City of Falls City

Polk County, Oregon

Water System Master Plan

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Project No. 2016-001

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Executive Summary

Section **ES**

This Section is meant to show highlights of the complete report. For more details, see the appropriate sections in the complete report.

ES.1 STUDY AREA & POPULATION

Detailed information on the Falls City water system study area is provided in Section 2.

ES.1.1 Study Area

The City of Falls City is approximately 20 miles southwest of the City of Salem in Township 8 South, Range 6 West W.M. in Polk County. The City is situated along both sides of the Little Luckiamute River. It is located within Polk County.

The service area for the Falls City water system generally coincides with the Falls City Urban Growth Boundary (UGB), which encompasses approximately 777 acres (1.2 square miles). Designated zoning in the City includes commercial-industrial, commercial-residential, forestry, public assembly institution, public open space, and residential. The service area also includes several users outside the UGB, and the Luckiamute Water District.

ES.1.2 System Population

The 2010 census data indicates that the City of Falls City had a population of 947. The Portland State University Population Research Center certified the 2015 population for the City as 950. Future population in the City was projected based on the growth rate adopted by the City as established in the Wastewater Facilities Plan. The population within the City of Falls City is expected to grow at an annual growth rate of 1.5% per year. Based on this rate, the population should increase to 1280 residents by the year 2035.

ES.1.3 System Description

The Falls City water system consists of two intakes (Teal Creek and Glaze Creek) that gravity feed a slow sand filter water treatment plant. The water travels from the plant to some of the services and then the 600,000 gallon storage reservoir. Water travels from the reservoir to the remaining services in the City. Some areas are beyond pressure reducing valve stations.

ES.2 WATER USAGE & SYSTEM DEMANDS

Detailed information on the City's water usage and system demands is provided in Section 5.

ES.2.1 Customer Accounts

Billing records were analyzed to determine the number of active residential and non-residential users served by the City's water system. Water accounts reporting no annual water consumption were not included within the active account inventory. As Table ES-1 shows, the system provides water to 403 active customers as of 2015. The table shows a reduction in the number of residential users over the period shown. Overall, active water accounts serviced by the City's water system have decreased over the study period.

Table ES-1 – City of Falls City Active Water Account Inventory

Customer Water Accounts	2010	2011	2013	2014	2015
Residential Accounts	394	394	384	389	385
Non-Residential Accounts	17	19	18	18	16
Bulk	2	2	2	2	2
Total Accounts	413	415	404	409	403

Customer Water Consumption

Monthly billing records for 2010-2015 (except 2012) were obtained from the City and analyzed. A glitch in the billing software caused data loss for 2012, so it could not be included. A summary of annual water use is provided in Table ES-2 broken down into categories by user type. Total annual water consumption averaged nearly 38 million gallons over the study period. During this period, residential use has been approximately 76.8% of total usage. However, in 2015, bulk water increased to 23% of total system use. The City changed policy on how much water it sells to Luckiamute Water District, and they report that this larger quantity is planned to continue into the future. It should be noted that the values listed in the following table are only for metered customer water usage and do not include data for the system's unmetered users.

Table ES-2– Annual Water Consumption[1]

Year	Residential Usage (gallons)	Non-Residential Usage (gallons)	Luckiamute Usage (gallons)	Total Water Usage (gallons)
2010	28,173,000	2,553,000	4,343,000	35,069,000
2011	28,071,000	2,613,000	6,191,000	36,875,000
2013	29,339,000	2,500,000	5,467,000	37,306,000
2014	30,541,000	2,463,000	5,614,000	38,618,000
2015	31,141,000	2,359,000	10,203,000	43,703,000
Average	29,453,000	2,497,600	6,363,600	38,314,200

[1]Does not included usage by unmetered accounts

Residential water usage was further analyzed to determine average usage on a per account and per capita basis (Table ES-3). Average usage has equaled 207 gallons per account per day (gal/acct/day) and 85 gallons per capita per day (gpcd). The average per capita consumption in Oregon is about 111 gpcd[1]. Several factors that may be contributing to the low per capita usage rate include low-income residents, climate, and inaccurate service meters.

Table ES-3 – Average Residential Metered Usage[1]

	2010	2011	2013	2014	2015	Average
Ave. Res. Usage (gal/acct/day)	196	195	209	215	222	207
Average Capita Usage (gpcd)	82	81	85	88	90	85

ES.2.2 Non-Residential Usage

A summary of water consumed by non-residential users is provided in the following table. One of the largest water users is the High School but there are several residential accounts that are sometimes as much or more than the school. The City attributes this to people using City water for irrigation on agricultural properties. The other major usage is the bulk water sales to the Luckiamute Water District. Policy changes have increased the amount of water sold to the Luckiamute Water District, 2015 is a more applicable value to consider compared to the average for future years.

Table ES-4 – Average Non-Residential Metered Usage & Bulk Sales

	2010	2011	2013	2014	2015	Average
Ave. Non-Res. Usage (gal/acct/day)	411	377	381	375	404	390
Average Bulk Sales (gpd)	11,899	16,962	14,978	15,381	27,953	17,435

ES.2.3 Water Production

The following table details total annual production, average daily demand (ADD), maximum monthly demand (MMD), and maximum daily demand (MDD) from 2010-2015, (excluding 2012 which was excluded to analyze the same years of consumption and production data.)

[1] AWWA Water Distribution Systems Handbook, Larry W. Mays, 2000. Table 3.1

Table ES-5 – Plant Production Summary

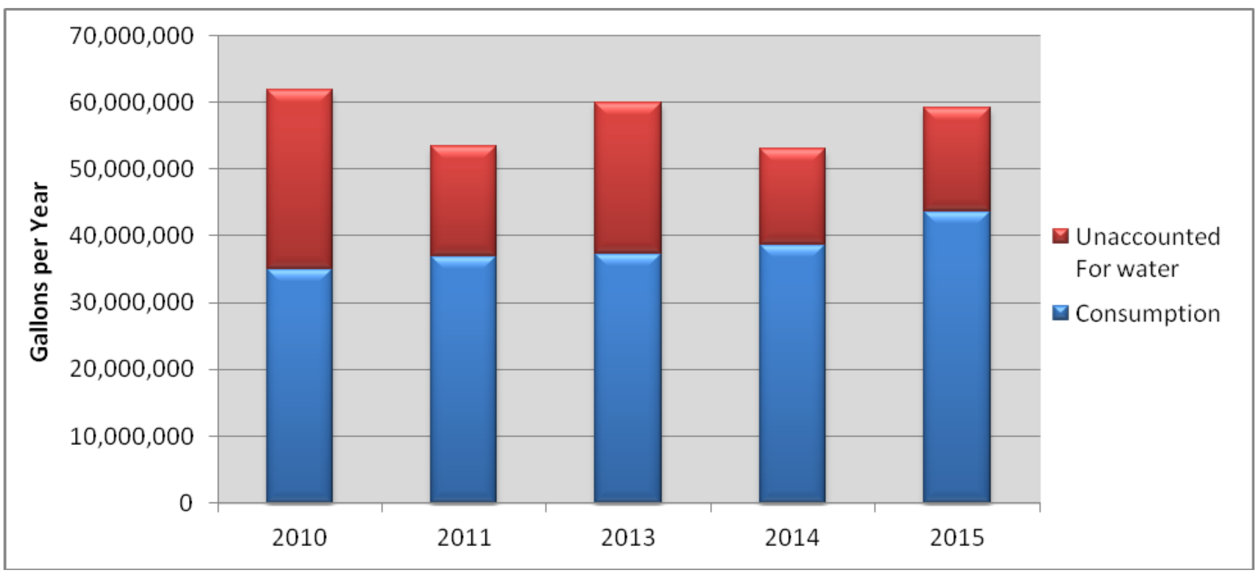
Year	Total (mg)	Average Day (gpd)	Max Month (gpd)	Max Day[1] (gpd)
2010	61.81	169,794	255,194	323,500
2011	53.35	146,162	196,677	268,000
2013	59.96	164,266	276,935	314,500
2014	53.02	145,268	220,032	289,500
2015	**59.26**	**162,353**	**287,839**	**349,000**
Average	57.48	157,569	247,335	308,900

** Bold values indicate maximum value in data set
[1]Based off two-day running average to account for peak production days followed by low production days that imply a non-use-based problem occurred such as a filter malfunction.

ES.2.4 Unaccounted Water

Not all water produced is consumed by a water system's users. A portion of treated water is required for system flushing and sampling. Unaccounted for water is the difference between total water produced and the total metered usage of system's customers and operations. This difference can be attributed to leakage in the distribution system, inaccuracies in water meters, water lost during water main breaks, water used fire fighting, and other public non-metered use. The following chart shows the amount of total production attributed to customer meters and unaccounted for water.

Chart ES-1 – City of Falls City Water Production Audit



In general, the amount of unaccounted for water in the system has decreased each year since 2010, with the exception of 2013. Over the period analyzed, unaccounted water has averaged 33% of total water production, or approximately 96 million gallons. The typically accepted percent of water loss is 10%. At that point, it is no longer considered economical to reduce leaks, and the Oregon Water Resources Department doesn't require actions in a water management and conservation plan.

ES.2.5 Projected Water Demands

Typically the primary factor affecting future water production is system growth. The typical methodology of projecting water system demands based on unit designs multiplied by forecasted growth was used to project future water demands in the City of Falls City.

Table ES-6 presents projected future water demands in the system. These demands are dependent on a number of variable factors. Therefore it is recommended that the system carefully monitor future demands and update this Master Plan if there is a large discrepancy between projected and actual demands.

Table ES-6 – Projected Average, Maximum Monthly & Maximum Daily Demands

Demand Type	2015 (Current)	2035
Max Day	243	347
Max Month	161	228
Average Day	73	156
Winter Day	56	138
Peak Hour	365	484

ES.3 EXISTING SYSTEM INVENTORY & ANALYSIS

Although parts of the system date back to 1915, the majority of the City's current water system was upgraded in 1999. Water is provided from surface water intakes at Glaze Creek and Teal Creek. Raw water is diverted from the creeks and conveyed to the water treatment plant. Water is treated using a three-cell slow sand filter system and then gravity fed to the treated water reservoir which feeds the majority of City's distribution system. The rest of the system is fed from the reservoir feed line. The current system has a design capacity of 183 gpm or 0.26 MGD per filter, but the City reports that it only produces 390 gpm with all filters active, under optimal conditions.

Detailed information on existing infrastructure inventory is presented in Section 4. Analysis of system capacity and condition is provided in Section 7.

ES.3.1 Water Supply

Description & Assessment

The City of Falls City relies on Glaze Creek and Teal Creek as its primary drinking water supply sources. The City also has 4 other active water rights and one cancelled water rights whose sources are currently not connected to the system. This allows a maximum combined allowable diversion of 2,720 gpm, or 1,347 gpm of diversion that is connected to the system. Typically raw water is diverted from Glaze Creek in the winter/spring, and Teal Creek in the summer/fall.

A summary of key deficiencies related to the City's water supply system is provided below:

- **Poor Water Quality** – Seasonal spikes in Teal Creek turbidity associated with runoff during storm events make treatment of raw water difficult.

- **Screen** – The existing intake on Teal Creek does not sufficiently prevent debris (particularly fir needles, leafs, and rocks) from entering transmission piping to WTP. Objects can clog transmission lines causing maintenance problems and impairing treatment capabilities. Also, the screen is not equipped with mechanical cleaning so large debris can block screen and restrict diversions.

- **Transmission Piping** – The spring source is conveyed to the water treatment plant via a pipeline of varying size and material. This pipeline is old and in questionable condition. It was originally constructed in 1915, (replaced in the 1970s) and has likely degraded overtime. Inaccurate survey technology at the time likely led the construction of the pipeline outside of the easement allotted for the water line. There are portions of the pipeline that the City doesn't know its exact location. Other portions of the raw water line are above ground.

Improvement Alternative Analysis

The City's water supply from Glaze and Teal Creeks is sufficient to meet the City's current water needs. However, there are concerns about the viability of the raw water transmission line and the accessibility of the existing intakes. Further investigation is needed to determine what the best option for source improvements. This plan recommends a separate intake study to analyze the specific details of each option. A few preliminary options are discussed in the following paragraphs.

Alternative W1 - Improvements to Current Intakes & Raw Water Transmission Line

If the City were to rehabilitate the existing infrastructure, it would require updating to fish friendly intakes with fine screens or a well with surface water intrusion drilled diagonally into creek bank. The raw water line would also need to be located, repaired, and brought below grade in all areas. Locations of the raw water line that are outside of easements would need easement acquisition, to ensure the City has access to every part of their system. This would retain the existing gravity system. This item is likely the most costly option, but will need to be further evaluated in the intake study to determine its relative merit.

Alternative W2 - Install Intake Closer to Water Treatment Plant

This alternative would reduce the length of raw water transmission line and place the intake in a location that is more accessible to City Staff adjacent to the plant. Installation of an intake closer would initiate the need for pumping to the water treatment plant, which could increase maintenance costs. It would require a water rights transfer.

Alternative W3 - Backup Well at Water Treatment Plant

This alternative would place a backup well on the Water Treatment Plant site. It would be used in case of raw water transmission line failure. The existing intakes and raw water lines would remain the same. It would require a water rights transfer. This would be a medium cost option, but provide a viable solution in case of a large emergency such as an earthquake.

Alternative W4 – No Action

The last alternative investigated for the City's water supply system is the "No Action" alternative. As the name implies, this alternative would make no improvements to any of the City's water supply facilities, thus problems associated with water quality, access, capacity, and maintenance on the raw water transmission line would persist. Consequently, in case of some emergencies, it could be a very long time that the City has no water available.

Water Supply Alternatives Analysis & Recommended Supply Improvements

Further investigation is needed to determine what the best option for source improvements. This plan recommends a separate intake study to analyze the specific details of each option and select a path forward.

ES.3.2 Water Treatment

Description & Assessment

The City's water treatment plant (WTP) was originally built in 1999 with some updates completed as needed since. The plant includes a triple-cell slow sand filtration system and disinfection. The existing WTP has an existing maximum capacity of 390 gpm. The WTP should be capable meeting maximum day demand (MDD) with 24 hours or less of operating a day, therefore the maximum daily treatment capacity is 562,000 gallons.

WTP slow sand filtration systems are credited with 2.0–log *giardia* and a 2.0-log *cryptosporidium* removal. Chlorine disinfection provides an addition 1.0–log *giardia* removal credit.

A review of online data available on the State's Drinking Water Program's website shows that the City of Falls City water system has been cited for three violations since 2011. They are all reporting violations. Although reporting is important to monitor public safety by the state, none of these violations constituted a public health risk after the monitoring results were presented.

Existing deficiencies of the City's WTP include:

- **Condition** – Overall, it appears that in the WTP is in relatively good condition, with only a few minor repairs needed including:
  - Some portions of concrete are starting to show some signs of wear and should be resealed, and patched as necessary to slow damage.
  - A few leaks have been noticed in the vaults that need to be repaired.
  - The City desires to replace the chlorine line to the clearwell.

Improvement Alternative Analysis

There are no major issues with the existing water treatment plant, so no alternatives need to be considered. The following are proposed minor recommendations:

- Repair minorly damaged and spawling concrete around plant and clearwell.
- Replace chlorine line to clearwell
- Repair leaks in vaults

ES.3.3 Water Storage

Description & Assessment

Treated water is gravity fed from the WTP to some connections and then to the City's only storage reservoir. The reservoir is a welded steel tank. Although the tank has a nominal capacity of 600,000 gallons, operating capacity is only 585,650 due to the overflow level. The reservoir site is fenced and the access road is gated. The reservoir is equipped with a float level indicator to monitor water levels in the tank. When the water level drops, the local altitude valve will open to begin filling the tank. The valve automatically shuts off when water levels reach a set point. Treated water stored in the reservoir tank flows to the distribution system through a 12-inch pipeline. The elevation of the tank is sufficient to provide pressure to all users without the need for additional pumping.

Deficiencies related to the City's treated water storage include:

- **Condition** – The exterior of the tank appears to be in good condition with the exception of peeling paint on the roof. The interior of the reservoir was recently inspected and cleaned in the summer of 2016. Only minor rust was discovered in the inspection. It is recommended to get this done every three years to monitor the internal conditions of the reservoir, and assess when coating may be needed. There are three bullet marks that need to be repaired, but they did not cause structural damage or cause leakage.

Improvement Alternative Analysis

The roof should be repainted. The bullet holes in the tank should be repaired, and the interior of the tank should continue to bemonitored for corrosion.

ES.3.4 Distribution System

Description & Assessment

The City's distribution system was constructed during various phases beginning in approximately 1915. Age, size, condition, material of pipelines vary throughout the system. Detailed mapping is not available and much of the information on underground water lines remains unknown.

Pipeline breaks are common throughout the distribution system. These breaks are typically the result of weak and degraded pipe material such as asbestos cement in combination with excessively high mainline pressures, which exceed 125 psi in some locations.

A list of existing deficiencies related to the City's distribution system is provided below.

- **Condition** – Age, size, condition, and material of pipelines vary throughout the system. Pipeline leaks and breaks are common throughout the distribution system. These breaks are typically the result of weak and degraded pipe material especially asbestos cement pipe.

- **Leaks** – leaks are suspected through the system based on the age and material of the pipes.

- **Performance** – Distribution system capacity was evaluated using WaterCAD modeling software. Many areas of town have excessive pressures while other parts of town have low pressures. Rezoning is needed to combat this issue. In addition, many of the pipes in the system are undersized to carry the capacity needed to supply the system.

- **Unmetered Hook-Ups** – There are two connections that are not metered in the City Parks. These are only used occasionally for seasonal cleaning.

- **Service Meters**_– Meters typically have a useful life of 10-15 years, however, many of the system's water meters are over 20 years old. As service meters age, they typically underreport water usage. This results in inaccurate data used in water audits as well as potential revenue loss.

Improvement Alternative Analysis

The City's water distribution system varies in condition and performance. Many pipelines in the older sections of the system (pre-1996) are undersized and in poor condition. Leaks and brakes in these sections are common and believed to be a major contributor to the high volume of water loss in the system. Additionally, many of the system's existing customer meters have been in service for 20 years or longer. Standard useful life for a water meter is 10 to 20 years. As meters ages, they tend to underreport water usage. Underreported water usage may also account for some of the unaccounted water in the system. Replacing these meters would provide the City with more accurate data of water usage and may also increase system revenue.

Advantages and disadvantages of each of the distribution system alternatives are presented in Table ES-7

Table ES-7 - Comparison of Distribution System Alternatives

Alt.	Description	Advantages	Disadvantages
D1	Gravity Fed System	• Replaces the most degraded pipelines in the distribution system • High reduction in water loss • Low O&M time & costs • Reduces high pressures and increases low pressures	• High pressure transmission lines • Large number of PRVs
D2	Pump Driven System	• Replaces the most degraded pipelines in the distribution system • High reduction in water loss • Reduces high pressures and increases low pressures • Maintains reasonable pressures in transmission lines	• O&M costs & time that would not exist with other options • Large number of PRVs
D3	Standard Meter Replacement	• Improve accuracy of customer usage • May result in increased revenue • Can replace meters on an "as needed" basis	• Requires physical access to meter (e.g. not able to perform meter readings when covered in snow) • Requires several days of staff time to read meters • Potential loss of revenue
D4	AMR Meter Replacement	• Significant reduction in time required to read meters • Will allow meter readings to be done even if meter is buried in snow • Most accurate system • May increase revenue	• Largest capital cost • Requires upgrade of all meters • Requires additional equipment
D5	No Action	• No capital cost	• Local areas of low & high pressure • Increased O&M of system • Risk of major break • Continued poor accuracy of some customer meters • Loss of revenue due to underreported usage • Requires physical access to meter • Requires several days of staff time to read meters

Reducing pressures in the system should be the City's highest priority. For this reason, the "No Action" alternative (D5) is not advisable. Rezoning the distribution system as part of the Gravity Fed option is recommended as the highest priority project because it is expected that high pressures are the largest cause of breaking pipes in the system. Recommended improvements to replace asbestos cement and undersized pipes should also be high priority to further reduce water main breaks and improve system performance. It is also recommended that the City replace its existing metering system with an AMR system (D4). This will improve meter accuracy, reduce staff time required for reading meters and billings, and allow meters to be read regardless if snow or other cover prevents physical access to meters.

