. One of the primary purposes of an audit is to identify volumes of water loss. A water audit also enables analysis of the water supplier's own water use.

Ashland's methodology of estimating annual water losses and the inputs used by the City for its audits are described in Section 2.8. As noted in Section 2, the City's average historical water audits documented annual losses below the target of 10 percent established by OWRD's administrative rules except for 2022. The City's 2022 water loss was higher than normal because of a large leak that the City discovered after a multi-month search. The leak was promptly repaired in 2023. Due to the leak, the City's 2023 water loss estimate should be elevated as well compared to the historical average, but is anticipated to return to 10 percent or less for the 2024 audit and annually thereafter.

The City uses a systematic methodology to calculate water loss by subtracting metered and authorized, unmetered consumption from demand. Authorized, unmetered consumption includes estimates of system flushing, street sweeping, jet-rodding, and fire department use.

The City obtains metered consumption volumes from reports generated from its utility billing system. The reported quantities describe water that was consumed 2 months prior to the month identified on these reports due to a time lag between actual consumption, meter reads, and input of data into the City's utility billing system. To mitigate for this lag, the City adjusts these reports to align the date of actual consumption and diversion. These adjustments improve the accuracies of the City's monthly and annual water loss estimates. Metered water use volumes also include bulk water sales.

The rule requires an analysis of the City's own water use to identify alternatives to increase efficiency. As a result, the City has reduced its own use of water. The City initiated a facilities-wide audit intended to assess the water efficiency of each City-managed property, including, but not limited to parks. Though this project was not completed, the City identified and performed some improvements as a result of the audit, such as replacing 850 sq. ft. of turf with artificial turf in a median strip and replacing all median strip irrigation spray heads with more efficient models that reduced overspray and resulted in a more efficient application.

Five-Year Benchmarks

- Continue to conduct annual water audits.
- Within the next 5 years, resume facilities water audits as resources allow and, upon completion, seek to modify practices to reduce water use based on the audit results.

3.4.2 System-wide Metering

All water connections are fully metered and the City installs meters for all new water connections.

Five-Year Benchmark

- Continue to require existing water system connections remain metered and new customer water connections are metered.

3.4.3 Meter Testing and Maintenance

Ashland periodically tests the accuracy of its master meters located at its WTP and along the TAP intertie. The meters at the WTP were tested and calibrated in 2017. The TAP intertie master meters are relatively new and have not been tested since installation in 2014 and 2016. The City intends to establish a master meter-testing program to ensure periodic meter testing.

The City can test the accuracy of service meters when the City suspects failure or upon customer request. Meters that are found to be out of specification, defined as registering beyond +/- 5 percent of manufacturers' standard, are repaired or replaced. The City is alerted to failing meters through its utility billing system when water use is unusually low relative to historical usage.

Five-Year Benchmarks

- Establish a 5-year testing program for master meters by 2025 and begin testing these meters in

2026. Master meters will be recalibrated, repaired, or replaced as needed.

- Continue to repair or replace service meters upon failure.

3.4.4 Water Rate Structure

In addition to a water charge based on meter size and a charge for service, the City charges for the quantity of water metered using a progressive, tiered rate structure. All customers except for those in the Government and Municipal categories have multiple tiers. The rates for each successive tier are progressive, that is, are higher than the rates associated with the next lowest tier. These rates increase per tier as metered consumption increases.

For residential customers, the number of tiers depends upon the season: from October to May, four tiers are applied to usage and a fifth tier is applied to the period June through September (peak season). The rate structure for residential irrigation and commercial and institutional irrigation customers is similar, but only includes three tiers during non-peak season and adds a fourth during peak season. For the commercial and institutional irrigation customers, the City uses one tier during non-peak season and adds a second tier during peak season. Two tiers are applied to commercial customers' use, regardless of the season. Water rates are provided in Appendix D. The City anticipates that future rate increases will apply to all tiers except the first tier, creating a more pronounced price signal to customers in the higher tiers and providing further incentive for customers to efficiently use water.

The City reads and bills customers monthly. This frequency affords its customers timely opportunities to modify consumption in response to consumption provided on water utility bills.

Five-Year Benchmark

- Continue to bill customers based, in part, on the volume of water consumed and on a monthly basis.

3.4.5 Water Loss Analysis

This rule requires that a municipal water provider must compare their water loss estimates as calculated through their annual water audit to an established water loss threshold of 10 percent. If water loss exceeds this 10 percent threshold, the provider must provide a description and analysis in the provider's WMCP identifying potential factors for the loss and selected actions for remedy within 2 years of the approval of a WMCP. The City's water audit revealed water loss in 2022 that was greater than 10 percent, therefore this rule applies to the City.

The rule further states that if the provider's actions do not result in the reduction of water losses to 10 percent or less within 5 years of approval of the WMCP, the water supplier shall develop and implement a regularly scheduled and systematic program to detect and repair leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the provider or a line replacement program detailing the size and length of pipe to be replaced each year; or, develop and implement a water loss control program consistent with AWWA's standards.

The City's historical water losses have been less than 10 percent since at least 2003, as noted in the City's 2014 WMCP, except for 2022 due to a large leak that took the City several months to locate

(leaking water was flowing into Ashland Creek). The City anticipates that its annual water loss estimate will drop below 10 percent for the 2024 audit. If its water losses continue to exceed 10 percent by 2025, the City will meet the rule requirement by performing an analysis of potential factors for losses and report this to OWRD within 2 years of issuance of a final order approving this WMCP. Ongoing losses above 10 percent after 5 years of final order issuance will require the City to implement one of the three measures required in the rule.

Five-Year Benchmark

- If losses continue to exceed 10 percent in 2024, the City will perform a water loss analysis and inform OWRD of the results within 2 years of issuance of a final order approving this WMCP.

3.4.6 Public Education

Ashland's education program includes a wide range of measures that offer methods for customers to use water efficiently indoors and outdoors. The City highlights several of these measures below and provides the full list of measures and descriptions in Appendix E:

- **Web presence:** The City's webpages provide a range of indoor and outdoor water conservation information, such as water-wise landscaping techniques and irrigation practices. The City also uses its website to promote its financial incentives and inform customers of available technical services.
- **Printed materials:** Ashland publishes newsletters and brochures for distribution to customers in water bills and at events and at public displays at the City's Public Works & Community Development building, City Hall, and North Mountain Park Nature Center. Topics covered in these printed materials include watering methods and schedules, indoor water use guide, tips for using water indoors and outdoors, methods to read water meters, graywater, rainwater catchment, and drought response.
- **In-person outreach:** Public and private events provide an opportunity for the City to directly engage with customers. Employees staff booths with conservation displays and provide opportunities to distribute water efficient devices (e.g., faucet aerators) and answer questions about conservation. Examples of events attended by the City include Science Works on Earth Day and the Salmon Festival. The City also has presented water conservation topics to trade organizations, including the Southern Oregon Landscape Contractors Board and Rogue Valley Association of Realtors; homeowners' associations; and student bodies at local schools.

  The City provides water use history to new homeowners upon request. This service highlights the importance of efficient water use to potentially new customers and affords the City an opportunity to engage in conversations with customers about efficient water use.
- **Partnerships:** Ashland partners with other organizations to promote conservation. For example, the City provides material to the Ashland Climate Collaborative, a grassroots civic organization that publishes a newsletter promoting water conservation in collaboration with the City. As another example, Ashland and MW organize and provide water conservation-related presentations to landscape contractors at the monthly Southern Oregon Landscape Association for which contractors can receive Continuing Education Units.

- **Other:** Other promotional activities include purchasing advertisements in local print and on-air media and movie ads at movie theaters.

In response to the COVID pandemic and staffing resource shortages, the City postponed some public education programming. The City intends to add the following measures back into its public education program and expand these efforts over time per measures identified during meetings with the MAC. Within the next 2 years, the City intends to:

- Expand the "Kids Conservation Corner" on the City's website to include additional content appropriate for school age children.
- Improve web access to information on fire adaptive landscaping offered on the City's website.
- On the City's conservation webpage, cross-reference fire adaptive landscaping information as found on www.fireadaptedashland.org.
- Increase social media presence by using the City's social media outlets to further promote conservation.
- Reinstate the City's utility bill conservation newsletter.

Over the next 5 years, the City intends to:

- Expand smart controller education in order to increase the impact of the City's existing rebate program in order to help reduce peak season use.
- Further align outreach efforts with respect to messaging of fire adaptive landscaping and water conservation landscaping techniques.
- Request high school students assist in conservation outreach and education to elementary aged students.
- Identify ways the City can connect with customers on the topic of conservation in places where these customers interact with the City, such as during the permitting process and other city transactions.
- Re-initiate classroom presentations and tours to students of the watershed, both of which were put on hold during the COVID pandemic.
- Incorporate water conservation concepts into fire hardening measures and other environmental programs (e.g. climate change)

Five-Year Benchmarks

- Maintain the existing level of public education programming as described, with modifications to the program over time to accommodate shifts in priorities and available resources.
- Re-instate or expand the City's public education program over the next 5 years as described.

3.5 Additional Conservation Measures

OAR 690-086-0150(5)(a-e)

OAR 690-086-0150(5) requires municipal water suppliers that serve a population of more than 1,000 and propose to expand or initiate the diversion of water under an extended permit for which resource issues have been identified, or if the population served is more than 7,500, to provide a description of the specific activities, along with a 5-year schedule to implement several additional conservation measures. In 2022, the City served a population of over 7,500; therefore, the City is required to implement the following additional conservation measures.

3.5.1 Technical and Financial Assistance Programs

The City's conservation program offers a variety of technical and financial assistance. Technical assistance measures that promote water conservation include the following existing services, many of which are highlighted on the City's website:

- Websites hosted by the City and the Conservation Collaborative provide a variety of water-wise landscaping techniques. Examples include a weekly lawn irrigation schedule based on average historical weather conditions along with example calculations of water needs of plants using an evapotranspiration (ET) formula, tree watering guidelines, and a watering calculator, which offers recommended settings for automatic irrigation controllers. The website also focuses on indoor water efficiency. For example, the website describes how customers can conduct self-audits of indoor water use, how to fix leaks, and water-efficient tips, such as running full loads of laundry.
- Brochures and guidebooks on selecting a landscape and/or irrigation systems, tree watering guide, water meter reading guide, and commercial kitchen efficient water use guide.
- On-site irrigation system evaluations for residential (i.e. single family and homeowners associations), multifamily, and commercial customers conducted by the City. Evaluations are offered during the summer months and consist of a comprehensive assessment of the design, operation, and management of sprinkler systems. Assistance with sprinkler controllers and watering schedules is provided. A brief report outlining general evaluation observations and suggestions for future use is mailed following the evaluation.
- On-site home water use evaluation of the efficiency of residential and commercial plumbing fixtures at customers' homes and businesses. These evaluations are conducted by the City, and include replacement of showerheads, faucet aerators, and additional tools to reduce water use, as needed.
- The annual Water Quality Report frequently includes irrigation tips because the report is distributed near the beginning of the irrigation season.
- Information on installing residential greywater systems and building rainwater catchment systems.
- Water auditing services are offered by the City to commercial and institutional customers, such as hotels and motels and primary and high schools and Southern Oregon University.

The City offers financial assistance by providing rebates for lawn replacement. The residential lawn replacement program provides rebates of up to $1.25 per sq. ft. of turf removed and replaced with climate appropriate, low-water use landscapes and efficient irrigation systems.

Ashland's Conservation Division has provided water efficient irrigation spray heads and other equipment to the Parks and Recreation Departments. Given the Conservation Division's experience performing irrigation system evaluations at customers' locations, the Conservation Division intends to begin providing irrigation system evaluations at select City parks within the next 2 years. An additional measure for implementation within the next 2 years include providing financial incentives for irrigation contractors to install water-wise landscaping. Over this period, the City will begin to define these measures and seek implementation.

Five-Year Benchmarks

- Maintain existing technical and financial assistance measures as described.
- Within 2 years, begin performing irrigation system evaluations at City parks.
- Within 2 years, establish and implement a program to provide financial incentives for irrigation contractors to install water-wise landscapes.

3.5.2 Supplier-Financed Retrofit or Replacement of Fixtures

The City of Ashland offers financial incentives in the form of rebates for replacing inefficient fixtures and provides water efficient devices to customers:

- Rebate of $200 (for residential customers) and $250 (HOAs and commercial customers) are provided for the purchase of EPA WaterSense labeled Smart Irrigation Controllers.
- Showerheads, faucet aerators, and moisture meters are provided free upon request, offered as part of the indoor and outdoor evaluations, and distributed at some events attended by the City (e.g., Salmon Festival).
- Rebate ranges of up to $75 for the installation of an EPA WaterSense labeled toilet (1.28 gallons per flush). Rebate amount depends on the number of toilets installed and rate of flush of the toilet(s) being replaced.
- Rebates are given to residential customers who purchase clothes washers with the EPA ENERGY STAR label. Rebates are $80 if the home has an electric water heater and $50 if the home has a gas water heater.
- Rebates may be provided to commercial customers for the installation of water efficient devices, such as water efficient dipper wells and ice machines. These rebates are offered on a case-by-case basis following the results of water use evaluations performed by the City.

In addition to these ongoing offerings, the City intends to plan for and begin offering grants to low-income residents to obtain and install water efficient fixtures.

Measure Benchmarks

- Maintain supplier-financed retrofit and replacement measures
- Within 2 years, develop and implement a grant program eligible to low-income residents focused on the installation of water efficient fixtures.

3.5.3 Rate Structure and Billing Practices that Encourage Conservation

The City of Ashland bills customers monthly based on an inclining block rate structure that includes seasonal pricing. These features of the rate structure encourage water users to use water efficiently. The City intends to evaluate modifications to its rates to further incentivize efficient use of water. These modifications could establish commodity charges that are more progressive than the current charges. A cost of service study may be performed prior to evaluate this option.

Five-Year Benchmarks

- Continue billing customers monthly for the amount of water used, at least in part.
- Over the next 2 years, consider revising the commodity charges to make them more progressive.

3.5.4 Water Reuse, Recycling, and Non-potable Opportunities

As part of the development of this WMCP, the MAC considered five types of large-scale projects related to the use of reclaimed water. The full results are described in Exhibit 2 of Appendix C. In summary, these project types included the use of reclaimed water by one or more customers; use of untreated well water; capture, treatment, and use of stormwater; discharge of reclaimed water into Ashland Creek and Emigrant Lake; and reuse of water at industrial customers' sites. The City intends to use this list of projects to determine if further study is warranted for any of these project types.

Graywater and rain catchment systems can help customers offset the use of City water or water provided by TID. To encourage customers to install these systems, the City's website includes videos of presentations on the topic of greywater and a planning and installation guide for rain barrels. The City has also hosted presentations on these topics to civic groups.

Measure Benchmarks

- Continue promoting graywater and rain catchment systems.
- Within the next 5 years, using the list of large-scale reclaimed water use projects (Exhibit 2 of Appendix C), consider further study of one or more of the most feasible projects.

3.6 Other Measures

Ashland promotes other means of conservation, including the following:

- City code (18.04.04.30) requires that commercial, industrial, non-residential, and mixed-use developments subject to Site Design Review shall use water-wise strategies. For example, the code requires that plants must be primarily drought tolerant, landscaped areas must be mulched, and lawn areas are to represent a small area of the overall landscaped space.

- Three landscape demonstration sites are managed by the City. At these sites, the City has installed water-wise landscape plants or replaced turf with landscaping or artificial turf.
- From 2012 to 2019, the City estimated the volume of water saved as a result of the City's provision of water efficient devices (e.g. showerheads) and appliance and fixture rebates. Data and water savings for 2019 is shown in Exhibit 3-2.

Exhibit 3-2. Water Savings Estimate, 2019

2019	Number Distributed/Rebates Given	Estimated Annual Savings (Gallons)
Toilets	87	410,443
Showerheads	145	898,813
Aerators	161	295,650
Kitchen	104	249,113
Washing Machine	35	189,070
Outdoor Audits	40	400,000
Completed lawn replacements	12	335,490
Total		**2,778,579**

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4. Municipal Water Curtailment Element

This section satisfies the requirements of OAR 690-086-0160 (1) – (4). This rule requires a description of past supply deficiencies and any current capacity limitation. It also requires inclusion of stages of alert and the associated triggers and curtailment actions for each stage.

4.1 Introduction

Curtailment planning is the development of proactive measures to reduce water demand during periods of temporary shortages of supply. The goal of this Plan is to define objective criteria and actions to prepare the City for management of water supplies in these types of events. This WMCP addresses the need to maintain essential public health and safety while applying curtailment measures in an equitable manner that minimizes impacts on economic activity and lifestyle to the greatest degree possible. This may include more restriction on uses deemed less essential.

This WMCP incorporates curtailment procedures described in Ashland Municipal Code (AMC) Chapter 14.06 as amended November 17, 2020, but is not entirely consistent with the AMC. For example, the AMC prohibits water-wasting activities generally defined in AMC 14.06.010J as irrigating plants between certain hours of the day, at any stage, whereas this Plan imposes increasingly restrictive measures for each successive stage of alert, and does not prohibit irrigation outright. Thus, a water-wasting activity as defined in the AMC may be allowed in one or more of the stages in this WMCP. Moreover, this curtailment plan is at least as stringent as MW's curtailment plan published in MW's 2017 WMCP, meeting a requirement of the surplus water agreement between the two water providers. Plan concurrence helps ensure that restrictions imposed by MW also will be observed by Ashland given the shared infrastructure and source of supply of Lost Creek Reservoir. To the extent that is practical, Ashland will encourage actions that are regionally consistent and able to be communicated to the public with a unified message. Note that in some cases, Ashland may experience a shortage of supply whereas other regional water providers, such as MW, may not, leading to the imposition of this curtailment plan by Ashland only.

While this Plan includes specific triggering conditions, it should be recognized that the circumstances to which this WMCP may apply could vary in terms of severity as well as whether they are anticipated or occur suddenly. The time of year during which curtailment is needed would also impact what types of actions might be appropriate. Some events might impact only a portion of the water system, with actions tailored accordingly.

This Plan is intentionally thorough to enable a variety of options to be quickly identified for consideration in potentially stressed circumstances, with the understanding that some proposed actions might not be implemented or may be deferred to later curtailment stages. The objective of this WMCP is therefore to provide guidance while allowing flexibility to respond according to specific circumstances.

The City evaluated emergency events that could impact its system and identified the following potential causes of water supply shortages.

- Long-term drought

- Fire in the watersheds of the City's sources of supply that affects water quality
- Contamination such as from a chemical spill, which necessitates shutting down either water source
- Flooding that forces shutdown of one or more facilities
- Landslides or other natural disaster that damage water pipelines or facilities
- Power outages, particularly those impacting the WTP
- Facility or equipment failure, either from natural or human causes

The methods by which the City can continue to meet demand during one of these events is described below.

4.2 History of Water Supply Deficiencies and Capacity Limitations

OAR 690-086-0160(1)

The City's three water sources—Ashland Creek, the TID canal, and the Lost Creek Reservoir—typically have met the City's system needs. However, the City has experienced supply deficiencies in 2001 and 2009, as noted in the City's previous WMCP, and more recently in 2014, 2015, 2018, and 2020. In 2014, 2015, and 2018, a low snow-pack in the watershed led to historically low snowmelt, contributing to low Reeder Reservoir levels and prompting the City to request that customers reduce water use, though the City did not implement its curtailment plan. In 2020, the City implemented Stage 1 of its curtailment plan in response to several events that contributed to a supply shortage. In that year, the City experienced a below average water year, with only 13.47 inches of rainfall (the average water year is 18.35 inches), resulting in an early drawdown of Reeder Reservoir (July 11, 2020).[12] In response, the City started treating TID water on July 21, 2020, but had to stop treating this supply on August 31, 2020 due to water quality concerns resulting from an algal bloom within the TID system. Shortly thereafter, TID shut off the supply to Ashland canal (used by some City water customers for irrigation purposes) due to issues at the Green Springs power plant created by a windstorm on September 8. City staff intended to begin supplementing Reeder Reservoir supplies with water from Lost Creek Reservoir via TAP the week of September 8th, but on September 8, the catastrophic Almeda fire impacted the abilities of the Cities of Talent and Phoenix transmit water via the TAP intertie to Ashland. The lack of additional supply from TID and via TAP, coupled with unseasonable temperatures for September and a low-water year, prompted the City to initiate water curtailment Stage 1 on September 14, 2020, which was lifted on October 20, 2020.

4.3 Capacity Limitations and Drought Response

The diversion and transmission infrastructure associated with the City's primary water supplies exceed the City's recent peak summer demands of approximately 6 mgd. During periods of sustained high

[12] City of Ashland. 2021. *City of Ashland Water Supply Update and Drought Management Plan*. May 3, 2021.

demand or low quantities of supply from Ashland Creek and Lost Creek Reservoir, the City may rely on Partner Cities listed in the Coordinated Water Management and Water Sharing Agreement for excess supply. This source of supply may also be utilized if the City experiences one of the emergency events that causes a water supply shortage. Should water be unavailable or severely limited from these sources, the City may be able to truck in water obtained from neighboring water providers and may need to implement the following curtailment plan.

4.4 Curtailment Stages and Initiating Conditions

OAR 690-086-0160(2) and (3)

The City has adopted a five-stage curtailment plan to be invoked in the event of a water supply shortage that jeopardizes or may jeopardize the City's ability to meet system demands. These stages include increasingly stringent curtailment responses and are designed to be initiated and implemented in progressive steps; however, stages can be skipped to accommodate the severity of a shortage. The curtailment plan includes both voluntary curtailment measures in the first stage with mandatory measures in Stages 2 through 5. Compliance measures in later stages would likely be more acceptable to customers if voluntary and less restrictive measures have been attempted first. Upon implementation of a curtailment stage, there will be ongoing reevaluation to determine the appropriate curtailment stage. Moreover, at any stage, additional restrictions can be imposed if deemed necessary.

