Water Management and Conservation Plan

June 2017

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MEDFORD WATER COMMISSION

FINAL REPORT

Water Management and Conservation Plan

Prepared for

Medford Water Commission

June 2017

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Acronyms and Abbreviations

ac-ft	Acre-feet
ADD	average day demand
AMI	advanced metering infrastructure (refers to a type of flow meter with automated data collection capabilities)
AMR	Automatic meter read
AWE	Alliance for Water Efficiency
BCWEP	Bear Creek Watershed Education Partners
BBS	Big Butte Springs
cfs	cubic feet per second
CII	Commercial/Industrial/Institutional
COBU	Claim of Beneficial Use
DEQ	Oregon Department of Environmental Quality
Duff WTP	Robert A. Duff Water Treatment Plant
ET	evapotranspiration
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
IWA/AWWA	International Water Association/American Water Works Association
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
MMD	maximum month demand
MWC	Medford Water Commission
OAR(s)	Oregon Administrative Rule(s)
ORS	Oregon Revised Statute
OWRD	Oregon Water Resources Department
SFR	single family residential
SONCC	Southern Oregon/Northern California Coast
UGB	Urban Growth Boundary
URA	Urban Reserve Area
USACE	United States Army Corps of Engineers
USGS	U.S. Geological Survey
WMCP	Water Management and Conservation Plan

SECTION 1

Introduction

This introductory section provides an overview of the Medford Water Commission (MWC) purpose and function, a summary of the *Water Management and Conservation Plan* (WMCP; plan) organization and regulatory requirements, a list of local governments affected by the WMCP, and the plan update schedule.

Overview

The Medford Water Commission (MWC) was established through the Medford City Charter to operate the public water system for the City of Medford. The MWC system has been assigned the state and federal Public Water System Identification No. 4100513.

In addition to customers within Medford, MWC serves a limited number of individual customers outside the Medford city limits. MWC also provides water on a retail basis to customers within the unincorporated community of White City. Collectively, these customers are classified as "outside" retail customers. The conservation and curtailment measures in this plan apply to these customers.

Additionally, MWC provides water wholesale on a continuous basis to five nearby cities (cities of Central Point, Eagle Point, Jacksonville, Phoenix, and Talent) and to the City of Ashland as a supplemental supply, as needed. While the MWC encourages these wholesale customers to adopt similar conservation and curtailment strategies, and participated in a collaborative work group with the other cities to produce the *Southern Oregon Conservation Strategies Plan* (Maddaus Water Management, 2013), these cities all have water rights of their own and are responsible for their own conservation activities.

This plan also includes service provided to three water districts (Charlotte Ann, Elk City, and Jacksonville Highway). As preparation of this plan was nearing completion in May 2016, patrons of the Jacksonville Highway Water District voted to dissolve, and effective July 2016 became part of the "outside" customer group. The service population within water districts served by MWC has been declining for decades, because when portions of a district is annexed into Medford, the remainder of the district often dissolves. Customers no longer within districts become "outside" customers upon district dissolution. While the water districts also are considered wholesale customers, each of them contracts with MWC to provide billing and maintenance services. While not obligated, MWC also has provided conservation services to district customers.

This plan uses data through 2015 for population, production, and consumption characteristics. The analyses occurred in conjunction with the preparation of MWC's 2016 *Water Distribution System Facility Plan*, and were coordinated with regional population growth planning from the Portland State University Population Research Center.

Figure 1-1 is a map showing MWC's water sources. MWC's principal year-round source of water is the Big Butte Springs, located about 30 miles northeast of Medford and 5 miles east of the town of Butte Falls. The recharge area for the springs is approximately 56,000 acres, and includes the western slope of Mount McLoughlin. The capacity from the springs varies from approximately 25 to 35 million gallons per day (mgd) depending on rainfall, snow pack, and groundwater conditions, but the transmission pipeline capacity limits withdrawal to a maximum of 26.4 mgd.

MWC uses the Rogue River as a supplemental source of water when demands exceed the Big Butte Springs capacity. The demand varies according to weather conditions, but currently the Rogue source tends to be used during portions of April through October. Water from the Rogue River is treated at the Robert A. Duff Water Treatment Plant (Duff WTP), which is located approximately 3 miles north of

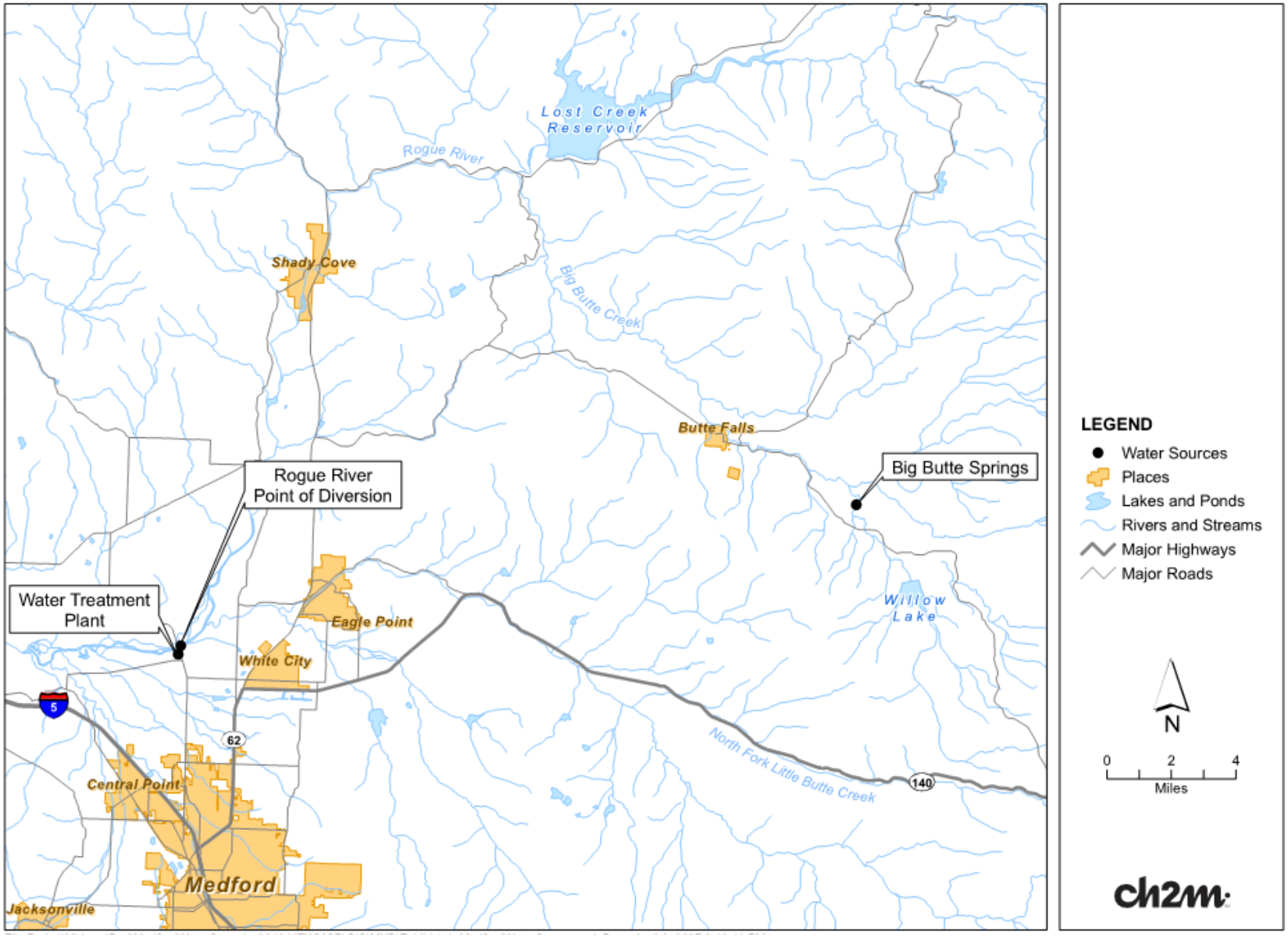


Figure 1-1. Medford Water Commission Water Sources

Medford city limits, near TouVelle State Park. Water from the Rogue River is withdrawn through an intake facility approximately 1,500 feet north of the Duff WTP. The current treatment capacity of the Duff WTP is 45 mgd, with projects now underway to expand its capacity to 65 mgd by 2022.

In addition to Medford's Rogue River water rights, all of the cities served on a wholesale basis have acquired rights to additional water that can be withdrawn at the Duff WTP during the summer months. Some of the water withdrawn for these cities is stored water from the Lost Creek Reservoir, located approximately 20 miles upstream of MWC's Duff WTP. The reservoir contains approximately 465,000 acre-feet of storage. Of this storage capacity, 10,000 acre-feet are allocated for municipal and industrial use, of which approximately 3,900 acre-feet has been acquired by city customers served by MWC.

Plan Organization

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

The plan is organized into the sections shown in **Table 1-1**, each addressing the requirements in specific sections of OAR chapter 690, Division 86.

Table 1-1. Water Management and Conservation Plan Organization

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

Affected Local Governments

The following governmental agencies may be affected by this WMCP:

- City of Medford
- City of Central Point
- City of Eagle Point
- City of Jacksonville
- City of Phoenix
- City of Talent
- City of Ashland
- Charlotte Ann Water District
- Elk City Water District
- Medford Irrigation District
- Rogue River Valley Irrigation District
- Talent Irrigation District
- Jackson County
- Eagle Point Irrigation District (shares BBS water rights)

Thirty days before submitting this WMCP to the Oregon Water Resources Department (OWRD), the draft plan was made 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. A sample of the letters requesting this input, and responses received, are provided in **Appendix A**.

Plan Update Schedule

MWC anticipates submitting an update of this plan within 10 years of plan approval. As required by OAR Chapter 690, Division 86, a progress report will be submitted within 5 years of plan approval.

SECTION 2

Water Supplier Description

This section describes MWC water sources, service area population, historic water use, and water rights.

Source

MWC uses water from two sources: Big Butte Springs and the Rogue River. Big Butte Springs is the commission's principal source of water, and water from the Rogue River is used as a supplemental source when demands exceed the springs' supply. Currently, the Duff WTP on the Rogue River operates during the months of April through October. This source will be required for longer periods to meet increasing demands as population increases within the region.

MWC holds a variety of water rights for Big Butte Springs, which are detailed later in this section. This groundwater source provides exceptionally high-quality water that is consistently cold, clear and requires minimal treatment. The springs' capacity varies from approximately 25 to 35 mgd depending on rainfall, snow pack, and groundwater conditions, but the transmission pipeline capacity limits withdrawal to a maximum of 26.4 mgd. Water from the springs is disinfected with chlorine and flows by gravity to reservoirs in the City of Medford.

MWC holds one water right for 100 cfs (64.6 mgd) from the Rogue River, a surface water source with high-quality water. Water from the Rogue River is treated to meet drinking water standards at the Duff WTP, which has a current treatment capacity of 45 mgd.

Water from these two sources blends within the distribution system. The MWC water system includes approximately 510 miles of pipeline (distribution plus transmission pipelines), 12 pump stations, and 16 distribution reservoirs.

Interconnections with Other Systems

In addition to serving customers within the City of Medford, MWC also directly serves some customers in unincorporated areas ("outside" customers), the largest group of which are within the White City Unincorporated Community (White City) boundary. Most of these outside customers were once within water districts that dissolved. MWC provides water to two remaining water districts: Charlotte Ann Water District and Elk City Water District. As this report was being completed, an election was held for dissolution of the Jacksonville Highway Water District. Effective July 1, 2016, customers of this district became "outside" customers. For the purposes of drinking water quality reporting, the districts fall under the MWC umbrella, rather than being considered separate water systems.

MWC provides treated water to six nearby cities on a wholesale basis. These cities are considered separate water systems, beginning at their points of connection with the MWC system. The cities are Ashland, Central Point, Eagle Point, Jacksonville, Phoenix, and Talent. All but Ashland receive water from MWC year-round. Ashland supplements its water supply with water from the MWC system, as needed. Within this report, including all tables and figures, the term "other cities" refers to these six city customers.

Intergovernmental Agreements

MWC has intergovernmental agreements with each of the water districts and cities it serves. The cities of Phoenix, Talent, and Jacksonville have acquired water rights to water stored in Lost Creek Reservoir, which MWC treats and transports for their use during the summer season. A summary of the contracts between MWC and the cities is contained in **Table 2-1.** As part of their water supply contracts, the other

cities served by MWC are all required to obtain water rights to meet their summertime demands, and will develop their own WMCPs.

Table 2-1. Summary of Contracts Between MWC and Cities

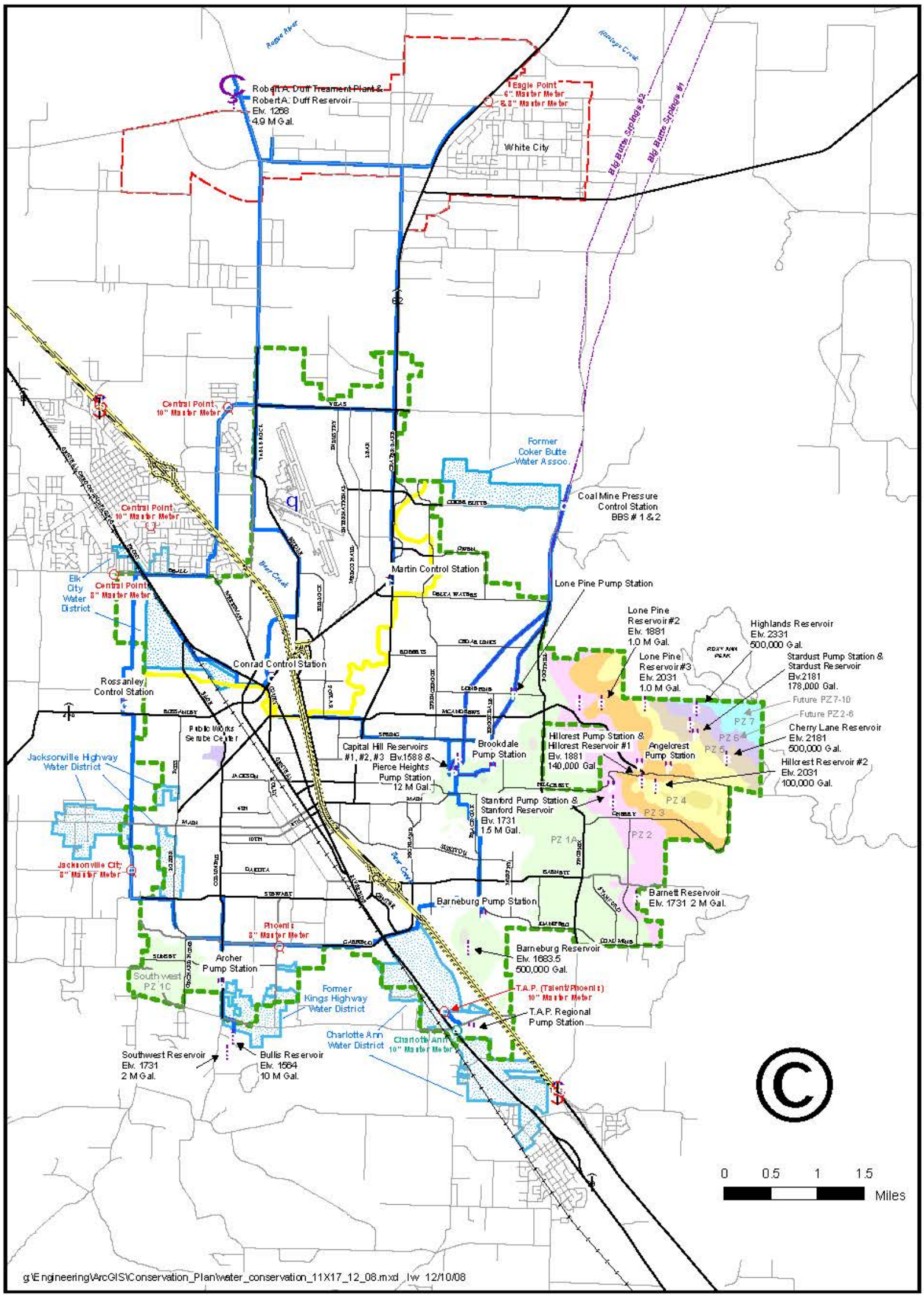
City	Expiration Date	Maximum Rate of Use			
		Winter[a]		Summer[a]	
		gpm	mgd	gpm	mgd
Ashland[b]	October 1, 2021	1,480	2.13	1,480	2.13
Central Point	October 1, 2021	1,833	2.64	4,958	7.14
Eagle Point	October 1, 2021	1,008	1.45	2,727	3.93
Jacksonville	October 1, 2021	476	0.69	1,289	1.86
Phoenix	October 1, 2021	440	0.63	1,190	1.71
Talent	October 1, 2021	495	0.71	1,338	1.93

[a]For all cities, agreements specify the months that high-use delivery rates apply are May through September, and low-use months are October through April.
[b]Supply to Ashland is supplemental.

Service Area Description

MWC's current service area, shown in **Figure 2-1**, includes the City of Medford, lands within the water districts, and White City. The boundaries of the other cities are not included in Figure 2-1. While they will continue to rely on the Commission's water rights during winter months, since each of them have obtained at least some of their own summer water rights, they are subject to submittal of their own WMCPs.

In 2015, the MWC water system served an estimated total population of approximately 136,000 people, with approximately 77,000 people inside the Medford city limits and 59,000 individuals outside the city limits. Within Medford city limits, over 23,000 accounts were residential (including both single and multiple family residences), and 2,500 were classified as commercial, industrial, or municipal accounts. Data through 2015 have been used throughout this plan.



Legend

- Master Meters for Wholesale Cities
- Transmission Lines
- Urban Growth Boundary
- White City Boundary
- Water Districts Current or Dissolved
- PZ1 Higher Elevation Pressure Zone
- Low Level Gravity Boundary
- Main Water Lines = > 20'

Water Commission Facilities

- Control Station / Pump Station
- Pump Station
- Reservoir
- Treatment Plant

MEDFORD WATER COMMISSION

Medford Water Commission
Data produced by City of Medford, Jackson County
December 2008

Figure 2-1. MWC Service Area and Water Facility Map

System Description

Figure 2-2 presents a schematic of the MWC distribution facilities. Water from Big Butte Springs is chlorinated to meet drinking water standards, and flows by gravity to Medford in two, approximately 30-mile-long transmission mains with a combined capacity of 26.4 mgd. The first pipeline was completed in 1927, and the second was completed in 1951. The transmission lines, shown as BBS #1 and BBS #2 in Figure 2-2, pass over 75 summits between the springs and the city. They are operated in one of two modes: in full-pipe mode, both pipelines operate at full capacity, with special back-pressure control valves to maintain flow; in pipe-and-a-half mode (sometimes referred to as "half-pipe mode"), BBS #2 is operated at full capacity while BBS #1 is operated at half capacity. Full pipe mode delivers the total 26.4 mgd capacity, and pipe-and-a-half mode delivers a capacity of 19.8 mgd. Because of the age of the transmission lines, and the hydraulics of their operation, MWC is unable to reduce the flow to below 19.8 mgd. This means that during the winter months when system demand is less than 19.8 mgd, water routinely overflows at Capital Reservoir. Supervisory control and data acquisition (SCADA) data are used to estimate overflow conditions for flow pacing the dechlorination pumps, but the system is not currently configured to automatically capture and totalize overflow volumes. MWC staff used SCADA data to estimate monthly overflows at Capital Reservoir for 2015.

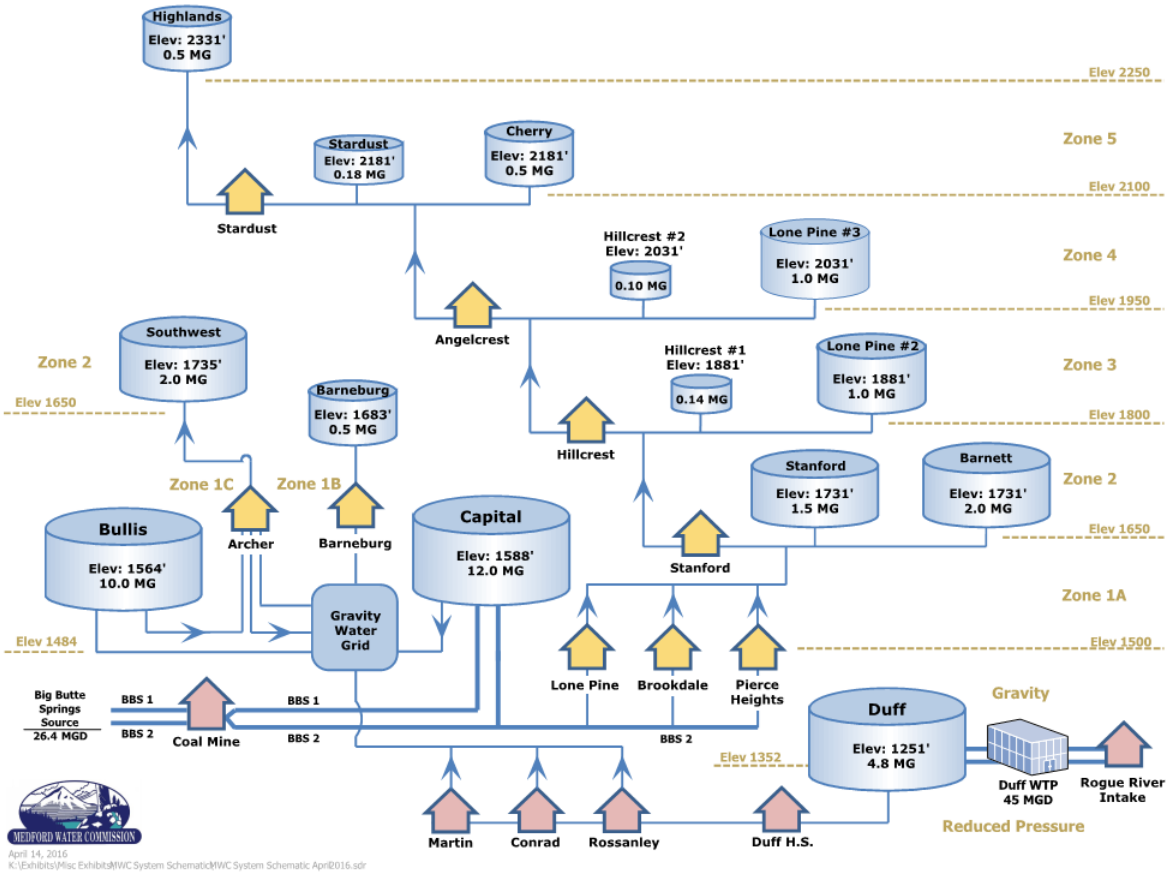


Figure 2-2. MWC's Water Supply System Schematic

Water from the Rogue River, which is a supplemental water source during summer months, is withdrawn through a screened intake structure just north of the Duff WTP. Treatment includes ozonation, coagulation, flocculation, and sedimentation as necessary, followed by filtration and disinfection. Treated water flows into a 42-inch transmission main leading to the distribution system in

Medford, as well as into a 24-inch main that serves White City and a 48-inch main that goes south and then east, feeding other mains to Highway 62.

As illustrated in the schematic, MWC serves widely varying topographies with elevations ranging from 1,250 to 2,250 feet. To provide appropriate pressures and reliable service to all MWC customers, the system uses multiple pressure-control stations, pump stations, reservoirs, and piping that interconnects the system.

MWC has 16 reservoirs in service, including the Duff WTP Clearwell reservoir. Three reservoirs at Capital are the main receiving reservoirs for the system, being fed from the Big Butte Springs transmission lines. The Capital and Bullis reservoirs provide storage for the Gravity Zone. All distribution reservoirs are located on hills, and therefore provide gravity storage for the respective service levels they serve. This report does not include storage facilities located within the six cities served on a wholesale basis. Those add to total storage of water treated by MWC, but are owned and operated by the respective cities.

Table 2-2 lists all MWC reservoirs in service, including their service level, overflow elevation, material type, and volume. Only three reservoirs, Southwest, Barneburg, and Highlands, do not have backup storage capacity within the same service level.

Table 2-2. MWC Reservoir Inventory

Name	Pressure Zone	Overflow Elevation (ft)	Volume (MG)	Material	Year Built
Capital[a]	Gravity Zone	1,588	12.0	Concrete	1-1908 2-1927 3-1945
Bullis	Gravity Zone	1,564	10.0	Concrete	1965
Barnett	Zone 1A	1,731	2.0	Concrete	1983
Stanford	Zone 1A	1,731	1.5	Concrete	1971
Barneburg	Zone 1B	1,684	0.5	Concrete	1959
Southwest	Zone 1C	1,735	2.0	Concrete	2000
Hillcrest No. 1	Zone 2	1,881	0.14	Concrete	1972
Lone Pine No. 2	Zone 2	1,881	1.0	Concrete	2005
Hillcrest No. 2	Zone 3	2,031	0.10	Concrete	1972
Lone Pine No. 3	Zone 3	2,031	1.0	Concrete	2006
Stardust	Zone 4	2,181	0.18	Concrete	1972
Cherry Lane No. 4	Zone 4	2,181	0.5	Concrete	1996
Highlands	Zone 5	2,331	0.5	Concrete	1996
Duff WTP Clearwell	Reduced Pressure	1,251	4.8	Concrete	1968
Total			**36.2**		

[a]The Capital Reservoir System has three tanks.

MWC has nine operating pump stations that supply water to service levels at higher elevations than the Gravity Zone. Additionally, there are three stations that perform dual functions, depending upon time of year. During the summer months, they pump water coming from the Duff WTP into the distribution system. When water is being supplied only from Big Butte Springs in the winter months, these facilities reduce the pressure for water flowing into the low-level zone. There are also pressure reduction stations on the Big Butte Springs lines, one of which (Coal Mine) serves both pipelines at what is considered to be the entry point of the MWC distribution system.

The water transmission and distribution system has approximately 510 miles of pipeline, which is upgraded and expanded annually to serve customers' growing demands. The majority of waterlines are made of either ductile iron (65 percent) or cast iron (28 percent). About 60 percent of the pipe is 6 and 8 inches in diameter.

Tables 2-3 and 2-4 provide inventories of existing pump stations and pipelines in the MWC system.

Table 2-3. MWC Pump Station Inventory

Pump Station or Control Station Name	Pressure Zone	Year Built	Pumps From	Pumps To (Reservoir and Overflow Elevation (ft))	Total Capacity (gpm)
Conrad	See Note	1968	Reduced Pressure	Gravity Zone	9,200
Martin	See Note	1969/2014	Reduced Pressure	Gravity Zone	4,500
Rossanley	See Note	1994	Reduced Pressure	Gravity Zone	12,000
Archer	Gravity Zone	1980/1999	Bullis	Capital (1,588)	8,400
Lone Pine	Zone 1A	2005	Gravity Zone	Stanford and Barnett (1,731)	2,500
Brookdale	Zone 1A	1970	Gravity Zone	Stanford and Barnett (1,731)	3,480
Pierce Heights	Zone 1A	1938	Gravity Zone	Stanford and Barnett (1,731)	2,000
Barneburg	Zone 1B	1959	Gravity Zone	Barneburg (1,684)	1,600
Archer	Zone 1C	1980/1999	Gravity Zone	Southwest (1,735)	1,550
Stanford	Zone 2	1971	Zone 1 Reservoirs	Hillcrest #1 and Lone Pine No. 2 (1,881)	3,640
Hillcrest	Zone 3	1972	Zone 2 Reservoirs	Hillcrest #2 and Lone Pine No. 3 (2,031)	2,490
Angelcrest	Zone 4	1972	Zone 3 Reservoirs	Stardust and Cherry Lane No. 4 (2,181)	1,800
Stardust	Zone 5	1995	Zone 4 Reservoirs	Highlands (2,331)	1,150

Note: This is a pump station/pressure reducing station. When Duff WTP operates, the station pumps to the Gravity Zone. When Duff WTP is offline, flow is in the reverse direction, from the Gravity Zone through pressure-control valves to the Reduced Pressure Zone.
Archer Pump Station is listed twice because it serves two pressure zones.

Table 2-4. MWC Distribution System Pipe Inventory by Material Type[a]

Material	Length (miles)	Portion of All Pipe
Concrete Cylinder	1	0.3%
Cast Iron	134	28.1%
Ductile Iron	311	65.3%
Galvanized Iron	< 1	0.1%
PVC	5	1.1%
Steel	4	0.9%
Welded Steel	20	4.2%
Total	**476**	**100.0%**

[a]Transmission lines from Big Butte Springs to Coal Mine Station are not included in this inventory.

Records of Water Use

This section begins by defining the terminology commonly used in discussions of recorded water use, followed by descriptions of system and monthly demands, peaking factor, per capita demands, demands for the overall system, demand factors inside the City of Medford, and consumption and nonrevenue water.

Terminology

Production refers to the quantity of water delivered to the distribution system. "Production" and "demand" are synonymous. For MWC, production is the total amount of water entering the distribution system from Big Butte Springs and the Duff WTP. Production may be divided into two broad categories: water that provides revenue to the utility, and water that does not provide revenue, also known as nonrevenue water. This breakdown is shown in the International Water Association/American Water Works Association (IWA/AWWA) water audit schematic provided in **Figure 2-3**.

<table>
<tr><td rowspan="8">System Input Volume</td><td rowspan="3">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Nonmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Nonrevenue Water</td></tr>
<tr><td>Unbilled Nonmetered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission or Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections to Customers' Meters</td></tr>
</table>

Figure 2-3. International Water Association/American Water Works Association Water Audit Schematic

Revenue water consists of all billed, metered water consumption, and any billed unmetered consumption, such as water that is sold for construction but is not metered. Some nonrevenue water is to be expected, including authorized, unbilled metered or unmetered consumption such as use for firefighting, and hydrant flushing, unauthorized consumption, water loss because of meter inaccuracies, and real losses such as through leaks, reservoir overflows, and evaporation. MWC estimates and accounts for unbilled authorized water uses including hydrant use, firefighting, water quality sampling, and main flushing. Reservoir drainage for maintenance, and water flushed when the BBS pipelines are transitioned from full to partial flow mode also are recorded. The remainder of the nonrevenue water is also referred to as unaccounted for nonrevenue water.

MWC has a sophisticated SCADA system that monitors and calculates many system parameters including production rates, reservoir storage volumes, and flow into and out of storage reservoirs. A SCADA calculation subtracts the unavoidable overflow at Capital Reservoir from daily demand calculations. The overflow primarily occurs during the winter months when BBS pipeline flows exceed demands since the system does not accommodate ongoing adjustments to match real-time demands. Overflow volume at

Capital or any other reservoir are not currently automatically totalized, and must be estimated manually.

Hourly water demands fluctuate in response to water use patterns by residential, commercial, and industrial customers. These short-term demands are met by a combination of production and withdrawals from the storage reservoirs.

Metered use or consumption refers to the portion of water use that is recorded by customer meters.

Connection refers to a metered connection of a customer to MWC's system.

Revenue water refers to billed consumption, and *nonrevenue water* refers to the difference between production and revenue water.

Specific demand terms include the following:

- **Average day demand (ADD):** total annual production divided by 365 days
- **Maximum day demand (MDD):** the highest daily production during a calendar year
- **3-day Maximum day demand (3-d MDD):** the average of the three highest consecutive daily demands
- **Maximum monthly demand (MMD):** the average daily demand during the calendar month with the highest total demand
- **Peak-hour demand (PHD):** the highest hourly demand during a calendar year

MDD is an important value for water system planning. The supply facilities (Big Butte Springs and the Duff WTP) 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 will result in a water shortage. The 3-day MDD provides an indication of the duration of a peak use period.

The most common units for expressing demands are million gallons per day (mgd). One mgd is equivalent to 695 gallons per minute (gpm) or 1.55 cubic feet per second (cfs). Units of million gallons (MG) also are used.

System Demands

Table 2-5 and **Figure 2-4** summarize demand records for the overall MWC system from 2000 through 2015. The overall system represents both individual retail accounts, and sales to other cities and water districts. ADD values have ranged from 25.8 mgd to 30.6 mgd. The growth in the ADD has been steady throughout this period, averaging approximately 0.21 mgd increase per year as illustrated by the linear regression line in Figure 2-4.

Table 2-5. Summary of MWC System Demands

Year	ADD (mgd)	MMD (mgd)	MDD (mgd)	3-d MDD (mgd)	Date of MDD	MMD to ADD Peaking Factor	MDD to ADD Peaking Factor	MDD to MMD Peaking Factor
2000	25.8	43.8	51.8		1-Aug	1.7	2.0	1.18
2001	27.3	46.0	50.3		10-Aug	1.7	1.8	1.09
2002	27.0	45.0	52.6		11-Jul	1.7	1.9	1.17
2003	26.2	45.8	57.8		29-Jul	1.7	2.2	1.26
2004	28.9	49.8	54.5		8-Aug	1.7	1.9	1.09
2005	28.6	52.5	59.7		4-Aug	1.8	2.1	1.14
2006	29.3	51.5	55.9	55.0	20-Jul	1.8	1.9	1.08
2007	27.2	46.6	55.6	55.2	10-Jul	1.7	2.0	1.19
2008	26.7	47.8	57.6	57.1	30-Jul	1.8	2.2	1.20
2009	27.7	51.3	61.8	61.0	29-Jul	1.8	2.2	1.21
2010[a]			57.4	56.6	23-Jul			
2011	25.9	47.2	48.8	47.2	9-Aug	1.8	1.9	1.03
2012	29.5	47.7	52.1	51.3	18-Aug	1.6	1.8	1.09
2013	29.9	51.7	56.0	54.3	23-Jul	1.7	1.9	1.08
2014	30.6	50.5	53.0	52.6	16-Jul	1.7	1.7	1.05
2015	30.4	49.7	62.3	58.8	2-Jul	1.6	2.1	1.25
Average	**28.12-5**	**48.5**	**55.4**	**54.9**		**1.7**	**2.0**	**1.14**

[a]Annual production values were unavailable because of difficulties with master metering.

