

WMCP

# Water Management and Conservation Plan

Prepared for  
City of Salem, Oregon



APRIL 2019



Prepared by:



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# Oregon

Kate Brown, Governor

## Water Resources Department

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April 29, 2019

City of Salem  
Attn: Jason Pulley, Public Works Department  
555 Liberty Street SE, Room 325  
Salem, OR 97301

Subject: Water Management and Conservation Plan

Dear Mr. Pulley:

Enclosed; please find the final order approving your Water Management and Conservation Plan and specifying that the diversion of water under Permit S-55045 remains authorized at no more than 0.0 cfs (*out of total permitted 144.0 cfs*).

The attached final order specifies that the City of Salem's plan shall remain in effect until **April 29, 2029**. Additionally, the City of Salem is required to submit a progress report to the Department by **April 29, 2024**, detailing progress made toward the implementation of conservation benchmarks scheduled in the plan. Finally, the City of Salem must submit an updated Water Management and Conservation Plan to the Department by **October 29, 2028**.

***NOTE:** The deadline established in the attached final order for submittal of an updated water management and conservation plan (consistent with OAR Chapter 690, Division 086) shall not relieve the City of Salem from any existing or future requirement(s) for submittal of a water management and conservation plan at an earlier date as established through other final orders of the Department.*

We appreciate your cooperation in this effort. Please do not hesitate to contact me at 503-986-0919 or [Kerri.H.Cope@oregon.gov](mailto:Kerri.H.Cope@oregon.gov) if you have any questions.

Sincerely,

Kerri Cope  
Water Management and Conservation Analyst  
Water Right Services Division

Enclosure

cc: WMCP File  
Application #S-55010 (Permit #S-55045)  
Joel Plahn, District #16, Watermaster  
GSI Water Solutions, Inc., Attn: Adam Sussman, 1600 Western Blvd., Suite 240, Corvallis, OR 97333





**BEFORE THE WATER RESOURCES DEPARTMENT  
OF THE  
STATE OF OREGON**

In the Matter of the Proposed Water                    )     FINAL ORDER APPROVING A  
Management and Conservation Plan for the        )     WATER MANAGEMENT AND  
City of Salem, Marion County                    )     CONSERVATION PLAN

**Authority**

OAR Chapter 690, Division 086, establishes the process and criteria for approving water management and conservation plans required under the conditions of permits, permit extensions and other orders of the Department.

**Findings of Fact**

1. The City of Salem submitted a Water Management and Conservation Plan (plan) to the Water Resources Department (Department) on January 18, 2019. The plan was required by a condition set forth in the final order issued on July 31, 2015 approving an extension of time for Permit S-55045 (*formerly S-45565*).
2. The Department published notice of receipt of the plan on January 22, 2019, as required under OAR Chapter 690, Division 086. No comments were received.
3. The Department provided written comments on the plan to the City on March 22, 2019. In response, the City submitted a revised plan on April 9, 2019.
4. The Department reviewed the revised plan and finds that the revised plan is consistent with the relevant requirements under OAR Chapter 690, Division 086.

**Conclusion of Law**

The Water Management and Conservation Plan submitted by the City of Salem is consistent with the criteria in OAR Chapter 690, Division 086.

**Now, therefore, it is ORDERED:**

**Duration of Plan Approval:**

1. The City of Salem Water Management and Conservation Plan is approved and shall remain in effect until **April 29, 2029**, unless this approval is rescinded pursuant to OAR 690-086-0920.

This is a final order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080, you may petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

**Development Limitation:**

2. The limitation of the diversion of water under Permit S-55045 (formerly S-45565) established in the Final Order approving an Extension of Time for Permit S-55045 (issued on July 31, 2015) remains unchanged. Subject to other limitations or conditions of the permit, therefore, the City of Salem is not authorized to divert any water under Permit S-55045 at this time.

**Plan Update Schedule:**

3. The City of Salem shall submit an updated plan meeting the requirements of OAR Chapter 690, Division 086 within **10 years** and no later than **October 29, 2028**.

**Progress Report Schedule:**

4. The City of Salem shall submit a progress report containing the information required under OAR 690-086-0120(4) by **April 29, 2024**.

**Other Requirements for Plan Submittal:**

5. The deadline established herein for the submittal of an updated Water Management and Conservation Plan (consistent with OAR Chapter 690, Division 086) shall not relieve the City of Salem from any existing or future requirement(s) for submittal of a Water Management and Conservation Plan at an earlier date as established through other final orders of the Department.

Dated at Salem, Oregon this 30<sup>th</sup> day of April 2019.



Lisa J. Jaramillo, Transfer and Conservation Section Manager for  
THOMAS M. BYLER, DIRECTOR  
Oregon Water Resources Department

Mailing date:                     MAY 01 2019                    

**Notice Regarding Service Members:** Active duty service members have a right to stay these proceedings under the federal service members Civil Relief Act. For more information, contact the Oregon State Bar at 800-452-8260, the Oregon Military Department at 503-584-3571 or the nearest United States Armed Forces Legal Assistance Office through <http://legalassistance.law.af.mil>. The Oregon Military Department does not have a toll free telephone number.

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## Acronyms and Abbreviations

ADC	average day consumption
ADD	average day demand
ASR	aquifer storage and recovery
AWWA	American Water Works Association
CAT	Curtailment Action Team
cfs	cubic feet per second
CIP	capital improvement program
City	City of Salem
DCP	drought contingency plan
DEQ	Oregon Department of Environmental Quality
FY	fiscal year
gpcd	gallons per capita per day
gpm	gallons per minute
IGA	intergovernmental agreement
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
MAF	million acre feet
MMD	maximum monthly demand
MPSF	Minimum Perennial Streamflows
NSW	North Santiam Watershed
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
OrWARN	Oregon Water/Wastewater Agency Response Network
OWRD	Oregon Water Resources Department
PVC	polyvinyl chloride
RM	River Mile
SCADA	supervisory control and data acquisition
SKATS	Salem-Keizer Area Transportation Study
SRC	Salem Revised Code
SSF	slow sand filter
TMDL	total maximum daily load
UGB	urban growth boundary
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WMCP	Water Management and Conservation Plan

# Executive Summary

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This Water Management and Conservation Plan (WMCP) describes the City of Salem's efforts to strengthen water supply reliability for its water customers. The City of Salem (City) recognizes that effective water management and conservation is critical, particularly given that the City of Salem is the capital of Oregon and serves one of the largest populations in the State.

This WMCP also fulfills requirements to submit an updated plan to the Oregon Water Resources Department (OWRD) that were included in a final order approving an extension of time on a City water use permit and in a final order approving the City's previous WMCP in 2014. Specific criteria outlined in administrative rules under OAR Chapter 690, Division 86 must be met to receive WMCP approval from OWRD. This WMCP contains the required elements for WMCP approval, which are as follows:

- Requirements under OAR 690-086-0125
  - Descriptions of the water supplier, water conservation measures and 5-year water conservation benchmarks, a water curtailment plan, and projected water supply needs (i.e., water demand).
  - A list of affected local governments to whom the City sent its draft WMCP, as well as any comments received by the affected local governments.
  - The City's proposed date for submitting an updated 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 to OWRD within 5 years of the final order.
  - A statement that the City is not requesting additional time to implement metering or a previous benchmark.
- Resources Issues under OAR 690-086-0140(5)(i)
  - This WMCP describes the fish species with state or federal protections located within the reach of the City's water right points of diversion on the North Santiam River (approximately River Mile 20) and Willamette River (approximately River Mile 85).
  - The City presents Department of Environmental Quality's 303(d) listings related to the City's North Santiam River and Willamette River municipal water rights. .
  - The City describes that its groundwater sources are not located within the boundaries of a designated critical groundwater area.
- Water Conservation Measures under OAR 690-086-0150(4) and (5)
  - The City's water management and conservation program is described, including water conservation measures required under OAR 690-086-0150(4 and 5) and 5-year benchmarks for implementation of conservation measures. The City's water conservation 5-year benchmarks are summarized in **Exhibit ES-1**.

Exhibit ES-1. Summary of Water Conservation Five-Year Benchmarks.

Five-Year Benchmark	Timeline
Conduct annual water audits, and evaluate demand and consumption data to observe trends for targeting conservation measures.	Continue
Require all new connections be metered	Continue
Test and repair or replace large meters annually, and small meters upon customer or City Customer Services request	Continue
Bill customers based, in part, on the metered quantity of water use.	Continue
Review the rate structure biannually to determine the size and timing of future rate increases needed to promote water conservation, fund capital and operating costs, and to achieve other utility objectives.	Continue
Bill customers on a monthly schedule and include water use histories in those bills.	Continue
Periodically include water conservation-themed bill inserts and messages.	Continue
Survey approximately 20 percent of the system annually, resulting in the entire system being surveyed at least every five years.	Full system survey every 5 years, next in 2024
Repairs of all reported and detected leaks will be performed in a timely manner, with large leaks and failed pipes being repaired immediately.	Continue
Look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection.	Continue
Identify an approach to address leakage in Line 1 between Geren Island and Turner Control and begin to pursue that approach. The City's goal is to attain a leakage rate below 10 percent.	By 2024
Within two years of approval of this WMCP, the City shall provide OWRD with a description and analysis identifying potential factors for the water loss and selected actions for remedy. If the selected actions do not reduce water loss to less than 10 percent within five years of approval of the WMCP, the City will take additional leak detection and repair measures.	By 2021 and 2024
Implement a public education program that reaches out to customers using such means as: the City's new website, telephone hotline, local newspaper, radio, topic-specific brochures, bill inserts, conversations at events (at least two are held annually), and speakers in classrooms or on tours.	Continue
Expand the water conservation content on the website with an emphasis on providing more educational links and more information on water-efficient irrigation practices.	By 2024
Update water conservation brochures.	By 2024
Update the promotional materials and messaging for the One Inch Per Week Lawn Watering Program, which have not been updated since the program began.	By 2024
Develop and help implement a water conservation lesson for elementary school students.	By 2024
Provide water audit kits, lawn gauges, and individual conservation tools upon request.	Continue
Add a home water audit tool to its website to assist customers with understanding their water use.	By 2021
Continue to provide residential indoor and outdoor conservation kits upon request.	Continue
Within the next two years, the City will complete development of administrative rules to formalize the application, evaluation, and awarding of City funded grants.	By 2021
Evaluate the feasibility of other cost share programs for replacing inefficient fixtures for commercial/industrial customers or multifamily property owners, if resources are available.	By 2024
Use untreated groundwater to irrigate the driving range and two City parks.	Continue

Exhibit ES-1. Summary of Water Conservation Five-Year Benchmarks Continued.

Five-Year Benchmark	Timeline
Look for water reuse, recycling, and non-potable opportunities.	Continue
Support allocating staff resources towards implementing conservation measures and to use evapotranspiration modeling.	Continue
Explore development of a water-efficient demonstration garden, possibly in collaboration with the Parks Department.	By 2024

- Water Curtailment Plan under OAR 690-086-0160
  - The City has a water curtailment plan consisting of four curtailment levels. The City describes the potential initiating conditions (i.e. triggers) and the curtailment measures for each level of curtailment. The curtailment measures include three components: public education, actions by the City, and actions by customers.
- Water Demand Projections under OAR 690-086-0170
  - The City projects that its maximum day demand (MDD) in 2038 will range between 84.9 cubic feet per second (cfs) and 114.9 cfs (54.9 million gallons per day (mgd) to 74.3 mgd), which is the projected MDD minus and plus a 15 percent variable, respectively. This range is based on the annual variability in MDD that the City has experienced to date. The City’s current total available water supply of approximately 109 to 114 cfs (70.1 – 73.7 mgd), which consists of North Santiam surface water rights limited to 102 cfs by the current transmission capacity from Geren Island plus approximately 7 to 12 cfs from its ASR system, is sufficient to meet the projected MDD in 2038 and nearly sufficient to meet the projected MDD with the 15 percent variance in 2038. Consequently, the City currently does not anticipate the need for access to water under its Willamette River water right permit S-55045 during this 20-year planning period.
  - The City’s demand projections are reasonable and consistent with land use plans of the City and affected local governments, and demonstrate that the City currently does not anticipate needing to divert water during the next 20 years under its Willamette River water right Permit S-55045. The City will seek to expand the capacity of its transmission lines from Geren Island when its MDD approaches the limitations on its system capacity. If the City were unable to increase the capacity of the transmission lines leaving Geren Island in the future, it would rely on Permit S-55045 to meet more of its MDD in the near-term.
  - The City projects that its MDD (with a 15 percent variance) will be approximately 144 cfs (93 mgd) by 2068. If the City’s North Santiam River supply and its ASR system are not available for use, the City will need to meet this demand in 2068 by using the entire 144 cfs (93 mgd) under the Willamette River Permit S-55045, if not sooner to help meet projected MDD as described above.

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# 1. Water Supplier Plan

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*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.*

## Introduction

### City of Salem and Water Resources

The City of Salem (City), located near the center of the Willamette Valley, is the capital city of Oregon and serves one of the largest populations in the State. The City primarily relies on the North Santiam River as its water source. The North Santiam River basin includes approximately 766 square miles, and is characterized by steep forested uplands and flat alluvial lowlands.<sup>1</sup> Surface water is conveyed by gravity from the North Santiam River to the water treatment facility on Geren Island, a 250-acre island located in the North Santiam River, upstream from the City of Stayton. Finished water is then conveyed approximately 17-miles from the treatment facility to the City's distribution system. In the future, the City plans to use the Willamette River as a water source, as well.

The City also appropriates groundwater and uses its aquifer storage and recovery (ASR) system during emergencies, water quality events, and peak demands to supplement surface water. The ASR wells store treated drinking water from the North Santiam, which is injected into the Columbia River basalt aquifer and stored for later recovery. Groundwater is available from wells on Geren Island and within the City's water service area.

The City recognizes that maintaining a reliable water supply is critical to supporting its large, growing population and that well-implemented water management and conservation activities strengthen reliability.

### WMCP Requirement

On November 25, 2014, the Oregon Water Resources Department (OWRD) issued a Final Order approving the City's 2014 Water Management and Conservation Plan (WMCP), which required the City to submit a progress report by November 24, 2019 and an updated WMCP by May 24, 2024. Subsequently, OWRD issued a Final Order dated July 31, 2015 approving an extension of time for water use Permit S-55045 (formerly Permit S-45565), which included a condition requiring the City to submit a WMCP and precluding use of water under the permit until access to water is authorized by a final order approving the City's WMCP.

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<sup>1</sup> E&S Environmental Chemistry, Inc.'s *North Santiam River Watershed Assessment*, 2002, located at: <http://northsantiam.org/wp-content/uploads/assessment-reports/2002-06-NORTH-SANTIAM-RIVER-WATERSHED-ASSESSMENT.pdf>

## WMCP Objective

The goal of this WMCP is to establish a working document (consistent with the City’s adopted water and wastewater master plans) that will guide development, financing, and implementation of water management and conservation programs, as well as water system development projects. In addition, this WMCP is intended to satisfy the requirement under the extension of time for Permit S-55045 to submit an updated WMCP.

## Plan Organization

This WMCP fulfills the requirements of the Oregon Administrative Rules (OAR) adopted by the Water Resources Commission in November 2002 (OAR Chapter 690, Division 86) regarding WMCPs. It describes the water management, water conservation, and curtailment programs to guide the wise use and stewardship of the City’s water supply.

The WMCP is organized into the following sections, each addressing specific sections of OAR Chapter 690, Division 86. Section 2 is a self-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 consider how the City can improve its water conservation and water supply planning efforts.

<b>Section</b>	<b>Requirement</b>
Section 1 – Water Supplier Plan	OAR 690-086-0125
Section 2 – Water Supplier Description	OAR 690-086-0140
Section 3 – Water Conservation	OAR 690-086-0150
Section 4 – Water Curtailment	OAR 690-086-0160
Section 5 – Water Supply	OAR 690-086-0170

## Affected Local Governments

### *OAR 690-086-0125(5)*

The following local governmental agencies may be affected by this WMCP:

- City of Salem
- City of Keizer
- City of Turner
- City of Stayton
- Marion County
- Polk County

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 in Appendix A.

In addition, the City provided the Suburban East Salem Water District, Orchard Heights Water District, and the City of Hillsboro with notice of the draft plan as a courtesy.



## **Plan Update Schedule**

***OAR 690-086-0125(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 five years of the final order.

## **Time Extension**

***OAR 690-086-0125(7)***

The City is not requesting additional time to implement metering or any other previous benchmarks.

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## 2. Water Supplier Description

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

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

### Water Sources

**OAR 690-086-0140(1)**

#### Surface Water

The North Santiam River is the City's primary water source. Water is diverted from the north channel of the river at approximately river mile (RM) 20 and is treated at the adjacent Geren Island Water Treatment Facility (Geren Island.)

The City also holds two water rights to appropriate water from the Willamette River. The City is in the midst of planning efforts to develop infrastructure to use its Willamette River water source.

#### Groundwater

In addition to surface water, the City also appropriates and treats groundwater at Geren Island. The City's collector well facility combines water from an infiltration gallery, the filter bed perimeter drains, and shallow groundwater to pump to the slow sand filters. The City is exploring the feasibility of developing two additional collector wells on Geren Island to increase its shallow groundwater supply. The City can also appropriate groundwater from three additional wells (the Middle, East, and West wells) on Geren Island. Finally, a limited amount of groundwater is available from wells within the City's water service area. The City's groundwater sources supplement surface water during emergencies, water quality events, and periods of peak demand.

#### Aquifer Storage and Recovery

The City's ASR system provides a supplemental water supply during periods of peak demand or emergencies. Treated drinking water from the North Santiam River is injected into the Columbia River basalt aquifer via the ASR wells. The injected water is stored in the aquifer for later recovery. The City currently has four active ASR wells and is exploring the feasibility of developing two more ASR wells. The City's ASR system provides flexible storage to supplement the surface water and groundwater supply sources during emergencies, high turbidity events, and periods of peak demand.

## Intergovernmental and Wholesale Agreements OAR 690-086-0140(1)

The City has intergovernmental agreements (IGA) with two other municipal drinking water systems: the City of Stayton and the City of Keizer. The City of Stayton is located southeast of Salem, near Geren Island. The City's agreement with the City of Stayton is effective through 2037. The City of Keizer is adjacent to and north of Salem and is located within the Salem-Keizer Urban Growth Boundary. The City's agreement with the City of Keizer (signed September 7, 2016) is effective through December 30, 2037. Under both of these agreements, the Cities of Stayton and Keizer can obtain water from the City of Salem during emergencies if surplus water is available. In addition, the City of Stayton must follow the City of Salem's curtailment plan if the plan is in effect at the time emergency supply is requested. The agreements also allow for both cities to provide water to the City of Salem.

The City also provides water to three wholesale customers: the City of Turner, Suburban East Salem Water District, and Orchard Heights Water District.

- **City of Turner.** The agreement with the City of Turner is effective until May 24, 2027, with an option to renew for two successive 10-year terms. The agreement states that Salem shall not limit water available to the City of Turner unless the City of Salem is limiting water to all of its customers.
- **Suburban East Salem Water District.** The agreement with the Suburban East Salem Water District is effective through December 31, 2017, but currently has a one-year extension as both parties work to update the agreement. The agreement states that the City will "use its best efforts" to supply water. The agreement also requires the Suburban East Salem Water District to implement conservation or curtailment measures at the City's request. The agreement does not limit the amount of water available to the Suburban East Salem Water District. The agreement recognizes that the City may annex the Suburban East Salem Water District's water service area at some time in the future. If annexation occurs, the District's customers will become the City's retail customers.
- **Orchard Heights Water District.** The agreement with the Orchard Heights Water District is effective through April 29, 2018, but currently has a one-year extension as both parties work to update the agreement. The agreement does not obligate the City to meet the Orchard Heights Water District's water needs and the City can limit supply to Orchard Heights if the City is limiting water to all of the City's customers.

Each of these wholesale customers owns, maintains, and operates its own water system, and bills its own customers.

## Interconnections with Other Systems

*OAR 690-086-0140(7)*

The City has the following interconnections with other municipal water supply systems:

- The City of Stayton and the City of Salem have an intertie in Transmission Line 2, near the intersection of West Water Street and North Holly Avenue, in Stayton. Through this interconnection, the City of Salem can provide up to 7 cfs (5 mgd) of treated water to the City of Stayton. The City of Stayton can also supply a limited amount of water to the City of Salem through this connection.
- The City of Keizer and the City of Salem have two interties. One intertie is located near the intersection of Cherry Avenue NE and Manbrin Drive NE, in the City of Keizer. This interconnection is capable of providing up to 7 cfs (5 mgd) of water to either city. The other intertie is located near Wiessner Drive NE and Northside Drive NE, in the City of Keizer. This interconnection is capable of providing up to 7 cfs (5 mgd) of water to the City of Keizer. However, water cannot currently be delivered to the City of Salem through this intertie because it does not yet have a booster pump installed. A booster pump is necessary to overcome the system pressure differential between the two water systems. The City of Salem agreed to construct the pump station on or before December 30, 2037, in its 2016 agreement with the City of Keizer.
- The City of Turner receives water from the City of Salem primarily by three metered connections, located at Val View Drive and Third Street, School Street SE and Chicago Street SE, and Boise Street SE and First Street.
- Suburban East Salem Water District receives water from the City of Salem by three metered connections, located near Arabian Avenue SE and Clydesdale Drive SE, State Street and 37<sup>th</sup> Avenue SE, and Center Street NE and 36<sup>th</sup> Avenue NE.
- Orchard Heights Water District receives water from the City of Salem by three metered connections, located at Landaggard Drive NW and Orchard Heights Road NW, Doaks Ferry Road NW and Emerald Drive NW, and 3017 Orchard Heights Road NW.
- The Illahee Acreage Water Association, a retail customer, is connected to the City water system near the intersection of Cheviot Way South and Corredale Drive South.

## Service Area Description and Population

*OAR 690-086-0140(2)*

**Exhibit 2-1** shows the City's current service area and wholesale customers. The City provides water to its retail customers and three wholesale customers outside city limits (Suburban East Salem Water District, City of Turner, and Orchard Heights Water District). The City's retail customers include customers within city limits as well as customers outside city limits, such as the Jan Ree area located within the northeast portion of the service area.

The City estimates that its water service population in 2017 was 195,816. The City’s total water service population includes populations within the City of Salem, the City of Turner (wholesale customer), Suburban East Salem Water District (wholesale Customer), Jan Ree Area, Eola-Chatnicka Area, and Orchard Heights Water District (wholesale customer). The City’s total water service population and the methodology for calculating that population is presented in **Exhibit 2-2**.

Exhibit 2-2. Population Breakdown by the City’s Water Service Areas, as of July 1, 2017.