Exhibit 4-1 presents the five curtailment stages, as well as the stages' initiating conditions (i.e., triggers).[13] The curtailment plan may be enacted for the entire system, or only in those geographic areas that are directly impacted by the water supply shortage. The City Manager may broaden or restrict the scope of enactment at any time for the duration during plan implementation.

Exhibit 4-1. Curtailment Stages of Alert and Initiating Conditions

Curtailment Stages (Curtailment Response)	Initiating Conditions
Stage 1 (Internal Planning)	A series of indicators suggest that a future shortage is possible; these may include drought-related conditions or foreseeable operational factors that prevent the City from meeting demand in whole or part
Stage 2 (Voluntary)	Continued and/or further indicators raise concerns about the ability to meet supply needs unless demand levels are reduced, or Sustained demand reaches or is anticipated to reach 90% of supply or delivery capacity
Stage 3 (Mandatory)	Indicators show that supply and/or delivery capacities are strained to meet current demand levels; these may include: Sustained demand reaches or is anticipated to reach 95% of supply or delivery capacities, or Water storage facilities are not routinely refilling, and City Manager determines that continuation could result in inability to meet fire protection or other essential needs.

[13] AMC 16.04.030 identifies only four stages of alert, whereas this curtailment plan lists five in order to match the number of stages of MW's curtailment plan.

Curtailment Stages (Curtailment Response)	Initiating Conditions
Stage 4 (Mandatory)	Series of indicators show that water consumption levels must be immediately reduced; indicators may include: Sustained demand is exceeding normal supply or delivery capacities, or Water storage facility(ies) is/are only 2/3 full, and City Manager determines that ability to meet fire protection or other essential needs is jeopardized. Supply or delivery capacities have been reduced or are anticipated to be reduced by up to 35%
Stage 5 (Mandatory)	Major water use reductions are deemed necessary to avoid system failure, inadequate fire protection capability and/or to assure protection of water quality; indicators may include: Sustained demand continues to exceed supply or delivery capacities, or Water storage facility(ies) is/are only 1/3 full Supply source or major facility is lost, reducing supply or delivery capabilities to less than 65% of normal capacities

4.5 Curtailment Plan Implementation

4.5.1 Stage 1 (Internal Planning)

Stage 1 is intended to raise awareness of the potential for water shortage based on preliminary indicators, such as drought-like conditions leading to low reservoir levels or operational constraints, such as planned infrastructure repair or replacement. Voluntary, but non-specific conservation activities may be encouraged. Under this stage, the City may take the following actions:

- Assemble a Water Shortage Action Team composed of public outreach, utility billing, water conservation, and public works water staff to determine the likelihood of a shortage and define outreach activities.
- Notify members of the City Council.
- Define appropriate internal actions to minimize waste or perception of waste by City operations. Determine whether activities such as main flushing and reservoir cleaning should be immediately reduced or accelerated to complete in advance of a potential higher level of curtailment. Contact landscape maintenance contractor(s) and Parks Department responsible for City sites to request that sprinkler maintenance needs be addressed, and appropriate sprinkling schedules followed.
- Notify wholesale city customers of the potential for a water supply shortage.

4.5.2 Stage 2 (Voluntary)

This status will activate more extensive outreach to inform customers of the potential for water shortages and encourage voluntary conservation of water through specific recommended measures.

Stage 2 City Actions

The City's actions will include the following:

- Establish a City-wide water reduction goal for system demand.
- Re-convene the Water Shortage Action Team to assess the likelihood of a shortage, define demand reduction goals, define outreach activities, and evaluate the possible need for additional personnel to assist with outreach and customer assistance activities.
- Notify members of the City Council and other City officials.
- Re-evaluate appropriate internal actions to minimize waste or perception of waste by City operations. Remind landscape maintenance contractors and Parks Department responsible for City sites that sprinkler maintenance needs must addressed, and appropriate sprinkling schedules followed.
- Notify staff and/or officials of wholesale city and water City customers of the curtailment determination, along with their need to enact equivalent provisions to assure that their efforts are no less intense than those imposed by the City. Inform them of water reduction goals.
- Consider providing direct notification to the following:
    - Representatives from sectors that might be most influential in causing water usage reductions. At this stage, the focus would be on water uses that are considered less essential, such as landscape irrigation, rather than those that would result in economic impacts.
    - Businesses that could be impacted if Stage 3 status becomes necessary, such as car washes, pool contractors and landscape contractors.
- Provide general notification to customers. Such notification will include a description of the current water situation, the reason for the requested actions, and a warning that mandatory restrictions may be implemented if voluntary measures are not sufficient to achieve water use reduction objectives or if conditions worsen.
- Consider initiating or expanding customer educational programs to assist customers in implementing curtailment actions. Examples might include giving presentations for homeowners and landscape managers and visiting customer locations to provide assistance in adjusting sprinkler schedules.
- Consider distribution of low-cost items such as toilet dye tablets, efficient showerheads, low flow aerators, early closing toilet flappers and hose nozzles, which would yield water savings and raise awareness of the water shortage situation.
- Monitor and report results of curtailment efforts and progress in meeting demand reduction goals to customers and City staff and officials.
- Implement Stage 1 restrictions per AMC 14.06.015 regarding water allocations by meter size.
- Implement AMC 14.06.08, temporary rate surcharges for use beyond allocation.

Stage 2 Customer Actions

The following voluntary actions may be requested of customers when Stage 2 is triggered:

- Request reduction in City-wide water use by the percentage determined to be the goal based on the comparable month in the prior year.
- Manage landscape watering. The following guidelines are encouraged:

  a. Water outside plants only between the hours of 9:00 p.m. to 9:00 a.m. May through July and 8 p.m. to 9 a.m. August through October, except for systems on drip irrigation systems, which may be used anytime.

  b. Encourage use of timing devices when watering with hoses.

  c. Suggest adherence to weather-based irrigation schedules, provided on the City website or other potential venues.

  d. Encourage sprinkler maintenance and adjustment to repair leaks, and minimize conditions such as over spray and high pressure that result in obvious water waste.

  e. When in use, hoses should be equipped with nozzles that maximize effectiveness of the spray pattern and shut off when not activated.

  f. Encourage repair of all known customer leaks.

  g. Reduce vehicle washing and use facilities that recycle water. Manual car washing should include use of a bucket and hose equipped with a shutoff nozzle for brief wetting and rinsing.

  h. Request that exterior paved surfaces be swept, rather than washed. If washing is necessary for such reasons as public health or safety, use of water brooms that provide maximum cleaning with minimum water usage is encouraged.

4.5.3 Stage 3 (Mandatory)

Stage 3 is similar to Stage 2 except that Stage 3 measures are mandatory.

Stage 3 City Actions

1. Re-assess City-wide water reduction goal for system demand. Re-convene the Water Shortage Action Team to assess the effectiveness of actions taken in Stage 2 and re-define demand reduction goals. Define additional outreach and enforcement measures, and re-assess the possible need for temporary staffing increases to assist with outreach, monitoring and enforcement.
2. Inform members of the City Council.
3. Review actions to minimize waste or perception of waste by City operations. Make appropriate reductions in hydrant and water line flushing without compromising water quality. Determine what internal actions can be taken for City to meet the percentage reduction goal being requested of

other customers. Confirm that irrigation of City-owned sites is in conformance with requirements below.

4. Notify City officials/staff of the changed curtailment status. Include direct notification to departments of any actions that may be relevant to their operations.

5. Notify staff and public agency customers of the changed curtailment status. Inform them of any water reduction goals. If possible, provide assessments of their performance in Stage 2, based on meter readings and observations. Remind other wholesale customers of the need to enact equivalent provisions to assure that curtailment efforts are no less intense than those imposed by the City.

6. Contact high use customers to encourage water use efficiency. Inform them of the potential future need for greater reductions, and solicit their input on how such reductions might be most equitably applied, while minimizing economic impact.

7. Contact others on the Contact List included as Appendix F, with a focus on those who will be most impacted by current and possible future curtailment actions. As deemed appropriate, meetings may be convened to enable input to be received relative to potential actions that may be taken.

8. Expand notification and outreach activities to customers as defined by the Action Team. This may include targeting specific customer groups. For example, restaurants might be encouraged to avoid serving water except upon request, and motels might be encouraged to promote reduced linen laundering. Translation and dissemination of information through Spanish-speaking media will also be pursued.

9. Monitor and report results of curtailment efforts and progress in meeting demand reduction goals. Keep City employees informed.

10. Implement AMC 14.06.08, temporary rate surcharges.

11. Implement water allocations by meter size.

Stage 3 Customer Actions

Except as modified below, all voluntary customer actions recommended in Stage 2 become mandatory.

1. Landscape watering shall be subject to some or all of the following conditions. Landscapes that were installed within the previous 40 days will be allowed some flexibility to enable plant establishment.

    a) Time-of-day guidelines in previous stage becomes mandatory, except for areas irrigated completely with drip, soaker or other watering method that applies water directly to the root zone without spray.

    b) Use of a hose bib mounted timing devices required when sprinkling from hoses.

    c) Landscape irrigation should follow a weather-based schedule, which will be provided on the City Web site, the Watering Info-line and by other means. This schedule may afford preference to ornamental trees and shrubs, which if lost would take years to re-establish. Lawn sprinkling

schedules might encourage dormancy, watering at a lower percentage of ET to keep roots alive, but without the goal of maintaining a uniformly green appearance.

d) Sprinklers and other irrigation components shall be repaired, adjusted and operated without waste. Prohibited waste may include, but would not be limited to leaks, over-spray of more than one foot onto paved surfaces, misdirected spray patterns, obvious runoff and operation at clearly excessive pressures.

2. Planting of new lawns and annual plants may be prohibited. Planting of shrubs and trees would be allowed, possibly subject to verified soil amendment and mulching (aimed at water retention) and/ or irrigating with drip, soaker hose or similar root zone water application method.
3. When in use, hoses must be equipped with nozzles that direct water and shut off when not activated.
4. Require repair of all known customer leaks.
5. No washing of personal motorbikes, motor vehicles or recreational vehicles except at commercial washing facilities that practice wash water recycling, or by using a bucket and hose equipped with a shut-off nozzle for brief wetting and rinsing.
6. Except for vehicles that must be cleaned to maintain public health and welfare such as food carriers and solid waste transfer vehicles, washing of commercial vehicles shall only be done in a facility that recycles water. Washing of vehicles for sale on commercial lots may be afforded less stringent washing regulations to enable limited washing on location, but at reduced schedules that result in significantly reduced water usage levels as compared to the prior year.
7. No washing sidewalks, walkways, driveways, parking lots, tennis court, and other hard-surfaced areas, except when necessary for public health and safety or to the minimal extent necessary to loosen caked-on mud or similar circumstances.
8. Except as needed for painting or construction, no washing of buildings and structures. No water for a fountain or pond for aesthetic or scenic purposes unless it recycles water and is leak free (with refill demands being equivalent to the current ET rate).
9. Non-compliant ponds that support fish will be afforded reasonable time to move fish or repair leaks.
10. Pools and hot tubs shall not be drained, and shall be managed to minimize the need to re-fill. This may include requirements for covering when not in use and other actions.
11. Water for the initial filling of new swimming pools may be restricted. Pools already under construction prior to imposition of such regulations will be allowed to fill, but may be subject to rate and time of day restrictions.
12. Where potable water is used on golf courses, it shall be restricted to watering only tees and greens.
13. Use of potable water for dust control or street cleaning may be disallowed or made subject to regulations setting maximum frequency or rate of application.

14. Restrictions may be placed on use of water from hydrants for any purpose other than firefighting and flushing deemed necessary to maintain water quality.

15. In addition to applicable items above, the City and wholesale city customers should adhere to the following:

    a. Amend street sweeping activities to minimize or eliminate use of potable water. If non-potable water is used, this shall be advertised on the sweeper.

    b. The fire department should discontinue training exercises that use water

    c. Cease use of decorative fountains

    d. Reduce hours of operation or make relevant operational changes to manage water use at pools or other water recreational facilities. Cease use of any water spray recreational facility that does not re-circulate water.

    e. Continue to decrease water use at fields and facilities determined to be less critical.

    f. Retrofit restrooms in city-owned facilities with water efficient fixtures.

4.5.4 Stage 4 (Mandatory)

At Stage 4, nonessential water use must be severely curtailed, and economic impacts cannot be avoided. The goals of the City's response will be to maintain water supplies necessary for health and safety needs of the community while minimizing economic hardship.

Stage 4 City Actions

1. Re-convene the Water Shortage Action Team to define updated City-wide demand reduction goal, review and assess actions taken to date, and evaluate new actions to be taken. Rationing protocols should be defined and uses prioritized. For example, fire suppression and critical sanitation needs for hospitals will be among uses given the highest priority. Implement temporary rate surcharges. The need for additional temporary staffing for expanded outreach and enforcement of mandatory water restrictions will also be re-assessed.

2. Contact members of the City Councilors. A special meeting may be called.

3. Re-evaluate actions to minimize waste or perception of waste by City operations. Make appropriate reductions in hydrant and water line flushing without compromising water quality. Consider prohibition on activation/ flushing of newly installed water lines or allow only during off-peak nighttime hours. Verify that irrigation of City owned sites is in conformance with requirements below.

4. Notify staff and officials of the City of the changed curtailment status and updated City-wide water reduction goals. Direct notification will be made to individual departments that may be impacted by new regulations.

5. Notify staff and public agency customers of the changed curtailment status, updated City-wide water reduction goals and the continued need to maintain actions equivalent to those being taken by City. If possible, provide assessments of their performance in Stage 3, based on meter readings and/ or observations.

6. Expand notification and outreach efforts to convey the severity of the conditions, and possibly include outreach options listed for prior stages, but not yet taken. Translation and dissemination of information through Spanish-speaking media will be continued.

7. Notify high-use customers of water volume limits and rationing protocols.

8. Contact and/ or meet with others on the Contact List included as Appendix F, particularly those who will be most impacted by current and possible future curtailment actions.

9. Identify possible sources of water that may be used to supplement supply for specific functions. This may include provision of non-potable water for uses such as dust control or watering of high priority landscapes or gardens.

10. Re-consider or continue distribution of low cost items identified in Stage 3 that would yield water savings and raise awareness of the water shortage situation

11. Monitor and report results of curtailment efforts and progress in meeting City-wide demand reduction goals. Keep all City employees informed.

12. Implement AMC 14.06.08, temporary rate surcharges.

13. Implement Stage 2 restrictions per AMC 14.06.015 regarding water allocations by meter size.

Stage 4 Customer Actions

Except as modified below, provisions imposed on customers in Stage 3 will remain in effect, and options listed in that stage but not implemented, will be re-assessed. The following additional or modified measures may also be adopted:

1. Further restriction of landscape irrigation, with regulations to be provided on the City Website, the Lawn Watering Info-line and other potential venues, are as follows:

    a. Watering of turf may be prohibited or allowed only one day per week to keep roots alive while grass goes dormant.

    b. Shrub watering will follow a restrictive schedule, reflective of current ET or a fraction thereof, along with plant survival needs.

    c. Tree watering shall be accomplished with use of soaker hoses or similar methods that apply water directly to the root zone, rather than broadcast spraying. Frequency and volume allowed will be established through consultation with the City's Arborist and/ or other tree experts. Use of non-potable water for this purpose may be encouraged.

    d. Time-of-day watering provisions imposed in Stage 3 remain in effect for all spray irrigation.

e. Use of hose bib mounted timing devices will be required when irrigating from hoses.

f. Sprinkling will be limited to certain days of the week. Allowances will vary according to season and plant type.

g. Sprinklers and other irrigation components must be repaired, adjusted and operated without waste as defined in Stage 3.

h. Exceptions to these regulations may be granted at the discretion of the City's conservation staff upon documentation that the landscape was installed within the previous 40 days or is deemed a high priority public use area.

2. No planting new landscapes.

3. No construction or installation of new pools or hot tubs shall be initiated, and existing pools and hot tubs may not be drained to less than 90 percent of capacity and refilled. Further restrictions on the filling of pools and hot tubs might also be imposed. Exceptions may be granted by the City's conservation staff if the pool or hot tub's use is required by a medical doctor's prescription or is deemed a high priority community recreational or health facility.

4. No water for a fountain or pond for aesthetic or scenic purposes unless necessary to support fish, and is leak free as defined in Stage 3. Measures shall be taken to move fish to aquariums or other smallest reasonable tub or ponds.

5. Except for vehicles that must be cleaned to maintain public health and welfare such as food carriers and solid waste transfer vehicles, washing of vehicles shall only be done in a facility that recycles water. This shall apply to all vehicles, including motorbikes and recreational vehicles, whether or not personal, commercial or displayed on sales lots.

6. No potable water use for dust control or street cleaning.

7. Stop serving water in restaurants unless requested by the customer. This action generates awareness for curtailment, and reduces use of water for washing glasses.

8. Hotels and motels shall discourage daily linen replacement by providing procedures for guests to opt for less frequent laundering.

9. No new water line extension work shall be initiated except as approved by the City.

10. No use of water from hydrants except for firefighting and flushing deemed necessary to maintain water quality.

11. No water running to waste onto paved surfaces or into gutters.

4.5.5 Stage 5 (Mandatory)

Stage 4 reflects an extreme circumstance in which water available is considerably less than normal demands, and it is imperative that all customer sectors participate in immediate demand reductions. This situation is most likely to result from a sudden event that severely impacts a major system component or affects multiple system components simultaneously. Examples might include failure of a

transmission main or intake structure, a chemical spill impacting a water source, a malevolent attack on the system or multiple failures resulting from an earthquake or flood. However, a less dramatic event such as an extended power outage affecting the Ashland WTP, but not the majority of customers, could also lead to sudden and significant curtailment needs.

Stage 5 City Actions

The goals of City's response are to avert system shutdown, and prevent adverse health and safety impacts to the community. City will respond with the following actions:

1. Reconvene the Water Shortage Action Team to define demand reduction needs and critical actions to be taken. Rationing protocols will be defined and water uses prioritized. Fire suppression and critical sanitation needs for hospitals will be among the uses given the highest priority.
2. Notify the local news media to request their assistance in notifying the public of the severity of the situation. This will include dissemination of information through Spanish-speaking media.
3. Contact staff and public agency customers. Inform them of water rationing determinations.
4. Contact the largest customers to inform them of applicable water rationing.
5. Mobilize City resources to perform rigorous public outreach and enforcement.
6. If deemed necessary, contact local law enforcement and fire departments to enlist help in notifying customers.
7. If water in the system is unsafe to drink, the Oregon Drinking Water Program will be contacted, and their assistance requested for responding to the problem.
8. If applicable, consider options for renting a water hauling truck and purchasing water from nearby communities, sending customers to a per-designated water distribution location, and supplying bottled water.
9. Implement AMC 14.06.08, temporary rate surcharges.
10. Implement Stage 2 restrictions per AMC 14.06.015 regarding water allocations by meter size.

Stage 5 - Customer Actions

Customer water use restrictions in Stage 5 will include those listed in Stage 4, except as modified below:

1. No irrigation of landscapes unless a greywater irrigation system is in use If Stage 4 remains in effect for an extended duration, and ongoing actions are proving successful in adequately maintaining reservoir levels, limited watering directly to the root zones of significant large trees and shrubs may be exempted from this ban. Frequency and volume allowed will be established through consultation with the City's Arborist and/or other tree experts. Use of non-potable water for this purpose may be encouraged.

2. No construction or installation of new pools or hot tubs shall be initiated, and existing pools and hot tubs shall not be drained and refilled. No water to refill swimming pools or hot tubs. Exceptions may be granted by the Manager if the pool or hot tub is deemed to serve an important community health function.

4.6 Water Allocation Table

City code AMC 14.06.015 sets volume limits by customer category by curtailment stage for each size of meter. These are repeated below in Exhibit 4-2. This table was modified for this WMCP to reflect five stages, not four, as identified in the municipal code.

Exhibit 4-2. Water Allocation Table

Customer Category	Meter Size (inches)	Stages (cubic feet)				
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Res Irrig	0.75	N/A	1,800	600	100	N/A
Res Irrig	1	N/A	1,800	600	100	N/A
Res Irrig	1.5	N/A	1,800	600	100	N/A
Res Irrig	2	N/A	1,800	600	100	N/A
Com Irrig	0.75	N/A	3,200	1,100	100	N/A
Com Irrig	1	N/A	6,100	2,100	200	N/A
Com Irrig	1.5	N/A	10,400	3,700	400	N/A
Com Irrig	2	N/A	15,200	5,300	500	N/A
Com Irrig	3	N/A	30,400	10,600	1,100	N/A
Gov Irrig	0.75	N/A	3,200	1,100	100	N/A
Gov Irrig	1	N/A	6,100	2,100	200	N/A
Gov Irrig	1.5	N/A	10,400	3,700	400	N/A
Gov Irrig	2	N/A	15,200	5,300	500	N/A
Gov Irrig	3	N/A	30,400	10,600	1,100	N/A
Gov Irrig	4	N/A	48,100	16,800	1,700	N/A
TID Irrig	4	N/A	48,100	16,800	1,700	N/A
Comm=l	0.75	N/A	6,400	4,800	3,200	1,600
Comm=l	1	N/A	12,200	9,200	6,100	3,100
Comm=l	1.5	N/A	20,900	15,600	10,400	5,200
Comm=l	2	N/A	30,400	22,800	15,200	7,600
Comm=l	3	N/A	60,800	45,600	30,400	15,200
Comm=l	4	N/A	96,200	72,200	48,100	24,100
Comm=l	6	N/A	186,400	139,800	93,200	46,600
Comm=l	8	N/A	304,400	228,300	152,200	76,100
Condo/multi-family	All	N/A	2,700	2,000	1,300	700
Resid=1	0.075	N/A	3,600	2,500	1,800	900
Resid=l	1	N/A	3,600	2,500	1,800	900
Resid=l	1.5	N/A	3,600	2,500	1,800	900

N/A = not applicable

4.7 Authority

Whenever possible, activation of this Curtailment Plan and stages thereof will be by a majority vote of the City Council. However, initial actions under the plan may be initiated upon a determination of urgency by the City Manager. The City Council, by a majority vote, may rescind the determination upon finding that the emergency no longer exists, or that the original declaration was made in error (Ashland Municipal Code 14.06.020). The City has asserted authority to implement non-voluntary curtailment or suspensions of water service through Section 14.060 of its Municipal Code.