ES.4 RECOMMENDED CAPITAL IMPROVEMENT PLAN

Details on the recommended capital improvement plan (CIP) for the City's water system is provided in Section 8.

ES.4.1 Priority 1 Projects

Priority 1 projects are the most critical and must be undertaken as soon as possible in order to satisfy the current operational and regulatory requirements. Priority 1 projects should be considered as the most immediate needs of the water system and completed within the next few years, or as soon as funding for these projects can be obtained. Priority 1A improvements should be completed in the next 0-5 years and generally consist of replacing asbestos cement piping in critical areas. Priority 1B improvements generally coincide with rezoning the system in order to reduce high pressure lines and in turn, reduce probability of pipe failure. Priority 1B should be completed in the next 0-10 years.

ES.4.2 Priority 2 Projects

Priority 2 projects are projects that should be undertaken within the first half of the planning period to restore aging facilities to new operating conditions and to increase system capacity. While they do not have to be undertaken immediately, they should be included in the capital improvement plan (CIP) and undertaken as funding is obtained. These improvements generally coincide with intake improvements and replacement of asbestos cement pipe.

ES.4.3 Priority 3 Projects

Priority 3 projects are less urgent system repairs that need to occur sometime within the planning period as these items become dysfunctional or in order to extend the life of facilities. Priority 3 also includes pipe looping to improve water quality in dead-end lines. Funding for Priority 3 projects are likely to be financed through a combination of system funds and rate increases.

ES.4.4 RECOMMENDED IMPROVEMENTS COST SUMMARY

A summary of the recommended capital improvement projects costs is provided in the Table ES-8. Detail cost estimates for each improvement is provided in the Appendix E.

Table ES-8 - Recommended Projects Costs Summary

No.	Project Name	Preliminary Estimated Cost
Priority 1A Projects(0-5 years)		
1A-1	Repair Bridge Holding Water line	$ 116,188
1A-2	Alan Street	$ 303,079
1A-3	Sheldon Avenue	$ 125,206
1A-4	Parry Road	$ 82,891
1A-5	Fairview Street and Terrace Street	$ 343,964
1A-6	Hopkins Street	$ 225,599
1A-7	Alley North of Main Street	$ 150,443
1A-8	Mill Street	$ 58,305
1A-9	Forest Lane and Clark Street	$ 256,458
Sub Total of Priority 1A Projects		*$ 1,662,131*
Priority 1B Projects(0-10 years)		
1B-1	Reservoir Transmission Line	$ 386,929
1B-2	North Zone Transmission Line	$ 675,350
1B-3	West Zone Transmission Line	$ 476,011
1B-4	Pine Street	$ 168,236
1B-5	Disconnect 6th and Mitchell	$ 4,225
1B-6	PRV Installations and Reconfigurations	$ 182,163
1B-7	7th Street and Prospect Street	$ 214,825
Sub Total of Priority 1B Projects		*$ 2,107,739*
Priority 2 Projects(10-15 years)		
2A	5th Street and Pine Street	$ 201,208
2B	Lewis Street and Lombard Street	$ 511,225
2C	Wood Street	$ 57,298
2D	School	$ 19,533
2E	Reservoir Improvements	$ 33,840
2F	Intake Siting Study and Improvements	$ 25,000
Sub Total of Priority 2 Projects		*$ 848,103*
Priority 3 Projects(15-20 years)		
3A	West Zone Loop	$ 555,653
3B	Northwest Improvements	$ 326,414
3C	Prospect Avenue	$ 86,076
3D	West Boulevard Loop	$ 101,351
3E	Clark Street Loop	$ 100,474
3F	Carey Court	$ 107,640
3G	Northeastern Fireflow	$ 251,973
3H	Priority 3 PRVs	$ 215,963
3I	Service Meters	$ 391,463
3J	Fire Hydrants	$ 330,525
3K	Water Treatment Plant Improvements	$ 7,150
Sub Total of Priority 3 Projects		*$ 2,474,680*
Total Recommended Improvement Project Costs		**$ 7,092,653**

The estimated cost for all system improvements is approximately $7 million in 2016 dollars. Funding options for proposed improvement projects are discussed in greater detail in Section 9.

SECTION 1

Introduction

Section

Introduction 1

1.1 BACKGROUND AND NEED

The City of Falls City is located approximately 7 miles southwest of Dallas and approximately 20 miles southwest of Salem in Polk County. The City has a population of approximately 950 residents and has experienced a small amount of growth over the past decade.

The majority of the City's current water system was upgraded in 1999. Water is provided from surface water intakes at Glaze Creek and Teal Creek. Raw water is diverted from the creeks and conveyed to the water treatment plant. Water is treated using a three-cell slow sand filter system and then gravity fed to the treated water reservoir which feeds the majority of City's distribution system. The rest of the system is fed from the reservoir via a 12"gravity trunk line. The current system has a design capacity of 183 gpm or 0.26 MGD per filter, but the City reports that it only produces 390 gpm with all filters active, under optimum conditions. A map of the system is shown in Figure 1 of appendix A.

Parts of the system are near or at the end of their useful life and need replacement. Other facilities lack the needed capacity or volume. The City of Falls City is in need of this *Water System Master Plan* to evaluate the system, identify needs, estimate improvement costs, and generally provide planning guidance for the water system over the next 20 years.

1.2 STUDY OBJECTIVE

This document will serve as both the *Water System Master Plan* (Plan) and the *Water Management & Conservation Plan* (WMCP).

The purpose of this *Water System Master Plan* (Plan) is to furnish the City of Falls City with a comprehensive planning document that provides engineering assessment of system components and guidance for planning and management of the water system over the next 20 years. This document satisfies the Oregon Drinking Water Program (DWP) requirements for water master plans. See Appendix B for these requirements.

The purpose of this *Water Management & Conservation Plan* (WMCP) is to develop a strategy to more effectively manage and conserve the City's valuable water sources. The City has voluntarily prepared this WMCP in accordance with revised rules described under OAR 690-086 in order to create a long term water management and conservation tool for the City's water system.

This Plan details infrastructure improvements required to maintain compliance with State and Federal standards. Capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meet the requirements of the Oregon Business Development Department (OBDD), the Oregon Water Resource Department (OWRD), the Rural Utilities Service (RUS), and the Oregon Drinking Water Program (DWP).

1.3 SCOPE OF STUDY

1.3.1 Planning Period

The planning period for this *Water System Master Plan* is 20 years, ending in the year 2035.

1.3.2 Planning Area

The primary planning area generally coincides with the City of Falls City's urban growth boundary (UGB), which is shown in Figure 1 of Appendix A. Adjacent lands and waters that are affected by the system, or will be affected by proposed improvements, will also be included. The City services several users outside City Limits as well as the Luckiamute Water District.

1.3.3 Work Tasks

In compliance with the Oregon Drinking Water Program and Oregon Water Resource Department required plan elements and standards, this Plan provides descriptions, analyses, projections, and recommendations for the City's water system over the planning period. The following elements are included:

- Study area characteristics including land use and population trends and projections
- Existing regulatory environment including regulations, rules, and plan requirements
- Description of the existing water system including supply, treatment, storage, and distribution
- Current water usage quantities and allocations
- Projected water demands
- Existing system capacity analysis and evaluation, including hydraulic model of distribution system
- Improvement alternatives and recommendations
- A summary of recommendations with associated costs
- Funding options
- Rate Study
- Water Management and Conservation Plan
- Maps of the existing system and recommended improvements

1.4 AUTHORIZATION

The City of Falls City contracted with HBH Consulting Engineers, Inc. on December 14, 2015 to prepare this Water System Master Plan. Included in the contract is a Scope of Engineering Services on which the scope of this Plan is based.

1.5 ACKNOWLEDGMENT

This Master Plan is the result of contributions made by a number of individuals and agencies. In particular, the following persons should be acknowledged for the important roles they played in the preparation, review, and development of this Plan:

Terry Ungricht .... City of Falls City
Domenica Protheroe...................................... City of Falls City
Don Poe.. City of Falls City
Johanna Birr... City of Falls City

In addition to these key personnel, we wish to thank the City of Falls City's City Council for providing support and input on this project.

SECTION 2

Study Area

2.1 PHYSICAL ENVIRONMENT

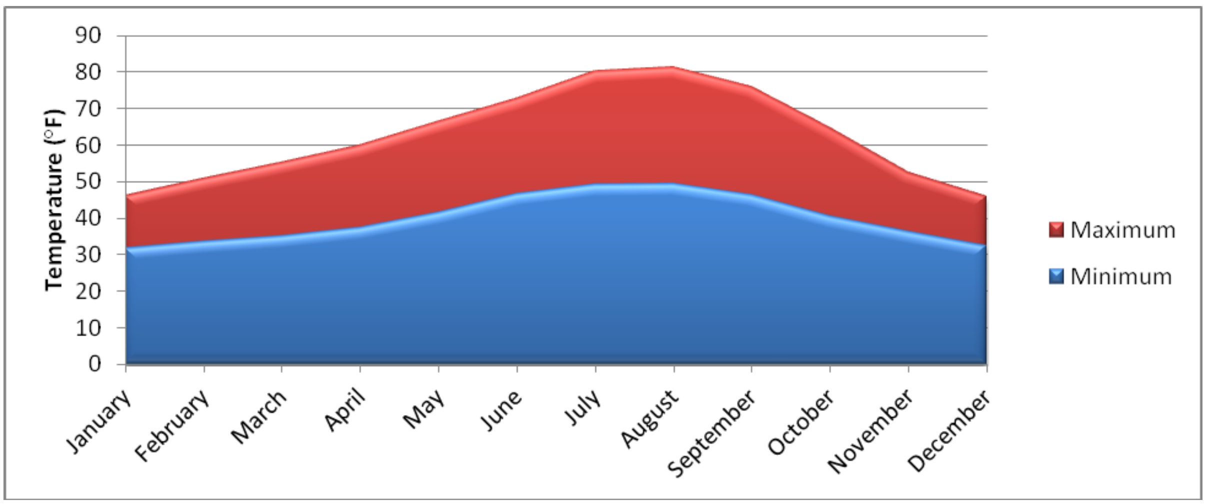
2.1.1 Location

The City of Falls City is approximately 20 miles southwest of the City of Salem in Township 8 South, Range 6 West W.M. in Polk County. The City is situated along both sides of the Little Luckiamute River.

2.1.2 Climate

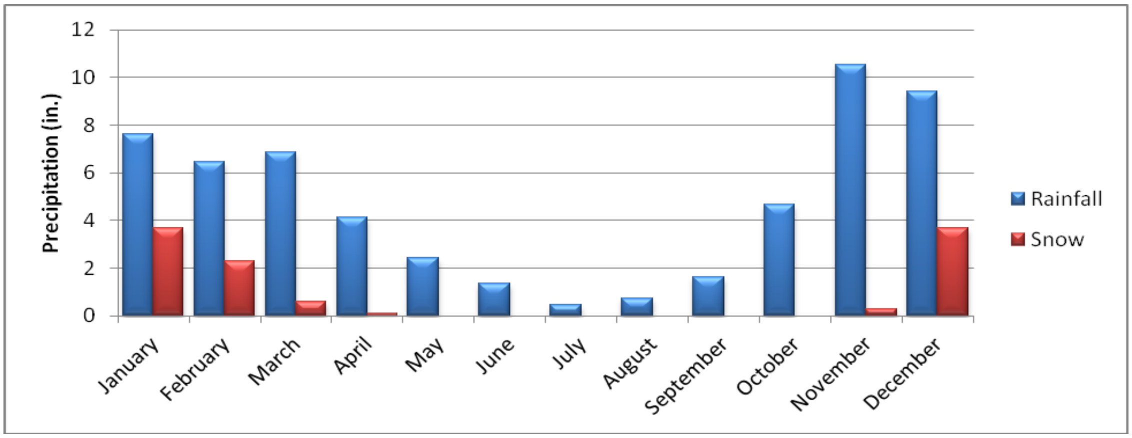
Climate information for Falls City was obtained using records collected at the nearby weather station (WRCC Station ID: OR352805). The area generally has mild summers and winters. Annually, the average temperature is 51.4°F.

Chart 2-1: Historical Temperature Data for Study Area (1961-2001)



Most of the annual 67 inches of precipitation is in the form of rainfall. The average annual snowfall is 10.8 inches. Two-thirds (66%) of yearly precipitation occurs during the wet weather months (Nov. - Feb.) On average, about 6% of the annual precipitation occurs during the dry weather months (Jun.-Sept.).

Chart 2-2: Average Precipitation for Study Area (1971 – 2000)



2.1.3 Topography

The terrain within the water distribution system varies from an elevation of 731 feet at the WTP to 683 at the treated water storage tank to approximately 337 near the river. The City's primary water sources are located at elevations of 898 feet and 1276 feet. The majority of the system's customers are at an elevation between 337 feet and 588 feet. Drainage generally runs towards the river, which bisects the City.

Elevations within this study are from Google Earth. The exception is the elevation of the storage reservoir and WTP which were adjusted from Google Earth to more closely replicate the pressures in field testing in modeled results.

2.2 LAND USE

Current zoning within Falls City's UGB is shown in Figure 2 of Appendix A. The majority of land within the service area is zoned for residential use. Other land uses permitted within the study area include commercial, forestry, industrial, and public. Table 2-1 lists the various land use categories and estimated area within the study area.

Table 2-1 - Land Use

Zoning	Area (acres)	Percentage of UGB
Commercial Industrial	39.2	5.0%
Commercial - Residential	16.0	2.1%
Forestry	121.9	15.7%
Public Open Space	16.9	2.2%
Public Assembly Institutional	6.0	0.8%
Residential	485.9	62.6%
Roads, ROW	90.6	11.7%
Total UGB Land	776.5	100.0%

2.3 Demographics

2.3.1 Existing Population

The 2010 census data indicated the City of Falls City had a population of 947. The population remained relatively unchanged since the last census. The 2015 certified population for the City is 950 persons. Population data for the City is provided in the following table.

Table 2-2 – Population Estimates

Year	City Population
2010	947
2011	945
2012	945
2013	950
2014	950
2015	950

2010 population based on US Census data
2011 to 2015 are populations certified by the Portland State University Population Research Center

2.3.2 Projected Population

Future population in the City was projected based on information obtained from the *City of Falls City Wastewater Facilities Plan*. That plan used the City's adopted average annual population growth within the City of Falls City of 1.5% per year. Based on this rate, the population should increase to 1280 residents by the year 2035. This represents a growth of 330 persons or an average of 16.5 persons per year over the next 20 years. It should be noted that in last five years, the population has only increased by 0.3% total. This population figure will likely provide a conservative plan for future growth.

Table 2-3 – Projected Population

Year	Projected Population[1]
2015	950
2020	1023
2025	1103
2030	1188
2035	1280

[1] Based on City's Adopted Average Annual Growth Rate of 1.5%

SECTION 3

Regulatory Conditions

Regulatory Conditions

Section 3

3.1 RESPONSIBILITIES OF A WATER SUPPLIER

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, water system facilities are free of public health hazards, and water system operation and maintenance are performed as required by these rules. This includes, but is not limited to, the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies and sampling points prescribed by OAR 333-061-0036 "Sampling and Analytical Requirements";
- Take immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040 "Reporting and Record Keeping";
- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded;
- Notify all customers of the system, as well as the general public in the service area, when the maximum contaminant levels have been exceeded;
- Notify all customers served by the system when the reporting requirements are not being met, or when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance;
- Maintain monitoring and operating records and make these records available for review when the system is inspected;
- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections (at the property line)at all times;
- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken;
- Conduct an active program for systematically identifying and controlling cross connections;
- Submit, to the Drinking Water Program (DWP), plans prepared by a professional engineer registered in Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement;
- Assure that the water system is in compliance with OAR 333-061-0235 "Operator Certification Requirements, Levels 1-4" relating to certification of water system operators.

3.2 PUBLIC WATER SYSTEM REGULATIONS

Water providers should always be informed of current standards, which can change over time, and should also be aware of pending future regulations. This Section is not meant to be a comprehensive list of all requirements but a summary of the general requirements.

Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. The rules can be found on the Internet at http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_333/333_061.html where copies of all the rules and regulations can be printed out or downloaded for reference.

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the State. Requirements are detailed in OAR Chapter 333, Division 61. The SDWA and associated regulations have been amended several times since inception with the goal of further protection public health.

SDWA requires EPA to regulate contaminants which present health risks and are known, or are likely, to occur in public drinking water supplies. For each contaminant requiring federal regulation, EPA sets a non-enforceable health goal, or maximum contaminant level goal (MCLG). This is the level of a contaminant in drinking water below which there is no known or expected risk to health. EPA is then required to establish an enforceable limit, or maximum contaminant level (MCL), which is as close to the MCLG as is technologically feasible, taking cost into consideration. Where analytical methods are not sufficiently developed to measure the concentrations of certain contaminants in drinking water, EPA specifies a treatment technique, instead of an MCL, to protect against these contaminants.

Water systems are required to collect water samples at designated intervals and locations. The samples must be tested in state approved laboratories. The test results are then reported to the State, which determines whether the water system is in compliance or violation with the regulations. There are three main types of violations:

1. MCL Violation — Occurs when tests indicate that the level of a contaminant in treated water is above EPA or the state's legal limit (states may set standards equal to, or more protective than, EPA's). These violations indicate a potential health risk, which may be immediate or long-term.

2. Treatment Technique Violation — Occurs when a water system fails to treat its water in the way prescribed by EPA (for example, by not disinfecting). Similar to MCL violations, treatment technique violations indicate a potential health risk to consumers.

3. Monitoring and Reporting Violation — Occurs when a system fails to test its water for certain contaminants, or fails to report test results in a timely fashion. If a water system does not monitor its water properly, no one can know whether or not its water poses a health risk to consumers.

If a system violates EPA/state rules, it is required to notify the state and the public. States are primarily responsible for taking appropriate enforcement actions if systems with violations do not return to compliance. States are also responsible for reporting violation and enforcement information to EPA quarterly.

There are now EPA-established drinking water quality standards for 88 contaminants, including seven microbials and turbidity, seven disinfection byproducts and residuals, 16 inorganics (including lead and copper), 53 organics, and five radiologic contaminants. These standards either have established MCLs or treatment techniques.

The following provides a general summary of current rules for a surface water system using conventional filtration treatment and serving less than 10,000 persons.

3.2.1 Total Coliform Rule

Routine samples collected by Oregon public water suppliers are analyzed for total coliform bacteria. Compliance is based on the presence or absence of total coliforms in any calendar month (or quarter). Sample results are reported as "coliform-absent" or "coliform-present". If any sample is coliform-present, a set of at least three repeat samples must be collected within 24 hours. Small water systems that collect one routine sample per month or fewer must collect a fourth repeat sample. Repeat sampling continues until the maximum contaminant level is exceeded or a set of repeat samples with coliform-absent results is obtained.

Small systems (fewer than 40 samples/month) are allowed no more than one coliform-present sample per month, including any repeat sample results. Larger systems (40 or more samples/ month) are allowed no more than five percent coliform-present samples in any month, including any repeat sample results. Confirmed presence of fecal coliform or *E. coli* presents an acute health risk and requires immediate notification of the public to take protective actions such as boiling or using bottled water.