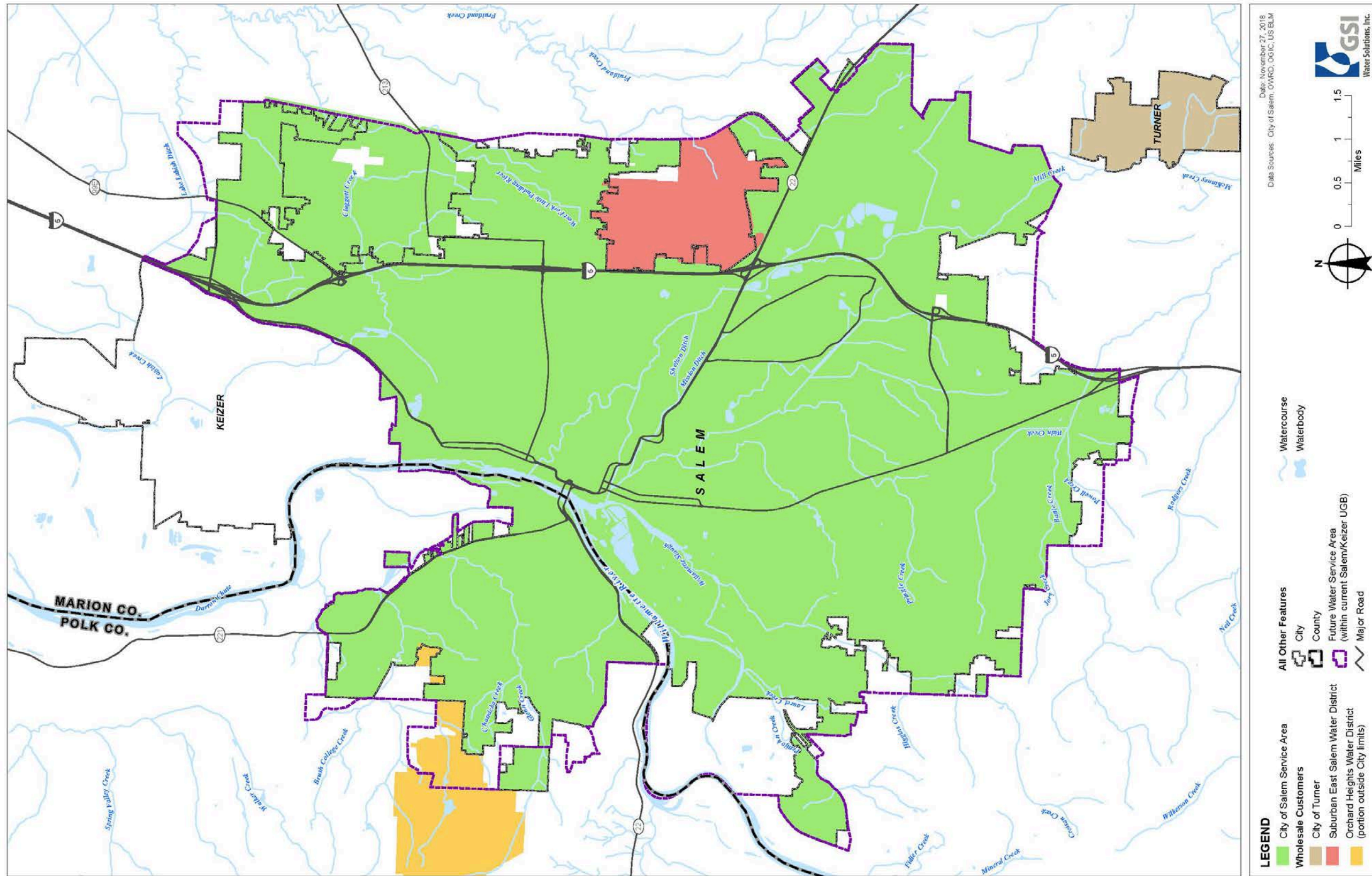
<b>Water Service Areas</b>	<b>Population</b>
City of Salem <sup>(1)</sup>	163,480
City of Turner <sup>(1)</sup>	2,005
Suburban East Salem Water District <sup>(2) (3)</sup>	13,593
Jan Ree Area <sup>(3)</sup>	15,123
Eola-Chatnicka Area <sup>(3)</sup>	1,165
Orchard Heights Water District <sup>(3)</sup>	450
<i>Total</i>	195,816

<sup>1</sup>Population data from Portland State University's Center for Population Research and Census ([www.pdx.edu/prc](http://www.pdx.edu/prc)) 2017 Certified Estimates.

<sup>2</sup>East Salem Water District is a wholesale customer and provides customer information to Salem.

<sup>3</sup>Population estimates calculated at 2.5 people per unit based on residential account and unit information as of July 2017, the latest available. Eola/Chatnicka and Orchard Heights population reductions resulted from annexations and changes in service provider.

Exhibit 2-1. City of Salem Current and Future Service Area and Wholesale Customers Map.



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## Records of Water Use

*OAR 690-086-0140(4) and (9)*

### Terminology

Demand, or production, is the amount of water entering the City's water system to meet the water needs of various users. Consumption is the amount of water sold. Generally, demand and consumption in municipal systems are expressed in units of million gallons per day (mgd), though they may also be expressed in cubic feet per second (cfs) or gallons per minute (gpm). For annual or monthly values, a quantity of water is typically reported in million gallons (MG). Water use per person (per capita use) is expressed in gallons per person (per capita) per day (gpcd).

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

- Average day demand (ADD) equals the total annual system input (demand) divided by 365 days.
- Maximum day demand (MDD) equals the highest system demand that occurs on any single day during a year. It is also called the one-day MDD.
- Maximum monthly demand (MMD) in MG equals the highest total monthly demand of the 12 months of a year. MMD in mgd equals the average day demand of the one month with the highest total demand of the 12 months of a year.
- Peaking factors are the ratios of one demand value to another. The most common peaking factor is the ratio of the MDD to the ADD.

MDD is an important value for water system planning. The supply facilities (treatment plants, pipelines, reservoirs) and water rights must be capable of meeting the MDD. If the MDD exceeds the combined supply capacity on any given day, finished water storage levels will be reduced. Consecutive days at or near the MDD may result in a water shortage.

### Timeframe of Analysis

This WMCP presents demand, consumption, and non-revenue water based on the fiscal year (FY), which runs from July 1 through June 30. (In comparison, the calendar year runs from January 1 through December 31.)

## Historical Water Demands

### Annual Demands

This WMCP presents both raw water and finished water annual demands. Raw water is the water diverted at the Geren Island intake and finished water is the treated water leaving Geren Island and entering the transmission system. The difference between the amount of raw water diverted and the amount of finished water leaving Geren Island is the process water used during water treatment. The City uses slow sand filtration as the primary treatment process. This process is manually controlled and can require process water that results in return flows. The City's system returns the majority of the process water to the North Santiam River within 500 feet of the Geren Island intake.

**Exhibit 2-3** summarizes the City’s historical raw water demands. During the period from July 2012 through June 2017, the City’s annual volume of raw water diverted averaged 13,545 MG, and the maximum annual volume of raw water diverted was 14,592 MG in FY 2012-2013. The City’s ADD averaged 37.09 mgd during the same period and its MDD peaked at 80.96 mgd in 2016-2017.

**Exhibit 2-3. Raw Water (Intake at Geren Island Treatment Facility) Historical Annual Volumes, Average Day, Maximum Day, and Peaking Factors.**

Fiscal Year	Raw Water (Intake)					Peaking Factor
	Annual Volume (MG)	ADD (mgd)	MDD (mgd)	MMD (MG)	MMD (mgd)	
2012-2013	14,592	39.98	72.77	1,706	56.85	1.8
2013-2014	13,401	36.72	58.23	1,625	52.43	1.6
2014-2015	13,712	37.57	58.17	1,505	48.55	1.5
2015-2016	12,633	34.52	75.56	1,743	56.23	2.2
2016-2017	13,545	36.68	80.96	1,313	43.77	2.2
Average	13,545	37.09	69.14	1,578	51.57	1.9
Maximum	14,592	39.98	80.96	1,743	56.85	2.2

**Exhibit 2-4** summarizes the City’s finished water demands. During the period July 2012 through June 2017, the City’s annual volume of finished water produced averaged 9,666 MG and the maximum volume of finished water produced was 10,104 MG in FY 2014-2015. ADD averaged 26.47 mgd during the same period and MDD peaked at 45.35 mgd in FY 2016-2017. Demand analyses hereafter are based on finished water demand.

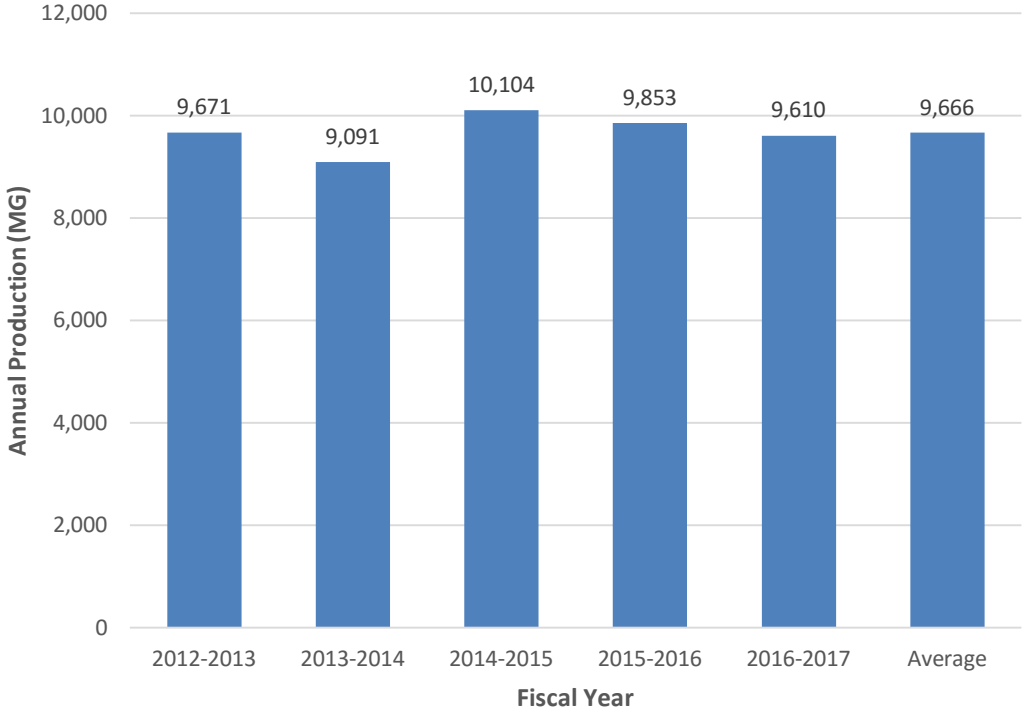
**Exhibit 2-4. Finished Water (Leaving Geren Island Treatment Facility to the Transmission System) Historical Annual Volumes, Average Day, Maximum Day, and Peaking Factors.**

Fiscal Year	Finished Water					
	Annual Volume (MG)	ADD (mgd)	MDD (mgd)	MMD (MG)	MMD (mgd)	Peaking Factor
2012-2013	9,671	26.49	44.21	1,113	35.90	1.7
2013-2014	9,091	24.91	43.66	1,237	39.89	1.8
2014-2015	10,104	27.68	45.30	1,247	40.23	1.6
2015-2016	9,853	26.92	42.56	1,090	35.17	1.6
2016-2017	9,666	26.33	45.35	1,047	33.76	1.7
Average	9,666	26.47	44.22	1,147	36.99	1.7
Maximum	10,104	27.68	45.35	1,247	40.23	1.8

MDD is strongly influenced by weather patterns and can be affected by the economy. Weather patterns often cause fluctuations in MDD from year to year. Weather patterns that influence MDD include: maximum temperatures, the number of consecutive days with high temperatures, when high temperatures occur in the summer, overall rainfall levels during the summer, and consecutive days without rainfall. Unusually hot and/or dry weather results in more outdoor irrigation, which increases the MDD. The economy may affect MDD, as well. Customers may choose to irrigate less to save money in an economic downturn. The economy also influences the number of new homes with landscaping needing intense irrigation for plant establishment and the opening or closing of facilities that use water in their operations.

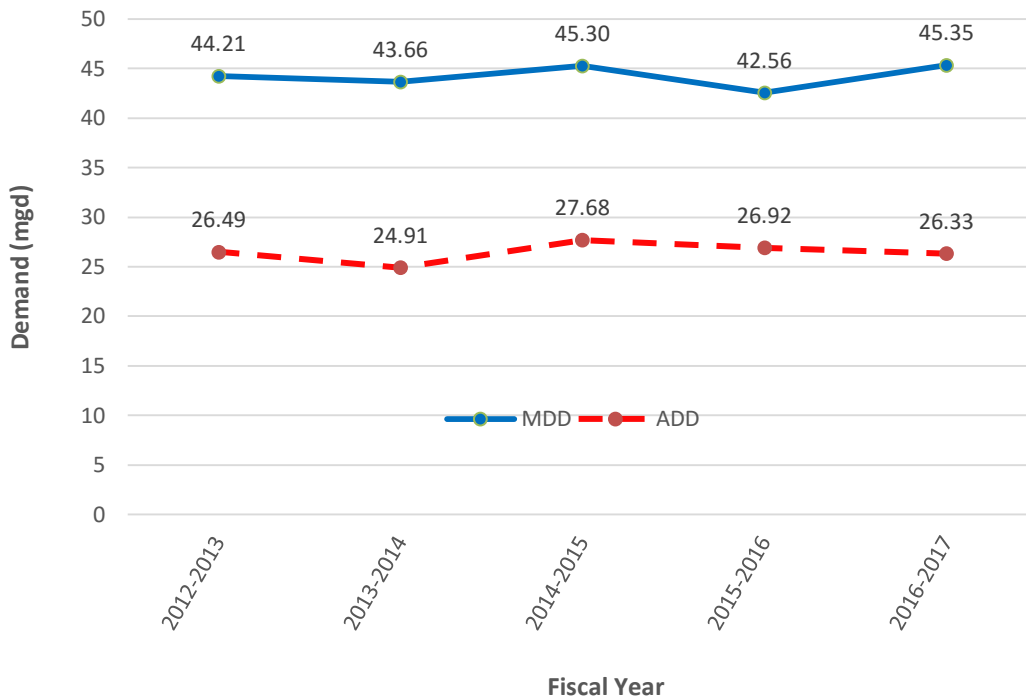
**Exhibit 2-5** shows the City’s annual demand from FY 2012-2013 to FY 2016-2017. During this time period, the City’s lowest annual finished water demand occurred in FY 2013-2014 with 9,091 MG, which makes it the lowest annual demand since at least FY 2007-2008 (as reported in the City’s approved 2014 WMCP). This relatively low annual demand was due to below average temperatures during the summer months. The highest annual finished water demand occurred in FY 2014-2015, resulting from the particularly hot and dry weather conditions experienced that year. For perspective, FY 2014-2015 annual demand was less than annual demands in FY 2007-2008 through 2009-2010.

**Exhibit 2-5. Annual Demand (MG), Fiscal Year 2012-2013 to 2016-2017.**



**Exhibit 2-6** shows the City’s ADD and MDD from FY 2012-2013 to FY 2016-2017. During this period, ADD ranged between 24.91 mgd (FY 2013-2014) and 27.68 mgd (FY 2014-2015) and MDD fluctuated over time with peaks in FY 2014-2015 and FY 2016-2017, which can be attributed to hotter and drier summer conditions those two years.

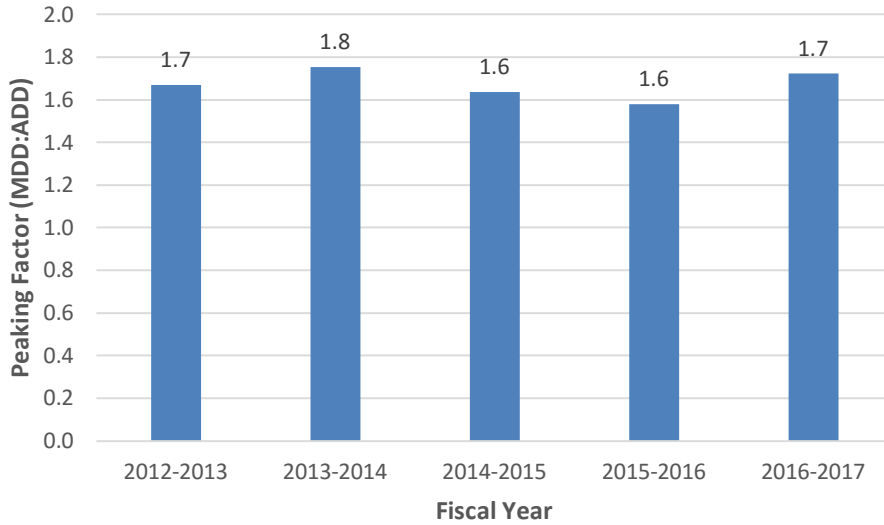
Exhibit 2-6. Average Day Demand (ADD) and Maximum Day Demand (MDD), Fiscal Year 2012-2013 to 2016-2017.



## Peaking Factors

Peaking factors are the ratios of one demand value to another; the most common peaking factor is the ratio of the MDD to the ADD. From FY 2012-2013 to FY 2016-2017, the City's MDD to ADD peaking factor averaged 1.7 and ranged from approximately 1.6 to 1.8, as shown in **Exhibit 2-7**. This average value is slightly less than the typical value for Willamette Valley water utilities, which generally ranges between 1.7 and 2.4.

Exhibit 2-7. Peaking Factors (MDD: ADD), Fiscal Year 2012-2013 to 2016-2017.

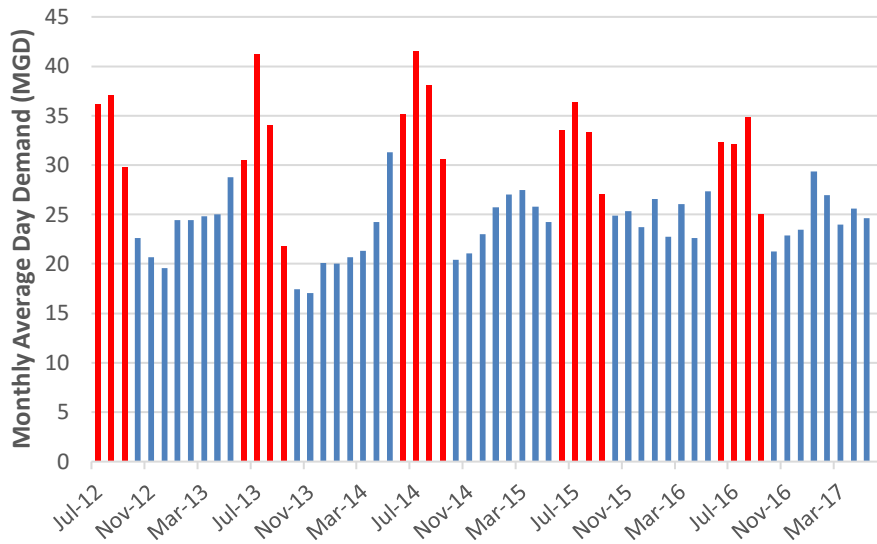


## Monthly Demand

The City’s MMD occurred in July in FYs 2013-2014 through 2015-2016, and in August in FYs 2011-2012 and 2016-2017. The MMD average volume was 1,147 MG during this reporting period and the greatest volume was 1,247 MG in July 2014.

**Exhibit 2-8** shows monthly demand data from July 2012 through June 2017 expressed as an average daily demand for the month, with the peak season months of June through September in red. During this period, the highest monthly ADD recorded was 45.6 mgd in July 2014. This exhibit highlights the seasonal change in demand that the City experienced and the months with the greatest demand: July and August. Consequently, these months are a primary focus of the City’s water conservation efforts.

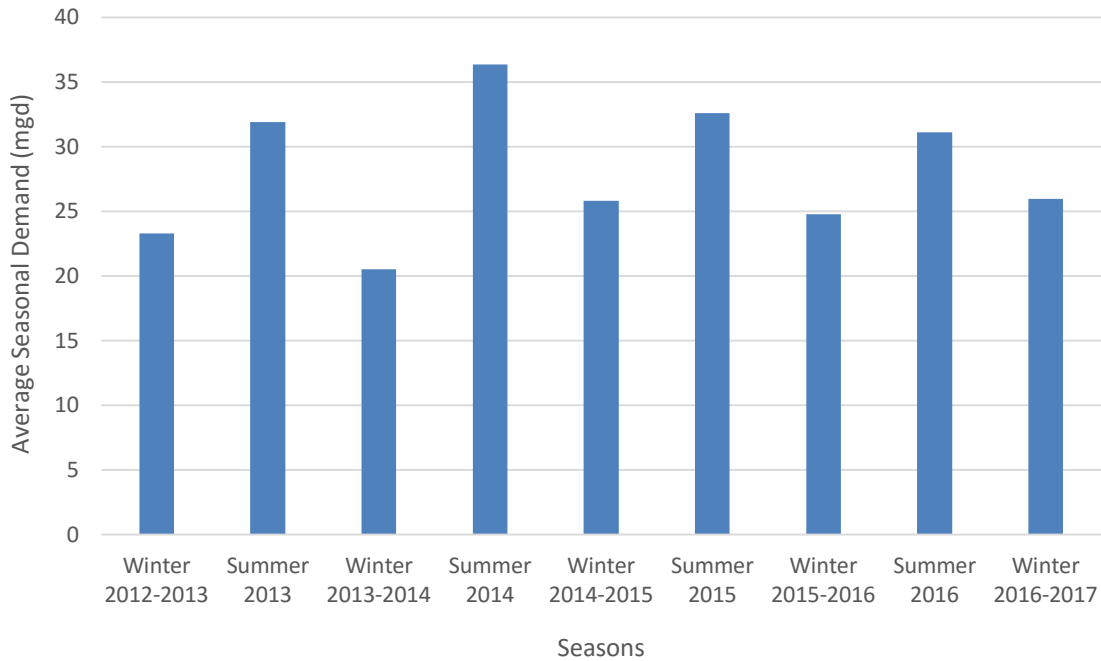
**Exhibit 2-8. Monthly Average Day Demand (mgd), July 2012-June 2017. Red indicates peak season months (June through September) while blue indicates non-peak season months.**



## Seasonal Demands

For the period December 2012 through March 2017, **Exhibit 2-9** illustrates the winter period (December through March) ADDs and the summer period (defined as June through September) ADDs. During this period, winter ADD fluctuated between 21 mgd and 26 mgd. As illustrated, the City’s ADD is notably greater during the summer months, which is primarily a result of outdoor water use for irrigation. Summer ADD ranged from 31 mgd to 36 mgd.

Exhibit 2-9. Historical Winter and Summer Demand (mgd), from December 2012 through March 2017.





## Per Capita Demand

Per capita demand, expressed in gpcd, is the City's total demand, divided by the estimated water delivery area population. Consequently, the calculated per capita demand values exceed the amounts of water actually used by a typical individual. In addition, per capita demand may not accurately portray year-to-year water use, because the calculation does not account for the difference in customer demographics, climate, rainfall, and current economic conditions. The calculation also does not account for specifics, such as changes in hotel occupancy or in large commercial or industrial uses, which may not have any relationship to population or actual efficiency of use. Nevertheless, per capita demands may show year-to-year trends and can be used to compare water use by the City's customers to that of other communities.

The City's estimated average day per capita demand in FY 2016-2017 was 134.5 gpcd, based on the FY 2016-2017 finished water ADD of 26.33 mgd and estimated water delivery population of 195,816. **Exhibit 2-10** presents average day per capita demands of the City and other water providers in the Willamette Valley. However, direct comparison of average day per capita demands between cities is not always appropriate given that some cities have unique circumstances that influence demand values.

Exhibit 2-10. Average day per capita demands of water providers in the Willamette Valley.

<b>Water Provider</b>	<b>Average day per capita demand (gpcd)</b>	<b>Source</b>
City of Salem	135.4	<i>City of Salem 2018 WMCP</i>
Eugene Water and Electric Board	133	<i>Eugene Water and Electric Board 2018 WMCP</i>
City of Corvallis	144	<i>City of Corvallis, 2010 Water Use and Water Conservation Project</i>
City of Veneta	110	<i>City of Veneta 2012 WMCP</i>
City of Beaverton	120	<i>Joint Water Commission 2010 WMCP</i>
City of Forest Grove	150	<i>Joint Water Commission 2010 WMCP</i>
City of Hillsboro	170	<i>Joint Water Commission 2010 WMCP</i>

## Customer Characteristics and Use Patterns

### *OAR 690-086-0140(6)*

The City has nine customer categories: residential, multi-family, commercial, industrial, institutional, public, irrigation, wholesale, and fire services. **Exhibit 2-11** describes each customer category.