4.8 Curtailment Communication

Communication of a water shortage and the associated curtailment actions is critical to ensure timely and effective response by water users. The City will communicate specific actions users can take to reduce usage and may include a summary of the current water situation, the reasons for the requested reductions, and a warning that additional cutbacks may be required if voluntary or mandatory measures do not sufficiently reduce water usage. The following list identifies methods that the City may use to notify its customers during any stage of alert:

- Postings on bulletin boards, websites (including the City website), public restrooms and similar venues.
- Press releases
- Social media alerts
- Newspapers and radio announcements
- Phone calls
- Door-to-door visits (e.g. distribution of door hangers)
- Water curtailment letters sent to customers
- Contacting the local news media to request their assistance in notifying the public of the severity of the situation. This will include dissemination of information through Spanish-speaking media.
- Providing notice on water bills and through utility bill inserts

4.9 Drought Declaration

If a declaration of a severe drought is declared by the Governor per Oregon Revised Statutes (ORS) 536.720, the Oregon Water Resources Commission may order political subdivisions within any drainage basin or subbasin to implement a water conservation or curtailment plan or both, approved under ORS 536.780. The conservation and curtailment elements of this WMCP meet these requirements. If Ashland is within a severe drought area declared by the Governor, such as Jackson County, the City will consider whether curtailment measures are needed to meet system demands. If ordered to implement a water conservation or curtailment plan during a declared drought, the City will comply by implementing the water conservation and curtailment provisions of this WMCP. Regardless of whether curtailment is needed, the City of Ashland will continue to encourage customers to conserve water.

5. Municipal Water Supply Element

This section satisfies the requirements of OAR 690-086-0170. This rule requires descriptions of the City's current and future service area and population projections, demand projections for 10 and 20 years, and the schedule for when the City expects to fully exercise their water rights. The rule also requires comparison of the City's projected water needs and the available sources of supply, an analysis of alternative sources of water, and a description of required mitigation actions.

5.1 Delineation of Service Area

OAR 690-086-0170(1)

The City's current water service area includes the area within the City's municipal boundary as shown in Exhibit 2-2. Within the next 20 years, the City's service area is expected to grow to include all lands within the current UGB. Growth within the City is anticipated to include infill and redevelopment of existing land to accommodate projected population growth. In addition, the City anticipates that it will annex land within its UGB within the 20-year planning period of this WMCP. Water service will be expanded to annexed land as development occurs.

5.2 Population Projections

OAR 690-086-0170(1)

Exhibit 5-1 shows the projected population of the City of Ashland UGB based on the *Jackson County Coordinated Population Forecast 2022 through 2072*, published by Portland State University in 2022.[14] Using the 2022 report, the City calculated annual average growth rates (AAGRs) to interpolate projected populations for 2033 and 2043. Projected population beyond 2043 is shown to align with the timeline for demand projections in Section 5.3. The projections reflect an AAGR of 0.43 percent from 2023 through 2043 and 0.45 percent from 2043 through 2073.

Because the projected populations are for the City's UGB, the 2023-projected population is higher than the City's current service area population. The average annual growth rate from 2070 through 2072 was extrapolated through 2073 to extend the forecast to 50 years.

[14] Chen, C., Sharygin, E., Whyte, M., Loftus, D., Rynerson, C., Alkitkat, H. 2022. Coordinated Population Forecast for Jackson County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2022-2072. Population Research Center, Portland State University.

Exhibit 5-1. Projected City of Ashland UGB Population, 2023-2073

Year	Forecast Population
2023	22,651
2033	23,611
2043	24,710
2053	25,942
2063	27,164
2073	28,379

5.3 Demand Projections

OAR 690-086-0170(3)

OAR 690-086-0170(3) requires water demand projections for 10 and 20 years and, at the option of the municipal water supplier, longer periods. For this WMCP, the City has developed water demand projections through 2073.

5.3.1 Conservation Measures' Impacts on Demand

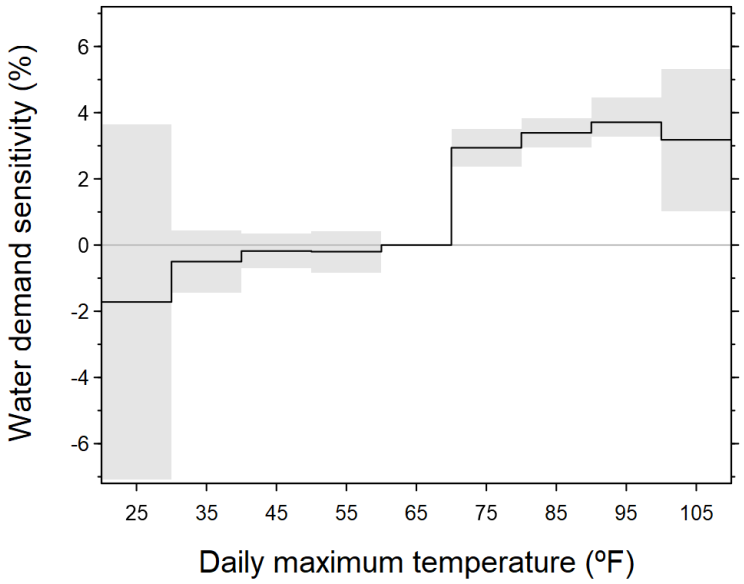
Water conservation savings are factored into the demand projections because of the use of historical demands in the analysis. These historical demands incorporate water savings realized from the City's comprehensive conservation program, federal water efficiency standards, and the strong water conservation ethic of the Ashland community, among other factors. While the City's planned enhancements and expansion of its conservation program described in Section 3 may incrementally further reduce demand, a majority of anticipated savings are likely realized. For the purpose of water supply planning, the City is only incorporating those water conservation savings already realized.

5.3.2 Climate Change Impacts on Demand

For the demand forecast analysis, GSI Water Solutions, Inc. (GSI), assumed that water demands would grow at the same rate as Ashland's water service population, with additional increases in demand caused by climate change. To evaluate the anticipated impact of increasing ambient air temperatures as a result of climate change on the City's demands, the Oregon Climate Change Research Institute (OCCRI) at Oregon State University conducted a climate change analysis for the City. OCCRI's full report, which also includes discussion of the anticipated impacts of climate change on the City's water supplies, is included in Appendix G. A summary of the methodology and results is provided below.

OCCRI's analysis of the City's 2011 through 2020 water demands showed that demand is sensitive to increases in temperature above 70°F. Specifically, OCCRI found that for each day that the daily maximum temperature is between 70 and 80°F in a given month, the monthly water demand increased by 2.9 percent over the baseline. Exhibit 5-2 (Figure 1 in Appendix G) shows the sensitivity of water demand to increases in temperature in increments of 10°F, with grey shaded areas showing 95 percent confidence intervals on sensitivity estimates.

Exhibit 5-2. Sensitivity of Monthly Water Demand to Daily Maximum Temperature



As shown in Exhibit 5-2, there is little difference in the sensitivity of water demand to increases in temperature from 70 to 110°F and confidence intervals (grey shading) overlap for each 10-degree increment. These data suggest that when temperatures exceed 70°F, water users tend to use more water, with landscape irrigation likely the primary driver of increased water use. But, as temperatures increase into the 80s and 90s°F, water use does not increase by a significantly greater amount. Possible explanations for this pattern include that water users consciously reduce water use in response to conservation messaging when temperatures are especially high or that water users are responding to tiered pricing by restricting usage during periods when temperatures are higher. Regardless of the reason for this pattern, it implies that the City will see the greatest increases in demand because of temperatures exceeding a threshold of 70°F with greater frequency, rather than as a result of increases in maximum daily temperatures.

Based on the demand sensitivity analysis, OCCRI estimated monthly climate change demand factors for each decade. The climate change demand factors reflect the percentage by which per-capita demands are projected to increase because of climate change. OCCRI used two different greenhouse gas concentration trajectories, identified as *Representative Concentration Pathways* (RCPs). OCCRI evaluated the impact on the City's per-capita demand under RCP 4.5 and RCP 8.5.

RCP 4.5 is intended to represent an intermediate scenario in which emissions start declining by approximately 2045 as a result of global response to climate change. Global mean temperatures are projected to increase by 35 degrees °F by the end of the century. RCP 8.5 is intended to represent a scenario in which emissions continue at their current levels throughout the 21st century, resulting in warming of 39°F by the end of the century. RCP 4.5 is considered a moderate emissions scenario whereas greenhouse gas concentrations assumed by RCP 8.5 are considered plausible over the short-term but may not be realistic over the long-term. Increases in the City's per-capita demand for each month and decade through the 2070s compared to a 2011 through 2020 baseline under RCP 4.5 and RCP 8.5 scenarios are shown in Exhibits 5-3 and 5-4, respectively.

Exhibit 5-3. Monthly Climate Change Demand Factors, RCP 4.5 Scenario

	2020s	2030s	2040s	2050s	2060s	2070s
January	0%	0%	0%	0%	0%	0%
February	0%	1%	1%	2%	2%	2%
March	0%	1%	3%	4%	5%	5%
April	1%	3%	4%	5%	6%	6%
May	1%	3%	4%	6%	7%	8%
June	1%	1%	2%	3%	4%	4%
July	0%	0%	1%	1%	1%	1%
August	0%	1%	1%	1%	1%	1%
September	1%	2%	2%	3%	4%	4%
October	1%	2%	4%	6%	7%	8%
November	0%	1%	1%	2%	3%	3%
December	0%	0%	0%	0%	0%	0%

Exhibit 5-4. Monthly Climate Change Demand Factors, RCP 8.5 Scenario

	2020s	2030s	2040s	2050s	2060s	2070s
January	0%	0%	0%	0%	0%	1%
February	0%	1%	1%	2%	2%	4%
March	0%	1%	2%	4%	6%	8%
April	1%	2%	3%	6%	7%	10%
May	1%	3%	5%	8%	10%	13%
June	1%	2%	3%	4%	5%	6%
July	0%	0%	1%	1%	1%	0%
August	0%	1%	1%	1%	1%	1%
September	1%	2%	4%	5%	6%	7%
October	1%	3%	5%	9%	12%	14%
November	1%	1%	2%	4%	5%	6%
December	0%	0%	0%	0%	0%	0%

Consistent with OCCRI's findings regarding the sensitivity of demand to different temperature thresholds, demands are projected to increase the most during spring and fall, when the frequency that daily maximum temperatures exceed 70°F is expected to increase the most compared to the baseline.

Exhibit 5-5 shows projected demand from 2023 through 2073 in 10-year increments under the RCP 4.5 scenario. Projected demands reflect conditions in typical years. During exceptionally dry years, resulting in greater water use for irrigation and other outdoor uses, peak season water demands may be higher. This is illustrated in Exhibit 5-5 with the inclusion of 2021 actual demands. Note that demand projections are based in part on the forecast population of the UGB shown in Exhibit 5-1. The City is expected to build out the current UGB over the next 20 years. As a result of climate change impacts, projected demands for 2033 are higher than would be expected if population increases were the only factors considered.

Exhibit 5-5. Projected Water Demand, RCP 4.5 Scenario, 2023-2073

	Annual Demand (MG)	Peak Season (May - September) Demand (MG)	ADD (mgd)	MDD (mgd)	Peaking Factor	UGB Population	Per Capita Daily Demand (gpcd)
2033	1,175	721	3.22	5.82	1.81	23,611	136
2043	1,237	758	3.39	6.10	1.80	24,710	137
2053	1,309	802	3.59	6.41	1.79	25,942	138
2063	1,378	843	3.77	6.72	1.78	27,164	139
2073	1,443	883	3.95	7.02	1.78	28,379	139

Exhibit 5-6 shows the City's projected demands under an RCP 8.5 emissions scenario.

Exhibit 5-6. Projected Water Demand, RCP 8.5 Scenario, 2023-2073

	Annual Demand (MG)	Peak Season (May - September) Demand (MG)	ADD (mgd)	MDD (mgd)	Peaking Factor	UGB Population	Per Capita Daily Demand (gpcd)
2033	1,177	722	3.22	5.81	1.80	23,611	137
2043	1,243	763	3.40	6.09	1.79	24,710	138
2053	1,320	808	3.62	6.41	1.77	25,942	139
2063	1,396	852	3.82	6.71	1.75	27,164	141
2073	1,471	895	4.03	7.00	1.74	28,379	142

For the purposes of evaluating the City's 10-year and 20-year projected demands, the RCP 8.5 scenario provides an appropriately conservative evaluation for demand planning purposes, while over the full 50-year timeframe of the City's projection, the RCP 4.5 scenario is likely most realistic. As this WMCP's planning period is 20 years, the City selected the use of the RCP 8.5 scenario to define its 20-year water needs.

Owen: Sentence or two here about why historical MDD is higher in recent years than projected for 2033. Was 2021 and 2022 extreme dry years, which our model doesn't account for?

5.4 Schedule to Exercise Permits and Comparison of Projected Need to Available Sources

OAR 690-086-0170(2) and (4)

In addition to evaluating the impacts of climate change on the City's demand, OCCRI also evaluated the anticipated impact of climate change on the City's water supplies, particularly changes in the timing of Ashland Creek peak streamflows. OCCRI evaluated changes in streamflow under both the RCP 4.5 and RCP 8.5 emissions scenarios using three datasets. Of these, the Columbia River Climate Change (CRCC) dataset using the Variable Infiltration Capacity (VIC) hydrologic model most closely resembles observed

flows in the general shape and timing of peak discharge. Thus, the City is presenting outputs only from this CRCC-VIC model. Exhibit 5-7 show changes in monthly streamflows under the RCP 8.5 scenario. The projections for the RCP 4.5 scenario are not presented, as the RCP 8.5 scenario provides an appropriately conservative evaluation for demand planning purposes over the 20-year planning timeline described in this section. The output shows a pattern consistent with general predictions for climate change in the Pacific Northwest: the model projects an increase in winter flows and reduction in spring and summer flows as more precipitation falls as rain, and a reduced snowpack that melts earlier in the year compared to a simulated baseline of 2000 through 2020 streamflow.[15]

Exhibit 5-7. Projected Percentage Change from Baseline in the Combined East and West Fork Ashland Creek Basin Discharge, RCP 8.5 Scenario

Month	Decade					
	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	20%	28%	38%	50%	80%	94%
Feb	13%	26%	45%	61%	83%	88%
Mar	9%	18%	30%	35%	45%	42%
Apr	5%	7%	6%	1%	-6%	-19%
May	-7%	-17%	-29%	-42%	-52%	-61%
Jun	-21%	-40%	-51%	-65%	-71%	-76%
Jul	-15%	-32%	-36%	-47%	-45%	-49%
Aug	-4%	-6%	-8%	-9%	-8%	-8%
Sep	5%	-1%	-3%	-10%	-8%	-9%
Oct	2%	2%	-10%	-12%	-21%	-13%
Nov	14%	19%	26%	26%	31%	36%
Dec	25%	36%	51%	55%	74%	87%

Based on the projected demands in Exhibit 5-5 and Exhibit 5-6 and estimates of the natural flow available from Ashland Creek based on Exhibit 5-7, GSI evaluated the use of water from the City's sources of supply. In general, the City relies exclusively on Ashland Creek natural flow (delivered by pipeline from Reeder Reservoir). As Ashland Creek natural flow declines during the summer—typically by July—the City begins to draw down storage in Reeder Reservoir. Depending upon the City's demand, how much demand is met using natural flow, and the duration over which the City must draw on Reeder Reservoir, the City may need to augment using water from Lost Creek Reservoir under its Certificate 96166 and Permit S-54337.

The City may also obtain water from TID via the Ashland Canal that is treated at the WTP to supplement water supplies when Ashland Creek natural flows are not sufficient to meet demand and to reduce reliance on Reeder Reservoir. However, during periods of drought, little or no water may be available to

[15] OCCRI used a simulated baseline of 1991 through 2020 flows for the analysis. For the purposes of this WMCP, GSI is using a simulated baseline of 2000 through 2020 flows. Over the past 30 years, the available period of record for the U.S. Geological Survey gages on East Fork (14353500) and West Fork Ashland Creek (14353000) runs from October 1, 2002 through the present. In order to ensure consistency in comparing projected streamflow to the City's demand, GSI used a simulated baseline period as close to the actual baseline period as possible.

the City under its contracts with TID and BOR, as has typically been the case, so this source of water is not considered reliable and for the purposes of this WMCP is not considered as a source of supply when forecasting future water supply needs.

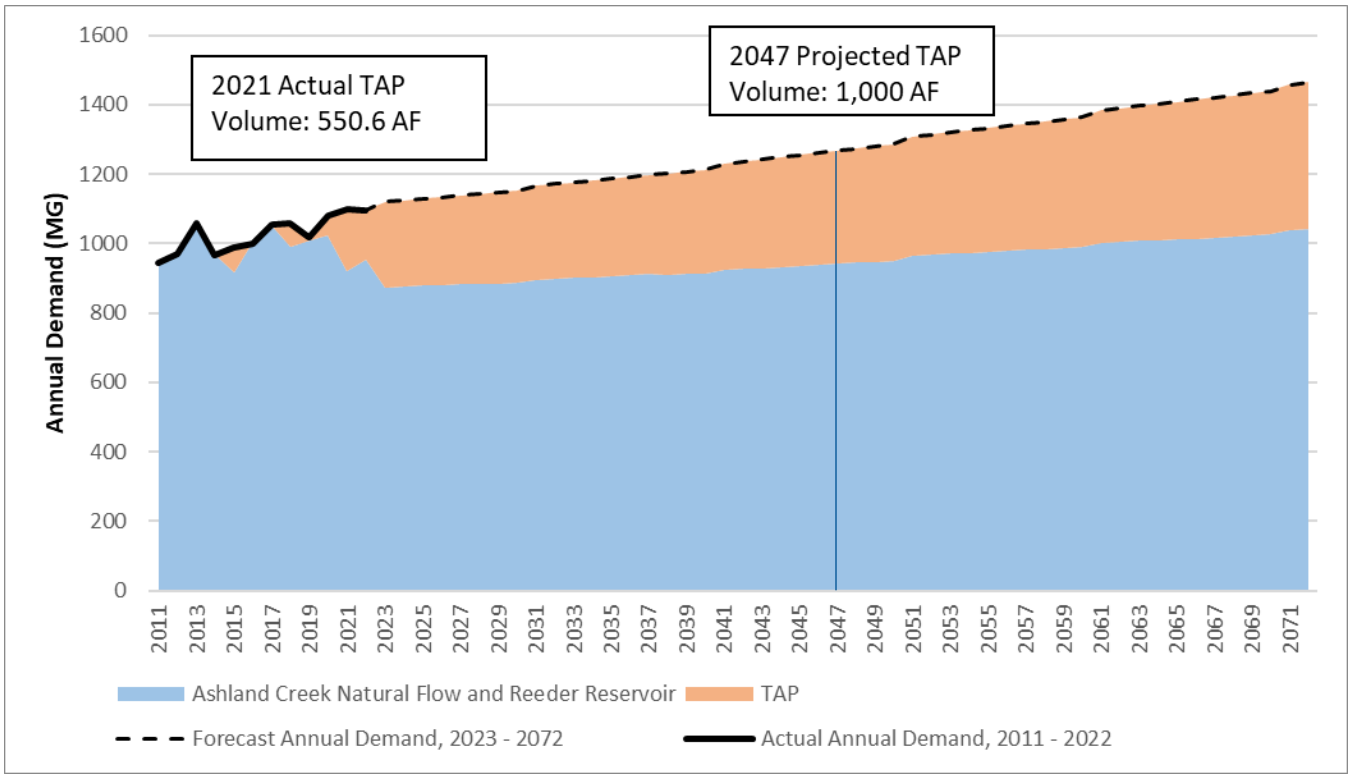
In many years, particularly dry years, the City must augment its summer water supplies with the use of water from Lost Creek Reservoir. To prevent drawing down Reeder Reservoir to low levels before the end of the low-flow season, the City typically uses water from Lost Creek Reservoir via the TAP intertie and Reeder Reservoir simultaneously. This also lowers the City's maximum rate of use from Lost Creek Reservoir, delaying the need to expand capacity of associated TAP infrastructure.

The City's water rights for use of Ashland Creek natural flow and stored water from Reeder Reservoir are fully developed. In addition, the City has used a total volume of 550.6 AF from Lost Creek Reservoir (delivered via the TAP intertie) in 2021, which has been perfected under Certificate 96166. The City has a remaining volume of 449.4 AF for development under extended Permit S-54337; the permit has a completion date of October 1, 2061.

As shown in Exhibit 5-7, projected changes in decadal average flows are significant; however, year-to-year variability in flows exceeds the magnitude of the projected changes under both the RCP 4.5 and RCP 8.5 scenarios. Actual observed flow conditions from the creeks during the peak demand season in 2021—when drought-like conditions were observed—were worse than decadal average conditions projected for the 2070s associated with climate change. Gage records for East Fork and West Fork Ashland Creek do not provide a complete record of the past century, but similarly dry years have occurred in 2018, 2015, 2014, 1977, and 1931. This suggests that regularly occurring droughts are the primary driver of the City's need for resilient water supplies compared to climate change impacts.