3.2.2 Surface Water Treatment Rules

Water systems must provide a total level of filtration and disinfection treatment to remove/inactivate 99.9 percent (3-log) of *Giardia lamblia*, and to remove/inactivate 99.99 percent (4-log) of viruses. In addition, filtered water systems must physically remove 99 percent (2-log) of *Cryptosporidium.*

Filtered water systems must meet specified performance standards for combined filter effluent turbidity levels, and water systems using conventional and direct filtration must also record individual filter effluent turbidity and take action if specified action levels are exceeded. Continuous turbidity monitoring of individual filters must be recorded every 15 minutes. The combined flow from combined conventional filters must have a turbidity measurement at least every four hours by grab sampling or continuous monitoring.

- Compliance for conventional filter systems is based on the combined filter effluent and 100% of measurements must be less than or equal to 1 NTU and 95% of the readings taken in any month must be less than or equal to 0.3 NTU.

- Compliance for alternative filter systems (slow sand, membrane, etc.) is based on the combined filter effluent and 100% of measurements must be less than or equal to 5.0 NTU and 95% of the readings taken in any month must be less than or equal to 1.0 NTU.

All water systems must meet specified CxT [concentration x time] requirements for disinfection, and meet required removal/inactivation levels. In addition, a disinfectant residual must be maintained in the distribution system.

- Continuous recording of disinfectant residual at entry point to the distribution system. Small system may be allowed to substitute 1-4 daily grab samples.
- Daily calculation of CxT at highest flow (peak hourly flow)
- Provide adequate CxT to meet needed removal/inactivation levels
- Maintain a continuous minimum 0.2 mg/L disinfectant residual at entry point to the distribution system
- Maintain a minimum detectable disinfectant residual in 95% of the distribution system samples (collected at coliform bacteria monitoring points)
- Conduct disinfection profiling and benchmarking

3.2.3 Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR); & Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

These additions to the SWTR have been implemented to reinforce the SWTR and increase public health protections by increasing the effectiveness of disinfection in addition to reducing the risk of *Giardia* and *Cryptosporidium* infection.

The LT1SWTR require that combined filtered water turbidity be less than 0.3 NTU in 95% of all samples collected each month in order to demonstrate compliance with the regulation. This applies to both conventional and direct filtration treatment plants. The maximum turbidity allowed is 1 NTU. The Rule requires individual filters to be monitored for turbidity and triggers additional reporting if performance limits are exceeded. The regulation assumes 2 log removal of *Cryptosporidium* when these standards are met. The LT1ESWTR applies to systems serving less than 10,000.

LT2ESWTR also applies to all surface water or ground water under the direct influence of surface water systems. The rule requires 2 years of *Cryptosporidium* sampling to define the requirement for additional treatment. Additional treatment options are identified in Microbial Toolbox. Additional treatment is required to be in place as of 2012 for systems serving 50,000 or more people, and as of 2013 or 2014 for smaller systems.

3.2.4 Disinfectants and Disinfection Byproducts

The Disinfectants/Disinfection By-Products (D/DBPs) rule and the Stage 1 D/DBP rule apply to all Community Water Systems and Non Transient Non Community Water Systems that treat water with a chemical disinfectant for primary or residual treatment. This rule is currently in effect and regulates Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAA5s), which include:

TTHMs:

- *Trichloromethane (chloroform)*
- *Tribromomethane (bromoform)*
- *Bromodichloromethane*
- *Dibromochloromethane*

HAA5s:

- *Monochloroacetic acid*
- *Dichloroacetic acid*
- *Trichloroacetic acid*
- *Monobromoacetic acid*
- *Dibromoacetic acid*

Compliance is determined based on meeting maximum contaminant levels (MCLs) for disinfection byproducts and maximum levels for disinfectant residual (MRDLs) over a running annual average of the sample results, computed quarterly.

- For water supplies under direct influence of surface water, TTHM/HAA5 monitoring is required in distribution system. One sample per quarter for systems serving 500-9,999 persons. One sample per year in warmest month required for systems serving less than 500.
- MCL for TTHM is 0.080 mg/L. MCL for HAA5 is 0.060 mg/L.
- System using surface water and conventional filter treatment must monitor for TOC and alkalinity. Enhanced coagulation if TOC is greater than 2.0 mg/L
- Comply with MRDLs. Limit for chlorine (free Cl_2 residual) is 4.0 mg/L. Limit for chloramines is 4.0 mg/L (as total Cl_2 residual). Limit for chlorine dioxide is 0.8 mg/L (as ClO_2)
- Bromate MCL of 0.010 mg/L
- Chlorite MCL of 1.0 mg/L

The Stage 2 D/DBPs rule is currently being implemented. This rule maintains the MCL levels established in Stage 1 D/DBP rule and adds MCLGs for four TTHMs and three HAA5s. The compliance sites consist of locations where high TTHMs are found, locations where high HAA5s are found and average detention time sites within the distribution system. The number of sites is based on the type of source water and population served. The rule provides for reduced monitoring for systems with very low disinfection by-products based on two years of existing data.

3.2.5 Lead and Copper

Excessive levels of lead and copper are harmful and rules exist to limit exposure through drinking water. Lead and copper enter drinking water mainly from corrosion of plumbing materials containing lead and copper. Lead comes from solder and brass fixtures. Copper comes from copper tubing and brass fixtures. Protection is provided by limiting the corrosivity of water sent to the distribution system. Treatment alternatives include pH adjustment, alkalinity adjustment, or both, or adding passivating agents such as orthophosphates.

Samples from community systems are collected from homes built prior to the 1985 prohibition of lead solder in Oregon. One-liter samples of standing water (first draw after 6 hours of non-use) are collected at homes identified in the water system sampling plan. Two rounds of initial sampling are required, collected at 6-month intervals. Subsequent annual sampling from a reduced number of sites is required after demonstration that lead and copper action levels are met. After three rounds of annual sampling, samples are required every 3 years. The number of initial and reduced samples required is dependent on the population served by the water system.

In each sampling round, 90% of samples from homes must have lead levels less than or equal to the Action Level of 0.015 mg/L and copper levels less than or equal to 1.3 mg/L. Water systems with lead above the Action Level must conduct periodic public education, and either install corrosion control treatment, change water sources, or replace plumbing.

3.2.6 Inorganic Contaminants

The level of many inorganic contaminants is regulated for public health protection. These contaminants are both naturally occurring and can result from agriculture or industrial operations. Inorganic contaminants most often come from the source of water supply, but can also enter water from contact with materials used for pipes and storage tanks. Regulated inorganic contaminants include arsenic, asbestos, fluoride, mercury, nitrate, nitrite, and others. Compliance is achieved by meeting the established MCLs for each contaminant. Systems that cannot meet one or more MCL must either install treatment systems (such as ion exchange or reverse osmosis) or develop alternate sources of water.

- Sample quarterly for nitrate (reduction to annual may be available) for surface water systems and sample annually for groundwater sources
- Communities with asbestos cement (AC) pipe must sample every 9 years for asbestos
- Sample annually for arsenic for surface water systems and sample every three years for groundwater sources.
- Sample surface water annually and groundwater sources every three years for all other inorganics. Waivers are available based on monitoring records showing three samples below MCLs. MCLs vary based on contaminant.

3.2.7 Organic Chemicals

Organic contaminants are regulated to reduce exposure to harmful chemicals through drinking water. Examples include acrylamide, benzene, 2,4-D, styrene, toluene, and vinyl chloride. Major types of organic contaminants are Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs). Organic contaminants are usually associated with industrial or agricultural activities that affect sources of drinking water supply, including industrial and commercial solvents and chemicals, and pesticides. These contaminants can also enter from materials in contact with the water such as pipes, valves, and paints and coatings used inside water storage tanks.

At least one test for each contaminant from each water source is required during every 3-year compliance period. Public water systems using surface water sources must test for VOCs annually. Compliance is achieved by meeting the established MCL for each contaminant. Quarterly follow up testing is required for any contaminants that are detected above the specified MCL. Only those systems determined by the State to be at risk must monitor for dioxin. Water systems using polymers containing acrylamide or epichlorohydrin in their water treatment process must keep their dosages below specified levels. Systems that cannot meet one or more MCL must either install or modify water treatment systems (such as activated carbon and aeration) or develop alternate sources of water.

3.2.8 Radiologic Contaminants

Radioactive contaminants, both natural and man-made, can result in an increased risk of cancer from long-term exposure and are regulated to reduce exposure through drinking water. Monitoring is required every three, six, or nine years depending on the initial results, with a return to quarterly monitoring if the MCL is exceeded. Compliance with MCLs is based on the average of the four initial test results, or subsequent quarterly tests. Community water systems that cannot meet MCLs must install treatment (such as ion exchange or reverse osmosis) or develop alternate water sources.

SECTION 4

Existing Water System

Section 4

Existing Water System

The City of Falls City owns and operates a community water system (OR4100394) serving approximately 950 persons through 403 active connections. The system's water supply includes surface water from Glaze and Teal Creeks. Water from the creeks is diverted to the water treatment Plant (WTP). The WTP consists of a triple-cell sand filter treatment plant. Treated water is disinfected and gravity feeds the City's distribution system.

Information on the existing system was obtained from WTP daily reports, previous studies, operation manuals, as-built drawings, interviews with operating staff, and site investigations.

4.1 WATER SOURCE

4.1.1 Description

The City of Falls City relies on Glaze and Teal Creeks as its primary drinking water supply sources. Glaze Creek is a tributary of Teal Creek. Both creeks are tributaries to the Luckiamute River.

The watershed for the intakes is located in Townships 8-9S, Ranges 6-7W and is approximately 3084± acres. The most predominant land use in the area appears to be logging from the aerial photographs. Logging operations appear to affect turbidity in the surrounding creeks. The aerial images show various stages of logging, cutting, and replanting in the watershed. Soil data for the area is currently available from the Natural Resource Conservation Service (NRCS). The soils in the area, are primarily steep all slopes are at least 3%, and 39% of the area is steeper than 30%.Most of the area is silty clay loam, gravelly clay loam, very shaly loam, or stony loam.

4.1.2 Falls City Water Rights

The City of Falls City holds seven water rights totaling 6.06 cfs or 2720 gpm. Table 4-1 provides a summary of these water rights. Only two water rights are currently actively used (Glaze Creek and Teal Creek),. The Rattling Springs water right was cancelled. Appendix C provides copies of the water right permits and certificates.

Table 4-1– City of Falls City Water Rights

Source	Tributary of	Water Rights, cfs (gpm)	Priority Date	Permit No.	Certificate No.
Teal Creek	Little Luckiamute River	1.00 (449)	11/4/1915	S2700	1832
Boughey creek (attempted transfer in 1939, but it was denied. Where is it now?	Teal Creek	0.5 (224)	5/11/1920	S4592	5072
Little Luckiamute River>Luckiamute	Big Luckiamute River	0.5 (224)	8/12/1939	S13970	14247
Albert Teal Spring>Teal Creek	Teal Creek	0.26 (117)	8/6/1970	S35215	39319
Rattling Spring > Teal Creek	Teal Creek	0.8 (359)	4/13/1974	S42509	---
Berry Creek > Little Luckiamute	Little Luckiamute River	1.00(449)	10/14/1970	S35222	---
Glaze Creek>Teal Creek	Teal Creek	2.00 (898)	3/4/1982	S46807	82931

4.1.3 Water Quality Data

Influent turbidities from the City's water sources are recorded at the treatment plant daily in a log book. This book was not available for analysis since it must remain in the treatment plant. The City reports that it manually controls the plant based on the influent turbidity. If turbidity rises past 5 NTU, then the plant is shut off.

4.1.4 Intake & Transmission Description

The City's intake and raw water transmission lines are located within an easement granted on private lands. The records of easement agreements are not clear to exact location, so the City would like to have a surveyor clearly delineate where the easement is and make sure that the intake pipe falls within them.

Teal Creek Intake

The existing Teal Creek intake was constructed in the early 1900s with a water right granted in 1915. It is located at 270 feet south and 1200 feet west from the northeast corner of Section 31, Township 8S, Range 6W. Water is diverted in accordance with the conditions established under water right Permit S2700. The intake consists of a concrete box with metal trash grate that converges into a pipe. The top of the inlet is angled perpendicular to the water surface. The intake is situated such that it takes up the majority of the flow in the summer. Water flows through the trash grate and into the concrete box where it is then conveyed to the WTP via a gravity water line.

The existing intake has a number of operational and maintenance concerns. Due to the water quality of Teal Creek, sedimentation accumulates in the box of the intake and requires annual dredging to maintain function. Additionally, there is no automatic cleaning system for the screen and consequently staff have to manually remove leaves, branches, and other debris that periodically clogs the intake. The intake is not equipped with an alarm to notify operating when a problem existing (i.e. clogged screen) and it may be several days before staff are aware of an issue. This is especially problematic during rainy times when there is limited or no access to the intake. Access in even in the summer is difficult at best.

This intake is used in times of the year when turbidities are low, and Glaze Creek flows are limited (typically summer and fall).

Glaze Creek Intake

The existing Glaze Creek intake was constructed in the 1980s with a water right granted in 1982. and is located at 3500 feet south and 1700 feet west from the northeast corner of Section 31, Township 8S, Range 6W. Water is diverted in accordance with the conditions established under water right Permit S2700. The intake consists of a wooden box with metal trash grate that converges into a pipe. The top of the inlet is angled perpendicular to the water surface. Water flows through the metal mesh into the concrete intake box where it is then conveyed to the WTP via a gravity water line.

The existing intake has a number of operational and maintenance concerns. There is no automatic cleaning system for the screen and consequently staff have to manually remove leaves, branches, and other debris that periodically clogs the intake. The intake is not equipped with an alarm to notify operating when a problem existing (i.e. clogged screen) and it may be several days before staff are aware of an issue. This intake is relatively remote and takes approximately a half hour to travel to from the water treatment plant.

This intake is used in times of the year when turbidities are high in Teal Creek, and Glaze Creek has sufficient flows (typically winter and spring).

Transmission System

Water is transported from either Teal or Glaze Creek to the WTP via a 12”/10"/8" gravity main that changes sizes and materials at unknown locations. The original pipeline from Teal Creek was installed in the early 1900s. Much of this transmission line is composed of approximately half PVC and half AC piping, however a short section of ductile iron exists. This transmission line runs approximately 5,000 feet across steep terrain with portion of the pipeline exposed above grade. The City does not own most of the land the along the pipe route.

Visual inspection of the transmission main has not been completed in several years; however, there are no known pipeline problems. The majority of the pipe is difficult or impossible to access.

4.2 WATER TREATMENT

The Falls City water treatment plant (WTP) utilizes a triple-cell slow sand filtration treatment plant. No chemical addition is required besides chlorine for disinfection. Treated water is disinfected using hypochlorination then pumped to the City's treated water reservoir. Operation of the plant is primarily automated, but is also equipped with manual over-rides. The WTP has a design capacity of 183 gpm per filter, but can only achieve 130 gpm per filter, under optimum conditions.

The existing WTP was originally constructed in 1999. The City made a number of upgrades to improve treatment performance including replacing monitoring equipment as needed, and skimming pond per O&M manual instructions.

WTP slow sand filtration systems are credited with 2.0–log *giardia* and a 2.0-log *cryptosporidium* removal. Chlorine disinfection provides an addition 1.0–log *giardia* removal credit.

4.2.1 Plant Operation

Raw water feeds the WTP via a gravity pipeline from Glaze Creek and Teal Creek. Under automated operation, plant operations are controlled based on an altitude valve set to respond to water level readings in the City's treated water reservoir. As the water level in the reservoir drop, an automated control valve at the reservoir opens and initiates plant operations. The WTP will automatically shutdown based on high effluent turbidity levels. The plant was designed to automatically turn off when the influent turbidities are too high, but the City reports that that feature doesn't work, so the plant must be started and stopped manually when influent turbidities change.

4.2.2 Treatment Processes

Treatment processes at the Falls City WTP include a slow sand filter and disinfection.

Manual Filter Screens

Each intake has a screen that removes large debris. Glaze creek screen has openings of about 0.5" square, and Teal Creek has openings of 2" square. The Glaze creek screen is manually cleaned approximately monthly and the Teal Creek Screen is dug out every year before use, as winter storms burry the entire intake and screen in sediment.

Soda Ash

The City has an installed system for soda ash addition, but does not currently use the system.

Slow Sand Filters

The City of Falls City water treatment system utilizes a three-cell slow sand filter system. Each filtration cell has a treatment area of 2,920 ft^2. The design filtration rate for the filter is 90 gpd/ft^2 resulting in a maximum flow rate of 182.5 gpm/ filter.

Filter media consists of gravels, sands, and anthracite for a total media depth of up to 36" inches. When filter reached 12", it should be refilled to 36". The City last skimmed the filters 2.5 years ago in cells 1 & 2 and cell 3 was offline in summer 2016 during the site visit due to lack of need.

Hach Model 1720D turbidimeters constantly monitor each of the filter's effluent turbidity, and plant effluent turbidity and records it on the system computer. There is also a direct read of the NTU on the meter. If the filter exceeds 5 NTUs, an autodialer alarm will notify the operator and the system will automatically shut down until it is manually restarted.

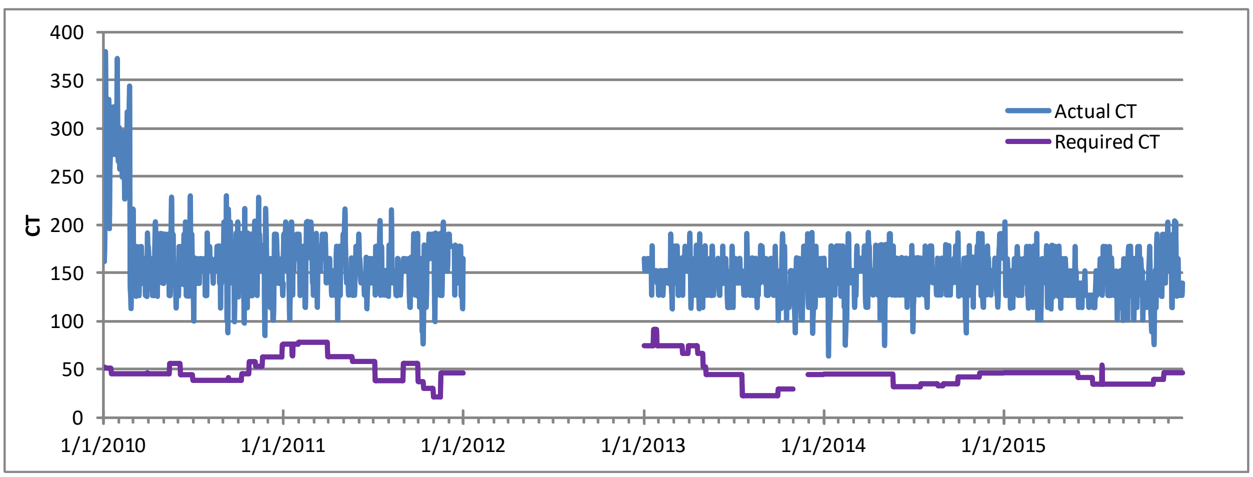
The filters are cleaned by skimming 1/2" to 1" of sand off the top when the filters start to back up.

Disinfection

Sodium Hypochlorite is used for disinfection. It comes in drums pre-mixed to 12.5% concentration of hypochlorite. A metering pump injects the solution into the treated water stream at the beginning of the clearwell which is baffled and serves as the chlorine contact chamber. The water gravity flows from the clearwell to some southern residences and the reservoir.

The inactivation ratio is determined based on "CT" which is the residual concentration (C) in mg/L multiplied by the contact time (T) in minutes. Required CT values are published in OAR and are dependent on the water temperature, pH, and chlorine residual. This information is collected in the clearwell chlorine monitoring station, which transmits monitored parameters back to the WTP. A Disinfection Contact Time Tracer Study was conducted in 2008. It measured the contact time to be 127 minutes. This value is used for daily calculations, as there is no way to measure this daily. The following chart compares required CT times (based on temperature and pH) with the systems calculated CT (based on residual at first user).