#### Exhibit 2-11. Customer Category Definitions.

Customer Category	Definition
Residential	Any connection that serves one residential unit per connection (a house or duplex with one connection per unit).
Multifamily	Any connection that serves greater than one residential unit (apartment complex with one connection for two or more units).
Commercial	Any commercial or industrial customer whose wastewater is not metered. Also includes any connection that is dedicated to fire flow.
Industrial	Any commercial or industrial customer whose wastewater is metered (food processing, computer parts manufacturing).
Institutional	Any commercial or industrial customer whose wastewater is metered plus has a large impact on the wastewater system, such as prisons, that results in the customer having a special wastewater charge.
Public	Any connection that serves local, state, or federal offices (school districts, state and federal administrative offices). Also, any connection that serves the City of Salem (administrative offices, operation centers, parks); these connections are metered, but not billed.
Irrigation	Any connection for commercial, industrial, or multifamily classes that is solely dedicated for irrigation.
Wholesale	Multiple connections with Suburban East Salem Water District, the City of Turner, and Orchard Heights Water District.
Fire Services	Any connection used by customers for emergency fire service. The City meters these connections, but does not actively record the amount of water used given that the use is minimal and infrequent. Consequently, this customer category is not analyzed in this WMCP.

**Exhibit 2-12** shows the number of customer service connections by customer category for FY 2016-2017.

Exhibit 2-12. Number of Service Connections, Fiscal Year 2016-2017.

Customer Category	Number of Connections (#)
Residential	42,605
Multi-Family	2,279
Commercial	2,931
Industrial	19
Institutional	8
Irrigation	655
Public	125
Wholesale	3
Total	48,625

The City utility billing system collects monthly consumption data. Billing data lags behind the actual consumption for each month and an adjustment is made to align consumption with production. This adjustment simply moves the billing data back one month to reflect the time period during which the water was actually consumed. For example, water use reported by June’s billing data is labeled as May consumption.

The annual metered consumption by customer category for FY 2012-2013 through 2016-2017 is shown in **Exhibit 2-13**. During this time period, consumption spiked for all customer categories in FY 2014-2015 as a result of drier weather conditions, but consumption has been relatively even for all other years across the customer categories. As shown in Exhibit 2-13 and **Exhibit 2-14**, residential consumption has remained below levels seen from FY 2007-2008 and FY 2008-2009 while commercial consumption has recovered in recent years since a dip that started in FY 2011-2012. Industrial/Institutional (called “Industrial” from FY 2007-2008 through FY 2011-2012) has been showing a decreasing trend over the past 10 years.

Exhibit 2-13. Metered Consumption by Customer Category, Fiscal Years 2012-2013 through 2016-2017.

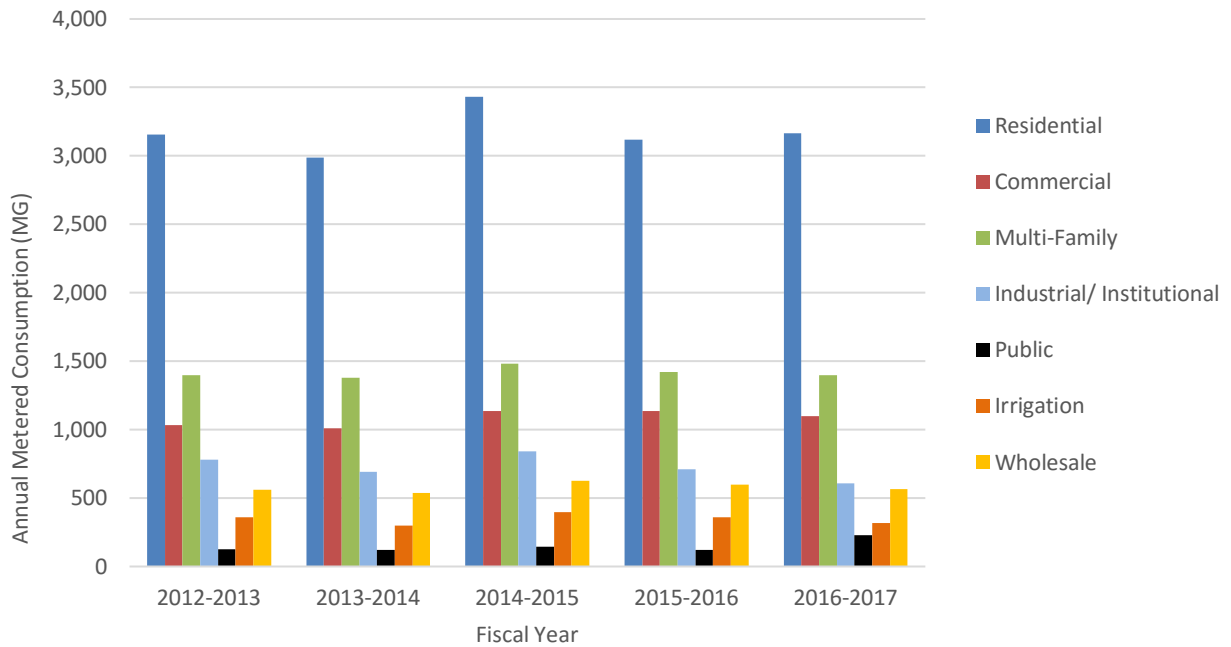
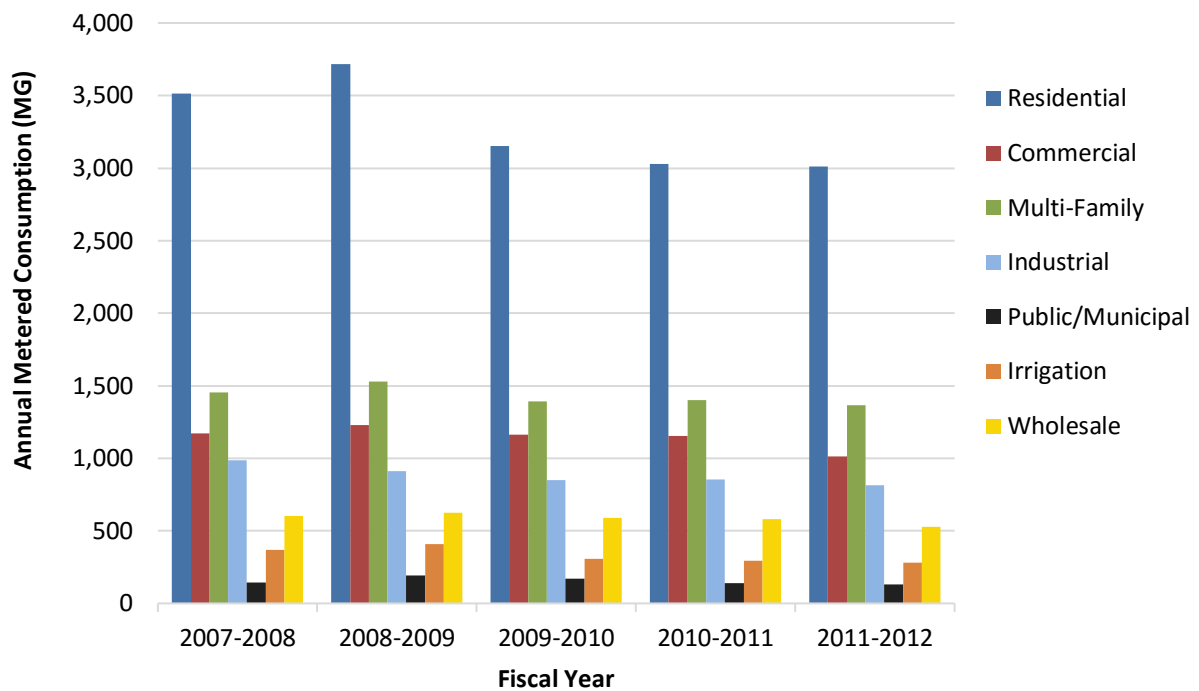
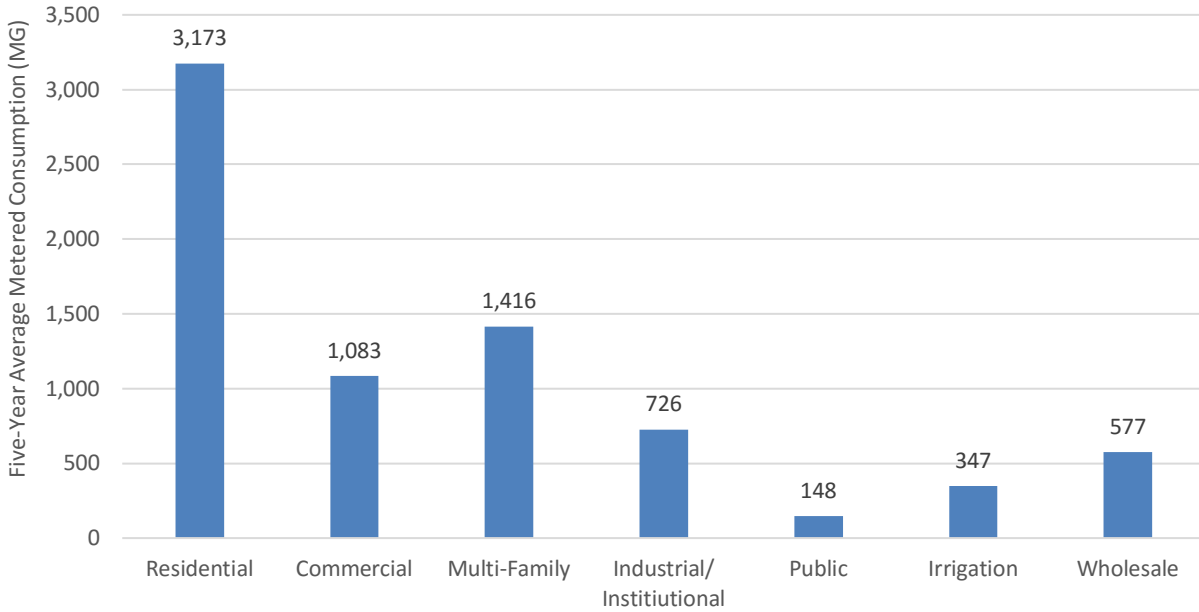


Exhibit 2-14. Metered Consumption by Customer Category, Fiscal Year 2007-2008 through 2011-2012.



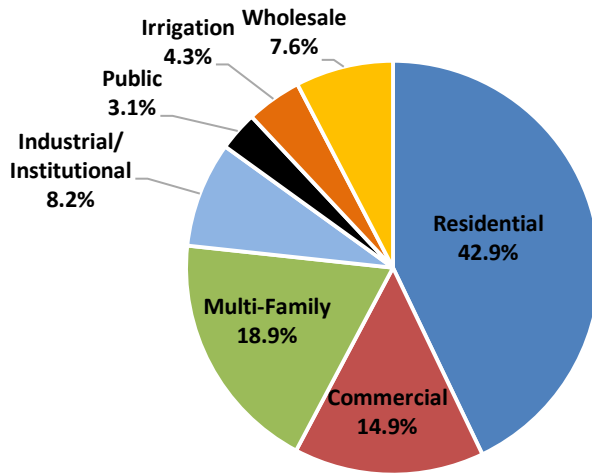
**Exhibit 2-15** shows the City’s average annual metered consumption by customer category over a five-year period from FY 2012-2013 through FY 2016-2017. The residential customer category showed the greatest average annual water use of 3,173 MG per year, which is slightly less than the average annual water use of 3,284 MG per year from FY 2007-2008 through FY 2011-2012.

**Exhibit 2-15. Five-Year Average Metered Consumption by Customer Category, FY 2012-2013 through 2016-2017.**



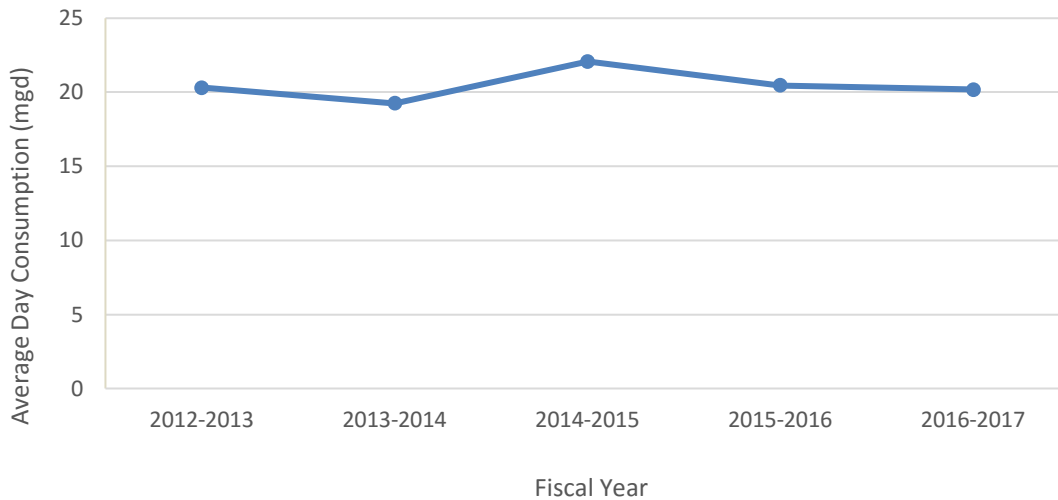
**Exhibit 2-16** presents a pie chart illustrating the percentage of water used by each customer category in FY 2016-2017. Residential water use represented 42.9 percent, multi-family residential water use represented 18.9 percent, commercial water use represented 14.9 percent, industrial/institutional water use represented 8.2 percent, wholesale represented 7.6 percent, irrigation represented 4.3 percent, and public represented 3.1 percent of total metered consumption. These percentages indicate that the water conservation opportunities may be greatest for residential users. The percentage of water used increased slightly for each customer category since FY 2011-2012 except for multi-family (decreased slightly) and industrial/institutional (decreased approximately 3 percent).

Exhibit 2-16. Percent Water Use by Customer Category, Fiscal Year 2016-2017.



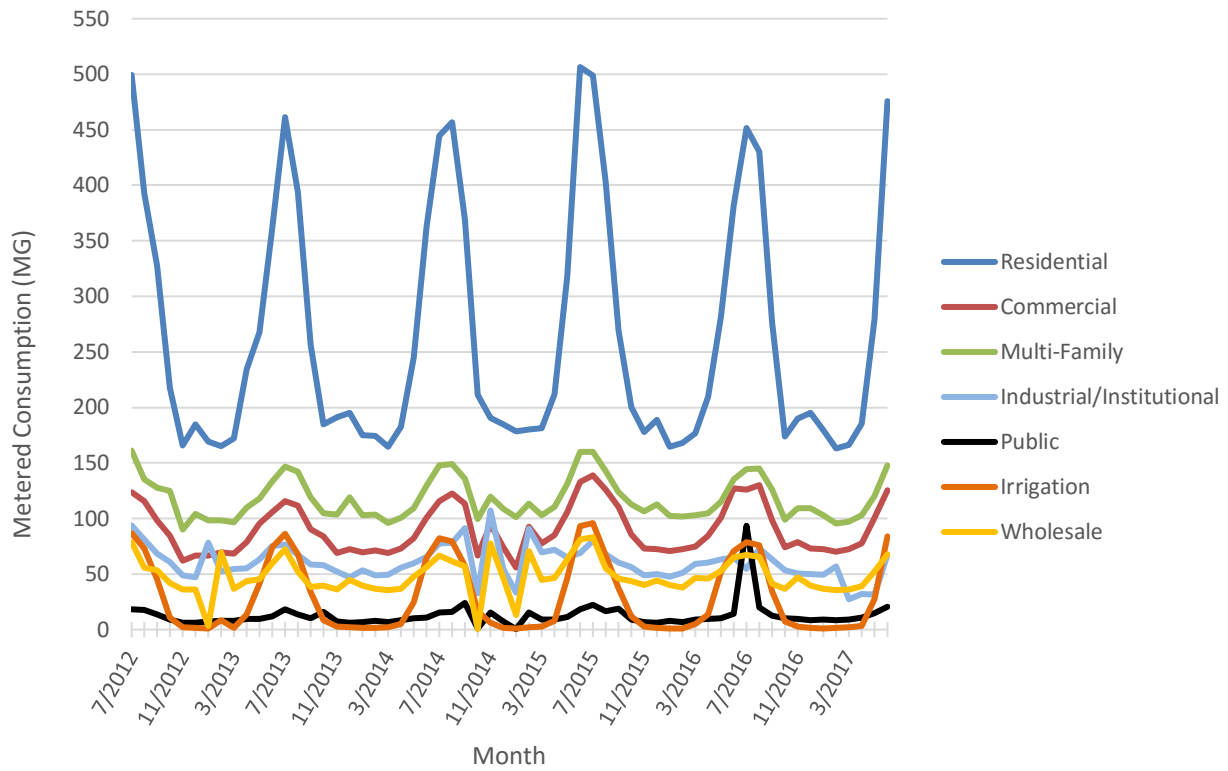
**Exhibit 2-17** presents annual average day consumption (ADC), the average amount of water consumed each day, from FY 2012-2013 through 2016-2017. The average ADC during this period was 20.46 mgd. The City uses ADC by class and in total for its revenue and demand projection calculations.

Exhibit 2-17. Average Day Consumption, Fiscal Year 2011-2012 through 2016-2017.



**Exhibit 2-18** shows the estimated monthly consumption by customer category for July 2012 through June 2017. As expected, consumption increased in the summer months on an annual basis, which can be attributed to outdoor water use for irrigation. The highest monthly consumption was 506.5 MG in June 2015 for residential water users, which is approximately 100 MG less than the highest monthly consumption for residential water users from FY 2007-2008 through FY 2011-2012 (602.6 MG in July 2007).

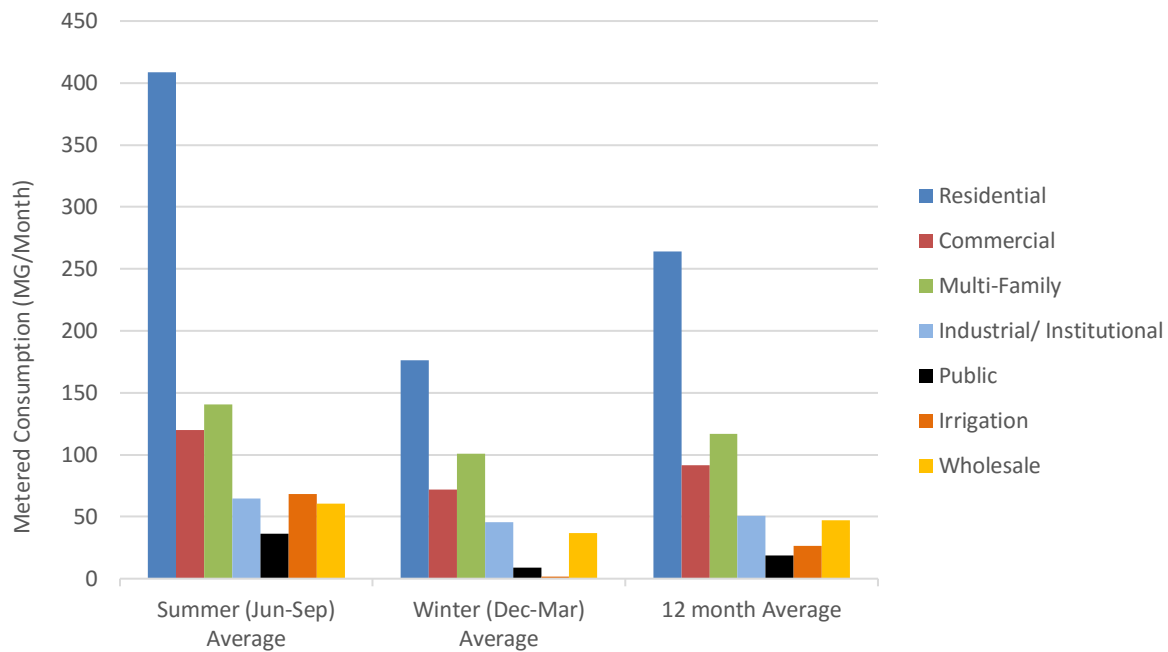
**Exhibit 2-18. Monthly Metered Consumption by Customer Category, July 2012-June 2017.**



## Seasonal Water Use

**Exhibit 2-19** shows the average monthly consumption by season and customer category for FY 2016-2017. For the purposes of this WMCP, the summer months are defined as June through September and the winter months are defined as December through March. The ratio of the City’s total summer season use to total winter season use was 2.0, meaning that water use during the summer season is twice as great as during the winter season. The City’s seasonal water use ratio is the same as the City of Corvallis (*City of Corvallis 2012 WMCP*) and less than the Eugene Water and Electric Board with 2.2 (*Eugene Water and Electric Board 2018 WMCP*).

**Exhibit 2-19. Seasonal Water Consumption by Customer Category, Fiscal Year 2016- 2017.**





## Largest Users

**Exhibit 2-20** lists the City's top 15 water consumers, some of which have multiple service connections listed under more than one customer category. These customers were responsible for use of 1,504.3 MG during FY 2016-2017, which is 20.4 percent of the total water consumption during that FY. Water conservation efforts targeting these customers could result in significant water savings.

Exhibit 2-20. Top 15 Users, Fiscal Year 2016-2017.

Customer Category	Volume Used (MG)
Wholesale	488.8
Industrial/Commercial	278.6
Public/Irrigation/Commercial	187.7
Industrial	64.7
Industrial/Irrigation/Commercial	63.5
Wholesale	62.6
Commercial/Irrigation	59.6
Industrial/Commercial	50.4
Public	42.1
Industrial/Commercial	38.4
Industrial/Commercial	37.8
Industrial/Commercial	35.6
Industrial/Commercial	32.0
Industrial	31.8
Institutional	30.7
<b>Total</b>	<b>1,504.3</b>

## Water Losses / Non-revenue Water

### *OAR 690-086-0140(9)*

The City defines water loss (i.e., non-revenue water) as the finished water demand (i.e., production, which includes surface water and groundwater) leaving Geren Island minus the sum of the following: metered water consumption by customers, the difference between water injected and water recovered from the City's ASR wells (i.e., water produced from Geren Island that remains stored in ASR), and unbilled authorized metered consumption (e.g., City facilities, fire services, and some metered fire hydrant uses). The City's other groundwater rights are used only for emergencies, so are not typically included in the City's water loss calculations. Finished surface water demand leaving Geren Island and ASR injection/recovery data are reported from the HACH software program, which is used to pull data from the City's supervisory control and data acquisition (SCADA) database. Consumption data are reported from the Hansen (asset management and utility billing software) database, which includes actual metered/billed

water use and estimates of authorized/unbilled water used by other City government departments. (The City’s three water fill stations, however, are metered.)

Thus, water loss consists of all unmetered uses (authorized and unauthorized) and system leakage. Authorized unmetered (not billed) uses include such uses as: fire hydrants, firefighting activities, water main flushing, reservoir draining and filling, hydro-truck filling, street sweepers, and water main testing. The City previously estimated water usage for these authorized unmetered uses (previously called Miscellaneous Water Use), but the amount of water was comparatively negligible, so the City no longer estimates these uses. Water loss also includes the use of water from the City’s three water fill stations, which has little impact on the overall volume of unbilled water use, similar to the aforementioned authorized unmetered uses described above. System leakage, as the name implies, is water lost for any reason, including deteriorating pipe, or compromised pipe joints, service connections, or valves. With proper record keeping and metering of water, the water loss percentage approaches the net volume lost to actual leakage.

**Exhibit 2-21** lists the City's historical water losses from calendar year 2012 through 2016. The City has chosen to report water loss by calendar year because the billing information is offset (i.e., up to one month off) from the demand information, making use of the FY less practical<sup>2</sup>. From 2012 through 2016, the City’s average water loss was 10.8 percent. The City’s water loss in 2016 was 12.8 percent. The City estimates that approximately one-fifth of the City’s water loss is attributed to leaks in the transmission line between the Geren Island WTP and Turner Control, which is an issue that the City is actively addressing (See Section 3, Water Loss Analysis). The reduction in water loss in recent years compared to those reported in the 2014 WMCP reflects an improved water auditing method utilized by the City. Data used in the water audit now comes from the Public Works Operations staff, instead of Planning staff. Operations staff uses finished water demand and ASR data from its HACH database and billing data from its Hansen database.