To project when the City could utilize the full volume of water from Lost Creek Reservoir under Permit S-54337, the City assumed 2021 hydrologic conditions (drought-like conditions) and RCP 8.5 climate-warming scenario. As described above, for the purpose of evaluating the City's projected demands, the RCP 8.5 scenario provides an appropriately conservative evaluation for demand planning purposes through 2043. Exhibit 5-9 shows how the City could use its sources of supply and the timeline for using the full 1,000 AF of Lost Creek Reservoir storage authorized by Certificate 96166 and Permit S-54337, assuming no disruptions to Reeder Reservoir supply. The projection shows the City would use the full volume authorized under these water rights by 2047 under these conditions. By 2043, the City anticipates use of 961.8 AF of water from Lost Creek Reservoir, being 550.6 AF under Certificate 96166 and 411.2 AF under Permit S-54337.

Exhibit 5-8. Comparison of Demand and Supply through 2073, RCP 8.5 Scenario



In addition to serving as an additional source of supply, Lost Creek Reservoir serves as a redundant source of supply for the City. During various operational scenarios, the City may need to use all 1,000 AF from Certificate 96166 and Permit S-54337 to meet demands, providing an additional 38 AF (12.4 MG) of water (1,000 AF to 962 AF) beyond 2043 demands and approximately 3 days of use based on an ADD in 2043 of 3.40 mgd. For example, disruptions in water supply from Reeder Reservoir may occur due to a fire in the Ashland Creek watershed. A 2023 analysis conducted by the City identified approximately 22 percent of the Douglas firs in the watershed were dead or dying, increasing the potential for fire. The watershed may also experience high turbidity events for which the City's WTP is not designed to treat or a harmful algal bloom in Reeder Reservoir in summer. Under these scenarios, when Ashland's primary sources of supply are unavailable (Reeder Reservoir and Ashland Creek), the City could require the full volume of Permit S-54337 (449.4 AF). Thus, given the projected demands described above and the need for a secure, redundant supply, the City is requesting access to the full amount of water under extended Permit S-54337 (449.4 AF) for the 20-year planning period of this WMCP, to 2043.

Extended Permit S-54337 has a completion date of October 1, 2061 and the City expects to beneficially use the full volume of water authorized (449.4 AF) by this date.

5.5 Alternative Sources

OAR 690-086-170(5)

OAR 690-086-0170(5) requires an analysis of alternative sources of water if any expansion or initial diversion of water allocated under existing permits is necessary to meet future water demand. The City intends to expand its diversion of water under Permit S-54337 during the planning horizon of this WMCP; consequently, this rule applies to the City.

The City views conservation as an additional source of supply and has sought to increase water efficiency of the City and its customers., The City has implemented and maintains a robust conservation program with a wide array of measures that encourage efficient use of water indoors and outdoors, as detailed in Section 3. For example, the City offers multiple rebates to customers for water-efficient fixtures (e.g. irrigation controller rebate) and practices (e.g. lawn reduction program); has adopted a five-tier water rate structure, with the fifth tier intended specifically to help reduce peak season use; and provides services to identify water savings opportunities at customers' sites (e.g. home audit); among a host of other measures. The vast offerings of the program are a testament to the significant resources and commitment the City has committed to ensuring the efficient use of its water supplies. The results of its conservation efforts are observed in its low-water losses (Section 2.8) and low per capita water use relative to historical usage (Section 2.6.1), among other measures.[16] As described in Section 3, the City intends to expand its program to promote additional conservation savings.

While additional conservation measures may further delay expansion of the City's use of Permit S-54337, conservation will not be enough to meet projected demands and projected demands for Lost Creek Reservoir stored water in the drought-year scenarios described above. Moreover, the costs to implement, administer, and maintain additional conservation measures may exceed the costs of utilizing Permit S-54337 given that the infrastructure necessary to divert, treat, and convey 1,000 AF of water using Certificate 96166 and Permit S-54337 is constructed and in use.

The City constructed the TAP intertie in 2015 to convey water from Lost Creek Reservoir authorized under Permit S-54337. This pipeline also serves as an interconnection with other water suppliers in the region and enables the City to share water among providers. As described above, the City participates in a water-sharing partnership under the Partner Cities IGA. This IGA establishes a framework for regional cooperation and provides the opportunity for Ashland and the other Partner Cities to share water supplies, thereby avoiding the potential for the Partner Cities to individually seek one or more *new* sources of supply to meet its future demand.

The City also has an interconnection with TID, which enables conveyance of water from TID's sources under an agreement with TID to Ashland. This non-potable water is sold to 2,000 households delivered through a series of ditches for irrigation purposes and can be treated at the City's WTP for potable use

[16] The City acknowledges that it has also benefited from the contributions of increasing stringent federal water efficiency standards and market forces for water using fixtures (e.g. toilets). The City has helped drive adoption of the most efficient fixtures by offering rebates for low flow fixtures, such as toilets, over time.

within the City's water system. In years that it is available, this source can take pressure off City water supplies during the summertime residential irrigation season.

5.6 Quantification of Maximum Rate and Monthly Volume

OAR 690-086-0170(6)

OAR 690-086-0170(6) requires a quantification of the maximum rate of withdrawal and maximum monthly use if any expansion or initial diversion of water allocated under an existing permit is necessary to meet demands in the 20-year planning horizon. The City is expanding its diversion of water under Permit S-54337. Consequently, this rule applies to the City.

The City anticipates use of the remainder of the undeveloped portion of extended Permit S-54337 of 449.4 AF by 2043. This volume averages 37.45 AF per month (12.2 MG per month) of use over a 12-month period and 0.41 mgd.

5.7 Mitigation Actions under State and Federal Law

OAR 690-086-0170(7)

Under OAR 690-086-0170(7), for expanded or initial diversion of water under an existing permit, the water supplier is to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act (ESA), Clean Water Act (CWA), and other applicable state or federal environmental regulations. The City intends to expand its diversion of water under Permit S-54337. Consequently, this rule applies to the City. However, the City is not required to comply with legal requirements specific to its use of Permit S-54337 related to the ESA, CWA, or other environmental regulations.

5.8 New Water Rights

OAR 690-086-0170(8)

Under OAR 690-086-0170(8), if a municipal water supplier finds it necessary to acquire new water rights within the next 20 years in order to meet its projected demand, an analysis of alternative sources of the additional water is required. The analysis must consider availability, reliability, feasibility and likely environmental impacts and a schedule for development of the new sources of water. The City does not anticipate the need to acquire new water rights within the planning period.

Note to City: The letters in Appendix A have not been sent.

Appendix A

Letters to Affected Governments and Responses

August , 2023

Matt Brinkley
Planning Director
City of Medford
200 S Ivy St
Medford, OR 97501
planning@cityofmedford.org

Subject: Water Management and Conservation Plan for the City of Ashland

Dear Mr. Brinkley,

The City of Ashland has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rules Chapter 690, Division 86 of the Oregon Water Resources Department.
Under these rules, the water supplier will make its draft WMCP available for review by affected local governments and seek comments related to consistency with the local governments' comprehensive land use plans. We are providing you an electronic version of Ashland's draft WMCP for your review.

Please provide any comments to me within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter or email response to that effect would be appreciated. You may send your comments to me at thenkle@gsiws.com.

If you have any questions, please feel free to contact me at 971-236-2550. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Water Resources Consultant

Enclosure

August , 2023

Kristen Maze
Community Development Director
City of Talent
PO Box 445
Talent, OR 97540

Subject: Water Management and Conservation Plan for the City of Ashland

Dear Ms. Maze,

The City of Ashland has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rules Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier will make its draft WMCP available for review by affected local governments and seek comments related to consistency with the local governments' comprehensive land use plans. We are providing you an electronic version of Ashland's draft WMCP for your review.

Please provide any comments to me within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter or email response to that effect would be appreciated. You may send your comments to me at thenkle@gsiws.com.

If you have any questions, please feel free to contact me at 971-236-2550. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Water Resources Consultant

Enclosure

GSI Water Solutions, Inc.

August , 2023

Joe Slaughter
Community and Economic Development Director
City of Phoenix
220 N Main St
Phoenix, OR 97535

Subject: Water Management and Conservation Plan for the City of Ashland

Dear Mr. Slaughter,

The City of Ashland has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rules Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier will make its draft WMCP available for review by affected local governments and seek comments related to consistency with the local governments' comprehensive land use plans. We are providing you an electronic version of Ashland's draft WMCP for your review.

Please provide any comments to me within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter or email response to that effect would be appreciated. You may send your comments to me at thenkle@gsiws.com.

If you have any questions, please feel free to contact me at 971-236-2550. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Water Resources Consultant

Enclosure

August , 2023

Shandell Clark
Planning Manager
Jackson County
10 South Oakdale Ave, Rm 100
Medford, OR 97501

Subject: Water Management and Conservation Plan for the City of Ashland

Dear Ms. Clark,

The City of Ashland has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rules Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier will make its draft WMCP available for review by affected local governments and seek comments related to consistency with the local governments' comprehensive land use plans. We are providing you an electronic version of Ashland's draft WMCP for your review.

Please provide any comments to me within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter or email response to that effect would be appreciated. You may send your comments to me at thenkle@gsiws.com.

If you have any questions, please feel free to contact me at 971-236-2550. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Water Resources Consultant

Enclosure

GSI Water Solutions, Inc.

August , 2023

Brad Taylor
Medford Water Commission
200 S Ivy St, Room 177
Medford, OR 97501

Subject: Water Management and Conservation Plan for City of Ashland

Dear Mr. Taylor,

The City of Ashland has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rule Chapter 690, Division 86 of the Oregon Water Resources Department.

Given the relationship between Ashland and your water district, we are providing you with an electronic copy of the draft WMCP as a courtesy. If you have any questions, please feel free to contact me at 971-236-2550 or thenkle@gsiws.com.

Sincerely,
GSI Water Solutions Inc.

Tim Henkle
Principal Water Resources Consultant

Enclosure

Appendix B

Watermaster Assessment of Priority Water Rights on Ashland Creek

Oregon
Tina Kotek, Governor

Oregon Water Resources Department
Shavon Haynes
Watermaster District 13
10 South Oakdale Rm
Medford, OR, 97501
(541) 774-6880
Shavon.L.Haynes@water.oregon.gov
www.oregon.gov/owrd

May 5, 2023

Scott A. Fleury
City of Ashland
20 N. Main Street
Ashland OR, 97520

Dear Mr. Fleury,

Listed below are the total rates, in cubic feet per second, for water rights on Ashland Creek which have a priority date of 1895 or older. This table shows the breakdown of water rights, based on the flows of Ashland Creek and priority date, between the City of Ashland and the ditch rights involved.

Total Flow of Ashland Creek (cfs)	City of Ashland Rights (cfs)	Required Release for Ditch Rights (cfs)	Ditch Names & Priority Date
1	0.804	0.196	Million-1856 (M)
2.427	1.183	1.244	(M) & Helman-1858(H)
8.515	6.183	2.333	(M),(H), & Smith/Meyer/Roper-1864(SMR)
17.058	14.033	3.025	(M),(H),(SMR) & Griswold/Delsman-1886(GD)
17.368	14.063	3.305	(M),(H),(SMR),(GD) & Eliason/Vogel-1895

Feel free to contact me with any questions or concerns.

Regards,

Shavon Haynes (him/his)

District 13 Watermaster – Field Services

10 S. Oakdale, Room 309a Medford, Oregon 97501 | Phone (w) 541-774-6883 (c) 541-218-5125

Appendix C

Ashland Conservation Program Technical Memorandum

TECHNICAL MEMORANDUM

City of Ashland Water Conservation Program Expansion and Enhancements

To: Scott Fleury, City of Ashland

From: Tim Henkle, GSI Water Solutions, Inc.
Adam Sussman, GSI Water Solutions, Inc.

CC: Julie Smitherman, Medford Water

Date: May 26, 2023

Introduction

As part of developing the City of Ashland's 2023 Water Management and Conservation Plan (WMCP), the City established the Management Advisory Committee (MAC). The MAC is made of up of Ashland citizens with knowledge and experience in water management and provides feedback to City staff on several topics covered in the WMCP. Several MAC members participated on the former Ashland Water Advisory Committee, which provided water conservation and water supply input to the City Council during development of the City's Water Master Plan. For development of the City's 2023 WMCP, the MAC provided suggested ways the City could expand or enhance the City's water management and conservation programs. This technical memorandum describes the process and outcomes of the MAC's discussions.

Conservation Program Background

The Oregon Water Resources Department's administrative rules requiring a WMCP (Oregon Administrative Rules Chapter 690, Division 86) stipulate that a water provider's WMCP include a water conservation element. For this element, a water provider must describe how the provider meets or intends to meet and implement up to 11 conservation measures. Historically, the City's program has exceeded these minimum requirements by offering an extensive suite of measures, such as providing technical and financial assistance; assistance replacing inefficient fixtures; and educational outreach materials to its residents, businesses, and institutions. The City's current conservation program's breadth and depth reflect the community's conservation ethic and desire to reduce environmental impacts. Thus, the City enjoys the support of the community and, as a result, has been able to establish partnerships with community organizations to help broadcast the conservation message. For example, the Ashland Climate Collaborative has worked in concert with the City to provide conservation outreach and education to City customers at community events and through this organization's website. Partnerships like this are relatively unique among Oregon water providers and have helped contribute to the City's development of one of the most extensive conservation programs in the state.

Since 2020, water conservation-related services are being provided through an agreement with Medford Water. Recently, the City's efforts to expand and enhance its program has been slowed due to staffing shortages, though the City expects to have additional support for water conservation efforts within the next 2 years. The City is also hopeful that discussions underway on the topic of establishing a more robust

coordinated regional water conservation effort by Medford Water and the cities of Ashland, Jacksonville, Talent, Phoenix, Central Point and Eagle Point (the Partners) will leverage resources of the Partners for a more cost-effective program.

Previous Studies

The City has conducted multiple studies since 2010 to help inform and refine its conservation program. These studies include the following:

- ***City of Ashland Water Conservation and Reuse Study.***[1] This study identified a long-term water supply strategy to support community health, the local economy, and environmental sustainability. With respect to conservation, the study identified three potential conservation program savings levels that could provide a 5 to 15 percent reduction in future demands. The study assumed a 5 percent reduction in its demand forecasts; however, the City intended to achieve a reduction of 15 percent. Among other additional future water "supply" options considered, four "purple pipe" projects were evaluated, but not selected, ranging from the use of limited volumes of reclaimed water at one property to use of all reclaimed water produced at the wastewater treatment plant (WWTP) at multiple properties.[2]
- **Water Savings and Cost-effectiveness Analysis.**[3] The City used the Demand Side Management Least Cost Planning Decision Support System (DSS) model developed by Maddaus to evaluate the water-savings impacts of over 30 conservation measures. The results helped the City target resources toward measures with greater water savings. Since 2018, the City has implemented many of the most impactful measures in full or in part.
- ***Ashland Climate and Energy Action Plan.***[4] The *Climate and Energy Action Plan* described opportunities for the City to reduce its carbon emissions and discussed resiliency measures to mitigate the impacts of climate change. Water conservation was recommended as a partial solution to carbon emission reduction and as a means to foster adaptation to future climate change impacts. Specific measures recommended for implementation included an expansion of conservation education and outreach, use of greywater and rainwater collection systems, and implementation of recommendations from the City's facility water audit. Following publication, the City pursued all of these measures.

Purpose and Methodology

The City invited five members of the public and a representative from the City Council to join the MAC and attend a series of meetings related to development of the City's 2023 WMCP. The meetings were facilitated by GSI Water Solutions, Inc. (GSI), and an appointed Chair of the MAC. Two of these meetings were devoted to the topic of water conservation. During these two meetings, the City sought input from the MAC on expanding or enhancing the City's existing customer-facing conservation program and on potential municipal water system reclaimed water use opportunities.

During its two meetings, the MAC and the City generated a list of conservation measures categorized under the topics of Education and Outreach; Technical and Financial Assistance; Rates, Reuse, and Other Measures. GSI and City staff then identified major benefits and barriers to adoption of the measures and informally evaluated each measure based on three criteria: (1) the availability of resources currently available, (2) potential for water reduction, and (3) level of effort to implement and maintain. The evaluation of resource availability was based on the availability of time, funding, and staffing in consideration of the intergovernmental agreement between the City and Medford Water to use Medford Water staff to implement

[1] City of Ashland Water Conservation and Reuse Study. Carollo Engineers. June 2011.
[2] Reclaimed water is water that has been used for municipal purposes, treated, and is suitable for reuse.
[3] Water Savings and Cost-effectiveness Analysis. Maddaus Water Management, Inc. 2018.
[4] Ashland Climate and Energy Action Plan. City of Ashland. March 2017.

the City's conservation program. If resources were available to devote to a measure, without consideration of the implementation status of all other current and future conservation measures, a value of "yes" was given.

The values presented under the criterion "Potential for Water Reduction" are based on estimates of water conservation measures' savings presented in the water savings and cost-effectiveness analysis conducted by the City in 2018. Because the measures identified by the MAC correlated with at least one measure in the 2018 analysis, the City was able to assign values to the conservation measures. Once these values were assigned, the City aggregated the measures into groupings of expected savings, with each group being assigned a range of savings, as follows:

- **High.** Equivalent to an expected City-wide savings of 15,416 to 215,130 gallons per day (gpd).
- **Medium.** Equivalent to an expected City-wide savings of 2,048 to 9,279 gpd savings.
- **Low.** Equivalent to an expected City-wide savings of 1 to 1,828 gpd savings.

Similarly, values of high, medium, and low were given to measures under the "Level of Effort to Implement and Maintain" criterion. The values assigned to this criterion provided estimates of the level of effort required to implement, administer, and maintain the measures based on the experience of GSI and the City. Only measures that the City was not implementing at this time were given values.

The City and MAC used these three criteria to identify the timing of implementation for each measure using short (0 to 2 years), medium (3 to 5 years), and long (greater than 5 years) terms. A summary of the conservation measures can be found in **Exhibit 1.**

At its second meeting, the MAC also discussed large water projects that use reclaimed water, collectively called reuse projects. These projects are distinct from the customer-facing reuse projects noted in **Exhibit 1** (i.e., greywater applications) in that they would be impractical for a typical City water customer to implement due to the scale, among other differences. MAC's discussions were based on a list of prospective projects provided by the City and associated examples. MAC's discussions also provided an opportunity to address potential drawbacks and benefits for each of the large-scale reuse projects. One of the purposes of reuse projects is to offset the use of potable water at locations that could otherwise use non-potable water, for example, for irrigation of park ballfields, thereby reserving potable water supplies for future use. Another driver for Ashland to consider reuse projects is the elimination of warm effluent discharges from the City's WWTP to cooler Ashland Creek. The results of the reuse projects discussion at the second MAC meeting are found in **Exhibit 2**.

Results

Customer-Facing Water Conservation Measures

A total of 30 customer-facing water conservation measures were identified, as shown in **Exhibit 1.** Approximately half of the conservation measures fall under the Education and Outreach category with the remainder falling under Rates, Reuse, or Other Conservation Measures. Of the 30 measures, 5 were identified for implementation within the next 2 years, 10 for implementation from 3 to 5 years, and 8 for implementation in greater than 5 years. The remainder of measures (7) were currently being implemented or needed additional study prior to implementation and thus were not evaluated. **Exhibit 1** is organized based on the timing of implementation. With respect to the timing of implementation, only five measures were identified to be implemented within the short-term (0 to 2 years) in keeping with the City's desire to largely maintain the existing program content for approximately 2 years (no program expansion) due to existing resource constraints. These five measures had been previously implemented, but temporarily postponed due to a position vacancy at the City which has since been filled.

The City intends to use the items identified in **Exhibit 1** to guide the development of the City's conservation program and to develop its 2023 WMCP. These measures will be re-visited and further refined prior to implementation based on resources available at that time.

Large-Scale Reuse Projects

Exhibit 2 includes a list of six types of large-scale reuse projects and at least one example of each that the City could consider for implementation. **Exhibit 2** also provides a summary of the potential benefits and drawbacks of each project type. A brief description of the project types is provided below, along with a general discussion of the benefits and drawbacks of reuse projects. Under state rules, the City's WWTP meets Class A water quality standards for reclaimed water, the highest ranking for recycled water. Class A designated water may be used beneficially in a wide variety of applications, including, but not limited to, projects that use reclaimed water.[5]

Reclaimed Water to One or More Customer(s)

Reuse projects vary in size. Communities may use reclaimed water to irrigate onsite landscaping at WWTPs or single or multiple offsite areas with large, irrigated landscaped areas, such as golf courses or parks, or have other opportunities to use non-potable water. Reclaimed water also may be used as make-up water for cooling towers at customer sites with significant cooling system demands. Projects even larger in scale include provision of treated wastewater from WWTPs to multiple customers for non-potable uses. Often, pipes dyed a purple color will be used to distribute non-potable water in order to distinguish these from pipes carrying potable water. These project types are known as "purple pipe" projects.

Untreated Well Water

Native groundwater not suitable for potable use may be used as a source of supply to offset the use of a water provider's water supply. This option serves a similar purpose as water reuse projects because the use of non-potable water supply can offset use of potable supplies.

Stormwater Capture

When completed, the City of Beaverton's stormwater capture project will collect, treat, and store stormwater from an area known as South Cooper Mountain, then use this water to meet approximately two-thirds of the irrigation needs of the area. This formerly rural area is being developed to provide a mix of urban uses and will include installation of a purple pipe distribution system simultaneous to installation of infrastructure for other utilities. Water will be stored in the City's aquifer storage and recovery system between collection during the rainy season and used during the dry season.