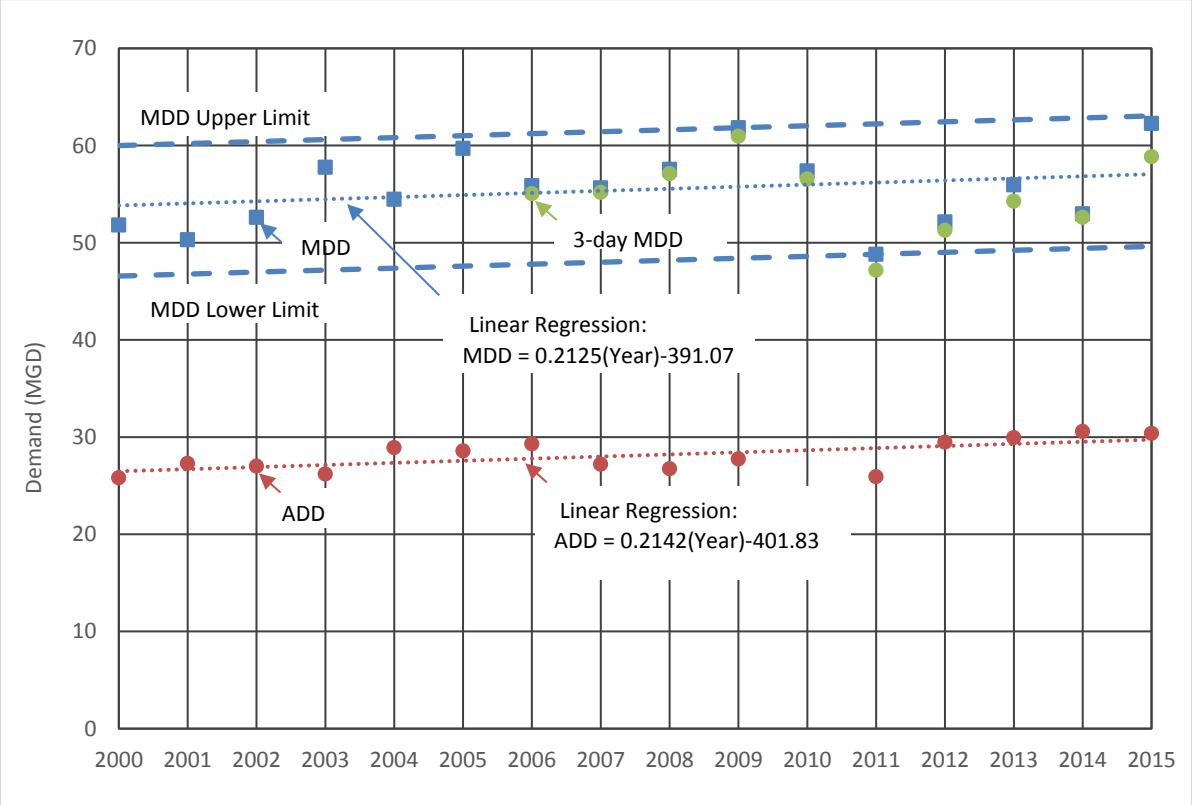


Figure 2-4. Average, Maximum Day, and 3-day Maximum Day Demand Records 2000-2015

Within the period 2000 to 2015, the MDD ranged from a low of 48.8 mgd to a high of 62.3 mgd, and fell within a band of minus 7 mgd to plus 6 mgd of the linear regression average MDD. The highest value of 62.3 mgd occurred on July 2, 2015. The MDD occurred in July for 9 of the years shown, and in August for 6 years. The 3-day MDDs were only slightly lower than the MDD, indicating that rather than being a single day event, peak demand events can last for up to three days.

MDDs fluctuate from year to year because they are strongly influenced by weather patterns and the economy. Factors influencing MDD include the following:

- High temperatures
- Number of consecutive days at high temperatures
- When the high temperatures occur during the summer (for example, if high temperatures occur earlier in the summer, the demands are often higher than if they occur later in the summer; summer demands are highly influenced by landscape irrigation, and this trend could be explained by evapotranspiration rates [actual plant water needs] declining after mid-July or simply because customers may tire of maintaining green landscapes later in the summer)
- Overall rainfall levels during the summer
- Consecutive days without rainfall
- Number of new homes with new landscapes, since owners will generally take extra care to keep newly installed landscapes thoroughly watered
- Regional drought messaging, especially via news media
- Economic downturns affecting all customers concerned about water bills, whether industrial, commercial, or residential.

Figure 2-5 shows the contribution of the other cities' ADD to the MWC system ADD. Other cities' contribution grew considerably between 2000 and 2008, largely because of increasing demands in Central Point and Eagle Point. Other cities' ADDs were relatively stable, averaging 6.6 mgd, between 2008 and 2015. Because MWC went through a transition in billing system software, 2013 data were not available. In late summer of 2014, MWC began serving the City of Ashland through the T.A.P. master meter shown to the south in the MWC service area in Figure 2-1. Talent and Phoenix also receive the majority of their water through this connection, with a portion also provided through Phoenix's Garfield meter. Water demands of the other cities grew from approximately 16 percent of MWC system demand in 2000 to 22 percent of MWC system demand in 2015.

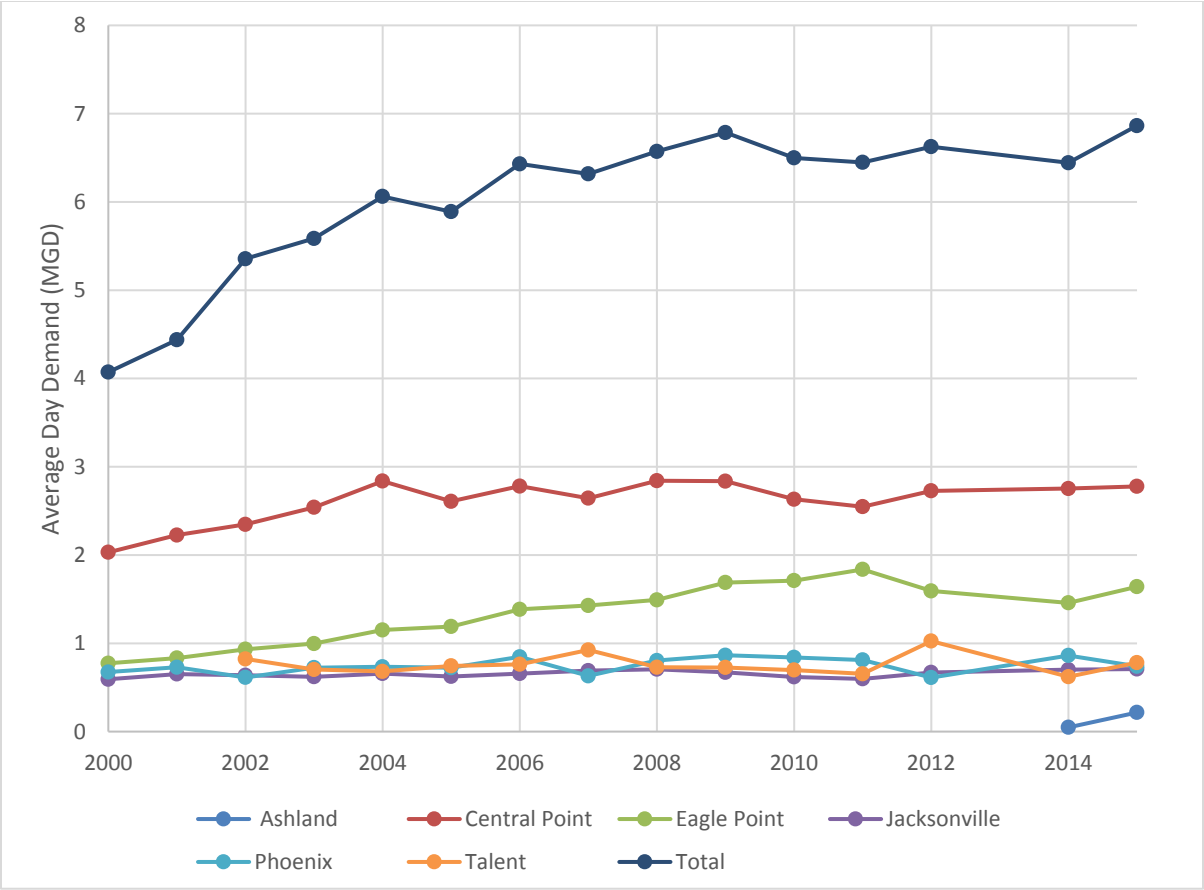


Figure 2-5. ADD for Other Cities 2000-2015

Monthly Demands

MWC experiences considerably higher demands in the summer months, much of which is related to irrigation of landscapes. **Figure 2-6** illustrates this seasonal trend in water demand, and presents monthly production by source for 2012 through 2015. BBS production is measured with magnetic flow meters located at the Coal Mine Pressure Control Station shown in Figure 2-1 on the transmission lines at the northeast edge of the distribution system. Because some customers are served upstream of these meters, the total flow is determined as the sum of flow at the Coal Mine meters plus the sum of metered customer flow upstream of Coal Mine. The BBS production pattern results from the two different modes of operation: pipe-and-a-half mode through the winter and spring months, and full-pipe mode in the summer months. Duff WTP generally operates approximately 6 months of the year. Duff was brought online in April in 2013, 2014, and 2015, and in May in 2012, and operation continued through September in 2013 and 2014, and through part of October in 2012 and 2015.

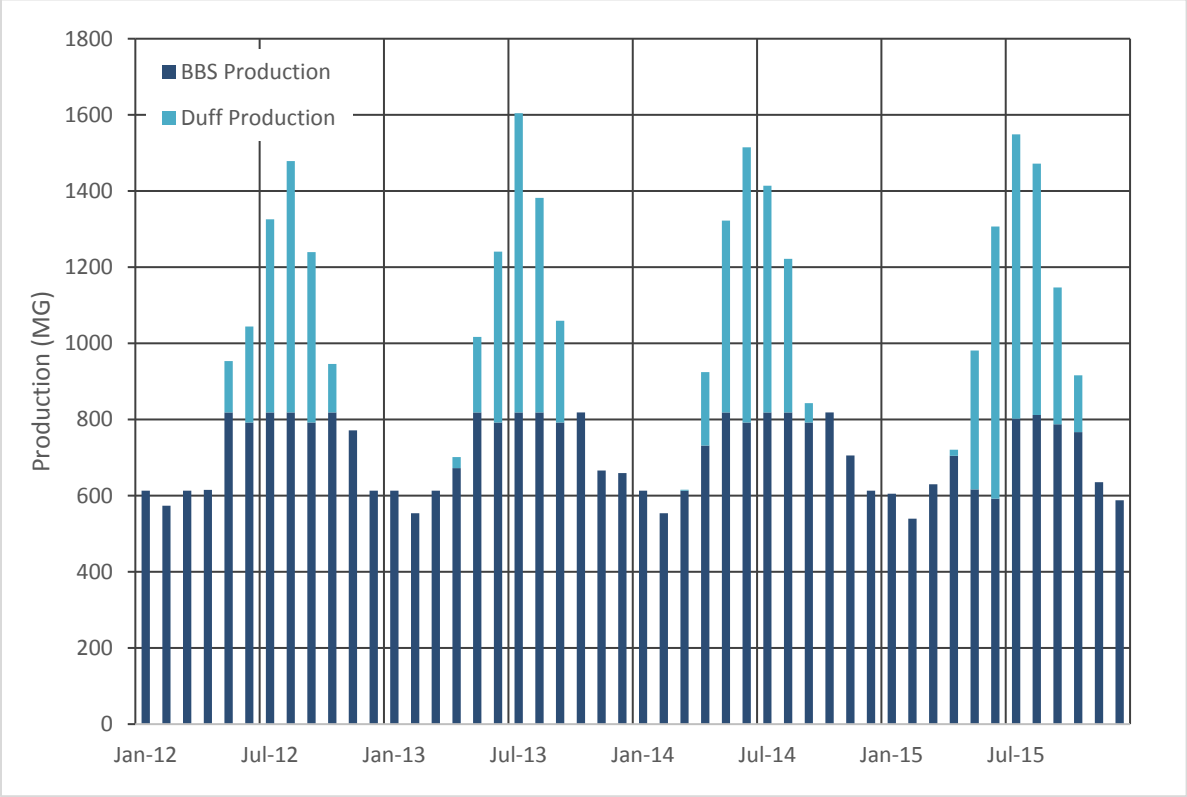


Figure 2-6. Monthly Production by Source 2012-2015

Figure 2-7 presents the percentage of monthly production from the Duff WTP for each month for 2012 through 2015, and the average value for the 4-year period. Duff contributed from 38 percent to 49 percent, and averaged 44 percent of July production for the period. Duff contributed an unusual percentage of June production in 2015, accounting for 55 percent of the monthly production. This was a result of using the BBS source at only pipe and a half level in June of 2015, rather than at full pipe as normally occurs during June. This mode of operation enabled the Eagle Point Irrigation District to more fully utilize the shared Big Butte source in June, delaying their use of Willow Lake water to meet demands. This action was taken due to unusually low snowfall levels in winter 2014-15, and coordinated efforts to avoid excessive draining of the lake. Historically, this has not been the protocol during most years, but has been done during a few other drought years, and can be expected to occur with more frequency in the future.

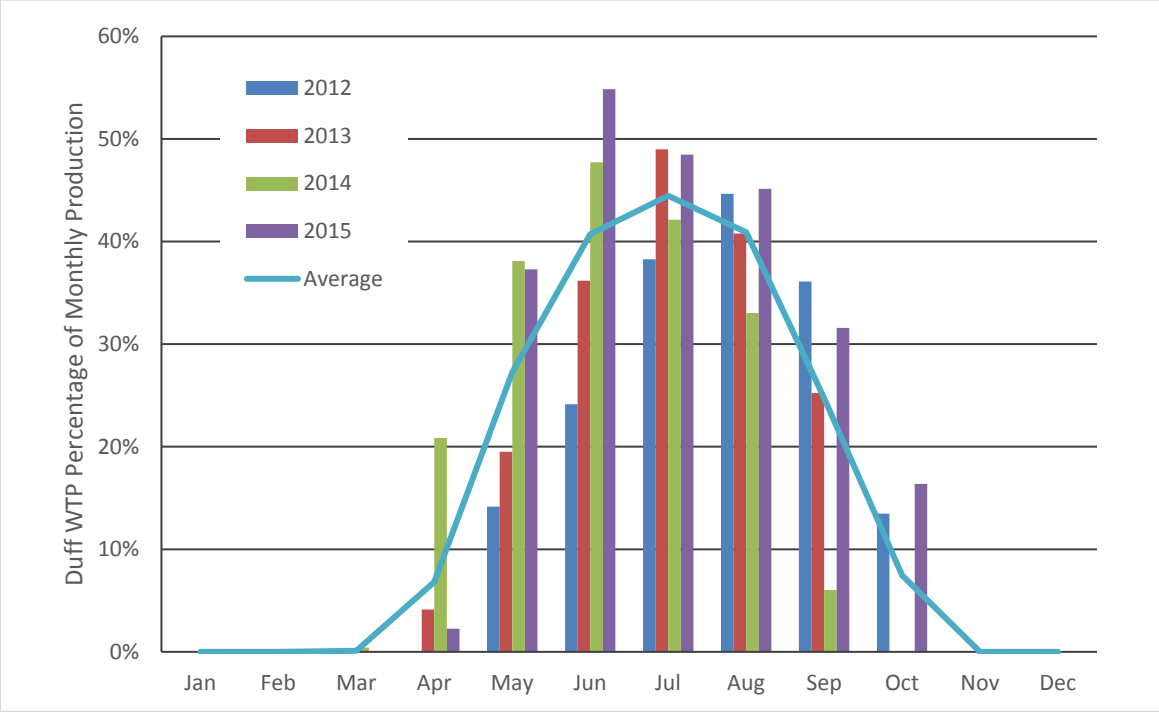


Figure 2-7. Percentage of Monthly Production Contributed from Duff WTP, 2012-2015

Figure 2-8 presents monthly production for 2015. Duff production is shown during the months April through October. Monthly BBS production is separated into the portion that serves customers upstream of the flow meters at Coal Mine Pressure Control Station, the portion that exceeds system demand and is therefore overflowed at Capital Reservoir during the winter months, and the remaining portion that serves MWC customers downstream of Coal Mine Pressure Control Station.

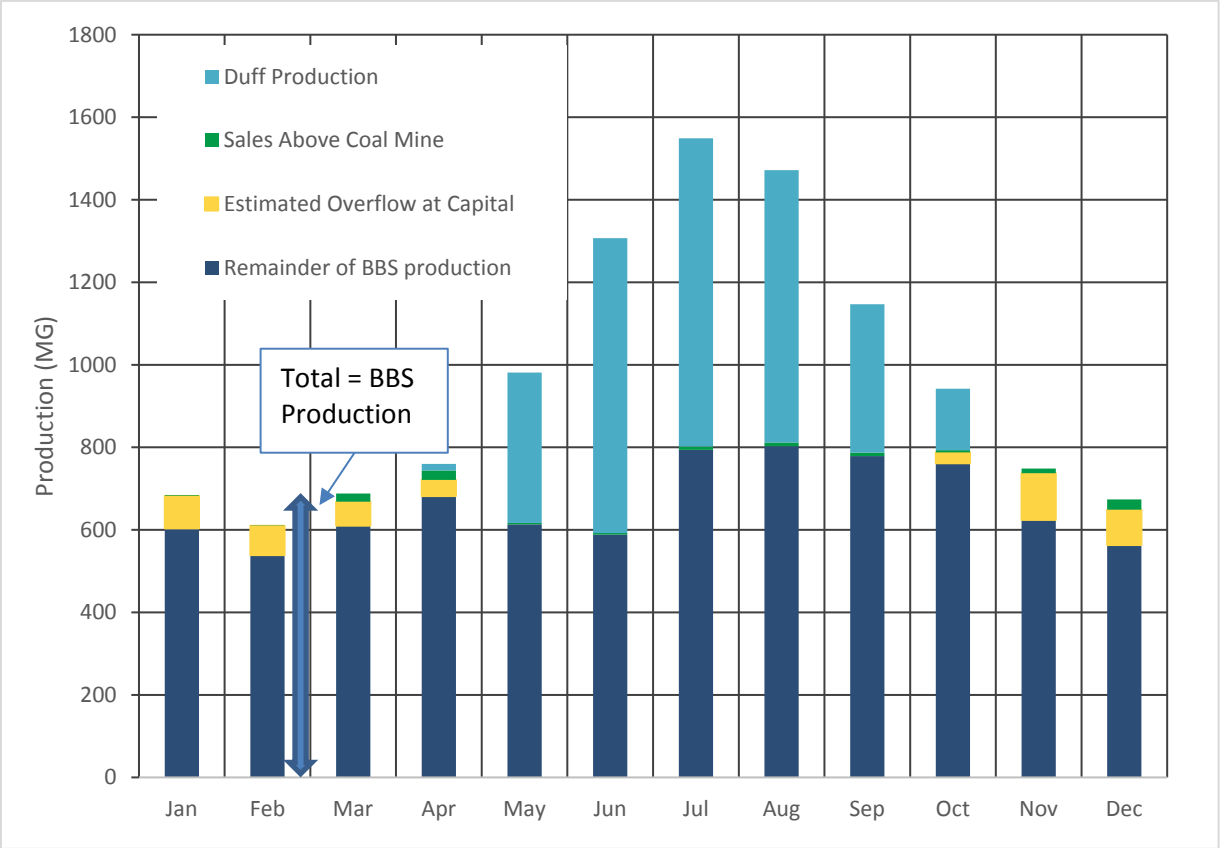


Figure 2-8. Monthly Production with BBS Flow Components Identified, 2015

Figure 2-9 shows the systemwide monthly demands as a percentage of annual demand for 2015. July averaged over 14 percent of annual demand, and demand during the four-month period from June through September averaged 49 percent of total annual demand.

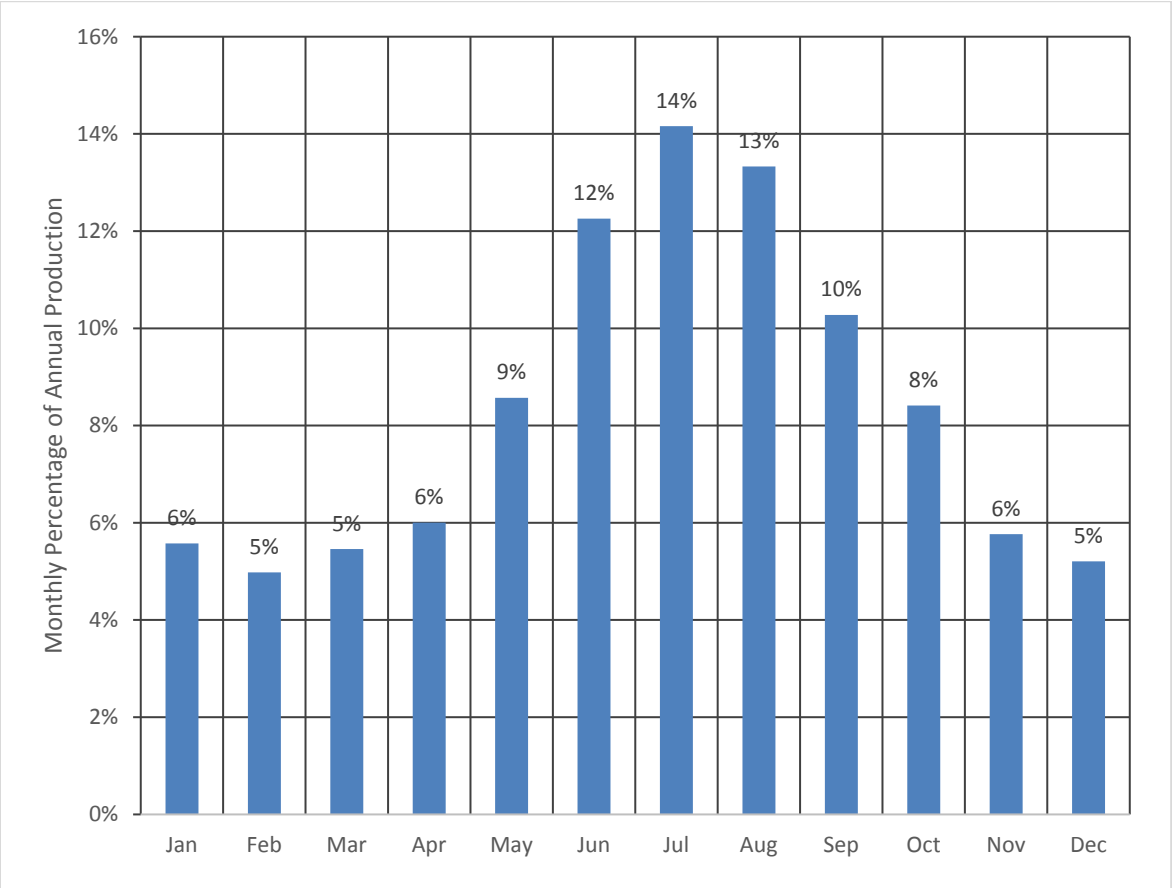


Figure 2-9. Monthly Production as a Percentage of Annual Production, 2015

The monthly demands of other cities are presented in **Figures 2-10** and **2-11.** Figure 2-10 presents monthly demand in terms of a daily rate and Figure 2-11 presents monthly demand in terms of volume for the six other cities served by MWC for the period 2012 to 2015. Because MWC went through a transition in billing system software, 2013 data were not available. The overall peak monthly demand for the other cities occurred in July and August of the 3 years shown. The highest maximum monthly demand (MMD) for the other cities totaled nearly 14 mgd in July of 2015. MWC serves five of the other cities year-round, but only serves Ashland on an as-needed basis, which is generally anticipated to occur during the summer months.

Collectively, the wholesale cities purchased 26 percent of water sold by MWC in 2015, varying from approximately 23 percent in winter months to approximately 28 percent during the summer.

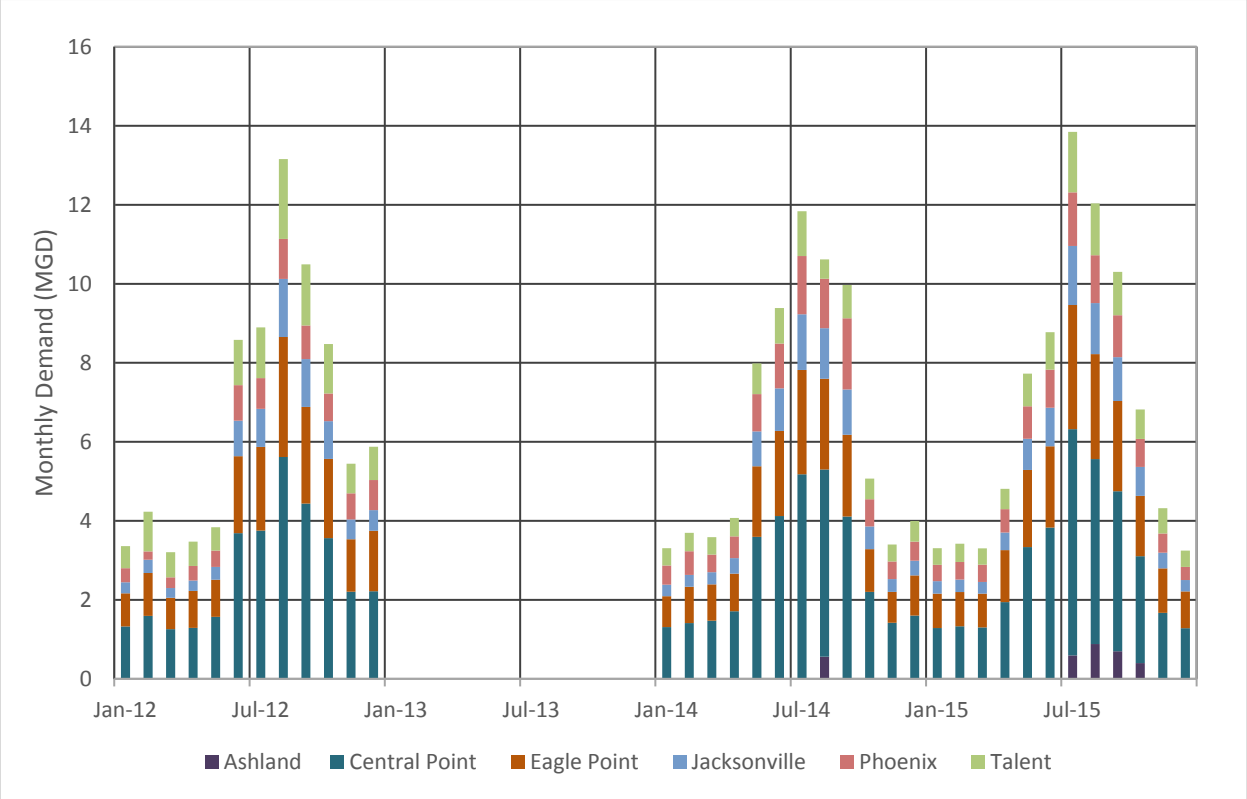


Figure 2-10. Monthly Demand of Other Cities, 2012-2015 – Daily Rate

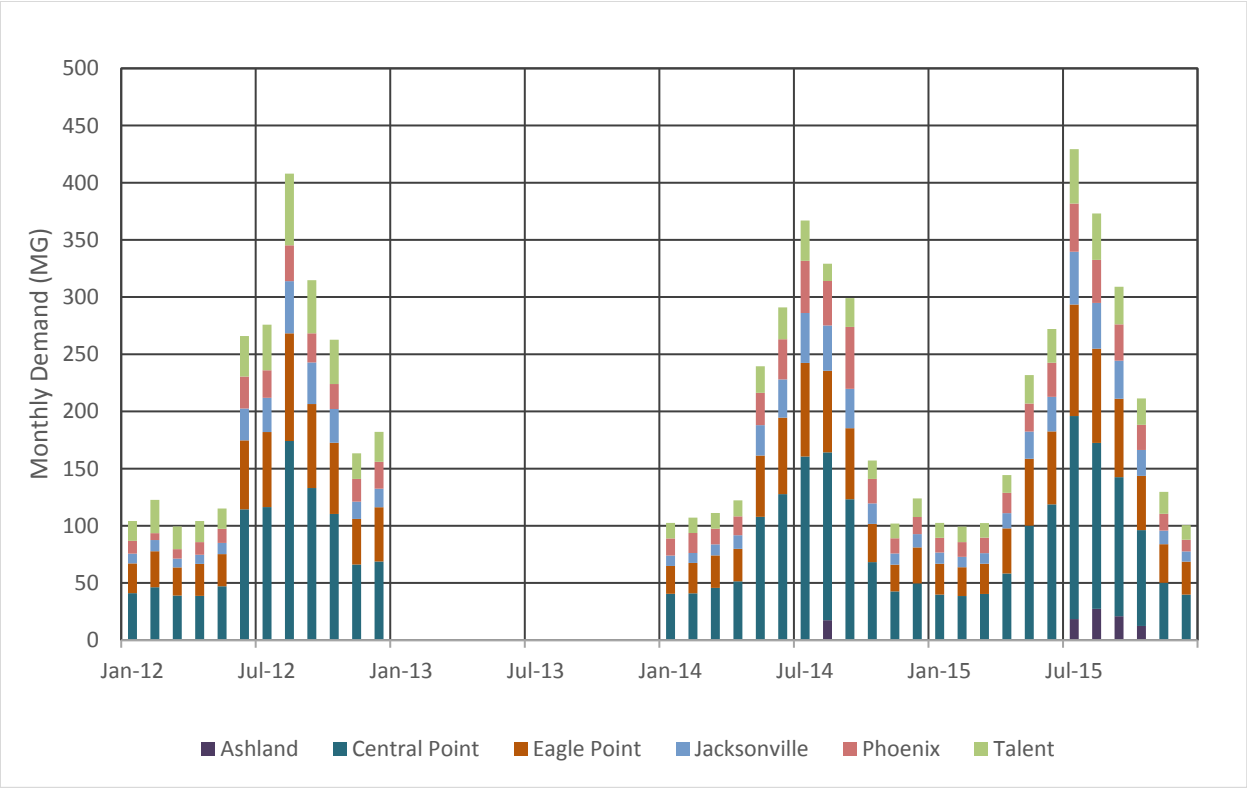


Figure 2-11. Monthly Demand of Other Cities, 2012-2015 -- Volume

Figure 2-12 shows the historical MMDs for the other cities from 2007 through 2015. Also shown is a hypothetical total MMD for other cities that would occur if all of the cities experienced a maximum month in the same month. Demands associated with the other cities remained relatively constant for the period. Central Point had the highest MMD, averaging 5.7 mgd for the period. Eagle Point was next, averaging 3.1 mgd, while Jacksonville, Phoenix, and Talent all had MMDs averaging 1.5 mgd for the period. The variability of use for Phoenix and Talent is believed to be related to metering issues with the Talent meter that determines the division of TAP line use between these two cities.

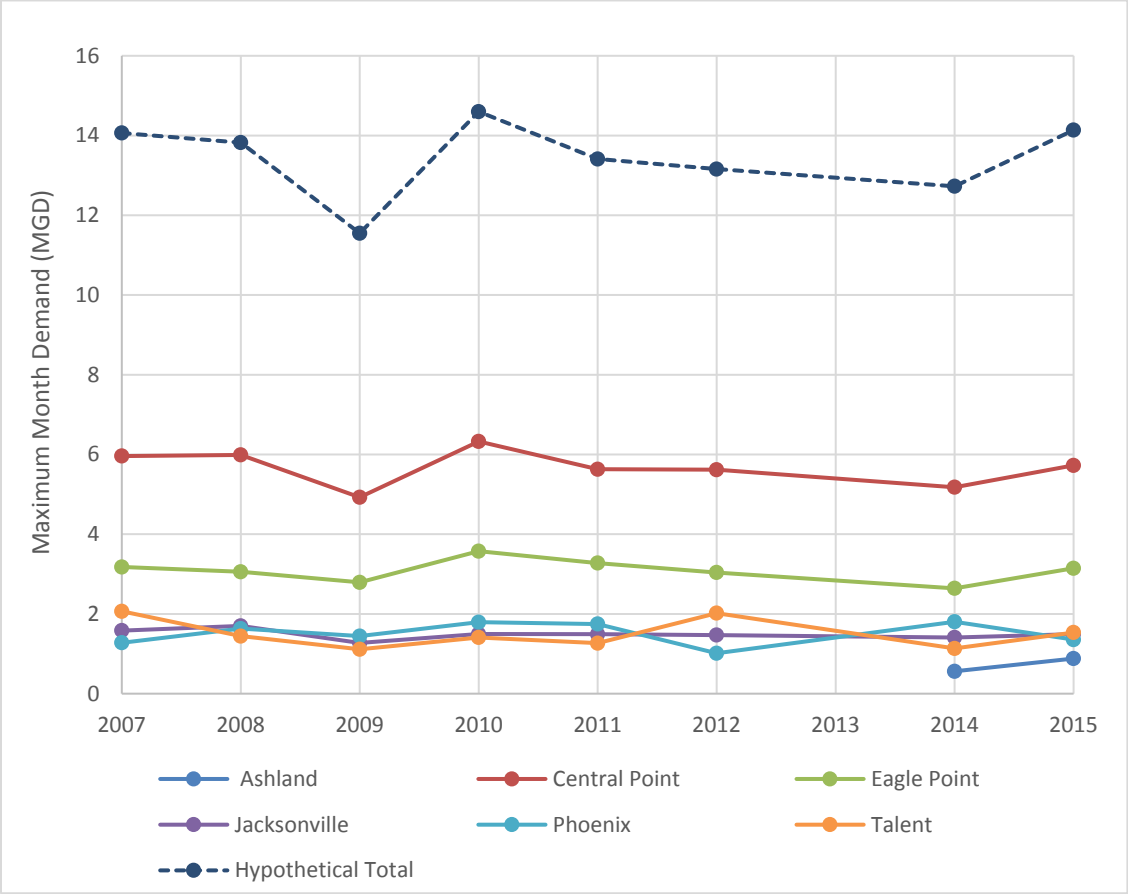


Figure 2-12. Historical Maximum Month Demand for Other Cities, 2007-2015

Peaking Factor

Peaking factors help describe the water system's peak summer use as compared with other usage parameters**. Figure 2-13** illustrates the history of MWC's peaking factors. The overall system MDD to ADD peaking factor has ranged from 1.8 to 2.2 and averaged 2.0 over the period 2000-2015. The systemwide MDD to MMD peaking factor averaged 1.14, and the MMD to ADD peaking factor averaged 1.7 over the period.

MDD data disaggregated for each customer group were not available because meters are read monthly, rather than daily. MWC is in the process of installing AMI-capable meters throughout the water system, but completion is still several years away.

AMI-capable registers have also been installed on all of the wholesale city master meters except the TAP meter, with work currently ongoing to access similar real-time usage data for the TAP meter. When completed, these master meters will provide granular usage data for the wholesale cities group, and their actual peak usage can be accurately determined.