Chart 4-1 – Comparison of Calculated and Required CT Values for Falls City WTP



Clearwell Storage

Filtered water is gravity fed from the WTP filters to the baffled concrete chlorine contact chamber. It has dimensions of 56ft. x 86 ft. by 11 ft., but not all is available for water due to lower overflow and weir levels. The capacity, as reported by the City, is 250,000 gallons.

Violation History

The City has the following violations, to which it has responded and returned to compliance.

Table 4-2 – Violation History for Falls City's Water System

Violation	Date	Analyte Group	Returned to Compliance	Points
DBP Late/Nonreporting	6/2013	DBP	9/2013	1
Monthly Sampling Report –L/N	5/2013	SWTR	7/2013	1
DBP Late/Nonreporting	9/2011	DBP	12/2011	1
Total Non-Compliance Points				3

L/N – Late/Nonreporting

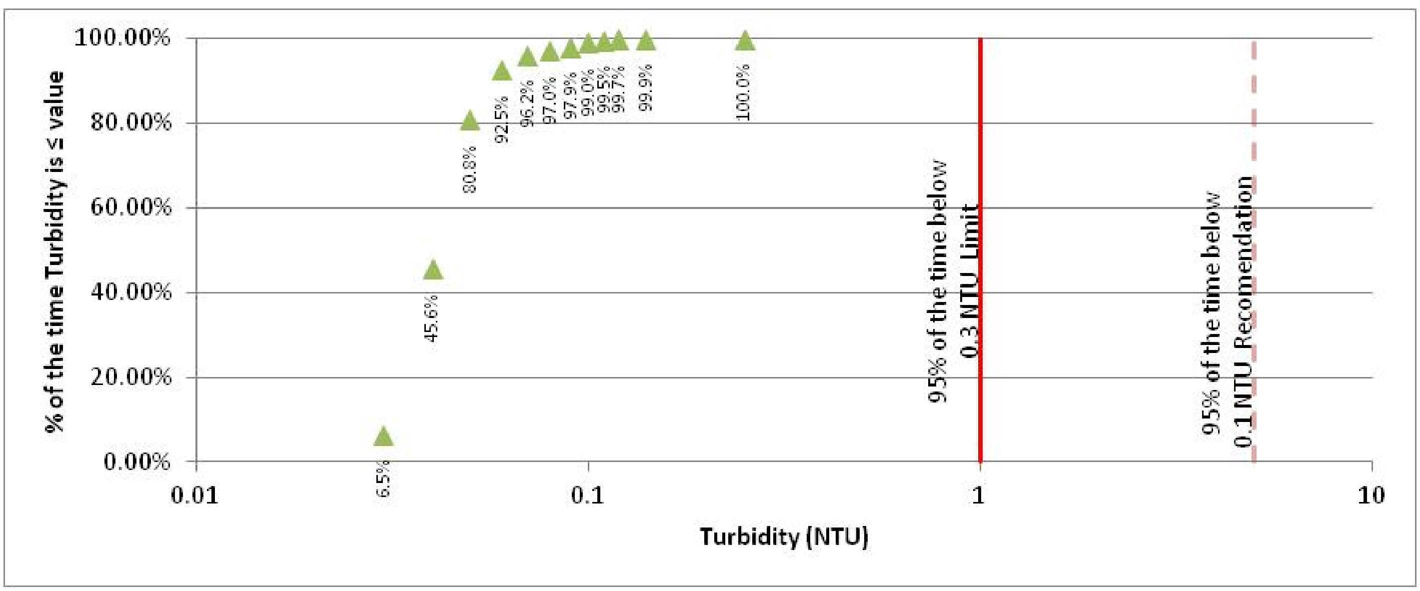
Although reporting is important to monitor public safety by the state, none of these violations constituted a public health risk after the monitoring results were presented.

Turbidity

Treated water must have turbidity level less than 1 NTU 95% of the time. Based upon the data supplied by the City, turbidity levels post filtration have ranged from 0.003 to 0.25 NTU over the five years analyzed with an average of 0.049 NTU with , 100% of the turbidity readings less than or equal to 0.25 NTU and 96 % less than or equal 0.07 NTU (Chart 4-2).

To avoid poor finished water quality, the WTP is shut off following heavy rains, when raw water turbidity levels spike. The WTP currently is shut down when the raw water turbidity exceeds 5 NTU.

Chart 4-2 – Cumulative Percentage of Recorded WTP Effluent Turbidity



4.2.3 Condition

The WTP is generally in good condition. The nature of slow sand filters is if you keep up with maintenance, they will function properly for a long time. The City has been proactive with replacing monitoring equipment as needed and maintains an active contract with Hach to keep their equipment up to date. The turbidity monitoring equipment was replaced in 2016. The chlorine analyzer and pH controllers have been replaced within the last five years. No leaks in the treatment cells or clearwell are known, but a few leaks have been noticed in the vaults that need to be repaired. Some portions of concrete are starting to show some signs of wear and should be resealed, and patched as necessary to slow damage. The City desires to replace the chlorine line to the clearwell.

4.3 WATER STORAGE

Treated water is gravity fed from the WTP through an 8-in pipeline through the southern residences to the City's 600,000 gallon water storage reservoir located on Chamberlin Rd. as shown in Figure 1 of Appendix A. The reservoir consists of a steel tank constructed in 1999. Although the tank has a nominal capacity is 600,000 gallons, operating capacity is only 585,650 gallons due to the overflow level. The reservoir site is fenced and the access road is gated.

The reservoir is equipped with an altitude valve to control water levels in the tank. When the water level drops, the WTP will activate and begin filling the tank. The pumps automatically shut off when water levels reach a set point. Treated water stored in the reservoir tank flows to the distribution system through a 12-in pipeline. The elevation of the tank is sufficient to provide adequate pressures to all users without the need for additional pumping. Pressures in some areas are higher than 130 psi, so some residences have individual PRVs.

Tank dimension and volume information is provided in the tables below.

Table 4-3 – Treated Water Reservoir

Radius	35.75 ft
Nominal Capacity	600,000 gallons
Operating Capacity	585,650 gallons
Outlet distance above floor	0.5 ft.
Overflow distance above floor	20.5 ft.

The exterior of the tank appears to be in good condition. A three scratches apparently from bullets were found. The roof needs to be repainted as the paint is starting to peel off. The interior of the reservoir was recently inspected and cleaned in the summer of 2016. Only minor rust was discovered in the inspection. It is recommended to get this done every three years to monitor the internal conditions of the reservoir, and assess when coating may be needed.

4.4 DISTRIBUTION SYSTEM

4.4.1 Piping Network

The Falls City water system has approximately 16 miles of distribution and transmission piping ranging in size from 1 inch to 12 inches in diameter (Table 4-4). The system is generally configured with a number of disconnected service areas with limited looping. The existing transmission and distribution piping, as well as fire hydrant coverage for the water system networks are shown in Appendix A in Figure 3 (Size), Figure 4 (Material), and Figure 5 (Fire Hydrant Coverage).

Table 4-4 – Pipe Inventory

Pipe Size	Distribution Piping (ft)	Transmission Piping (ft)	Total Piping (ft)	Percent of Piping
< 4"	8,440		8,440	10.25%
4"	7,934		7,934	9.64%
6"	22,726	2,429	25,155	30.55%
8"	14,823	662	15,486	18.81%
10"	7,585	11,951	19,536	23.72%
12"	4,822	970	5,792	7.03%
Total	66,331	16,013	82,343	100.00%

The original distribution system was installed in around 1915 when the first intake box was constructed at Teal Creek. Major improvements to the system were made in the 1990s, but a large portion of the system is still AC pipe, which is more likely to break, especially under high pressure conditions. Portions of the downtown area have pressures far in excess of recommended pressure ranges in order to provide pressure to the homes in the higher elevations. Falls City experiences frequent water main breaks due to these high pressures and old pipes.

Existing system model results for pressure and fire flow can be found in Figures 6-9 in Appendix A, and the tables in Appendix D.

4.4.2 Water Meters

Water meters are installed on nearly all connections. Only two City parks are connected to the system without a meter. The Faye Wilson Park connection is inactive and not used. Most of the water used at the Upper Park is through a metered connection,; very little is used from the unmetered connection. Many of the existing water meters have not been replaced since their original installation in 1993, in most cases, over 20 years ago.

SECTION 5

Water use and Projected Demands

Water Use & Projected Demand

SECTION 5

5.1 DESCRIPTION & DEFINITIONS

Water demand is the quantity of water delivered to the system over a period of time to meet the needs of consumers as well as the operating needs of the system. Additionally, virtually all systems have some leakage that cannot be economically removed and therefore included in total demand. Demand varies seasonally with the lowest usage typically in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning breakfast and early evening periods and lowest usage during nighttime hours. Water demand is described in the following terms:

Average Annual Demand (AAD) **-** The total volume of water delivered to the system in a full year. When demand fluctuates up and down over several years, an average is used.

Average Daily Demand (ADD) **-** The total volume of water delivered to the system over a year divided by 365 days.

Winter Day Demand (WDD) **-** The total volume of water delivered to the system between November and February divided by the total number of days in those months combined.

Maximum Monthly Demand (MMD) **-** The averaged daily usage during the month with the highest water demand. The highest monthly usage typically occurs during a summer month.

Peak Hour Demand (PH) **-** This value represents the largest volume of water delivered to the system in a single hour. Since Falls City does not collect data more frequently than daily, a peaking factor of 1.5 time MDD was used to calculate this. That factor is based on similar size communities with similar usage types. The transmission lines should be designed to handle the peak hour demand. The existing system pressures during this demand scenario are shown in Figure 7 in Appendix A.

Maximum Day Demand (MDD) **-** The largest volume of water delivered to the system in a single day. The water supply, treatment plant and storage should be designed to handle the maximum day demand. The existing system pressures during this demand scenario are shown in Figure 8 in Appendix A.

The Demands above can have many varying units, but for the purpose of this report, in most places the units are all converted to equivalent gallons per minute, so multiple scenarios can easily be compared.

5.2 WATER CONSUMPTION

In Falls City, water is consumed by residential and non-residential (commercial, industrial, public) users as well as the Luckiamute Water District. The majority of user connections are metered; however there are at least two known unmetered areas in city parks. Water meters are read once per month.

5.2.1 Overall Water Usage

Billing records were analyzed to determine the number of active bulk, residential and non-residential users served by the City's water system. Water accounts reporting no annual water consumption were not included within the active account inventory even if they have an active billing account. As Table 5-1 shows, the system provides water to 403 active customers as of 2015. Of these accounts, 96 % serve residential users. The number of residential and non-residential customers in the City has decreased slightly over the past six years.

Table 5-1 – City of Falls City Active Water User Locations Inventory

Customer Water Accounts	2010	2011	2013	2014	2015
Residential Accounts	394	394	384	389	385
Non-Residential Accounts	17	19	18	18	16
Bulk	2	2	2	2	2
Total Accounts	413	415	404	409	403

Monthly billing records were obtained from the City and analyzed from January 2010 through December 2015, with the exception of 2012. A malfunction of the City's billing system resulted in incomplete data for 2012, so it was excluded from the consumption and production analysis.

A summary of annual residential, non-residential, and Luckiamute water use is provided in Table 5-2. Total annual water consumption averaged nearly 38 million gallons over the years analyzed or an equivalent of 104,970 gpd. During this period, residential use has averaged nearly 29.5 million gallons (80,693 gpd) or approximately 76.9% of total usage.

For the period analyzed, peak water consumption occurred in 2015. While it may seem that demands are increasing over time, it is better to consider that the population has remained the same, but drought conditions have increased throughout the data period. The drought is most likely the cause of increased demand, so an average of all flows were considered in the data analysis.. It should be noted that the values listed in the following table are only for metered customer water usage and do not include data for the system's unmetered uses and frequent watermain breaks.

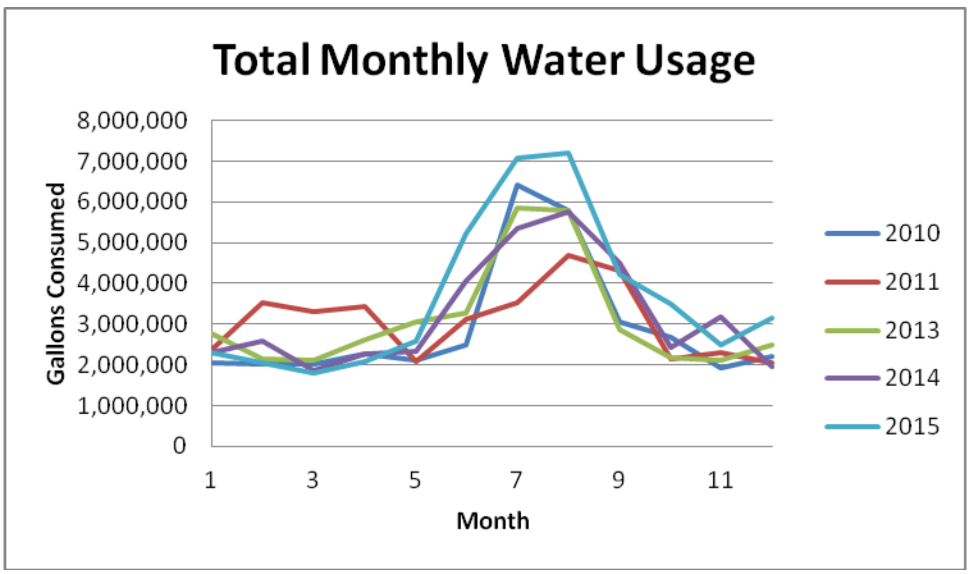
Table 5-2– Annual Water Consumption[1]

Year	Residential Usage (gallons)	Non-Residential Usage (gallons)	Luckiamute Usage (gallons)	Total Water Usage (gallons)
2010	28,173,000	2,553,000	4,343,000	35,069,000
2011	28,071,000	2,613,000	6,191,000	36,875,000
2013	29,339,000	2,500,000	5,467,000	37,306,000
2014	30,541,000	2,463,000	5,614,000	38,618,000
2015	31,141,000	2,359,000	10,203,000	43,703,000
Average	29,453,000	2,497,600	6,363,600	38,314,200

[1] Does not include usage by unmetered locations

Total monthly water consumption for the period of record is plotted on Chart 5-1. Over the years analyzed, monthly water consumption has averaged 3,192,850 gallons. Normal water consumption peaks during summer (usually July or August) and is lowest during winter. August 2015 reported the highest usage of 7.2 million gallons (232,194 gpd).

Chart 5-1 – Metered Monthly Water Consumption in the City of Falls City



5.2.2 Residential Usage

Residential water usage was further analyzed to determine average usage on a per account and per capita basis (Table 5-3). Based on residential water consumption and the number of active metered residential users from 2010 to 2011 and 2013-2015, average usage has equaled 207 gallons per account per day (gal/acct/day). During this time, the City's population has remained nearly constant ranging from 945-950 people. This equates to an average usage of 85 gallons per capita per day (gpcd). The average per capita consumption in Oregon is about 111 gpcd[1]. Several factors that may be contributing to the low per capita usage rate include low-income residents, climate, and inaccurate service meters.

Table 5-3 – Average Residential Metered Usage*

	2010	2011	2013	2014	2015	Average
Ave. Res. Usage (gal/acct/day)	196	195	209	215	222	207
Average Capita Usage (gpcd)	82	81	85	88	90	85

*Based on metered residential users only for RO and RI users

5.2.3 Non-Residential Usage

A summary of water consumed by non-residential users is provided in the following table. One of the largest water users is the High School, but there are several residential accounts that are sometimes as much or more than the school. The City attributes this to people using City water for irrigation on agricultural properties. The other major usage is the bulk water sales to the Luckiamute Water District. Policy changes have increased the amount of water sold to the Luckiamute Water District, so 2015 is a more applicable value to consider compared to the average for future years.

Table 5-4 – Average Non-Residential Metered Usage & Bulk Sales

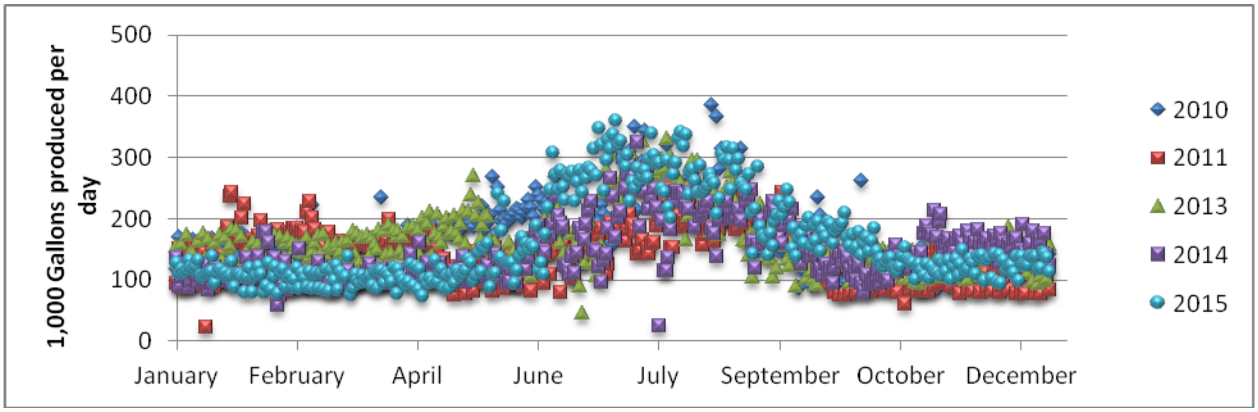
	2010	2011	2013	2014	2015	Average
Ave. Non-Res. Usage (gal/acct/day)	411	377	381	375	404	390
Average Bulk Sales (gpd)	11,899	16,962	14,978	15,381	27,953	17,435

5.3 WATER TREATMENT PLANT PRODUCTION

Plant production records were obtained from the City from January 2010 through December 2015, (excluding 2012, to keep years consistent with the consumption data). Daily plant production is shown graphically in Chart 5-2.

[1] AWWA Water Distribution Systems Handbook, Larry W. Mays, 2000. Table 3.1

Chart 5-2 – City of Falls City Daily WTP Production



The following table summarizes monthly water production from January 2010 through December 2015, excluding 2012. Annual production has increased some years and decreased other years of the five year period analyzed. The lowest monthly production occurred in January 2014 while December July 2015 had the highest production. July had the highest average monthly production followed closely by August.

Table 5-5- Monthly Water Production (million gallons)

	2010	2011	2013	2014	2015	Average
January	4.36	4.23	4.55	3.29	3.49	3.98
February	4.22	4.97	4.13	3.19	2.84	3.87
March	4.93	4.99	4.81	3.13	3.17	4.21
April	5.30	4.47	5.21	3.31	3.07	4.27
May	6.33	3.58	5.08	3.71	4.27	4.59
June	5.65	4.16	4.85	4.87	7.49	5.40
July	7.91	5.89	8.59	6.82	8.92	7.63
August	7.48	6.10	6.70	6.55	8.16	7.00
September	4.78	4.89	4.10	4.99	5.56	4.86
October	3.90	3.32	4.05	3.60	4.78	3.93
November	3.50	3.34	3.61	4.76	3.64	3.77
December	3.47	3.42	4.29	4.82	3.89	3.98
Total	61.81	53.35	59.96	53.02	59.26	57.48

The following table details the total annual production, average day, maximum month, and maximum day from 2010-2015 (excluding 2012). Averaging water production over the five years, the average day production is 157,459 gpd. The highest maximum month production of 287,548 gpd occurred in July 2015. The highest probable usage-based maximum day demand of 349,000 was recorded on the average of July 2-3 2015. Since the system has so many water line breaks, due to old pipe, a two day running average was taken to find the maximum day flows. This method is more indicative of typical usage in the system because it would suggest that there is two days in a row with high usage such as the summer. This process removes days when the production was high on one day following a low day that likely was based on some event at the plant and not necessarily a change in water demand needs. The City has some flexibility in when they run the plant due to the large capacity of the existing storage reservoir, so flows for one day can easily be produced the day before or after. Moving forward as the Capital Improvement Plan is completed and the pressures are reduced in the system, fewer pipe breaks should occur, so the future values of maximum day production will be closer to those shown with the two-day running average. It also accounts for day of high production followed or proceeded by days of characteristically low flow. The highest recorded day was 385,000 gpd on 8/13/2010, but it was followed by a day that had less than half of that production, so it is assumed that there was a problem in the system, and it was excluded from the dataset.