**Exhibit 2-21. Historical Water Loss.**

Calendar Year	Finished Water Demand (Geren Island) (MG)	ASR (MG)	Adjusted Demand (MG)	Billed Consumption (MG)	Water Loss (MG)	Water Loss (%)
2012	9,185	199	8,986	8,123	863	9.6
2013	9,240	105	9,136	8,086	1,049	11.5
2014	9,786	131	9,655	8,574	1,080	11.2
2015	9,981	275	9,706	8,865	841	8.7
2016	9,520	189	9,709	8,465	1,244	12.8
Average					1,015	10.8

<sup>2</sup> When calculating water loss beginning in January and ending in December, the billing information in January includes water used in December, which is less than 25 mgd. This offset from the delay in billing information is less than it would be in the summer months when water demand is the highest, on average around 40 mgd.

## Water Rights

### *OAR 690-086-0140(5)*

The City holds seven surface water rights and 25 groundwater rights that supply potable water to its municipal distribution system. In addition, the City holds a limited license authorizing the use of water for its ASR system. These water rights are described in more detail below and summarized in **Exhibit 2-22**.

The City also holds 13 non-municipal use water rights (six surface water and seven groundwater rights) that authorize the use of non-potable water for a variety of purposes including aesthetics, recreation, public park use, and irrigation. Many of these water rights are held by the City's Parks Division of Public Works. The City does not deliver water through its municipal distribution system for municipal customer supply under any of these water rights. The City's non-municipal water supply water rights are summarized in **Exhibit 2-23**.

### Surface Water

The City holds seven municipal surface water rights that authorize the use of up to a total of 393 cfs (254 mgd) from the North Santiam River and the Willamette River. The City's surface water rights are evidenced by one surface water registration, one permit, and five water right certificates.

The City primarily relies on surface water rights from the North Santiam River to meet its municipal water supply needs. The City holds five water right certificates (Certificates 87958, 87959, 88641, 88871, and 88872) for the use of up to 239 cfs (154 mgd) from the North Santiam River for municipal use. Four of the five water rights were originally issued following the adjudication of the North Santiam River and issuance of the North Santiam River Decree confirming the claimed water rights. These water rights have priority dates of 1856 or 1866. The City's remaining North Santiam River water right (Certificate 88872) has a 1923 priority date.

The City also holds two municipal water rights for the use of surface water from the Willamette River, which are evidenced by a surface water registration and a permit. The City's surface water registration (SW-626) is a claim for the use of surface water before Oregon enacted its water code in 1909. According to SW-626, this water use was developed in 1870 for municipal purposes. An adjudication of the Willamette River must be conducted before this right is confirmed. In the meantime, SW-626 provides the City with the authorization to use up to 10 cfs (6.5 mgd) from the Willamette River for municipal use. The City also holds a 144 cfs portion of Permit S-55045, which authorizes the use of up to 200 cfs (129 mgd) from the Willamette River. (The City assigned a 56 cfs portion of the permit to the City of Hillsboro in August 2016.) The priority date of this water right is December 6, 1976. In 2015, OWRD approved an extension of time for Permit S-55045 (formally Permit S-45565) until October 1, 2086. The City is currently not authorized to divert any water out of its 144 cfs portion of Permit S-55045 as a result of a development limitation included in the Final Order approving the Extension of Time for Permit S-55045 (formerly Permit S-45565) dated July 31, 2015 (the City of Hillsboro is authorized to divert 30.94 cfs out of its 56 cfs assigned portion of the permit). The City will only be able to divert water under the permit following issuance of a final order approving a WMCP that authorizes access to water under the permit. The City intends to use water from the

Willamette River to help meet its future water demands and to provide a redundant water supply in the event that its North Santiam River water supply is not available or is insufficient.

## Groundwater

The City holds 25 municipal groundwater rights that authorize the use of up to a total of 82.95 cfs (53.59 mgd). The City's municipal groundwater rights are evidenced by 11 groundwater registrations, 12 water right certificates, and two transfers. The City uses these groundwater rights primarily as a back-up water supply when its surface water supply is not adequate to meet demands, either due to limitations on water quantity or water quality.

The City's 11 groundwater registrations are claims for the use of groundwater initiated before the enactment of Oregon's groundwater code in 1955. OWRD must conduct an adjudication of the claims and the circuit court must issue a decree before OWRD can issue water right certificates confirming the groundwater uses claimed in these groundwater registrations. A groundwater adjudication for this area has not yet been initiated. Meanwhile, the City's groundwater registrations provide authorization to appropriate of up to 29.44 cfs (19.03 mgd) of groundwater. Four of the groundwater registrations (GR-3502, GR-3507, GR-3509 and GR-3510) allow the use of up to 22.23 cfs (14.37 mgd) from three wells and the infiltration gallery at Geren Island. Many of the City's other water rights evidenced by groundwater registrations are not currently in use.

The City also holds 12 water right certificates for the use of groundwater, which authorize the use of up to 52.4 cfs (33.9 mgd). Certificate 91526 authorizes the use of up to 30 cfs (19 mgd) for withdrawal via a collector well at Geren Island, and the City generally uses it when turbidity in the North Santiam River is high, or when algal fouling occurs, and surface water treatment is not feasible. Six of these water rights are associated with wells acquired from the Jan Ree Water District. Although not all of the wells are currently functional, the City could use these groundwater rights to provide water in extreme emergency conditions.

Finally, the City holds two rights that are currently evidenced by water right transfer T-10263. These rights authorize the use of up to 1.11 cfs (0.72 mgd) of groundwater. Transfer T-10263 allows the City to change the points of appropriation and place of use, and to change the character of use to municipal purposes for these rights. The changes are to be completed by October 1, 2032.

## City of Salem ASR System

OWRD issued the City's ASR Limited License #001 (LL-001) on March 6, 1997. The ASR limited license authorized ASR pilot testing for five years. Since LL-001 was issued, four modifications (renewals) have been approved (March 2002, March 2007, June 2012, and July 2017) that extended LL-001 to July 20, 2022. In its current form, LL-001 authorizes the use of up to 26.0 cfs (16.8 mgd) from the North Santiam River for injecting into a maximum of 15 ASR wells. The use is limited to a maximum storage volume of one billion gallons, and a maximum combined recovery rate of 13,800 gpm (30.7 cfs). The rate at which the City currently recovers stored water generally decreases during the recovery period in response to water level declines in the aquifer as the ASR storage volume is depleted. Typically, the City begins pumping water at rates of 11 to 12 cfs at the beginning of the recovery period but the rate is generally reduced to the range of 7 to 8 cfs by the end of the recovery period.

Exhibit 2-22. City of Salem Municipal Water Rights.

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		FY 2016-2017 Average Withdrawal Monthly (MG)	FY 2016-2017 Average Withdrawal Daily (mgd)	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal Monthly (MG)	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal Daily (mgd)	Comments
									Instantaneous (cfs)	Annually (MG)					
<b>Surface Water</b>															
North Santiam River	--	--	<del>7-7928</del>	88641	1856	Municipal	60	N/A	60	19,395 (in FY 2009-2010; based on records beginning in 2007-2008)	1,115.8	36.68	1,128.8	37.09	
North Santiam River	--	--	<del>7-7928</del>	88871	1866	Municipal	50	N/A	50						
North Santiam River	S-9056	S-12033	<del>7-7928</del>	88872	7/5/1923	Municipal	12	N/A	12						
North Santiam River	--	--	<del>7-5476</del>	87959	1856	Municipal	55	N/A	55						
North Santiam River	--	--	<del>7-3999</del>	87958	1856	Municipal	62	N/A	62						
Willamette River	--	--	SW-626		1870	Municipal	10	N/A	10	0	0	0	0	0	Not currently in use.
Willamette River	S-55010	S-55045			12/6/1976	Municipal	144 for City (Total rate of 200)	10/1/2086	0	0	0	0	0	0	Not currently in use. A 56 cfs portion of the permit was assigned to the City of Hillsboro in August 2016, leaving the City of Salem with a 144 cfs portion of the permit. The City of Salem currently does not have access to any water under its portion of the permit as a result of a development limitation included in the Final Order approving the Extension of Time for Permit S-55045 (formerly Permit S-45565). (The City of Hillsboro is authorized to divert 30.94 cfs out of its 56 cfs assigned portion of the permit).
<b>ASR</b>															
ASR #1, ASR #2, ASR #3, ASR #4, ASR #5, ASR #6, ASR #7, ASR #8, ASR #9, ASR #10, ASR #11, ASR #12, ASR #13, ASR #14, ASR #15	--	--	LL#001	--	N/A	Aquifer Storage and Recovery for Municipal Use	Divert 26 cfs for injection; store 1 billion gallons; recover at 30.7 cfs	3/6/2017		565.4 MG injected (2010); 527.1 MG recovered (2009)	Annual: 423.9 MG injected, 431.0 MG recovered; Monthly: 35.3 MG injected, 36.3 MG recovered	1.16 mgd injected; 1.18 mgd recovered	Annual: 432.0 MG injected, 379.1 MG recovered; Monthly: 36.0 MG injected, 31.8 MG recovered	1.18 mgd injected; 1.04 mgd recovered	Used to meet peak demands. Limited by finite storage capacity in the aquifer.

Exhibit 2-22 Continued. City of Salem Municipal Water Rights

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		FY 2016-2017 Average Withdrawal Monthly (MG)	FY 2016-2017 Average Withdrawal Daily (mgd)	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal Monthly (MG)	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal Daily (mgd)	Comments
									Instantaneous (cfs)	Annually (MG)					
<b>Groundwater</b>															
Middle Well at Geren Island			GR-3507		12/31/1940	Municipal	3.45	N/A	3.45		0	0	0	0	Currently not in use
East Well at Geren Island			GR-3509		12/31/1940	Municipal	2.45	N/A	2.45		<0.001	<0.001	0.68	0.02	Used during high turbidity events in North Santiam River, algal fouling events, flooding, etc.
West Well at Geren Island			GR-3510		12/31/1939	Municipal	3.95	N/A	3.95		0.28	0.009	0.7	0.02	Used during high turbidity events in North Santiam River, algal fouling events, flooding, etc.
Infiltration Gallery (Stayton/Geren Island)			GR-3502		12/31/1936	Municipal	12.38	N/A	12.38		178.36	5.85	181.9	5.78	Typically used during periods of high turbidity in the North Santiam River.
Infiltration Gallery (Stayton/Geren Island)	G-834	G-734		91526	01/02/1958	Municipal	30	N/A	30						
Orchard Heights Well			GR-3503		12/31/1930	Irrigation/Municipal	0.89	N/A	0.89		0	0	0	0	Currently not in use.
Wallace Road Well			GR-3504		12/31/1944	Municipal	0.89	N/A	0.89		0	0	0	0	Currently not in use.
West Salem City Hall West Well			GR-3505		12/31/1936	Municipal	0.56	N/A	0.56		0	0	0	0	Currently not in use.
Market Street Well			GR-3506		12/31/1930	Municipal	0.98	N/A	0.98		0	0	0	0	Currently not in use due to a contamination issue
West Salem City Hall East Well			GR-3508		12/31/1936	Municipal	0.45	N/A	0.45		0	0	0	0	Currently not in use
Jan Ree Wells 1-8, Hayesville Wells 1&2	G-9224	G-8558		66077	05/03/1979	Municipal	12.06	N/A	12.06		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Wells 5&6	G-5777	G-6836		57917	4/14/1972	Municipal	2.16 Well 5: 0.83 Well 6: 1.33	N/A	2.16		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Well 3	G-137	G-40		42199	09/23/1955	Quasi-Municipal	0.05	N/A	0.05		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Wells 1,2,3	G-3388	G-3183		42202	02/16/1966	Quasi-Municipal	1.08	N/A	1.08		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Well 4	G-4596	G-4321		42222	09/13/1968	Supplemental Domestic	1.08	N/A	1.08		0	0	0	0	For emergencies only due to high manganese and iron levels.

Exhibit 2-22 Continued. City of Salem Municipal Water Rights

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		FY 2016-2017 Average Withdrawal	FY 2016-2017 Average Withdrawal	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal	Five-Year (FY 2012-2013 to FY 2016-2017) Average Withdrawal	Comments
									Instantaneous (cfs)	Annually (MG)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)	
<b>Groundwater (continued)</b>															
Jan Ree Well 1	G-1979	G-1815		42200	04/07/1961	Group Domestic	0.37	N/A	0.37		0	0	0	0	For emergencies only due to high manganese and iron levels.
Hemlock Well	G-1853	G-1714		34803	10/03/1960	Group Domestic	0.15	N/A	0.15		0	0	0	0	For emergency use for West Salem.
Friendship (Goff) Well-SHWD Well #3, Woodmansee Park Well #1 (SHWD Well #6), ASR #1, ASR #2, ASR #4, & ASR #5			GR-14		03/02/1953 (0.50 cfs); 01/06/1954 (0.22cfs); 02/28/1952 (0.22 cfs); 04/18/1952 (0.19 cfs); 05/12/1954 (1.64 cfs)	Municipal	2.77	N/A	2.77		0	0	0	0	Limited use because wells are also used for ASR, and the ASR limited license requires recovery of stored water before use of native groundwater. A November 21, 2005 letter to OWRD documented the following changes to GR-14: Removal of 4 of the 6 original points of appropriation (Doege (Well 1), Butler (Well2), Dietz (Well 3), and Gardner (Well 4)); addition of four new points of appropriation (ASR #1, ASR #2, ASR #4, and ASR #5); and revision of the authorized place of use. GR-14 was assigned to the City on September 14, 2012.
ASR #1, ASR #2, ASR #4, & ASR #5	G-116	G-9		87902	09/08/1955	Municipal	1.12	N/A	1.12						Limited use because wells are also used for ASR, and the ASR limited license requires recovery of stored water before use of native groundwater.
ASR #1, ASR #2, ASR #4, & ASR #5	G-135	G-39		87903	09/23/1955	Municipal	1.00	N/A	1.00						
ASR #1, ASR #2, ASR #4, & ASR #5	G-871	G-770		87904	02/21/1958	Municipal	1.33	N/A	1.33						
ASR #1, ASR #2, ASR #4, & ASR #5	G-1006	G-898		87905	06/16/1958	Municipal	2.00	N/A	2.00						
Proposed Wells 1, 2, 3, 4, 5 & 6			GR-493; T-10264		12/31/1940	Municipal	0.67	N/A	0.67		N/A	N/A	N/A	N/A	Limited to a volume of 25,000 gallons per day. Currently not used because the proposed points of appropriation are not yet developed. Will provide redundant supply for NE Salem and Keizer.
Proposed Wells 1, 2, 3, 4, 5 & 6	G-1096	G-912	T-10263	<del>30189</del>	07/28/1958	Municipal	0.55	10/01/2032	0.55		N/A	N/A	N/A	N/A	Currently not used because the proposed points of appropriation are not yet developed. Will provide redundant supply for NE Salem and Keizer.
Proposed Wells 1, 2, 3, 4, 5 & 6	G-3642	G-3422	T-10263	<del>34918</del>	03/24/1967	Municipal	0.56	10/01/2032	0.56		N/A	N/A	N/A	N/A	Currently not used because the proposed points of appropriation are not yet developed. Will provide redundant supply for NE Salem and Keizer.

Exhibit 2-23. Non-Municipal Water Rights Held by the City of Salem.

Application	Permit	Certificate	Source	Use	Priority Date	Authorized Rate (cfs)	Authorized Volume (acre feet)	Acres to be irrigated
<b>Surface Water</b>								
--	--	38655	North Santiam River	"Recreation within Mill Creek channel"	1856	22	--	N/A
--	--	45786	North Santiam River	"Beautification purposes at Civic Center site"	1856	10	--	N/A
S-68610	S-50015	65400	North Santiam River	Aesthetic	11/6/1985	70	--	N/A
S-43731	S-32148	79837	Willamette River	Irrigation, Supplemental Irrigation – Minto Brown Park Cropland. (A 0.02 cfs portion is leased instream until 10/31/2016.)	6/16/1967	3.42*	--	Irrigation of 208.8 Ac Supp. Irrigation of 93.4 Ac
S-43731	S-32148	80154	Willamette River	Irrigation – Minto Brown Park Cropland	6/16/1967	0.08*	--	6.6 Ac
R-48501	R-6761	57946	Pringle Creek	"Recreation (Beautification)"	7/27/1971	N/A	4.5	N/A
<b>Groundwater</b>								
G-2383	G-2192	32221	Cascades Gateway Park Well	"Public Park Use, including chlorinization vehicle for bathing lake"	07/16/1962	0.22	--	N/A
G-3057	G-2853	35773	A well (at Cascades Gateway Park)	Public Park Use	03/26/1965	0.11	--	N/A
G-7317	G-6761	56361	Well #3 (at Cascades Gateway Park)	Park Use	03/31/1976	0.07	--	N/A
G-8928	G-8320	61380	A well (at Cascades Gateway Park)	Public Park Use (Potable Water)	08/15/1978	0.07	--	N/A
G-1602	G-1474	79847	Well 2 (Minto-Brown Park)	Irrigation	10/14/1959	0.99*	--	96.0 Ac
G-13282	G-12165	75923	Willow Lake WPCF Wells 1&2	Industrial	02/05/1993	0.031	--	N/A
G-16201	G-15846	94205	Willow Lake WPCF Wells 1&2	Irrigation	03/05/2009**	0.31*	--	25.1 Ac

\* Limited to one-eightieth of one cfs per acre and 2.5 acre-feet per acre.

\*\* The City has a COBU for this permit pending at OWRD.



## Aquatic Resource Concerns

### Water Quality

The City's North Santiam River water rights authorize diversion at approximately RM 20. At the authorized diversion, the North Santiam River is on Oregon Department of Environmental Quality's (DEQ) 303(d) list of water quality limited streams for dissolved oxygen (September 1 to June 15). The North Santiam River at the authorized diversion was de-listed in 2006 for temperature following approval of a Total Maximum Daily Load (TMDL).

The City's Willamette River water rights authorize diversion at approximately RM 85. At the authorized diversion, the Willamette River is on DEQ's 303(d) list of water quality limited streams for the following parameters: biological criteria (TMDL needed), dioxin, dissolved oxygen, iron, lead, *E. coli* (Fall, Winter, and Spring; TMDL approved in 2010), temperature (TMDL approved in 2010), and mercury (TMDL approved in 2012).

The list of water quality impairments in the North Santiam and the Willamette River can be found on DEQ's Web page for "Oregon's 2012 Integrated Report--Assessment Database and 303d List" at <http://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>.

### Listed Species

**Exhibit 2-24** shows the listed fish species in the North Santiam River and Willamette River within the reach of the POD.

### Critical Groundwater Area

None of the City's groundwater sources are located within the boundaries of a designated critical groundwater area.

Exhibit 2-24. Fish Species Occurring within the North Santiam River (approx. RM 20) and Willamette River (approx. RM 85) that are Listed under the Oregon Sensitive Species List or Federal Endangered Species Act.

Species	Common Name	Evolutionarily Significant Unit (ESU) (if applicable)	Federal Listing	State Listing
<i>Oncorhynchus mykiss</i>	Winter Steelhead	Willamette SMU, Upper Willamette River ESU	Threatened	Sensitive
		Lower Columbia SMU/ESU	Threatened	Sensitive-Critical
	Summer Steelhead	Lower Columbia SMU/ESU	Threatened	Sensitive-Critical
<i>Oncorhynchus tshawytscha</i>	Spring Chinook salmon	Upper Willamette River ESU, Lower Columbia River SMU/ESU	Threatened	Sensitive-“Critical”
<i>Oncorhynchus tshawytscha</i>	Fall Chinook salmon	Lower Columbia River SMU/ESU	Threatened	Sensitive-“Critical”
<i>Oncorhynchus keta</i>	Chum salmon	Lower Columbia SMU/Columbia River ESU	Threatened	Sensitive-“Critical”
<i>Oncorhynchus clarkii clarkii</i>	Coastal Cutthroat Trout	Lower Columbia SMU, including up to Willamette Falls	N/A	Sensitive-“Vulnerable” (below Willamette Falls)
<i>Oncorhynchus kisutch</i>	Coho	Lower Columbia River, including up to Willamette Falls	Threatened	Endangered
<i>Salvelinus confluentus</i>	Bull trout	N/A	Threatened	Sensitive-“Vulnerable”
<i>Oregonichthys crameri</i>	Oregon chub	Willamette River Basin	Delisted in 2015	Sensitive-“Vulnerable”
<i>Lampetra tridentata</i>	Pacific lamprey	N/A	Petitioned for Listing	Sensitive-“Vulnerable”
<i>Lampetra richardsoni</i>	Western Brook lamprey	Columbia River System	N/A	Sensitive-“Vulnerable”
<i>Thaleichthys pacificus</i>	Pacific Eulachon	Southern DPS, Northern Oregon and Washington	Threatened	Sensitive-“Vulnerable”

SMU: Species Management Unit  
 ESU: Evolutionarily Significant Unit

Sources:

Federal ESA listed species (T&E), from NOAA Fisheries Office of Protected Resources: <http://www.nmfs.noaa.gov/pr/species/esa/fish.htm>

Federal Sensitive species, from the Interagency Special Status/Sensitive Species Program for Oregon and Washington State:

<http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/>

Oregon State ESA listed species, from the Oregon Department of Fish & Wildlife:

[http://www.dfw.state.or.us/wildlife/diversity/species/threatened\\_endangered\\_candidate\\_list.asp](http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_list.asp)

Oregon State Sensitive Species, from the Oregon Department of Fish & Wildlife:

[http://www.dfw.state.or.us/wildlife/diversity/species/sensitive\\_species.asp](http://www.dfw.state.or.us/wildlife/diversity/species/sensitive_species.asp)

Federal Species of Concern, from the U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Office:

<http://www.fws.gov/oregonfwo/Species/Data/PacificLamprey/default.asp>

## Evaluation of Water Rights/Supply

*OAR 690-086-0140(3)*

As described above, the City holds municipal water rights authorizing the use of water from the North Santiam River, the Willamette River, and groundwater. The following provides a discussion of the reliability of the water rights from each of these sources.

### North Santiam River – Surface Water

The City holds municipal water rights on the North Santiam River authorizing the use of up to 239.0 cfs. The amount of water available to satisfy the City's water rights is a function of water right priority date (seniority) and streamflow. The relative priority of the City's North Santiam River surface water rights is a key factor in water reliability.

The North Santiam River Basin produces a significant quantity of water even during the driest months. According to streamflow records on the North Santiam River at Mehama, which is upstream from the City's authorized points of diversion, (U.S. Geological Survey [USGS] gage # 14183000, the minimum 7-day rolling average flow (by month) for the period 2000 and through 2017 was 861 cfs in July, 817 cfs in August, 898 cfs in September, and 914 cfs in October.

Based on priority date and streamflows above, the City's water right Certificates 87958, 87959, and 88641, which have priority dates of 1856, are highly reliable. These water rights are senior in priority to all other water rights for the use of water from the North Santiam River, except for a 50.0 cfs instream flow established in the North Santiam River decree, and would be met even during the lowest flows.

The City's water right Certificate 88871, which authorizes the use of up to 50 cfs from the North Santiam River and has a priority date of 1866, is also expected to be highly reliable. This water right shares a priority date with Certificate 30336 (held by Santiam Water Control District), which authorizes the use of up to 762 cfs for power uses. With the exception of one other small water right, the only water rights on the North Santiam River that are senior in priority to Certificate 88871 are those described above. Accordingly, Certificate 88871 is expected to be fully met except during the very lowest flows.

The City's final North Santiam River water right is Certificate 88872, which authorizes the use of up to 12 cfs and has a priority date of July 5, 1923. Although this right is junior to the City's other water rights, it is expected to be reliable during most times of the year.