Without these tools available for this study, however, MDD values for customers were estimated by multiplying the MMD values of the customer group by the overall system MDD to MMD peaking factor.

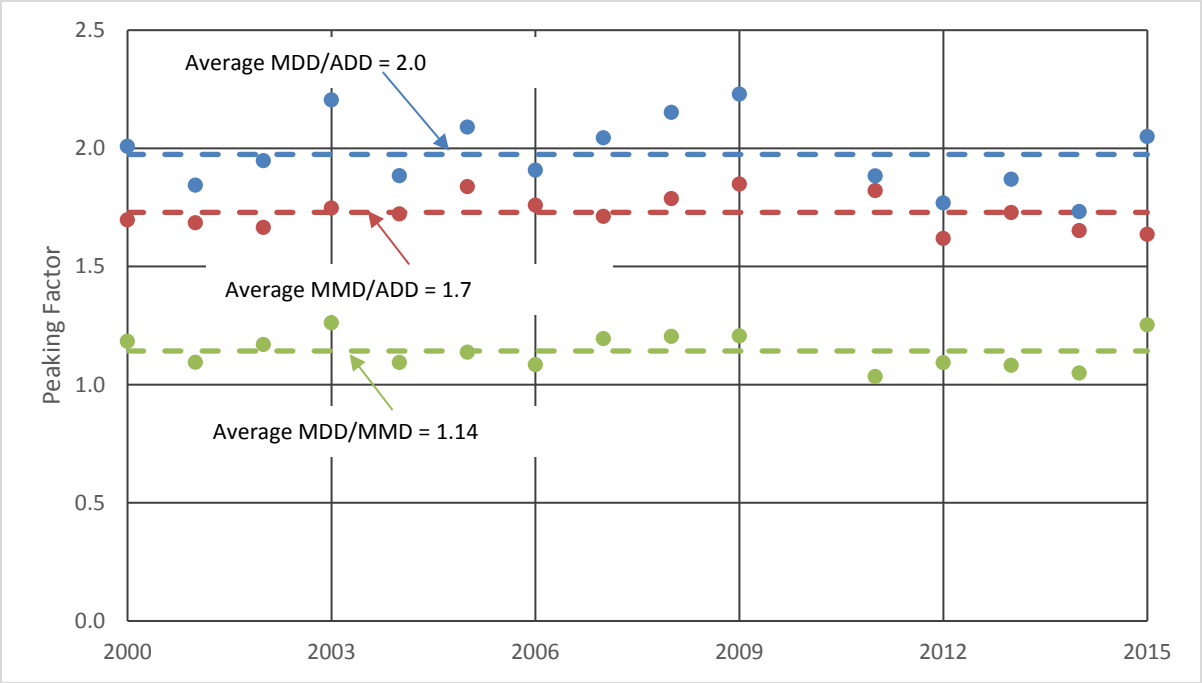


Figure 2-13. Historical Systemwide Peaking Factors, 2000-2015

Per Capita Demands

Per capita demands are calculated as daily demand divided by service population. Since demand includes use by commercial, industrial, and municipal customers as well as residential customers, the per capita value exceeds the amounts of water actually used by a typical individual. The region's hot and dry summers result in peak demands significantly higher than average demands.

While per capita data are included for all entities receiving MWC water, the cities served wholesale water are responsible for their own water management actions. Therefore, while MWC encourages careful water use, it neither conducts detailed analyses nor manages conservation levels of these cities. Such analyses may be found in these cities' individual WMCPs.

The per capita demand values are important because they are used for projecting future water use.

Table 2-6 shows the estimated service area populations for cities, water districts, and customers inside and outside of Medford city limits for 2015. Populations served within White City, the water districts, and individual accounts outside city limits were estimated by MWC staff based on U.S. Census data (U.S. Census Bureau, 2010), account data, and field investigation. Service area populations for the cities were estimated by adjusting the certified population estimates for 2015 from Portland State University's Population Research Center to account for households not receiving water but within city boundaries, or receiving water but outside of boundaries. The service area population for White City was similarly reduced from U.S. Census Bureau data to account for households within the community boundary that do not receive water service. The total 2015 service area population was estimated at 136,100.

Table 2-6. Determination of MWC Service Area Population, 2015

		Adjustments to Population					
	Population[a]	**Housing Units Served Outside Limits**	**Housing Units Not Served Inside Limits**	**Net Housing Units Served**	**Average House-hold Size**	**Population Adjustment**	**MWC Service Area Populations[b]**
Ashland[c]	20,405					-15,300	5,105
Central Point	17,485	34	3	31	2.61	80	17,565
Eagle Point	8,695	21	2	19	2.62	50	8,745
Jacksonville	2,880	74	5	69	2.02	140	3,020
Medford	77,655	0	130	-130	2.44	-320	77,335
Phoenix	4,585	0	0	0	2.26	0	4,585
Talent	6,270	35	0	35	2.29	80	6,350
White City	8,530	0	16	-16	3.08	-50	8,480
Other outside customers	1,080	0	0	0	-	-	1,080
Water Districts	3,835	0	0	0	-	-	3,835
Total							**136,100**

[a]Population values for cities and the White City Unincorporated Community area were obtained from the Portland State University Population Research Center. Populations for water districts, and other outside customers were estimated by MWC staff from census data, account records, and field surveys.

[b]Service area population accounts for only those households receiving water service. Therefore, households outside of a given boundary that receive water service are added, and households within the boundary that do not receive water service are subtracted.

[c]Service population for the City of Ashland was estimated at 25 percent of the city population based on MWC providing approximately 25 percent of Ashland's peak day water usage.

Per capita demand values are presented in **Table 2-7**. Per capita demands range considerably between the entities identified in Table 2-7, because of different mixes of residential, commercial, and industrial components. The majority of the region's industrial customers are located in White City and the remainder of the outside customer group, and these entities have the highest per capita demands. Water Districts and the City of Medford also have larger commercial and industrial sectors than the wholesale cities. In addition, the City of Medford houses the majority of the region's institutional customers, including two hospitals, and most federal, state, and county government offices. This diversity of water users is reflected in the varied per capita demand values of individual entities.

Table 2-7. Estimated 2015 Per Capita Demands of MWC Customers

	MWC Service Area Population[a]	Estimated Per Capita ADD (gpcd)	Estimated Per Capita MMD (gpcd)[b]	Estimated Per Capita MDD (gpcd)[c]
Ashland[d]	5,105	--	173	197
Central Point	17,565	158	326	372
Eagle Point	8,745	188	360	410
Jacksonville	3,020	235	494	564
Medford[e]	77,335	218	401	457
Phoenix	4,585	161	296	337
Talent	6,350	123	241	275
White City	8,480	443	650	741
Other outside customers	1,080	443	650	741
Water Districts	3,835	263	585	667
Systemwide Values	**136,100**	**223**	**365**	**458**

[a]Service area population accounts for only those households receiving water service. Therefore, households outside of a given boundary that receive water service are added, and households within the boundary that do not receive water service are subtracted. Service area population from Figure 2-11.
[b]Per capita MMD = Per capita ADD x MMD/ADD peaking factor specific to customer.
[c]Per capita MDD = Per capita MMD x overall system MDD/MMD peaking factor. The overall system MDD/MMD = 1.1.
[d]Values for Ashland are not representative of the community as a whole, but are strictly based on demand satisfied by MWC.
[e]Demand attributed to authorized overflow was not included in the per capita demand calculation, because this portion of demand will decrease over time as winter-time demands begin to match production from BBS.

Note:
gpcd = gallons per capita per day

For the City of Medford and outside customers, ADD was estimated as metered consumption plus a proportionate amount of the total nonrevenue water to represent total demand. Adding nonrevenue water to the metered consumption of customers directly metered and billed by MWC [excluding wholesale cities] is consistent with the IWA/AWWA water audit methodology, and results in the data from all customers being consistent. Wholesale city customers' per capita demand includes nonrevenue water that occurs downstream of the city master meters. The wholesale customers are responsible for reporting nonrevenue water values that occur across their individual distribution systems in their own WMCPs. Additionally, while this plan includes demand data for the cities MWC serves, these cities are responsible for their own water management activities.

Demand Factors for Overall System

Demand projections are often made by holding per capita demand factors constant, and projecting demand based on population increases alone. This practice assumes that the proportion of residential to commercial, institutional, and industrial water use remains constant into the future. It also does not account for the potential impact of conservation measures to reduce per capita demands. Introduction of

a single or several high-use industrial customers can greatly increase per capita demand, and the cumulative effect of plumbing code- and culture-driven conservation measures can reduce per capita demand.

The overall MWC system has experienced a decrease in maximum day per capita demands over the past two decades. **Figure 2-14** shows select MDD per capita values from 1994 through 2015. Also shown is the percentage of total metered consumption classified as industrial from 1990 to 2015. Reductions in MDD per capita prior to 2001, are in large part related to reductions in the industrial component of water use. However, since 2001, the percentage of industrial water use remained relatively constant while the MDD per capita continued to decrease. These decreases are likely related to factors such as conservation activities and pricing, improved efficiencies of plumbing fixtures and higher development densities. The severe downturn in the economy between 2007 and 2011 also resulted in considerable reductions in water consumption, both locally and nationwide, with only a modest partial recovery since then.

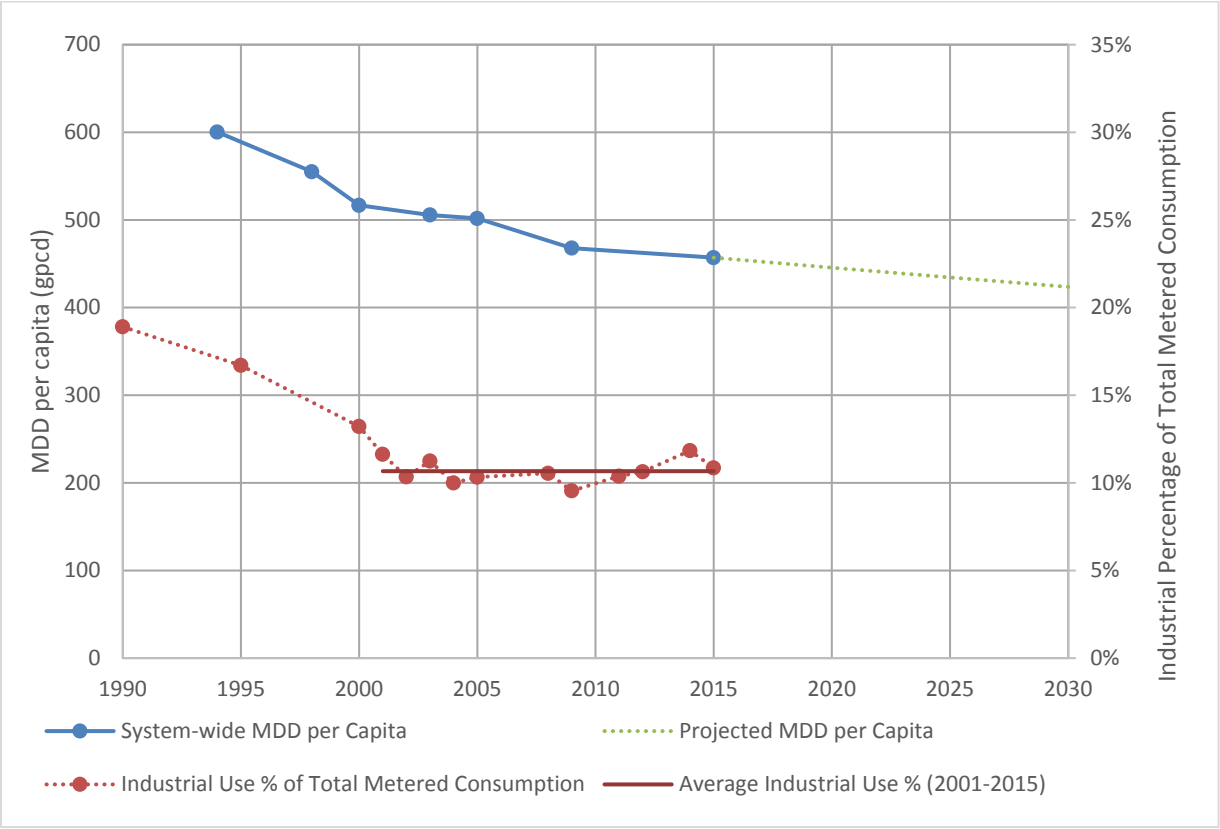


Figure 2-14. MWC Historical Systemwide MDD Per Capita, and Percentage of Industrial Use

As shown in Figure 2-14, MWC anticipates an additional annual decrease in systemwide MDD per capita of 0.5 percent over the next 20 years. This decrease is consistent with nationwide trends. For example, an April 2016 report by the Water Research Foundation titled *Residential End Uses of Water, Version 2 (project #4309)* found that per capita, single-family residential indoor water use decreased 15 percent since 1999. Regarding outdoor water use, the report found that a majority of the households studied, used less water for irrigation than a benchmark value, and only 13 percent of households exceeded the benchmark. The report further concluded that if the excess irrigation could be eliminated, a 16 percent per household savings could be realized.

Demand Factors Inside City of Medford

Per capita demand factors presented thus far include all metered water use for all categories of demand (residential, commercial, industrial) plus nonrevenue water. Demand attributed to authorized overflow was not included in the per capita average day demand calculation for City of Medford inside because this portion of demand is not currently related directly to customer use, and will decrease over time as winter time demands begin to match production from BBS. In 2015, the City of Medford's metered consumption accounted for 56 percent of all water sales, and 76 percent of net water sales after subtracting sales to wholesale city customers. Using the IWA/AWWA methodology, nonrevenue water was allocated based on net water sales, with 76 percent of the nonrevenue water (not including overflow) added to the inside Medford metered consumption to estimate demand. The remaining 24 percent of nonrevenue water was apportioned between outside customers and water districts.

Residential Per Capita Demand Factors

The overall per capita ADD for the City of Medford in 2015 was estimated at 218 gpcd. This represents a reduction from the estimated per capita demand of 246 gpcd in 2005 from the last WMCP. From billing data, single-family residential use represented 55 percent and multi-family use represented 16 percent of the total consumption within city limits. According to the *Medford Comprehensive Plan, Housing Element,* 2010, in 2009, single-family residences accounted for 64 percent of dwelling units and multi-family residences accounted for approximately 36 percent of dwelling units. Therefore, the single- and multi-family residential per capita demands were estimated as follows:

- Single-family average daily per capita demand = 0.55(218 gpcd)/0.64 = 187 gpcd
- Multi-family average daily per capita demand = 0.16(218 gpcd)/0.36 = 97 gpcd

A peaking factor of 2.0 was used to adjust ADD per capita to MDD per capita for each residential category.

Commercial and Industrial Demand Factors

Both commercial and industrial water demand within the City of Medford averaged 1.5 gpm per acre (2,160 gpd per acre). This was computed by dividing water demand by existing commercial and industrial enterprises by the occupied land area in each customer class to obtain average day demand factors, in gallons per minute per acre. This factor is comparable to commercial and industrial demand factors from other Oregon communities.

Consumption and Nonrevenue Water

As discussed previously in this section, all systems have unavoidable losses, and some portion of the water treated by a water utility is not expected to be sold. This "nonrevenue water" can include both legitimate "authorized" unbilled uses and "unauthorized" uses. MWC attempts to track and make estimates to quantify authorized uses, including water used by fire departments for fire suppression and training, usage by local public works agencies, and MWC's own water system operational tasks such as hydrant flushing, main flushing, water quality sampling stations, and estimated losses from repaired main breaks. Also tracked are overflows at the Capital Reservoirs, which largely occur during winter months, and are unavoidable because flows from Big Butte Springs cannot be adjusted to match real-time demands. All of these authorized unmetered water uses contribute to nonrevenue water.

Nonrevenue water also includes losses that cannot be tied to specific legitimate activities, and are referred to as unauthorized or unaccounted-for usage. Falling within this category are apparent losses associated with metering or data handling errors, water theft, and real losses from leakage.

In determining a system's nonrevenue water rate, the IWA/AWWA water audit method excludes wholesale water sales. For the MWC system, this means that the other cities' demands are removed from the calculation. This is because the other cities determine their own nonrevenue water rates, with the MWC master meter values equaling their production. In situations such as MWC's where the water sold to wholesale customers is wheeled through the supplier's distribution system to reach wholesale meters, the IWA/AWWA methodology does not recognize that losses tend to be proportional to flows and pipe sizing. By eliminating wholesale sales from the computation, the nonrevenue water is compared to a lower "net" production, in turn resulting in higher percentages of overall nonrevenue water and of the unauthorized/unaccounted-for portion of that nonrevenue water.

Figure 2-15 provides a breakdown of total water production by category for 2015. This graph shows that of the 17 percent nonrevenue water associated with MWC's retail customers in 2015, 6 percent (519 MG) was authorized, and 10.5 percent (900 MG) was attributable to unauthorized causes such as water theft, leakage, or apparent losses associated with meter error and data handling errors.

As per the IWA/AWWA water audit methodology, the 10.5 percent unauthorized loss results from comparing unauthorized losses to water demand attributed to City of Medford inside and outside customers (8,585 MG), rather than a comparison to total demand (11,090 MG). The percentage is approximately 8 percent, if unauthorized losses are compared to total demand.

With a total of 10.5 percent unauthorized or unaccounted for nonrevenue water, MWC's leakage rate is likely below the 10 percent target of OWRD for municipal systems. MWC is committed to refining SCADA calculations to continue to document nonrevenue water and to evaluate areas for reducing this metric.

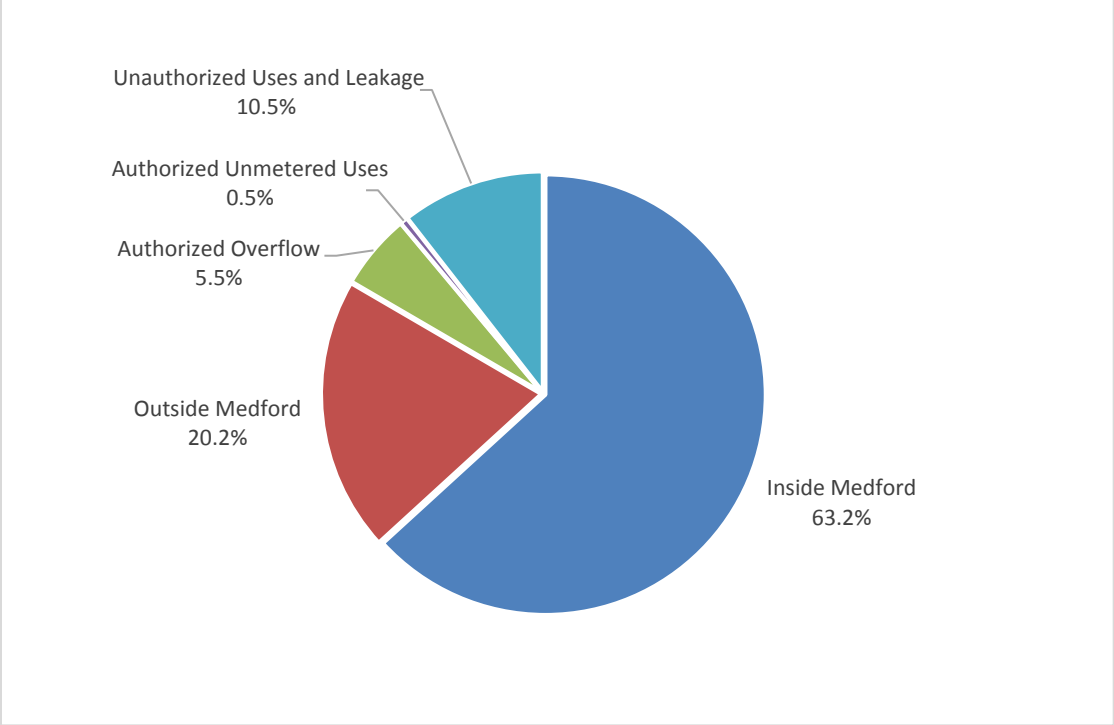


Figure 2-15. Water Use by Category Excluding Other Cities, 2015

Figure 2-16 illustrates a comparison of monthly production, metered consumption, and nonrevenue water values for 2015. Nonrevenue water was positive January through August, and was negative for September through December. A negative value is physically impossible, but month to month variability in nonrevenue water can result from the timing of reading of consumption meters versus production meters. For example, values for September represent *production* in September and metered *consumption* (sales) for water used during portions of the higher-use month of August and into September. As Figure 2-16 shows for 2015, a series of negative nonrevenue water values occurred in the fall, when demands trended downward, and the reverse in the spring as demands increased. Annualized nonrevenue values smooth out the monthly variability.

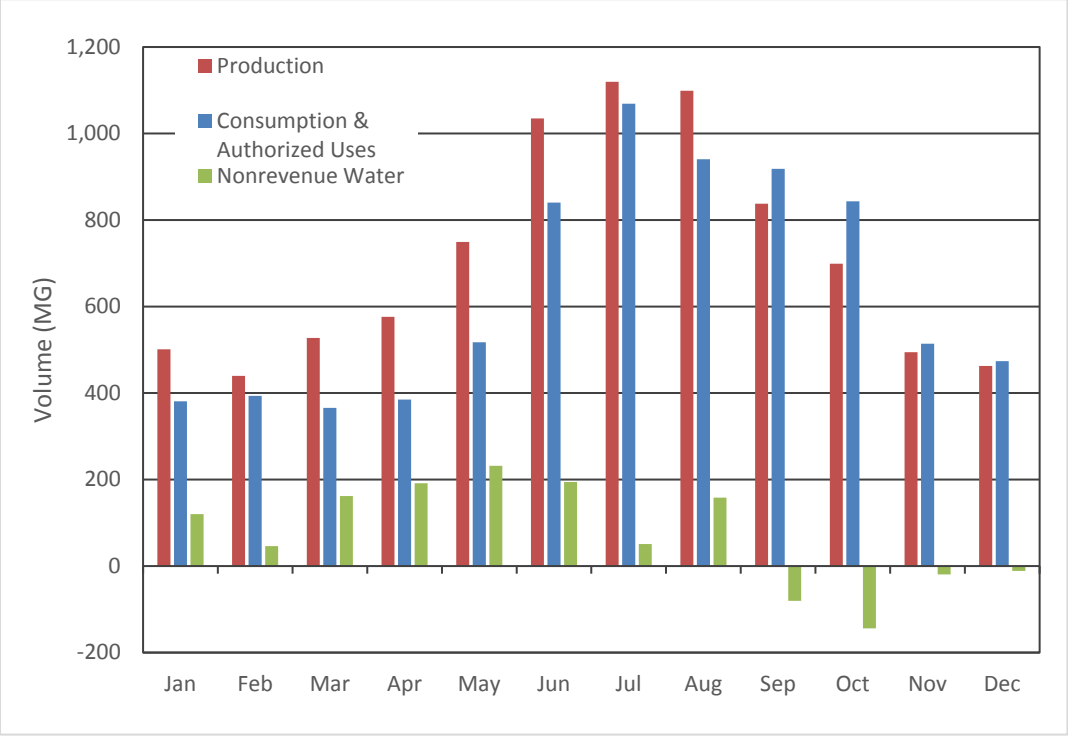


Figure 2-16. Monthly Nonrevenue Water, Excluding Other Cities, 2015

Customer Characteristics and Use Patterns

Inside Medford, Outside, and District Customers

A summary of annual consumption by billing system classification for MWC's system is shown in **Table 2-8**.

Table 2-8. MWC Metered Consumption by Customer Category

	Single-family		Multi-family		Commercial		Industrial		
Year	Inside	Outside and Districts	Inside	Outside and Districts	Inside	Outside and Districts	Inside	Outside and Districts	Total
2014	2,917	382	855	266	1,303	212	208	904	7,047
2015	3,009	382	857	261	1,350	219	183	862	7,122
Average	**2,963**	**382**	**856**	**263**	**1,326**	**216**	**196**	**883**	**7,085**
Percent	**42%**	**5%**	**12%**	**4%**	**19%**	**3%**	**3%**	**12%**	**100%**

Figure 2-17 illustrates the distribution of customer use between directly billed customers (excluding wholesale cities) located inside and outside City of Medford boundaries. The types of water use inside city limits are primarily residential (both single and multi-family) and commercial (including institutional usage). The majority of the industrial water use is located outside Medford city limits, particularly in White City and within some water districts. This is why the per capita use values for White City and other outside customers, and water districts is considerably higher than the per capita use for more densely populated areas with less industry within Medford city limits.

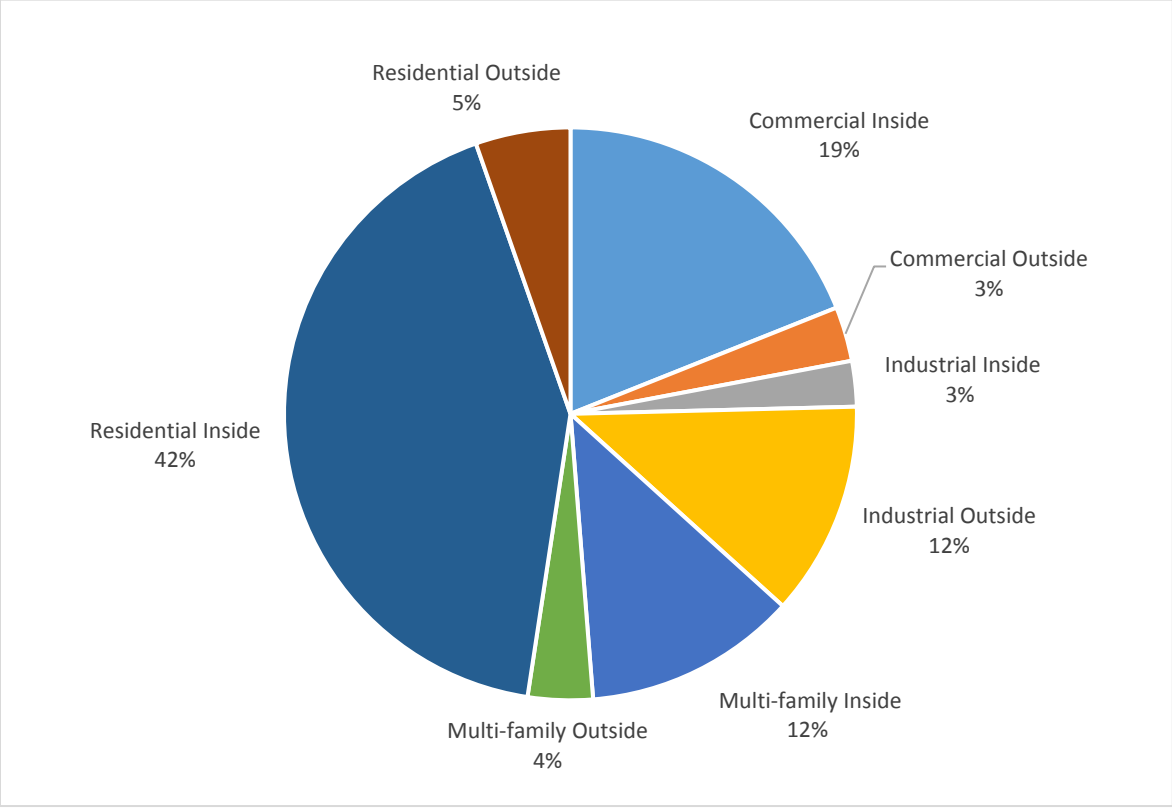


Figure 2-17. Water Use by Billing Category Inside Medford and Outside/District Customers, 2015

Table 2-9 provides a comparison of consumption by customer type between the last WMCP and this WMCP. The last plan reported average consumption for the period 2000 to 2005. The pattern of use by each customer type remained relatively constant for the period, only varying by a percentage point.

Table 2-9. Comparison of Systemwide Metered Consumption by Category 2000-2005 versus 2014-2015

Category	Average 2000-2005		Average 2014-2015	
	Consumption (MG)	Percent of Total	Consumption (MG)	Percent of Total
Residential	4,106	62%	4,464	63%
Commercial + Municipal[a]	1,507	23%	1,542	22%
Industrial	1,012	15%	1,079	15%
Total	**6,625**	100%	**7,085**	100%

[a]Commercial and municipal use were combined because MWC no longer tracks municipal use as a separate category. Institutional usage is also included in the Commercial category

Table 2-10 summarizes the largest 24 individual industrial commercial and multi-family water accounts for 2015. These accounts represent approximately 22 percent of all retail water sales.

Table 2-10. MWC's Largest Individual Water Accounts (Inside Customers, Outside Customers, and Water District), 2015

Customer Type	Annual Volume (MG)
Industrial	201
Commercial	181
Industrial	144
Industrial	136
Commercial	120
Industrial	118
Industrial	82
Industrial	74
Industrial	47
Commercial	46
Industrial	45
Commercial	40
Industrial	38
Commercial	38
Industrial	31
Multi-family	31
Multi-family	29
Multi-family	24
Industrial	21
Multi-family	20
Multi-family	20
Commercial	20
Multi-family	20
Commercial	19
Total	**1,546**

Customers Inside Medford

Table 2-11 summarizes annual metered consumption by category for customers within the City of Medford for 2010 through 2015. **Table 2-12** shows a comparison of use between this WMCP and the previous WMCP. While the overall average consumption for the two periods decreased somewhat, use patterns within the city remained relatively stable between the two periods.

Table 2-11. City of Medford Annual Metered Consumption, 2010-2015

Year[a]	Single-family (MG)	Multiple-family (MG)	Commercial (MG)	Industrial (MG)	Total (MG)
2010	2,653	822	1,190	232	4,897
2011	2,498	803	1,145	203	4,650
2012	2,672	820	1,208	212	4,911
2014	2,917	855	1,303	208	5,282
2015	3,009	857	1,350	183	5,399
Average	**2,750**	**831**	**1,239**	**208**	**5,028**
Percent	**55%**	**17%**	**25%**	**4%**	**100%**

[a]Because of the billing system transition, annual data for 2013 were not available.

Table 2-12. Comparison of Metered Consumption of Inside Customers 2000-2005 versus 2010-2015

	Average (2000-2005)		Average (2010-2015)	
Category	**Consumption (MG)**	**Percent of Total**	**Consumption (MG)**	**Percent of Total**
Single-family	2,931	56%	2,750	55%
Multi-family	823	16%	831	17%
Commercial	1,248	24%	1,239	25%
Industrial	208	4%	208	4%
Total	**5,210**	**100%**	**5,028**	**100%**

[a]Commercial and municipal use were combined because MWC no longer tracks municipal use as a separate category.

Table 2-13 shows the number of accounts per customer category for 2000 through 2015.

Table 2-13. Number of Accounts per Customer Category Inside Medford, 2000-2015

Year	Single-family	Multiple-family	Commercial[a]	Industrial	Total
2000	16,787	1,815	2,005	40	20,647
2001	17,045	1,880	2,035	38	20,998
2002	17,402	1,930	2,081	38	21,451
2003	18,288	1,996	2,148	41	22,473
2004	18,857	2,068	2,193	41	23,159
2005	19,202	2,124	2,293	41	23,660
2006	19,572	2,179	2,393	44	24,188
2007	19,740	2,268	2,461	47	24,516
2008	19,797	2,296	2,497	46	24,636
2009	19,865	2,290	2,503	44	24,702
2010	19,916	2,303	2,503	44	24,766
2011	19,996	2,305	2,514	44	24,859
2012	20,125	2,333	2,583	44	25,085
2013[b]	19,334	2,268	2,221	39	23,862
2014	20,658	2,361	2,488	44	25,551
2015	20,757	2,344	2,439		25,634

[a]Commercial accounts include institutional customers as well as accounts formerly designated as Municipal.
[b]Data based on 6 months of records in 2013.

Figure 2-18 shows the monthly metered consumption by customer category for the City of Medford from 2010 to 2015.

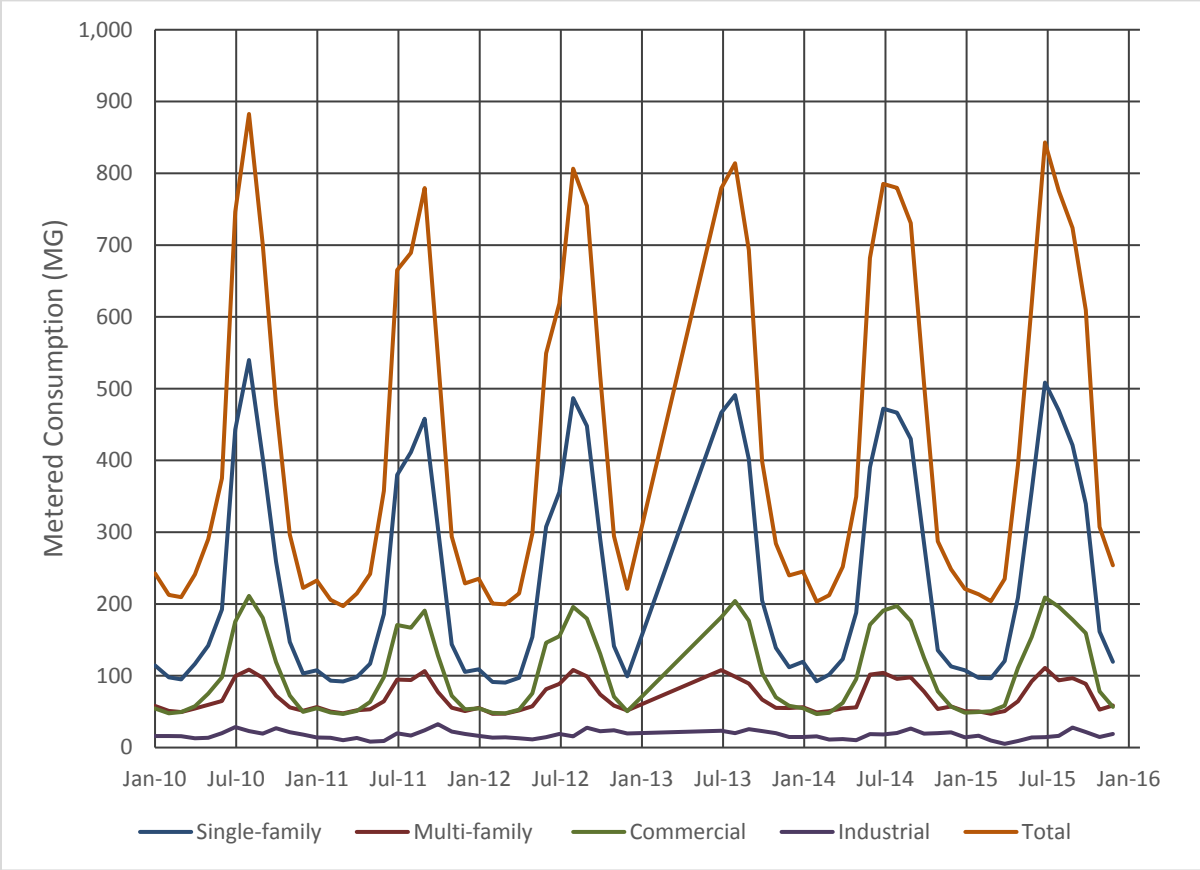


Figure 2-18. Monthly Metered Consumption by Category for Customers within the City of Medford, 2010-2015

Metered consumption increases for all categories in the summer months. Peak usage months are June through September, with December through March representing the period during which limited outdoor use occurs. The “shoulder” months of April, May, October, and November reflect transitions between seasons. Water use in these transitional periods may reflect some irrigation, or seasonal changes in commercial and industrial water requirements.