Discharge of Reclaimed Water to Ashland Canal

The City's *Water Conservation and Reuse Study* (2011) evaluated an option to divert reclaimed water from Ashland Creek into the Talent Irrigation District canal to reduce the environmental impacts of effluent discharge on the creek. A modification to this project concept was considered as a conservation program measure enhancement. Specifically, the City considered discharging reclaimed water into the Ashland canal (directly or via the Talent Irrigation District canal), thereby providing uninterrupted non-potable supply to properties along this canal for irrigation purposes or for diversion to the City's water treatment plant. Either of these options would serve reduce demand on the City's potable water supply.

Discharge of Reclaimed Water to Emigrant Lake

Under this scenario, reclaimed water would be piped and discharged into Emigrant Lake, an impoundment resulting from the U.S. Bureau of Reclamation project's Emigrant Lake Dam. The lake is a tributary to Bear Creek. This option could resolve the City's need to reduce the thermal loads on Ashland Creek introduced by

[5] See Oregon Administrative Rules 340-055-0012 (Recycled Water Quality Standards and Requirements) for information about available applications of reclaimed water (https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1472).

the City's WWTP effluent, bolster supplies for recreation in the lake, and augment releases from the reservoir for downstream use.

Industrial Reuse

Wastewater from the City's industrial customers may be reused by other customers to reduce potable water demands. For example, Calpine's facility in Umatilla, Oregon, generates a significant volume of cooling water blowdown from its cooling towers. This non-potable blow-down water is used by a neighboring property to irrigate cropland.

Reuse Projects' Benefits and Drawbacks

Reuse projects can provide multiple benefits to the environment and municipal water supplies. These projects can offset the use of drinking water sources and allow utilities to preserve supplies for future needs. An additional benefit includes the potential preservation of water quality in water bodies that would otherwise receive WWTP effluent. Indeed, wastewater utilities have relied on reuse projects to meet or help meet water quality parameters such as those required by National Pollution Discharge Elimination System permits.

Regulatory requirements to preserve water quality in receiving water bodies are a significant driver of reuse projects in the state. For example, Ashland evaluated four options for use of reclaimed water among other alternatives during development of its 2011 *Water Conservation and Reuse Study* to determine if any of these options were feasible to meet the City's regulatory obligation to comply with thermal load limits set for Ashland Creek. (Ultimately, these options were not pursued.) Without this driver, communities may have fewer incentives to implement reuse projects given the costs of these project types. Moreover, the public's lack of acceptance for the use of reclaimed water for non-potable uses may deter reuse projects. For example, the MAC noted that previous attempts to develop reuse projects in Ashland have been met with community objections. Additionally, the use of reclaimed water diverts a source of water from a receiving water body, potentially resulting in harm to downstream uses and users of this source.

Each reuse project is unique, with varying levels of benefits and drawbacks. These benefits and drawbacks can change over time, particularly as the availability of water declines in the region due to climate change, regulatory requirements become more stringent, and demand for water increases as a result of population increases.[6] Because of these factors, the reuse projects described herein may warrant further examination beyond the cursory review performed during the MAC process. The expense associated with further study may be partially funded through the Oregon Water Resources Department's Feasibility Study Grants program for reuse projects. Through this program, funded studies receive a grant of 50 percent of the project study cost.[7]

Opportunities for Implementation

The goal of the MAC was to provide input to City staff on water conservation measures. These measures are summarized in **Exhibits 1** and **2** and are intended to be the basis for the City during conservation program expansion enhancement of existing measures. The City anticipates re-implementing some of the measures that the MAC identified due to restoration of staffing resources. Additionally, the City anticipates enhancing and expanding its program within the next 2 years based on additional resources that may become available, allowing for the opportunity to implement additional measures recommended by the MAC. The City's program will also benefit longer term from a regional approach to water conservation programming that is being considered by the Partners.

[6] One example of this type of occurrence is when the Ashland canal ran dry in 2020 and 2021 due to low supply levels in the source reservoirs.

[7] More information about the state's Feasibility Study Grants is available at: https://www.oregon.gov/owrd/programs/FundingOpportunities/FeasibilityStudyGrants/Pages/default.aspx

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
On the City's conservation webpage, cross-reference Fire Adaptive Landscaping (FAL) information from www.fireadaptedashland.org	Merges two mutually-beneficial landscaping techniques	City does not have a staff position to update website	Partially in process	Not currently	High	High	Short-term	Advisory Committee	City's 2018 water savings and cost-effectiveness analysis (DSS) model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Re-instate utility bill conservation newsletter	• Low effort • High visibility	City does not have a staff position to lead communication efforts	For implemen-tation	Yes	High	High	Short-term	Advisory Committee	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Increase social media presence	• Low effort • High visibility	City does not have a staff position to lead communication efforts	For implemen-tation	Yes	High	High	Short-term	Advisory Committee	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
City's website should be easier to find information about FAL	Easy-to-access resource for customers	City does not have a staff position to update website	For implemen-tation	Yes	High	High	Short-term	Advisory Committee	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled	Outreach & Education
Expand kids conservation page on City website	Expands outreach	None initially identified	For implemen-tation	Not currently	High	High	Short-term	City staff	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Incorporate water conservation concepts into fire hardening measures and other environmental programs (e.g. climate change)	Merges mutually-beneficial messaging, potentially expanding audience	None initially identified	For implemen-tation	Yes	Medium	High	Medium-term	City staff	DSS model ranks outdoor landscaping measures as providing a range of low to high water savings relative to other measures modeled.	Outreach & Education

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
Reinitiate classroom education and tours	Expands outreach	Requires not insubstantial city resources to maintain	For implemen-tation	Yes	High	Medium	Medium-term	City staff	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Connect with customers on topic of conservation in places where they interact with the City, e.g. permitting, bus. license, and other city transactions	Potentially expands audience	None initially identified	For implemen-tation	Yes	High	Medium	Medium-term	City staff	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Request assistance from high schoolers for outreach or education to elementary aged students	• Students connecting with students for possible greater impact • HS students learn while teaching • Potentially minimal city management of program • Addresses immedite need for school presence	• City may lose control of outreach content/messages. • HS teachers may not have time to take this on given the many deamnds	For implemen-tation	Yes, assumes largely high school teacher-led	High	Low	Medium-term	Advisory Committee	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Align outreach efforts between Fire Dept. and Conservation program and messaging of both	• Merges two mutually-beneficial landscaping techniques • Simplifies messaging to customers	• Outside of Conservation program's control • Some FAL principles may conflict with water-wise landscaping	Partially in process	Not currently	High	High	Medium-term	Advisory Committee	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
Provide more smart controller education	Increases impact of existing rebate program and touches other smart controller users, thereby reducing peak season use	Requires not insubstantial city resources (staffing, funding, or time) to develop program	Partially in process	Yes	High	Medium	Medium-term	City staff	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Outreach & Education
Conservation rates to reflect water scarcity	Reduces use by medium and high users	Potential challgenges by community	Partially in process	Yes	Medium	Medium	Medium-term	Advisory Committee	Indoor water use is relatively inelastic, resulting in minor reductions to consumption resulting from increases to water utility rates. Outdoor water use is more elastic than indoor, resulting in a higher potential for water reduction during peak season resulting from rate increases.	Rates
Perform irrigation evaluation of parks	• Reduces peak season use • Increases City's efficient use of water	None initially identified	For implemen-tation	Yes	Medium	High	Medium-term	City staff	DSS model ranks Commercial, Industrial, and Institutional landscape irrigation evaluations as providing medium water savings relative to other measures modeled.	Technical & Financial Assistance
Offer irrigation contractors incentives to use water-wise landscaping	Reduces peak season use	• Requires ongoing outreach given transient nature of profession • Requires not insubstantial city resources (staffing, funding, or time)	For implemen-tation	Yes	Medium	Medium	Medium-term	Advisory Committee	Many customers rely on contractors to install and maintain irrigation systems.	Technical & Financial Assistance

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
Offer grants to lower income customers to install water wise fixtures & other measures	Addresses potential needs of underserved community	Requires not insubstantial city resources	For implemen-tation	Need to identify funding source	High	Low	Medium-term	Advisory Committee	DSS model ranks Indoor Fixture Give-aways as providing high water savings relative to other measures modeled.	Supplier-financed Retrofit or Replacement of Fixtures
Wyland Mayor's Water Conservation Challenge (https://mywaterpledge.com/)	Additional method to reach customers	None initially identified	For implemen-tation	Yes	High	Medium	Long-term	GSI	DSS model ranks Education and Outreach as providing high water savings relative to other measures modeled.	Other Conservation Measures
Create a report on conservation program effectiveness	• Informs city council and public • Helps direct program efforts	Requires not insubstantial city resources to develop and maintain	For implemen-tation	Yes	Low	Medium	Long-term	Advisory Committee	Measure not directly related to action that would result in increased water efficiency	Other Conservation Measures
Change City code to require FAL at all new property types, not just Commercial	Expands FAL to all new property types	• 'Potentially extended effort to revise requirement. • Code change is a time intensive process	For implemen-tation	Not currently	Low	Medium	Long-term	Advisory Committee	Slow rate of residential growth forecast for City	Other Conservation Measures
Install snow fences	Fences to capture snow, reduce evaporation, and promotes aquifer recharge or creek flow	Impacts unknown--study required	For implemen-tation	No	Unknown	High	Long-term	Advisory Committee	N/A	Other Conservation Measures
Street medians with grass can be adopted by local contractors and managed using Xeriscape techniques after removing some/all of the grass	• Reduces peak season use • Re-enforces water-wise landscaping as a valid option	Constant upkeep needed to maintain appearance	For implemen-tation	Yes	Low	Medium	Long-term	Advisory Committee	Small amount of irrigated land affected, resulting in low water savings	Other Conservation Measures & Education and Outreach

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
Inform public of water supply status/advertise availability of Reeder Reservoir dashboard	Can help explain why conservation during peak season is important	• Caters to a small customer segment interested in such things • City does not have a staff position to lead communication efforts	Partially in process	Not currently	Low	High	Long-term	Advisory Committee	Measure not directly related to actions that would result in increased water efficiency	Outreach & Education
Provide opportunities to collect and reuse rain water and greywater.	Reduces peak season use	Few rain events during peak season limits rain water capture benefits	Partially in process	Yes	Low	Medium	Long-term	Advisory Committee	DSS model ranks rainwater catchmnent and graywater systems as providing low to medium-low water savings relative to other measures modeled.	Reuse
Revise smart controller rebate program to include water savings requirements and reduce rebate receipt requirement from two to one years	Increases effectiveness of program	None initially identified	For implemen-tation	Yes	Medium	Medium	Long-term	City staff	DSS model ranks Smart Controller Rebate as providing medium water savings relative to other measures modeled.	Technical & Financial Assistance
Tap into customers' conservation ethic during outreach efforts	May newly inspire customers to adopt water efficient measures	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Other Conservation Measures
Give consideration to equity issues when adminstering conservation program	Addresses potential needs of underserved community	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Other Conservation Measures
Devise a method to evaluate and evaluate effectiveness of conservation measures (e.g. rebates)	Informs city which measures are most effective and where to direct future resources	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Other Conservation Measures

Exhibit 1: Prioriy List of New and Ongoing Conservation Measures
City of Ashland

Measure	Major Benefits	Major Barriers	Measure Status[1]	Resources Currently Available (time, budget, staff) via IGA with Medford Water[2]	Potential for Water Reduction[3]	Level of Effort to Implement & Maintain	Recommended Timing of Implementation[4]	Measure Source	Basis of Potential for Water Reduction[5]	Correlate w/ WMCP Conservation Section
Use city resources where they can be most effective	Promotes financially responsible use of city resources	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Other Conservation Measures
Provide water use history to new homeowners (possible component of providing a "water inspection" prior to home purchase--see below)	• Highlights the importance of water usage • Segue to a "conversation" with homeowner about water wise options • Reaches customers that would not otherwise seek efficiency measures	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Outreach & Education
Convince customers to conserve by promoting a wide-range of reasons that conservation is important	Recognizes that each customer may have different motivations (save money, save planet, etc.)	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Outreach & Education
Offer ongoing water efficiency training to irrigation contractors	Reduces peak season use	N/A	In process	N/A	N/A	N/A	(6)	Advisory Committee	N/A	Outreach & Education

[1] "Measure status" entries definitions: "for implementation"--measure has not been implemented, "In process"--City is addressing this measure, "Partially in process"--City has elements of this measure in place.
[2] For values of "not currently" given to measures that are identifed as partially implemented in the Measure Status column, this means that for the measures currently not implemented, resources are not available.
[3] Explanaition of values based on City's 2018 water savings and cost-effectiveness analysis (Decision Support System or DDS model) conducted by Maddaus Water Management, Inc. (2018). Values correlate to water savings as follows: High = 15,416 - 215,130 gallons per day city-wide savings (gpd); Medium = 2,048 - 9,279 gpd savings; Low = 1 - 1,828 gpd savings
[4] Recommended Timing of Impementation: Short-term, 0-2 years; Medium-term, 3-5 years; Long-term, 5+ years.
[5] Based on results from the City's water savings and cost-effectiveness analysis conducted by Maddaus Water Management, Inc. (2018)
[6] Measure is currently implemented.

Exhibit 2: Water Reuse Project Examples and Ideas
City of Ashland

Reuse Category	Project Type	Examples	Major Benefits[1]	Major Drawbacks[1]
Reclaimed Water to One or More Customer	Irrigate onsite	City of Newberg: Uses reclaimed water to irrigate 27 acres of landscaping at WWTP grounds and to supply site's hydrants	• Reduces peak demands on potable supply • May help comply with water quality requirements associated with water body receiving WWTP effluent	• Small volume of reclaimed water used relative to the cost to upgrade onsite irrigation system
	Irrigate more than one off-site location	City of Beaverton: See below. City of Ashland: City evaluated a purple pipe program limited to specific properties throughout service area. such as North Mountain Park and the Oak Knoll Golf Course. (See City of Ashland Water Conservation and Reuse Study [Carollo, 2011], Technical Memorandum 8).	• Reduces peak demands on potable supply • May help comply with water quality requirements associated with water body receiving WWTP effluent • Offsets use of City's existing water rights at North Mountain Park.	• System infrastructure and planning costs may eclipse benefits • Public acceptance of the use of treated wastewater (for non-potable uses) • Reduces wastewater discharges to receiving water bodies
	Industrial reuse	Wichita Falls, TX, PPG facility: Since cooling towers do not require high quality water, this facility received reclaimed water for use in its cooling towers.[2]	• Cooling towers do not require high quality water • Saves expense of purchasing potable water	• May require the expense of constructing a reservoir to provide constant supply to cooling towers in addition to "purple pipe" distribution system
	Irrigate one off-site location	City of Newberg: Reclaimed water distributed to Chehalem Park and Rec. District golf course at up to 350 gal./min. for irrigation of 120 acres of greens. City of Veneta: Reclaimed water used to irrigate approximately 70 acres of hay on City-owned property. City of Ashland: Reclaimed water evaluated for use as irrigation on City-owned Imperatrice Ranch property. Alternative not selected by City to reduce stream thermal loads generated by municipal wastewater discharges in Ashland Creek. (See City of Ashland Wastewater Facilities Plan [Keller Asscociates, 2014]) City of Cottage Grove: Distribution of reclaimed water to a local golf course for irrigation purposes, representing 60 to 80 percent of the effluent generated by the WWTP during the irrigation season. City expanding system by constructing storage for reclaimed water for use at additional locations.	• Potentially reduces demands on potable supply • May help comply with water quality requirements associated with water body receiving WWTP effluent	• System infrastructure and planning costs may eclipse benefits • Public acceptance of the use of treated wastewater (for non-potable uses) • Potentially limited opportunities for large volumes of recycled water use • Reduces wastewater discharges to receiving water bodies
Untreated well water	Untreated well water	Sunrise Water Authority: Water from a well that produces a lower-quality water than SWA's other sources serves a "purple pipe" system.	• Reduces peak demands on potable supplies	• System infrastructure and planning costs may eclipse benefits

Exhibit 2: Water Reuse Project Examples and Ideas
City of Ashland

Reuse Category	Project Type	Examples	Major Benefits[1]	Major Drawbacks[1]
Stormwater capture and storage for reuse	Collect and reuse stored stormwater for irrigation	City of Beaverton: Collects and treats stormwater, pumps water into a local aquifer for storage, and recovers the water for use during peak season	• Reduces peak demands on potable supplies	• Public acceptance of the use of treated wastewater • System infrastructure and planning costs may eclipse benefits • Local hydrogeology must be able to accommodate Aquifer Storage and Recharge (ASR) projects
Discharge of WWTP effluent to Ashland canal	WW discharge to Ashland canal during peak season to supplement water used for irrigation purposes	City of Ashland: Concept would divert WWTP effluent from Ashland Creek into the Ashland canal, providing a consistent source of water to the canal for use by those that rely on the canal as a source of non-potable supply. Potential opportunity for the City to re-treat this water at its water treatment plant in order to help meet system demands.	• May help comply with water quality requirements associated with water body receiving WWTP effluent • Forestalls the use of potable water for irrigation by customers that use non-potable water from canal	• Diverts water from Bear and Ashland Creeks, where ODFW wishes to maintain as much flows as possible (City of Ashland Wastewater Facilities Plan [Keller Asscociates, 2014], p. 4-5) • Flows may exceed customer irrigation demands, and requiring additional accomodations for reuse of remaining WWTP effluent
Discharge of Reclaimed Water to Emigrant Lake	Transport and discharge of reclaimed water to Emigrant Lake	City of Ashland: Transport and discharge reclaimed water to Emigrant Lake for future use.	• May help comply with water quality requirements associated with water body receiving WWTP effluent • Bolster lake volumes for recreational use • Augment releases for downstream uses	• TID canal downstream users acceptance of the use of treated wastewater • System infrastructure and planning costs may eclipse benefits
Industrial cooling tower blowdown for irrigation	Industrial reuse of water	Calpine: Calpine (Umatilla, OR) supplies cooling tower blowdown to neighboring Simplot for use as irrigation on crop land.	• Saves Simplot the expense of buying or producing its own irrigation water and Calpine the expense of treating or paying for treatment by utility • Reduces the need for use of aquifer	• Identifying user and generators within close proximity in order to keep construction and maintenance costs low

[1]Considerations for major benefits and drawbacks: regulatory hurdles, financial costs, public acceptance, environmental impacts

[2]https://www.process-heating.com/articles/92671-cooling-towers-provide-water-reuse-opportunity

Appendix D

Water Rates

RESOLUTION NO. 2019-10

A RESOLUTION REVISING RATES FOR WATER SERVICE PURSUANT TO ASHLAND MUNICIPAL CODE SECTION 14.04.030 AND REPEALING RESOLUTION 2018-12.

THE CITY OF ASHLAND RESOLVES AS FOLLOWS:

SECTION 1. The "Water Rate Schedule" marked as "Exhibit A" and attached to this Resolution, shall be effective for actual or estimated consumption on or after July 1, 2019.

Prorated calculations are permitted for any bills prepared for a partial month or billing period that overlaps the effective date of this Resolution.

Miscellaneous Charges and Connection Fees established by previous resolutions remain in effect until revised by separate Council Action.

SECTION 2. Copies of this resolution shall be maintained in the Office of the City Recorder.

SECTION 3. Classification of the fee. The fees specified in Section 1 and Section 2 of this resolution are classified as not subject to the limits of Section 11b of Article XI of the Oregon Constitution (Ballot Measure 5).

SECTION 4. Resolution 2018-12 is repealed.

This resolution was duly PASSED and ADOPTED this 4th day of June, 2019, and the effective date is July 1, 2019, upon signing by the Mayor.

Melissa Huhtala, City Recorder

SIGNED and APPROVED this 5th day of June, 2019.

John Stromberg, Mayor

Reviewed as to form:

David Lohman, City Attorney

City of Ashland, Oregon
WATER RATE SCHEDULE

CITY OF ASHLAND

All water service provided by the City of Ashland shall be in accordance with Chapter 14.04 of the Ashland Municipal Code.

Billing:

The minimum monthly charge shall be the sum of the Customer Charge; Meter Charge; plus Quantity Charge, if applicable; and Miscellaneous Charges, if applicable. Billing shall occur monthly with charges due and payable upon receipt.

Customer Charge:
A single customer charge is applied to each water account regardless of the number of metered water services.

Customer Charge, per account	July 2018	July 2019
Per month	$ 12.82	$ 13.33

Meter Charge:
The meter charge applies to all metered water services and does not include any water consumption.

Meter Charge, per meter	July 2018	July 2019
0.75" and Fire Guard meters	$ 15.02	$ 15.62
1" meter	$ 15.66	$ 16.29
1.5" meter	$ 71.65	$ 74.52
2" meter	$ 113.86	$ 118.41
3" meter	$ 228.32	$ 237.45
4" meter	$ 362.11	$ 376.59
6" meter	$ 712.51	$ 741.01
8" meter	$ 1,129.57	$ 1,174.75

Quantity Charge:
All customers will be charged the following rates per cubic foot of water used.