Despite the apparent reliability of the City's water rights from the North Santiam River, several issues exist that affect the current and future reliability of the North Santiam River as a water source. For example, the surface water intake on the North Santiam is vulnerable during very low flows in dry years and is also susceptible to water quality concerns typically during summer months. To help address these concerns, the City is an active member of the North Santiam Watershed (NSW) Drought Contingency Task Force, which developed a Drought Contingency Plan (DCP) (accepted in April 2018 by the Bureau of Reclamation) to foster a collaborative approach to drought planning and response within the watershed. Specifically, the goal of the DCP is "to build long-term resiliency to drought in order to minimize impacts to the communities, local economies, and critical natural resources within the watershed. The DCP provides a drought monitoring framework to identify different stages of drought, vulnerabilities of assets and other conditions from drought, mitigation actions to reduce risks

and impacts before a drought, response actions during a drought, and a collaborative process for promoting a quick and efficient response to drought. The DCP identifies low streamflows at the City’s intake on the North Santiam River as a vulnerability (meaning the ability of the intake to divert water under low flow conditions may be compromised). As a consequence, the DCP identifies streamflows in the North Santiam (at the Mehama gage) as one indicator of NSW Drought Stages (Stage 1-Potential for Drought:  $\leq 1,000$  cfs; Stage 2-Moderate Drought:  $\leq 900$  cfs; Stage 3- Severe Drought:  $\leq 800$  cfs; Stage 4-Extreme Drought:  $\leq 700$  cfs). Each drought stage has recommended response actions. As shown in **Exhibit 2-25**, the mean daily flows at the Mehama gage have fallen within NSW Drought Stage 1 Indicator in seven of the last 18 years and within NSW Drought Stage 2 Indicator in three of the last 18 years. Streamflows did not fall within NSW Drought Stage 3 or Stage 4 Indicators during that time period.

Exhibit 2-25. Number of Days Flows Have Been Within NSW Drought Stage Indicators (mean daily flows from 2000-2017) on the North Santiam River near Mehama (USGS Gage Number 14183000).

Year	NSW Drought Thresholds (cfs)				Period Flow Targets Missed (Earliest-Latest) <sup>1</sup>
	700	800	900	1000	
2000	0	0	0	0	
2001	0	0	3	87	July 22 - October 22
2002	0	0	0	19	August 18 - September 5
2003	0	0	32	43	July 22 - September 2
2004	0	0	0	9	August 15 - August 23
2005	0	0	0	8	March 13 - March 20
2006	0	0	0	28	August 10 - September 6
2007	0	0	0	0	
2008	0	0	0	0	
2009	0	0	5	7	August 2 - August 8
2010	0	0	0	0	
2011	0	0	0	0	
2012	0	0	0	0	
2013	0	0	0	0	
2014	0	0	0	0	
2015	0	0	0	0	
2016	0	0	0	0	
2017	0	0	0	0	

<sup>1</sup>First and last day flow target missed; the range that the flow targets were missed was continuous between those days in each year except 2001.

As an outcome of initial analyses, the City has decided to firm up the ability to appropriate water from the North Santiam by pursuing development of new collector wells on Geren Island using its existing water rights, an effort that is currently in process.

In addition to considering existing water rights, impacts from low streamflows on infrastructure, and water quality events, an evaluation of the reliability of the City's North Santiam River water rights must also consider the Minimum Perennial Streamflows (MPSF) that were established for the river on June 22, 1964. OWRD historically established MPSFs for waters throughout the State of Oregon. According to OAR 690-077-0054, all MPSFs established before June 25, 1988 shall be converted to instream water rights, but several MPSFs have not yet been converted to instream water rights. The MPSFs are composed of natural flow and released stored water components. The natural flow (live flow) portion of the MPSF at Mehama is 580 cfs and the released stored water component is up to 640 cfs. If the live flow portion of the MPSF is converted to an instream water right, it is expected to have a June 22, 1964 priority date and would, therefore, be junior in priority to the City's North Santiam River water rights. On the other hand, if the released stored water portion of the MPSF was converted to an instream water right, it could potentially affect the reliability of the City's water rights despite its junior priority date. The stored water released from Detroit Reservoir would be a different source from the natural flow to which the City is entitled. In other words, the City would not be authorized to appropriate the 640 cfs of released stored water to meet its water needs. However, serious concerns have been raised about the consequences of converting the MPSFs, and significant uncertainty is associated with the ultimate "conversion" of the stored water component of the minimum perennial streamflows to instream water rights.

As previously mentioned there are several additional issues that affect the current and future reliability of the North Santiam River as a water source. First, the conveyance capacity of the transmission line from Geren Island to the City's distribution system currently limits the actual water supply to 102 cfs, and second, that long transmission line is vulnerable to serious damage from a large-scale earthquake. The City is exploring development of its Willamette River water rights to address both issues. Finally, as mentioned above, water quality events can reduce access to this source. In the summer of 2018 the reliability of North Santiam River water was affected by cyanotoxins originating from blue-green algae leaving Detroit Lake. In response, the City is planning to enhance water treatment at Geren Island by adding an ozonation plant capable of killing cyanotoxins.

## **Willamette River**

The City holds two water rights on the Willamette River for up to 144 cfs under Permit S-55045 and up to 10 cfs under surface water registration SW-626. Water has not been put to beneficial use under these water rights to date. In addition, the City currently does not have access to water under its portion of Permit S-50045 as a result of a development limitation included in the Final Order approving the Extension of Time for Permit S-55045 (formerly Permit S-45565) dated July 31, 2015. The City will only be able to divert water under the permit following issuance of a final order approving a WMCP that authorizes access to water under the permit.

The reliability of water supply under Permit S-55045 and SW-626 has been assessed below by analyzing water availability, historical streamflows, and the priority dates of the water rights. However, the ultimate reliability of SW-626 cannot be determined because the right is currently evidenced by a surface water registration. As previously described, OWRD must conduct an adjudication of surface water rights on the Willamette River before the City has certainty as to this surface water right. In addition, use of the City's Willamette River water rights will require a capital investment to construct a diversion structure, water treatment plant, pumping facilities and pipelines needed to convey this water to the City service area.

## Water Availability and Historical Streamflows

OWRD's online water availability database indicates (after considering all existing consumptive use and non-consumptive use water rights, including instream water rights) that water is available for appropriation from the Willamette River at Salem gage (14191000). The water availability database shows that up to 993 cfs of water is available for appropriation from the Willamette River at Salem in the month of August, with higher rates available every other month of the year at an 80 percent exceedance probability. Accordingly, the Willamette River should have sufficient water supply for all existing water rights, including those held by the City.

The reliability of Permit S-55045 is also affected by permit extension conditions under the extension Final Order dated July 31, 2015, which extended the completion date of the permit until October 1, 2086. As part of the municipal permit extension process, the Oregon Department of Fish and Wildlife (ODFW) recommended conditions to OWRD intended to "maintain the persistence of listed fish." Listed species identified in the Final Order were: Fall Chinook, Spring Chinook, coastal cutthroat, coho, Pacific lamprey, winter steelhead, and Oregon chub (The Oregon chub has since been federally delisted but remains a State "sensitive-vulnerable" species). The Final Order incorporated the recommended conditions to maintain the persistence of listed fish, which established fish persistence target flows on the Willamette River. If the target flows are not met, the City's use of water under Permit S-55045 would be reduced in proportion to the amount by which the target flow is not met (based on a 7-day rolling average of mean daily flows). The overall reduction would not exceed 20 percent of the undeveloped portion of the permit.

A comparison of historical streamflows to the target flows included in Permit S-55045 suggests that the water right would generally provide a reliable water supply source. Exhibit 2-26 shows the permit extension target flows for Permit S-55045, the 2000-2017 average minimum 7-day rolling average flow for each month, and the minimum 7-day rolling average flow recorded in 2015 to provide an example of flows during a dry year. The average minimum 7-day rolling average flow for a given month is the average of the lowest recorded 7-day rolling average flow during that month for each of the 18 years of data. As shown in **Exhibit 2-26**, the average minimum 7-day rolling average flow in the Willamette River at the Salem gage from 2000 through 2017 exceeded the target flows in Permit S-55045 for each month. In 2015, however, the average minimum 7-day rolling average was less than the target flows for April through September. This indicates that during low-flow years, the City's use of water under Permit S-55045 could be reduced. Additional analysis of this issue was done to evaluate the extent to which the City's permit could be affected by the need to meet the target flows.

Exhibit 2-26. Fish Persistence Target Flows and Average Minimum 7-day Rolling Average Flows (2000-2017) in the Willamette River, Measured at U.S. Geological Survey (USGS) Gage 14191000.

Period	Flow Target (cfs)	2000 - 2017 Average Minimum (cfs)	2015 Minimum (cfs)
January	6,000	24,690	21,829
February	6,000	16,306	13,329
March	6,000	16,416	10,104
April 1 - 15	15,000	22,652	13,643
April 16 - 30	17,000	19,952	11,114
May	15,000	16,060	8,717
June 1 - 15	12,600	14,666	7,143
June 16 - 30	8,500	10,395	6,354
July	5,630	7,003	5,503
August	5,630	6,547	5,287
September	5,630	6,945	5,327
October	5,630	8,947	6,449
November	6,000	12,461	7,597
December	6,000	20,921	13,571

Further analysis of seven-day rolling average streamflow records for the Willamette River at the Salem gage (USGS 14191000) from January 2000 through December 2017 showed that target flows for Permit S-55045 were not met on 5.1 percent of the days. **Exhibit 2-27** shows the number of days from 2000 through 2017 that the seven-day rolling average flow did not meet the above-described target flow, the time periods during which those days with missed targets occurred, and the average and maximum deficit of streamflows compared to target flows. The target flows were not met at some time in 11 out of the 18 years. The days when target flows were not met were mostly in April, May, and June, which do not correspond to the City's period of peak demands in July and August. Target flows were not met during those peak season months in only two years: 2001 and 2015. The average percentage that target flows were missed was less than 10 percent in every year from 2000 through 2017, except 2015. From 2000 through 2017, the maximum percentage that target flows were missed was 43.3 percent in 2015.

Exhibit 2-27. Comparison of Willamette River Flows and Permit S-55045 Target Flows, 2000-2017.

Year	Number of Days Target Flow Missed	Period Target Flows Missed (Earliest-Latest) <sup>1</sup>	Average Deficit (cfs)	Average Deficit (%)	Max Deficit (cfs)	Max Deficit (%)
2000	1	June 12	29	0.2%	29	0.2%
2001	80	April 1 - August 24	629	6.3%	2886	21.7%
2002	2	June 15 - June 30	59	0.5%	86	0.7%
2003	13	May 28 - June 30	718	8.3%	1353	15.9%
2004	25	April 1 - May 29	573	3.5%	1657	9.7%
2005	2	April 29 - April 30	364	2.1%	443	2.6%
2006	0					
2007	20	May 30 - June 30	363	3.2%	1473	11.7%
2008	0					
2009	0					
2010	0					
2011	0					
2012	0					
2013	13	May 17 - June 15	697	5.2%	1571	12.5%
2014	4	June 6 - June 9	150	1.2%	243	1.9%
2015	142	April 6 - September 16	2427	18.0%	6283	43.3%
2016	31	May 17 - June 30	889	6.6%	2029	14.9%
2017	0					

<sup>1</sup>First and last day flow target missed; the flow target may have been met on some days within that range.

It is helpful to understand that, since the early 2000s, the U.S. Army Corps of Engineers (USACE) has managed the thirteen federal reservoirs in the Willamette Basin Project to meet fish flow targets at the City of Salem gage (USGS Gage 14191000). The USACE, however, manages for flow targets established in the 2008 Biological Opinion (BiOp) for the Willamette Basin Project<sup>3</sup> and the USACE's target flows (shown in Exhibit 2-31), differ slightly from those included in Final Order approving an extension of time for Permit S-55045. As a result, USACE management of the reservoirs may result in the target flows in Permit S-55045 not being met during low flow water years.

The BiOp target flows measured on the Willamette River at Salem are adjusted based on the volume of stored water in mid-May, as described in **Exhibit 2-28**. The Willamette Project Biological Opinion Flow Objectives for the Willamette River at Salem are presented in **Exhibit 2-29**, which includes an example of an "insufficient year." Given that the BiOp flow objectives vary throughout the year, as well as streamflows, the impact of the BiOp flow objectives will depend on the time of year. A USACE analysis determined that 10 years between 1936 and 1999 (64-year period) were "deficit years".

<sup>3</sup> The minimum stream flow targets adopted by the BiOp are based on the minimum stream flow targets included in the 2007 USACE Biological Assessment.



Exhibit 2-28. Description of the 2008 Biological Opinion Target Flows Based on Stored Water in Mid-May.

Type of Year	Amount of USACE Reservoir Storage (million acre-feet, MAF)	USACE Reservoir Management Strategy
“Adequate Year” or Better	At least 1.20 MAF are anticipated to be stored by mid-May	Manage reservoirs to meet Minimum Flow Objectives. See Exhibit 2-31.
“Insufficient Year”	0.90 MAF to 1.19 MAF are anticipated to be stored in the reservoirs by mid-May	Minimum flow objectives are adjusted in proportion to where the projected storage volume falls in the scale between 0.90 and 1.20 MAF. See Exhibit 2-31 for an example of an “Insufficient Year” flow objectives when total storage in mid-May is 0.95 MAF.
“Deficit Year”	Less than 0.90 MAF are anticipated to be stored in the reservoirs by mid-May	Minimum flow objectives in April and May are equal to target flows, being: <ul style="list-style-type: none"> <li>• 3,000 cfs (35 percent) lower than the target flows during late June, and</li> <li>• 630 cfs (11 percent) lower than the target flows during July and August.</li> </ul>

Exhibit 2-29. Willamette Project Biological Opinion Flow Objectives for the Willamette River at Salem.

Time Period	Minimum Flow Objectives in at least Adequate Years (cfs)	Example “Insufficient Year” Flow Objectives based on 0.95 MAF (cfs)	“Deficit Year” Flow Objectives (cfs)
April 1 – 15	17,800	15,467	15,000
April 16 – 30	17,800	15,467	17,000
May 1 – 31	15,000	15,000	15,000
June 1 – 15	13,000	11,333	11,000
June 16 – 30	8,700	6,033	5,500
July 1 – 31	6,000	5,167	5,000
August 1 – 15	6,000	5,167	5,000
August 16 – 31	6,500	5,250	5,000
September 1 – 30	7,000	5,333	5,000
October 1 – 31	7,000	5,333	5,000

Note: The minimum streamflow targets adopted by the Bi-Op are based on the minimum streamflow targets included in the 2007 USACE Biological Assessment.

## Priority Date

Surface water registration SW-626 has a priority date of 1870 and Permit S-55045 has a priority date of December 6, 1976, such that SW-626 is senior and Permit S-55045 is junior to the June 22, 1964 priority date of the unconverted MPSF at Wilsonville. The unconverted MPSFs on the Willamette River have both natural flow and released stored water components. At Salem, the natural flow component of the unconverted MPSF is 1,300 cfs and the released stored water component is up to 4,700 cfs. These flows are, for the most part, lower than the target flows currently used by the USACE to manage the reservoirs, such that conversion of the MPSFs will not likely impact the reliability of Permit S-55045. However, the City will continue to track activities associated with converting the MPSFs in the Willamette Basin. In addition, as discussed above the City will follow the Willamette Valley project reallocation process to understand the extent to which stored water from USACE managed reservoirs in the Willamette River Basin is protected instream in the future.

## Groundwater

The City holds 25 groundwater rights that provide authorization to appropriate up to 82.95 cfs of groundwater for municipal use. The City primarily uses its groundwater supply for emergency use and supply redundancy. Groundwater generally provides a reliable source of supply for emergency use in supply redundancy, though use of groundwater is limited under a number of the City's water rights for a variety of reasons.

## Geren Island

The City's groundwater rights on Geren Island (Certificate 91526 and Groundwater Registrations GR-3507, GR-3509, GR-3510, and GR-3502) are typically used during high turbidity events or other times when the surface water supply from the North Santiam River needs to be supplemented. These groundwater rights are generally considered reliable, however, the reliability of Certificate 91526 (which authorizes the use of up to 30 cfs) is affected by fish persistence conditions that apply to a 29.6 cfs portion of the certificate. If streamflows in the North Santiam River near Mehama (USGS Gage Number 14183000) fall below the target flows identified in **Exhibit 2-30**, access to the 29.6 cfs portion of the certificate would be reduced by the percentage that the target flow is missed (based on a seven-day rolling average of mean daily flow). An analysis of the seven-day rolling average of mean daily flows measured in the North Santiam River near Mehama from January 1, 2013 through December 31, 2017 showed that the fish persistence target flows for Certificate 91526 were missed 6.7 percent of the time. The target flows were missed in September each year, as well as in May and October in 2015. During this five-year period of analyzed, fish persistence target flows were missed by maximum of 31.2 percent (September 1, 2015), which would have resulted in curtailment of 9.24 cfs out of the 29.6 cfs. Fish persistence target flows were missed by 16.1 percent on average, which would result in an average curtailment of 4.78 cfs out of the 29.6 cfs.

In its current operations, the City primarily uses Certificate 91526 (and the associated Collector well) to enhance water production from Geren Island during winter-time high turbidity events. Because the fish persistence target flows of Certificate 91526 are routinely met during the winter, it is unlikely that the City's use of Certificate 91526 would be curtailed during this time because of the fish persistence conditions. However, in the future scenario of the City using groundwater to supplement its surface water supply during the summer, there are likely to be days during most years, primarily during the month of September, when the fish persistence

target flows of Certificate 91526 are not met, resulting in a curtailment of the rate of groundwater that can be appropriated under the certificate.

Exhibit 2-30. Fish Flow Targets on the North Santiam River near Mehama (USGS Gage Number 14183000).

Time Period	Target Flows (cfs)
October-December	1,500
January-February	1,200
March 1-March 15	1,200
March 16-March 31	1,500
April-May	1,500
June	1,200
July 1-July 15	1,200
July 16-July 31	1,000
August	1,000
September	1,500

### In-town

Five of the City’s groundwater registrations (GR-3503, GR-3504, GR-3505, GR-3506 and GR-3508), which authorize the use of up to 3.77 cfs, are currently not in use. An additional six groundwater right certificates (associated with the Jan Ree wells), which authorize use of up to 16.8 cfs, are only used for emergency purposes due to water quality concerns. Certificate 34803, which authorizes the use of up to 0.15 cfs, is utilized in west Salem as needed for supplemental supply. Additionally, the groundwater registration and four water right certificates that have ASR wells 1 through 5 as their authorized points of appropriation are used only on a limited basis. The City’s ASR limited license requires recovery of the stored water before the City pumps native groundwater from these wells. Since the City is typically ready to begin injection after it has completed pumping stored water, native groundwater is rarely appropriated from these wells. Finally, the City has not yet developed the proposed points of appropriation approved by T-10264 and T-10263, and is not, therefore, currently using these water rights. Once the wells are developed, the groundwater will be used for redundant supply for NE Salem.

### Aquifer Storage and Recovery

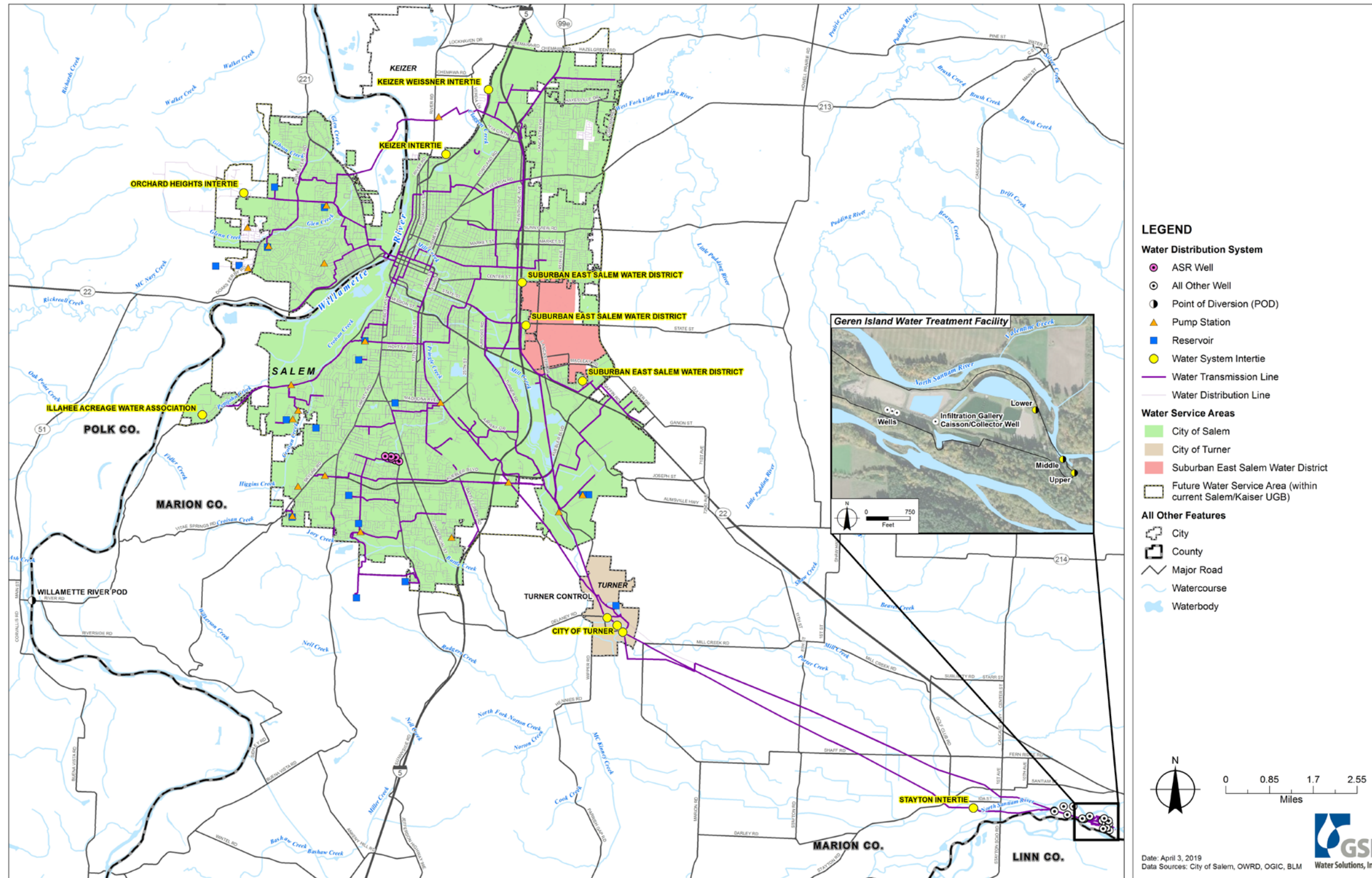
The City uses its ASR system to meet peak demands. Recovery rates typically decline from 11 to 12 cfs at the beginning of the recovery period to the range of 7 to 8 cfs by the end of the recovery period. The City’s ASR system is also limited by the finite storage capacity of the aquifer. The City has been increasing the volume of water stored using ASR over the past few years to increase the volume of ASR water that can be used for supplemental water supply. The City will bring ASR Well 6 (an existing well) online in the near future and the City is currently investigating a possible site for ASR Well 7.

## **System Description**

*OAR 690-086-140(8)*

The City operates a public drinking water system (Public Water System Identification Number OR4100731). The City's water system includes a slow-sand filtration water treatment plant, 20 operating pump stations, 18 reservoirs, approximately 765 miles of pipeline, and groundwater and ASR wells. **Exhibit 2-31** presents a schematic of the City's existing water distribution system.

Exhibit 2-31. City of Salem Water Distribution System Schematic.



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## North Santiam River Intakes

The City has three intakes on the North Santiam River: the Upper, Middle, and Lower intakes. The Middle Intake is the primary intake and has a capacity of 227 cfs (146.7 mgd). The Upper Intake is used as needed to meet peak or emergency demands. The Lower Intake is used to maintain water in habitat dedicated to the threatened Oregon chub and is no longer used for potable water production.

## Geren Island Water Treatment Facility

Water diverted from the North Santiam River is treated at the water treatment facility on Geren Island, a 250-acre island in the North Santiam River, located upstream from the City of Stayton and approximately 17 miles from Salem. The primary water treatment process on Geren Island is slow sand filtration.