Seasonal trends are further illustrated in **Figure 2-19**, which shows the average monthly consumption for single-family residential, multi-family residential, and commercial and industrial customer classes by season for the period 2011-2015. As noted, for the purpose of comparing peak use rates with base usage, the summer season was defined as June through September (billed July through October). Single-family residential consumption rates were approximately 4 times greater during the summer than during the winter. Commercial and industrial water use also increased, but to lesser extents, during the summer. Most of this increase is tied to landscape irrigation, while some is related to use of water in cooling and refrigeration or otherwise explained by the nature of a manufacturer. For example, wood product facilities tend to use greater volumes of water during the summer and into the fall.

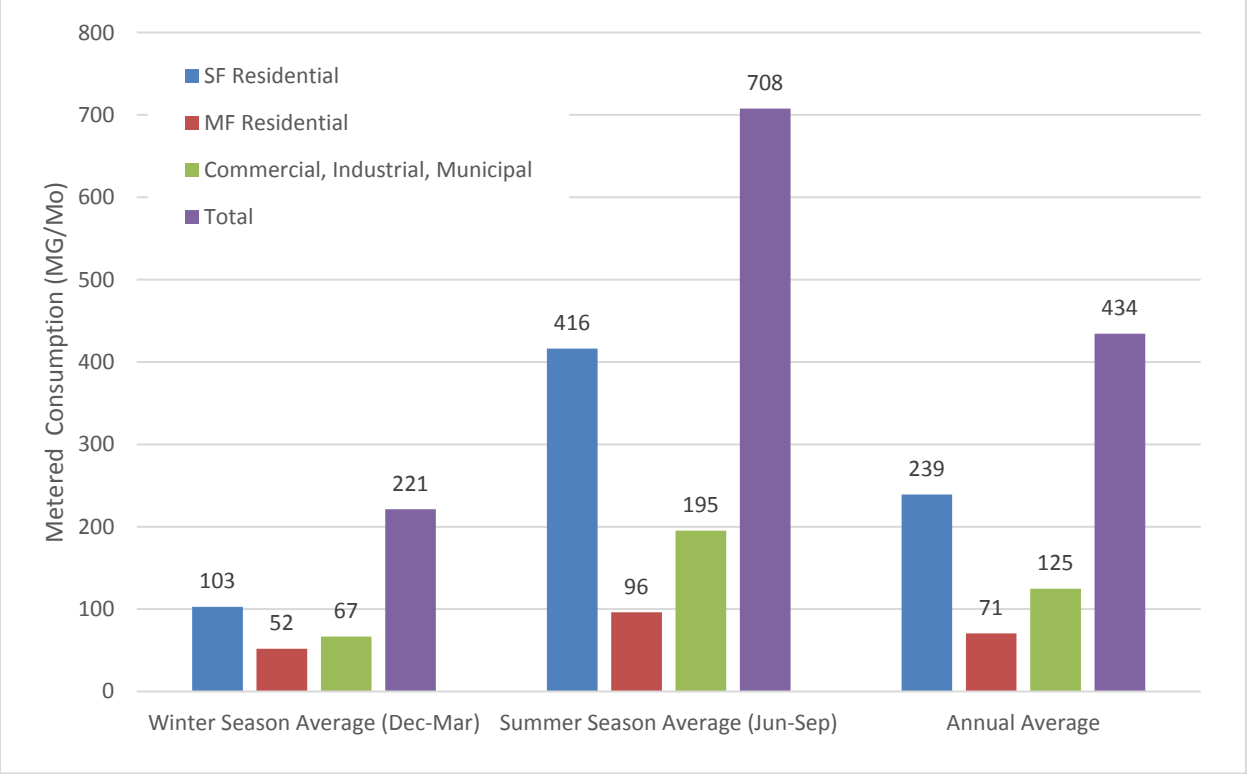


Figure 2-19. Seasonal Water Consumption by Customer Category within Medford City Limits, 2011 to 2015

The average monthly consumption for the four "summer" months was 708 MG per month (22.8 mgd) compared to an annual average of 434 MG per month (14.0 mgd) and a wet season average of 221 MG per month (7.1 mgd). A dry season to wet season ratio of approximately 3.2 (708/221 = 3.2) is typical of water utilities that provide a high proportion of summer water supply to meet demands for outdoor irrigation and seasonal manufacturing requirements.

If wintertime consumption is assumed to be representative of annual indoor water use (or at least to exclude outdoor irrigation) for residential and municipal customers, the winter season average rates of 103 MG per month for single-family residential customers, 52 MG per month for multi-family residential customers can be applied to a 12-month period to determine the average annual indoor use. Under this assumption, water used for irrigation is the difference between total use and the calculated indoor use.

Figure 2-20 presents the average annual indoor and outdoor use by category for the period 2011 through 2015. Outdoor use represented approximately 57 percent of annual use by single-family residences and 26 percent of use by multi-family residences. This suggests that conservation efforts targeting outdoor use by single-family residential customers could reduce peak season water demands. Conservation efforts targeting indoor water consumption may also prove beneficial.

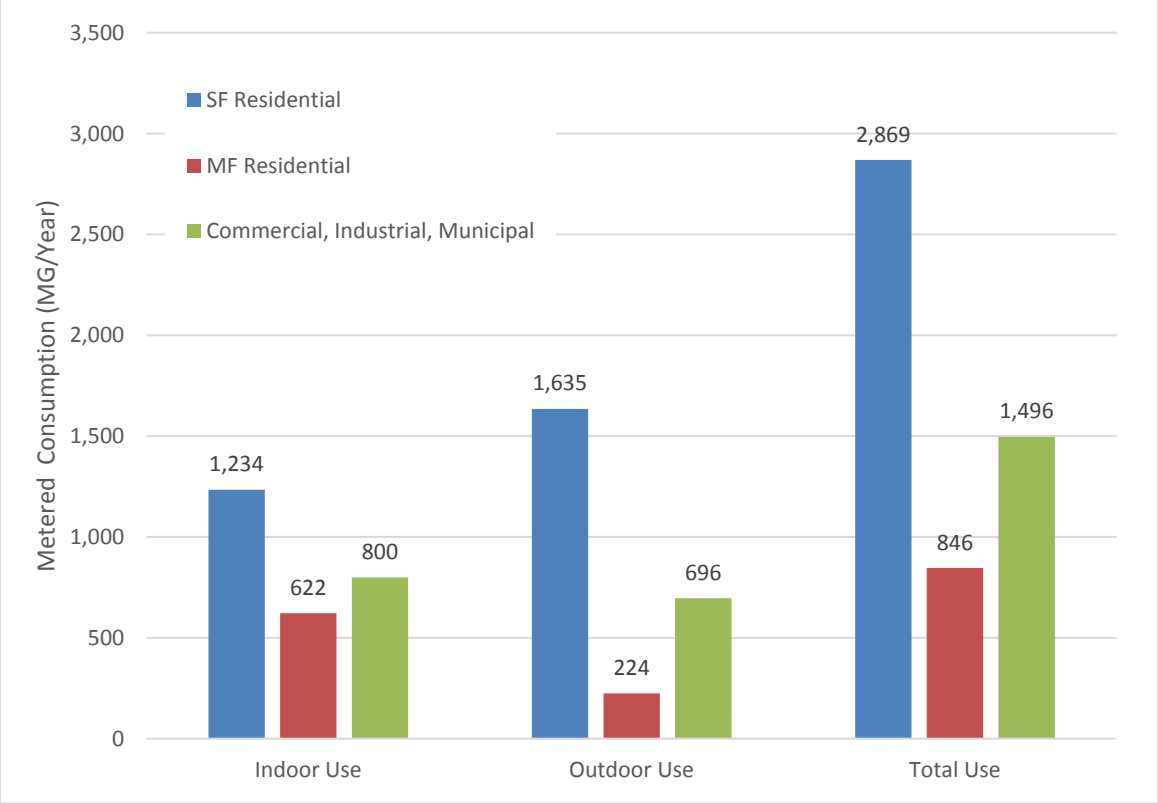


Figure 2-20. City of Medford Average Annual Indoor and Outdoor Metered Consumption by Category (2011-2015)

Water Rights

Water Law Introduction

Under Oregon water law, with few exceptions, the use of public water (both ground and surface water) requires a water right permit from OWRD. The administration of water rights by OWRD is based on the doctrine of prior appropriation. Under this doctrine, in times of shortage the first person to have obtained a water right permit (the senior appropriator) is the last to be limited in low water conditions. The date of application for the water right permit usually establishes the priority date or place in line of an appropriator. In water-short times, the senior appropriator can demand the full amount of their water right regardless of the needs of junior appropriators. If there is surplus beyond the needs of the senior appropriator, the next most senior appropriator can take as much as needed to satisfy their right and so on down the line until there is no surplus. A state officer (OWRD Watermaster) oversees which junior appropriators must stop using water so that senior users can be satisfied.

The right to use water is typically first granted in the form of a water use permit. The permit describes the priority date, the amount of water that can be used, the location and type of water use, and often a number of water use conditions. The permit allows the water user to develop the infrastructure needed to put the water to full beneficial use – a requirement of Oregon water law. Upon development and utilization of the permitted water, a report called a Claim of Beneficial Use (COBU) can be filed. Once it is approved by OWRD, a water right certificate is issued confirming the status of the right. Obtaining a water right certificate is the best way to ensure the protection of the use. Municipal water use certificates are not subject to cancellation because of nonuse.

Water right permits typically have timelines for making full beneficial use of the water. If more time is needed than provided in the permit, the permit holder may request an extension of time from OWRD. In the past, extensions of time were routinely granted by OWRD. Under current rules, an extension of time may involve an analysis of what would happen to state and federally listed fish species if the undeveloped portion of the permit were to be used.

MWC Water Rights

MWC is authorized to use the waters of the Big Butte Creek Watershed and the Rogue River for municipal use through six water rights, summarized in **Table 2-14**. MWC also holds a number of irrigation rights in the Big Butte Creek Watershed, described in the Other Rights section below.

Municipal Rights

Big Butte Creek Watershed. MWC has five municipal water rights in the Big Butte Creek Watershed that authorize diversion from Big Butte Springs and Four Bit Creek, as well as from storage in Willow Creek Reservoir. MWC's oldest, or most senior water right is a 1915 right for 30 cfs (19.4 mgd) from Big Butte Springs (Certificate 53323). MWC's next oldest water right dates from 1923. This right is for an additional 30 cfs (19.4 mgd) from Big Butte Springs (Permit S-6703). A portion of this right, 10.8 cfs (7.0 mgd) has been certificated (Certificate 86994), bringing the total certificated flow from Big Butte Springs to 40.8 cfs (26.4 mgd), which is the current capacity of the pipelines from the Big Butte Springs facility. In 1925, the Oregon Legislature also allocated all remaining unappropriated water within the Big Butte Creek drainage to Medford (ORS 538.430). Subsequently, MWC acquired a water right permit enunciating this legislative action but without identifying any specific quantity (Permit S-6884). MWC obtained additional permits in 1949, and subsequently completed construction of Willow Creek Reservoir. Permit R-1118 allows storage of up to 10,000 acre-feet in the reservoir. A total of 8,320 acre-feet of storage has been certificated (Certificate 87017). Permit 20177 allows MWC to take 95 cfs from storage (to mitigate impacts to downstream rights held by Eagle Point Irrigation District, which shares the same priority as MWC's rights) and to take 7 cfs (4.5 mgd) from Big Butte Springs on Willow Creek. Flow from Willow Lake Reservoir, up to 46.5 cfs (30.1 mgd), was certificated (Certificate 86995)

Table 2-14. MWC Municipal Water Rights

Application No.	Permit No.	Priority Date	Certificate Number	Source as Identified in Water Right	Facility Name used by entity	Allowed Rate (cfs)	Allowed Rate (mgd)	Actual Diversion: Maximum Instantaneous Rate Diverted to Date (cfs)	Actual Diversion: Maximum Instantaneous Rate Diverted to Date (mgd)	Authorized Completion Date	Notes or Limitations to water use
S-10119	S-6704	8/21/1915	53323	Big Butte Creek[a]		30	19.4	30	19.4	N/A	Pipeline capacity from Big Butte Creek/Springs is currently limited to 40.8 cfs (26.4 mgd).
S-8092	S-6703	10/20/1923	86994	Big Butte Spring[a]		10.8	7.0	10.8	7.0	N/A	Pipeline capacity from Big Butte Creek/Springs is currently limited to 40.8 cfs (26.4 mgd).
			--			19.2	12.4	0	0.0	10/1/2056	Pipeline capacity from Big Butte Creek/Springs is currently limited to 40.8 cfs (26.4 mgd). Fish persistence conditions are expected to limit access to water under this permit.
S-10120	S-54935 (replaced S-6884)	5/28/1925	--	Big Butte Creek and tributaries and Big Butte Springs[a]		All remaining unappropriated water		3.1	2.0	10/1/2056	Fish persistence conditions are expected to limit access to water under this permit.
R-24210	R-1118	10/17/1949	87017	Willow and Fourbit Creek[a,b]	Willow Lake Res.	8,320 acre-feet		8,320 acre-feet		N/A	N/A
			--			1,680 acre-feet		0	0.0	10/1/2056	Willow Lake Reservoir's capacity is currently 8,320 acre-feet.
S-24211	S-20177	10/17/1949	86995	Willow Lake Reservoir[a,b]		46.5	30.1	46.5	30.1	N/A	Water is released from Willow Lake Reservoir to compensate Eagle Point Irrigation District for MWC's diversion of water from Big Butte Springs. Pipeline capacity from Big Butte Creek/Springs is currently limited to 40.8 cfs.
			--	Big Butte Springs and Willow Lake Reservoir[a,b]		55.5	35.9	0	0.0	10/1/2056	
						(7 cfs from Big Butte Springs, remainder from reservoir)					
S-29527	S-23210	10/22/1954	86832	Rogue River[c,d]	Duff WTP	60.85	39.3	60.85	39.3	N/A	N/A
			--			39.15	25.3	-		10/1/2050	The Duff WTP capacity is currently approx. 70 cfs (45 mgd). Fish persistence conditions are expected to limit access to water under this permit.

[a]No fish species on state or federal endangered species list occur in proximity to Big Butte Springs or Willow and Four Bit Creeks. Threatened coho occur several miles downstream from points of diversion. Willow Creek is on the Oregon Department of Environmental Quality's (DEQ's) 303(d) list for temperature from river mile (RM) 0 to 4.5. Big Butte Creek from RM 0 to 11.6 is on DEQ's 303(d) list for dissolved oxygen, *E. coli*, and temperature. There are no critical groundwater areas in the vicinity.
[b]Water impounded per Certificate 87017 and released under Certificate 86995 is not used for MWC potable water supply. This water is released for use by Eagle Point Irrigation District in exchange for maximum use of Big Butte Springs' water by MWC.
[c]At the point of diversion, the Rogue River offers spawning and rearing habitat for threatened coho. It is six miles upstream from the nearest 303(d) designation (for temperature). The Rogue River is 303(d) designated for fecal coliform from RM0 to 27.2 year-round, and from RM 94.9 to 110 during the summer. There are no critical groundwater areas in the vicinity.
[d]Total Rogue River withdrawals represent all water withdrawn at Duff WTP, and include water withdrawn under water rights held by Central Point, Eagle Point, Jacksonville, Phoenix, and Talent.

Note:
N/A = Not applicable

About 46.5 cfs (29.7 mgd) of water has been diverted from storage in Willow Creek Reservoir (Certificate 86995) in exchange or substitution for water authorized under Eagle Point Irrigation District rights with concurrent priority dates. Water stored in the reservoir is supplied to the district during the irrigation season in exchange for higher-quality water taken from Big Butte Springs by MWC. MWC's storage permit allows impoundment of 10,000 acre-feet, but the reservoir's current capacity is limited to 8,320 acre-feet.

In summary, MWC's authorized diversions for municipal use from the Big Butte Creek Watershed (including from stored waters) total 162 cfs (104.7 mgd) plus the amount of water that may ultimately be available under permit S-6884 and the associated legislative withdrawal. Of these existing water rights, current maximum beneficial use is approximately 90.5 cfs (58.5 mgd). MWC is currently seeking extensions of time for the noncertificated portions of Permits S-20177 and R-1118.

Rogue River. MWC holds a 1954 municipal water use permit (Permit S-23210) for withdrawing 100 cfs (65 mgd) from the Rogue River about three miles north of Medford's city limits. This source supplies the Duff WTP. Of this right, 60.85 cfs (39.3 mgd) was certificated (Certificate 86832) for use by Medford. Permit S-23210 for 39.15 cfs has been extended to 2050 with fish persistence conditions. MWC plans to expand the plant capacity to 100 cfs (65 mgd) in approximately 2022. This would reach the initial design capacity for this facility, and would equal the full use of Permit S-23210. However, since this facility also treats water associated with water rights held by other cities served, further expansion of the Duff WTP will be needed to fully exercise MWC's Rogue River water rights.

Other Rights

As shown in **Table 2-15**, MWC also holds eight certificated water rights for irrigation of 717 acres in the vicinity of Big Butte Springs. These rights were attached to properties acquired by the commission through its watershed protection program. The most senior right dates from 1905 and the most junior right dates from 1920. Combined diversion allowed under these rights during the summer irrigation season totals approximately 9 cfs (5.8 mgd). Currently, the lands are irrigated to produce hay for local sale. MWC is considering transferring these rights to municipal use in the future.

Table 2-15. Summary of Irrigation Water Rights

Water Right Application/ Permit/Decree/ Certificate	Source	Priority Date	Type of Beneficial Use	Max. Authorized		Max. Withdrawal to Date		Average Monthly Diversion for the Previous Year	Authorized Date for Completion
				Rate (cfs)	Duty (af-ft/ac)	Rate (cfs)	Duty (af-ft/ac)		
Rogue River Decree Cert: 15846	Four Bit Creek	1905	Irrigation	0.42	4.5	0.42	Up to 4.5	Not Available	N/A
App: S-5269 Permit: S-3283 Cert: 9821	Four Bit Creek	11/27/1916	Irrigation and domestic	0.40	4.5	0.40	Up to 4.5	Not Available	N/A
App: S-5744 Permit: S-3550 Cert: 5107	Two Springs Tributary to Four Bit Creek	10/17/1917	Irrigation, livestock and domestic	1.83	4.5	1.83	Up to 4.5	Not Available	N/A
App: S-5823 Permit: S-3579 Cert: 4898	Four Bit Creek	11/2/1917	Irrigation	3.13	4.5	3.13	Up to 4.5	Not Available	N/A
App: S-7336 Permit: S-4637 Cert: 6740	Willow Creek	6/10/1920	Irrigation	1.63	4.5	1.63	Up to 4.5	Not Available	N/A
App: S-7613 Permit: S-4854 Cert: 7434	Four Bit Creek	11/12/1920	Irrigation	1.0	4.5	1.0	Up to 4.5	Not Available	N/A

Other City Water Rights

The six other cities served wholesale by MWC also hold water rights diverted at the Duff WTP, which are summarized in **Table 2-16.** These rights are applied toward these cities' usage during the summer period.

Table 2-16. Water Rights Held by Other Cities with Points of Diversion at Duff WTP

City	Water Right	Maximum Authorized Rate (cfs)	Maximum Authorized Volume (ac-ft)	Completion Date	Source
Ashland	S-54337	No rate given	1,000	9/7/2021	Lost Creek Reservoir
Central Point	T-9900	1.846	666	10/1/2011	Rogue River
	T-10120	1.13	No duty given	10/1/2012 COBU pending	North and South Forks Little Butte Creek
	T-10465	1.2	447.6	10/1/2014 COBU pending	North and South Forks Little Butte Creek, and Four Mile Lake Reservoir and waters draining into Cascade Canal and Fish Lake Reservoir
	Subtotal	*4.176*	*1,113.6*		
Eagle Point	Certificate 88552	0.9	321.3	N/A	Four Mile Lake and Fish Lake Reservoirs
	T-10527	0.5	181.5	10/1/2013 COBU pending	Four Mile Lake Reservoir and waters draining into Cascade Canal and Fish Lake Reservoir
	T-10614	1.15	273.7	10/1/2015	Four Mile Lake Reservoir and waters draining into Cascade Canal and Fish Lake Reservoir
	T-10960	1.77	520.3	10/1/2016	Four Mile Lake Reservoir and waters draining into Cascade Canal and Fish Lake Reservoir, and North and South Fork Little Butte Creeks
	Certificate 85409	1.25	356.94	N/A	Four Mile Lake Reservoir and waters draining into Cascade Canal and Fish Lake Reservoir
	Subtotal	*5.57*	*1,653.74*		
Jacksonville	Certificate 87360	No rate given	400	N/A	Lost Creek Reservoir
	Permit S-54974	No rate given	200	11/19/2035	Lost Creek Reservoir
	Subtotal		*600*		
Phoenix	Permit S-47672	5	400	10-01-2001a	Lost Creek Reservoir and Rogue River
	Permit S-52650	3.1	600	10-01-1999a	Lost Creek Reservoir
	Subtotal	*8.1*	*1,000*		

Table 2-16. Water Rights Held by Other Cities with Points of Diversion at Duff WTP

City	Water Right	Maximum Authorized Rate (cfs)	Maximum Authorized Volume (ac-ft)	Completion Date	Source
Talent	Permit S-53898	No rate given	759	10/1/2065	Lost Creek Reservoir
	Certificate 91134	No rate given	533	N/A	Lost Creek Reservoir
	Subtotal		*1,292*		
Total		**17.846**	**6,659.34**		

[a]Extension of time application pending for this permit.

Notes:
COBU = Claim of Beneficial Use
N/A = Not applicable

Aquatic Resource Concerns

Anadromous fish species are present in the Big Butte Creek watershed, including Chinook and coho salmon and winter and summer steelhead. Only coho are listed as threatened (under the federal Endangered Species Act). However, the limit to their distribution is several miles downstream from MWC's Big Butte Springs diversions; coho are not present in the diversion reaches proper. Big Butte Creek is on DEQ's 303(d) list as water quality limited for dissolved oxygen, *E. coli*, and temperature from its mouth to the junction of the North and South Forks—some 7 river miles downstream of Big Butte Springs. The stream reaches near Big Butte Springs are not on the 303(d) list.

A number of anadromous fish species are present in the middle Rogue River, including coho, Chinook, and steelhead, of which only the Southern Oregon/Northern California Coast (SONCC) coho salmon is listed under the federal Endangered Species Act (Threatened). The middle Rogue River is considered critical habitat for SONCC coho (NMFS, 2014). There are several significant off-channel areas in the middle Rogue River with potential for use by salmon (DEA, 2016). Adult coho have rarely been observed spawning in the mainstem Rogue River, except in the immediate vicinity of Cole Rivers Hatchery where hatchery coho return (Oregon Department of Fish and Wildlife, 1989). Juvenile coho do not rear in the mainstem Rogue River; rather, they remain in the tributaries until out-migration during the spring freshet (DEA, 2016).

The substrate in the middle Rogue River consists of resistant cemented gravels that can act as sills or weirs, potentially forming beneficial riffles (Klingemann, 1987). These areas are currently stable relative to other portions of the river where the bed is more readily movable. Flow patterns can change easily with the deposition of gravel and cobble in other reaches of the river.

Temperatures in the middle Rogue River average between 16 and 17°C and are within the optimal range for migrating adult salmon, thus presenting no thermal barriers to migration.

The biggest water quality concerns in the middle Rogue River are bacteria, temperature, dissolved oxygen, nutrients, pH, chlorophyll a, altered hydrology, habitat modification, sediment/turbidity, and mercury. Nitrates, bacteria, arsenic, and fluoride are of moderate concern for water quality (DEQ, 2012). The middle Rogue River is water quality limited year round for *E. coli.*

Withdrawals

A summary of the monthly, daily, and average annual withdrawals from the BBS, Rogue River, and Willow Creek/Lake for water year 2014-2015 is presented in **Table 2-17.** Average daily, monthly, and annual withdrawals for the period 2011 through 2015 are presented in **Table 2-18**. These withdrawals are made under MWC's municipal water rights shown in Table 2-14 and those of other cities shown in Table 2-16.

Table 2-17. MWC's Daily, Monthly, and Annual Water Withdrawals for Water Year 2014-2015

	Big Butte Springs		Rogue River (Duff WTP)		Willow Creek/Lake	
Month	**Monthly (MG)**	**Average Daily (mgd)**	**Monthly (MG)**	**Average Daily (mgd)**	**Monthly (ac-ft)**	**Average Daily (ac-ft/d)**
January	613	19.8	0	0.0	0	0.0
February	554	19.8	0	0.0	0	0.0
March	613	19.8	0	0.0	0	0.0
April	554	24.4	3	0.1	0	0.0
May	819	26.4	193	6.2	0	0.0
June	792	26.4	504	16.8	84	2.8
July	819	26.4	723	13.3	803	25.9
August	819	26.4	596	19.2	1,414	45.6
September	792	26.4	404	13.5	1,279	42.6
October	819	26.4	65	2.1	351	11.3
November	706	23.5	0	0.0	0	0.0
December	613	19.8	0	0.0	0	0.0
Average Annual	**8,692**	**23.8**	**2,487**	**6.8**	**3,931**	**10.8**

Table 2-18. MWC's Average Daily, Monthly, and Annual Water Withdrawals for the Period 2011-2015

Month	Big Butte Springs		Rogue River (Duff WTP)		Willow Creek/Lake	
	Monthly (MG)	Average Daily (mgd)	Monthly (MG)	Average Daily (mgd)	Monthly (ac-ft)	Average Daily (ac-ft/d)
January	613	19.8	0	0.0	0	0.0
February	559	20.0	0	0.0	0	0.0
March	613	19.8	0	0.0	0	0.0
April	653	21.8	11	0.4	0	0.0
May	805	26.0	168	5.4	0	0.0
June	792	26.4	469	15.6	21	0.0
July	819	26.4	710	22.9	859[a]	27.7
August	819	26.4	677	21.8	993	32.0
September	792	26.4	420	14.0	908	30.3
October	819	26.4	57	1.9	201	6.5
November	702	23.4	0	0.0	0	0.0
December	620	20.0	0	0.0	0	0.0
Average Annual	**8,608**	**23.6**	**2,512**	**6.9**	**2,151**	**5.9**

[a]Excludes July 2012, anomalous data point.

Evaluation of Water Rights and Supply

As measured by water rights and source capacity, MWC is well-positioned to meet its long-term water supply needs. Supply constraints are imposed not by water rights capacity, but by current infrastructure. These constraints include the 26.4 mgd capacity of the transmission pipelines from Big Butte Springs, and the 45-mgd capacity of the Duff WTP.

MWC's municipal rights are senior in priority to many users in the Rogue River Basin, especially in terms of its Big Butte Springs source, where it has some of the oldest rights in that drainage. Based on the OWRD Web-based water right information system, the only downstream user of any size in the Big Butte Springs drainage is Eagle Point Irrigation District. In the Rogue River adjudication (a court process to define water rights predating the state permit process), the district was assigned an identical priority date as MWC for using the waters of Big Butte Creek. A cooperative arrangement between the two parties resulted in the Willow Creek Reservoir exchange system described above, thus making Big Butte Springs a very reliable source. MWC's supply standing was also buttressed by the law the Oregon Legislature passed in 1925 that designated the remainder of the water in the Big Butte Creek drainage for Medford's use. This is a strong protection that only a relatively few municipalities can claim. Consequently, only during drought conditions is the source stressed to the point where curtailment may be required.

MWC's 1954 diversion from the Rogue River represents its newest right, though it is now over 60 years old. This source is also quite reliable, with little, if any, water use restrictions historically. An instream right is established on the Rogue River above the former Gold Ray Dam, but because of its junior priority date (1959), it has not affected operation of MWC's Duff WTP.

MWC is securing the strength of its supply position by obtaining water right certificates. As summarized in Table 2-15, MWC has certificated or partially certificated all 5 of its municipal water rights. It has diverted water under four of these (S-6703, S-6884, S-20177, S-23210) and is evaluating future use under (S-6884). MWC is working with OWRD to provide information needed to maintain progress in developing the sources authorized under its water rights and as necessary to obtain extensions of time to develop the uses.

Big Butte Springs is a plentiful source of water, varying from approximately 25 to 35 mgd depending on climatic conditions. MWC's water rights allow full use (approximately 43 mgd) of this source, even exceeding what may be available naturally on an average basis. However, only 26.4 mgd currently can be conveyed through MWC's twin transmission lines. MWC continues to evaluate additional use of the Big Butte Creek drainage. This may occur through additional use of Big Butte Springs as allowed under S-20177 (which would require additional pipeline capacity), or potentially through additional winter storage. An additional point of diversion at the Duff treatment plant will allow more use of the drainage's unappropriated water (which is estimated to range between 30 and 50 cfs (20 to 32 mgd) during the summer low-flow period). At such time as replacement of the transmission main(s) from Big Butte Springs becomes appropriate from a maintenance standpoint, enlarging their capacity and further springs development may also be considered. While the springs output might at times be insufficient to fill enlarged pipelines during the summer months, increased pipeline capacity could enable this high-quality source to meet growing winter demands during high flow months.

MWC's allowed diversion from the Rogue River (approximately 65 mgd) is currently limited by a treatment plant capacity of 45 mgd. Since water rights held by the cities of Central Point, Eagle Point, Jacksonville, Phoenix and Talent are also processed at Duff WTP, MWC water rights treated at this facility are further reduced. MWC places a higher priority on increasing this capacity to meet most of its growing demand, rather than on any near-term expansion of Big Butte Springs facilities.

In summary, MWC has developed about 100 of the 169 mgd allowed under its water rights certificates and permits. Approximately 69 mgd remains in yet-to-be-fully-developed water right permits, excluding the unquantified water right permit based on the legislative withdrawal of Big Butte Creek.

SECTION 3

Water Conservation

MWC has been engaged in conservation activities for more than twenty years. MWC's first WMCP was submitted in March 2009, and a progress report was submitted in 2014. A current progress report, including information related to benchmarks from the 2014 progress report is presented in **Appendix B**. In conjunction with this plan, MWC reviewed and analyzed current and potential future conservation activities. **Table 3-1** summarizes MWC's conservation program benchmarks, both required and optional, that MWC plans to pursue during the period of 2016 through 2021. A discussion of the MWC's review and analyses of conservation measures also follows.