Residential, per dwelling unit October - May	July 2018	July 2019
0-300 cf per cycle	$ 0.0269	$ 0.0280
301 to 1,000 cf per cycle	$ 0.0335	$ 0.0348
1,001 to 2,500 cf per cycle	$ 0.0454	$ 0.0472
Over 2,500 cf per cycle	$ 0.0586	$ 0.0609
Residential, per dwelling unit June - September		
0-300 cf per cycle	$ 0.0269	$ 0.0280
301 to 1,000 cf per cycle	$ 0.0335	$ 0.0348
1,001 to 2,500 cf per cycle	$ 0.0454	$ 0.0472
2,501 to 3,600 cf per cycle	$ 0.0586	$ 0.0609
Over 3,600 cf per cycle	$ 0.0754	$ 0.0784

Residential Irrigation October - May	July 2018	July 2019
0-1000 cf per cycle	$ 0.0335	$ 0.0348
1,001-2500 cf per cycle	$ 0.0454	$ 0.0472
over 2,500 cf per cycle	$ 0.0586	$ 0.0609
Residential Irrigation June - September		
0 to 1,000 cf per cycle	$ 0.0335	$ 0.0348
1,001 to 2,500 cf per cycle	$ 0.0454	$ 0.0472
2,501 to 3,600 cf per cycle	$ 0.0586	$ 0.0609
Over 3,600 cf per cycle	$ 0.0754	$ 0.0784

Commercial, less than 2" meter	July 2018	July 2019
0-2,500 cf per cycle	$ 0.0335	$ 0.0348
> 2,500 cf per cycle	$ 0.0454	$ 0.0472
Commercial, 2" or larger meter		
0-15,000 cf per cycle	$ 0.0335	$ 0.0348
> 15,000 cf per cycle	$ 0.0454	$ 0.0472

Institutional (governmental and municipal)	July 2018	July 2019
Per cubic foot	$ 0.0321	$ 0.0334

Commercial and Institutional Irrigation	July 2018	July 2019
October to May	$ 0.0362	$ 0.0376
June to September	$ 0.0490	$ 0.0510

Miscellaneous Charges:

TID Irrigation:

TID, unmetered service	July 2018	July 2019
Per season, per acre or portion of acre	$ 211.81	$ 241.18
TID, metered service		
Meter Replacement Charge*, by meter size		
0.75" meter	$ 1.29	$ 1.34
1" meter	$ 1.93	$ 2.01
1.5" meter	$ 3.05	$ 3.17
2" meter	$ 4.11	$ 4.27
3" meter	$ 8.80	$ 9.15
4" meter	$ 19.12	$ 19.88
6" meter	$ 26.51	$ 27.57
8" meter	$ 31.97	$ 33.25
Quantity Charge	$ 0.0024	$ 0.0025

**Meter replacement charge is assessed each month, regardless of consumption.*

Fire Protection Service:

Fire Protection Service	July 2018	July 2019
Customer Charge, if applicable	$ 12.82	$ 13.33
Meter Replacement Charge	$ 1.29	$ 1.34
Meter Charge	$ 15.02	$ 15.62
Quantity Charge	$ 0.0369	$ 0.0384
Unmetered Fire Protection Service	$ 15.02	$ 15.62

Bulk Water:

For water provided on a temporary basis through a bulk meter on a fire hydrant, the following charges apply:

Bulk Water	July 2018	July 2019
Deposit*	$ 2,030.38	$ 2,111.60
Basic Fee	$ 256.37	$ 266.62
Quantity Charge	$ 0.0369	$ 0.0384

**Deposit is refundable less basic fee, quantity charge, and any damage to the city meter, valve, wrench, and/or hydrant.*

Outside City Limits:

All rates and charges for water service provided outside the city limits will be 1.5 times the rates for water service provided within the city limits.

Appendix E

List of Customer-Focused Conservation Measures

Current Customer-Focused Conservation Measures Implemented by the City of Ashland

Conservation Program Elements	Description
Rate Structure	The City's four-tier rate structure is based on the quantity of water consumed; progressive rates
	The City implements a fifth tier in the summer to encourage conservation and decrease peak usage
	The City has increased rates each year since 2014
Public Education and Outreach	Water efficiency webpages with indoor and outdoor water saving tips, rebate program information
	WaterWise landscaping and water conservation webpage
	Online landscape irrigation needs calculator
	Articles in the newletter and in monthly utility bills
	Presentations to schools (K-12, college), civic groups, homeowners associations, Bed & Breakfast
	Participation in community events by staffing City booth
	Table tent cards for restaurants--"water served upon request"
	Water-wise calendar art contest at primary schools
	Handouts and brochures including topics like watering schedules, indoor and outdoor water use, meter reading, greywater, rainwater catchment, drought, irrigation for trees
	Conservation-focused displays at library and public work building
	Partnerships with North Mountain Park Nature Center
	The City has developed information about greywater and rainwater catchment
	Outreach performed via advertisements in local newspapers, television interviews, radio, and advertisements before movies at local theaters
Technical Assistance and Financial Incentives	The City provides free irrigation system evaluations, and assistance with programing sprinkler controllers and water schedules available for all customers
	The City provides indoor water analyses that evaluate indoor water use, including looking for leaks--focus on residential, multifamily, and commercial customers
	The Water Wise Landscape website provides provides water efficient landscaping and gardening information
	The City provides a weekly watering guide each Monday posted on the website, developed a water use calculator to allow customers to evaluate their own water use, and provides a sample watering schedule
	Greywater system and rainwater catchment system construction and installation advice
	Rebates for replacing lawns with low water use landscaping and smart irrigation controller
	Incentives for commercial kitchen appliances such as air-cooled ice machines and pre-rinse spray valves
	Rebates for toilets, washing machines, smart controllers
Fixture Retrofit and	Give-aways: low-flow faucet aerators, low-flow showerheads, and soil moisture meters
	See "Technical assistance and financial incentives"
Other	Promulgated water-wise landscape standards for new construction
	Historically, reviewed landscape and irrigation plans submitted to the Planning Division and provided direction for meeting water efficiency standards

Appendix F

Curtailment Plan Contact List

Appendix F: Curtailment Plan Contact List

The following is a working list of contacts for easy reference in the event of imposition of curtailment actions. It will be updated and modified by the Public Information Coordinator as deemed necessary. In addition to communication actions aimed at the general public, the following will be contacted directly as appropriate:

City Contacts:

- City Administrator
- Department Directors

Customers:

- Wholesale customers
- Commercial, industrial and institutional customers
    - Highest water users
    - Schools
    - Domiciliary

Health Professionals:

- Jackson County Health Department
- Oregon Dept of Human Services, Drinking Water Program Hospitals

Landscape Interests:

- Landscape contractors
- Landscape architects
- Nurseries
- Landscape maintenance firms

Miscellaneous business interests:

- Chamber of Commerce
- Car Washes
- Swimming pool contractors
- Construction industry: commercial and utility contractors, Home builder's Assoc., Rental Management firms

Appendix G

Projected Climate Change Impacts on Water Demand and Supply for City of Ashland

Projected Climate Change Impacts on Water Demand and Supply for the City of Ashland, Oregon

June 2023

Technical memorandum to GIS Water Solutions, Inc.

Prepared by
The Oregon Climate Change Research Institute

Projected Climate Change Impacts on Water Demand and Supply for the City of Ashland, Oregon

Technical Memorandum to GIS Water Solutions, Inc.

Prepared by

David E. Rupp, PhD., Associate Professor Senior Research
Oregon Climate Change Research Institute
College of Earth, Ocean, and Atmospheric Sciences
104 CEOAS Admin Building
Oregon State University
Corvallis, OR 97331

June 2023

Recommended citation:
Rupp, D. E. (2023). Projected Climate Change Impacts on Water Demand and Supply for the City of Ashland, Oregon, Technical Memorandum to GSI Water Solutions, Inc., Oregon Climate Research Institute, Corvallis, OR.

Table of Contents

Introduction

This technical memorandum provides 1) background information on climate change and its impacts on the City of Ashland and its surroundings, and 2) estimates of the effect of climate change on factors affecting the volume of water used by the City of Ashland's (Ashland) water system (demand) and its primary water supply source: Ashland Creek.

Regional climate change and potential impacts to the hydrological cycle

Emissions from industrialization will continue to increase the concentrations of greenhouse gases in the atmosphere worldwide, causing Earth's atmosphere, oceans, and lands to warm. This warming will have both direct and indirect effects on the hydrological cycle (IPCC, 2021). Ultimately, the rate of climatic changes will depend on the future rate of greenhouse gas emissions.

Because future greenhouse gas emissions are unknown, plausible scenarios of future emissions are typically considered when making projections of future climate. Two scenarios commonly assumed (and the ones we rely on here) are known as Representative Concentration Pathway (RCP) 4.5 and 8.5 (Van Vuuren et al., 2011). RCP 4.5 and RCP 8.5 are often considered moderate and high-end emissions scenarios, respectively. The greenhouse gas concentrations assumed by RCP 8.5 towards the end of the twenty-first century are currently considered unlikely (Hausfather and Peters 2020) but still plausible over the next few decades (Schwalm et al 2020).

Potential changes to the future climate and the associated effects on the hydrological cycle have been reported previously for the City of Ashland (Dalton 2016), Jackson County (Dalton et al. 2023), the Rogue River basin (Doppelt et al., 2008) and the State of Oregon (see Fleishman 2023 and the series of Oregon Climate Change Assessments at https://blogs.oregonstate.edu/occri/oregon-climate-assessments). The remainder of this section highlights relevant findings primarily from Dalton (2016) and Dalton et al. (2023).

The annual average temperature in Ashland has already increased by about 2.5°F over the last century and the temperature is projected to increase at a faster rate during the next several decades. For example, by the 2050s, the annual average temperature is projected to be 4 and 5°F warmer relative to a 1950 – 2005 baseline, under RCP4.5 and 8.5, respectively. Changes to the magnitude and frequency of hot days may be relevant to water demand so merit attention. For example, by the 2050s, the temperature on the hottest day of the year is projected to increase by 6 and 7°F, while the frequency of days over 100°F is projected to increase by 6 and 11 days per year, under RCP 4.5 and 8.5, respectively.

Annual average precipitation in Ashland is projected to change very little in response to anthropogenic climate change. Although there is a projected future trend in the region towards more winter precipitation and less summer precipitation, the changes for Ashland and Jackson County are small. In Jackson County for example, the summer low precipitation total that historically had a 20% chance of occurring in any given year (1971 – 2000 baseline), is projected to have a 23% chance of occurring in any year by the 2050s: In other words, such a low summer

precipitation total will occur with only slightly higher frequency. Overall, future seasonal precipitation over the next several decades will be dominated by natural variability whereas climate change will play a minor role.

Projections of climate-driven changes to municipal water demand in Ashland or other nearby communities have not been made in previous studies of climate impacts. We expect that the impact of climate change on municipal water demand will depend not only on environmental factors but also on human behavior. In this study, we estimate changes to Ashland's water demand under future climate scenarios (see section below).

With respect to Ashland's water supply, the most significant changes to the hydrological cycle will be caused by increasing temperature as opposed to changes in precipitation totals. The primary hydrological changes will be driven by the changing snow regime as temperatures rise. The transition to more rainfall and less snowfall will lead to a smaller and earlier peak snowpack and snowmelt's contribution to streamflow will be reduced and occur earlier. As a result, average monthly discharge from the Middle Rogue River basin (USGS HUC 17100308) is projected to increase in winter months (December – November) and decrease in the spring and early summer months (April – July).

A diminished snowpack will cause the period of low summer streamflow to begin earlier than it has historically. The earlier onset of the low flow period will lengthen the low-flow season unless fall rains also begin earlier, but there is yet no clear evidence from observations or climate models that the onset of the rainy season will be strongly affected by climate change. The longer low-flow season will increase the frequency of hydrological summer drought as measured by the summer runoff total relative to the historical average summer runoff total. In Jackson County for example, the summer low runoff total that historically had a 20% chance of occurring in any given year is projected to have a 50% chance of occurring in any year by the 2050s.

Ashland's water supply may also be affected by higher evaporation and transpiration (i.e., evapotranspiration) rates caused by higher temperatures in source watersheds. Larger losses from evapotranspiration, particularly in summer, may contribute to an increased frequency of summer hydrological drought. However, both increased plant water use efficiency due to higher carbon dioxide (CO_2) concentrations and possible changes in vegetation types may offset the higher atmospheric evaporative demand to a substantial amount.

Although the total annual precipitation is projected to change little, heavy precipitation events are expected to become more intense because warmer air can hold more water. Higher intensity rainfall can increase turbidity in the water supply therefore increasing the demands on water treatment facilities. Precipitation on the wettest day of the year in Jackson County is projected to increase by 12 and 15% (RCP4.5 and 8.5, respectively) by the 2050s relative to the 1971 – 2000 baseline. Precipitation on the wettest consecutive five days is projected to increase by 9 and 12% (RCP4.5 and 8.5, respectively) by the 2050s. Landslides triggered by rainfall and saturated soil can contribute especially large amounts of sediment to streams. However, the probability of rainfall-driven landslides is not projected to increase significantly, although this projection does not consider other changes that could increase likelihood of landslides, such as increased

occurrence of wildfire that may lead to turbidity events in the Ashland Creek watershed due to greater exposure of soils.

Ashland's primary water supply is Reeder Reservoir on Ashland Creek just southwest of Ashland. Ashland also receives water from the Talent Irrigation District (TID) which has stored water rights at Hyatt Reservoir and Howard Prairie Reservoir, about 12 and 15 miles east of Ashland, respectively. To meet demand during periods of low supply from Ashland Creek, Ashland relies on its water right at Lost Creek Lake (approximately 30 miles north of Ashland). Lost Creek Lake also supplies water to the Medford Water Commission (MWC) and other water suppliers. Although we focus on Ashland Creek below, the impacts of climate change across these sources will share common characteristics due to the generally similar climate of the basins that feed these various sources of water. The main impacts to the upper Rogue River (a primary source for Lost Creek Lake) and other rivers and creeks that originate in the mountains will be an increase in flow in winter months, a decrease in flow in the spring and early summer months, and a lengthened low-flow season, where the magnitude of the change at some point in the future will depend on the historical contribution of the snowpack to streamflow in each basin. How these changes ultimately affect available reservoir water throughout the year depends on the reservoirs' volumes and the extent to which they are also managed for competing uses: flood management, hydropower, downstream environmental flow targets, and recreation.

Climate Change Impacts on Ashland's Water Demand

We estimated the effect of climate change on the monthly volume of water used by Ashland's water system (demand) on the basis of historical relationships between monthly demand and weather variables (see Appendix A for additional detail on data and methods). A key assumption made is that historical relationships will remain the same into the future, that is, demand fluctuates with changes in weather generally.

The weather variables used as potential predictors were daily maximum temperature (*Tmax*), daily minimum temperature (*Tmin*) and daily precipitation. To compare weather variables to monthly water demand, daily weather was aggregated to monthly metrics by counting the number of days in a month that a variable fell within a bin spanning a range of values. For example, for *Tmax*, we constructed bins at 10°F intervals and each bin contained the count of the number of days in a month when the temperature fell within that specific bin.

Water demand was most sensitive to *Tmax* therefore we defined sensitivity to temperature as the percentage change in monthly water demand for each day in a month in which *Tmax* fell within a specified temperature range (Figure 1). For example, for every day in a month that *Tmax* was between 70°F and 80°F, the monthly water demand was increased by 2.9% over a baseline demand. Baseline demand was calculated as the average historical demand when 60°≤ *Tmax* <70°F and therefore days with 60°≤ *Tmax* <70°F had no effect on the baseline demand. Sensitivities varied by temperature bin above 70°F, but *Tmax* <60°F had no effect on water demand. Percentages were additive, so if *Tmax* was between 70°F and 80°F for 15 days in a month and between 80°F and 90°F for another 15 days, the demand would have been 15 × 2.9% + 15 × 3.4% = 95% above the baseline.

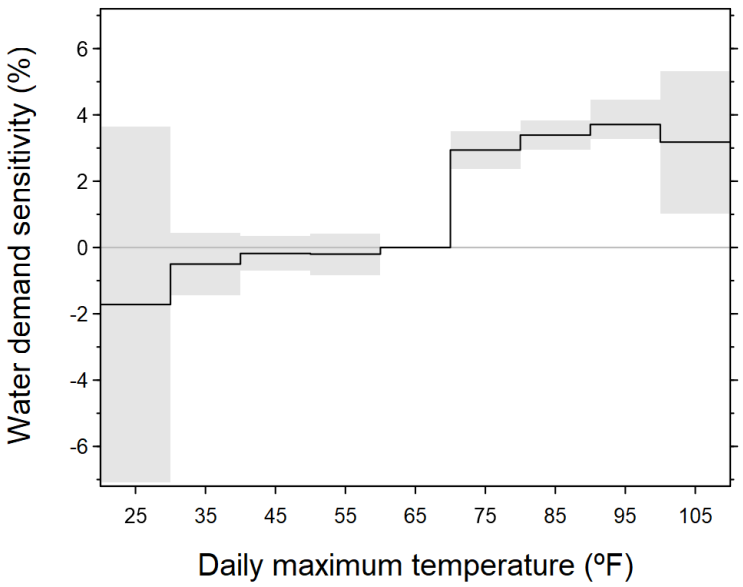


Figure 1. Sensitivity of monthly water demand to daily maximum temperature (*Tmax*). Shaded areas show 95% confidence intervals on the estimates of sensitivity. Sensitivity is defined as the percentage change in monthly water demand due to a day in a month in which *Tmax* falls within a specified temperature range.

Precipitation, particularly its absence, was found to be a statistically significant but minor factor. We defined sensitivity to precipitation as the percentage change in monthly water demand for each day in a month without measurable precipitation. To be precise, for every day in a month that precipitation was less than 0.01 inches, the monthly water demand was increased by 0.5% over a baseline demand. The sensitivity to days with sizable amounts of rain (i.e., one standard deviation above the mean) was not statistically significant.

Based on the empirically derived sensitivities, we projected the change in water demand using simulated *Tmax* and precipitation under two greenhouse gas emissions scenarios: Representative Concentration Pathway (RCP) 4.5 and 8.5 (see Appendix A). Both scenarios project for Ashland an increase in the number of days with higher temperatures and a corresponding loss of cooler days (Figure 2, upper panel). The number of days with no measurable rain per month is projected to increase slightly in spring and fall implying an expansion of the summer dry season (Figure 2, lower panel).

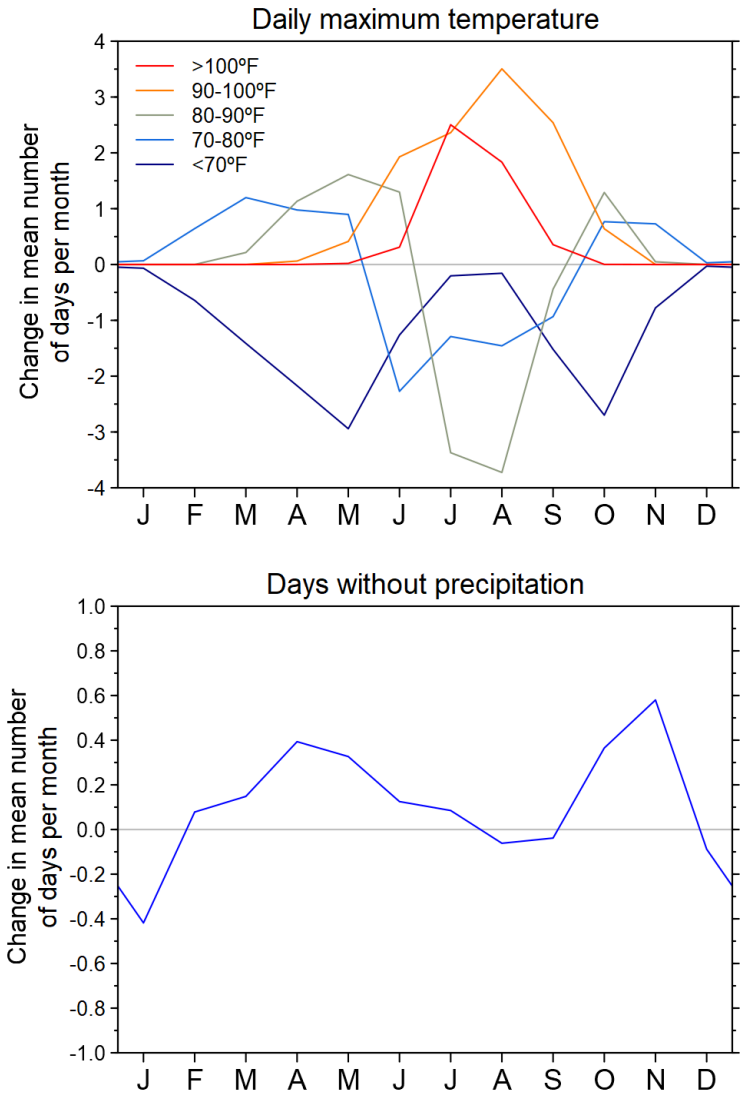


Figure 2. Projected change by 2051 – 2060 under the RCP4.5 scenario in (upper panel) the mean number of days per month when the daily maximum temperature (*Tmax*) fell within specified temperature ranges and (lower panel) the mean number of days per month with no measurable precipitation. Changes are relative to 2011 – 2020.

Water demand relative to the period 2010 – 2020 is projected to increase in all months due to the changing climate (Figure 3 and Tables 1 and 2). The largest percentage increases, although still modest, are in spring and autumn (e.g., demand increases by 7% in May and October by the end of the 2070s under RCP 4.5). Percentage changes during the coldest (December – January) and warmest months (July – August) show a shift over time to greater demands, but the effects are marginal. The generally larger increases in water demand under RCP 8.5 (Table 2) relative to RCP 4.5 (Table 1) are consistent with the greater temperature increases associated with RCP 8.5.