Water treatment on Geren Island started in the 1930s with an infiltration gallery and a water collection chamber feeding Transmission Line 1 (36 inch diameter). In the 1950s, the infiltration gallery was upgraded and one slow sand filter (SSF 1) was added. Along with the construction of the slow sand filter, a 54-inch transmission line (Line 2) was added to the system to increase conveyance capacity. In 1970, a second filter (SSF 2) was added, effectively doubling the treated water capacity. The water treatment facility remained unchanged until after 1996 when the facility was upgraded by the addition of a screened intake structure, two new slow sand filters, a pretreatment facility, and the addition of the process pump station.

The five-pump process pump station improves reliability and operational flexibility during a high turbidity event on the river or other events that diminish the ability to treat water coming directly from the North Santiam River. Capable of pumping up to 77 cfs (50 mgd), the pump station allows the City to collect water that has been through the roughing filter or directly from the caisson and infiltration gallery. The water is then pumped onto the slow sand filter beds for final treatment. In addition, the East and West wells are capable of delivering groundwater to the slow sand filters for treatment.

The treatment facility has a theoretical peak capacity of 195 cfs (126 mgd), with a safe yield of approximately 112 cfs (72 mgd) when one filter bed is out of service for cleaning, one in the ripening phase of operation, and the other beds are in declining rates prior to cleaning.

## Transmission

The City's transmission system is composed of an upper and lower system. The upper system starts at Geren Island and ends at the Turner Control master meter located near the City of Turner. From Geren Island, treated water is delivered into twin 69-inch mains that run west on the island. The lines then cross the North Santiam River and terminate at a connection manifold that links the 69-inch mains with transmission lines No. 1 and No. 2. Crossovers between the transmission lines allow either transmission line to feed the twin-cells of Franzen Reservoir, located in the City of Turner. Upper Transmission Line No. 2 also provides service to the City of Turner. The upper system is approximately 9.5 miles long and can deliver a maximum of 113 cfs (73 mgd) to Turner Control.

The lower transmission system starts at Turner Control, which houses the master meters and flow control valves to regulate and distribute flow to the two lower transmission pipelines. The longer main is approximately 14.7 miles long and terminates at Mountain View Reservoir in

west Salem; the shorter main is approximately 7.3 miles long and terminates at Fairmont Reservoir in south Salem. Combined, the lower transmission system can deliver a maximum of 139 cfs (90 mgd), assuming a consistent hydraulic grade line from Franzen Reservoir to Mountain View Reservoir.

## Storage

There are 18 reservoirs within the City of Salem service area, as shown in **Exhibit 2-32**. The reservoirs provide a total storage capacity of approximately 137.2 MG. Franzen Reservoir contributes 92 MG to the total capacity.

Exhibit 2-32. Summary of System Reservoirs.

Reservoir	Max Volume (MG)	Overflow Elevation (feet)	Reservoir Type	Service Level
Franzen <sup>1</sup>	92.0	414.0	Floating Cover	G-0
Fairmont	9.9	334.0	Concrete Tank	G-0
Mountain View	9.9	334.0	Concrete Tank	G-0
Candalaria	0.5	444.0	Concrete Tank	S-1
Mader	1.5	444.0	Steel Tank	S-1
Seeger	1.6	599.0	Steel Tank	S-2
Kurth	1.6	599.0	Steel Tank	S-2
Chacarun	2.0	599.2	Concrete Tank	S-2
Croisan Upper	0.8	599.0	Concrete Tank	S-2
Lone Oak	5.6	599.0	Concrete Tank	S-2
Skyline	1.2	729.0	Concrete Tank	S-3
Glen Creek	2.2	503.0	Concrete Tank	W-1
Grice Hill	2.3	503.0	Concrete Tank	W-1
Eola #1b	0.9	651.0	Concrete Tank	W-2
Eola #2	0.2	780.0	Concrete Tank	W-3
College	0.5	482.0	Steel Tank	T
Mill Creek	2.2	444.0	Concrete Tank	S-1
Champion Hill	2.3	729.0	Concrete Tank	S-3
<b>Total Storage Capacity</b>	<b>137.2</b>			

<sup>1</sup>Franzen Reservoir was reconstructed in 2004.

Source: City Records



## Wells

The City has 20 groundwater wells and four ASR wells, as shown in **Exhibit 2-33**.

Exhibit 2-33. Municipal Well Characteristics.

Well Name	Depth (ft)	Well Diameter (in)	Estimated Pumping Capacity (gpm)
<b><i>Geren Island Wells</i></b>			
East Well at Geren Island	60	12	1,250
Middle Well at Geren Island	60	14	not available
West Well at Geren Island	60	16	1,250
Collector Well (Geren Island)	29	n/a	n/a
Infiltration Gallery (Geren Island)	not available	not available	not available
<b><i>Jan Ree Wells</i></b>			
Haysville No. 1	113	8	400 <sup>1</sup>
Haysville No. 2	163	10	500
Jan Ree No. 1	220	10	700 <sup>1</sup>
Jan Ree No. 2	223	12	700
Jan Ree No. 3	135	8	400
Jan Ree No. 4	215	12	600
Jan Ree. No. 5	190	8	500
Jan Ree No. 6	190	12	700
Jan Ree No. 7	246	10	300 <sup>1</sup>
Jan Ree No. 8	201	10	500
<b><i>West Salem Wells</i></b>			
Hemlock	270	10	250
Orchard Heights Well	165	8	400
Wallace Road Well	389	12	400
West Salem City Hall Well – West	303	not available	250
West Salem City Hall Well - East	135	10	200
<b><i>ASR Wells</i></b>			
ASR Well #1	315	12	1032 <sup>2</sup>
ASR Well #2	330	16	1700-1750 <sup>3</sup>
ASR Well #4	327	16	1770-1900 <sup>3</sup>
ASR Well #5	350	16	1400-1540 <sup>3</sup>

<sup>1</sup>Lower priority wells to re-activate due to poor accessibility at Haysville No. 1 and higher sand content in Jan Ree No. 1 and Jan Ree No. 7.

<sup>2</sup>2009 data

<sup>3</sup>Data range indicates ASR well when fully charged at the beginning of the season, to the end of the season, as reported in the 2012 ASR Annual Report.

Source: Jan Ree and Hemlock wells from City records, all other wells from well logs and registration statements maintained on OWRD website at [http://apps.wrd.state.or.us/apps/gw/well\\_log/Default.aspx](http://apps.wrd.state.or.us/apps/gw/well_log/Default.aspx)

## Pump Stations

The City has 21 pump stations, as shown in **Exhibit 2-34**.

Exhibit 2-34. Summary of Existing Pump Stations.

Pump Station	Service Level	# of Pumps	Maximum Capacity (gpm)	Firm Capacity (gpm)
Keizer Intertie	G-0	1	3,500	0
Edwards S1	S-1	3	3,600	2,400
Edwards S2	S-2	3	5,000	3,000
Fairmount S1	S-1	1	1,000	0
Fairmount S2	S-2	2	2,000	1,000
Mill Creek	S-1	2	2,000	1,000
S. River Rd	S-1	4	3,500	2,500
Boone	S-2	3	8,000	4,000
Croisan Lower	S-2	2	430	215
Creekside	S-3	3	3,600	2,400
Skyline	S-3	3	5,400	3,600
Croisan Upper	S-3	3	2,270	470
Davis Rd	S-4	4	2,860	1,660
Skyline #4	S-4	2	180	50
Deer Park	S-1	3	4,500	3,000
Jefferson	W-1	2	2,000	1,000
Mountain View	W-1	4	7,200	5,400
Limelight	W-2	3	2,400	1,600
Chatnicka	W-3	3	380	80
Eola #2	W-3	2	900	450
Rockridge	S-3	4	800	400

## Distribution System Pipe Sizes

Within the City’s service area, water is distributed through a distribution system network consisting of approximately 765 miles of pipe. The distribution system consists of pipe diameters that range from 0.75-inch to 69-inches. Pipe materials are asbestos cement, cast iron, concrete cylinder pipe, ductile iron, polyvinyl chloride (PVC), and steel. The standard for new pipe installed since 1982 is ductile iron. A summary of the pipe inventory is shown in **Exhibit 2-35**.

Exhibit 2-35. Summary of Pipeline Sizes.

Nominal Pipe Size (in)	Total Length (miles)
2	16.7
3	0.7
4	71.4
6	176.4
8	241.0
10	46.4
12	76.1
14	4.9
16	30.9
18	16.3
20	8.8
24	24.6
27	0.3
30	3.8
36	17.4
42	6.1
48	8.2
54	10.2
64	0.5
69	4.5
<b>Total</b>	<b>765.2</b>

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# 3. Water Conservation

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*This section addresses the requirements of OAR 690-086-0150(1) – (6).*

*This rule requires a description of specific required conservation measures and benchmarks, and additional conservation measures implemented by the City.*

## Current Conservation Measures

*OAR 690-086-0150(1)*

### Progress Report

OWRD approved the City’s most recent WMCP on November 25, 2014. **Exhibit 3-1** shows the conservation measures required by OAR 690-086-0150(4)-(6), the City’s five-year benchmarks as described in its 2014 approved WMCP, as well as a progress report for each benchmark.

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Exhibit 3-1. City of Salem Previously Approved 5-year Benchmarks and Summary of Progress.

Section Requirement	Sub- section Requirement	2014 Benchmark	2017 Progress Summary
<p>OAR 690-086-150 (4) A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers:</p>	(a) An annual water audit that includes a systematic and documented methodology for estimating any un-metered authorized and unauthorized uses	The City will continue to conduct annual water audits, and evaluate production and consumption data to observe trends for targeting conservation measures. To better account for unmetered, authorized use, the City will continue to coordinate with the following internal departments and divisions to identify and measure the use of water by the Salem Fire Department, Operations Wastewater Collections, and Operations Stormwater.	The City continues to conduct annual water audits. FY 2016/17 showed water loss at 12.8%. The City continues to work with staff to identify and measure City use.
	(b) If the system is not fully metered, a program to install meters on all un-metered water service connections.	The City will continue to require all new connections be metered.	The City continues to require all new connections be metered.
	(c) A meter testing and maintenance program	The City will continue to test and repair or replace large meters annually, and small meters upon customer or City Customer Services request.	Meter testing was not performed for the last two years due to lack of resources and staffing. The program resumed July 1, 2017.
	(d) A rate structure under which customers' bills are based, at least in part, on the quantity of water metered at the service connections	The City will continue to bill customers, in part, based upon the metered quantity of water use.	The City's rate structure for all customer classes continues to be based, in part, on the quantity of water consumed.
		It will also periodically review the rate structure to determine the size and timing of future rate increases needed to promote water conservation, fund capital and operating costs, and to achieve other utility objectives.	The City regularly reviews its rate structure, with the last review being performed in 2016 to set rates for the 2017 and 2018 calendar years.
	(e) If the annual water audit indicates that system leakage exceeds 10 percent, a regularly scheduled and systematic program to detect leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the municipal water supplier;	The City will continue to survey 10 percent of the system annually, resulting in the entire system being surveyed every ten years.	The leak detection program started in June of 2014. Since then, the City has completed leak detection in six of its ten zones.
		Repairs of all reported and detected leaks will continue to be performed in a timely manner.	Repairs of all reported and detected leaks continue to be performed in a timely manner.
		After the new loggers have been installed, the City will evaluate their performance in reducing water loss and investigate the feasibility of purchasing and installing additional equipment for this purpose.	The loggers proved valuable to the City as a tool for helping to identify leaks. As a result, the City purchased 20 new leak loggers in 2013 to expand the program.
		The City will also look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection.	The City continues to look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection.
	(f) A public education program to encourage efficient water use and the use of low water use landscaping that includes regular communication of the supplier's water conservation activities and schedule to customers	The City's goal is to attain a leakage rate below 10 percent.	The City continues to pursue its goal of less than 10 percent leakage annually.
The City will continue to implement a small-scale public education program, focused primarily on providing available educational materials for residential customers and schools upon request, and at a limited number of annual festivals.		The City continues to implement a public education program. The City promotes water conservation through such means as its website (e.g., leak detection tips), local radio, school presentations, and conversations at festivals. Section 3 details the City's public education activities.	

Exhibit 3-1. City of Salem Previously Approved 5-year Benchmarks and Summary of Progress Continued.

Section Requirement	Sub- section Requirement	2014 Benchmark	2017 Progress Summary
<p>OAR 690-086-150 (6) If the supplier serves a population greater than 1,000 and proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), or if the supplier serves a population greater than 7,500, description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following measures; or documentation showing implementation of the measures is neither feasible nor appropriate for ensuring the efficient use of water and the prevention of waste</p>	(a) A system-wide leak repair or line replacement program to reduce system leakage to 15 percent and if the reduction of system leakage to 15 percent is found to be feasible and appropriate, to reduce system leakage to 10 percent	The City will continue to survey 10 percent of the system annually, resulting in the entire system surveyed every ten years.	The leak detection program started in June 2014. Since then the City has completed leak detection in seven of its ten zones.
		Large leaks and failed pipes will be repaired or replaced immediately.	The City continues to meet this benchmark.
		Repairing smaller leaks and replacing aging pipes will occur, as needed, based on budget and staff availability.	The City continues to repair small leaks and replace aging pipes.
		The City will continue to look for internal coordination opportunities to increase the cost-effectiveness of leak detection and repairs.	The City continues to look for these opportunities.
	(b) Technical and financial assistance programs to encourage and aid residential, commercial, and industrial customers in implementation of conservation measures;	The City's goal is to attain a leakage rate below 10 percent.	The City continues to pursue its goal of less than 10 percent leakage annually.
		During the next five years, the City will continue to provide water audit kits and individual conservation tools upon request.	Water audit kits and individual conservation tools continue to be provided to customers.
	(c) Supplier financed retrofitting or replacement of existing inefficient water using fixtures, including distribution of residential conservation kits and rebates for customer investments in water conservation;	Although the City does not budget funds specifically for the water conservation grant program, proposed projects are evaluated on a case-by-case basis and funded if the project has demonstrable benefits to the City and customer.	The City continues to be open to considering water conservation project proposals. These projects are typically funded up to a maximum of \$50,000. The City is developing administrative rules to formalize the application, evaluation, and awarding of City funded grants.
		During the next five years, the City will continue to provide residential indoor and outdoor conservation kits upon request.	Residential indoor and outdoor conservation kits continue to be provided.
	(d) Adoption of rate structures, billing schedules, and other associated programs that support and encourage water conservation;	The City will evaluate the feasibility of resuming cost share programs for replacing inefficient fixtures for commercial/industrial customers or multifamily property owners, if budget and staff availability permit.	The City implemented small scale cost-sharing projects to replace old showerheads with low-flow showerheads in multifamily complexes. The City provided assistance based on requests from the multifamily property managers.
		The City will continue to bill customers using a rate structure based in part on water use.	The City's rate structure for all customer classes continues to be based, in part, on the quantity of water consumed.
		The City will continue to bill its customers on a monthly schedule and to include water use histories in those bills.	The City continues to bill its customers on a monthly schedule and to include water use histories in those bills.
	(e) Water reuse, recycling, and non-potable water opportunities; and	The City will continue to periodically include water conservation-themed bill inserts and messages.	Bill inserts have been used to advertise the Annual Water Quality Report. This report contains conservation messages (See Appendix B).
		The City will continue to use untreated groundwater to irrigate the driving range and the two City parks.	The City continues to use untreated groundwater to irrigate the driving range and two City parks.
	(f) Any other conservation measures identified by the water supplier that would improve water use efficiency.	The City will consider requiring its wholesale customers to develop WMCPs, or in the case of Suburban East Salem Water District, to update its WMCP, before renewing their wholesale agreements to encourage them to conserve water.	The City is currently in negotiations with Suburban East Salem Water District (District) about its wholesale agreement. The requirement to update its WMCP is not included in the negotiations. The City determined that the District is already required to submit the WMCP by the State, and therefore, contract language requiring a WMCP was deemed unnecessary. The City has not required other wholesale providers to submit WMCPs to date.
Due to budget limitations, the City will continue to allocate resources at current levels toward implementing conservation measures, focusing primarily on leak detection, line and meter repair and replacement, and the annual water audit.		The City continued to allocate resources towards implementing conservation measures at a consistent level.	
The City will also continue to provide resources on residential water use education, particularly related to peak season outdoor water use.		The City continues to meet this benchmark. The City continues to stock and distribute water conservation resources, including water conservation kits, leak detection kits, and lawn watering gauges.	



## Additional Conservation Programs

*OAR 690-086-0150(3)*

In addition to the above described conservation measures, the City has continued the following leak detection measures since the 2014 WMCP was approved:

- Increase internal coordination with Wastewater Collections and Stormwater Services:
  - Wastewater Collections utilizes a television inspection crew to inspect sewer mains. When the crew sees infiltration into the pipe that is indicative of a water main leak, the video and location of the infiltration are shared with Water Services for further investigation.
  - Stormwater Services reports areas where stormwater drainage sampling shows a significant presence of fluoride. This information is shared with Water Services for further investigation.
- Transmission line surveys. Surveys of the two transmission lines between Geren Island and Turner Control were conducted to evaluate their condition. Approximately one-dozen repairs were initiated following the surveys and repairs are estimated to have reduced leakage by 0.2 mgd. Options for implementing a comprehensive rehabilitation of the lines are currently undergoing analysis as part of the City's Water System Master Plan updating process.
- Isolation valves installed on the 36-inch (Line 1) and 54-inch (Line 2) transmission lines. Prior to installing these isolation valves, whenever maintenance was needed on these transmission lines, they had to be drained along the entire length from Geren Island to Turner Control. The valves provide the ability to dewater only a portion of the lines, thus reducing the need to evacuate the lines. Line 1 was completed in September 2013; Line 2 was completed in November 2013.
- Structural evaluations of finished water reservoirs. Evaluations are conducted annually to confirm structural integrity and include a 48-hour leak test. Recommended repair projects are added into the City's Capital Improvement Program (CIP).
- Relocation of lower transmission Line 1. The City relocated a portion of Line 1 under I-5, which had been leaking. The cost for this project was \$1.8 million.
- Replacement of leak prone section of Line 2. The City is currently designing and budgeting to replace a portion of line 2 that crosses underneath an irrigation canal operated by the Santiam Water Control District. This section of line 2 has had numerous breaks, most recently in May 2018.

## Use and Reporting Program

### *OAR 690-086-0150(2)*

The City's water measurement and reporting program complies with the measurement and reporting standards in OAR Chapter 690, Division 85.

The City currently measures the amount of water diverted from the North Santiam River using an in-channel flow meter located immediately downstream of the City's water intake. Treated water is measured directly downstream of Geren Island. Additional flow meters measure water within the transmission system, ending at Turner Control.<sup>4</sup> Groundwater use is calculated based upon the pump rating and duration of pumping; ASR well water use is measured by flow meters located at each well.

The City submits monthly water use measurements to OWRD on an annual basis. Reporting is for the previous water year (October 1 to September 30). The City's water use records can be searched for here: [https://apps.wrd.state.or.us/apps/wr/wateruse\\_query/](https://apps.wrd.state.or.us/apps/wr/wateruse_query/)

## Required Conservation Programs

### *OAR 690-086-0150(4)*

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

1. Annual water audit
2. System-wide metering
3. Meter testing and maintenance
4. Unit-based billing
5. Leak detection and repair (if system leakage exceeds 10 percent)
6. Public education

During the next five years, the City plans to initiate, continue, or expand the following conservation measures that are required of all municipalities. These measures, along with associated five-year benchmarks, are described below.

#### **1. Annual Water Audit.**

OWRD defines a water audit as an analysis of the water system that includes a thorough accounting of all water entering and leaving the system to identify leaks in the system, and authorized and unauthorized water uses, metered or estimated. The water audit also includes analysis of the water supplier's own water use.

The City conducts a full water audit annually, which includes all metered and unmetered authorized consumption. As previously described in Section 2, the City defines water loss (i.e., non-revenue water) as the finished water demand (i.e., production; includes surface water and groundwater) leaving Geren Island minus the sum of the following: metered water consumption by customers, the difference between water injected and water recovered from the City's ASR wells (i.e., water produced from

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<sup>4</sup> Meters include: one magnetic flow meter on each of the twin 69-inch water mains, magnetic flow meters on the inlet and outlet pipes measuring water entering and exiting Franzen Reservoir, and three magnetic meters measuring water conveyed through Turner Control. Total flow at Turner Control is calculated by summing the flow from the last three meters.

Geren Island that remains stored in ASR), and unbilled authorized metered consumption (e.g., City facilities and some metered fire hydrant uses). The City's other groundwater rights are used only for emergencies, so are not typically included in the City's water loss calculations. Finished surface water demand leaving Geren Island and ASR injection/recovery data are reported from the HACH software program, which is used to pull data from the City's SCADA database. Consumption data are reported from the Hansen (asset management and utility billing software) database, which includes actual metered/billed water use and estimates of authorized/unbilled water used by other divisions within the City, with the exception of the City's three water fill stations that are metered.

Thus, water loss consists of all unmetered uses (authorized and unauthorized) and system leakage. Authorized unmetered (not billed) uses include such uses as: fire hydrants, firefighting activities, water main flushing, reservoir draining and filling, hydro-truck filling, street sweepers, and water main testing. The City previously estimated water usage for these authorized unmetered uses (previously called Miscellaneous Water Use), but the amount of water was comparatively negligible, so the City no longer estimates these uses. Water loss also includes the use of water from the City's three water fill stations, which also has little impact on the overall water loss value. System leakage, as the name implies, is water lost from the system for any reason, including deteriorating pipe, or compromised pipe joints, service connections, or valves. With detailed record keeping and metering of water, the water loss percentage approaches the net volume lost to actual leakage. The City's water audit calculations are based on the American Water Works Association (AWWA) guidance manual, *Water Audits and Leak Detection*.

The City's water loss was 12.8 percent in 2016 and averaged 10.8 percent from 2012 through 2016. The City estimates that approximately one-fifth of the City's water loss is attributed to leaks in the transmission line between the Geren Island WTP and Turner Control, which is an issue that the City is actively addressing, as detailed under Water Loss Analysis later in Section 3.

*Five-Year Benchmarks:* The City will continue to conduct annual water audits, and evaluate demand and consumption data to observe trends for targeting conservation measures.

## **2. System-wide Metering.**

The City's system is fully metered. Its annual budget includes funding to meter new services.

*Five-Year Benchmarks:* The City will continue to require all new connections be metered.

## **3. Meter Testing and Maintenance.**

The City currently implements a program to test and repair or replace meters. Large meters (greater than three-inches in diameter) are tested annually, and repaired or replaced as needed. There are approximately 362 large meters within the City's system. The City's water system currently includes 48,529 small meters. The City completed a small meter replacement program in 2005, moving entirely to touch-read or radio-read meters. Based on accuracy testing of the oldest small meters in the system, the City is

expecting a 25-year life cycle for small meters. As the end of the life-cycle approaches, the City will begin random meter testing to ensure continued function and accuracy. Small meters will continue to be tested in response to customer or Customer Services request, and will be replaced or repaired if needed. In FY 2015-2016, the City temporarily halted all meter testing due to resource constraints, however in FY 2017-2018, the City re-initiated this program.

*Five-Year Benchmarks:* The City will continue to test and repair or replace large meters annually, and small meters upon customer or City Customer Services request.

**4. Water Rate Structure.**

City of Salem water customers are billed a water service charge and consumption charge on a monthly basis. The water service charge is billed at a fixed rate based on meter size. The consumption charge is based on the volume of use and customer class. This rate structure promotes conservation by enabling customers to control the largest portion of their bill: the amount of water consumed. A description of the City’s monthly service and consumption charges are provided in **Exhibit 3-2**. The City reviews its cost of service and rate structure every two years. The City’s most recent cost of service analysis was adopted by City Council on October 8, 2018; new rates go into effect on January 1, 2019.