Table 3-1. MWC Summary of 5-year Conservation Benchmarks, 2016-2021

Objective/OWRD Requirement	Benchmark	Start Date/Frequency
Water Audits		
Perform annual water audits	Continue to refine annual statistical reports (audits) using the enhanced features of the new billing and finance software system that was launched in 2013.	Ongoing
Document unmetered water usage	Better define components of unbilled water; improve quantification of hydrant use, reservoir overflows, etc.	2016
	Better integrate accounted for nonrevenue water into annual statistical reports. Review AWWA M36 water audit/loss control procedures to confirm adequacy of our procedures	2017
	Survey other water providers to assess procedures for metering water utilized from hydrants associated with construction, pool filling, etc.	2017
	Begin a test program with a limited number of meters to assess impact of adding meters to hydrant devices.	2018
Metering		
Fully meter system	System is fully metered. Meters will continue to be installed for all new services	Ongoing
	Meter replacement program to AMI. First phase pilot FlexNet radio communication system anticipated to be installed within 2016.	2016: 1500 AMI radios per year
	Consider increase in rate of meter installation if feasible.	2020: 2000 AMI radios per year
Meter Testing and Maintenance		
	Continue ongoing meter testing, including field testing of meters 3" or larger.	Ongoing
	Add standard for test ports and bypasses to be installed with Omni T2 meters to facilitate field testing of these meters.	2016

Table 3-1. MWC Summary of 5-year Conservation Benchmarks, 2016-2021

Objective/OWRD Requirement	Benchmark	Start Date/Frequency
Rate Structure & Billing Practices		
Quantity-based billing	Continue current monthly billing that includes quantity-based billing.	Ongoing
Rate structure that encourages conservation	Consider adding another tier to single-family residential customer rates, and reducing quantity at which current third tier begins; not likely sooner due to comprehensive rate analysis having just been completed and acclimation to new computer billing software ongoing	2020-2021:
	Continue surcharges for unrepaired leaks. Threat and/or imposition of leak/ high use surcharges very effective at incentivizing leak repair	Ongoing
	Evaluate possible rate structure modifications for commercial, institutional and industrial customers and multi-family residential customers, including consideration of summer tiers based on extent to which winter use is exceeded. Also evaluate establishing a separate rate category for all irrigation accounts.	2020-2021
Leak Detection & Repair		
System leakage less than 10%	Current system leakage is less than 10%. Improve documentation of valid unbilled uses to enable more accurate identification of true losses. Continue to monitor nonrevenue water.	Ongoing
	Investigate improving documentation of excess BBS water overflowed at Capital Reservoirs during winter months to better assure this loss component is accurately quantified.	2017
Line replacement and maintenance programs	Add documentation of leaks including descriptions, photos, and locations to GIS.	2016
	Integrate existing pipe coupon database into GIS; continue going forward.	2017
	Continue to contribute funding toward future main replacements	Ongoing
	Maintain cathodic protection for Big Butte Springs transmission pipelines	Ongoing
	Maintain access to BBS transmission pipelines by clearing vegetation and improving access roads.	Ongoing
Minimize customer side leakage	Continue efforts to identify and encourage repair of customer leaks at current program level. Continue utilization of high-use surcharges. Addition of Flex Net and continued installation of AMI meters will help facilitate identification and verification of leaks.	Ongoing
	Explore acquiring additional Meter Masters for Conservation staff to better enable them to confirm and document suspected leaks on non-AMI meters.	2018
Public Education Programs		
Outreach and Education programs to encourage efficient water use	Review and update materials, including development of conservation brochures on various topics, such as landscape tips, leak detection and indoor water usage.	Ongoing
	Include a conservation outreach component in a formalized Public Information Plan	2017
	Continue development of enhanced website features, and increase promotion of them through bill messages, social media, newsletters and brochures; as well as paid advertising	Ongoing

Table 3-1. MWC Summary of 5-year Conservation Benchmarks, 2016-2021

Objective/OWRD Requirement	Benchmark	Start Date/Frequency
Outreach and Education programs to encourage efficient water use *(continued)*	Continue to pursue opportunities to expand use of print and broadcast media, including news/feature stories and paid advertising.	Ongoing
	Consider additional promotional opportunities, including yard signs, bus advertising, etc.	Ongoing
	Continue promoting EPA WaterSense products through outreach materials and rebate/incentive programs	Ongoing
	Seek radio presentation opportunities, and continue to be responsive to television interview requests. Expand outreach to seek additional presence on television news and feature stories.	Ongoing; 1 radio program every year and 1 TV feature every 2 years
	Continue and increase promotion of outreach with local service clubs	Ongoing
	Continue to build audience and develop regular conservation message presence on social media sites Facebook and Twitter	Ongoing: 40 posts per year
	Continue to leverage national events promoting conservation, such as the National Mayor's Challenge.	Ongoing
Schools/Youth education	Rebuild school conservation kit and develop a teacher packet with materials targeted to school education benchmarks, as well as specific to MWC water system, and the role of conservation in meeting local water needs.	2016-2017
	Distribute education materials online and directly through schools. Increase marketing to make teachers aware of availability of such materials, including the existing Conservation for Kids section in website and ongoing improvements thereto.	2017
	Expand and seek opportunities for school presentations, with conservation activities focused on elementary students. Continue to participate in youth education events.	2016
Outdoor Water Use (Public/Landscaping professionals and customers)	Continue offering a Lawn Watering Infoline (phone recording) giving up-to-date evapotranspiration-based sprinkling schedules and tips from spring through fall.	Ongoing
	Continue active membership in the Southern Oregon Landscape Association (SOLA). Provide training opportunities aimed at water efficiencies within the landscape for homeowners as well as landscape professionals.	Ongoing: 1 training event every 1 to 3 years
	Continue to seek landscape-oriented presentation opportunities.	Ongoing: 2 to 4 presentations per year
	Continue development of landscape-oriented website features. Increase promotion of these offerings (including existing water-wise gardening site, and real-time sprinkling times and tips) utilizing social media, news features, etc.	Ongoing. Evaluate annually
	Continue irrigation audit program	Ongoing; 70 ± audits per year
	Continue to participate in venues such as Spring Garden Fair and other community events promoting water conserving landscaping.	Ongoing; 1 to 3 events per year

Table 3-1. MWC Summary of 5-year Conservation Benchmarks, 2016-2021

Objective/OWRD Requirement	Benchmark	Start Date/Frequency
Multi-family residential properties, hotels, motels, commercial	Increase outreach to multi-family residential property owners and hotels relative to fixture replacement. Create a more systematic approach to working with local hotels, including promotion of WaterSense Hotel Challenge actions.	Ongoing: 4 new in-person contacts per year; 4 mailings per year.
	Continue networking with local rental owners association, including educating them on the financial benefits of reducing water usage, fixing leaks, etc.	Ongoing
	Concurrent with launch of urinal rebates, pursue outreach to entities such as the Chamber of Commerce, commercial malls, etc. to inform businesses about rebates and benefits of other water-conserving fixtures and actions.	2017
Technical & Financial Assistance Programs		
Provide technical and financial assistance to encourage efficient water use by customers	Continue conservation grant program for public/nonprofit entities. Increase outreach under this program	Ongoing; strive to maintain budget at current level of $20,000 per year.
	Continue irrigation audits; enhance targeting of high users	Ongoing
	Consider pilot program of cost-sharing incentives for largest commercial/industrial/institutional customers, with possible initial focus on cooling towers	2020-2021
	Re-convene Waterwise Landscape Committee to develop incentives for incorporating water efficiency measures in landscapes associated with new construction, including CII, multi-family and single family residential. For CII and multi-family developments, these will add to provisions in already-adopted landscape codes.	2016
	Evaluate adding rebates or other incentive for retrofitting existing landscapes and or irrigation systems	2017
	Research and evaluate cost-share programs and develop protocols for funding assistance for customers' leak repairs, and installation of pressure regulation upstream of all plumbing and irrigation components at existing residences.	2016
	Establish revolving fund(s) for leak repair and/or pressure regulation cost share program(s), with phased implementation.	2018-2019 budget year
	Consider incentive programs for better incorporating indoor water efficiency measures in new construction, possibly including isolated recirculating hot water systems.	2019
	Continue to make improvements to water-wise gardening web feature, providing a useful guide for implementing water-efficient landscaping in our region.	Ongoing
Fixture Retrofit/Replacement		
Implement fixture replacement programs	Continue toilet rebate program, which includes give-aways of water efficient shower heads and faucet aerators on an as-needed basis. Consider reducing incentive to make more funds available for other incentive programs.	Ongoing; 200 per year
	Initiate high efficiency urinal rebate program	2017

Table 3-1. MWC Summary of 5-year Conservation Benchmarks, 2016-2021

Objective/OWRD Requirement	Benchmark	Start Date/Frequency
Implement fixture replacement programs *(continued)*	Continue dialogue with city staff to identify opportunities to partner in fixture retrofits in city-owned facilities	Ongoing
Water Reuse/Recycling		
Consideration of reuse, recycling and non-potable water opportunities	Continue involvement and funding of the WISE project, which is exploring agricultural reuse of municipal wastewater	Ongoing
	No urban reuse anticipated within benchmark period. Wastewater treatment not under MWC's jurisdiction, urban reuse opportunities not currently cost effective, and availability of wastewater for urban uses dependent on outcome of WISE project	Beyond benchmark period
Other Conservation Measures		
Encourage conservation in new construction	Following a multi-year committee project, water-wise landscape codes for Medford were adopted June 2013, and went into effect December 2013. Conservation staff will continue to provide review of newly required irrigation plans.	Ongoing
	Attend Land Development meetings to make connections with developers, with the goal of working cooperatively to facilitate integration of water conservation measures in targeted large construction projects.	Ongoing; Attend 45 meetings per year
	Facilitate minor modifications to Medford's waterwise landscape codes. Once these are finalized, encourage adoption of similar codes by MWC's wholesale city customers.	2017
	Consider implementation of regulations for water recycling for facilities such as car washes, where single pass water usage is particularly wasteful. Be alert to pursue when comprehensive modifications to regulations are being conducted.	2020

Current Conservation Measures

MWC has implemented a significant water conservation program focused on the Commission's retail customers. Current activities relevant to water management and conservation include the following:

Annual Water Audit. MWC documents production and consumption of water monthly. Production meter issues in 2010, and implementation of a new billing and finance system in 2013, caused challenges to the normal statistical reporting, but a new report format and improvements were completed in February 2016.

In the past, MWC monitored unaccounted for water, and calculated the percent unaccounted for water based on total system supply minus the amount of water unavoidably overflowed at Capital Reservoir during the winter months as compared with sales. MWC has increased the detail of its water auditing. Beginning in 2009, MWC began to take steps to monitor and record estimates of unmetered but authorized water uses. Authorized but unmetered uses of water from hydrants is a major component, including main flushing, firefighting, city and county public works access, and construction uses. Construction use of water from hydrants is currently billed at a flat rate of $10 per day, without any metering, but MWC will be exploring metering options used by other utilities.

An effort is also underway to improve the accuracy of measuring overflow from the Capital reservoirs in recognition of the importance of monitoring reservoir overflow in a transparent and auditable manner. In keeping with IWA/AWWA water auditing methodology, MWC also now subtracts wholesale water sales from production values before calculating nonrevenue water percentages. MWC's water audits will be documented in MWC's five-year progress report.

System-Wide Metering. The MWC water system has been fully metered for decades. Over the last decade, MWC has been involved in full replacement of all of its meters, initially installing Automatic Meter Read (AMR) meters, and now AMI-capable meters. The initially installed AMR meters allow for radio reading, whereas the recently installed smart meters are capable of being radio read and employing advanced metering infrastructure (AMI) technology. A first phase project to install Flex Net is planned for later this year. In addition to enabling remote reading of the AMI capable meters, this will also provide office staff with access to real-time flow data from these meters, enabling quick identification of customer leaks. This type of meter technology also incorporates advances in meter technology, with the ability to detect lower flow rates than older model meters, thereby reducing an apparent loss component of nonrevenue water. Approximately 55 percent of all customer meters are less than 11 years old, with remaining meters being changed out to AMI capable models over a 5- to 10-year period.

Meter Testing and Maintenance. MWC tests all meters greater than 2-inches and all 1.5–inch turbine meters every 10 MG or every five years, whichever comes first. MWC tests all 1.5-inch and larger meters and 1 out of every 4 smaller new meters before installing them to ensure accuracy. All meters 3-inch and larger are installed with test ports and bypasses to facilitate field testing. MWC will be adding the installation of bypasses and test ports for Omni T2 meters in standards revisions later this year.

Rates. MWC uses an inclining block rate structure for single family residential (SFR) customers, which is favorable for encouraging water conservation. There are three rate blocks, both inside and outside city limits. Seasonal rates that increase during the summer apply to all other customers, including wholesale accounts. For example, SFR customers inside city limits in the Gravity Pressure Zone in 2016 are charged a base charge plus $0.52 per 1,000 gallons for the first 5,000 gallons of water used, $0.94 per 1,000 gallons for water use between 6,000 and 25,000 gallons, and $ 1.36 per thousand gallons for usage over 25,000 gallons. Tiers for other SFR customers (those outside city limits or in higher pressure zones) are similar, but higher than charges shown above.

Billing statements include a comparison of the monthly consumption for a full year, including the same month from the prior year. This enables customers to compare current usage with previous use, which can help them identify possible leaks or higher than normal consumption. Through an online portal, customers can also compare their usage with others on their street and the community as a whole.

A comprehensive rate analysis by an outside consultant was conducted in 2015, which confirmed that the current rate structure was appropriate and effective. The current structure has significant differences in charges between tiers and a reasonable differential between winter and summer rates, both of which encourage more efficient water usage during high use summer periods. MWC conservation staff nonetheless anticipates further analysis of the rate structures, with the possibility of changes such as adding a 4th tier and lowering the quantity at which the third tier begins for SFR customers, and consideration of incorporating tiers to summer rates of other customer groups, possibly based on the extent to which winter use is exceeded. Establishing a separate rate category for all irrigation accounts is also a likely consideration.

Any such changes to rate structures are not likely to occur in the next few years, however. MWC began migration to an entirely new computer billing software system in 2013, which became a multi-year acclimation process for Commission staff. Further complicating that process with billing structure changes has therefore been unrealistic, and in turn the thorough rate analysis completed in 2015 was

conducted with the objective of guiding rate analyses over the next several years under the general structure currently utilized.

Leak Detection. MWC has occasionally hired an outside leak detection company in recent years to survey limited portions of the distribution system. Pipe condition is also monitored through the use of coupons (small circular pipe sections removed when making main line connections), and coupon data indicate that pipelines are in very good condition. In 2013, a FCS S30 Surveyor sounding device was purchased to assist crews in locating leaks.

The MWC annually adds funds to a pipeline replacement fund to be used for future pipeline replacement and for unplanned projects resulting from city road construction activities. The fund balance in 2016 was $3,177,700.

MWC has provided cathodic protection to the Big Butte Springs pipelines for decades, which has been shown to minimize corrosion and in turn reduce the potential for leakage. However, a thorough analysis was pursued a few years ago, showing a few areas of vulnerability. MWC therefore acquired easements for and installed three additional anode beds, resulting in effective cathodic protection for the entire length of both pipelines. Significant work has also been done over the last ten years to improve access and visibility of these pipelines, which each cross approximately 30 miles of forest and farmland en route to town.

MWC addresses customer-side leaks with notifications enclosed in bills if unusually high water use is flagged by the billing system. Additionally, based on a review of water use each March, single family residential customers with higher than normal winter water use are typically notified via letter and phone to make them aware of possible plumbing leaks. Leak detection brochures and toilet dye strips are enclosed in these mailings.

MWC regulations also include a water waste provision allowing imposition of a 300 percent surcharge and/or termination of water service for customers deemed negligent of wasting water. While the surcharge is imposed infrequently, and termination even less so, they are valuable tools, with the threat of these actions often inspiring action when other efforts to encourage conservation or leak repair have proved unsuccessful. MWC's customer service staff actively pursues normal leaks, and passes those not quickly resolved on to conservation staff. A list of customers with the highest water usage within each customer group is also prepared monthly, which conservation staff reviews to identify excessive or unusual usage. Meter Masters and real-time data from AMI meters are also frequently utilized to verify and establish the magnitude of suspected leaks. These practices and tools, combined with direct contact with customers, have resulted in significant water savings, with a five-year total of largest leaks eliminated estimated at nine million gallons per month.

Public Information. MWC has a varied and active community outreach program and supports the following programs for public information relating to water conservation:

- Website has numerous conservation features:
  - Water Wise Gardening web feature, hosted by GardenSoft, launched June 2012; includes hundreds of photos and tips; MWC was first utility in Pacific Northwest to utilize a comparable tool; won PNWS-AWWA Excellence in Communication award
  - Evapotranspiration (ET) information provided and updated regularly during irrigation season, along with sample sprinkling times correlated to current ET
  - Many tips and links, both to internally developed material (such as local sample lawn watering schedules and sprinkler design tips) and to other relevant web sites
  - Conservation for Kids section, which also includes internally developed information and links to other kid-friendly sites

- Presence on social media sites Facebook and Twitter
- MWC is an EPA WaterSense Partner, and has participated in WaterSense promotions
- Lawn Watering Infoline (phone recording) provides up-to-date ET-based sprinkling schedules and tips from spring through fall
- Dissemination of sample lawn watering schedules, providing watering tips and suggested seasonally adjusted run times based on local weather and sprinkler types
- Significant networking with local "green industry," including active participation with Southern Oregon Landscape Association (SOLA), and sponsorship of related training opportunities
- Participation in venues such as Spring Garden Fair and employee events for local companies
- Water-wise landscaping presentations at various venues
- School presentations (occasional, upon request), mostly elementary, and have served as guest instructor for community college landscape workforce training program
- Assisted with and provided funding for assembly of a conservation study kit, which has been available for distribution to local schools and youth groups through a local environmental education group; MWC has now taken possession of this kit to improve on its content and marketing
- Participation at Kids 'N Bugs and Kids 'N Creeks (event held in a local park)
- Brochures (some purchased, some developed internally)
- Guest presenter at variety of venues, including radio gardening shows, garden fairs, Master Gardeners programs, local service clubs and drought forums
- Features in local newspaper, some specifically requested by MWC, others serving as information source upon request
- Promotion of various programs, such as signage prepared for stores and outreach to plumbers and rental owners association relative to toilet rebates
- Rotating videos displayed in main office include conservation messages
- Print media advertisements, primarily in Mail Tribune special supplements and in local Spanish newspaper
- Conservation articles in newsletters and in the annual Consumer Confidence Report
- Conservation messages included on face of billing statements; utilize a rhyming format to integrate a "fun" element to educational message
- Periodic interviews with TV and newspaper reporters
- Interaction with developers, building contractors, and landscape contractors to discuss and encourage more water efficient landscape designs

In 2015, a dedicated public information specialist was added to MWC staff, which will aid in expansion and improvement of MWC's public outreach efforts, including conservation-focused activities.

Irrigation Audits. Free irrigation audits (evaluations) to help customers better understand their sprinkler systems have been provided every summer since 2001. From 2009 through 2015, MWC provided 430 of these sprinkler assessments. In these audits, staff visits sites to educate customers about their sprinkler systems, identify maintenance issues, and provide appropriate watering schedules based on site-specific watering rates. Findings are presented during the audit, as well as in a follow-up report. Participants are also given free moisture meters to assist them in managing their irrigation.

While residential customers have been the primary participants, several parks, commercial sites, and churches have also been audited. Some participants are targeted based on high water usage, but the majority of audits are conducted at the request of property owners who have learned about the program through advertising or word of mouth.

In addition to the ability to teach property owners how to operate their irrigation systems effectively, these evaluations often lead to opportunities to communicate with landscape maintenance contractors. This offers an added potential benefit of the information provided being utilized on other properties maintained by these firms. Additionally, this program has led to significant expertise for MWC staff, along with insight on prevalent shortcomings of sprinkler systems being installed. That has been beneficial in identifying contractor training topics and outreach goals. Furthermore, these evaluations are favorable public relations opportunities, with considerable positive customer feedback. Therefore, while this program is relatively costly due to the considerable staff time involved, it is seen as a very beneficial component of MWC's conservation activities, and in turn is anticipated to be continued indefinitely.

Water-Wise Landscape Guidelines. Following a multi-year committee project, water-wise landscape codes for the City of Medford were adopted June 2013, and went into effect December 2013. These provisions apply to developments that are subject to normal Planning Department reviews, which generally includes all projects except for individual single family properties. Conservation staff remains very involved in implementation of the new codes, including providing review of newly-required irrigation plans.

Given the hot, dry summers in the MWC service area, the irrigation of landscaping is a huge component of water demands. While incentives for voluntary measures inspire some changes, efforts elsewhere have demonstrated that mandatory codes are far more effective. The passage and implementation of Medford's water-wise landscape codes is therefore considered a major factor in achieving water use reductions over time.

Development of supplemental voluntary incentive programs is also anticipated, but moving forward on those was delayed by the long time frame associated with adoption and subsequent implementation of the landscape codes. MWC conservation staff will continue to working with the City of Medford on some fine tuning of the recently-adopted codes, with one objective being an easily emulated model for the wholesale city customers to consider. MWC will also be exploring incentives for voluntary actions that improve landscape water efficiency. These would likely apply to single family residential properties, as well as expand on mandatory measures already applicable to properties subject to the new development codes.

Conservation Incentive Programs. MWC has provided financial support to several conservation programs. Irrigation auditor training has been sponsored, including partial tuition for public employees responsible for grounds maintenance at parks and school properties.

A Conservation Grants program provides incentives for public and non-profit agencies to pursue water conservation activities on their premises. Projects have included water-wise landscaping at City Hall and a fire station, retrofitting of traffic islands from grass to low water using plants, purchase of a weather station for scheduling irrigation in city parks, conversion of athletic fields from grass to artificial turf, and plumbing retrofits (high efficiency urinals and faucets) at local schools, and replacement of a lawn-dominated landscape with water-wise landscaping at a local church.

MWC's conservation focus and interaction with the City of Medford has led the city to pursue several water efficiency measures independently. The most significant measure is installation of artificial turf on playing fields throughout the U.S. Cellular Park. Sustainable principles were also employed in the design of the Oregon Hills Park.

As mentioned above, MWC will be considering other incentive programs focused on landscape irrigation and consideration of programs aimed at assistance for customer leak repairs.

Staff Professional Development. MWC staff actively participates in the Pacific Northwest Section of the American Water Works Association Conservation Committee. This involvement has included various training, such as instruction in performing commercial water audits. MWC conservation staff also attend conservation-oriented conferences, such as those sponsored by the Alliance for Water Efficiency (AWE).

Fixture Retrofit and Replacement. A toilet rebate program was implemented in 2009. Efficient shower heads and aerators are offered in conjunction with toilet rebates and available upon request at the customer service counter. In conjunction with its conservation grants program, MWC has also worked with the Medford school district to replace urinals with 1/8 gallon per flush models, and has participated in a few other small scale fixture replacement projects. The primary additional indoor retrofit program is anticipated to focus on more widespread replacement of urinals with high efficiency models.

Use and Reporting Program

The Medford Water Commission has a water use measurement and reporting program that complies with the measurement standards in OAR Chapter 690, division 86.

Required Conservation Programs

The Oregon Administrative Rules for Water Management and Conservation Plans require that all water suppliers establish five-year benchmarks for implementing the following required conservation measures:

- Annual water audit
- System-wide metering
- Meter testing and maintenance
- Unit-based billing program
- Leak detection and repair (if system leakage exceeds 10 percent)
- Public education

As described in the preceding subsection, MWC has implemented all of the above measures. MWC conducts annual water audits, is fully metered, and has an active meter testing program. They also utilize inclining block and seasonal rate structures. MWC conducts public outreach through a variety of means, including printed and electronic media, presentations and irrigation audits. MWC has pursued leak detection measures and followed up with repairs or pipe replacements as leaks have been identified.

Additional Conservation Measures

MWC has a diverse conservation program, and many of their activities go above and beyond the minimum conservation program requirements. For example, MWC conservation staff worked with the City of Medford to develop and implement landscape and irrigation related development codes that integrate water efficiency principles. As this effort targeted the most significant use of water during peak summer periods, focusing on installation of climatically appropriate landscaping and efficient irrigation systems from the start, MWC conservation staff considers this to be a highly meaningful accomplishment. Some minor fine tuning of these codes is anticipated, after which MWC will encourage other cities that purchase MWC water to consider adoption of comparable provisions.

The current and new conservation measures listed in this chapter and summarized in Table 3-1 will be implemented to promote sustainable use of MWC's water supply and to help defer capital improvements costs. However, conservation measures will not preclude the need for securing additional long-term water supply.

Expanded Use Under Extended Permits

MWC plans to develop water rights associated with extended permit S-23210 which involves diverting water from the Rogue River, an area with resource issues. Under these circumstances, affected water suppliers are required to develop leak repair and line replacement programs within 5 years that will reduce system-wide leakage to less than 15 percent. MWC's current annual leakage is estimated at less than 10 percent. This rule therefore doesn't apply to MWC, although they will continue actions to keep water losses to a minimum.

Expanded Use Under Extended Permit S-23210

Under this rule requirement, a water provider that serves a population greater than 1,000 and intends to expand use under extended permits for which resource issues have been identified shall establish 5-year benchmarks for implementing a number of listed conservation measures or document that the measures are neither feasible nor appropriate.

A summary of the 5-year benchmarks for additional conservation measures developed by MWC are contained in Table 3-1. Further descriptions of the additional conservation measures evaluated are presented below.

Analyses of Potential New Conservation Measures

MWC is committed to continue implementing new conservation measures to maximize the benefits of their water resources. In deciding which measures to implement, MWC generally has identified conservation measures that are expected to provide the most water savings compared to their implementation costs. This section explains the analysis of potential measures.

The cost to produce water during the peak season is higher than the non-peak season, because Rogue River water must be pumped and treated more extensively than water from the BBS. Therefore, reducing peak season water demands has the largest impact on water production costs. More efficient water usage during peak periods also has the greatest potential for helping to delay infrastructure expansions, from pipelines and pump stations to treatment plants.

As described in Section 2, for the period 2011 through 2015, approximately 57 percent of water used by single family residential customers within the City of Medford was for outdoor purposes, primarily landscape irrigation, and the remaining 43 percent was used for indoor purposes. Other retail customer categories had lower rates of outdoor use, but as multi-family residential and commercial, institutional and industrial categories tend to have larger irrigated land areas, selectively targeting some of those customers may also reap benefits.

MWC's conservation activities currently have a significant focus on outdoor water use through diverse activities ranging from educational offerings such as conservation brochures and website features to irrigation audits and a grant program that has financed water efficient landscapes.

MWC has successfully implemented a toilet rebate program, and is considering adding a urinal rebate program. They also offer free shower heads and faucet aerators upon request.

In conjunction with this plan, the AWE Water Conservation Tool was used to provide a benefit cost analysis of existing and potential new conservation measures. This tool provides a standardized methodology for water savings and benefit-cost accounting and includes a library of pre-defined conservation activities with typical water savings parameters based on actual conservation program experience.

It is recognized that programs targeting customers using large amounts of water address significant amounts of the overall water demand in the system, both for average and maximum day. Conservation programs that focus on reductions in indoor use realize reductions year round, reducing both the average annual and maximum day demands. While programs that target irrigation don't impact winter demands, they can play a very significant role in reducing demands during high use periods, including maximum day demands. Supply-side programs such as leak detection and repair contribute to reductions in both average and maximum day demands.

Outdoor irrigation savings can be achieved through programs such as promoting the use of weather-based irrigation devices, or replacement of turf with less thirsty plants. Reductions in indoor use can be accomplished by fixture replacement programs, such as high efficiency toilets which replace older toilets using 3.5 gallons or more per flush with WaterSense certified toilets that use 1.28 gallons per flush, which exceed current plumbing standards of 1.6 gallons per flush. MWC has made considerable progress in market penetration with its toilet rebate program, and has also supplied 2.0 gpm shower heads and efficient aerators upon request. While these shower heads and aerators are more efficient than current codes and have much lower flow rates than older fixtures, they are a smaller component of overall water usage, and not seen as an action with potential for significant additional water savings.

The AWE tool determines a unit cost in dollars per million gallons (MG) of water saved, based on estimated costs of various conservation activities. These costs include initial fixed and per unit costs as well as annual follow-up costs for program promotion or evaluation. Conservation program costs include labor performed by utility staff, direct expenses (including amounts rebated as well as peripheral costs such as printing for public education brochures), and contract costs (such as the cost for hiring a leak detection company). While an effort was made to determine realistic costs for the programs evaluated, actual unit costs that incorporate more detailed accounting of expenses are likely to be higher than what is presented here. Under the model, unit benefit in dollars per MG produced is calculated based on both the production cost of water and, if applicable, the cost to treat wastewater. However, MWC is not responsible for treating wastewater, so only has saved water production costs to offset the cost of conservation measures. As the operator of the wastewater treatment facility, the City of Medford therefore benefits from reduced sewer loads from indoor conservation measures funded by MWC.

Following are programs evaluated:

1. High efficiency toilet rebate programs
2. Distribution of efficient showerheads
3. Urinal rebate programs (Commercial/Industrial/Institutional [CII] customer)
4. Rebates for high efficiency clothes washers
5. Conductivity-based cooling system upgrade
6. Landscape audit programs
7. Weather-based ("smart") irrigation controller rebates
8. Landscape turf replacement programs
9. Rebates for waterwise landscaping with new construction

Model assumptions used in the analyses are included in **Appendix C,** and **Figure 3-2** presents the calculated unit cost of each program in dollars per million gallons saved. As noted, while costs and activity levels used were based on preliminary estimates made by MWC conservation staff, actual costs and water savings will vary depending on the actual level of staff effort required to implement specific programs, actual amounts of incentives offered and the level of participation by customers. Typical costs

for water loss control measures (leak detection and repair) based on a 90% confidence interval of seven U.S. water loss control programs is included for comparison to other conservation measure costs.

The estimated cost of production of BBS water is $66 per MG, and the cost of production of water at the Duff WTP water is approximately $500 per MG, according to values provided by MWC. None of the measures in **Figure 3-1** have unit costs less than BBS or the blended cost of BBS and Duff WTP and only one cost less than the cost of production at Duff WTP. Therefore none meet the typical standard for adoption, being that the financial benefit is less than the cost. However, that has been the case throughout the 20+ years that MWC has operated a conservation program, and their program has moved forward despite this impediment. Rather, actions have been pursued based on the premise that conservation is logical and appropriate, and upon the potential to delay the need for new additional infrastructure, particularly new treatment facilities that will eventually be needed to treat additional Rogue River water.

While this model considers avoided costs associated with adding treatment and distribution capacity, landscape retrofit/turf replacement measures addressing peak usage would score more favorably due to their potential to defer expensive infrastructure improvements specific to their seasonal requirement. As this is considered an important factor for MWC, these actions remain under consideration, despite a high cost relative to benefit based on current costs.

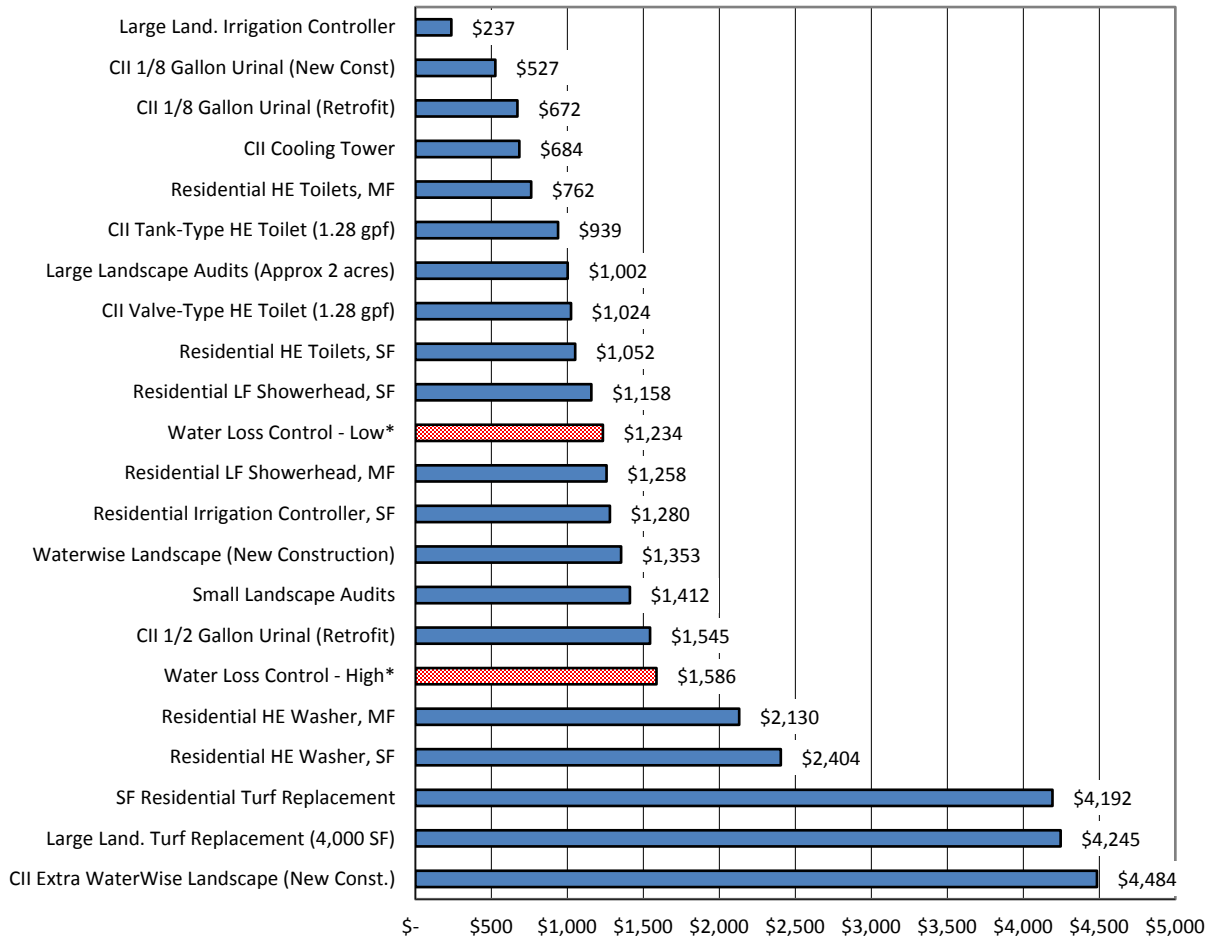


Figure 3-1. Calculated Conservation Measure Unit Cost in Dollars per MG Water Saved

A blended cost of production based on the relative contribution of the two water sources was used to estimate benefit to cost ratios for each program. These ratios are shown in **Figure 3-2**. A benefit to cost ratio greater than one indicates that MWC can recoup the cost of a conservation program through savings in water production costs. A benefit to cost ratio less than 1 indicates that a conservation program costs more to implement than the value of the savings. This kind of comparison does not take into account non-quantifiable environmental benefits for reduced water withdrawals. It also does not capture the avoided costs for expanding supply capacity.

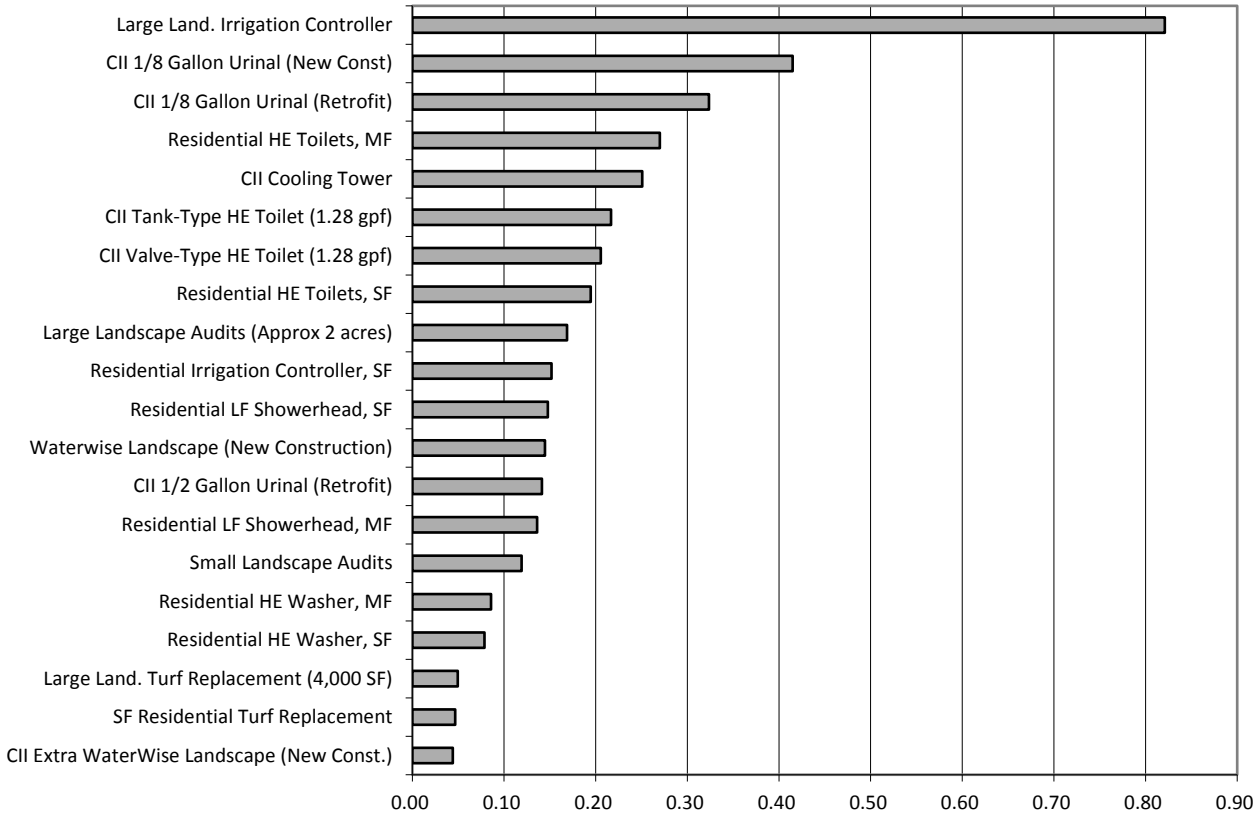


Figure 3-2. Benefit to Cost Ratio for Proposed Conservation Measures

Water Reuse

The Division 86 rules indicate that utilities shall implement, if feasible, water reuse, recycling, and non-potable water opportunities (690-086-0150 6(e)).