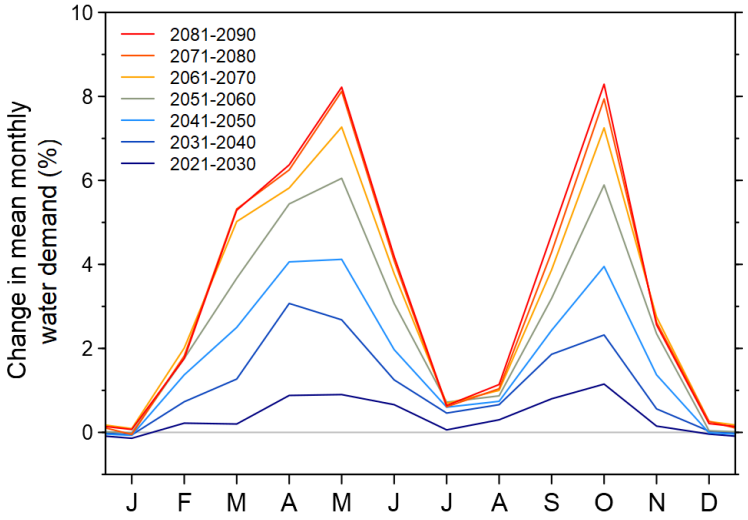


Figure 3. Projected change in the mean monthly water demand by decade under the RCP4.5 scenario due to weather effects only. Changes are relative to 2011 – 2020.

The largest percentage increases occur in the spring and autumn due to the sharp increase in demand sensitivity to *Tmax* ≥ 70°F compared to lower temperatures (Figure 1). Because spring and autumn months in particular experience a future increase in days with *Tmax* ≥ 70°F at the expense of a loss of cooler days (*Tmax* < 70°F), the change in sensitivity at the 70°F-threshold is most felt during these months. The larger future decrease in days with no measurable precipitation in spring and autumn also leads to a larger increase in demand in these seasons, although the influence of precipitation is much smaller than that of temperature. One can imagine that outdoor activities that use water (e.g., gardening, outdoor sports) may begin earlier in the spring and continue longer into autumn as more days exceed 70°F and there are fewer rainy days.

The relatively small percentage increase in demand during the months of July – August may be unexpected, but it results from demand sensitivities to *Tmax* that do not vary much above the 70°F-threshold (Figure 1). While July and August gain days with *Tmax* ≥ 90°F, they do mainly at a loss of days with *Tmax* between 70 – 90°F (Figure 2, upper panel). For example, if a day with *Tmax* between 80 and 90°F becomes a day with *Tmax* between 90 and 100°F, the net effect is quite small: a 0.3% increase in monthly water demand. At *Tmax* ≥ 100°F, the uncertainty on the estimated sensitivity is large (Figure 1) due to small number of days this hot in the observed record and it is possible that the sensitivity to extremely hot days is being underestimated.

Table 1. Projected percentage increase in monthly water demand from a baseline demand under the RCP4.5 scenario. The baseline represents an average hypothetical demand during 2011 – 2020. Only the response to climate is considered while all other effects are held constant over time.

	Percent Change by Decade						
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080	2081 – 2090
Jan	0	0	0	0	0	0	0
Feb	0	1	1	2	2	2	2
Mar	0	1	3	4	5	5	5
Apr	1	3	4	5	6	6	6
May	1	3	4	6	7	8	8
Jun	1	1	2	3	4	4	4
Jul	0	0	1	1	1	1	1
Aug	0	1	1	1	1	1	1
Sep	1	2	2	3	4	4	5
Oct	1	2	4	6	7	8	8
Nov	0	1	1	2	3	3	3
Dec	0	0	0	0	0	0	0

Table 2. Projected percentage increase in monthly water demand from a baseline demand under the RCP8.5 scenario. The baseline represents average hypothetical demand during 2011 – 2020. Only the response to climate is considered while all other effects are held constant over time.

	Percentage Change by Decade						
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080	2081 – 2090
Jan	0	0	0	0	0	1	1
Feb	0	1	1	2	2	4	5
Mar	0	1	2	4	6	8	10
Apr	1	2	3	6	7	10	12
May	1	3	5	8	10	13	15
Jun	1	2	3	4	5	6	7
Jul	0	0	1	1	1	0	0
Aug	0	1	1	1	1	1	0
Sep	1	2	4	5	6	7	8
Oct	1	3	5	9	12	14	16
Nov	1	1	2	4	5	6	8
Dec	0	0	0	0	0	0	0

Climate Change Impacts on Ashland's Water Supply Availability

We estimated the effect of climate change on Ashland's water supply to Reeder Reservoir using hydrological models to simulate basin discharge at gaged locations on East and West Ashland Creeks. Though a few ungaged creeks feed Reeder reservoir, East and West Ashland Creek together contribute by far most of the flow to the reservoir so excluding these smaller creeks should have little effect on our results. The hydrological models were driven by precipitation and temperature inputs that were derived using output from global climate models (GCMs) run under the same two scenarios of greenhouse gas emissions used for water demand projections (RCP 4.5 and 8.5). The hydrological models did not consider evaporation losses from Reeder reservoir, but an increase in evaporative loss from the reservoir would be expected in a future warmer climate.

Appendix B provides a more detailed description of the data and methods. Briefly, we derived projections of future percentage changes in mean daily and monthly discharge from a baseline period (1991 – 2020). Projections were calculated using three datasets: the Columbia River Climate Change dataset using the Variable Infiltration Capacity hydrological model (CRCC-VIC), the same Columbia River Climate Change dataset but using the Precipitation-Runoff Modeling System (CRCC-PRMS), and the LOCA CMIP5 Hydrology dataset using the VIC model (LOCA-Hydro5).

The projected changes in discharge from East and West Ashland Creek follow the pattern typical of basins in the region with important snowmelt contributions: future increases in winter discharge and future decreases in spring and summer discharge (Figure 4). A key difference among the datasets is the timing of the maximum projected percentage decrease in discharge. Although this maximum decrease shifts earlier in the spring over time as the climate warms, it mainly occurs in June in CRCC-VIC (Tables 3 and 4), in May in CRCC-PRMS (Tables 5 and 6), and in July in LOCA-Hydro5 (Tables 7 and 8).

These differences in the timing of the projected maximum percentage decrease can be associated with when the datasets simulate historical average peak discharge during the year: CRCC-PRMS simulates the earliest peak discharge (early May), LOCA-Hydro5 the latest (late June), and CRCC-VIC falls in between (late May). Of the three datasets, the CRCC-VIC mean annual hydrograph most closely resembles the observations in its general shape and in the timing of peak discharge (See Appendix B.3), which may support favoring the CRCC-VIC projections over the others.

Previous hydrological modeling of Ashland Creek using the Distributed Hydrologic Surface Vegetation Model (DHSVM; see Appendix B for details) shows a projected maximum percentage decrease in discharge occurring in July, most like LOCA-Hydro5. Moreover, the projected changes in discharge from DHSVM most closely resemble those from LOCA-Hydro5 over the entire year (Figure 5). DHSVM notably differs from the other datasets in that it projects substantial declines in September and October discharge, whereas the other datasets project only relatively small changes.

Given the general inferior performance of CRCC-PRMS with respect to the historical record, we felt justified in eliminating that dataset from further analysis of water supply availability. LOCA-Hydro5 has an average peak discharge that occurs too late in the year, yet its projected changes

most closely match those from DHSVM, which does not have such a bias (data not shown). Without additional information with which to decide on whether to exclude a dataset, this analysis considers the projections from both CRCC-VIC and LOCA-Hydro5.

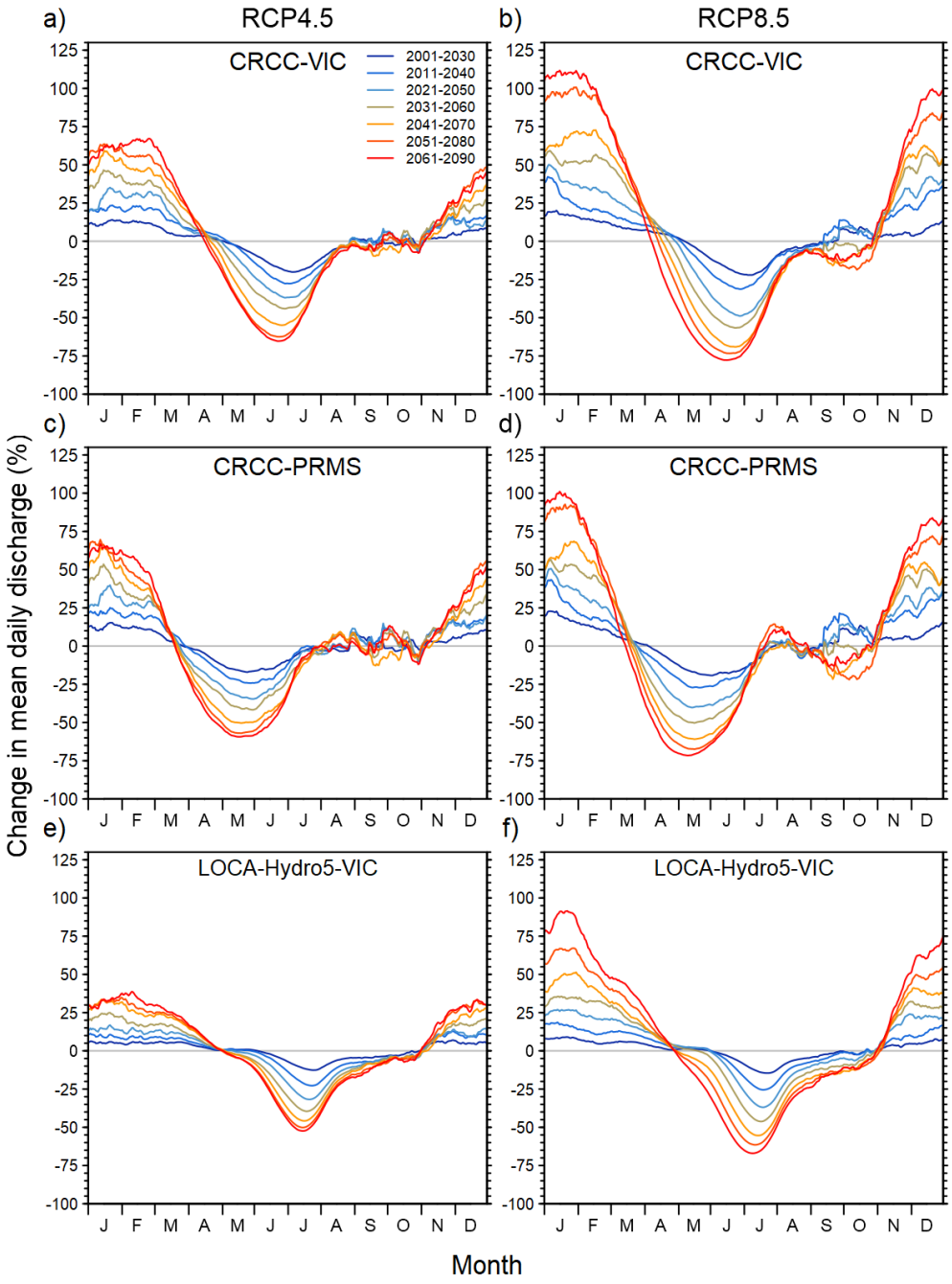


Figure 4. Projected percentage change from baseline (1991 – 2020) in combined East and West Fork Ashland Creek basin daily discharge under the RCP 4.5 (left column) and 8.5 (right column) scenarios as simulated by CRCC-VIC, CRCC-PRMS, and LOCA-Hydro5.

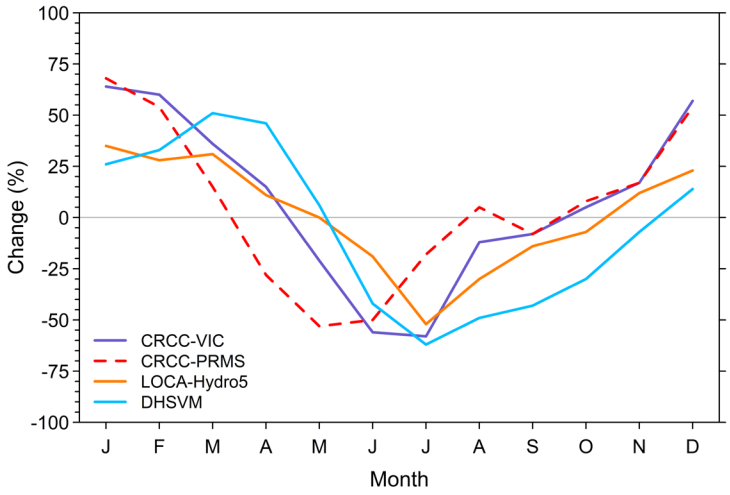


Figure 5. Projected percentage change from the 1980s to the 2040s in combined East and West Fork Ashland Creek basin daily discharge from CRCC-VIC, CRCC-PRMS, and LOCA-Hydro5 under RCP 4.5 scenario and from DHSVM under the A1B scenario (see Appendix B.1).

Table 3. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP4.5 scenario from CRCC-VIC. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	20	31	46	59	64	62
Feb	24	32	38	47	56	67
Mar	13	18	25	33	39	45
Apr	7	5	6	7	6	2
May	-4	-11	-18	-28	-36	-38
Jun	-23	-32	-40	-53	-61	-64
Jul	-24	-32	-39	-44	-47	-47
Aug	-6	-6	-5	-5	-6	-8
Sep	1	1	-4	-6	-3	-3
Oct	1	4	7	1	1	-3
Nov	10	9	11	5	10	14
Dec	14	9	20	26	37	32

Table 4. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP8.5 scenario from CRCC-VIC. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	30	40	50	63	95	111
Feb	21	35	55	73	96	101
Mar	14	22	36	41	50	48
Apr	8	10	9	3	-3	-16
May	-9	-18	-30	-43	-53	-62
Jun	-28	-45	-55	-68	-73	-78
Jul	-24	-39	-43	-52	-51	-54
Aug	-6	-8	-10	-11	-10	-10
Sep	5	-1	-3	-11	-8	-10
Oct	7	7	-6	-8	-17	-9
Nov	16	21	28	28	33	38
Dec	31	42	58	62	81	95

Table 5. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP4.5 scenario from CRCC-PRMS. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	21	36	52	65	65	65
Feb	22	28	32	40	46	57
Mar	9	9	9	9	7	9
Apr	-8	-17	-23	-31	-36	-40
May	-22	-32	-40	-50	-57	-59
Jun	-22	-29	-33	-43	-47	-51
Jul	-1	-3	-8	-12	-9	-7
Aug	0	0	7	8	6	0
Sep	4	4	-4	-6	2	1
Oct	0	5	10	2	4	1
Nov	10	9	11	3	8	11
Dec	15	12	22	30	40	36

Table 6. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP8.5 scenario from CRCC-PRMS. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	31	40	49	60	90	100
Feb	19	30	46	55	69	66
Mar	6	9	12	9	7	-2
Apr	-12	-22	-33	-42	-50	-58
May	-27	-40	-50	-61	-67	-71
Jun	-21	-34	-41	-49	-52	-54
Jul	-7	-6	-5	-11	0	-3
Aug	-3	1	-2	1	3	4
Sep	12	2	0	-13	-9	-10
Oct	11	11	-5	-7	-20	-7
Nov	16	20	28	29	33	36
Dec	28	38	50	54	70	80

Table 7. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP4.5 scenario from LOCA-Hydro5. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	9	14	24	33	33	34
Feb	9	13	17	25	29	36
Mar	9	12	17	22	24	25
Apr	4	5	6	8	9	10
May	1	-1	-2	-3	-5	-4
Jun	-5	-9	-15	-20	-25	-27
Jul	-21	-31	-39	-46	-50	-52
Aug	-11	-15	-18	-20	-22	-23
Sep	-7	-7	-8	-8	-11	-12
Oct	-5	-6	-4	-5	-5	-7
Nov	10	11	9	9	13	18
Dec	10	9	17	22	29	26

Table 8. Projected percentage change from baseline in the combined East and West Fork Ashland Creek basin discharge under the RCP8.5 scenario from LOCA-Hydro5. The baseline represents the average discharge during 1991 – 2020.

	Percentage Change by Decade					
Month	2021 – 2030	2031 – 2040	2041 – 2050	2051 – 2060	2061 – 2070	2071 – 2080
Jan	18	27	36	49	67	91
Feb	11	22	33	42	51	61
Mar	12	17	21	25	34	43
Apr	5	9	9	8	10	12
May	2	2	1	-5	-8	-14
Jun	-6	-10	-18	-30	-40	-49
Jul	-25	-36	-46	-55	-61	-66
Aug	-10	-15	-19	-24	-28	-31
Sep	-5	-8	-12	-16	-15	-16
Oct	-2	-4	-6	-9	-11	-11
Nov	8	15	19	20	22	27
Dec	12	23	29	38	47	60

Summary of Water Demand and Supply Projections

We estimated the effect of future climate change on monthly water demand for the City of Ashland and on the water supply from Ashland Creek. Projected changes in demand and supply were made for each future decade out to the year 2090 assuming two scenarios, one moderate (RCP 4.5) and one high-end (RCP 8.5), of future greenhouse gas emissions.

Considering only climate change as the factor, future monthly water demand is projected to increase as the temperature increases, and to a much smaller extent, as the number of dry days per month decreases slightly over much of the year. Future demand, as a percentage of historical demand, is projected to increase most in the spring and fall months. For example, in April, May, and October, demand increases by 4% above 2011 – 2020 levels by 2041 – 2050 under RCP 4.5. In mid-summer, when demand is historically high, future demand is only projected to increase by ~1%. The lack of any substantial change in summer arises from the relationship between Ashland's historical water demand and local temperature data, which showed only small differences in the sensitivity of demand once the temperature increased above 80°F. In other words, the amount of water used when the temperature reached 85°F was similar to when the temperature reached 95°F, all else being equal.

Projected changes in monthly water supply from Ashland Creek are largely driven by the decreasing contribution of snowmelt to streamflow as temperatures rise in the future. The reduction in the snowpack leads to large percentage decreases in future late spring/early summer flow when historically the snowpack was melting at its fastest rate. For example, mean June discharge from Ashland Creek is projected decrease by about 40% by 2041 – 2050 under RCP 4.5. The future decrease in flow extends through the summer, with mean August discharge decreasing by 5 – 18% and mean September discharge decreasing by 4 – 8% for the same time horizon and emissions scenario. In contrast, winter months are projected to have an increase in discharge due to more rainfall at the expense of less snowfall, but also due to a small increase in winter precipitation overall. The largest changes occur in January, with increases of 17 – 46% by 2041 – 2050 under RCP 4.5, for example. Although large changes are projected during some months, the total annual discharge is projected to be affected little by climate change.

Appendices

Appendix A: Data and methods for water demand projections

A.1. Data

Daily water demand from the City of Ashland (Ashland) water treatment plant (WTP) was acquired for the years 2005 through 2022. Daily water diverted from the Talent, Ashland, Phoenix Intertie project (TAP) were acquired for the years 2015 – 2022. The first use of TAP water by Ashland was on 29 June 2015. WTP and TAP values were summed to get the total daily water demand for Ashland.

Observed daily precipitation, daily minimum temperature (*Tmin*), and daily maximum temperature (*Tmax*) for an area representing the City of Ashland were acquired from the PRISM Climate Group at https://www.prism.oregonstate.edu. The PRISM data are gridded with a resolution of 1/24 degree (~4 km cell width or an area of roughly 6 square miles). Specifically, we used data at the grid cell centered on (42.2069N, -122.7126W) for the years 2005 through 2022.

Simulations of daily weather variables under multiple climate change scenarios and spanning the years 1950-2099 were acquired from the Climatology Lab at the University of California, Merced at http://www.climatologylab.org/maca.html. Daily precipitation, *Tmin*, and *Tmax* were derived from global climate model (GCM) output that was statistically downscaled to 1/24-degree resolution over the contiguous United States. The downscaling was done using the Multivariate Adaptive Constructed Analogs Method (MACA; Abatzoglou and Brown, 2012). Like the PRISM data, the MACA data are gridded with a resolution of 1/24 degree. We used the data from MACA and PRISM at the same geographic location.

The MACA dataset (specifically the version called "MACAv2-METDATA") includes downscaled output from 20 GCMs (see Table A1) that were used in the Coupled-Model Intercomparison Project Phase 5 (CMIP5; Taylor et al., 2012) that provided the climate projections for the International Panel on Climate Change (IPCC) Assessment Report 5 (AR5; IPCC, 2013). This dataset includes climate projections using RCP 4.5 and 8.5.

A.2. Methods

We estimated the sensitivity of monthly water demand to weather using observed records of water demand and weather variables. We then applied these sensitivities to projections of future changes in weather variables to estimate changes in water demand due to climate change.

Sensitivities of water demand to weather variables were estimated using ordinary least squares regression. Monthly water demand was modeled as a function of weather and other factors that allowed for a non-linear response of water demand to weather. Daily weather was aggregated to monthly by summing the number of days in a month that a variable fell within a bin spanning a range of values. For *Tmin* and *Tmax*, we constructed bins in 10° F intervals and each bin contained the count of the number of days per month when the temperature fell within that

specific bin. For precipitation, we summed the number of days with no measurable precipitation and the number of days with precipitation > one standard deviation above the mean. Intuitively, the model coefficients on the bins allowed us to identify how an additional hot, cold, dry, or wet day affects water demand. The statistical model also included the effects of holidays and weekends, and quarterly differences (i.e., January – March, April – June, July – September, and October – December). The year was also treated as a factor so that time-varying demand resulting from changes in water use efficiency or population could be accounted for implicitly.

We applied the sensitivities to observed weather obtained from the model coefficients to the simulated weather from the MACA dataset. The results were monthly time series of simulated water demand from 1950 – 2099 corresponding to each of 20 GCMs and two RCPs (i.e., 40 time series). To both help cancel potential errors among the GCMs and smooth out climate variability not driven by increasing greenhouse gas concentration, we averaged the time series of water demand across the 20 GCMs for each RCP.