**Exhibit 3-2. Monthly Water Service and Consumption Charges, Effective January 1, 2018.**

<b>Service Charge (By Meter Size per Connection)</b>	
5/8-3/4"	\$ 10.15
1"	\$ 12.83
1-1/2"	\$ 21.74
2"	\$ 32.44
3"	\$ 60.95
4"	\$ 93.03
6"	\$ 182.14
8"	\$627.69
10"	\$984.13
<b>Consumption Charge (by Customer Class per 100 Cubic Feet)</b>	
Residential (Single Family)	\$ 2.56
Multiple Dwelling Units - Individual Meters	\$ 2.56
Multiple Dwelling Units - Shared Meter	\$ 2.16
Irrigation	\$ 3.50
Commercial (Including Fire)	\$ 2.26
Industrial	\$ 1.53
Institutional	\$ 2.09
Public	\$ 2.45
Water Fill Station	\$0.75

*Five-Year Benchmarks:* The City will continue to bill customers based, in part, on the metered quantity of water use. It will also continue to review the rate structure biannually to determine the size and timing of future rate increases needed to promote water conservation, fund capital and operating costs, and to achieve other utility objectives.

## 5. Water Loss Analysis

The City's water loss was 12.8 percent in 2016 and averaged 10.8 percent from 2012 through 2016. The City is actively addressing its water loss through its systematic program to detect and repair leaks in its transmission and distribution system.

The City estimates that approximately one-fifth of the City's water loss is attributed to leaks in the transmission line (Line 1) between the Geren Island WTP and Turner Control, and as a result, has made addressing those leaks a top priority. The City is currently updating its Master Plan, and is using the process to determine the most cost-effective approach to repairing leaks in Line 1. To reduce leakage until a long-term solution is implemented, the City repaired leaks in Line 1 joints throughout 2017. The joints are thought to be one of the primary locations of leaks in Line 1.

The City is addressing other potential sources of water loss through implementation of its multi-point leak detection and repair program of its storage and distribution system. Select finished water reservoirs are evaluated annually for structural integrity and leakage. Leak loggers are used to conduct leak surveys of distribution lines<sup>5</sup>. The loggers can also be used to confirm whether leak repairs were performed correctly by immediately testing repaired lines for leakage. The City purchased 20 data loggers in 2013 to survey greater areas and increase accuracy in pinpointing leaks. Loggers record the estimated rate of loss, the pipe material and size, the location, and the dates the leak was found and repaired.

The City surpassed its initial goal of surveying at least 10 percent of the system annually (with the entire system surveyed every 10 years) since starting its more robust leak detection program in 2014. The leak detection and repair program is implemented over 10 zones by map grid (each zone containing 75 to 80 miles of pipeline), and the City has completed surveys of six zones since 2014, a rate of more than one zone per year. The City is considering turning the leak detection survey program into a 5-year program with five zones, each containing approximately 150 miles of pipeline.

Once a leak is detected, field crews repair large-volume leaks immediately. Smaller-volume leaks are placed on a schedule to be repaired as a capital improvement project or by an Operations repair crew. Leaks in waterlines are prioritized for repair based upon number of leaks in the line, the size of the leaks, and severity of the leaks.

In addition to the logger surveys, Water Services coordinates with other City divisions to identify additional problem areas. If video inspections of the sewer system show evidence of infiltration into the sewer due to a water main break, Wastewater Collections will share this information with Water Services for further investigation. If

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<sup>5</sup> Two loggers are temporarily placed on a pipeline approximately 400 feet apart to detect atypical sounds. Sounds are automatically downloaded to record general trouble areas, and staff use correlators to pinpoint the location of the sound for repair.

analyses of stormwater drainage show elevated fluoride concentrations (fluoride is added to the City's drinking water but is not found naturally in regional groundwater or surface water), Stormwater Services will share this information with Water Services for further investigation.

As part of its leak detection and repair program, the City continues to replace pipes annually. Pipeline replacement prioritization is now based on rankings, not the type (i.e., material) of pipe. Factors affecting the ranking include the type, size, age, and condition (based on leak repair records) of the pipe. Pipes are immediately replaced when failure occurs or during coordination efforts with other City activities, such as replacements that occurred with the Street Bond Projects. All pipes are replaced with ductile iron.

In addition, the City identifies potential leaks on the customers' side of the meters during routine customer meter reading. When a meter reading indicates an abnormal increase in water usage from the prior month, City staff notifies the customer of a potential leak and provides technical and financial assistance and/or education measures (see Public Education discussion below).

The City is aware that OAR 690-086-0150(4)(e)(A) and (B) require the City to provide a description and analysis identifying potential factors for loss and selected actions for remedy to OWRD within two years of approval of this WMCP, and if the selected actions do not reduce water loss to less than 10 percent within five years of approval of the WMCP, the City will have to take additional leak detection and repair measures.

*Five-Year Benchmarks:* The City will aim to survey approximately 20 percent of the system annually, resulting in the entire system being surveyed at least every five years. Repairs of all reported and detected leaks will continue to be performed in a timely manner, with large leaks and failed pipes being repaired immediately. The City will continue to look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection. In the next five years, the City will identify an approach to address leakage in Line 1 between Geren Island and Turner Control and will begin to pursue that approach. The City's goal is to attain a leakage rate below 10 percent. Within two years of approval of this WMCP, the City shall provide OWRD with a description and analysis identifying potential factors for the water loss and selected actions for remedy. If the selected actions do not reduce water loss to less than 10 percent within five years of approval of the WMCP, the City will take additional leak detection and repair measures.

## **6. Public Education.**

The City provides water conservation information to its customers through various programs to encourage efficiency, such as low water use landscaping. To reach a range of customer (based on age and income), the City communicates information using the following media: the City's website, telephone hotline, local newspaper, topic-specific brochures, bill inserts, and in-person conversations at festivals (at least two festivals are held annually).

Since 2014, the City performed the following outreach activities aimed at providing conservation information to its customers.

- **Houck Middle School Presentation:** The City discussed City of Salem’s drinking water, the North Santiam River as Salem’s drinking water source, daily and seasonal uses of water, and the water cycle; compared the watershed’s water quality and accessibility to clean drinking water; and provided activity booklets focused on watersheds, droughts, and water conservation.
- **Student Presentations:** Since 2014, the City has provided ten Clean Water Challenge presentations and eight Water Cycle/Conservation presentations, held two water festivals, and supported one student project.
- **Interview with KMUZ:** The City spoke with a local radio station about the City’s drinking water, the slow sand filtration treatment process, comparisons of winter and summer supply and demands, connecting conscientious decisions that help conserve water during daily activities, and benefits to downstream users and wildlife.
- **Interactive Watershed Story Map:** The City built an educational virtual tour of the North Santiam Watershed on the City’s website. Viewers are able to navigate to areas within the watershed to learn about public data collection, water monitoring sites, drought concerns, and restoration and conservation projects. The virtual tour also highlights the water treatment process, distribution and maintenance, and groundwater protection areas for the ASR wells.
- **Geren Island Tours:** The City provided tours to various groups including: elementary, middle, and high schools; OWRD staff; new internal staff; and the NW Youth Corps. Tour topics have included: water treatment processes, seasonal supply and demand, and education on dam operations and how those operations may impact water flow and water quality. The City typically provides approximately 14 tours per year.
- **Green Schools – Water Audits:** In 2016 and 2017, City water conservation staff provided three presentations (two for elementary school students and one for middle school students) of “How To Do a Water Audit” for the Oregon Green School Summit, reaching approximately 70 students each time. At this summit, groups of students from multiple schools around the State learn about how to perform water audits within their schools. This includes how to detect leaks in toilets and faucets, and calculating water wasted per unit and as a total. Students also learn about the water cycle, what a watershed is, the watersheds in Oregon, and how actions impact downstream schools and people. They are taught ways to conserve water in school and at home, as well.
- **STEM Night – 4 Corners (2017 and 2018):** The City taught students about the water treatment process, and challenges involved in treating water for 200,000 residents in the City of Salem. The City asked students to suggest tips on how to store water, reuse, and conserve water during summer seasons when demand is high. The City provided activity booklets focused on watersheds, droughts and water conservation.
- **Free Fishing Day at Detroit Lake, USFS and Public Works Day:** The City staffs tables at these annual events to inform the public about the City of Salem’s drinking water sources, treatment process, water quality and quantity, climactic

impacts on sources, how human actions may impact this source, and other topics. The City provides activity booklets focused on watersheds, droughts, and water conservation.

- **National Night Out – Water Conservation for Salem Neighborhoods:** The City staffs a table at this annual event to provide residents indoor and outdoor conservation kits. Attendees can either sign up to receive a kit and/or take a sign-up sheet to provide for their neighborhood block party where other residents can sign up for kits. Residents can also obtain pamphlets about source water and information on how to get their home sampled for water quality parameters.
- **One Inch Per Week Lawn Watering Program:** The City’s water demands in summer are much greater than in winter, as shown in Section 2, due largely to seasonal increases in residential water consumption. As a result, the City initiated a successful One Inch per Week lawn watering program in 2003 to encourage efficient lawn watering in an effort to reduce summer residential water use. The program is advertised on the City’s website and through the Annual Water Quality Report, which is delivered to all water customers. The City provides lawn watering measuring gauges upon request. Additional outdoor water use information is provided in the Water-Wise Plants guide, which is available on the City’s website.

In April 2018, the City participated in the Wyland National Mayor’s Challenge for Water Conservation. The City issued a press release and used social media to encourage customers to go to a website where they could pledge to conserve water on behalf of the City. The City’s participation promoted water conservation actions and publicly demonstrated the City’s commitment to conserving water.

*Five-Year Benchmarks:* The City will continue to implement a public education program that reaches out to customers using such means as: the City’s new website, telephone hotline, local newspaper, radio, topic-specific brochures, bill inserts, conversations at events (at least two are held annually), and speakers in classrooms or on tours. In the next five years, the City will expand the water conservation content on the website with an emphasis on providing more educational links and more information on water-efficient irrigation practices. In the next five years, the City will also update its water conservation brochures. In the next five years, the City will update the promotional materials and messaging for its One Inch Per Week Lawn Watering Program, which have not been updated since the program began. In addition, the City will develop and help implement a water conservation lesson for elementary school students during the next five years.

## Additional Conservation Measures

### *OAR 690-086-0150(5)*

OAR 690-086-0150(5) requires municipal water suppliers that either: (a) serve a population greater than 1,000 and propose to expand or initiate diversion of water under an extended permit for which resource issues have been identified, or (b) serve a population greater than



7,500, to provide a description of the specific activities, along with a five-year schedule to implement several additional conservation measures.

The City serves a population greater than 7,500. As a result, the City is required to provide activities and five-year benchmarks related to the following additional measures:

1. Technical and financial assistance programs
2. Supplier financed retrofit or replacement of inefficient fixtures
3. Rate structure and billing practices that encourage conservation
4. Water reuse, recycling, and non-potable opportunities
5. Other conservation measures

A summary of the City's five-year benchmarks for these additional conservation measures is provided below.

### **1. Technical and Financial Assistance Programs**

The City currently provides technical assistance to its customers to help them identify and quantify leaks. Water audit kits are available to residential customers, which include step-by-step guides on calculating water use, toilet leak detection dye tablets, a flow meter bag (to calculate gallons per minute of water used), and a drip gauge cylinder. Dye tablets demonstrate whether a toilet has a leak, and flow meter bags calculate gallon per minute of water used. Drip gauge cylinders placed under faucets or pipe connections collect and measure dripping water. Based upon the volume of water drops collected over time, the cylinders indicate how much water would be wasted each year if the leak were not repaired. Indoor water conservation kits include a flow meter bag, as well. These tools and kits are provided upon request and at outreach events.

As described previously, the City also provides lawn watering measuring gauges upon request, which are also distributed at outreach events. These gauges can be used to measure irrigation rates, helping to reduce overwatering.

*Five-Year Benchmarks:* The City will continue to provide water audit kits, lawn gauges, and individual conservation tools upon request. In the next two years, the City will add a home water audit tool to its website to assist customers with understanding their water use.

### **2. Supplier Financed Retrofit or Replacement of Inefficient Fixtures**

Residential indoor and outdoor water conservation kits are provided to City customers upon request. The kits are advertised on the City's website, at outreach events, and in the Annual Water Quality Report and other City publications. Indoor kits may include water-efficiency tools and fixtures, such as low-flow showerheads, low-flow kitchen and bathroom faucet aerators, toilet leak detection dye tablets, and an adjustable toilet flapper. Low-flow showerheads and faucet aerators are also offered upon request to small multi-family property owners. Outdoor conservation kits may include garden hose repair ends, a lawn watering gauge, and a garden hose nozzle seal. In addition, the City has implemented some small-scale cost share projects to replace inefficient showerheads with low-flow showerheads in multifamily complexes. The City provided assistance based on requests from multifamily property managers. The City currently does not have a formal cost share program. However, the City is developing administrative rules to formalize the application, evaluation, and awarding of City

funded grants. To date, the City has typically funded cost share projects up to a maximum of \$50,000.

*Five-Year Benchmarks:* The City will continue to provide residential indoor and outdoor conservation kits upon request. Within the next two years, the City will complete development of administrative rules to formalize the application, evaluation, and awarding of City funded grants. During the next five years, the City will evaluate the feasibility of other cost share programs for replacing inefficient fixtures for commercial/industrial customers or multifamily property owners, if resources are available.

### **3. Rate Structure and Billing Practices that Encourage Conservation**

As previously described, the City's billing consists of a water service charge that is a fixed rate based on meter size and a water consumption charge based on customer class and the volume consumed. The City converted from bi-monthly to monthly billing in 2009, providing customers with timely feedback on their water consumption and related cost savings. Monthly billing allows customers to potentially change their water usage within a relatively short period.

The City implements the following additional billing practices to encourage water conservation:

- Reporting customer water use history on monthly bills to compare usage over the course of the current year and previous years
- Periodically including bill inserts to communicate conservation information
- Periodically including short water-saving messages on the bills

Water use history can raise awareness about potential leaks because they can reveal unexplained increases in water use. Bill inserts and other forms of communication provide the opportunity for consistent reminders to conserve.

*Five-Year Benchmarks:* The City will continue to bill customers based, in part, on the metered quantity of water use. The City will continue to bill its customers on a monthly schedule and to include water use histories in those bills. The City will continue to periodically include water conservation-themed bill inserts and messages.

### **4. Water Reuse, Recycling, and Non-potable Opportunities**

The City uses untreated well water, instead of treated potable water, to irrigate a golf course driving range on City property. Approximately 5.0 to 5.5 MG of treated water are conserved each irrigation season through use of this non-potable water supply. The City also uses groundwater from wells located at two City parks for irrigation purposes.

*Five-Year Benchmarks:* The City will continue to use untreated groundwater to irrigate the driving range and the two City parks. The City will continue to look for water reuse, recycling, and non-potable opportunities.

## 5. Other Conservation Measures

Other conservation measures the City implements are:

- *Conservation staffing.* The City allocates approximately five percent of its department-wide staff resources toward implementing conservation measures.
- *Evapotranspiration modeling.* The City Parks Department uses a computer model to determine evapotranspiration rates and help direct the amount of irrigation water that should be applied to its grounds.

*Five-Year Benchmarks:* The City will continue to support allocating staff resources towards implementing conservation measures and to use evapotranspiration modeling. In the next five years, the City will explore development of a water-efficient demonstration garden, possibly in collaboration with the Parks Department.

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# 4. Water Curtailment

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*This section satisfies the requirements of OAR 690-086-0160.*

*This rule requires a description of past supply deficiencies and current capacity limitation. It also requires inclusion of stages of alert and the associated triggers and curtailment actions for each stage.*

## Introduction

Water curtailment plans outline proactive measures that water suppliers may take to reduce demand and to find alternative supplies during short-term water supply shortages. The intent of water curtailment planning is to minimize the impacts of water supply shortages, which may result from incidents such as: prolonged drought, mechanical or electrical equipment failure in the system, unanticipated catastrophic events (flooding, landslides, earthquakes and contamination), or events not under control of the water supplier (e.g., localized or area-wide power outages, harmful algal blooms, high turbidity, and intentional malevolent acts).

## History of System Curtailment Episodes

### *OAR-690-086-0160(1)*

Over the last ten years, the City has experienced one curtailment episode that stemmed from a series of events. The curtailment event occurred in July 2009 and was caused by the following conditions and events: typical high summer water demands; reduced storage capacity as a result of required reservoir repairs; reduced production at Geren Island as a result of an algae bloom in Detroit Reservoir on the North Santiam River; and reduced supply (i.e., flow) as a result of gate failures at Big Cliff Dam (also on the North Santiam River). A Level 2 curtailment was issued on July 28, 2009 and lasted through August 2, 2009. The following measures were implemented:

1. Customers were requested to suspend outdoor water uses, including car washing, sidewalk and patio cleaning, and residential lawn and turf watering. Garden watering was permitted.
2. The City suspended irrigation at City parks. Watering of sensitive areas and areas actively being used for tournaments was permitted.
3. The City suspended water supply to decorative fountains. Splash pads were kept in operation for recreation, to encourage citizens to use these facilities rather than residential irrigation systems.

Backup water supplies exist in the form of interties with other water providers, groundwater and the City's ASR system. Interties with the Cities of Stayton and Keizer can provide up to 10 cfs (6.5 mgd) to the City of Salem; however, agreements with the cities do not guarantee water during an emergency event. ASR wells can provide up to 12.7 cfs (8.2 mgd) of treated drinking water, and local wells can provide up to an additional 1.55 cfs (1 mgd). The Jan Ree well field has a maximum capacity of approximately 12 cfs (7.8 mgd), but would require three to four

weeks to activate the wells. Utilizing all of these available backup resources, the City could produce up to 36.25 cfs (23.5 mgd) (including the Jan Ree wells). This is compared to an average day demand of finished water over the five-year period from FY 2012-2013 through 2016-2017 of 42.9 cfs (27.7 mgd).

Future curtailment episodes could occur as a result of significant drought affecting North Santiam River flow, failure of aging infrastructure, flooding and high turbidity events affecting filtration at Geren Island, system wide earthquake damage, or other catastrophic events that may affect water supply.

## Curtailment Event Triggers and Stages

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

The City developed a multi-level curtailment plan to describe the standards and procedures that will be employed in the event of a water shortage. The curtailment plan is designed to ensure that essential water delivery can be maintained in the event of limited water supply.

The levels are designed to be initiated and implemented in progressive steps. The plan includes both voluntary and mandatory rationing depending on the cause, severity, and anticipated duration of the shortage.

**Exhibit 4-1** presents the four curtailment levels and their initiating conditions (i.e., triggers). The City’s initiating conditions focus on a minimum available storage (85 MG), and a descending supply to demand ratio. If minimum available storage falls below 85 MG, the following curtailment stages are triggered based upon the supply to demand ratio.

Exhibit 4-1. Curtailment Levels 1 through 4.

Curtailment Stages	Initiating Conditions: If minimum available storage is below 85 million gallons and there is a:
<b>Level 1: Alert</b>	<ul style="list-style-type: none"> <li>• Rolling five day average when supply is 90% to 95% of demand</li> </ul>
<b>Level 2: Voluntary Curtailment</b>	<ul style="list-style-type: none"> <li>• Rolling five day average when supply is 80% to 89% of demand</li> </ul>
<b>Level 3: Mandatory Curtailment</b>	<ul style="list-style-type: none"> <li>• Rolling five day average when supply is 70% to 79% of demand</li> </ul>
<b>Level 4: Severe Curtailment</b>	<ul style="list-style-type: none"> <li>• Rolling five day average when supply is below 70% of demand</li> </ul>

Curtailment may also be triggered by a catastrophic event such as toxic contamination of the City's surface water supply, or a natural disaster or similar event that prevents Geren Island or the transmission system from operating for an extended period of time. If such an event occurs, the City will implement its Emergency Operations Plan (2004). For example, the City implemented the Emergency Operations Plan in response to a fuel spill in the North Santiam River in December 2017; however, the spill did not trigger a stage of curtailment. The Emergency Operations Plan also covers other significant water supply issues, such as treatment plant flooding and pipeline breaks.

## Authority and Enforcement

The City's water curtailment plan is now in the city code under Administrative Rule Chapter 109, Division 800-3.

When the City approaches curtailment-initiating conditions, the Curtailment Action Team (CAT) convenes to assess the significance of the conditions and the need for curtailment. The CAT makes recommendations regarding curtailment implementation, including the curtailment level, amount of time for curtailment, and curtailment measures. These recommendations are provided to the Director of Public Works (Director), who is authorized to implement the curtailment plan. Measures within the plan may be applied to the entire system, or only to specific water-use sectors or geographic areas that are affected by any water supply shortage. All plan provisions remain in effect until the Director terminates the curtailment measure(s). The Director has the authority to enforce the plan and may suspend water service to any customer that fails to abide by its provisions. The Director will consult with the City Manager before implementing certain actions, as noted in the following section.

## Curtailment Plan Implementation

### *OAR-690-086-0160(4)*

Under the authority of the Director, the City notifies affected parties that curtailment measures are to be implemented. Generally both retail and wholesale customers are notified, as well as City staff charged with managing water use. Under the City's IGAs with the City of Turner and Orchard Height Water District, the City can limit supply to these wholesale customers when it is limiting water supply to its retail customers, thereby requiring curtailment by all of these customers. Curtailment measures include three components: public education, actions by the City, and actions by customers.

### Level 1: Alert

When a Level 1 Alert is activated, as defined by the conditions in Exhibit 4-1, retail and wholesale customers are notified of a potential water supply shortage. If conditions persist, customers may be asked to voluntarily reduce their water use. Notifications are made using various media methods as indicated below. Potential curtailment measures include:

- Public education
  - Utilize the City website and water quality hotlines to disseminate information about potential water shortage issues.
- City actions
  - Activate the CAT.
  - Develop messages for water conservation and media outreach materials including press releases and website information.
  - Provide conservation brochures at key City offices.
  - Begin preparations for possible operational changes to supplement water supply. Encourage customers to use water wisely. Provide messages through television, local news, the conservation and water quality hotlines, website, radio, social media, and town meetings, as needed.

## Level 2: Voluntary Curtailment

Activation of Level 2 Voluntary Curtailment escalates notification messages from a potential shortage to an actual shortage, although the messages continue to focus on voluntary measures for customers. City water customers are notified of voluntary curtailment measures using various media methods as indicated below. Wholesale customers, top water users, critical water customers (e.g., hospitals, medical clinics, dialysis centers, etc. that rely on uninterrupted supply of water in order to maintain operations), City Council members, and the Oregon Water/Wastewater Agency Response Network (OrWARN) are also notified. Potential curtailment measures include:

- Public education
  - Update the City of Salem website, and water conservation and water quality hotlines to notify customers of voluntary curtailment and to disseminate water conservation information.
  - Coordinate with various media sources to provide current information on the water supply shortage; deliver media releases to appropriate media sources.
  - Remind water customers of City of Salem's water waste ordinance, as detailed in Salem Revised Code (SRC) 72.240.
- City actions
  - Reduce watering at City facilities and/or parks as determined by the City Manager.
  - Discontinue operating City decorative fountains that do not recirculate water.
  - Reduce operating hours of the City's splash fountains.
  - Limit City hydrant and water line flushing to essential needs for safety and human health.
  - Prohibit City-staff from washing sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
  - Discontinue washing City vehicles.
  - Restrict using City-supplied water for street sweeping.
  - Activate available backup water supplies.
- Customer actions
  - Request that City water customers voluntarily reduce outdoor water uses such as lawn watering, car washing, patio cleaning, etc.