Table 5-6 – Plant Production Summary

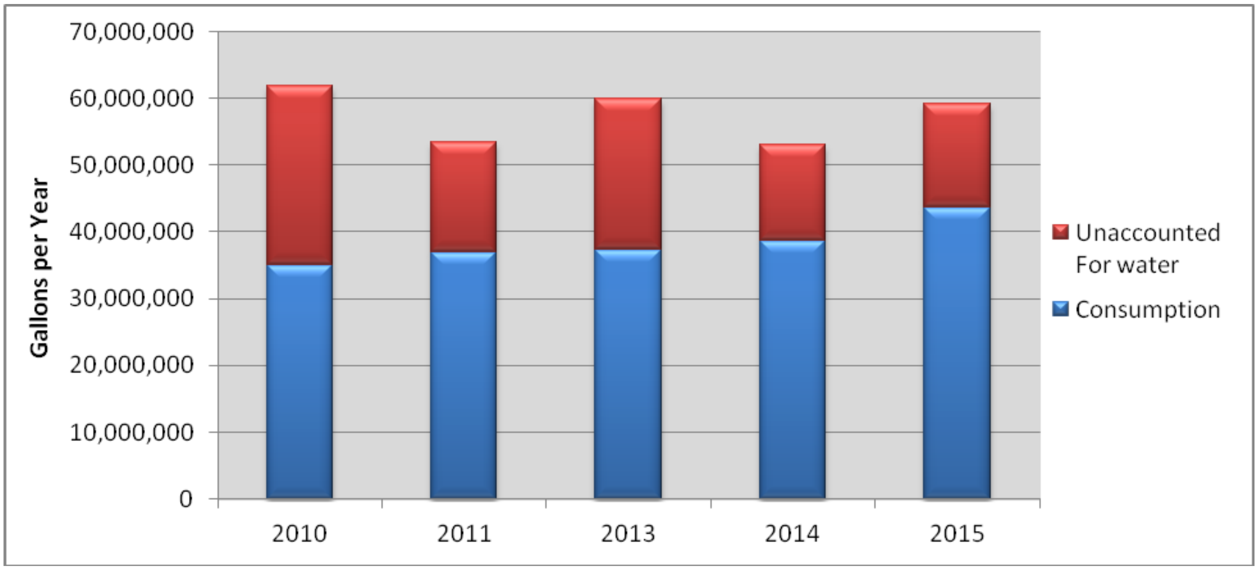
Year	Total (mg)	Average Day (gpd)	Max Month (gpd)	Max Day[1] (gpd)
2010	61.81	169,794	255,194	323,500
2011	53.35	146,162	196,677	268,000
2013	59.96	164,266	276,935	314,500
2014	53.02	145,268	220,032	289,500
2015	**59.26**	**162,353**	**287,839**	**349,000**
Average	57.48	157,569	247,335	308,900

** Bold values indicate maximum value in data set
[1]Based off two-day running average to account for peak production days followed by low production days that imply a non-use-based problem occurred such as a filter malfunction.

5.4 UNACCOUNTED FOR WATER

Not all water produced is consumed by a water system's users. A portion of treated water is required for system flushing and sampling. Unaccounted for water is the difference between total water produced and the total metered usage of system customers and operations. This difference can be attributed to leakage in the distribution system, inaccuracies in water meters, water lost during water main breaks, water used fire fighting, and other public non-metered use. The following chart shows the amount of total production attributed to customer meters and unaccounted for water.

Chart 5-3 – City of Falls City Water Production Audit



In general, the amount of unaccounted for water in the system has decreased each year since 2010, with the exception of 2013. Over the period analyzed, unaccounted water has averaged 33% of total water production, or approximately 96 million gallons. The typically accepted percent of water loss is 10%. At this point it is no longer considered economical to reduce leaks, and the Oregon Water Resources Department doesn't require actions to reduce leakage in a water management and conservation plan.

Table 5-7 – Unaccounted for Water as a Percentage of Total Water Production

Year	Unaccounted for Water
2010	43%
2011	31%
2013	38%
2014	27%
2015	26%
Average	33%

Unaccounted water can represent real or apparent water loss. Real water loss is water that is physically lost from the system, such as through a broken water main. Apparent water loss is water that is used by the system but not measured. Sources of apparent water loss include unmetered connections and inaccurate service meters.

5.5 PROJECTED WATER DEMANDS

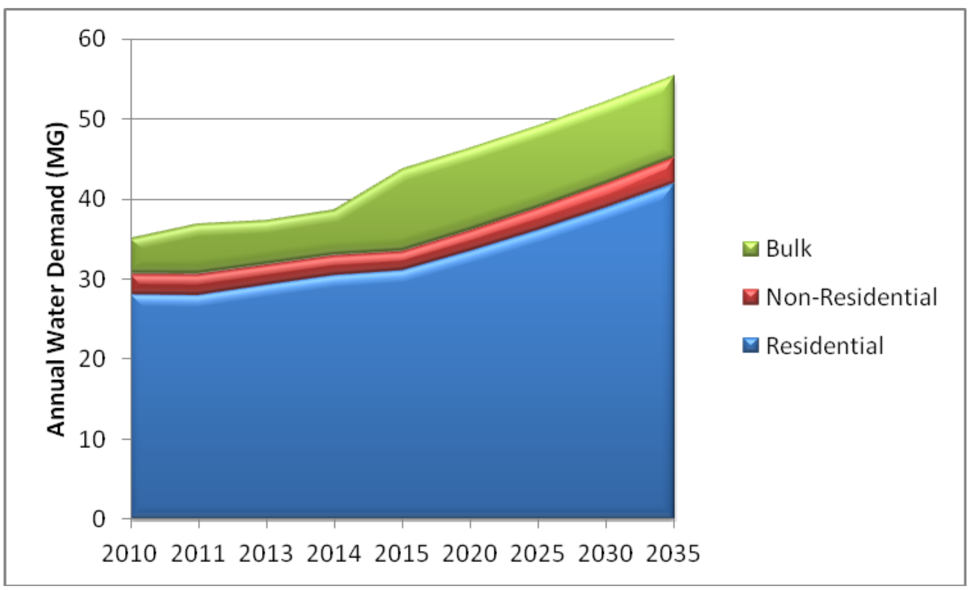
Typically the primary factor affecting future water production is system growth. The typical methodology of projecting water system demands based on unit designs multiplied by forecasted growth was used to project future water demands in the City of Falls City.

Projected water use for the system is based on the following assumptions:

- Water loss will remain relatively proportional to the number of people served during the 20-year planning period
- Future population growth will occur at a rate of 1.5%
- Average water consumption is equal to 85 gallons per capita per day (gpcd). This accounts for both user consumption and metered water used as part of the system operation (e.g. sampling, flushing), but does not include Luckiamute.

The following chart shows the projected growth of annual water production in the City's water system of the 20-year planning period, ending in 2035. Luckiamute should be added on to this chart. Policy dictates what Luckiamute can use. They recently have taken the maximum amount that Falls City lets them purchase. In 2015 that was 10,203,000 gallons, and that trend is expected to continue until such time that policy majorly changes in the City, or there is major unexpected growth that limits water availability to outsiders.

Chart 5-4 – Projected Annual Water Demand



Annual water production is expected to increase to 55 million gallons by the year 2035. This correlates to an average daily demand of approximately 161,000 gpd. Maximum monthly and daily demands were calculated based on projecting the 2015 values out using population inreases. Luckiamute was assumed to be taking as much water as they are allowed to take. The 20-year MMD is projected to be approximately 328,000 gpd. By 2032, the projected MDD is expected to be approximately 500,000 gpd.

Table 5-8 – Projected Demands

Demand Type	2015 (Current) gpm	2035 gpm
Max Day	243	347
Max Month	161	228
Average Day	73	156
Winter Day*	56	138
Peak Hour**	365	484

**Selected from average days of November-February*
***Calculated using a peaking factor of 1.5 time MDD*

The above listed water demand forecast is dependent on a number of variable factors. Therefore it is recommended that the system carefully monitor future demands and update this *Master Plan* if there is a large discrepancy between projected and actual demands.

SECTION 6

Design Criteria and Level of Service

Design Criteria & Level of Service

Section 6

6.1 DESIGN LIFE OF IMPROVEMENTS

The design life of a water system component is sometimes referred to as its useful life or service life. The selection of a design life is a matter of judgment based on such factors as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation. The estimated and actual design life for any particular component may vary depending on the above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

As discussed in Section 1, the planning period for this Water System Master Plan is 20 years ending in the year 2035. The planning period is the time frame during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land use considerations.

The planning period for a water system and the design life for its components may not be identical. For example, a properly maintained steel storage tank may have a design life of 60 years, but the projected fire flow and consumptive water demand for a planning period of 20 years determine its size. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60 years would still be useful and remain in service for another 40 years. The typical design life for system components are discussed below.

6.1.1 Treatment Plant Equipment

The design life of most motorized equipment is typically 20 years. Buildings and major structures should have a design life of 50 years. Steel components exposed to weather or submerged can deteriorate within 10 to 15 years if not properly maintained. Periodic maintenance and painting will provide a useful life of more than 20 years unless larger facilities are required. Flowmeters typically have a design life of 10 to 15 years. Valves usually need to be replaced after 15 to 20 years of use.

6.1.2 Treatment Plant Equipment and Structures

Major structures and buildings should have a design life of approximately 50 years. Equipment such as chlorine feed systems and turbidimeters usually have a useful life of about 15 to 20 years. The useful life of some equipment can be extended, when properly maintained, if additional capacity is not required.

6.1.3 Water Transmission and Distribution Piping

Water transmission and distribution piping should easily have a useful life of 40 to 60 years if quality materials and workmanship are incorporated into the construction and the pipes are adequately sized. Steel piping used in the 1950's and 60's that has been buried, commonly exhibits significant corrosion and leakage within 30 years. Asbestos Cement pipe is brittle and often causes breaks before the useful life of other pipe materials. Cement mortar lined ductile iron piping can last up to 100 years when properly designed and installed.

6.1.4 Water Storage

Distribution storage tanks should have a design life of 60 years (painted steel construction). Actual design life will depend on the quality of materials, the workmanship during installation, and the timely administration of maintenance activities. Several practices, such as the use of cathodic protection, regular cleaning and frequent painting can extend or assure the service life of steel reservoirs. Ground settlement, earthquakes, and inadequate quantities of reinforcing steel can all lead to a substantially reduced life for concrete structures.

6.2 SIZING AND CAPACITY CRITERIA

Demand projections presented in Section 5.6 are used to size improvements. Various components of the system demand are used for sizing different improvements. Methods and demands used are discussed below.

6.2.1 Water Treatment Plant Capacity

Treatment plants must be able to successfully treat quantities of raw water equal to the MDD. The 20-year MDD is used as the design flow. A WTP should produce this MDD with 24 hours or less operation time required.

6.2.2 Treated Water Storage

Total storage capacity must include reserve storage for equalization storage, emergency storage, and fire suppression:

- Equalization Storage - Typically set at 25% of the MDD to balance out the difference between peak hourly demand and supply capacity so that these variations in demand are not imposed on the water supply source.

- Emergency Storage - Required to protect against a total loss of water supply such as would occur with a broken transmission line, an electrical outage, equipment breakdown, or natural disaster. At a minimum, emergency storage should be equal to 75% of the MDD assuming that water use would be restricted during times of emergencies. Falls City has selected to provide 200% of the ADD for emergency storage, due to the unreliability of the intake water quality during certain portions of the year.

- Fire Suppression Storage - Falls City chooses to provide 2,000 gpm fire flow for non-residential structures based on the physical possibilities and financial resources of the City. Based upon the Oregon Fire Code, a duration of 2 hours would be required for the fire flows. This would equate to a total fire storage requirement of 180,000 gallons.

For Falls City, an emergency storage of 200% of the ADD will be used in addition to equalization storage and fire storage.

Another important design parameter for reservoirs is elevation. Different portions of the City can be better served by different elevations of reservoir. Distribution reservoirs should be located at an elevation that maintains adequate water pressure throughout the system, sufficient water pressures at high elevations and reasonable pressures at lower elevations. The pressure range in the system should stay within the range of 30 to 80 psi. Pressures below 30 psi cause annoying flow reductions when more than one water-using device is in service. High pressures may cause faucets to leak, valve seats to wear out quickly, and system leakage to increase. Standard practice suggests that water pressures not exceed 80 psi at service connections, unless the service is provided with a pressure-reducing device. Another pressure criterion, related to fire flows, commonly requires a minimum of 20 psi at the hydrant used for fire fighting. OHA also requires that service connection pressures never drop below 20 psi.

6.2.3 Distribution System

Distribution mains are typically sized for fire flow and 20-year population demand, or fire flow and saturation development demand. The mains should be at least six inches in diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 30 psi at maximum flow rates. The State of Oregon requires a water distribution system be designed and installed to maintain a pressure of at least 20 psi at all service connections at all times. The distribution system must be sized to handle the peak hourly flows and to provide fire flows while maintaining minimum pressures.

In addition to the above design criteria, the following guidelines are recommended for the design of water distribution systems:

- Six-inch (6") diameter lines - minimum sized lateral water main for gridiron (looped) system and dead-end mains.

- Eight-inch (8") diameter lines - minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.

- Ten-inch diameter (10”) and larger - as required for trunk (feeder) mains based on hydraulic analysis.

- A fire flow rate of 1,000 gpm for most residential areas and a 2,000 gpm for most commercial areas is the goal. Due to the geography of the city, achieving these fire flow is not feasible in every portion of the City, so tanker trucks will still need to be used for some structures.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding eight-inches in diameter, which is installed to provide water service and fire protection for a local area including the immediately adjacent property. The normal size of lateral mains for single-family residential areas is six-inches in diameter. However, eight-inch lateral mains may be required to meet both the domestic and fire protection needs of an area.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. For the placement of a fire hydrant on a permanently dead-ended main, the minimum size of such laterals should be eight inches in diameter. Six-inch diameter mains may be used for a stub-out not exceeding 500 feet in length supplying a single fire hydrant not on a public street and for internal fire protection. On new construction, the minimum size lateral main for supplying fire hydrants within public ways should be six-inches provided six-inch mains are looped.

A computer model of the distribution system is part of this study. The model incorporates actual pipe sizes and materials as well as system pipe junction elevations and storage tank elevations. The system is checked for ability to provide fire flows during times when the system demand is at the 20-year MDD. The system will also be checked at the 20-year PHD. System pressure must remain above 20 psi under all conditions. The model will be developed using a software program called WaterCAD®.

6.3 BASIS FOR COST ESTIMATES

The cost estimates presented in this Plan in section 8 will typically include four components: construction cost, engineering cost, contingency, and legal and administrative costs. Each of the cost components is discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. Construction costs are based on competitive bidding as public works projects. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended are summarized in Section 8 along with associated costs. Detailed cost estimates are provided in Appendix E.

6.3.1 Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to system maps of the existing facilities to determine construction quantities, elevations of the reservoirs and major components, and locations of distribution lines. Where required, estimates were based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. Cost estimates prepared in this plan are based on the September 2016 ENR index. If specific ENR index figures are not available, the historical ENR growth pattern has been around 3% per year.

6.3.2 Contingencies

A contingency factor equal to approximately twenty percent (20%) of the estimated project cost has been added. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

6.3.3 Engineering

The cost of engineering services for major projects typically include special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25% of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects. Engineering costs for design and construction presented in this Plan should average 20% of the estimated construction costs.

6.3.4 Legal and Administrative

An allowance of five percent (5%) of construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project that the City could incur.

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SECTION 7

System Analysis and Improvement Alternatives

Section 7

System Analysis & Improvement Alternatives

7.1 WATER SUPPLY EVALUATION

7.1.1 Capacity Assessment

The City of Falls City has seven water rights as show in the following table and described in better detail in Section 10. The total amount of water allocated to the City is 2,720 gpm. This table also lists the current and projected peak demands for the City's water system.

Table 7-1 – Summary of Existing Water Rights Compared to Existing & Future MDD

Water Right	Maximum Allowable Diversion	Maximum Possible With Existing Infrastructure
Teal Creek[1]	449 gpm	449 gpm[3]
Glaze Creek[1]	898 gpm	898 gpm[3]
Little Luckiamute River	224 gpm	Not connected
Albert Teal Spring	117 gpm	Not connected
Rattling Spring	359 gpm	Not connected
Berry Creek	449 gpm	Not connected
Boughey Creek	224 gpm	Not connected
Total Water Rights	2,720 gpm	1347 gpm[3]
System Demands		
2011 Maximum Daily Demand[2]	243 gpm	
20-Year Maximum Daily Demand	327 gpm	

[1] City's primary seasonal water sources
[2] Based on 24-hr production
[3] Under ideal conditions only

As Table 7-1 shows, the total allocated water supply to the City is more than sufficient to meet the system's long-term water supply needs. However, the City currently does not have functional infrastructure at all of the points of diversion shown. Only Teal Creek and Glaze Creek are currently able to produce water until repairs are made. For the current population, this arrangement is sufficient, but may change if growth patterns change.

7.1.2 Intake Conditions

Teal Creek

The Teal Creek intake consists of box leading to a pipe with a coarse grate to block out large debris. The capacities of the intake and its transmission line to the WTP are sufficient to meet projected peak demands. However, as noted in Section 4, the existing intake has a number of operational and maintenance concerns including:

- High seasonal turbidity in Teal Creek makes treatment difficult and reduces WTP capacity, so a different supply source is used in the winter.
- Sedimentation in the intakes requires frequent cleaning.
- Existing screen does not prevent debris from entering raw water stream, which can clog pipes and impair WTP performance.
- Access to the intake site is limited or impossible during winter and difficult due to steep and slippery conditions at all parts of the year.

Glaze Creek

The Glaze Creek intake consists of pipe leading to a box covered with chicken wire and back to a pipe. The capacities of the intake and its transmission line to the WTP are sufficient to meet projected peak demands. However, as noted in Section 4, the existing intake has a number of operational and maintenance concerns including:

- Low flows in summer, insufficient of supplying the City with enough water.
- Access to the intake site is limited during winter. It is located in a remote location that takes City staff a long time to drive to.
- Existing screen does not prevent debris from entering raw water stream, which can clog pipes and impair WTP performance.

7.1.3 Summary of Water Supply Deficiencies

A summary of key deficiencies related to the City's water supply system is provided below:

- **Poor Water Quality** – Seasonal spikes in Teal Creek turbidity associated with runoff during storm events make treatment of raw water difficult.

- **Screen** – The existing intake on Teal and Glaze Creeks do not sufficiently prevent debris from entering transmission piping to WTP. Objects can clog transmission lines causing maintenance problems and impairing treatment capabilities. Also, the screens are not equipped with mechanical cleaning so large debris can block screen and restrict diversions.

- **Transmission Piping** – The water from the intakes is conveyed to the water treatment plant via a pipeline of varying size and material. This pipeline is old and in questionable condition. It was originally constructed in 1915, and has likely degraded overtime. Inaccurate survey technology at the time likely led the construction of the pipeline outside of the easement allotted for the water line. There are portions of the pipeline that the City doesn't know its exact location. Other portions of the raw water line are above ground, which can cause problems with freezing temperatures if the line were to freeze, invites valdalism, and can cause an air pocket which may reduce capacity in the inlet pipe

7.2 WATER TREATMENT EVALUATION

The City's water treatment plant (WTP) was originally built in 1999 with some updates completed as needed since. The plant includes a triple-cell slow sand filtration system and disinfection.