Climatological monthly water demand was calculated by averaging water demand for the calendar month over 30-year increments for each decade beginning in the 2010s and ending in the 2070s. For example, the water demand representative of August during the 2010s (i.e., 2011 – 2020) was taken as the average August water demand over the years 2001 – 2030. Percentage changes for each decade into the future were calculated relative to the 2010s' baseline.

Table A1. Global climate models[1] included in the MACA, CRCC, and LOCA-Hydro5 datasets

Global climate model	MACA weather	CRCC hydrology	LOCA-Hydro5 hydrology
ACCESS1-0			X
ACCESS2-0			X
BCC-CSM1-1	X		X
BCC-CSM1-1M	X		X
BNU-ESM	X		
CanESM2	X	X	X
CCSM4	X	X	X
CESM1-BGC			X
CESM1-CAM5			X
CMCC-CM			X
CMCC-CMS			X
CNRM-CM5	X	X	X
CSIRO-MK3-6-0	X	X	X
EC-EARTH			X
FGOALS-G2			X
GFDL-CM3			X
GFDL-ESM2G	X		X
GFDL-ESM2M	X	X	X
GISS-E2-H			X
GISS-E2-R			X
HadGEM2-AO			X
HadGEM2-CC	X	X	X
HadGEM2-ES	X	X	X
INMCM4	X	X	X
IPSL-CM4A-LR	X		X
IPSL-CM4A-MR	X	X	X
IPSL-CM5B-LR	X		
MIROC5	X	X	X
MIROC-ESM	X		X
MIROC-ESM-CHEM	X		X
MPI-ESM-LR			X
MPI-ESM-MR			X
MRI-CGCM3	X		X
NorESM1-M	X		X

[1]The CMIP5 ensemble member r1i1p1 was used from each GCM, except for CCSM for which r6i1p1 was used.

Appendix B: Data and methods for water supply projections

B.1. Data

Daily average streamflow for East Fork Ashland Creek at USGS gauge 14353500 and West Fork Ashland Creek at USGS gage 14353000 were acquired from the USGS at https://waterdata.usgs.gov/nwis/sw.

Simulations of daily basin discharge under multiple climate change scenarios for the East and West Fork Ashland Creek basins were acquired from two sets of data. The first set is a product of the Columbia River Climate Change (CRCC) project funded by the Bonneville Power Administration, USACE, and Bureau of Reclamation (RMJOC, 2018). The CRCC simulations cover much of northwestern United States, span the years 1950 – 2099, and were generated using 40 distinct modeling configurations and therefore consist of 40 scenarios of basin discharge. The 40 configurations are the product of two hydrological models driven with inputs derived from ten CMIP5 GCMs under two RCPs.

The ten GCMs were chosen based on relatively good performance with regards to observed historical climate (Rupp et al., 2013; RMJOC, 2018) and availability of the MACA-downscaled data (See Table A1). The GCM daily precipitation and daily minimum and maximum temperature data were statistically downscaled to 1/16-degree resolution using the MACA method. Note that while the general downscaling procedure is the same as discussed in Appendix A.1 above, the downscaled data here differ in resolution and in the observational dataset used to the train the statistical downscaling (see https://www.climatologylab.org/maca.html). Specifically, the version of MACA data used are called "MACAv2-Livneh").

The two hydrological models consist of the Variable Infiltration Capacity Model (VIC version 4.2.glacier.01; Liang et al., 1994) and a gridded implementation of the Precipitation-Runoff Modeling System (PRMS; Leavesley et al., 1983), both at 1/16 degree (~6 km). See Chegwidden et al. (2019) for an overview of the CRCC simulations.

The second set of basin discharge data comes from the LOCA CMIP5 Hydrology (LOCA-Hydro5) that is part of the "Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections" archive at https://gdo-dcp.ucllnl.org/downscaled_cmip_projections. The LOCA-Hydro5 simulations cover the conterminous United States, span the years 1950 – 2099 and were generated using precipitation and daily minimum and maximum temperature data from 32 CMIP5 GCMs (See Table A.1) under two RCPs (4.5 and 8.5). The GCM data were statistically downscaled to 1/16 degree using the Locally Constructed Analogs (LOCA) method (Pierce et al. 2014; 2015). Hydrology was simulated at 1/16-degree resolution using VIC version 4.2.c (Vano et al. 2020).

For both the CRCC and LOCA-Hydro5 datasets, 1/16-degree gridded model output was mapped onto polygons representing the East and West Fork Ashland Creek basins. Basin discharge was calculated as an area-weighted sum of the grid cell discharge, where the weights were proportional to the area of the basin that overlapped each grid cell.

Lastly, summarized projections of future streamflow in the East and West Fork Ashland Creek were acquired from tables in the document titled "Effects of Climate Change in Ashland Creek, Oregon" dated July, 2010, and accessed at https://www.ashland.or.us/Files/2010-07-13%20Ashland%20Creek%20Climate%20Change.pdf. This document describes how the Distributed Hydrologic Surface Vegetation Model (DHSVM) version v.2.4 (Wigmosta et al. 1994) was applied to simulate the hydrology of East and West Fork Ashland Creek basins using statistically downscaled meteorological data from ten CMIP3 GCMs under the greenhouse gas emissions scenario A1B. A1B falls between the RCP 4.5 and RCP 8.5 scenarios in terms of greenhouse gas concentration. Although the document does not state the spatial resolution of the model, figures in the document suggest that DHSVM was run at a much finer resolution than the VIC and PRMS models.

B.2. Methods

Daily time series of basin discharge were summarized identically for the CRCC and LOCA-Hydro5 datasets. Firstly, to help cancel potential errors among the GCMs, we averaged the time series of daily basin discharge across all GCMs for each hydrological model and each RCP. Secondly, climatological daily basin discharge was calculated by averaging discharge for each day of the calendar year over 30-year increments for each decade beginning in the 2010s and ending in the 2070s. For example, the water demand representative of July 21 during the 2010s (i.e., 2011 – 2020) was taken as the July 21 discharge averaged over the years 1991 – 2020. Thirdly, to further help smooth out 'internal' climate variability not driven by increasing greenhouse gas concentrations, we smoothed the daily climatological discharge for each decade with a 31-day moving average. Lastly, percentage changes in discharge for each decade were calculated relative to the 2010s' baseline.

B.3. Comparison of simulated and observed basin discharge

We compared the simulated and observed basin discharge climatology to help determine a qualitative level of confidence to the projected changes in future discharge from the different data source.

Simulated discharge from the CRCC-VIC, CRCC-PRMS, and LOCA-Hydro5 was much higher than observed discharge over most of the year (Figures B1 – B3; Table B1). CRCC-PRMS overestimated discharge the most and LOCA-Hydro5 the least. There are several possible reasons for the overestimation of discharge. The reasons include overestimation of precipitation, underestimation of losses from evapotranspiration (ET), and/or underestimation of groundwater that flows out of the basin and resurfaces at a point downstream from the point of measurement. A comparison across simulations of precipitation inputs point to overestimation of precipitation as the primary reason (Table B1): Average annual precipitation in the CRCC and LOCA-Hydro5 simulations was 86% and 46%, respectively than in the DHSVM simulations (Table B1). A secondary reason may be the underestimation of ET losses with some of the hydrological models. The runoff ratio (mean annual discharge divided by mean annual precipitation) is a relative measure of ET (high runoff ratio implies low ET). The runoff ratio was highest for CRCC-PRMS (0.72) and lowest for LOCA-Hydro5 (0.49), whereas the runoff ratio for DHSVM was 0.55 (Table B1).

True precipitation and evapotranspiration for the East and West Ashland Creek basins are not known, but it is reasonable to assume that the values of these water fluxes from DHSVM are more likely to be closest to actual values given DHSVM was calibrated to five years of streamflow records from the two creeks and that DHSVM most accurately represents the topographic variability of the basins. The relatively coarse-resolution hydrological models in CRCC and LOCA-Hydro5 would not have been calibrated using observed streamflow at East or West Fork Ashland Creek gages but would have used gages that were farther downstream and measured discharge from an area much larger than either basin. Using DHSVM as the reference, therefore, we would assume that precipitation from both CRCC and LOCA-Hydro5 was much too high and that CRCC-PRMS substantially underestimated ET losses.

Despite the large biases in precipitation in CRCC and LOCA-Hydro5, relative (though not absolute) impacts of climate change might still be simulated well if the hydrological model is accurately simulating what the hydrological fluxes in the basin would be under the higher precipitation. For example, CRCC-VIC generally reproduced the relative shape of the observed annual hydrograph (Figure B1). Importantly, the timing of the simulated peak discharge in late May to early June was consistent with observations. This peak represents the onset of rapid snow melting as the temperature increases following the snow accumulation period. CRCC-PRMS produced peak discharge three to four weeks too early in the spring (Figure B2) whereas LOCA-Hydro5 produced peak discharge a month or more too late (Figure B3).

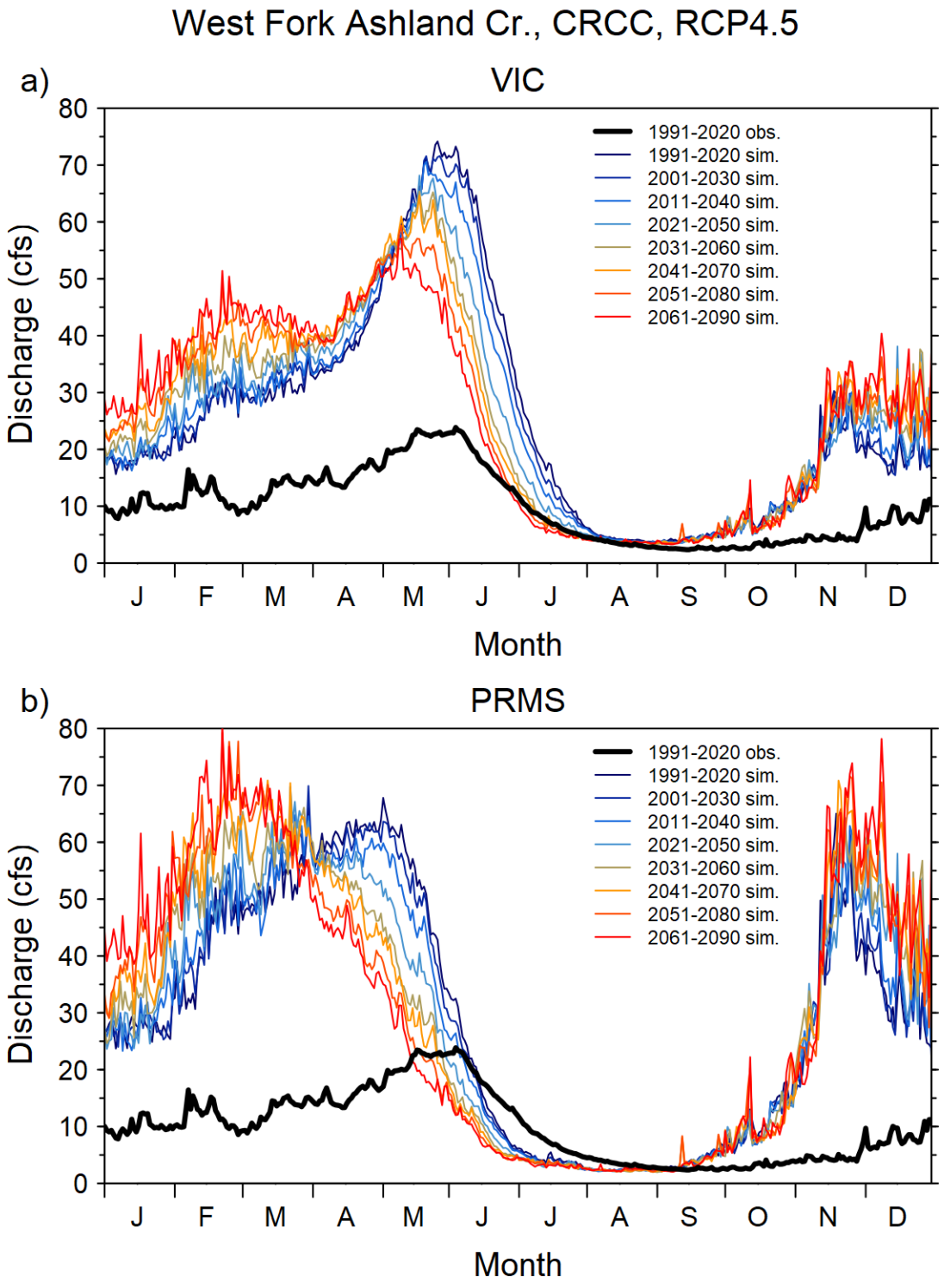


Figure B1. Simulated (sim.) and observed (obs.) 30-year average daily discharge from the West Fork Ashland Creek basin. Simulated discharge is from the CRCC dataset using the a) VIC and b) PRMS hydrological models with the RCP4.5 scenario.

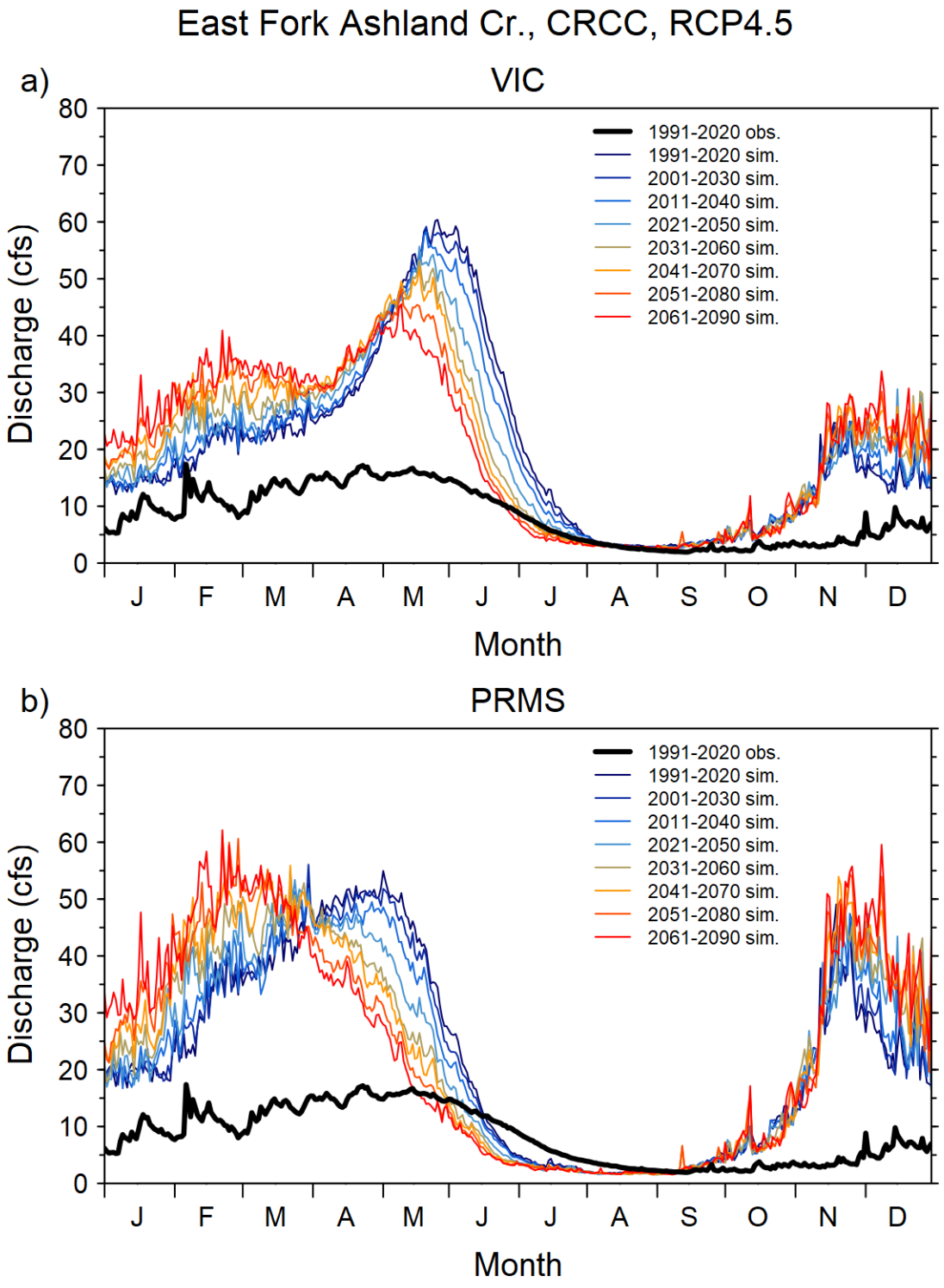


Figure B2. Simulated (sim.) and observed (obs.) 30-year average daily discharge from the East Fork Ashland Creek basin. Simulated discharge is from the CRCC dataset using the a) VIC and b) PRMS hydrological models with the RCP4.5 scenario.

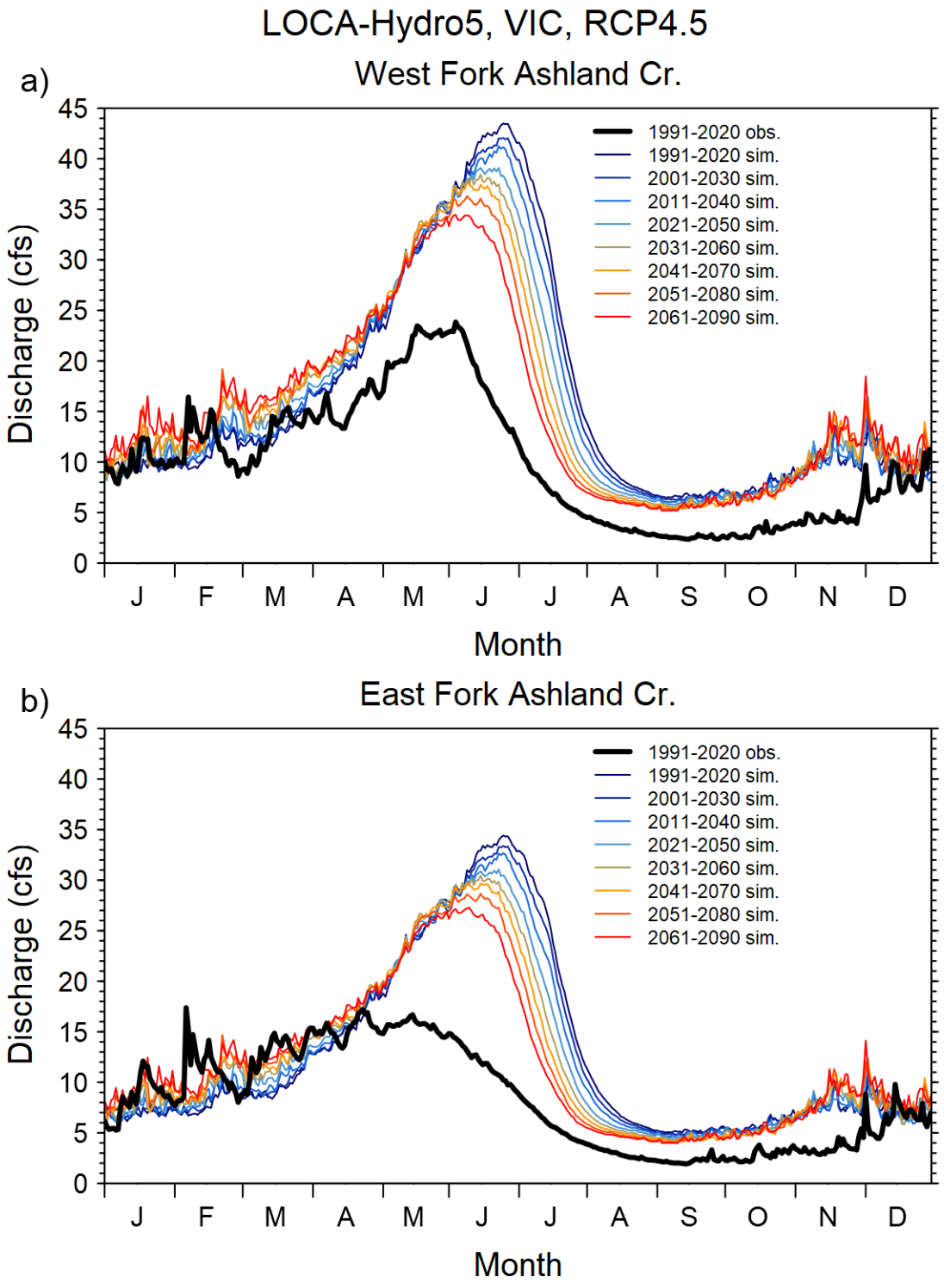


Figure B3. Simulated (sim.) and observed (obs.) 30-year average daily discharge from the a) West Fork and b) East Fork Ashland Creek basins. Simulated discharge is from the LOCA-Hydro5 dataset with the RCP4.5 scenario. LOCA-Hydro5 uses the VIC hydrological model only.

Table B1. Average annual precipitation, runoff, and runoff ratio for the East and West Fork Ashland Creek basins during 1991 – 2020 from CRCC-VIC, CRCC-VIC, and LOCA-Hydro5 and for the combined East and West Fork Ashland Creek basins during 1970 – 1999 from DHSVM.

Basin	Dataset	Average annual precipitation (mm)	Average annual runoff (mm)	Runoff ratio
East Fork Ashland Creek	CRCC-VIC	1337	834	0.62
	CRCC-PRMS	1337	947	0.71
	LOCA-Hydro5	1052	517	0.49
	Measured		349	
West Fork Ashland Creek	CRCC-VIC	1314	804	0.61
	CRCC-PRMS	1314	931	0.71
	LOCA-Hydro5	1034	498	0.48
	Measured		318	
Combined East and West Fork	DHSVM	717	395	0.55

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