## Level 3: Mandatory Curtailment

Implementation of a Level 3 Mandatory Curtailment indicates a critical water supply shortage. The Director has the authority to activate mandatory restrictions. City water customers are notified of mandatory curtailment requirements using all major media sources and are updated regularly. Wholesale customers, top water users, City Council members, and OrWARN are also notified, and the City's Emergency Operations Center is prepared for activation. Potential curtailment measures include:



- Public education
  - Provide updates on the status of the water situation to the media daily until the Level 3 alert is canceled.
  - Update the City website, including the water quality and water conservation hotlines, with current water situation updates.
  - Remind water customers of the City of Salem's regulation that prohibits water waste.
- City actions
  - Further reduce/restrict watering City facilities and/or parks as determined by the City Manager.
  - Discontinue operating all City decorative and splash fountains.
  - Restrict City hydrant and water line flushing to emergency use only.
  - Restrict City Fire Department training exercises to those that do not use water.
- Customer actions
  - Enact mandatory restrictions on all lawn watering and other non-essential water uses.
  - Prohibit use of City-supplied water to wash sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
  - Prohibit use of City-supplied water to wash vehicles and boats.
  - Prohibit use of City-supplied water for cleaning, filling, or maintaining levels in decorative fountains.
  - Prohibit use of City-supplied water to fill swimming pools or other pools.
  - Prohibit use of City-supplied water on all golf courses, except as needed to keep greens and tee boxes alive.

#### Level 4: Severe Curtailment

Implementation of a Level 4 Severe Curtailment also indicates a critical water supply shortage and activates mandatory restrictions to limit water use to only essential uses. City water customers are notified using all major media sources. Wholesale customers, top water users, critical water customers, and City Council members are also notified. Wholesale customers are asked to comply with curtailment measures. The Emergency Operations Center is activated if determined necessary by the City Manager. Potential curtailment measures include:

- Public education
  - Provide updates on the status of the water situation to the media daily until the Level 4 alert is canceled.
  - Update the City website, and water quality and water conservation hotlines with current water situation updates.
  - Notify customers regarding Salem's waste water ordinance. Prohibit all non-essential water use according to SRC 72.250. Violators may be cited and water service may be interrupted for repeat violations per SRC 72.260.
- City actions
  - Restrict all uses of City-supplied water to essential uses only, such as consumption, maintaining human health, and fire-fighting. Prohibit all non-essential uses and enforce under the City's ordinances.

- Customer actions
  - Restrict all uses of City-supplied water to essential uses only, such as consumption, maintaining human health, and fire-fighting. Prohibit all non-essential uses and enforce under the City's ordinances.
  - Restrict water usage by large industrial and institutional customers, except for fire protection and other critical functions as determined by the City Manager.

## Drought Declaration

The City recognizes the importance of having a plan in place in the event of a drought. As previously described in Section 2, the City is a member of the NSW Drought Contingency Plan Task Force, which developed a DCP (accepted in April 2018 by the Bureau of Reclamation). The DCP provides a drought monitoring framework to identify different stages of drought, vulnerabilities of assets and other conditions from drought. The DCP also describes mitigation actions to reduce risks and impacts before a drought, response actions during a drought, and a collaborative process for promoting a quick and efficient response to drought. The DCP identifies low streamflows at the City's intake on the North Santiam River as a vulnerability (meaning the ability of the intake to divert water under low flow conditions is limited), and therefore, identifies 7-day rolling average flows in the North Santiam (in cfs at the Mehama gage) as one indicator of NSW Drought Stages<sup>6</sup>. NSW member recommended responses to the NSW Drought Stages fall into the following categories: conservation messaging, public education, and outreach; monitoring and evaluation; water rights management; water conservation; and emergency responses. Given that NSW members are distinctly different, the specific responses within those categories are anticipated to differ.

If the Governor declares a drought in Marion County, the City will:

- Communicate with customers about the drought declaration and the status of the City's water supply via the City website, as well as encourage water conservation;
- Communicate with the NSW Drought Contingency Plan Task Force and take appropriate actions as outlined in the DCP; and
- Implement the appropriate stage of water curtailment if the drought declaration coincides with a curtailment trigger as described in Exhibit 4-1.

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<sup>6</sup> Stage 1-Potential for Drought:  $\leq 1,000$  cfs; Stage 2-Moderate Drought:  $\leq 900$  cfs; Stage 3- Severe Drought:  $\leq 800$  cfs; Stage 4- Extreme Drought:  $\leq 700$  cfs.

# 5. Water Supply

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*This section satisfies the requirements of OAR 690-086-0170.*

*This rule requires descriptions of the City's current and future water delivery areas 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.*

## Delineation of Service Areas

**OAR 690-086-0170(1)**

**Exhibit 2-1** shows the City's future water service area, which includes areas within the current Salem/Keizer Urban Growth Boundary (UGB).

## Population Projections

**OAR 690-086-0170(1)**

The City's projected service area population is 246,196 in 2028 and 277,957 in 2038, as shown in **Exhibit 5-1**. The City estimated the population projections for 2028 using 2017 population data as a baseline and 2030 population projections from the Mid-Willamette Valley Council of Governments 2015-2035 Salem-Keizer Area Transportation Study (SKATS). The 2030 population projections of 253,025 for the Salem Area consists of a 2030 population of 204,320 under a medium growth scenario for the City of Salem plus 48,705 under a medium growth scenario for the area inside the UGB but outside the city limits of the cities of Salem and Keizer. The 2030 population projection for the Turner UGB is 3,664. The City used the 2017 population and 2030 population projections to calculate growth rates from 2017 through 2030 (2.072 percent for the Salem Area and 4.747 percent for the Turner UGB), which the City then used to derive the projected population in 2028. The City developed the population projections for 2038 by using the 2030 projected population as a baseline and then applying the anticipated population growth rate for areas of Marion and Polk County outside of UGBs after 2030 of 1.0 percent, which is slightly less than the SKATS study projected average annual growth rate from 2010 through 2030 for Marion County of 1.2 percent.

**Exhibit 5-1. Projected Population.**

Year	Projected Population		
	Salem Area	Turner UGB	Total
2017	193,811	2005	195,816
2028	242,857	3339	246,196
2038	273,990	3968	277,957

## Demand Forecast

*OAR 690-086-0170(3)*

The City took the following steps to develop its water demand projections.

1. For each customer category, the City used a five-year rolling average of ADC for FY 2012-2013 through FY 2016-2017 to calculate the category's percentage of total baseline ADC.
2. The City applied the percentages to the 2018 MDD of 48.14 mgd to develop 2018 baseline demand projections for each customer category.
3. The City applied the City of Salem plus UGB population growth rate from 2017-2030 of 2.072 percent to the 2018 baseline demand projections of the irrigation, multifamily, single-family residential, public, and wholesale customer categories, except the City applied the City of Turner plus UGB population growth rate from 2017-2030 of 4.747 percent to the City of Turner (wholesale customer) 2018 baseline demand projections. The growth rate applied after 2030 for both cases was 1.0 percent.
4. The City applied the Mid-Willamette Valley Council of Governments SKATS annual compounding employment growth rate of 1.1828 percent through 2035 and then applied a growth rate of 1.0 percent thereafter to the 2018 baseline demand projections of the commercial, industrial, and institutional customer categories.
5. The City summed the annual demand projections of each customer category to calculate the projected MDDs.
6. To account for uncertainty in the data and application of the trends, the City calculated range factors of +/-15 percent of projected MDD values to plan for a potential range in future water demands. The City chose this range to capture annual variability in MDD, and based it on observed variability to date, such as when MDD was more than 15 percent greater than the mean in FY 2009-2010 (Appendix C, 2014 Salem WMCP).

The resulting 10-year and 20-year demand projections are presented in **Exhibit 5-2**. These projections are less than those projected in the 2014 WMCP as a result of the following: (1) the 5-year ADC from FY 2012-2013 through FY 2016-2017 was less than the preceding five years, and (2) the 2014 WMCP used a 2010 baseline for projections versus a 2018 baseline in this WMCP.

**Exhibit 5-3. Projected MDD.**

Year	Unit	MDD	+15% of MDD	-15% of MDD
2028	mgd	58.1	66.8	49.4
	cfs	89.8	103.3	76.4
2038	mgd	64.6	74.3	54.9
	cfs	99.9	114.9	84.9

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

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

The North Santiam River is the City's primary water source. As described in Section 2, the City holds five certificated municipal water rights for use of up to 239 cfs (155 mgd) from the North Santiam River, which is diverted at Geren Island. The City also holds five water rights (four groundwater registrations and Certificate 91526) authorizing the appropriation of up to 52.23 cfs (34 mgd) of groundwater at Geren Island, and the City has access to these water rights as needed to provide supply redundancy during algal fouling or high turbidity events. The Geren Island treatment plant cannot effectively treat North Santiam River water during high turbidity events (which primarily occur during winter and spring) or during algal fouling events (which primarily occur during summer), so the City and must use groundwater at Geren Island to meet its demands during these events. However, the capacity of the transmission line leaving Geren Island is currently limited to 102 cfs (66 mgd).

In addition, the City holds Permit S-55045 and SW-626 for use of up to 154 cfs (100 mgd) from the Willamette River. The City does not currently have the infrastructure in place to utilize the Willamette River source, but the City intends to use its Willamette River supply to provide redundancy and resiliency for its North Santiam River supply, as well as to meet future demands, which is discussed further below.

As described in Section 2, the City's other groundwater rights are currently not in use or are used only for emergency purposes due to water quality concerns. These other groundwater rights would not typically be used during a high turbidity or algal fouling event. Further, the City's ASR system presently has pumping rates that range from 7 cfs to 12 cfs (4.5 - 7.8 mgd) during the recovery period.

The City projects that its MDD in 2038 will range between 84.9 cfs and 114.9 cfs (54.9 - 74.3 mgd), which is the projected MDD minus and plus the 15 percent variable, respectively. As previously described, the City's demand projections encompass a range based on the annual variability in MDD that the City has experienced to date. The City's demand projection is for finished water leaving Geren Island and entering the transmission system. Additional demand at the source (North Santiam River) is required, based on the need for process water at Geren Island.

The City's current total available water supply of approximately 109 to 114 cfs (70.1 - 73.7 mgd), which consists of North Santiam surface water rights limited to 102 cfs by the current transmission capacity from Geren Island plus approximately 7 to 12 cfs from its ASR system, is sufficient to meet the projected MDD in 2038 and nearly sufficient to meet the projected MDD with the 15 percent variance in 2038. The City will also seek to expand the capacity of its transmission lines from Geren Island when MDD approaches the limitations on its system capacity. If the City were unable to increase the capacity of the transmission lines leaving Geren Island in the future, it would rely on Permit S-55045 to meet more of its MDD in the near-term.

The City's need for redundancy and resiliency, as well as additional supply to meet future demands, can be met by developing Permit S-55045 for the use of up to 144 cfs (93 mgd) from the Willamette River (City of Salem's share of the permit). The City's North Santiam River water supply is vulnerable to water quality issues in the summer months and the extensive

transmission system from Geren Island is vulnerable to serious damage by a large-scale earthquake, which would leave the City without sufficient water supply. Having the Willamette River as a redundant source will greatly increase the reliability of the City's water supply. The City recently began investigating the potential for developing a water system (collector wells, a water treatment plant, and associated infrastructure) with a capacity of supplying up to 20 mgd from the Willamette River. Over the long-term, the City intends to fully develop Permit S-55045 to provide a redundant water supply for the City's North Santiam River water system, as well as to meet additional demand. (This development will likely occur in phases, with the initial increment of development likely being in an amount necessary to meet average day demands.) In addition, Permit S-55045 will provide redundancy for the City's ASR system, which the City uses to meet peak demands or during water supply emergencies. (A small portion of Permit S-55045 will also be required for operating the Willamette River water treatment plant.)

The City projects that its MDD (with a 15 percent variance) will be approximately 144 cfs (93 mgd) by 2068. If the City's North Santiam River supply and its ASR system were not available for use, the City would need to meet this demand by using the entire 144 cfs (93 mgd) under Permit S-55045. As a result, the City projects that all of Permit S-55045 will be needed by as early as 2068. (The City does not plan to rely on developing SW-626 initially because the reliability of this surface water registration is not known until the Willamette Basin is adjudicated.) If the City were unable to increase the capacity of the transmission lines leaving Geren Island, it would rely on Permit S-55045 sooner to help meet projected MDD.

In summary, the City considers its current water supply to be sufficient to meet its projected MDD in 2038, and as a result, the City is not seeking access to water under its Willamette River water use Permit S-55045 in this WMCP. The City anticipates that full beneficial use of Permit S-55045 will occur by 2068.

## **Alternative Sources**

### ***OAR 690-086-0170(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 does not intend to expand or initiate diversion of water allocated under an existing permit during this WMCP 20-year planning period. Consequently, this rule does not apply.

## **Quantification of Projected 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 currently does not intend to expand or initiate diversion of water allocated under an existing permit during this WMCP 20-year planning period. Consequently, this rule does not apply. In the event that the City's development of Permit S-55045 is accelerated, it will submit an updated WMCP and seek access to the permit.

## **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, Clean Water Act, and other applicable state or federal environmental regulations. The City does not intend to expand or initiate diversion of water allocated under an existing permit during this WMCP 20-year planning period.

Consequently, this rule does not apply. However, the City is aware that Permit S-55045 is conditioned to maintain the persistence of listed fish.

## **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. As described above, the City's existing water rights are sufficient to meet projected demands during the next 20 years. Consequently, the City currently does not plan to acquire additional water rights within that timeframe.

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# **APPENDIX A**

## **Local Government Letters and Responses**





December 7, 2018

Norman Wright, Director  
City of Salem Community Development Department  
555 Liberty St SE, Room 305  
Salem, OR 97301  
[nwright@cityofsalem.net](mailto:nwright@cityofsalem.net)

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

Dear Mr. Wright:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Shane Witham  
City of Keizer  
Planning Division  
PO Box 21000  
Keizer, OR 97307  
[withams@keizer.org](mailto:withams@keizer.org)

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

Dear Mr. Witham:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Dan Fleishman, Planning and Development Director  
City of Stayton  
362 N. 3<sup>rd</sup> Avenue  
Stayton, OR 97383  
[dfleishman@ci.stayton.or.us](mailto:dfleishman@ci.stayton.or.us)

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

Dear Mr. Fleishman:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

David Sawyer, City Administrator  
City of Turner  
P.O. Box 456  
Turner, OR 97392  
[manager@cityofturner.org](mailto:manager@cityofturner.org)

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

Dear Mr. Sawyer:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure





December 7, 2018

Joe Fennimore  
Marion County Planning Director  
5155 Silverton Road NE  
Salem OR 97305  
[planning@co.marion.or.us](mailto:planning@co.marion.or.us)

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

Dear Mr. Fennimore:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Austin McGuigan, Planning Director  
Polk County  
850 Main Street  
Dallas, OR 97338  
[m McGuigan.austin@co.polk.or.us](mailto:m McGuigan.austin@co.polk.or.us)

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

Dear Mr. McGuigan:

The City of Salem (City) 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.

Under these rules, the water supplier must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. We have provided you with an electronic version by email of the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the WMCP appears consistent with your Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comments to me at [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com). Thank you for your interest.

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Bruce Carnine, Manager  
Suburban East Salem Water District  
3805 LaBranch St SE  
Salem, OR 97317  
[bcarnine@qwestoffice.net](mailto:bcarnine@qwestoffice.net)

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

Dear Mr. Carnine:

The City of Salem (City) 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. Under these rules, the water supplier is required to 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. As a courtesy, the City is providing you with an electronic version by email of the City's Draft WMCP. If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

Sincerely,

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Board of Directors  
Orchard Heights Water Association  
P.O. Box 5196  
Salem, OR 97304

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

Dear Members of the Board of Directors:

The City of Salem (City) 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. Under these rules, the water supplier is required to make its Draft WMCP available for review by affected local governments. As a courtesy, the City is providing you with an electronic version of the City's Draft WMCP on a USB flash drive. If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure



December 7, 2018

Niki Iverson, Water Resources Manager  
City of Hillsboro  
150 E Main St  
Hillsboro, OR 97123-4028  
[Niki.Iverson@hillsboro-oregon.gov](mailto:Niki.Iverson@hillsboro-oregon.gov)

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

Dear Ms. Iverson:

The City of Salem (City) 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. Under these rules, the water supplier is required to make its Draft WMCP available for review by affected local governments. As a courtesy, the City is providing you with an electronic version by email of the City's Draft WMCP. If you have any questions, please feel free to contact me at 541-257-9006 or [sdeszoeke@gsiws.com](mailto:sdeszoeke@gsiws.com).

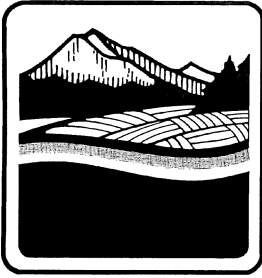
Sincerely,  
GSI Water Solutions, Inc.

A handwritten signature in cursive script that reads "Suzanne de Szoeki".

Suzanne de Szoeki  
Water Resources Consultant

Enclosure





# ***Marion County*** **OREGON**

## **PUBLIC WORKS**

(503) 588-5036

December 11, 2018

### **BOARD OF COMMISSIONERS**

Janet Carlson  
Kevin Cameron  
Sam Brentano

Suzanne de Szoeki  
Water Resources Consultant  
Via electronic mail to: [SDeSzoeki@gsiws.com](mailto:SDeSzoeki@gsiws.com)

### **DIRECTOR**

Brian Nicholas

Dear Ms. De Szoeki:

### **ADMINISTRATION**

### **BUILDING INSPECTION**

### **EMERGENCY MANAGEMENT**

### **ENGINEERING**

### **ENVIRONMENTAL SERVICES**

### **OPERATIONS**

### **PARKS**

### **PLANNING**

### **SURVEY**

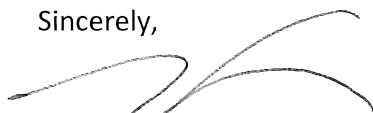
Thank you for providing a draft copy of the Water Management and Conservation Plan for the City of Salem. As you point out, Oregon Administrative Rule Chapter 690, Division 86 requires that affected local governments be provided an opportunity to review the plan for consistency with their local comprehensive land use plan prior to the city submitting a draft plan to the Oregon Water Resources Department for review.

The Marion County Comprehensive Plan (MCCP) Urbanization Element, Environmental Goals encourage planning that does not exceed the capacity of water, energy, air and other resources. In addition, the MCCP Environmental Quality and Natural Resources Element, Goal C strives for the provision of an adequate quantity of water for beneficial uses within the county, including water for domestic, municipal, industrial, commercial and recreation uses. Goal D emphasizes the significance of educating property owners about the importance of the use of their property for water quality and quantity and encourages water conservation practices to hold water demand to a minimum through a public information program.

The Water Management and Conservation Plan for the City of Salem is consistent with the Marion County Comprehensive Plan, as both plans recognize water to be a significant resource, encourage the provision of adequate water for residents' use, and support conservation practices when necessary.

Please do not hesitate to contact me if you have any questions.

Sincerely,



Brandon Reich  
Senior Planner

**From:** [David Sawyer](#)  
**To:** [Suzanne de Szoeki](#)  
**Subject:** RE: Salem Draft Water Management and Conservation Plan  
**Date:** Wednesday, December 12, 2018 9:29:51 AM

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I have reviewed the document and Turner has no comment.

David Sawyer, City Administrator  
P O Box 456  
5255 Chicago Street  
Turner, OR 97392  
503-743-2155  
[manager@cityofturner.org](mailto:manager@cityofturner.org)

---

**From:** Suzanne de Szoeki <[SDeSzoeki@gsiws.com](mailto:SDeSzoeki@gsiws.com)>  
**Sent:** Friday, December 7, 2018 12:01 PM  
**To:** [manager@cityofturner.org](mailto:manager@cityofturner.org)  
**Subject:** Salem Draft Water Management and Conservation Plan

Dear Mr. Sawyer:

The City of Salem is providing you a copy of the City's draft Water Management and Conservation Plan. Please see the attached letter for more information and the draft WMCP for review.

Thank you,  
Suzanne

**Suzanne de Szoeki**  
**Water Resources Consultant | GSI Water Solutions, Inc.**  
direct: 541-257-9006 | cell: 541-224-4588  
1600 SW Western Boulevard, Suite 240 | Corvallis, OR 97333  
[www.gsiws.com](http://www.gsiws.com) | [sdeszoeki@gsiws.com](mailto:sdeszoeki@gsiws.com)  
*Work Schedule: Monday-Thursday until 2 pm, Friday until 1 pm*



# **APPENDIX B**

2017 Annual Water Quality Report Excerpt



# Water Conservation

*fact:*

**A leaky toilet could waste up to 200 gallons of water per day**

## Conservation Starts at Home

On average, one person uses over 100 gallons of water per day. Each water customer in the City of Salem can help conserve water by changing daily practices at home or work. Even a posting sign about water conservation tips is helpful. Some small changes include:

- Turn off the tap while brushing your teeth or washing your hands.
- Use a shower bucket. Instead of letting water run down the drain, collect it using a bucket and then water plants, or fill watering bucket for pets.
- Wash your cars on the lawn.
- Fix leaky toilets and faucets. Surprisingly, one drip per a second can add up to a lot in a day, and a year. This could be fixed and money can be saved.
- Landscape with plants, shrubs and trees that are suitable for this climate, and don't require excess watering during the summer. Remember, one inch per week.

The City of Salem can provide leaky toilet detection tablets and drip calculators. One can determine a leak by adding food coloring in the toilet tank. If the color shows up in the bowl without flushing, you have a leak. Good resources for native plants would include organizations and agencies like Marion Soil & Conservation District. For more information, go to **[www.marionswcd.net](http://www.marionswcd.net)**. To learn more about the tips listed above or about water conservation, visit the EPA Water Sense website at **[www.epa.gov/WaterSense](http://www.epa.gov/WaterSense)**.

## City Offers Free Conservation Kits to Water Customers

Retrofitting existing fixtures can help reduce the amount of water you use every day and will help save money on your utility bill. The City offers free indoor and outdoor water conservation kits to its customers. To request a free water conservation kit, please call the Water Quality Hotline at 503-588-6323, or email us at **[water@cityofsalem.net](mailto:water@cityofsalem.net)**.

## One Inch Per Week Program

As much as 50 percent of water used outdoors is wasted from inefficient watering methods and systems. During the summer months, a high demand of water supply to customers comes at a period when water resources are already stressed due to hotter temperatures, drier conditions, and increased demand from vegetative growth. With this in mind, it is important to maintain a careful balance of your water needs, but to also keep in mind that the water used for drinking water comes from a river that is shared by other communities, wildlife, fish, and recreational users.

There are many uses for water during the summer months, including washing cars and walkways,

filling pools, and watering gardens, lawns and landscapes. There is an effective way to decrease outdoor water usage, thus saving money, water and energy. By giving your lawn only what it needs, you will potentially improve the durability of grass, reduce the need for chemical amendments like fertilizers, and decrease lawn mowing frequency. This will also improve local stream habitats for fish and wildlife, and improve water quality healthy for all downstream users on the Willamette River. Tips to efficiently improve your landscape include:

- Raise your lawn mower blade height to three inches. Longer grass blades retain more moisture, help keep weeds to a minimum, and encourage roots to grow deeper. Keep the mower blade sharp.
- Water deeply and infrequently. This encourages deep and strong root systems. Generally, landscapes need no more than **one inch per week**.
- Replace your irrigation system's clock timer controller with a weather-based irrigation controller, or a soil moisture sensor.
- Water early in the morning or late in the evening when temperatures are cool and the sun is low.
- Use mulch around vegetated areas. Mulch help retain moisture and keeps weeds out.
- Contact Oregon State University agriculture extension or other university extensions about fertilizer guides and applications. This will determine how much fertilizer is needed and reduce excess fertilizers from being used by unwanted vegetation like algae or weeds, or washing into nearby streams. It will also save costs. Remember, you can always add more.

Request a free One Inch per Week lawn watering gauge, provided by the City of Salem. To find out more information, call the Water Quality Hotline at 503-588-6323, or email [water@cityofsalem.net](mailto:water@cityofsalem.net).

## *By the Numbers*

**43.35**  
million gallons  
peak daily water usage  
August 20, 2016

**22.20**  
million gallons  
average daily winter demand  
Jan.-Apr. and Oct.-Dec. 2016

**32.40**  
million gallons  
average daily summer demand  
June-September 2016

**9.520**  
billion gallons  
total water produced  
by the City of Salem in 2016