MWC has been an active participant in the Water for Irrigation, Streams, and Economy (WISE) project, a collaborative water management program for the Bear Creek and Little Butte Creek watersheds in Jackson County. Among other components, this project is exploring opportunities for agricultural reuse of wastewater generated by the regional treatment plant. The wastewater treatment plant is owned and operated by the City of Medford under a regional governance agreement, so implementation of reuse is not under the MWC's guidance or control. The WISE project is an activity that may not directly benefit water supplies available for use by MWC, but furthers other regional water efficiency efforts.

At this time, the WISE project appears to be the most realistic reuse opportunity. The regional wastewater treatment facility is not located in close proximity to the majority of the MWC service area. Use of reclaimed water for large irrigated areas in the City of Medford would require extensive piping and pumping. The most realistic urban reuse option might involve the White City industrial area. This

area is relatively close to the wastewater plant and has high water needs. Further exploration of this reuse opportunity is not likely to occur within the next several years, because the quantity of water available for urban reuse will not be known until the WISE program is either implemented or abandoned.

There are occasional opportunities for use of non-potable irrigation water within the MWC service area. For example, most golf courses within the region primarily use water provided by irrigation districts. Some large tracts of land subject to new development have irrigation water rights associated with them. However, direct use of this water is seldom preferred because little of it is delivered under pressure, and additional piping to enable service to individual subdivision parcels is expensive. The water also tends to contain debris that chokes sprinkler systems and introduces weed seeds if not well filtered. Water management changes for local irrigation districts, including those proposed with the WISE project, would improve the feasibility for use or transfer of irrigation water rights, but any such changes are long term and still uncertain.

SECTION 4

Curtailment Plan

This section describes the curtailment plan proposed for adoption by the MWC.

Overview

Curtailment planning is the development of proactive measures to reduce water demand if the water supply is reduced temporarily. Supply shortages could result from a number of situations, including those identified in this section.

The goal of this curtailment plan is to define objective criteria and actions to prepare MWC for management of water supplies in the event of diminished supply or reduced delivery capacity. This curtailment plan recognizes the need to maintain essential public health and safety while applying measures in an equitable manner that minimizes impacts on economic activity and lifestyle. Actions may include more restriction on uses deemed less essential.

Initial curtailment procedures were adopted by MWC in 1992. Those procedures were revised in conjunction with MWC's 2009 WMCP, both to comply with OAR Chapter 690, Division 86, and to reflect desired modifications. The plan herein builds on those previously adopted curtailment procedures. Minimal modifications have been made to the 2009 plan.

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

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

Authority

The authority under which this plan will be implemented are the City of Medford Charter, and MWC's *Regulations Governing Water Service* handbook.

City of Medford Charter

Section 21 of the City of Medford Charter (1976) grants MWC the authority to "distribute, furnish, sell and dispose of water, and provide water service…on such terms and conditions as the Board of Water Commissioners determines to be in the best interests of the city." This provision allows for the imposition of curtailment measures necessary to preserve supply.

Regulations Governing Water Service Handbook

In addition, MWC has asserted authority to implement nonvoluntary curtailment or suspensions of water service through Section 15 of its *Regulations Governing Water Service* handbook. Review and revision of portions of that guidance document will be performed as needed to assure consistency with this WMCP. Amendments will include addition of provisions for curtailment-related rate surcharges. Relevant provisions of that handbook are paraphrased below.

The Medford Water Commission has the authority to terminate service and implement non-voluntary curtailment or suspensions of water service under the *Regulations Governing Water Service* handbook.

Following are brief descriptions of sections of these regulations relevant to curtailment actions. Portions of this document may be revised to better conform with this plan.

Section 6.12 Waste of Resource

This section provides procedures for addressing leak and waste abatement. While in later curtailment stages, the imposition of penalties would likely take priority over the provisions of this section, this section includes procedures that might be employed during lower stages of curtailment.

Section 9 Discontinuance of Service

Procedures and fees are set forth for termination and resumption of service, which are referenced within the Curtailment Plan.

Section 10 Appeals

While generally reflective of appeals of bills, procedures set forth in this section can be applied to appeals associated with the Curtailment Plan.

Section 15 Interruptions, Curtailments, Fluctuations and Shortages

This section addresses the Commission's commitment to supply satisfactory and continuous water service, but recognizes that there will at times be some degree of failure, interruption, or curtailment. It is further stipulated that MWC cannot and will not guarantee constant or uninterrupted delivery of water service and shall have no liability to its customers or any other persons for such interruptions.

Plan Implementation

Whenever possible, activation of this curtailment plan and stages thereof will be by a majority vote of the Board of Water Commissioners. However, actions under the plan may be initiated upon a determination of urgency by the Commission's Manager. The Board of Commissioners, by a majority vote, may rescind the determination upon finding that the emergency no longer exists, or that the original declaration was made in error.

The plan may be enacted for the entire system, or only in those geographic areas that are directly impacted by the water supply shortage. The Manager may broaden or restrict the scope of enactment at any time for the duration of the plan implementation.

As previously noted, several nearby cities and water districts also rely on the MWC to provide treated water to their jurisdictions. The Commission's 1992 curtailment plan was applicable to and adopted by these other entities. Some of the cities have subsequently prepared updated water management and conservation plans associated with their own water rights. This, coupled with revisions contained within this plan, resulted in curtailment plans that are not fully consistent between jurisdictions. To the extent that is practical, the MWC will encourage actions that are regionally consistent and which can therefore be deemed equitable and able to be communicated to the public with a unified message. If a wholesale entity is unwilling or unable to implement consistent actions, their individual actions should yield comparable reductions in water usage.

Water System Capacity Constraints and Historical Supply Deficiencies

MWC's two water sources, Big Butte Springs (BBS) and the Rogue River, have continuously met the system's needs with no service disruptions. Curtailment would be necessary only if capacity constraints and supply deficiencies arise.

Capacity Constraints

BBS water is transported through two transmission pipelines, each of which has a capacity of 13.2 mgd. These pipelines follow slightly different routes to town, lessening the potential for a single event to impact both pipelines simultaneously. During droughts, the available supply of the BBS has fallen below 26.4 mgd. Between 1991 and 2015, the Willow Creek Reservoir failed to completely fill on four occasions. Because of coordination of water rights with the Eagle Point Irrigation District, limitations on MWC's water use from BBS were as low as approximately 20 mgd (31 cfs) at some points in time. The current summer capacity of the Rogue River supply is 45 mgd, as limited by the treatment capacity of the Duff WTP.

Current peak summer demands for the overall system have occasionally exceeded 60 mgd. Therefore, should either the BBS or the Rogue River supply be interrupted during peak summer periods, curtailment would be necessary. The water system currently relies entirely on the BBS supply during winter months, and failure of one or both BBS pipelines could also result in at least a short-term need for curtailment, either until the BBS supply could be fully restored or the Rogue River supply could be brought online.

Historical Supply Deficiencies

Alternate sources of supply available to MWC are limited. Local groundwater tends to be marginal in quantity, so drilling of wells to supplement supplies is not a viable option. MWC is the supplier of potable water to most neighboring cities, of which only Ashland operates a treatment facility of its own. While there is an interconnection with the City of Ashland, its primary purpose is to supplement Ashland's water supplies by MWC, with limited potential for the reverse. Ashland is generally more impacted by drought than MWC; however, there might be potential to receive some water from the City of Ashland, depending on the time of year and whether the precipitating event was regional in nature. If Ashland did have surplus water available to use as an emergency supply, as a result of quantity and proximity, it would likely be limited to Talent and Phoenix.

In extreme circumstances, limited amounts of potable water might be available via water trucked from the cities of Grants Pass, Gold Hill, Rogue River, or Butte Falls. If only a portion of MWC's system was compromised, limited amounts of water could also be trucked from other portions of the water system.

Level 2 treated wastewater from the regional reclamation plant might be a potential source for uses (such as dust control) that could utilize trucked nonpotable water. Local irrigation water may provide another potential option for nonpotable water, provided that irrigation supplies were not similarly subject to shortage.

Potential causes of water supply shortages include, but are not limited to the following:

- Long-term drought
- Fire in the BBS or Rogue River watersheds that affects water quality
- Contamination, such as from a chemical spill, that necessitates shutting down either water source
- Flooding that forces shutdown of one or more facilities
- Landslides or other natural disaster that damage water pipelines or facilities

- Power outages, particularly those impacting the Duff WTP
- Facility or equipment failure, either from natural or human causes

MWC's history of curtailment actions is very limited. In May of 1992, MWC requested voluntary reductions of customer's water usage for a brief period during a local outbreak of *Cryptosporidiosis*, which had resulted in MWC temporarily discontinuing use of its BBS supply until the source of the outbreak was determined. These requests were lifted once the BBS supply was found to be safe, and came back online.

MWC also referenced its 2009 curtailment plan in the spring of 2010 because replacement of fish screens at the Duff WTP was scheduled within the summer instream work window following a dry winter, during which Willow Lake did not fully fill. In recognition that water supplies could be limited by the combined impact of reduced withdrawal capacity and lower flows from the BBS drainage, in April, May, and June of 2010, MWC provided Stage I notification of a possible water supply shortage, including dissemination of a press release, newsletter article, and notification to wholesale city customers of actions that might become necessary. Further curtailment actions were not needed because weather during the critical summer work period was not extreme, and water supplies remained adequate to meet customer demands.

During the recent drought years of 2014 and 2015, MWC stressed the importance of wise water usage, and was able to meet all demands without specific curtailment actions or notifications.

Curtailment Stages and Contact List

MWC's plan recognizes five stages of increasingly stringent curtailment response. The initiating conditions for each stage are presented in **Table 4-1**, along with the actions that would be taken. The initiating conditions provide guidelines, may not be all-inclusive, and might not impact customers within all portions of the MWC service area. Optimally the curtailment activities would be implemented in lower stages first, with each stage building on the prior stage; this sequence is preferred but not mandatory. Compliance measures would also likely be more acceptable to customers if voluntary and less restrictive measures have been attempted first. However, MWC could implement measures proportionate to a sudden disruption of service without prior notification or action. Upon implementation of a curtailment stage, ongoing reevaluation will occur to determine the appropriate curtailment status.

Table 4-1. Curtailment Stages

Stage	Initiating Conditions	Actions
1. Awareness of Potential Water Shortage	A series of indicators suggest that a future shortage is possible; these may include drought-related conditions or other supply factors	Raise public awareness about potential for water shortage through such means as general articles in newsletters, newspapers, website, and social media
2. Potential Water Shortage Alert	Continued and/or further indicators raise concerns about the ability to meet supply needs unless demand levels are reduced, or Sustained demand reaches 90 percent of supply	Enhance public awareness and outreach efforts to convey potential water shortage message Request voluntary water use reductions Consider rate surcharges
3. Water Shortage	Indicators show that supply and/or delivery capacities are strained to meet current demand levels; these may include: Sustained demand reaches 95 percent of supply or delivery capacities, or Water storage facility(ies) is/are not routinely refilling, and Manager determines that continuation could result in inability to meet fire protection or other essential needs.	Strengthen notification messages and further outreach methods regarding water shortage conditions Impose mandatory restrictions on water use Consider potential enforcement of restrictions Consider rate surcharges or increase of charges from Stage 2
4. Severe Water Supply Shortage	Series of indicators show that water consumption levels must be immediately reduced; indicators may include: Sustained demand is exceeding normal supply or delivery capacities, or Water storage facility(ies) is/are only 2/3 full, and Manager determines that ability to meet fire protection or other essential needs is jeopardized. Supply or delivery capacities have been reduced by up to 35%	Provide urgent notification messages; significant outreach/customer notification Impose further mandatory restrictions on water use Enforce restrictions Impose or increase rate surcharges
5. Emergency Water Supply Disruption	Major water use reductions are deemed necessary to avoid system failure, inadequate fire protection capability and/or to assure protection of water quality; indicators may include: Sustained demand continues to exceed supply or delivery capacities, or Water storage facility(ies) is/are only 1/3 full Supply source or major facility is lost, reducing supply or delivery capabilities to less than 65% of normal capacities	Provide extreme alert; urgent notification of customers, both by broadcast means and direct notification Only essential water use allowed Enforce significant restrictions on use Impose heightened rate surcharges

Table 4-2 provides a list of contacts for people of groups to notify during a curtailment event.

Table 4-2. Contact List

Contact Category	Contact
City of Medford Contacts	• City Manager • Department Directors
Customers	• Wholesale customers • Commercial, industrial and institutional customers • Highest water users • Schools • Domiciliary
Health Professionals	• Jackson County Health Department • Oregon Department of Human Services, Drinking Water Program • Hospitals
Landscape Interests	• Landscape contractors • Landscape architects • Nurseries • Landscape maintenance firms
Miscellaneous business interests	• Chamber of Commerce • Car Washes • Swimming pool contractors • Construction industry: commercial and utility contractors, Homebuilder's Association • Rental management firms

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

Curtailment Actions

Stage 1: Awareness of Potential Water Shortage

Stage 1 will be implemented to provide general awareness of the potential for water shortage based on preliminary indicators of reduced supplies. Voluntary, but nonspecific conservation activities will be encouraged. Under Stage 1, MWC will take the following actions:

1. Assemble a Water Shortage Action Team as identified in **Table 4-3** to determine the likelihood of a shortage and define outreach activities. This team will convene and meet regularly to assess water supply, distribution, and demand whenever it appears that a curtailment order may be necessary, as defined within the curtailment plan.

2. Notify Members of the Board of Water Commissioners.

3. Define appropriate internal actions to minimize waste or perception of waste by MWC operations. Determine whether activities such as main flushing and reservoir cleaning should be immediately reduced or accelerated to complete in advance of a potential higher level of curtailment. Contact landscape maintenance contractor responsible for MWC sites to request that sprinkler maintenance needs be addressed, and appropriate sprinkling schedules followed.

4. Notify officials of the City of Medford and wholesale city customers of the potential for a water supply shortage.

5. Raise public awareness through general notification measures. This might consist of press releases or notices with monthly bills.

Table 4-3. Water Shortage Action Team

Team Member	Responsibilities
Primary Staff	
Manager	• Contact: Commissioners, City Manager, Water Shortage Action Team members
Public Information Coordinator	• Prepare and distribute press releases, and meet with media as spokesperson • Notify other cities and water districts • Prepare other public information materials
Conservation Coordinator	• Provide direction, input, and enforcement of actions
Operations Superintendent	• Monitor the distribution system, including reservoirs and pump stations • Maintain production at Big Butte Springs
Water Treatment Plant Director	• Maintain production at Duff Water Treatment Plant
Water Quality Director	• Monitor water quality
Customer Service Supervisor	• Obtain information from Public Information Coordinator and Manager • Staff office to handle customer inquiries • Monitor payment status of penalties and surcharges • Switch phones from call forward if necessary
Principal Engineer	• Be available to assist in all areas as directed by the Manager
All team members will keep the Manager informed on a regular basis.	
Additional Staff[a]	
Finance Director	• Keep team informed about financial impact of curtailment actions
Human Resources/Payroll Technician	• Assist with hiring of additional staff if determined to be necessary • Advise on status of employee overtime resulting from curtailment
Technical Services Coordinator	• Inform team on relevant computer tasks that may be appropriate • Modify billing programs as necessary to accommodate surcharges and penalties.
Additional parties added as deemed appropriate.	

[a]Additional MWC staff will also participate as part of the Water Shortage Action Team when it appears that staffing needs, expenses, and surcharges will become applicable.

Stage 2: Potential Water Shortage Alert

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

Stage 2 – MWC Actions

Under Stage 2, MWC actions will include the following:

1. Convene the Water Shortage Action Team to assess the likelihood of a shortage, define demand reduction goals, define outreach activities, and evaluate the possible need for additional personnel to assist with outreach and customer assistance activities.

2. Notify members of the Board of Water Commissioners.

3. Reevaluate appropriate internal actions to minimize waste or perception of waste by MWC operations. Remind landscape maintenance contractors responsible for MWC sites that sprinkler maintenance needs must addressed and appropriate sprinkling schedules followed.

4. Notify City of Medford officials. Include information on actions relevant to the city.

5. Notify staff and officials of wholesale city and water district customers of the curtailment determination, along with their need to enact equivalent provisions to assure that their efforts are no less intense than those imposed by MWC. Inform them of water reduction goals.

6. Consider providing direct notification to others on the Contact List included as Table 4-2, such as:

    a. Representatives from sectors that might be most influential in causing water usage reductions. At this stage, the focus would be on water uses that are considered less essential, such as landscape irrigation, rather than those that would result in economic impacts.

    b. Businesses that could be impacted if Stage 3 status becomes necessary, such as car washes, pool contractors, and landscape contractors.

7. Consider implementation of temporary rate surcharges. These can be beneficial in promoting customer action, financing additional costs associated with curtailment (such as increased staffing, and the development and distribution of information materials and conservation devices), and in offsetting potential revenue losses from decreased sales.

8. Provide general notification to customers. Such notification will include a description of the current water situation, the reason for the requested actions, and a warning that mandatory restrictions may be implemented if voluntary measures are not sufficient to achieve water use reduction objectives or if conditions worsen. Include drinking water quality information in notices, so that the public understands the role of flushing in maintaining water quality.

    MWC may request that notices be posted on bulletin boards, websites, public restrooms, and similar venues. Guidelines and conservation information will also be placed on the MWC website, including detailed information to facilitate customer's use of weather-based irrigation scheduling. Use of press releases to maximize notification is anticipated.

9. Consider initiating or expanding customer educational programs to assist customers in implementing curtailment actions. Examples might include presentations for homeowners and landscape managers, and site visits to provide assistance in adjusting sprinkler schedules.

10. Consider distribution of low-cost items such as toilet dye tablets, efficient showerheads, low-flow aerators, early closing toilet flappers, and hose nozzles, which would yield water savings and raise awareness of the water shortage situation.

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

12. Consider disseminating outreach materials such as (a) informational cards for restaurants and hotels to support water conservation practices (for example, not routinely serving water unless requested, and explaining towel and sheet laundering options), and (b) general information about actions customers can take to achieve requested water savings.

Stage 2 – Customer Actions

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

1. Reduce water use by the percentage determined to be the goal based on the comparable month in the prior year.
2. Manage landscape watering. The following guidelines are encouraged:
    a. Water landscapes only between the hours of 9:00 p.m. to 6:00 a.m., if on automatic timers, and between the hours of 7:00 p.m. to 9:00 a.m., if performed manually.
    b. Encourage use of timing devices when watering with hoses.
    c. Suggest adherence to weather-based irrigation schedules, provided on the MWC website, the Lawn Watering Infoline, and other potential venues.
    d. Encourage sprinkler maintenance and adjustment to repair leaks, and minimize conditions such as overspray and high pressure that result in obvious water waste.
3. When in use, equip hoses with nozzles that maximize effectiveness of the spray pattern and shut off when not activated.
4. Encourage repair of all known customer leaks.
5. Reduce vehicle washing and use facilities that recycle water. Manual car washing should include use of a bucket and hose equipped with a shutoff nozzle for brief wetting and rinsing.
6. Request that exterior paved surfaces be swept, rather than washed. If washing is necessary for such reasons as public health or safety, encourage the use of water brooms that provide maximum cleaning with minimum water usage.
7. Maintain swimming pools, hot tubs, ponds, and other water features in a manner that minimizes the need to fill or refill.
8. Integrate recirculation/reuse of water where appropriate. Examples include water features and heating/cooling equipment.
9. Request that the City of Medford and other city customers set good examples with their internal operations by implementation of the applicable items above, as well as the following:
    a. Reduce water used in street sweeping.
    b. Ask Fire Department to limit or avoid training exercises that use water.
    c. Consider reducing use of any fountain or water spray recreational facility that does not recirculate water, and pursue actions needed to retrofit these facilities.
    d. Identify important recreational facilities and fields in order to concentrate on preserving these, while decreasing water use at less critical facilities and fields.
10. Encourage restaurants to stop serving water unless requested by the customer. This action generates awareness for curtailment, and reduces use of water for washing glasses.
11. Encourage hotels and motels to discourage daily linen replacement by providing procedures for guests to opt for less frequent laundering.

Stage 3: Water Shortage

Stage 3 is similar to Stage 2 except that the voluntary measures will be made compulsory. This may be because of a worsening water supply situation or insufficient water savings from the voluntary measures. Additional nonessential water use will be prohibited.

Stage 3 – MWC Actions

MWC will take the following actions:

1. Reconvene the Water Shortage Action Team to assess the effectiveness of actions taken in Stage 2 and redefine demand reduction goals. Sector-specific targets for water use reductions may be developed. Define additional outreach and enforcement measures, and reassess the possible need for temporary staffing increases to assist with outreach, monitoring and enforcement.
2. Contact Members of the Board of Water Commissioners.
3. Review actions to minimize waste or perception of waste by MWC operations. Make appropriate reductions in hydrant and water line flushing without compromising water quality. Determine what internal actions can be taken for MWC to meet the percentage reduction goal being requested of other customers. Confirm that irrigation of MWC-owned sites is in conformance with requirements below.
4. Notify City of Medford officials/staff of the changed curtailment status. Include direct notification to departments of any actions that may be relevant to their operations.
5. Notify staff and officials of the wholesale city and water district customers of the changed curtailment status. Inform them of water reduction goals. If possible, provide assessments of their performance in Stage 2, based on meter readings and observations. Remind other cities of the need to enact equivalent provisions to assure that curtailment efforts are no less intense than those imposed by MWC.
6. Consider implementation of or increases to temporary rate surcharges. These can be beneficial in promoting customer action, financing additional costs associated with curtailment (such as increased staffing, development and distribution of information materials and conservation devices), and in offsetting potential revenue losses from decreased sales.
7. Contact high-use customers to encourage water use efficiency and the possible imposition of water reduction goals. Inform them of the potential future need for greater reductions, and solicit their input on how such reductions might be most equitably applied, while minimizing economic impact.
8. Contact others on the Contact List included as Table 4-2, with a focus on those who will be most impacted by current and possible future curtailment actions. As deemed appropriate, convene meetings to obtain input relative to potential actions that may be taken.
9. Expand notification and outreach activities to customers as defined by the Action Team. This may include targeting specific customer groups. For example, restaurants might be encouraged to avoid serving water except upon request, and motels might be encouraged to promote reduced linen laundering. Pursue translation and dissemination of information through Spanish-speaking media.
10. Monitor and report results of curtailment efforts and progress in meeting demand reduction goals. Keep MWC employees informed.

11. Disseminate outreach materials such as (a) informational cards for restaurants and hotels to support water conservation practices (for example, not routinely serving water, and explaining laundering options), and (b) general information about actions customers can take to achieve requested water savings.

Stage 3 – Customer Actions

Except as modified below, all voluntary customer actions recommended in Stage 2 become mandatory. The following modifications and additional restrictions also may be imposed:

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

    a. Time-of-day guidelines included in Stage 2 become mandatory, except for areas irrigated completely with drip, soaker, or other watering method that applies water directly to the root zone without spray.

    b. Use of hose bib mounted timing devices will be required when sprinkling from hoses.

    c. Landscape irrigation should follow a weather-based schedule, which will be provided on the MWC website, the Lawn Watering Infoline, and by other means. This schedule may afford preference to ornamental trees and shrubs, which if lost would take years to reestablish. Lawn sprinkling schedules might encourage dormancy, watering at a lower percentage of ET to keep roots alive, but without the goal of maintaining a uniformly green appearance.

    d. Sprinkling may be limited to certain days of the week. As an example, in July, properties with even addresses might irrigate on Sunday, Tuesday, and Friday, while properties with odd addresses would water on Monday, Thursday, and Saturday, with no irrigation occurring on Wednesdays to facilitate refilling of reservoirs. Schedules would vary according to season and specific circumstances.

    e. Sprinklers and other irrigation components should be repaired, adjusted, and operated without waste. Prohibited waste may include, but would not be limited to leaks, overspray of more than 1 foot onto paved surfaces, misdirected spray patterns, obvious runoff, and operation at clearly excessive pressures.

2. Planting of new lawns and annual plants may be prohibited. Planting of shrubs and trees would be allowed, possibly subject to verified soil amendment and mulching (aimed at water retention), and/or irrigating with drip, soaker hose, or similar root zone water application method.

3. When in use, hoses must be equipped with nozzles that direct water and shut off when not activated.

4. Repair of all known customer leaks will be required.

5. Washing of personal motorbikes, motor vehicles, or recreational vehicles will not be allowed except at commercial washing facilities that practice wash water recycling, or by using a bucket and hose equipped with a shutoff nozzle for brief wetting and rinsing.

6. Except for vehicles that must be cleaned to maintain public health and welfare such as food carriers and solid waste transfer vehicles, washing of commercial vehicles will only be done in a facility that recycles water. Washing of vehicles for sale on commercial lots may be afforded less stringent washing regulations to enable limited washing on location, but at reduced schedules that result in significantly reduced water usage levels as compared to the prior year.

7. Washing of sidewalks, walkways, driveways, parking lots, tennis courts, and other hard-surfaced areas will not be allowed, except when necessary for public health and safety or to the minimal extent necessary to loosen caked-on mud or similar circumstances.

8. Except as needed for painting or construction, no washing of buildings and structures.

9. No water for a fountain or pond for aesthetic or scenic purposes unless it recycles water and is leak free (with refill demands being equivalent to the current ET rate). Noncompliant ponds that support fish will be afforded reasonable time to move fish or repair leaks.

10. Pools and hot tubs will not be drained, and will be managed to minimize the need to refill. This may include requirements for covering when not in use and other actions.

11. Water for initial filling of new swimming pools may be restricted. Pools already under construction prior to imposition of such regulations will be allowed to fill, but may be subject to rate and time-of-day restrictions.

12. Where potable water is used on golf courses, it will be restricted to watering only tees and greens.

13. Use of potable water for dust control or street cleaning may be disallowed or made subject to regulations setting maximum frequency or rate of application.

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

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

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

    b. Fire Department should discontinue training exercises that use water.

    c. Cease use of decorative fountains.

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

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

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

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

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

Stage 4: Severe Water Supply Shortage

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

Stage 4 – MWC Actions

MWC will respond with the following actions:

1. The Water Shortage Action Team will meet to define updated demand reduction goals, review and assess actions taken to date, and evaluate new actions to be taken. Rationing protocols should be defined and uses prioritized. For example, fire suppression and critical sanitation needs for hospitals will be among uses given the highest priority.

   If not already implemented, rate surcharges will be imposed. The need for additional temporary staffing for expanded outreach and enforcement of mandatory water restrictions also will be reassessed.

2. Contact members of the Board of Water Commissioners. A special Water Commission meeting may be called.

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

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

5. Notify staff and officials of the cities and districts that are MWC customers of the changed curtailment status, updated water reduction goals, and the continued need to maintain actions equivalent to those being taken by MWC. If possible, provide assessments of their performance in Stage 3, based on meter readings, observations, or both.

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

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

8. Contact and/or meet with others on the Contact List included as Table 4-2, particularly those who will be most impacted by current and possible future curtailment actions.

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

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

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

Stage 4 – Customer Actions

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

1. Water volume limits may be imposed on all customers.
2. Further restriction of landscape irrigation, with regulations to be provided on the MWC website, the Lawn Watering Infoline, and other potential venues, are as follows:
    a. Watering of turf may be prohibited or allowed only one day per week to keep roots alive while grass goes dormant.
    b. Shrub watering will follow a restrictive schedule, reflective of current ET or a fraction thereof, along with plant survival needs.
    c. Tree watering will be accomplished with use of soaker hoses or similar methods that apply water directly to the root zone, rather than broadcast spraying. Frequency and volume allowed will be established through consultation with the City of Medford's Arborist or other tree experts. Use of nonpotable water for this purpose may be encouraged.
    d. Time-of-day watering provisions imposed in Stage 3 remain in effect for all spray irrigation.
    e. Use of hose bib mounted timing devices will be required when irrigating from hoses.
    f. Sprinkling will be limited to certain days of the week. Allowances will vary according to season and plant type.
    g. Sprinklers and other irrigation components must be repaired, adjusted, and operated without waste as defined in Stage 3.
    h. Exceptions to these regulations may be granted at the discretion of the Manager upon documentation that the landscape was installed within the previous 40 days or is deemed a high-priority public use area.
3. No planting new landscapes during Stage 4.
4. No construction or installation of new pools or hot tubs will be initiated during Stage 4, and existing pools and hot tubs may not be drained to less than 90 percent of capacity and refilled. Further restrictions on filling of pools and hot tubs might also be imposed. Exceptions may be granted by the Manager if the pool or hot tub's use is required by a medical doctor's prescription or is deemed a high-priority community recreational or health facility.
5. No water for a fountain or pond for aesthetic or scenic purposes unless necessary to support fish, and is leak free as defined in Stage 3. Measures will be taken to move fish to aquariums or other smallest reasonable tub or ponds.
6. Except for vehicles that must be cleaned to maintain public health and welfare such as food carriers and solid waste transfer vehicles, washing of vehicles will only be done in a facility that recycles water. This will apply to all vehicles, including motorbikes and recreational vehicles, whether personal, commercial, or displayed on sales lots.
7. No potable water use for dust control or street cleaning.
8. No new water line extension work will be initiated except as approved by MWC.

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

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

Stage 5: Emergency Water Supply Disruption

Stage 5 reflects an extreme circumstance in which water available is considerably less than normal demands, and it is imperative that all customer sectors participate in immediate demand reductions. This situation is most likely to result from a sudden event that severely impacts a major system component or affects multiple system components simultaneously. Examples might include failure of a transmission main or intake structure, a chemical spill impacting a water source, a malevolent attack on the system or multiple failures resulting from an earthquake or flood. However, a less dramatic event such as an extended power outage affecting the Duff Treatment Plant, but not the majority of customers, could also lead to sudden and significant curtailment needs.

Stage 5 – MWC Actions

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

1. The Water Shortage Action Team will convene to define demand reduction needs, and critical actions to be taken. Rationing protocols will be defined and water uses prioritized. Fire suppression and critical sanitation needs for hospitals will be among the uses given the highest priority.

2. Members of the Board of Water Commissioners will be contacted. An emergency Water Commission meeting may be called.

3. Notify the local news media to request their assistance in notifying the public of the severity of the situation. This will include dissemination of information through Spanish-speaking media.

4. Contact staff and officials of the City of Medford and of the cities and districts that are MWC customers. Inform them of water rationing determinations.

5. Contact the largest customers to inform them of applicable water rationing.

6. Mobilize MWC resources to perform rigorous public outreach and enforcement.

7. If deemed necessary, contact local law enforcement and fire departments to enlist help in notifying customers.

8. If water in the system is unsafe to drink, the Oregon Drinking Water Program will be contacted, and their assistance requested for responding to the problem.

9. If applicable, consider options for renting a water hauling truck and purchasing water from nearby communities, sending customers to a predesignated water distribution location, and supplying bottled water.

Stage 5 – Customer Actions

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

1. Water volume limits will be imposed on all customers.

2. No irrigation of landscapes with potable water. If Stage 4 remains in effect for an extended duration, and ongoing actions are proving successful in adequately maintaining reservoir levels, limited watering directly to the root zones of significant large trees and shrubs may be exempted from this ban. Frequency and volume allowed will be established through consultation with the City

of Medford's Arborist and/or other tree experts. Use of nonpotable water for this purpose may be encouraged.

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

4. Strengthened rate surcharges will be imposed, particularly if Stage 5 curtailment is anticipated to be in place for an extended period.

Variances

MWC may, in writing, grant temporary variances for prospective uses of water otherwise prohibited after determining that because of unusual circumstances, failure to grant such variance would cause undue hardship or would adversely affect the health or safety of the applicant or the public. Variance requests will be made directly to a management-level employee designated by the MWC Manager.

Penalties

Violations of regulations identified in the Stages 3 through 5 may be enforced by MWC as follows:

1. First violation: Notice of Violation issued advising of the violation and informing of sanctions to be imposed if violations continue.

2. Second violation: Stage 3, a fine which is the greater of $75 or 20 percent of the customer's water charges for the prior month; Stage 4, a fine which is the greater of $100 or 25 percent of the customer's water charges for the prior month; Stage 5, a fine which is the greater of $125 or 30 percent of the customer's water charges for the prior month.

3. Third violation: Stage 3, a fine which is the greater of $150 or 40 percent of the customer's water charges for the prior month; Stage 4, a fine which is the greater of $200 or 50 percent of the customer's water charges for the prior month; Stage 5, a fine which is the greater of $250 or 60 percent of the customer's water charges for the prior month.

4. Fourth and subsequent violations: Stage 3, a fine which is the greater of $300 or 80 percent of the customer's water charges for the prior month; Stage 4, a fine which is the greater of $400 or 90 percent of the customer's water charges for the prior month; Stage 5, a fine which is the greater of $500 or 100 percent of the customer's water charges for the prior month.

5. Depending on the magnitude of curtailment in effect, reasonable time will be provided for offenses to be corrected. However, each day during which a violation occurs may be deemed a separate offense.

6. All fines will be added to monthly water charges. Failure to pay fines with associated monthly water bills may be regarded as an overdue water bill, with reminder notices and shutoff provisions applied as if payment of regular charges had not been made.

7. MWC may dispense with fines and terminate water service after the second violation if water waste is blatant and the offending party expresses a disregard for correction. A Notice of Intent to Terminate Water Service will be delivered as set forth in #8 below at least 24 hours prior to termination of service. Disconnected service will be restored if the customer does the following:

a. Pays 50 percent of the amount owing on fines, as well as fees normally charged for restoration of service following termination for nonpayment of water bills. The remainder of the fine(s) may be paid with subsequent water bills.

b. Gives suitable assurances to the MWC that the action causing the disconnection will not be repeated.