7.2.1 WTP Capacity Assessment

As noted in Section 4, the existing WTP has a maximum operating capacity of 390 gpm under optimal conditions. The WTP should be capable meeting maximum day demand (MDD), therefore the maximum daily treatment capacity is 562,000 gallons. As Table 7-2 shows, the City still has 90,000 gpd more capacity than it uses by the end of the 20-year planning period.

Table 7-2 – Additional Treatment Capacity Required to Meet Current & Future Demands

	Maximum Daily Demand (gpd)	Excess Treatment Capacity (gpd)
Current	350,000	211,600
20-Year (2035)	471,600	90,000

7.2.2 WTP Condition

In addition to the treatment capacity needs, the WTP has a few minor issues. The following is a list of problems currently reported by staff:

- Some portions of concrete are starting to show some signs of wear and should be resealed, and patched as necessary to slow damage.
- A few leaks have been noticed in the vaults that need to be repaired.
- The City desires to replace the chlorine line to the clearwell.
- The City reports that the only problems with performance come following storms which cause high turbidity in the intake locations.

7.2.3 Summary of WTP Deficiencies

Existing deficiencies of the City's WTP include:

Condition – Overall, it appears that in the WTP is in relatively good condition, with only a few minor repairs needed.

Performance – the City reports the filters taking longer to clean when there is high turbidity from a storm. The inlet can be shut off in these times to avoid having to treat water with high turbidity.

7.3 TREATED WATER STORAGE EVALUATION

7.3.1 Storage Capacity Assessment

Water storage is needed to provide the difference between peak demands and supply capacity, provide water during power failures and equipment or line failures, and to provide water for fire protection. As discussed in Section 6.2, the minimum recommended storage volume equals two times the ADD for emergency storage, plus 25% of the MDD for operational and equalization storage plus 180,000 gallons for fire demand storage. The 180,000 gallons of fire protection storage provides for 1,500 gpm fire flow for 2 hours.

Storage requirements for the City are present in Table 7-3. The City currently has maximum 835,650 gallons of available storage in its treated water reservoir tank and clearwell. Based on stated storage requirements, the City currently has a storage surplus of 358,000 gallons. Assuming no changes to current water trends, this surplus will only decrease to nearly 255,000 gallons by the end of the 20-year planning period.

Table 7-3 – Treated Water Storage Requirements (gallons)

	Current	2035
MDD	350,000	471,579
ADD	104,970	141,434
Operations & Equalization (0.25 MDD)	87,500	117,895
Emergency (2x ADD)	209,941	282,868
Fire Suppression (1500 gpm @ 2 hours)	180,000	180,000
Total Storage Needs	477,441	580,762
Total Storage Available	835,650	835,650
Storage Surplus	358,209	254,888

7.3.2 Storage Tank Condition

The exterior of the treated water reservoir appears to be in good condition. The reservoir interior was cleaned and inspected recently in the summer of 2016. It is only showing minor signs of rust, which should be continued to be monitored in future cleanings, but no interior recoating is needed at this time. The roof is rusting and showing signs of wear.

7.3.3 Summary of Storage Deficiencies

Deficiencies related to the City’s treated water storage include:

- **Condition** – The exterior of the tank appears to be in good condition with the exception of peeling paint on the roof. The interior of the reservoir was recently inspected and cleaned in the summer of 2016. Only minor rust was discovered in the inspection. It is recommended to get this done every three years to monitor the internal conditions of the reservoir, and assess when coating may be needed. There are three bullet marks that need to be repaired, but they did not cause structural damage or cause leakage.

7.4 DISTRIBUTION SYSTEM EVALUATION

7.4.1 Hydraulic Analysis

The City's water system was modeled and analyzed using the WaterCAD software. At the most basic level, the model consists of links and nodes. Nodes represent the various elements of the system including water sources, pumps, pipe connections, and storage tanks. The links represent the distribution pipes.

The model was developed using actual pipe sizes and materials based on best available information. The purpose of the model is to evaluate the system's distribution performance under various scenarios. This analysis will assist in identifying distribution system shortcomings and will form the basis in developing improvement recommendations.

The scope of the work for this *Master Plan* does not include the calibration of the hydraulic model. Therefore, results from the hydraulic model may differ from actual conditions. The City may wish to budget for and have the hydraulic model calibrated to provide more accurate results. If the hydraulic model is calibrated, revisions to this *Master Plan* may be required.

Simulated Scenarios & Performance Criteria

The distribution model was used to investigate a number of conditions to determine the adequacy of the existing system. The evaluation of the distribution system's performance is based on its ability to meet the following service performance criteria:

Average Daily Demand Performance Criteria
- Pressure should be maintained between a maximum of 80 psi and a minimum of 30 psi
- Maximum velocity within the distribution system pipelines should be 3 to 5 fps
- The existing system pressures during this demand scenario are shown in Figure 6 in Appendix A.

Peak Hour Demand Service Criteria
- Minimum allowable service pressure should be 40 psi
- Maximum velocity within the distribution system pipelines should be 7 fps
- Headloss within the distribution system should be limited to 10 feet per 1000 feet of pipeline
- The existing system pressures during this demand scenario are shown in Figure 7 in Appendix A.

Maximum Daily Demand plus Fire Flow Service Criteria
- The minimum allowable residual pressure should be 20 psi
- Calculated available fire flow at each node should meet or exceed specified fire flow requirements of 1,000 gpm in residential areas and 1,500 gpm in commercial areas
- Maximum velocity within the distribution system pipelines should be 10 fps
- Headloss within the distribution system should be limited to 10 feet per 1000 feet of pipeline

- The existing system pressures during this demand scenario are shown in Figure 8 in Appendix A.

Model Results

The City's distribution system was analyzed under the various scenarios listed above. Results of these analyses were compared to the prescribed service performance criteria related to pressure, pipe velocity, pipe head loss, and fire flow availability. Figures 6-9 in Appendix A illustrate existing system pressures and available fire flow. Detailed results from the various scenarios analyzed by the WaterCAD model are provided in Appendix D.

Overall the City's distribution system performed poorly under the various current and future demand scenarios. Calculated pressures ranged between 20 psi to 140+ psi. Required fire flow was exceeded in most areas, but there are some undersized lines.

Figure 6-9 in Appendix A show areas within the distribution system that do not appear to meet pressure and/or fire flow criteria under the existing demand scenarios.

7.4.2 Distribution System Condition

The City's distribution system was constructed during various phases beginning in the 1915. Age, size, condition, material of pipelines vary throughout the system. Detailed mapping is not available and much of the information on underground water lines remains unknown.

Pipeline breaks are common throughout the distribution system. These breaks are typically the result of weak and degraded pipe material such as asbestos cement in combination with excessively high mainline pressures, which exceed 125 psi in some locations.

7.4.3 Summary of Distribution System Deficiencies

A list of existing deficiencies related to the City's distribution system is provided below.

- **Condition** – Age, size, condition, and material of pipelines vary throughout the system. Pipeline leaks and breaks are common throughout the distribution system. These breaks are typically the result of weak and degraded pipe material especially asbestos cement pipe.

- **Leaks** – leaks are suspected through the system based on the age and material of the pipes.

- **Performance** – Distribution system capacity was evaluated using WaterCAD modeling software. Many areas of the city have excessive pressures while other parts of the city have low pressures. Rezoning is needed to combat this issue. In addition, many of the pipes in the system are undersized to carry the capacity needed to supply the system.

- **Unmetered Hook-Ups –** There are two connections that are not metered.

- **Service Meters** – Meters typically have a useful life of 10-15 years, and, many of the system's water meters are over 20 years old. As service meters age, they typically underreport water usage. This results in inaccurate data used in water audits as well as potential revenue loss.

7.5 SYSTEM IMPROVEMENT ALTERNATIVES ANALYSIS & RECOMMENDATIONS

7.5.1 Water Supply Improvements Alternatives

The City's water supply from Glaze and Teal Creeks is sufficient to meet the City's current water needs. However, there are concerns about the viability of the raw water transmission line and the accessibility of the existing intakes. Further investigation is needed to determine what the best option for source improvements. This plan recommends a separate intake study to analyze the specific details of each option. A few preliminary options are discussed in the following paragraphs.

Alternative W1 - Improvements to Current Intakes & Raw Water Transmission Line

If the City were to rehabilitate the existing infrastructure, it would require updating to fish friendly intakes with fine screens or a well with surface water intrusion drilled diagonally into creek bank. The raw water line would also need to be located, repaired, and brought below grade in all areas. Locations of the raw water line that are outside of easements would need easement acquisition, to ensure the City has access to every part of their system. This would retain the existing gravity system. This item is likely the most costly option, but will need to be further evaluated in the intake study to determine its relative merit.

Alternative W2 - Install Intake Closer to Water Treatment Plant

This alternative would reduce the length of raw water transmission line and place the intake in a location that is more accessible to City Staff adjacent to the plant. Installation of an intake closer would initiate the need for pumping to the water treatment plant, which could increase maintenance costs. It would require a water rights transfer.

Alternative W3 - Backup Well at Water Treatment Plant

This alternative would place a backup well on the Water Treatment Plant site. It would be used in case of raw water transmission line failure. The existing intakes and raw water lines would remain the same. It would require a water rights transfer. This would be a medium cost option, but provide a viable solution in case of a large emergency such as an earthquake.

Alternative W4 – No Action

The last alternative investigated for the City's water supply system is the "No Action" alternative. As the name implies, this alternative would make no improvements to any of the City's water supply facilities, thus problems associated with water quality, access, capacity, and maintenance on the raw water transmission line would persist. Consequently, in case of some emergencies, it could be a very long time that the City has no water available.

Water Supply Alternatives Analysis & Recommended Supply Improvements

Further investigation is needed to determine what the best option for source improvements. This plan recommends a separate intake study to analyze the specific details of each option and select a path forward.

7.5.2 Water Treatment Improvements Alternatives

There are no major issues with the existing water treatment plant, so no alternatives need to be considered. The following paragraph describes minor recommendations.

Recommended Water Treatment Improvements

- Repair minorly damaged and spawling concrete around plant and clearwell.
- Replace chlorine line to clearwell
- Repair leaks in vaults

7.5.3 Water Storage Improvements Alternatives

There are no major issues with the existing water storage, so no alternatives need to be considered. The following paragraph describes minor recommendations.

Recommended Water Storage Improvements

- The roof should be repainted.
- The bullet holes in the tank should be repaired.
- The interior of the tank should be inspected. If the condition of the interior of the tank is found to be needing attention for the inspection, the recommendations from the tank inspector should be followed.

7.5.4 Distribution Improvements Alternatives

The City's water distribution system varies in condition and performance. Many pipelines in the older sections of the system (pre-1990s) are undersized and in poor condition. Leaks and breaks in these sections are common and believed to be a major contributor to the high volume of water loss in the system. Additionally, many of the system's existing customer meters have been in service for 20 years or longer. Standard useful life for a water meter is 10 to 20 years. As meters age, they tend to underreport water usage. Underreported water usage may also account for some of the unaccounted water in the system. Replacing these meters would provide the City with more accurate data of water usage and may also increase system revenue.

Alternative D1 – Gravity Fed System

This alternative would completely replace the existing asbestos cement and undersized pipes in the distribution system The proposed improvements would upgrade the system by installing pipeline, new pressure reducing valves, hydrants and gate valves would be installed as part of this project. Zones in this alternative would be separated by pressure reducing valves (PRVs), and everything would be fed through gravity lines.

Alternative D2 – Pump Driven System

This alternative would completely replace the existing asbestos cement and undersized pipes in the distribution system The proposed improvements would upgrade the system by installing pipeline, new pressure reducing valves, hydrants and gate valves would be installed as part of this project. Zones in this alternative would be separated by pressure reducing valves (PRVs), and the majority of the system would be fed through gravity lines, except the northern portion of the City with higher elevations that would be fed through a new pump station. Pumped systems add costs and maintenance on an ongoing basis that gravity systems don't have.

Alternative D3 – Standard Meter Replacement

This alternative would allocate money to replace service meters. The City could replace all meters at once or on an "as-needed" basis. The system would still require staff to physically read each meter, thus snow or other site condition may prevent accessibly to meter. The average cost to replace a standard water meter is approximately $300.

Alternative D4 – AMR Meter Replacement

This alternative would replace the existing metering system with an automatic metering reading (AMR) system. This would require replacement of all service meters as well as installing a small transmitter at each meter. The transmitter would convey water usage data to a hand-held receiver which can download the data into billing software. Using this system would significantly reduce time requirements for reading meters and would not be impaired by weather or site conditions. The average cost to install a new AMR meter is approximately $500, plus an additional $10,000 for reading equipment and software.

Alternative D5 – No Action

This alternative would make no improvements to the City's distribution system including not replacing meters. As a result, the system would continue to degrade resulting in increased water loss and inaccurate account of water consumption requiring larger facilities to be constructed to address treatment and storage capacity deficiencies. Under this alternative, portions of the City's distribution system would remain vulnerable of prolonged water outages should a major pipeline break occur. pressures are disproportionally high in some parts of town, and low in other parts of town.

Distribution System Alternatives Analysis

Advantages, and disadvantages of each of the distribution system alternatives are presented in Table 7-4

Table 7-4 - Comparison of Distribution System Alternatives

Alt.	Description	Advantages	Disadvantages
D1	Gravity Fed System	• Replaces the most degraded pipelines in the distribution system • High reduction in water loss • Low O&M time & costs • Reduces High Pressures • Increases Low pressures	• High pressure transmission lines • Large number of PRVs (9)
D2	Pump Driven System	• Replaces the most degraded pipelines in the distribution system • High reduction in water loss • Reduces High Pressures • Increases Low pressures • Maintains reasonable pressures in transmission lines	• O&M costs & time that would not exist with other options • Large number of PRVs (9)
D3	Standard Meter Replacement	• Improve accuracy of customer usage • May result in increased revenue • Can replace meters on an "as needed" basis	• Requires physical access to meter (e.g. not able to perform meter readings when covered in snow) • Potential loss of revenue
D4	AMR Meter Replacement	• Significant reduction in time required to read meters • Will allow meter readings to be done even if meter is buried in snow • Most accurate system • May increase revenue • Additional funding may be needed	• Largest capital cost • Requires upgrade of all meters • Requires additional equipment
D5	No Action	• No capital cost	• Local areas of low & high pressure • Increased O&M of system • Risk of major break • Continued poor accuracy of some customer meters • Loss of revenue due to underreported usage • Requires physical access to meter • Requires several days of staff time to read meters

Distribution System Alternatives Analysis

Reducing pressures in the system should be the City's highest priority. For this reason, the "No Action" alternative (D5) is not advisable. Rezoning the distribution system as part of the Gravity Fed option is recommended as the highest priority project because it is expected that high pressures in combination with deteriorating AC pipes are the largest cause of breaking pipes in the system. Recommended improvements to replace asbestos cement and undersized pipes should also be high priority to further reduce water main breaks and improve system performance. It is also recommended that the City replace its existing metering system with an AMR system (D4). This will improve meter accuracy, reduce staff time required for reading meters and billings, and allow meters to be read regardless if snow or other cover prevents physical access to meters.

SECTION 8

Recommended Capital Improvement Plan

Recommended Capital Improvement Plan

Section 8

Below is a summary of all the recommendations for the City's water supply, storage, and distribution systems. This includes clear and concise information on project selection, capacity needs, project prioritization, and project costs. These recommendations were developed through analyses and studies that were completed in previous sections of the Plan.

As the projects vary in their criticality, the projects have been divided into three separate and distinct priority groups. The priority groups are further described below:

Priority 1 Projects: Priority 1 projects are the most critical and must be undertaken as soon as possible in order to satisfy the current operational and regulatory requirements. Priority 1 projects should be considered as the most immediate needs of the water system and completed within the next few of years, or as soon as funding for these projects can be obtained. Priority 1A improvements should be completed in the next 0-5 years and generally consist of replacing asbestos cement piping in critical areas. Priority 1B improvements generally coincide with rezoning the system in order to reduce high pressure lines and in turn, reduce probability of pipe failure. Priority 1B should be completed in the next 0-10 years.

Priority 2 Projects: Priority 2 projects are projects that should be undertaken within the first half of the planning period to restore aging facilities to new operating conditions and to increase system capacity. While they do not have to be undertaken immediately, they should be included in the capital improvement plan (CIP) and undertaken as funding is obtained. These improvements generally coincide with intake improvements and replacement of asbestos cement pipe. Some of these replacements include upsizing lines in order to increase local pressures.

Priority 3 Projects: Priority 3 projects are less urgent system repairs that need to occur sometime within the planning period as these items become dysfunctional or in order to extend the life of facilities. Priority 3 also includes pipe looping to improve fire flow and water quality in dead-end lines. Funding for Priority 3 projects are likely to be financed through a combination of system funds and rate increases. Many fire flow decisions projects are dependent upon policy decisions.

8.1 SUMMARY OF RECOMMENDED IMPROVEMENTS

Improvements to the City's water system are needed to:

- Reduce the pressures in high pressure areas and raise pressures in low pressure areas
- Replace deteriorating and undersized distribution pipelines including asbestos cement pipes
- Further investigate the possibilities of a new intake through an intake siting study
- Replace water meters
- Repairs to the treatment plant
- Recoat the reservoir roof and inspect the interior

Each of the alternative improvements is discussed in detail in Section 7 and appendix E, and shown in Figures 10-12 of Appendix A. Where piping improvements are listed, it includes valves, applicable appurtenances, trenching, backfill, surface repair, erosion and sediment control, etc.

Results of the model run with the proposed system and 2035 demands are shown in Figures 13-14 in Appendix A. It should be noted that there are a few areas outside the desired pressure and fire flow ranges in the proposed solution. It was determined that serving those areas with pressures and fire flows meeting the goals outlined would represent an extreme cost for only a few structures. The fire flow can be assisted by using tanker trucks. This practice is currently in use by the City, but the proposed improvements will reduce the number of structures that require this practice. The pressures are all below 100 psi in the proposed solution which is commonly agreed upon as the ultimate maximum pressure. Currently the system pressures are in excess of 140 psi in some locations, so this is a significant improvement. The only location with lower than 40 psi pressure should be noted because it is one of the Luckiamute connections. It is currently at the end of a 2" line and has 36 psi available. Pressure would likely increase if the City or Luckiamute increased this size. This improvement was not included in the CIP because it is outside of City limits, and could potentially fall under the jurisdiction of another water system.

8.1.1 Priority 1A Projects

Highest priority improvements, indicated as Priority 1 projects, include improvements to the City's most pertinent sections of its distribution system. The numbering and lettering of these projects does not coincide with importance. These priority 1 projects were selected as priority 1A because they are improvements that the City anticipates it can reasonably acquire funding for in the next 5 years. These particular improvements do not necessarily need to be completed simultaneously. The City anticipates having more funds available after 5 years to correct the priority 1 improvements that must be completed simultaneously. If funding cannot be achieved for the entirety of priority 1 projects, a water model should be used to determine which improvements could be left out based on the amount of funding available.

Priority 1A projects are listed below:

1A-1: Repair Bridge Holding Water line

- Repair the bridge crossing for the waterline across the river.

1A-2: Alan Street

- Install 1,800 feet of 6-inch PVC waterline to replace existing undersized line the entirety of Alan Street, south to Bryant Street on Wood and 5th Streets.
- Install 200 feet of 8-inch PVC waterline to replace existing undersized line south of Bryant Street to the alley.
- This increases pressures and fire flows in the area and removes AC pipe.

1A-3: Sheldon Avenue

- Replace section of 2-inch line on the south end of Sheldon Avenue with 400 ft. of 8-inch PVC waterline.
- Install 300 feet of 8-inch waterline to complete the large loop in the area.
- This increases pressures and fire flows within the area, and removes long dead-end lines.