In addition to the foregoing, the MWC may, prior to restoration of services, install a flow-restrictor device on the customer's service.

8. MWC will deliver notices of violation, fines, and intent to terminate service to the occupant(s) of the premises or offending parties. If no occupant is present, MWC will leave the notice at the premises by a door hanger or similar means. MWC will also attempt to leave a phone message or mail notices by regular mail to the occupant at the address of the subject premises where the violation has occurred. If possible, efforts will also be made to notify the property owner or manager, if different from the occupant.

9. Provisions relative to termination of water service as set forth in #7 above do not apply to water service temporarily shut off in order to immediately eliminate significant waste when the occupant of the premises has not received full notification as set forth herein and is not at the premises to notify at the time of shutoff. Such shutoffs will not require notice, and will not be subject to reconnection terms set forth in #7, but may qualify as a violation subject to fines.

Appeals

Every party is entitled to go through the appeal process defined in Section 10 of the *Regulations Governing Water Service* handbook. This will apply to appeals of variances denied as well as fines imposed. When fines are appealed, 50 percent of the fine must still be paid when due, with the remainder deferred until a final decision is rendered on the appeal. Any amount paid that is overturned on appeal will be credited to the water account to which it was charged.

Modifications

MWC may modify or revise this plan, or any portion if deemed appropriate. Modifications of the plan can be approved by majority consent of the Board of Water Commissioners.

This policy is intended to conform to all applicable federal and Oregon State statutes. If any part is now, or becomes, in conflict with said statutes, only that portion which is determined to be in violation will become invalid.

SECTION 5

Water Supply Element

This section describes MWC's service area population and demand projections, and compares projected withdrawals with available sources. This analysis serves as the basis of MWC's greenlight water request.

Delineation of Service Areas

The MWC service area includes the City of Medford, three water districts located near Medford, and the unincorporated community of White City to the north of Medford. There are also a limited number of small enclaves of customers outside of incorporated cities, most of whom were once within now-dissolved water districts.

In the May 2016 election, residents within the Jacksonville Highway Water District approved a ballot measure for dissolution of this district. If the dissolution is approved by MWC and finalized, customers from this water district will become "outside" customers. This action is still in a pending status, and was not anticipated as this plan was being prepared, so the potential resulting re-allocation of customers and their demands is only integrated into this plan to a modest extent.

Figure 5-1 identifies Medford's Urban Growth Boundary (UGB) and its proposed Urban Reserve Area (URA). These are the areas into which the city is projected to grow within the next several years, with the UGB representing MWC's likely service area in the short term.

The areas delineated as the URA for the City of Medford are future growth areas identified through a regional, long-term planning project known as Regional Problem Solving (RPS) that culminated in the *Greater Bear Creek Valley Regional Plan* that was adopted by the Medford City Council on August 16, 2012. These growth areas, shaded purple on Figure 5-1, represent lands into which Medford will grow over a time horizon of approximately 50 years.

MWC also provides water to six other cities on a wholesale basis, but as they are responsible for water delivery beyond MWC's master meters, these cities are not included in Figure 5-1. The wholesale city customers are responsible for their own water management and conservation activities, and as stated in Section 2, they have each taken actions to acquire water rights to meet their own summertime demands. They likely will continue to rely on water rights held by MWC to meet winter demands, and on MWC's water treatment, transmission and major distribution infrastructure year round.

The City of Ashland became the sixth city to purchase treated water from MWC when they completed a connection to the MWC water system in 2014. Intended primarily as an emergency supply, Ashland used this new connection during the summers of 2014 and 2015 when their primary water supplies were severely drought stressed.

Population Projections

The previous WMCP relied on population projections developed for the *Jackson County Comprehensive Plan, Population Element* adopted February 21, 2007. Population projections were used to estimate average annual growth rates for the periods 2005 to 2026 and 2026 to 2040 to apply to communities receiving water service from MWC.

In 2013, through legislative action, responsibility for regional population projections was transferred from counties to the Portland State University (PSU) Population Research Center (PRC). The PRC finalized its *Coordinated Population Forecast for Jackson County, its Urban Growth boundaries (UGB) and Area Outside UGBs 2015-2065* in June 2015. These UGB population projections were used to determine projected average annual growth rates for populations within Medford, the other cities, White City and

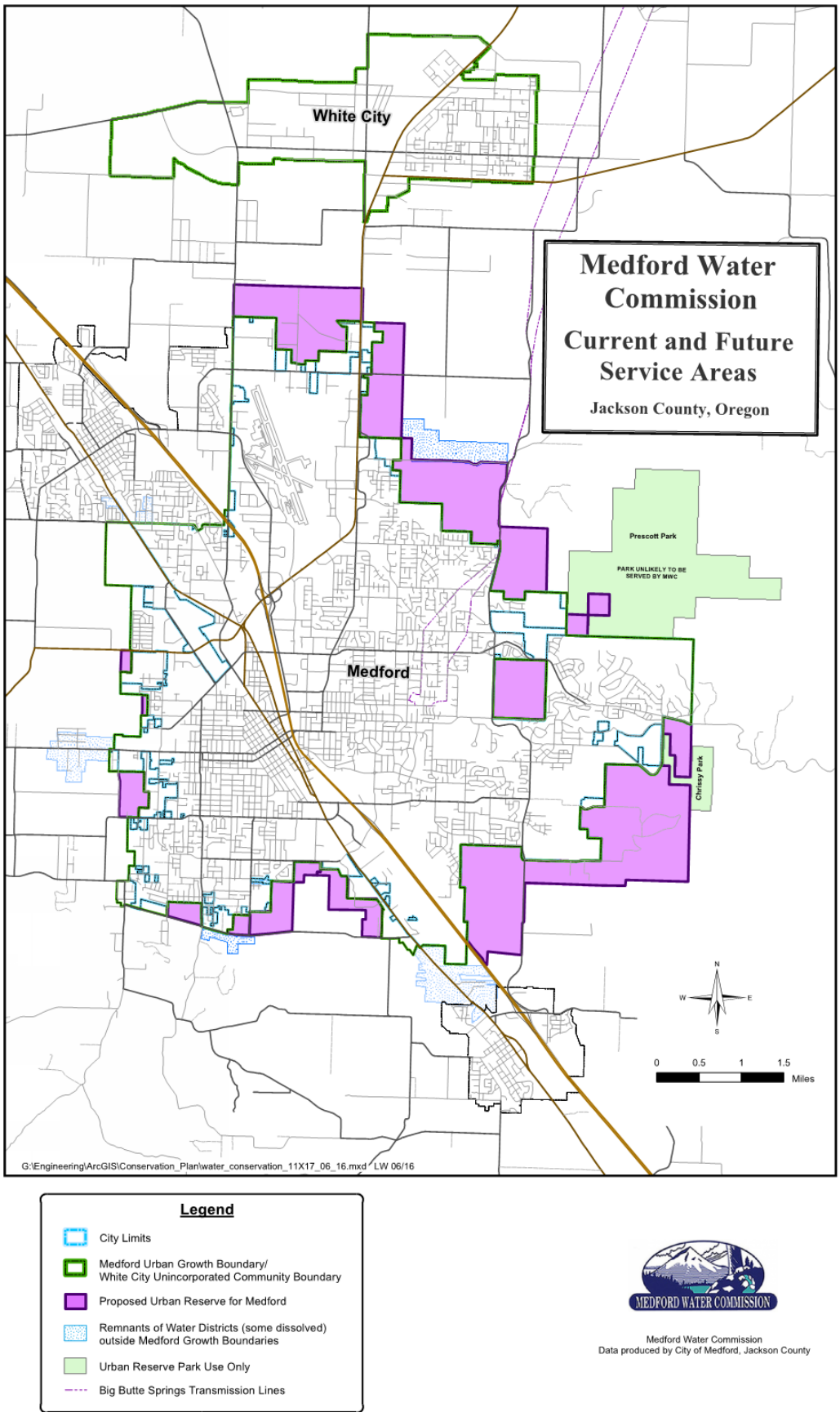


Figure 5-1. City of Medford Existing Service Area (Medford Urban Growth Boundary and White City Unincorporated Community Boundary) and Proposed Future Service Area (Urban Reserve Area)

outside customers. PRC-certified 2015 population estimates for the cities were adjusted to service populations as described in Section 2. The adjusted service population for Ashland includes a quarter of the city's population based on the assumption that the MWC may supply approximately a quarter of Ashland's demand on peak use days. For the unincorporated community of White City, United States census data were used to estimate a 2015 service population, with adjustments made by MWC staff where water service boundaries didn't match Census boundaries. Because areas served outside of corporate boundaries (water districts and outside customers) are not evaluated by PSU, and Census boundaries do not align with their service areas, MWC staff determined the baseline populations for these customer groups.

Table 5-1 presents the criteria used to project service area populations for the retail and wholesale customers of MWC. Because White City is more urban than rural, an average of city growth rates was used to project future population within the White City area, rather than the lower non-city growth rates.

As water districts are not allowed to expand, and have tended to either dissolve or lose population to adjoining cities, their populations are shown as declining, rather than growing. Conversely, at least part of the population from districts that dissolve is typically absorbed by the outside customer group, with other portions being annexed into adjacent cities (primarily Medford and Phoenix).

While this makes no difference in the total population served, it can mean a sudden re-allocation of population that can substantially impact specific customer groups involved. For example, following the recent dissolution of the Jacksonville Highway Water District, its population initially has become part of the outside customer group. This shift increased the outside customer population (excluding outside customers within White City) by more than 75 percent overnight. As this district was predominantly single family residential, the customer mix of the outside customer group also will be increasingly residential, while the remaining district customer group will become more dominated by multi-family, commercial and industrial users.

Because this type of change in population is the result of unique artificial factors, the population changes associated with district and outside customer groups are not typical of the rural population in Jackson County, nor are they very predictable. In addition to impacting each other, they also contribute population to adjacent cities, sometimes in large blocks. All districts can impact Medford's population to a minor extent, but far more significant is the large portion of the Charlotte Ann Water District within the Urban Reserve boundary for Phoenix, which would increase that city's current population by 50% if fully annexed.

Of course, population projections can't predict the timing and extent of this type of sudden population change, assuming instead that change will occur gradually over time. This report is to be reflective of official population projections, and the analyses associated with it were largely completed prior to the likely water district dissolution becoming evident. Therefore, this dissolution was integrated more modestly into population projections within different categories over time than actually occurred.

Growth rates derived from PSU PRC projections are lower than those from the *Jackson County Comprehensive Plan, Population Element* used in the previous WMCP. Therefore, population and demand projections developed for this WMCP are lower than the last plan.

Table 5-1. Population Growth Rates and Demand Factors for MWC

Criteria	Ashland	Central Point	Eagle Point	Jacksonville	Medford	Phoenix	Talent	White City[c]	Outside Customers[d]	Water Districts[d]
2015 Service Area Population[a] =	5,105	17,565	8,745	3,020	77,335	4,585	6,350	8,480	1080	3,835
AA Growth Rate 2015-2025[b] =	0.6%	1.1%	2.6%	2.3%	1.2%	1.8%	1.5%	1.7%	2.5%	-1.2%
AA Growth Rate 2025-2040[b] =	0.3%	1.0%	1.6%	1.5%	1.0%	1.5%	1.8%	1.4%	2.4%	-1.1%
AA Growth Rate 2040-2065[b] =	0.1%	0.6%	0.7%	1.5%	0.7%	1.1%	1.6%	1.0%	1.0%	-1.0%
Per Capita ADD (gpcd) =	42	158	188	235	218	161	123	443	443	299
Per Capita MMD (gpcd) =	173	326	360	494	401	296	241	650	650	666
Per Capita MDD (gpcd) =	197	372	411	565	458	338	276	742	742	761

[a]Service Area Population reflects an adjustment to the cities' population to add households outside of city limits who receive water service and/or subtract city residents who do not receive water service from the city. See Table 2-15 for detailed analysis.

[b]Average annual growth rates for each period were obtained from the *Coordinated Population Forecast for Jackson County, its Urban Growth boundaries (UGB) and Area Outside UGBs 2015-2065*.

[c]Because of its urban nature, White City growth rates were taken as an average of Medford and other wholesale city growth rates.

[d]Growth rates estimated by MWC staff to reflect dissolution of water districts, many of whom will become outside customers.

Estimated average annual growth rates for each period were applied to baseline 2015 service area populations to project future service area populations as follows:

$$P_t = P_{t_0}(1+R)^{(t-t_0)} \quad (1)$$

Where

P_t = service area population at time, t
P_{t0} = service area population at starting time, t_0
R = average annual growth rate.

Although MWC and some of its city wholesale customers continue to honor service arrangements with existing customers located beyond corporate limits, MWC policies generally limit further extension of water service beyond current and future urban boundaries. Service area population growth is therefore expected to occur within these urban entities, rather than as individual outside customers or within water districts. As city boundaries grow, many individual and water district customers are likely to be annexed, so these individual populations will decrease, but the overall service area population will continue to include these customers. Therefore for projection purposes, outside and water district populations were increased based on projected average annual growth rates, as described. **Table 5-2** presents projected service area populations.

Table 5-2. Projected MWC Service Area Populations

Community	2016	2026	2036
Ashland[a]	5,231	6,469	7,184
Central Point	17,761	19,823	21,850
Eagle Point	8,968	11,433	13,418
Jacksonville	3,088	3,832	4,454
Medford	78,242	87,776	97,088
Phoenix	4,667	5,557	6,429
Talent	6,444	7,491	8,958
White City	8,627	10,207	11,728
Outside customer	1,086	1,416	1,796
Water Districts	3,856	3,361	3,009
Total	137,970	157,364	175,914

[a]Ashland's initial service population set equal to ¼ of the city population. Service area population increases were set equal to the overall city population increase.

Water Demand Forecast

Per capita demands for 2015 were estimated from historical water demand and service area population estimates for MWC's retail and wholesale customers, and were presented in Section 2, and summarized in Table 2-7. A base demand projection was made by holding these values constant throughout the planning period, and multiplying per capita values by the projected service populations of the individual entities. The results of the base demand projection are provided in **Table 5-3**.

Table 5-3. Summary of Projected Demands (mgd)

City	2016			2026			2036		
	ADD	MMD	MDD	ADD	MMD	MDD	ADD	MMD	MDD
Ashland	0.2	0.9	1.0	0.3	1.1	1.3	0.3	1.2	1.4
Central Point	2.8	5.8	6.6	3.1	6.5	7.4	3.5	7.1	8.1
Eagle Point	1.7	3.2	3.7	2.1	4.1	4.7	2.5	4.8	5.5
Jacksonville	0.7	1.5	1.7	0.9	1.9	2.2	1.0	2.2	2.5
Medford	17.0	31.3	35.8	19.1	35.2	40.2	21.2	38.9	44.4
Phoenix	0.8	1.4	1.6	0.9	1.6	1.9	1.0	1.9	2.2
Talent	0.8	1.6	1.8	0.9	1.8	2.1	1.1	2.2	2.5
White City, Outside, and Water Districts[a]	5.5	8.9	10.1	6.2	10.1	11.5	6.9	11.1	12.7
Total	**29.5**	**54.6**	**62.4**	**33.6**	**62.3**	**71.1**	**37.5**	**69.5**	**79.3**

[a]The demands for White City, other outside customers, and water district are combined because of similarity in demand characteristics, and because the population from water districts has tended to transition into the outside customer group over time.

The overall system ADD is projected to be 33.6 mgd (52 cfs) by 2026 and 37.5 mgd (58 cfs) by 2036. The overall system MDD is projected to approach 71.1 mgd (110 cfs) by 2026 and 79.3 mgd (123 cfs) by 2036. Other cities' MDDs represent an increasing percentage of overall system MDD from approximately 23 percent in 2016 to 26 percent by 2036.

Assuming that per capita demands remain constant provides a reasonable and conservative estimate of future demand for infrastructure planning. However, this approach assumes that the proportion of customer types remains relatively constant with time, and does not account for effects of conservation activities. As explained in Section 2, and shown in Figure 2-14, MWC's overall system maximum day per capita demand has decreased over time. It is reasonable to expect further declines, with code-driven efficiencies and other conservation activities. Therefore, an alternate projection is provided that includes continued reduction of total system per capita MDD at a rate of 0.5 percent per year during the planning period. However, to account for increasing uncertainty in service area population estimate over time, and uncertainty related to possible changes in the customer mix an allowance was added to the MDD conservation projection beginning at 0 in 2016, and increasing uniformly to 5 percent of MDD in 2036. Both the base projection and alternate conservation plus allowance projection are presented **Table 5-4** and **Figure 5-2**. MWC has chosen to base its greenlight water analysis on the lower MDD projection that integrates conservation and the uncertainty allowance.

Table 5-4. Comparison of Overall System MDD Projections: Constant Per Capita Demand Versus Conservation Plus Allowance

Year	MDD: Constant Per Capita Demand (mgd)	MDD: Conservation plus Uncertainty Allowance (mgd)
2026	71.1	70.2
2036	79.3	76.5

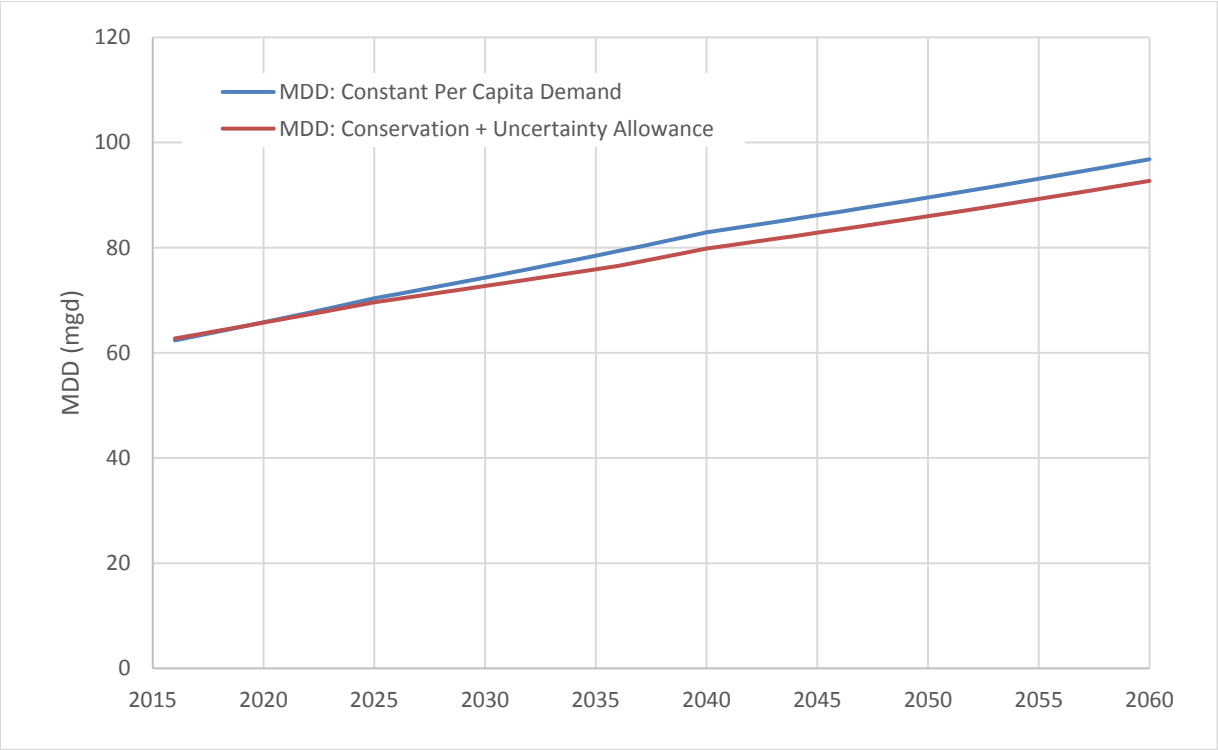


Figure 5-2. Overall System MDD Projections

In Figure 5-4, the conservation plus allowance projection beyond 2036, holds the 2036 per capita MDD value constant and does not further increase the uncertainty allowance. MWC has chosen to base its greenlight water analysis on the lower, conservation plus allowance, MDD projection.

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

The Medford Water Commission's (MWC) existing Duff No. 1 facility currently treats water that is diverted from the Rogue River under authorization from multiple water rights. These water rights provide the MWC with authorization to divert sufficient water to meet the Duff No. 1 facility's current capacity of approximately 70 cfs (45 mgd). These water rights will also be sufficient to meet the facility's expanded capacity of 100 cfs (65 mgd), scheduled for completion in 2022.

Water diverted for the Duff No. 1 WTP is primarily diverted under the MWC's water right certificate 86832, which authorizes the use of up to 60.85 cfs (39 mgd) from the Rogue River for municipal purposes. In addition, from May through September the MWC diverts, treats, and delivers water under water rights that are held by the five other cities to which the MWC provides water year round, and water rights held by the City of Ashland. During the non-peak season, the MWC provides these cities with water supplied from BBS. The other cities' water rights primarily authorize the use of stored water from Lost Creek Reservoir, Four Mile Lake Reservoir and Fish Lake Reservoir for municipal purposes. These water rights currently authorize the use of up to a total of 17.846 cfs (11.5 mgd). In addition, the water rights authorize the use of up to 2,892 acre-feet (943 MG) of stored water with no specified rate of diversion. If this volume of stored water were diverted at a continuous rate during the period from May through September, it would equate to an additional rate of 11.86 cfs (7.7 mgd). Thus, the other cities' current water rights are estimated to equate to a diversion of approximately 29.7 cfs (19.2 mgd).

Finally, the MWC holds Permit S-23210, which authorizes the use of up to 39.15 cfs (25 mgd) from the Rogue River for municipal purposes. Use of water under this permit is subject to the fish persistence conditions described in Section 2, and is the source of any greenlight water request resulting from this WMCP. Approximately 14 of the 39.15 cfs authorized by this water right would be used to meet the Duff No. 1 WTP's full capacity of 100 cfs (65 mgd) (60.85 cfs + 25.346 cfs + 13.8 = 100 cfs).

Table 5-5 is a summary of water rights held by Medford plus a total of all the water rights held by other cities. As discussed in Section 2, drought conditions, or MWC's agreement with Eagle Point Irrigation District can limit the BBS supply to approximately 31 cfs instead of the 40.8 cfs, full capacity of the BBS transmission lines when Big Butte Creek flows go below certain levels. During this "drought limited". condition, the roughly 10 cfs difference must be supplied from the Rogue River. Therefore, the reliable maximum authorized withdrawal under MWC water rights is approximately 92 cfs, and including the other cities is 117 cfs.

Table 5-5. Summary of Maximum Authorized Withdrawal by Source

Water Rights	cfs	mgd	Notes
Medford BBS (certificate 53323 +86994)	40.80	26.4	Drought limited = 31 cfs (20 mgd)
Medford Rogue River (certificate 86832)	60.85	39.3	No limitations
Subtotal Medford	**101.65**	**65.7**	**Drought limited = 91.65 cfs (59.2 mgd)**
Other City Sum of Permits Rogue River[a]	29.70	19.2	
Total Medford and Other Cities	**131.35**	**84.9**	**Drought limited = 121.35 cfs (78.4 mgd)**
Medford Permitted Rogue River (S-23210)	39.15	25.3	Fish persistence limitations; subject to greenlight water request
MWC additional Rogue River (S-54935) Transferred point of diversion from BBS	50.00	32.3	Fish persistence limitations; subject to greenlight water request

The water supply for Duff No. 2 WTP expansion and intake project is expected to come from three sources. First, the MWC will use the remaining 25.35 cfs under its Rogue River Permit S-23210, which is described above.

In addition, the MWC intends to divert water under Permit S-54935[1], which authorizes the diversion of all of the unappropriated water in Big Butte Creek drainage. The original permit authorized diversion from Big Butte Creek, however to help protect stream flows for fish in that high value fish habitat, while maintaining a reliable supply for the populations MWC serves, an amended Permit S-54935 was approved by the Oregon Water Resources Department (OWRD), authorizing the diversion of this water from a downstream point on the Rogue River. Therefore, MWC will allow water to flow through the Big Butte Creek watershed and down the Rogue River approximately 23 miles to the proposed Duff No. 2 intake. Based on gauge data from the mouth of Big Butte Creek, MWC anticipates that approximately 50 cfs (32 mgd) will flow from the mouth of Big Butte Creek to the Duff No. 2 intake to be diverted under Permit S-54935 during summer months. The use of water under this permit is conditioned by the OWRD to protect listed fish.

[1] MWC's permit S-54935 is often referred to as "the withdrawal permit." This permit, which was originally Permit S-6884, is based on an Oregon statute, which states that the City of Medford is entitled to all of the unappropriated water in the Big Butte Creek Basin as of May 29, 1925. (The MWC was created in 1922 for the purpose of operating the water system on behalf of the City.) OWRD interprets this statute and water right to allow the MWC to appropriate as much water as is flowing at the mouth of Big Butte Creek (although MWC could appropriate water at any location on the creek).

The remaining approximately 14.65 cfs (9.5 mgd) of supply to meet the 90 cfs (58 mgd) capacity of Duff No. 2 is expected to come from Lost Creek Reservoir. Water in Lost Creek Reservoir is stored during the high-flow winter months for use during the lower-flow, peak demand period. The United States Army Corps of Engineers (USACE) issues contracts for the use of water from this reservoir. The MWC does not yet have a contract or water right for the use of this stored water; however, according to USACE, an additional 5,950 acre-feet of stored water remains available for municipal use contracts.

Table 5-6 summarizes the individual and cumulative capacities of the MWC existing and future water production facilities. Both unrestricted and restricted flow at BBS are shown.

Table 5-6. Summary of Capacities (Current and Planned) of MWC Water Production Facilities

Facility and Phase	Capacity (cfs)	Capacity (mgd)	Cumulative Capacity Non-Drought (cfs)	Cumulative Capacity Non-Drought (mgd)	Cumulative Capacity: Drought (cfs)	Cumulative Capacity: Drought (mgd)
BBS	40.8	26.4	40.8	26.4		
BBS Drought	30.8	19.9			30.8	19.9
Duff 1 Current	69.6	45	110.5	71.4	100.5	65
Duff 1 Buildout	100.6	65	141.4	91.4	131.4	85
Duff 2 Phase 1	30.9	20	172.3	111.4	162.3	105
Duff 2 Phase 2	61.8	40	203.3	131.4	193.3	125

Figures 5-3 and 5-4 show the projected raw water withdrawals from the BBS and the Rogue River based on the conservation plus allowance demand projection shown in Figure 5-2, and the sum of the maximum authorized withdrawal rates based on Medford only and Medford plus the water rights held by the wholesale cities. Also shown are the anticipated increase in cumulative supply capacity resulting from expansion of Duff 1 and construction of Duff 2. Figure 5-3 reflects production when BBS flows are *not* drought restricted, and Figure 5-4 shows production when BBS flows are restricted in order to accommodate shared BBS water rights. Because water is needed within the WTP for backwashing filters and other operations, approximately 7 percent more water must be withdrawn from the Rogue River than is delivered to the system to meet a given demand. BBS spring water does not have a similar treatment factor. As shown in Figure 5-3, by 2036, the total maximum withdrawal required under unrestricted BBS flow conditions is approximately 124 cfs (80 mgd) (41 cfs from BBS and 83 cfs from Duff 1).

In contrast, as shown in Figure 5-4, the total maximum withdrawal required under restricted BBS flow conditions is 124.5 cfs (31 cfs from BBS and 93.5 cfs from Duff 1). The amount that the withdrawal projection exceeds the maximum reliable withdrawal rate within the 20-year planning period is equal to the total amount of greenlight water MWC anticipates needing prior to 2036. Figure 5-4 shows that the anticipated greenlight water needed by 2036 is equal to 3.1 cfs (2.0 mgd).

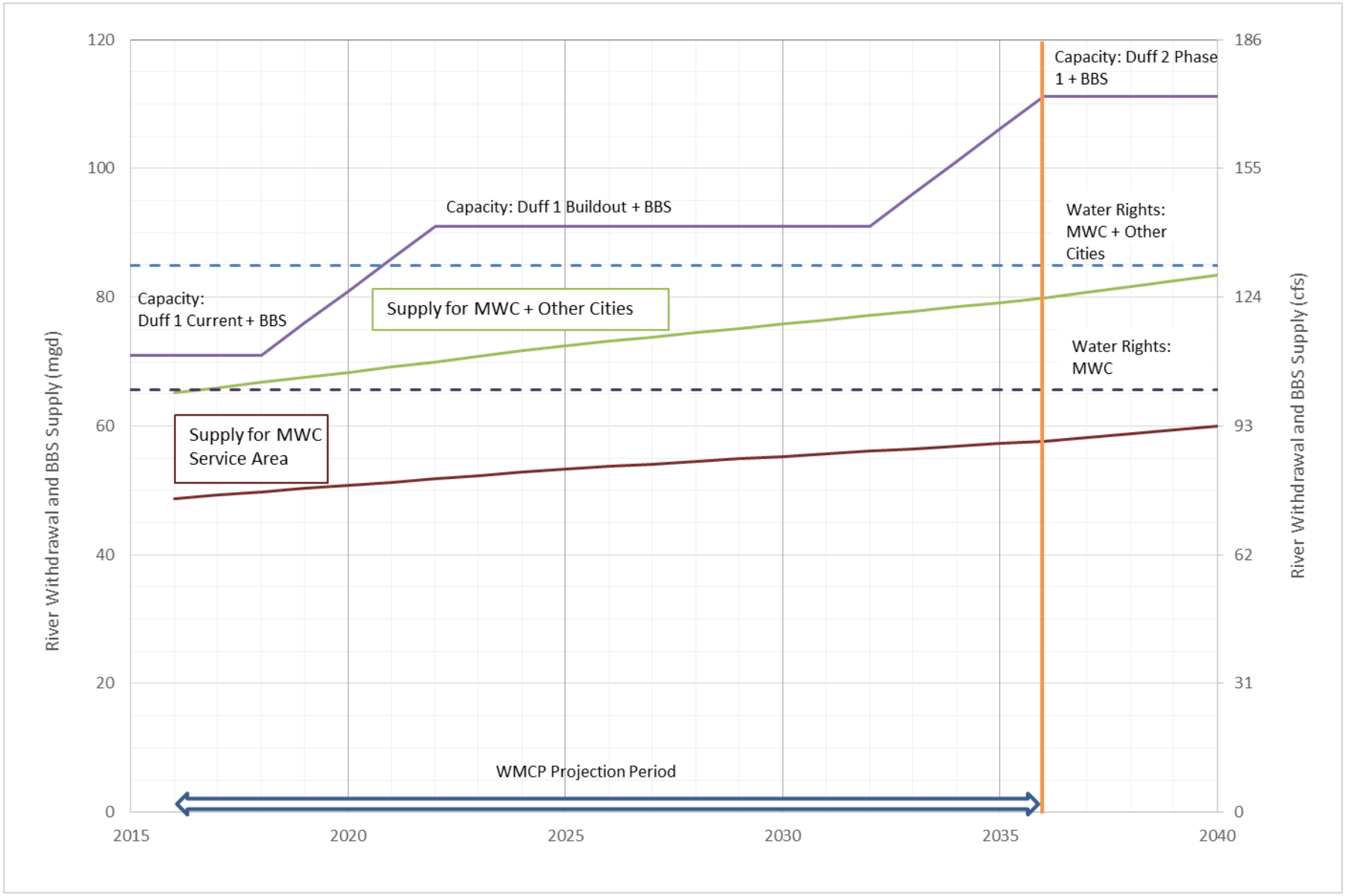


Figure 5-3. MWC Supply Projections Compared to Water Rights; Unrestricted BBS

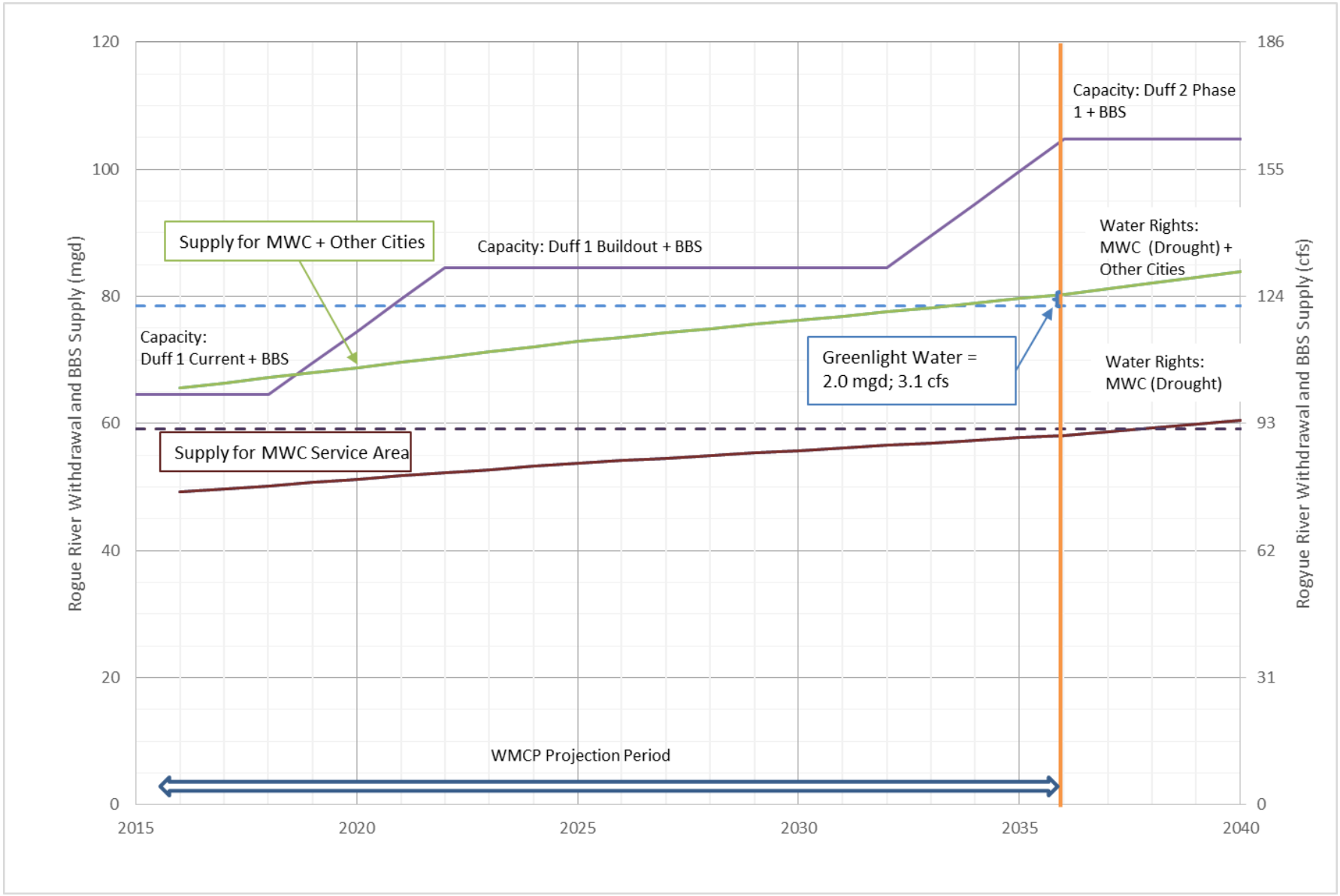


Figure 5-4. MWC Supply Projections Compared to Water Rights; Drought Limited BBS

Alternative Sources

The MWC has access to two reliable water sources, and the MWC is planning an expansion of treatment capacity on its Rogue River water source to meet the overall system 20-year demand projections.