1A-4: Parry Road

- Install 500 feet of 6-inch PVC waterline along Parry Road to meet in with new 8-inch waterline along Parry Road. This is replacing the old asbestos pipe.

1A-5: Fairview Street and Terrace Street

- Replace 2,000 feet of existing waterline in Fairview and Terrace Streets with 6-inch PVC waterline.
- Install 300 feet of PVC waterline along the alley to connect with the eastern end of the Parry Road line.
- This replaces outdated AC pipe, and creates additional looping to improve pressures.

1A-6: Hopkins Street

- Replace 1,500 feet of pipe with 6-inch PVC waterline from Bridge Street to Cameron, and then form the West Zone Transmission Line west, three tax lots. This is replacing the old asbestos pipe, and upsizing to the standard minimum size of 6".
- These lines are not connected, and are part of two pressure zones, but were grouped due to proximity.

1A-7: Alley North of Main Street

- Replace 800 feet of existing waterline in in the alley north of Main Street from 4th Street to 2nd Street, and south from the alley along 3rd Street to Main Street with 8-inch PVC waterline.
- Replace 100 feet of waterline south of the alley along 3rd street, and connect into Main Street. It currently isn't connected.
- This replaces outdated AC pipe, and creates an additional loop to Main Street.

1A-8: Mill Street

- Install 400 feet of 6-inch PVC waterline to along Mill Street.
- This replaces an undersized AC line.

1A-9: Forest Lane and Clark Street

- Install 1,700 feet of 6-inch PVC waterline to replace undersize and outdate AC pipe.
- This increases pressures and fire flows within the area, and replaces AC pipe.

Priority 1A projects should be completed within the next 0-5 years or as soon as funding is available.

8.1.2 Priority 1B Projects

Highest priority improvements, indicated as Priority 1 projects, include improvements to the City's most pertinent sections of its distribution system. The numbering and lettering of these projects does not coincide with importance. For Priority 1B, all improvements are intended to be completed together to achieve the desired results. Completing these projects one at a time will likely have negative effects on the system, and could cause portions of the system not to work at all. The intent of these improvements is to rezone the system. If funding cannot be achieved for the entirety of these projects, a water model should be used to determine which improvements could be left out based on the amount of funding available.

Priority 1B projects are listed below:

1B-1: Reservoir Transmission Line

- Install 2,100 feet of 10-inch PVC waterline to connect upstream of the new PRV at the UGB, then run up Lewis Street, turning left on 1st Street, and then right on West Boulevard to Chamberlain Road. This line will run parallel to the existing line. The new line should be made of materials that can support higher pressures such as ductile iron.

- This parallel line allows high pressure water to bypass the southern zone and still fill the reservoir. The installation of a PRV allows for the southern zone to have reasonable pressures
- All rezoning projects, including this one, need to be done at the same time.

1B-2: North Zone Transmission Line

- Install 2,500 feet of 10-inch PVC waterline to connect the existing reservoir feed line to the new North Zone. This pipeline will run parallel to the existing 12" line and share the same river crossing. It will run from 4th Street, south of Pine Street to Bridge and Chamberlain Road.
- This creates a transmission line to service the new pressure zone in the north. By avoiding the existing PRV, it allows the pressures in the northern portion of the City to be increased without increasing the pressures downtown.
- All rezoning projects, including this one, need to be done at the same time.

1B-3: West Zone Transmission Line

- Install 2,500 feet of 8-inch PVC waterline to connect the existing reservoir feed line to the new West Zone. This pipeline will run North from where Chamberlain Road turn east to Hopkins Street west of the new PRV, then run north toward Hopkins Street in the unimproved right-of-way, then follow Cameron north to Parry Road and turn east approximately 400 feet along Parry Road.
- Disconnect the west zone from the central zone at the intersection of Parry Road and Harrington Road.
- This creates a transmission line to service the new pressure zone in the west. By avoiding the existing PRV, it allows the pressures in the western portion of the City to be increased without increasing the pressures downtown.
- All rezoning projects, including this one, need to be done at the same time.

1B-4: Pine Street

- Install 1,100 feet of 6-inch PVC waterline to connect the alley on 3rd Street up to Pine Street, across to 1st Street and back south to the alley to the intersection of East Avenue and Sheldon Avenue.
- This removes undersized 1" lines and adds looping.

1B-5: Disconnect 6th and Mithchell

- Disconnect and abandon water lines on 6th Street and Mitchell Street west of 6th Street. Reconnect services to nearest live waterline.

1B-6: PRV Installations and Reconfigurations

- Adjust the existing PRVs to meet the needs of the new pressure zones.
- Install 4 PRVS to separate proposed zones.
- Design pressures of zones are shown in Figure 10 in Appendix A.
- Pipes that should be disconnected, and valves that should be closed are included on the Figure 10 in Appendix A.
- PRV settings will be determined in final design based on elevation of the PRV etc.
- This improvement will create the new pressure zones in combination with the piping changes in other Priority 1 projects.
- All rezoning projects need to be done at the same time.

1B-7: 7th Street and Prospect Street

- Install 1,200 feet of 8-inch PVC waterline to replace existing undersized line the entirety of 7th Street and east on Prospect Avenue to 5th Street.

- This increases pressures and removes AC pipe.

Priority 1B projects should be completed within the next 0-10 years or as soon as funding is available.

8.1.3 Priority 2 Projects

Other projects that need to be completed within the next 15 years include:

2A:5th Street and Pine Street

- Replace 1,100 feet of existing waterline in 5th Street from the alley south of Bryant Street and then across Pine Street to 4th Street with a 6-inch PVC waterline.
- This replaces outdated AC pipe.

2B: Lewis Street and Lombard Street

- Replace 2,200 feet of existing waterline with 10-inch PVC waterline from the UGB along Lewis Street and Lombard Street to South Main Street.
- This replaces outdated AC pipe.

2C: Wood Street

- Replace 400 feet of existing waterline in Wood Street between Prospect Avenue and Fairoaks Street with 6-inch PVC waterline.
- This replaces outdated AC pipe.

2D: School

- Replace 100 feet of undersize AC pipe with 6-inch PVC waterline to connect to the school.

2E: Reservoir Improvements

- Recoat the roof of reservoir.
- Inspect interior of reservoir to see if anything needs to be done to the interior.
- Repair bullet holes.

2F: Intake Siting Study & Improvements

- Conduct a study to determine the best location for a new and/or additional water source.
- It should evaluate ways to improve existing intakes, a well at the site of the treatment plant, and moving the intake closer to the treatment plant.
- If the existing intakes are to remain, then the intake piping should be evaluated as well with recommendations on how to bring it below grade in all areas, and make sure it is within the easement.

The Priority 2 project improvements can be undertaken within 15 years or as funding becomes available.

8.1.4 Priority 3 Projects

Priority 3 projects are intended to be completed at some time within the 20 year planning period on an as-needed basis.

3A: West Zone Loop

- Install 3,600 feet of 6-inch PVC waterline to connect the western end of the Hopkins street line, west to Harrington Street, turning North on Harrington, then west on the unimproved right-of-way, and north along the UGB, then east to the western end of the Parry Road line. This creates a loop that will improve water quality and fire flows within the West Zone.

3B: Northwest Improvements

- Install 2,100 feet of 6-inch PVC waterline to replace all existing waterlines west of 7th Street, and north of the river.
- This improves water quality and increases fire flows in the area.

3C: Prospect Ave

- Install 500 feet of 8-inch PVC waterline to replace existing waterlines between 6^{th} and 7^{th} Streets.
- This improves water quality and increases fire flows in the area.

3D: West Boulevard Loop

- Install 700 feet of 6-inch PVC waterline to create a loop.
- This increases water quality by removing dead-end lines. It is not needed for pressures or fire flows.

3E: Clark Street Loop

- Install 700 feet of 6-inch PVC waterline to create a loop.
- This increases water quality by removing dead-end lines. It is not needed for pressures or fire flows.

3F: Carey Court

- Install 700 feet of 6-inch PVC waterline to connect Carey Ct. to the intersection of East Avenue and Sheldon Avenue.
- This increases pressures and fire flows within the area, and removes a dead-end line.

3G: Northeastern Fire flow

- Install approximately 1,400-3,100 feet of 8-inch PVC waterline along Ellis then east.
- The lines shown are one possibility, more or less could be added based on policy.
- If the full area were to be serviced by fire flows greater than 1000 gpm, then 3,100 ft. of line should be installed. It is most likely sufficient to only include the lines shown on Figure 11 in Appendix A, as the home with less than 1000gpm aren't in the UGB.
- Modeling should be considered to determine how much pipe the City desires to put in to service just a few houses for this area. The pressures are fine with the shown improvements.

3H: Priority 3 PRVs

- Install PRVs in the areas with shut valves from the priority 1.
- This would finish off the water quality loop by reopening the connection closed by improvement 1I.

3I: Service Meters

- Replace existing customer water meters with AMR system
- If funding is not available for this project it may be re-prioritized as Priority 2.

3J: Fire Hydrants

- Install fire hydrants as shown or where desired by the fire department to reduce the number of structures protected solely by tanker trucks.

3K: Water Treatment Plant Improvements

- Repair spawling and damaged concrete
- Seal leaking valve vaults
- *Replace chlorine feed line*

8.2 RECOMMENDED IMPROVEMENTS COST SUMMARY

A summary of the recommended capital improvement projects costs is provided in the Table 8-1. Detail cost estimates for each improvement is provided in the Appendix E. The estimated cost for all system improvements is approximately $7 million in 2016 dollars. Funding options for proposed improvement projects are discussed in greater detail in Section 9.

No.	Project Name	Preliminary Estimated Cost
Priority 1A Projects(0-5 years)		
1A-1	Repair Bridge Holding Water line	$ 116,188
1A-2	Alan Street	$ 303,079
1A-3	Sheldon Avenue	$ 125,206
1A-4	Parry Road	$ 82,891
1A-5	Fairview Street and Terrace Street	$ 343,964
1A-6	Hopkins Street	$ 225,599
1A-7	Alley North of Main Street	$ 150,443
1A-8	Mill Street	$ 58,305
1A-9	Forest Lane and Clark Street	$ 256,458
Sub Total of Priority 1A Projects		*$ 1,662,131*
Priority 1B Projects(0-10 years)		
1B-1	Reservoir Transmission Line	$ 386,929
1B-2	North Zone Transmission Line	$ 675,350
1B-3	West Zone Transmission Line	$ 476,011
1B-4	Pine Street	$ 168,236
1B-5	Disconnect 6th and Mitchell	$ 4,225
1B-6	PRV Installations and Reconfigurations	$ 182,163
1B-7	7th Street and Prospect Street	$ 214,825
Sub Total of Priority 1B Projects		*$ 2,107,739*
Priority 2 Projects(10-15 years)		
2A	5th Street and Pine Street	$ 201,208
2B	Lewis Street and Lombard Street	$ 511,225
2C	Wood Street	$ 57,298
2D	School	$ 19,533
2E	Reservoir Improvements	$ 33,840
2F	Intake Siting Study and Improvements	$ 25,000
Sub Total of Priority 2 Projects		*$ 848,103*
Priority 3 Projects(15-20 years)		
3A	West Zone Loop	$ 555,653
3B	Northwest Improvements	$ 326,414
3C	Prospect Avenue	$ 86,076
3D	West Boulevard Loop	$ 101,351
3E	Clark Street Loop	$ 100,474
3F	Carey Court	$ 107,640
3G	Northeastern Fireflow	$ 251,973
3H	Priority 3 PRVs	$ 215,963
3I	Service Meters	$ 391,463
3J	Fire Hydrants	$ 330,525
3K	Water Treatment Plant Improvements	$ 7,150
Sub Total of Priority 3 Projects		*$ 2,474,680*
Total Recommended Improvement Project Costs		**$ 7,092,653**

SECTION 9

Financing Options

Financing Options

Section 9

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance, such as low interest loans or grants. Below, a number of major Federal/State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed. Projects are usually funding by a combination of grant, loan and local funds.

9.1 GRANT AND LOAN PROGRAMS

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has its own particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having its specific requirements, not all communities or projects may qualify for each of these programs. *Oregon Water & Wastewater Funding and Resource Guide*¸ prepared by Rural Community Assistance Corporation (RCAC) is provided in Appendix F.

9.1.1 Oregon Community Development Block Grant (OCDBG) Program

The Oregon Business Development Department Infrastructure Finance Authority (OBDD-IFA) administers the State's annual federal allocation of CDBG funds. Funds for the program come from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems.

Only non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Cities and counties may undertake projects to improve existing facilities owned by other public bodies, such as water or sanitary districts. A City or County can only have one CDBG application under consideration by the State at any one time. Applications are not accepted when a jurisdiction has three or more administratively open CDGB projects. Applications may be submitted year around.

OCDBG grants are available for each of three phases necessary to complete water and/or wastewater system improvements; preliminary engineering and planning, final engineering, and construction. Engineering costs are limited to 20% of the total budget. No matching fund is required. The maximum grant available for a single project is $2,000,000 or $20,000 per permanent residential connection, whichever is less. This maximum grant allocation covers all aspects of the single project for a five year period. Projects may not be separated into phased in order to apply for more that the maximum grant funding during the five year period.

Grants awarded may be used for the following public works projects:

- Projects necessary to bring municipal water systems into compliance with the requirements of the Safe Drinking Water Act by the Oregon Department of Human Services – Drinking Water Program.

- Projects where the municipal system has not been issued a notice of noncompliance from the Oregon Health Services, Safe Drinking Water Program, but the department determines that a project is eligible for assistance upon finding that; a recent letter, within the previous twelvemonths, from the appropriate regulatory authority (DHS-DWP) or their contracted agent, indicating a high probability that within two years the system will be notified of non-compliance, and department staff deems it reasonable and prudent that program funding will assist in bringing the water system into compliance with current regulations or requirements proposed to take effect within the next two years.

- Water system planning, design and construction projects necessary to eliminate water rationing. The applicant must demonstrate past (within last 2 years) and/or consistent water rationing events due to insufficient drinking water quality or supply.

- Planning, design and construction projects necessary for the provision of dependable and efficient water storage, treatment and/or transmission to meet domestic drinking water needs

Projects eligible for funding must be to solve problems faced by current residents, not projects intended to provide capacity for population and economic growth. CDBG funds may be used in projects that are needed to benefit current residents but which will be built with capacity for future development. In these cases, the CDBG participation is limited to that portion of the project cost that is necessary to serve the current population.

In order to be eligible for CDBG, a system must at least 51% of permanent residents must characterized as low or moderate incomes based on the most recent OBDD Method of Distribution and the monthly user rate at construction completion of proposed projects meets the threshold rate criteria. The Threshold rate criteria states that by completion of the proposed project, the average system annual water rate is equal to or exceeds 1.25% of the current MHI as defined by the most recent *American Community Survey 5-Year Estimate*.

For additional information on the CDBG programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org/Infrastructure-Programs/CDBG/.

9.1.2 Water/Wastewater Financing Program

The 1993 Legislature created the Water/Wastewater Financing Program for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments in meeting the Safe Drinking Water Act and the Clean Water Act. The fund is capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds. The Oregon Business Development Department Infrastructure Financing Authority (OBDD-IFA) administers the program.

Program eligibility is limited to projects necessary to ensure compliance with the Safe Drinking Water Act or the Clean Water Act where a Notice of Non-Compliance has been issued. Cities, Counties, Districts and other public entities may apply to the program.

Eligible activities include the following:

- Water source, treatment, storage, and distribution improvements.
- Wastewater collection and capacity.
- Storm system.
- Purchase of rights of way and easements necessary for infrastructure development.
- Design and construction engineering.

The grant/loan amounts are determined by a financial analysis based on demonstrated need and the applicant's ability or inability to afford additional loans (dept capacity, repayment sources and other factors). The programs guidelines, project administration, loan terms, and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years, however, loans are generally made for 20-year terms. Loans are generally repaid with utility revenues, general funds, or voter approved bond issues. Borrowers that are "credit worthy" may be funded through sale of state revenue bonds.

Interested applicants should contact OBDD-IFA prior to submitting an application. Applications are accepted year-round. For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.3 Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to municipalities (cities, districts, tribal councils, etc.) to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and

- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The SPWF program is capitalized through biennial appropriations from the Oregon Lottery Economic Development Fund by the Oregon State Legislature, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Business Development Department Infrastructure Authority (OBDD-IFA) administers the fund. The following criteria are used to determine project eligibility.

The SPWF is primarily a loan program. Grant funds are available based upon economic need of the municipality. The maximum loan term is 25 years, though loans are generally made for 20-year terms. The grant/loan amounts are determined by a financial analysis based on a demonstrated need and the applicant's ability or inability to afford additional loans (debt capacity, repayment sources and other factors). Borrowers that are "credit worthy" may be funded through the sale of state revenue bonds. Loans are generally repaid with utility revenues, local improvement districts (LID's), general funds, or voter approved bond issues.

Determination of the final amount of financing and the loan/grant/bond mix will be based on the financial feasibility of the project, the individual credit strength of an applicant, the ability to assess specially benefited property owners, the ability of the applicant to afford annual payments on loans from enterprise funds or other sources, future beneficiaries of the project, and six other applicable issues.

The maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. The maximum SPWF grant is $500,000 for a construction project and cannot exceed 85% of the total project cost. Grants are made only when loans are not feasible.

Technical Assistance grants and loans may finance preliminary planning and engineering studies and economic investigations to determine infrastructure feasibility. Up to $10,000 in grant funds and $20,000 in additional loan funds may be awarded to eligible applicants with fewer than 5,000 persons living within the City.

For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.4 Safe Drinking Water Revolving Loan Fund

The purpose of this loan fund is to provide funding to drinking water systems to comply with the Safe Drinking Water Act (SDWA), i.e., to protect the public health. It is intended to assist community and nonprofit, non-community water systems plan, design and construct drinking water facilities needed to correct non-compliance issues and to further the public health protection goals of the SDWA. Funds may be used for the following types of activities:

- All drinking water facilities necessary for source of supply, filtration, treatment, storage, transmission and metering.
- The acquisition of real property necessary for the project
- Preliminary and final engineering, surveying, legal review and other support activities necessary for the construction of the project
- Construction contingencies in approved change orders.
- Cost necessary for recipients to contract environmental review services
- A reasonable amount of community growth may be accommodated in the project. Growth may not be the primary purpose for constructing the facilities; public health improvement must be the main goal.

The Oregon Health Division and the Oregon Business Development Department (OBDD) rate proposed projects. The applicant must submit a "Letter of Interest" which is used to rank projects in a Project Priority List. Projects must be on the Priority List to receive funding. Highest ratings are given to projects that present the following:

- Project addresses the most serious risk to human health.

- Project is necessary to ensure Safe Drinking Water Act compliance.

- Applicant has the greatest financial need, on a per household basis, according to affordability criteria.

Special consideration is given to projects at small water systems that serve 10,000 or fewer people, consolidating or merging with another system as a solution to a compliance problem, and which have an innovative solution to the stated problem.

Additional consideration will be given to disadvantaged communities. A disadvantaged community is defined as one whose average water cost for a residential customer in the service area of the water system is at least the state average for like systems (which have recently undergone a construction project) after the proposed project improvements are completed and currently meets at least two of the three criteria listed below:

- Community water system debt is at least $250 per capita (for sewer and water systems combined $500 per capita).

- The water system includes at least 51% low and moderate-income persons.

- The residents of the community water system have documented financial burden due to a recent (within the past two years) national or state declared disaster with documented not reimbursable expenses (minimum of $25 per capita).

Applicants with 300 or more service connections are eligible for assistance with final design and construction projects only if they maintain a current, approved master plan that evaluates the needs of the water system for at least a twenty-year period and includes the major elements outlined in OAR 333-061-0060(5). Systems with less than 300 service connections may receive funding for an engineering feasibility analysis instead of a master plan.