The MWC is committed to minimizing impacts resulting from its use of the Rogue River and will engage in all necessary state and federal permitting to move forward. The MWC is also committed to the wise management and conservation of its Rogue River water source as outlined in the conservation measures in Section 3 of this WMCP. These measures, most of which provide water at a cost greater than use of either the BBS or the Rogue River supplies, will delay but not replace the need to exercise permit S-23210 and other Rogue River water rights supplied by the other wholesale cities for diversion at MWC's Rogue River treatment facilities.

MWC will continue to maximize its use of the high quality BBS source to the extent possible, and has been granted an additional point of diversion at the Duff WTP on the Rogue River for water in excess of the BBS transmission capacity. This enables flow within Big Butte Creek to be maintained for its full length.

The use of either local groundwater or aquifer storage and recovery (ASR) to store water available in the winter for use during peak summer demands are not seen as feasible alternatives. The hard rock geology of the Medford area does not provide reliable well yields and is not suitable for ASR.

As discussed in the Water Conservation element (Section 3), reuse of treated wastewater for agricultural purposes is being considered as part of a regional project known as WISE (Water for Irrigation, Streams, and Economy). Therefore this water source currently is not being considered for municipal use.

A number of conservation actions identified in Table 3-1 will be undertaken to reduce the need for additional water resources. While conservation activities will be pursued with cost-benefit considerations, the findings of the cost-benefit analyses described in Figure 3-2 and Appendix C suggest that the identified conservation activities will not provide water at a cost that is lower than other supplies.

MWC also may consider the following alternate sources of water in the future:

1. Acquisition and conversion of agricultural natural flow and/or stored water rights
2. Conversion of agricultural water rights appurtenant to MWC-owned land on the BBS watershed to municipal use
3. Purchase of stored water in Lost Creek Reservoir
4. Implementation of additional conservation measures

Greenlight Water Request and Quantification of Maximum Rates and Monthly Volumes

OAR 690-086-0170(6) requires a quantification of the maximum rate of withdrawal and maximum monthly use if expansion of water allocated under an existing permit is necessary to meet demands in the 20-year planning horizon. As described above and illustrated in Figure 5-4, the MWC's overall system water demand could reach an MDD of 124.5 cfs (80.5 mgd) within 20 years. This exceeds the drought limited maximum withdrawals by 3.1 cfs (2.0 mgd). As such, the MWC requests access to 7.5 cfs of greenlight water through this plan. With a MDD to MMD peaking factor of 1.14, the additional 7.5 cfs equates to an additional maximum month withdrawal of 131 MG (4.8 mgd/1.14 x 31 days= 131 MG).

Table 5-7 summarizes estimated maximum instantaneous and monthly withdrawals under existing water rights for the MWC system.

Table 5-7. Summary of Estimated Maximum Withdrawals by Water Supply

Water Right Information	Permitted Quantity (cfs)	Estimated Maximum Rate of Withdrawal 2036 (cfs)	Estimated Maximum Month Withdrawal Volume 2036 (MG)	Notes
Big Butte Creek Watershed				
App: S-10119 Permit: S-6704 Cert: 53323	30	30	601	Unrestricted
App: S-8092 Permit: S-6703 Cert: 86994	30	10.8	216	Unrestricted
App: S-10120 Permit: S-54935 formerly S-6884	"All remaining unappropriated water."	0	0	
Subtotal BBS		**40.8**	**818**	**Unrestricted**
Rogue River				
App: S-29527 Permit: S-23210 Cert: 86832 Rights supplied by other cities	S-23210 is for 100 cfs Other cities = 29 cfs	93.5	1,644	Drought Restriction on BBS
Total		**124.5**	**2,245**	**Restriction on BBS**

Mitigation Actions under State and Federal Law

Under OAR 690-086-0170(7), for expanded or initial diversion of water under an existing permit, the water supplier is to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act (ESA), Clean Water Act and other applicable state or federal environmental regulations.

In anticipation of expanding water supply capacity at the existing Duff WTP site, MWC has engaged in environmental analyses to identify issues related to wetlands and animal and plant species listed as threatened or endangered by either Federal or State agencies. Details of these analyses may be found in MWC's 2016 *Robert A. Duff Water Treatment Plant Facility Plan.*

The MWC is not aware of any additional legal requirements involving mitigation actions, but will comply with all necessary state and federal permitting requirements prior to expansion of diversion of water under Rogue River permit S-23210 or expansion of use of the BBS water rights.

New Water Rights

The MWC does not anticipate needing new water rights within the 20-year planning horizon.

SECTION 6

References

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Appendix A
Local Government Agency Correspondence

No comments were received from affected agencies.

Appendix B
MWC WMCP Progress Report
2014 to Present

APPENDIX B

Progress Report for Medford Water Commission Water Management and Conservation Plan

Action items	Commitment in 2014-16 Progress Report	Current Status
WATER AUDITS		
Components in 2009 WMCP		
Perform Annual Water Audits		
Continue and refine annual water audits, including improved linkages between pages and better defined methods for summarizing totals and calculating values.	MWC has prepared annual statistical reports for decades, but some improvements were desired. Report is to be revised under new billing and finance system.	Updated reports and improvements thereto were delayed by implementation of new billing & finance software, but new report format and improvements were completed in February 2016.
Assess BBS and Coal Mine metering to assure accuracy and quantify transmission line losses.	Flowtube magnetic meters are to be installed at Coal Mine fall 2014.	Flowtube magnetic meters were installed at Coal Mine in 2014. With those meters in place, new meters at BBS are not considered imperative, so are not scheduled within 10 years.
Document unmetered water usage		
Better define components of unbilled water; improve quantification of hydrant use, reservoir overflows, etc.	Continue to evaluate and refine. Research other utilities' practices relative to documenting hydrant use; possibly do pilot program on metering hydrant use associated with construction.	Beginning in 2009, efforts were implemented to better account for non-revenue water. MWC now documents unmetered, but legitimate water usage associated with such activities as water quality testing and hydrant flushing. Also worked with fire departments and others who use hydrants to estimate their water usage.
METERING		
Components in 2009 WMCP		
Fully meter system		
Already fully metered.	Continuing	System fully metered
Meter testing/maintenance program		
Continue current meter testing program. Consider expanding by performing additional meter testing. Continue to enforce existing design standards requiring test ports and bypass lines for all larger meters.	Continuing	Larger meters are tested prior to installation, as are representative samples of small meters. Meters 3" and larger are also installed with test ports and bypasses to facilitate field testing.

Action items	Commitment in 2014-16 Progress Report	Current Status
Test sample meters being removed & enter findings on database.	Spot checks done; no evidence that oldest meters were problematic. New focus is on expediting installation of AMI meters, which should negate need for this.	Because no particular older meters were proving problematic, focus changed and this was not pursued further.
Target underperforming meter types for replacement.	This is no longer a proposed action because no particular meters were found to be underperforming. Instead, move forward with full migration to AMI.	Between AMR/AMI/touch read meter replacements that have been ongoing, approximately 55% of meters in the ground are less than 11 years old.
Meter replacement program to AMR. Once replacement is completed in areas that are difficult/dangerous to read, focus on underperforming meter types.	See new AMI measure below.	Initial AMR meters no longer available; now installing AMI meters. Since no particular meter types were found to be underperforming, focus has been on eliminating targeted manually read routes.
New component in 2014 Progress Report		
Expedite meter replacement with AMI meters	Initiate AMI Propagation Study to assess needs/benefits of full functioning AMI.	Propagation study completed, providing guidance toward implementation of FlexNet. Meter replacements to AMI meters was expedited for a few years, but currently is back to initial schedule due to budget constraints.
RATE STRUCTURE AND BILLING PRACTICES		
Components in 2009 WMCP		
Quantity based billing		
Currently perform quantity-based billing	Continuing	Have monthly billing, which includes metered quantity-based component.
Rate structure that encourages conservation		
Evaluate adding a tier and increasing differential between tiers for SFR customers	Proposed action completed. Consider adding another tier.	Additional tier and larger differentials between tiers implemented in 2011; much improved price message for high use. Comprehensive Cost of Service Study by independent consultant completed in 2015 found price structure to be appropriate.
Evaluate increasing the differential between summer/winter for all other customers.	Completed	Completed; implemented in March 2011; significant changes adopted.
Consider modifications to rate structure for wholesale cities aimed at encouraging conservation/peak use reduction (possibly more individualized).	Not likely to be pursued	Not done

Action items	Commitment in 2014-16 Progress Report	Current Status
Continue surcharges for unrepaired leaks.	Continuing	Ongoing efforts continuing, with significant success. Threat and/or imposition of leak/high use surcharges very effective at incentivizing leak repair
New component in 2014		
Consider modifications to rate structures for commercial/industrial and/or multi-family residential customers. Establish separate "irrigation" billing category and rates.	May not occur within 2 ½ year period due to need for staff to first become adept with new billing/finance software.	As anticipated, did not occur in the 2 ½ years after completion of Progress Report. Due to continued adjusting to the new billing/finance software, significant billing structure changes were not considered during a comprehensive 2015 Cost of Service Study/rate structure evaluation.
LEAK DETECTION AND REPAIR		
Components in 2009 WMCP		
System leakage of less than 10%		
Current unaccounted for water is less than 10%; improve documentation of unbilled uses to enable more accurate identification of true losses.	Continue refining statistical analyses replace questionable master meters to improve data accuracy. Increase leak detection and other measures if unaccounted-for water is confirmed to be near or above 10%	Unaccounted-for water is currently near 10 percent, with system leakage less than 10 percent. Master meters at Coal Mine have been replaced and significant progress has been made to quantify valid uses of non-revenue water (firefighting, hydrant flushing, etc.) Some specific leak detection efforts were pursued, but were hampered by leak contractors' inability to utilize standard methods on large diameter pipe. 2013: Purchased new FCS S30 Surveyor sounding device to assist crews in locating leaks.
Line replacement program		
Develop database on pipe condition based on coupon removals, leaks, etc.	Continue refining methodology, add database to GIS.	Data collection regarding condition of pipe coupons began in 2008, but not added to GIS. Recently expanded the documentation of leaks, including descriptions, precise locations and photos to be integrated in GIS.
Continue funding major line rehabilitation program.	Continuing	Primary intent is to save funds for future line replacement, but have/are also using for unplanned projects resulting from city road construction activities, etc. Current balance is $3,177,700
Minimize customer side leakage		
Continue/expand customer leak notification activities.	Continue to notify customers of leaks; Increased installation of AMI meters likely to identify even more leaks	Significant actions are taken regarding persistent customer leaks/water waste. We notify and continue to pursue; 5-year total of largest leaks eliminated totaled more than 9 million gallons per month. Current practice includes mailed high usage notifications (many generated by new billing system), and personal follow-up by conservation staff for leaks not repaired. Billing staff also prepares monthly list of “top 25 water users” for each customer group, which

Action items	Commitment in 2014-16 Progress Report	Current Status
		is useful in identifying unusual/excessive customer water usage.
New components in 2014		
Projects to maintain integrity of BBS transmission mains: Make cathodic protection enhancements aimed at maintaining pipe condition.	Complete the cathodic protection enhancements currently underway.	Easements were acquired and three additional anode beds were installed. Combined with already existing installations, now have complete cathodic protection for both Big Butte Springs pipelines (each approximately 30 miles in length).
Clear pipeline paths; improve visibility of any leaks.	Continue expanded efforts at clearing pipeline paths.	Significant work on improving access to and visibility of the Big Butte Springs pipelines was performed from 2008 - 2014. This included improving access roads and bridges and clearing vegetation. Projects on #2 pipeline are mostly completed, with some work remaining on #1 pipeline. Budget cuts and staff being needed elsewhere have resulted in slowing of work on these tasks.
PUBLIC EDUCATION PROGRAMS		
Components in 2009 WMCP		
Education programs to encourage efficient water use		
Continue newsletters, bill messages, booths at public venues, promotion of school conservation kit, etc.	Continuing, with several new landscape/irrigation brochures currently in development	Continuing; many newsletter articles, messages on bills, presentations, brochures, handouts with lawn watering schedules and tips. Bill includes consumption comparison graph. Several new landscape/irrigation brochures have been completed. MWC has participated in local events and promoted national events as the Wyland Foundation Mayors Challenge for Water Conservation. In 2015, dedicated Public Information Coordinator position was established to provide more attention and expertise to all outreach, including conservation activities. A school conservation kit was developed several years ago in cooperation with other watershed education entities. MWC did not directly manage its promotion or use, and found its utilization to be minimal. MWC recently took possession of the kit to make improvements to its contents and assume the marketing role.
Continue newsletters, bill messages, booths at public venues, promotion of school conservation kit, etc.		Youth education offerings have included presentations at schools and treatment plant tours upon request, Public Works Day, Kids & Bugs events. For more than 15 years, have provided a Lawn Watering Infoline (phone recording) giving up-to-date ET-based sprinkling schedules and tips from spring through fall.

Action items	Commitment in 2014-16 Progress Report	Current Status
Increase outreach to targeted sectors, such as public officials, developers, landscapers, business groups.	Increase outreach, including work with multi-family and hotels relative to fixture replacements	Considerable interaction with landscaping industry is established and ongoing. MWC is an active member of Southern Oregon Landscape Association (SOLA). MWC has participated with sponsorship of training sessions, including for Smart Controllers in November 2014. Conservation staff have been guest presenters for Rogue Community College horticulture program, Master Gardeners, etc. Involvement with these entities affords opportunities to interact with and influence landscaping industry, a major factor of summer water demands. Have begun reaching out to multi-family residential and hotel owners relative to fixture replacements. Met with local rental owners association, and have worked with some motel owners relative to promotion of toilet rebates and other fixture replacements. Have participated in venues such as Spring Garden Fair and employee events at local businesses, with focus on conservation education for attendees. Continuing outreach with Rotary and other service clubs as opportunities present themselves.
Continue development of enhanced website features.	Continue to enhance and advertise website.	Considerable progress made; many links and new information added on ongoing basis: • Comprehensive Water Wise Gardening site, hosted by GardenSoft, launched in June 2012 and updated in 2015. Site includes hundreds of photos and tips. MWC was first utility in Pacific NW to utilize a comparable tool; won PNWS-AWWA Excellence in Communication award. • Provision of up-to-date suggested sprinkling times and tips correlated to current evapotranspiration rate (ET). • Many tips and links are available on MWC website, including both internally developed material (such as local sample lawn watering schedules and sprinkler design tips) as well as links to other relevant web sites. • Conservation for Kids section includes internally developed information and links to other kid-friendly sites.
Co-sponsor irrigation auditor training for local landscapers	Not likely offered again in next 2 1/2 years	Done in 2009 and again in 2014 - including offer of partial tuition payment for public agency employees responsible for grounds maintenance
Continue irrigation audit program	Continue; time intensive but great program	This program includes thorough on-site assessments of individual landscapes, their irrigation systems and sprinkler schedules. These are very much appreciated by customers. From 2009 through 2015, MWC provided 430 of these Sprinkler Assessments. Averaging about 61 per year (late spring through early fall), this has varied with staffing levels, with fewer

Action items	Commitment in 2014-16 Progress Report	Current Status
		conducted 2009 - 2011 due to reduced staffing during the economic downturn, and ±80 the last few summers. Customer education occurs during the assessment, and a follow-up report summarizes and prioritizes findings. About half of the assessments involve properties maintained by gardeners, so have the potential to change practices on other properties those gardeners maintain. In addition to typical homes with about 6,000 square feet of irrigated area, assessments have been done on large estate properties and CII and multi-family residential sites having acres of irrigated area.
Promote EPA WaterSense products	Continue	Promoting with rebates, signage, newsletters.
Continue involvement with Bear Creek Watershed Education Partners (BCWEP); consider more formalized youth education programs	Continue	Have remained involved with BCWEP; including Watershed Symposiums and Kids & Bugs events.
New components in 2014		
Increased use of TV, radio, newspaper	Continue and attempt to expand.	• Have made use of TV, radio and print media to reach local audiences with conservation messages. Outreach includes both paid advertising and feature content. • Guest presenter on radio gardening shows 3-4 times on different occasions; focus on efficient landscape irrigation and water-wise landscaping. • Many TV interviews on drought related issues the last few years. Also gave interview and made video explaining how to determine appropriate watering schedules for home irrigation systems (90-second video is posted on our website). • Began using print advertisements, publishing in Mail Tribune special supplements (WaterWise gardening website featured) and 3 times a year in local Spanish magazine.
Consider use of social media (Facebook, Twitter, etc.)	Contingent on MWC developing.	Facebook & Twitter launched in January 2016
TECHNICAL & FINANCIAL ASSISTANCE PROGRAMS		
Components in 2009 WMCP		
Provide technical and financial assistance to encourage efficient water use by customers		
Continue conservation grant program for public/nonprofit entities. Increase outreach under this program.	Effective program; continue to utilize.	Have continued to promote and approve grants. Grants have ranged from funding installation of ultra high efficiency urinals to replacement of a lawn-dominated landscape with water-wise landscaping at a local church.

Action items	Commitment in 2014-16 Progress Report	Current Status
Continue irrigation audits; enhance targeting of high users.	Continue; improve tracking of results.	Continuing and targeting high users. See details in Public Education Programs
Add irrigation feature/ promotion of water wise plants on web site.	Improve existing feature and consider new features.	Award winning water wise gardening web feature added 2012, enhanced in 2015.
Consider pilot program of cost sharing incentives for large commercial/industrial/ institutional customers.	Not likely in next 2 ½ years.	Not pursued; requires high expertise level of staff and/or hiring of qualified consultant. Also requires large budget to provide sufficient incentive to achieve short payback period expected by CII customers.
Consider financial incentives for incorporating water efficiency measures in new construction, especially landscaping.	Likely to implement some incentives.	Planned; delayed by long time required for code modification project, which was considered the first step in this process, with incentives to be a second priority.
Consider financial assistance for customer installations of pressure regulating devices and leak repairs.	Continue with actions related to pressure regulation; keep goal of establishing leak repair funding.	Leak fund delayed until new finance software was fully functional, but use of low income assistance funds to facilitate repairs has been approved. Worked with Medford Building Dept. to better assure proper installation of pressure regulation, including locating reducers where they can be easily found, and will serve irrigation systems as well as the structures.
FIXTURE RETROFIT/REPLACEMENT		
Components in 2009 WMCP		
Implement fixture replacement programs		
Initiate toilet rebate program; possibly urinal replacements	Continue with toilet rebates; consider urinal rebates on a comprehensive scale.	Toilet rebate program initiated November 2009; modified in July 2012. Current rebate applies to all customer classes @ $85 (+$5 recycling voucher) for replacement of 2+ gpf models and $40 (+ voucher) for replacement of lower volume toilets with WaterSense models. As of January 2016, have rebated 1,240 toilets (average 17 per month). Efficient shower heads and aerators are also offered to rebate participants. Rebates for urinal replacement not yet implemented.
Encourage retrofits of city-owned facilities with funding assistance through conservation grants.	Keep looking for opportunities, but lower priority	Attempts thus far have resulted in minimal progress; MWC has no influence on city's actions or budget.
Consider retrofit options for other fixtures that contribute to efficient water use.	Urinals and irrigation/landscape incentives are most likely to be pursued next, possibly within next 2 ½ years.	MWC has kept abreast of additional options, but existing programs have kept staff busy, so no additional retrofit programs have been pursued. Efficient showerheads and aerators are provided in conjunction with toilet rebates, and upon request at MWC office. Staff have found that random distribution results in many products not being installed, so only requested items are provided on an individualized basis.

Action items	Commitment in 2014-16 Progress Report	Current Status
WATER REUSE/RECYCLING		
Components in 2009 WMCP		
Consideration of reuse, recycling and non-potable water opportunities		
Continue involvement and funding of the WISE	Continue to support	WISE is a comprehensive and very costly project primarily focused on increasing the efficiency of non-potable irrigation water distribution within the Bear Creek valley, while also exploring agricultural reuse of municipal wastewater. MWC manages neither the irrigation water nor the wastewater, but has contributed funding, staff time and direction to this project. Multiple analyses and permitting elements are largely reliant on federal and state funding, so while the project continues to move forward, progress is slow.
No urban reuse anticipated within benchmark period Wastewater treatment is not under MWC's jurisdiction, urban reuse opportunities aren't currently cost effective, and availability of wastewater for urban uses is dependent on outcome of WISE project.	Beyond benchmark period	Status still same; no potential actions are anticipated within the benchmark period.
OTHER CONSERVATION MEASURES		
Components in 2009 WMCP		
Encourage conservation in new construction		
Work with City of Medford staff and policy makers to encourage development of water conserving development guidelines	Continue to work with city to facilitate	Completed. Following a multi-year committee project, water-wise landscape codes for Medford were adopted June 2013, and went into effect December 2013. Conservation staff remains very involved in its implementation, including providing review of newly required irrigation plans. Passage and implementation of these codes is considered a major factor in achieving water use reductions over time.
Consider similar effort with wholesale cities (encouraging development of water conserving site development guidelines).	Once Medford's new codes are functioning smoothly, increase outreach to encourage wholesale cities to adopt comparable codes.	Encouraged cities that purchase water from MWC to include this in actions proposed in OWRD conservation grant project. It was in turn identified as a priority project. To date, such regulations have not been pursued by any of the wholesale cities, and MWC has waited to further encourage action until Medford's codes have been fully refined.
Encourage and work cooperatively with targeted construction projects to facilitate integration of water conservation	Continue	Construction was limited over some of last 8 years, but have had some successes. Conservation staff has recently begun attending Land Development meetings, the first step in the city's development process, with the objective of incorporating conservation earlier in the process.

Action items	Commitment in 2014-16 Progress Report	Current Status
Consider implementing regulations related to recycling for car washes, water parks, etc.	Remain under consideration.	Requirement for water recycling by water features was included in waterwise landscape codes. Other potential actions have been researched, but no official actions have been taken
New component in 2014		
Consider new water wise demonstration garden	Contingent on city approval of park site and shared funding, but possible if done in stages; expensive.	Did not move forward due to multiple challenges. This project has been removed from MWC budget due to cost and change in direction. It is believed that MWC's WaterWise Gardening web feature along with proposed recognition of appropriate private landscapes (through yard signs, etc.) will better serve the same function at a lower cost.

Appendix C
Conservation Measure Cost Benefit Analysis Assumptions

AWE CONSERVATION TRACKING TOOL: DEFINE CONSERVATION ACTIVITIES WORKSHEET

Activity ID	Activity Name	Class	Savings, Per Unit (gpy)	Savings, Annual Rate of Decay (%)	Savings, Peak Period (% of Annual Savings)	Savings, Useful Life (yrs)	Savings, Participant Free Riders (% of Participants)
1	Residential HE Toilets, SF	Single Family	9,981	0%	42%	25	15%
2	Residential HE Toilets, MF	Multi Family	16,472	0%	42%	25	15%
3	Residential LF Showerhead, SF	Single Family	2,062	0%	42%	8	0%
4	Residential LF Showerhead, MF	Multi Family	1,898	0%	42%	8	0%
5	Residential HE Washer, SF	Single Family	7,043	0%	42%	11	0%
6	Residential HE Washer, MF	Multi Family	25,310	0%	42%	8	0%
7	Residential Irrigation Controller, SF	Single Family	24,000	0%	80%	15	0%
8	Small Landscape Audits	Multi Family	50,000	0%	80%	5	0%
9	SF Residential Turf Replacement	Single Family	23,000	0%	80%	15	20%
10	Waterwise Landscape (New Construction)	Single Family	50,000		80%	15	15%
11	CII 1/2 Gallon Urinal (Retrofit)	Commercial	6,206	0%	42%	25	10%
12	CII 1/8 Gallon Urinal (Retrofit)	Commercial	24,000	0%	42%	25	10%
13	CII 1/8 Gallon Urinal (New Const)	Commercial	24,000		42%	25	10%
14	CII Tank-Type HE Toilet (1.28 gpf)	Commercial	11,473	0%	42%	25	15%
15	CII Valve-Type HE Toilet (1.28 gpf)	Commercial	11,473	0%	42%	25	15%
16	CII Cooling Tower	Commercial	209,880	0%	70%	5	0%
17	Large Landscape Audits (Approx 2 acres)	Commercial	211,271	0%	80%	5	0%
18	Large Land. Irrigation Controller	Commercial	250,000	0%	80%	15	0%
19	Large Land. Turf Replacement (4,000 SF)	Commercial	86,940	0%	80%	20	30%
20	CII Extra WaterWise Landscape (New Const.)	Commercial	40,000	0%	80%	15	10%

AWE CONSERVATION TRACKING TOOL: DEFINE CONSERVATION ACTIVITIES WORKSHEET

Activity ID	Activity Name	Utility Costs, Year Denominated	Utility Costs, Initial Fixed ($)	Utility Costs, Initial Variable ($/unit)	Utility Costs, Years of Follow-up (yrs)	Utility Costs, Follow-up Fixed ($/yr)	Utility Costs, Follow-up Variable ($/unit/yr)
1	Residential HE Toilets, SF	2016		$165.00			
2	Residential HE Toilets, MF	2016		$165.00			
3	Residential LF Showerhead, SF	2016		$13.00			
4	Residential LF Showerhead, MF	2016	$0.00	$13.00			
5	Residential HE Washer, SF	2016	$0.00	$190.00			
6	Residential HE Washer, MF	2016		$440.00			
7	Residential Irrigation Controller, SF	2016		$290.00	2		$90.00
8	Small Landscape Audits	2016		$360.00			
9	SF Residential Turf Replacement	2016		$1,180.00	0		
10	Waterwise Landscape (New Construction)	2016		$880.00			
11	CII 1/2 Gallon Urinal (Retrofit)	2016		$220.00			
12	CII 1/8 Gallon Urinal (Retrofit)	2016		$370.00			
13	CII 1/8 Gallon Urinal (New Const)	2016		$290.00			
14	CII Tank-Type HE Toilet (1.28 gpf)	2016		$165.00			
15	CII Valve-Type HE Toilet (1.28 gpf)	2016		$180.00			
16	CII Cooling Tower	2008		$625.00			
17	Large Landscape Audits (Approx 2 acres)	2016		$1,080.00			
18	Large Land. Irrigation Controller	2016		$635.00	2	$0.00	$135.00
19	Large Land. Turf Replacement (4,000 SF)	2016		$5,270.00			
20	CII Extra WaterWise Landscape (New Const.)	2016		$2,470.00			

AWE CONSERVATION TRACKING TOOL: DEFINE CONSERVATION ACTIVITIES WORKSHEET

Activity ID	Activity Name	Participant Costs, Year Denominated	Participant Costs, Initial ($)	Participant Costs, Years of On-going (yrs)	Participant Costs, On-going ($/Yr)	Participant Savings, Sewer (gpy)
1	Residential HE Toilets, SF	2016	$100.00	0.00	$0	9,596
2	Residential HE Toilets, MF	2016	$100.00	0.00	$0	9,596
3	Residential LF Showerhead, SF	2008	$0.00	0.00	$0	2,062
4	Residential LF Showerhead, MF	2016	$0.00	0.00	$0	1,898
5	Residential HE Washer, SF	2008	$180.00	0.00	$0	7,043
6	Residential HE Washer, MF	2008	$450.00	0.00	$0	25,310
7	Residential Irrigation Controller, SF	2008	$250.00	10.00	$138	0
8	Small Landscape Audits	2016	$150.00	0.00	$138	0
9	SF Residential Turf Replacement	2016	$3,500.00	0.00	$0	0
10	Waterwise Landscape (New Construction)	2016	$2,000.00	0.00		
11	CII 1/2 Gallon Urinal (Retrofit)	2016	$250.00			6,206
12	CII 1/8 Gallon Urinal (Retrofit)	2016	$400.00	0.00	$0	6,206
13	CII 1/8 Gallon Urinal (New Const)	2016	$200.00			
14	CII Tank-Type HE Toilet (1.28 gpf)	2016	$100.00	0.00	$0	11,473
15	CII Valve-Type HE Toilet (1.28 gpf)	2016	$150.00	0.00	$0	11,473
16	CII Cooling Tower	2008	$2,225.00	0.00	$0	209,880
17	Large Landscape Audits (Approx 2 acres)	2016	$500.00	0.00	$0	0
18	Large Land. Irrigation Controller	2016	$500.00	0.00	$0	0
19	Large Land. Turf Replacement (4,000 SF)	2016	$15,000.00	0.00	$0	0
20	CII Extra WaterWise Landscape (New Const.)	2016	$2,800.00			0

AWE CONSERVATION TRACKING TOOL: DEFINE CONSERVATION ACTIVITIES WORKSHEET

Activity ID	Activity Name	Plumbing Code, Year Effective	Plumbing Code, Unit Savings (gpy)	Plumbing Code, Natural Replacement Rate NRR (%)
1	Residential HE Toilets, SF	1994	7801.223074	4%
2	Residential HE Toilets, MF	1994	16268.22965	4%
3	Residential LF Showerhead, SF	1994	2062.25	12%
4	Residential LF Showerhead, MF	1994	1898	12%
5	Residential HE Washer, SF	2011	0	0%
6	Residential HE Washer, MF	2011	0	0%
7	Residential Irrigation Controller, SF	0	0	0%
8	Small Landscape Audits	0	0	0%
9	SF Residential Turf Replacement	0	0	0%
10	Waterwise Landscape (New Construction)			
11	CII 1/2 Gallon Urinal (Retrofit)			
12	CII 1/8 Gallon Urinal (Retrofit)	0	0	0%
13	CII 1/8 Gallon Urinal (New Const)			
14	CII Tank-Type HE Toilet (1.28 gpf)	1994	9327.391136	4%
15	CII Valve-Type HE Toilet (1.28 gpf)	1994	9327.391136	4%
16	CII Cooling Tower	0	0	0%
17	Large Landscape Audits (Approx 2 acres)	0	0	0%
18	Large Land. Irrigation Controller	0	0	0%
19	Large Land. Turf Replacement (4,000 SF)	0	0	0%
20	CII Extra WaterWise Landscape (New Const.)			

ANNUAL CONSERVATION PROGRAM PARTICIPATION

Enter Annual Conservation Activity

Class	Activity Name	2016	2017	2018	2019	2020	2021	2022
Single Family	Residential HE Toilets, SF	140	140	140	130	130	130	120
Multi Family	Residential HE Toilets, MF	30	30	30	40	40	40	50
Single Family	Residential LF Showerhead, SF	40	40	40	40	40	40	40
Multi Family	Residential LF Showerhead, MF	30	30	30	30	30	30	30
Single Family	Residential HE Washer, SF	0	0	0	0	25	40	50
Multi Family	Residential HE Washer, MF	0	0	0	0	5	8	10
Single Family	Residential Irrigation Controller, SF	0	5	10	10	15	15	15
Multi Family	Small Landscape Audits	65	70	75	75	75	75	75
Single Family	SF Residential Turf Replacement	0	0	5	10	15	15	15
Single Family	Waterwise Landscape (New Construction)	0	0	5	10	15	15	15
Commercial	CII 1/2 Gallon Urinal (Retrofit)	0	5	5	7	7	9	9
Commercial	CII 1/8 Gallon Urinal (Retrofit)	0	10	10	14	14	16	16
Commercial	CII 1/8 Gallon Urinal (New Const)	0	5	5	8	8	10	10
Commercial	CII Tank-Type HE Toilet (1.28 gpf)	30	30	30	30	30	25	25
Commercial	CII Valve-Type HE Toilet (1.28 gpf)	0	10	10	15	15	15	20
Commercial	CII Cooling Tower	0	0	1	1	1	1	1
Commercial	Large Landscape Audits (Approx 2 acres)	5	7	10	10	10	10	10
Commercial	Large Land. Irrigation Controller	0	3	6	9	12	15	15
Commercial	Large Land. Turf Replacement (4,000 SF)	0	0	0	2	2	3	3
Commercial	CII Extra WaterWise Landscape (New Const.)	0	0	2	2	4	4	6

ANNUAL CONSERVATION PROGRAM PARTICIPATION

Enter Annual Conservation Activity

Class	Activity Name	2023	2024	2025	2026
Single Family	Residential HE Toilets, SF	120	120	110	110
Multi Family	Residential HE Toilets, MF	50	50	60	60
Single Family	Residential LF Showerhead, SF	40	40	40	40
Multi Family	Residential LF Showerhead, MF	30	30	30	30
Single Family	Residential HE Washer, SF	50	50	50	50
Multi Family	Residential HE Washer, MF	10	10	10	10
Single Family	Residential Irrigation Controller, SF	20	20	20	20
Multi Family	Small Landscape Audits	75	75	75	75
Single Family	SF Residential Turf Replacement	15	20	20	20
Single Family	Waterwise Landscape (New Construction)	15	20	20	20
Commercial	CII 1/2 Gallon Urinal (Retrofit)	9	11	11	11
Commercial	CII 1/8 Gallon Urinal (Retrofit)	16	18	18	18
Commercial	CII 1/8 Gallon Urinal (New Const)	10	12	12	12
Commercial	CII Tank-Type HE Toilet (1.28 gpf)	25	25	20	20
Commercial	CII Valve-Type HE Toilet (1.28 gpf)	20	20	20	20
Commercial	CII Cooling Tower	1	1	1	1
Commercial	Large Landscape Audits (Approx 2 acres)	10	10	10	10
Commercial	Large Land. Irrigation Controller	15	15	15	15
Commercial	Large Land. Turf Replacement (4,000 SF)	4	4	5	5
Commercial	CII Extra WaterWise Landscape (New Const.)	6	8	8	8