For additional information on this and other OBDD-IFA programs, call (503)-986-0123 or visit the OBDD-IFA website at http://www.orinfrastructure.org

9.1.5 State Water Resources Department: Water Development Loan Fund

The Water Development Loan Fund (WDLF) may grant loans to individuals, cities, local governments, and other public and private entities. The goal of the fund is to provide low-cost, long-term, fixed-rate financing incentives that promote projects that achieve the state's long-term water management goals.

Eligible projects include:

- **Drainage projects:** facilities installed to provide for the removal of excess water to increase soil versatility and productivity.

- **Irrigation projects:** facilities designed to provide water to land for the purpose of irrigation.

- **Community water supply project:** an undertaking, in whole or in part, in Oregon for the purpose of providing water for municipal use. A community is an incorporated or unincorporated town or locality with more than three service connections and a population of less than 30,000 people.

- **Fish protection project:** an undertaking, in whole or in part, in Oregon for the purpose of watershed protecting fish or fish habitat.

- **Watershed project:** a water development project in Oregon that provides more than one use. The primary use of the project must be one of the uses listed above. Secondary uses may include other water uses that are compatible with the primary use.

Funds to finance a water development project are obtained through the issuance and sale of self-liquidating bonds. The bonds are repaid by participants in the program and at no cost to the state or the Oregon taxpayer. The amount and type of loan security required depends on the borrower and the type of project. A first lien on real estate is required security for all loans. Other security may also be required.

Interested parties should contact the Water Resources Department for details. For additional information on the WDLF programs, call 1-800-624-3199 or visit the WRD website at http://www.wrd.state.or.us.

9.1.6 Water and Waste Disposal Loans and Grants (RUS)

The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. Administered by the USDA Rural Development office, the RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

RDA has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.

- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities.

- Be financially sound and able to manage the facility effectively.

- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.

- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities in which the proposed project is located.

All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise improve water supply and distribution facilities including reservoirs, pipelines, wells, pumping stations, water supplies, or water rights.

- Construct, repair, improve, expand, or otherwise improve waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.

- Acquire needed land, water supply or water rights.

- Legal and engineering costs connected with the development of facilities.

- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.

- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

- Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority or the useful life of the improvement facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to ½% of the MHI. In addition, an annual funding allocation limits the RDA funds. To receive a RDA loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

RDA will advise the applicant as to how to assemble information to determine engineering feasibility, economic soundness, cost estimates, organization, financing, and management matters in connection with the proposed improvements. If financing is provided, the RDA will also make periodic inspections to monitor project construction.

Applications for financial assistance are made at area offices of the RDA. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water.

9.1.7 Emergency Community Water Assistance Grants (ECWAC)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, ECWAC is available to communities when disaster strikes. Congress may appropriate funds for the program after a flood, earthquake, or other disaster if Federal assistance is warranted.

In order to receive assistance through an ECWAC grant, applicant must fulfill the following requirements:

- Demonstrate that a significant decline in quantity or quality of water occurred within two years of the date the application was filed with RUS,
- Public bodies and nonprofit corporations serving rural areas, including cities or towns whose population does not exceed 10,000 people may be eligible.

Projects that are eligible for assistance include the following:

- Extend, repair or perform significant maintenance on existing water systems.
- Construct new water lines, wells, or other sources of water, reservoirs, and treatment plants.
- Replace equipment and pay costs associated with connection or tap fees.
- Pay related expenses such as legal and engineering fees and environmental impact analyses, or acquire rights associated with developing sources of treating, storing, or distributing water.
- Achieve compliance with the requirements of the Federal Water Pollution Control Act (33 U.S.C et seq.) or with the Safe Drinking Water Act when noncompliance is directly related to a recent decline in potable water quality.

The maximum grant available through ECWAC is $500,000. Grants for repairs, partial replacement, or significant maintenance on an established system cannot exceed $150,000. Otherwise, grants may be made for 100% of eligible project costs.

Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.rd.usda.gov/programs-services/emergency-community-water-assistance-grants.

9.1.8 Rural Community Assistance Corporation (RCAC) Financial Services

The mission of RCAC's Financial Services is to manage resources, develop programs and participate in collaborative efforts, enabling RCAC to provide suitable and innovative solutions to the financial needs of rural communities and disadvantaged populations. In 1996, RCAC was designated a Community Development Financial Institution by the US Treasury to help address the capital needs of rural communities and has since added other loan programs. These programs include community facilities (housing, educational centers, public buildings, etc.) as well as lending for water and wastewater improvements.

Long-term loans are made in communities with a population of 20,000 or fewer. The Community Facility Loan Guarantee Program from USDA Rural Development enables RCAC to make low-interest loans with amortization periods of up to 30 years. The primary goal of Financial Services is to serve low- and very-low income rural residents. The primary borrowers are nonprofit organizations and municipalities.

Additional information can be found at http://www.rcac.org.

9.2 LOCAL FUNDING SOURCES

The amount and type of local funding obligations for infrastructure improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include ad valorem taxes, various types of bonds, service charges, connection fees, and system development charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

9.2.1 General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments (user charges or some other sources) is sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of water system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of general obligation bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and their general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS deductible.
- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

9.2.2 Ad Valorem Taxes

Ad valorem property taxes are often used as revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. In addition, the ability of communities to levy property taxes has been limited with the passage of Ballot Measure 5 and other subsequent legislation. While the impacts of the various legislative efforts are still unclear, capital improvement projects are exempt from property tax limitations if new public hearing requirements are met and an election is held.

9.2.3 Revenue Bonds

The general shift away from ad valorem property taxes and toward a greater reliance on user fees makes revenue bonds a frequently used option of long term debt. These bonds are an acceptable alternative and offer some advantages to general obligation bonds. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance revenue bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

9.2.4 Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds, but is quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50% of the total assessments to be levied. As a result, a substantial cash payment is usually required by owners of undeveloped property. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds, and are usually more favorable.

9.2.5 Capital Construction (sinking) Fund

Sinking funds are often established by budgeting for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

A City may wish to develop sinking funds for each sector of the public services. The fund can be used to rehabilitate or maintain existing infrastructure, construct new infrastructure elements, or to obtain grant and loan funding for larger projects.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in a municipal budgeting process.

9.2.6 User Fees

User fees can be used to retire general obligation bonds, and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the applicable system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs.

User fees should be based on a metered volume of water consumption. Through metered charges, an equitable and fair system of recovering water system costs is used. Flat fees and unmetered connections should be avoided. Large water users should pay a larger portion of the water system costs. Through higher rates and metered billing, this can be accomplished.

9.2.7 Connection Fees

Most municipalities charge connection fees to cover the cost of connecting new development to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

9.2.8 System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.

The Oregon Systems Development Charges Act was passed by the 1989 Legislature (HB 3224) and governs the requirements for systems development charges effective July 1, 1991. Two types of charges are permitted under this act: 1) improvement fees, and 2) reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon Systems Development Charges Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues and the estimated cost and timing of each improvement. However, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. The projects and costs developed in this Water System Master Plan may be used for this purpose. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding.

9.2.9 Local Improvement District (LID)

A local improvement district (LID) or multiple LIDs can be formed by the City to be responsible for securing and repaying the debt. A LID incorporates property owners within a defined boundary who agree to fund all or a portion of an improvement project. LID projects are best suited for improvements that benefit a limited number of users rather than the entire system.

The City may be required to assist in the LID process through facilitation and administration of the project. Agreements should be prepared detailing who will pay for engineering and planning costs, administration costs, interim financing, and other costs related to a public works project.

The LID formation process requires public hearings, at which, a remonstrance (no vote) of two thirds of the influenced area can halt the process. A successful LID area would result in liens against the LID properties at the end of the project or a full payment from all or some of the property owners.

Disadvantages to a LID include the requirement of a significant amount of time and interest from the City if they choose to administer the LID. It is not uncommon to have some or many within the LID boundary that are opposed to the project. Those in opposition to the project must either rally enough support to derail the project or work for some other compromise. The political and administrative fall out is often borne by the City.

9.2.10 Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

SECTION 11

RATE STUDY

WATER MANAGEMENT & CONSERVATION PLAN

SECTION 10

10.1 INTRODUCTION

The purpose of this *Water Management & Conservation Plan* (WMCP) is to develop a strategy to more effectively manage and conserve the City's valuable water sources. The City has voluntarily prepared this WMCP in accordance with revised rules described under OAR 690-315 in order to create a long term water management and conservation tool for the City's water system.

This WMCP includes the four key elements required by OAR 690-315:

- **Water Supplier Description** – Provides current information about the water supplier (City of Falls City) and the water supplier's system. This section provides a description of the City's water sources, service area, service population and users, adequacy and reliability of water supply, water use characteristics, water rights, water system demands, maps, and leakage estimates.

- **Water Conservation Element** – Describes past and current water conservation practices implemented by the City. Future conservation measures are developed with set benchmarks for implementation.

- **Water Curtailment Element** – Develops a plan that will enable a water supplier to react quickly and effectively to meet a community's needs in the event of a water supply emergency. The curtailment plan is based on indentified stage alerts that trigger increasingly restrictive water use measures.

- **Water Supply Element** – Determines whether or not the City will need to increase its water supply in order to meet future needs and supplies supporting documentation based on projected growth of user base and water demands. This section also provides a schedule for perfection of each water right.

OAR 690-315 stipulates that WMCP are required as a condition for a water right permit or permit extension. Exceptions are made for water suppliers serving a population less than 1,000 or can demonstrate that they will apply water to full beneficial use in less than 5 years. Both of these exemptions apply to the City of Falls City, making this WMCP a voluntary effort not mandated by the State Water Resource Department (WRD). However, WRD has discretion to require the City to submit a WMCP should the system apply for new or extended water rights.

The following table lists the elements required by the Division 86 Rules and notes where discussion of these elements can be found in the this WMCP as well as in the City's 2016 *Water Master Plan.*.

Table 10-1 - Water Management & Conservation Plan Requirements & Page Numbers

Item	OAR Reference	WMCP
Supplier's source(s)	690-086-0140 (1)	10-4
Current service area and population served	690-086-0140 (2)	10-3
Assessment of adequacy and reliability of existing water supplies	690-086-0140 (3)	10-5
Present and historic use	690-086-0140 (4)	10-5
Water rights inventory table and environmental resource issues	690-086-0140 (5)	10-4
Customers served and water use summary	690-086-0140 (6)	10-5
Interconnections with other systems	690-086-0140 (7)	10-3
System schematic	690-086-0140 (8)	Fig. 1 App. A
Quantification of system leakage	690-086-0140 (9)	10-6
Progress report on implementation of conservation measures scheduled in a previously approved WMCP	690-086-0150 (1)	NA
Water use measurement and reporting program	690-086-0150 (2)	10-8
Currently implemented conservation measures	690-086-0150 (3)	10-8
Annual water audit	690-086-0150 (4)(a)	10-9
Full metering of systems	690-086-0150 (4)(b)	10-9
Meter testing and maintenance program	690-086-0150 (4)(c)	10-9
Rate structure based on quantity of water meter	690-086-0150 (4)(d)	10-8
Leak detection program	690-086-0150 (4)(e)	10-8
Public education program	690-086-0150 (4)(f)	
System leakage reduction program <15%	690-086-0150 (5)	10-8
System leakage reduction program <10%	690-086-0150 (6)(a)	10-8
Technical and financial assistance programs	690-086-0150 (6)(b)	NA
Retrofit/replacement of inefficient fixtures	690-086-0150 (6)(c)	NA
Rate structure and billing practices to encourage conservation	690-086-0150 (6)(d)	10-8
Reuse, recycling, and non-potable opportunities	690-086-0150 (6)(e)	10-8
Other proposed conservation measures	690-086-0150 (6)(f)	10-10
Water supply assessment and description of past deficiencies	690-086-0160 (1)	10-4
Stages of alert	690-086-0160 (2)	10-13
Triggers for each stage of alert	690-086-0160 (3)	10-16
Curtailment actions	690-086-0160 (4)	10-13
Future service area and population projections	690-086-0170 (1)	10-17
Schedule to fully exercise each permit	690-086-0170 (2)	10-18
Demand forecast	690-086-0170 (3)	10-17
Comparison of projected need and available sources	690-086-0170 (4)	10-18
Analysis of alternative sources	690-086-0170 (5&8)	WMP Chap. 7
Maximum rate and monthly volume quantification	690-086-0170 (6)	NA
Mitigation actions under state and federal laws	690-086-0170 (7)	NA
Greenlight water Request-Conservation measure schedule and cost effectiveness	690-086-0130 (7)(a)	11-18
Greenlight Water Request- Justification that selected source is most feasible and appropriate	690-086-0130 (7)(b)	11-18
Greenlight Water Request - Mitigation requirements	690-086-0130 (7)(c)	11-18

10.2 WATER SUPPLIER DESCRIPTION

An effective WMCP requires a detailed understanding the water supplier's (City of Falls City) service area, customers, water demand characteristics, source supply, and water system infrastructure. Much of this information has been discussed in the City's 2016 *Water Master Plan*. The following pages will provide a summary of important information related to the Falls City water system including a demographic and customer characteristics, analysis of water sources, water usage and production, and system infrastructure.

10.2.1 Service Area & Population

See Section 2 of the City's 2016 *Water Mater Plan* for additional information on the water system's current service area and population.

Service Area

The City of Falls City is approximately 20 miles southwest of the City of Salem in Township 8 South, Range 6 West W.M. in Polk County. The City is situated along both sides of the Little Luckiamute River.

The service area for the Falls City water system generally coincides with the Falls City Urban Growth Boundary (UGB), which encompasses the majority of the water users, is approximately 770 acres (1.2 square miles). The Falls City UGB is depicted in Figure 1 in Appendix A. The City's water system also services some users outside the UGB, and the Luckiamute Water District.

Population

The 2010 census data indicated the City of Falls City had a population of 947. The population remained relatively unchanged since the last census. The 2015 certified population for the City is 950 persons.

Interconnections

The City has two interconnections with the Luckiamute Water District, providing water to connections outside its UGB.

10.2.2 Water Supply Source

Description of Water Supply

The water system currently utilizes a gravity-fed, surface water intake located at Glaze Creek as the primary wet-weather water supply source, and a gravity-fed, surface water intake located at Teal Creek as the primary dry-weather source. The City also possesses water rights on Boughey Creek, Little Luckiamute River, Albert Teal Spring, Rattling Spring, and Berry Creek, but does not have any functioning facilities at these locations, so ir desires to transfer the unused water rights to a location that can be used. All of the City's water rights are certified except rattling Spring and Berry Creek. All of the City's water rights are for surface water diversions. Section 4 of the attached 2016 Water Master Plan gives an in-depth description of the intake facilities.

Table 10-2 provides a summary of relevant information for each of the City's water rights including location, permit/certificate numbers, priority date, authorized rate, type of usage, and deadline for completion of beneficial usage. Copies of water right permits, certificates, and other documentations are provided in Appendix C.

Table 10-2 – Water Rights Inventory

Source Name	T-R-S-QQ	POD Location	Permit No.	Cert. No.	Priority Date	Rate cfs (gpm)	Use[1]	Authorized Completion Date
Little Luckiamute River	8S-6W-21-NW NW	S. 12° 30' E 726ft. from NW corner	S13970	14247	8/12/1939	0.5 (224)	M	NA
Albert Teal Spring	8S-6W-32-NE NW	1270' south and 400' east of NW corner	S35215	39319	8/6/1970	0.26 (117)	M	NA
Rattling Spring	8S-6W-29-SE SW	1107.8' north and 834' east from corner of section 29&32	S42509	-	4/13/1974	0.8 (359)	M	Canceled
Berry Creek	8S-6W-20-NW SW	3500' north and 5075'west from SE corner	S35222	-	10/14/1970	1.00 (449)	M	8/29/2014
Boughey Creek	8S-6W-29-SW NW	East 66.9 chains and south 41.9 chains from the NW corner	S4592	5072	5/11/1920	0.5 (224)	M	NA
Glaze Creek	8S-6W-31-SE NW	3500'south 1700' west from northeast corner	S46807	82931	3/4/1982	2.00 (898)	M	NA
Teal Creek	8S-6W-31-SE NE	South 2070' and West 1200' from NE corner	S2700	1832	11/4/1915	1.00 (449)	M	NA

[1] M = Municipal

Assessment of Water Supply

The primary concerns regarding the Teal Creek source involve seasonal poor water quality and inaccessibility issues. The availability of the secondary Glaze Creek source is limited by available flow in the dry-weather season. A brief summary of each source's limitations is provided below:

Teal Creek:

- **Poor Water Quality** – Turbidities spike during storm events. The fine sediment in the watershed makes treatment difficult.

- **Accessibility** – Access to the Teal Creek intake is along several miles of forest trail accessible only be gator, and the last section must be on foot. Several feet of snow accumulate on this road during winter months making access to the intake very difficult. The existing intake is on top of a large waterfall that is very slippery.

Glaze Creek:

- **Water Quantity** – This source dries up almost entirely in the summer.

Additional information on the City's existing water supply is provided in Sections 4.1 and 7.1 of the City's *Water Master Plan.*

10.2.3 Historical Water Usage

Water Service Customers & Consumption

The water system currently serves 403 active customers. This includes 385 residential users, 2 bulk meters for the Luckiamute Water District, and 16 non-residential users. Non-residential connections include commercial, industrial, and public sector users.

In 2015, total metered customer water usage equaled nearly 44 million gallons. In 2010-2014 approximately 37 million gallons were used. This spike is due to a political change that encouraged Luckiamute to purchase more water from the City of Falls City, as opposed to getting it from other sources. This policy can continue as long as it is in the City's best interest to do so.

Table 10-3 – Summary of Recent Customer Inventory and Metered Usage

Year	Residential Customers		Non-Residential Customers		Luckiamute	Total System	
	Accts.	Usage[1] (gallons)	Accts.	Usage (gallons)	Usage (gallons)	Accts.	Total Usage[1] (gallons)
2010	394	28,173,000	17	2,553,000	4,343,000	413	35,069,000
2011	394	28,071,000	19	2,613,000	6,191,000	415	36,875,000
2013	384	29,339,000	18	2,500,000	5,467,000	404	37,306,000
2014	389	30,541,000	18	2,463,000	5,614,000	409	38,618,000
2015	385	31,141,000	16	2,359,000	10,203,000	403	43,703,000

[1] Does not included usage by unmetered accounts

See Section 5 of the City's *Water Master Plan* for additional information on system's customers and data concerning metered water consumption.

Water Production

The City's *Water Master Plan* analyzed five years of water production data from January 2010 through December 2011, and then from January 2013through December 2015. There was a computer glitch that deleted data from 2012 in the billing system, so it was left out of the analysis. The results of this analysis showed, that unlike metered consumption, water production has not necessarily been increasing over recent years. This is likely due to conservation measures adopted by the City that reduce unmetered usage such as repairing leaking water mains. A summary of annual average day production, maximum month production, and maximum day production for each of the five years analyzed is provided in the following table. See Section 5.3 of the City's *Water Master Plan* for detailed water production analysis.

Table 10-4 – 5-Yr Water Production Summary

Year	Total (mg)	Average Day (gpd)	Max Month (gpd)	Max Day[1] (gpd)
2010	61.81	169,794	255,194	323,500
2011	53.35	146,162	196,677	268,000
2013	59.89	164,266	276,935	314,500
2014	53.02	145,268	220,032	289,500
2015	**59.26**	**162,353**	**287,839**	**349,000**
Average	57.48	157,659	247,335	308,900

** Bold values indicate maximum value in data set
[1]Based off two-day running average to account for peak production days followed by low production days that imply a non-use-based problem occurred such as a filter malfunction.

Unaccounted Water

Analysis of the City's records shows that over the years analyzed, unaccounted water in the system has ranged from 43% to 26.8%. The following table shows the annual % of unaccounted water. It has been decreasing in recent years due to the City's efforts to conserve water and repair leaks in a timely manner.

Table 10-5 –Unaccounted for Water

Year	Unaccounted for Water
2010	43%
2011	31%
2013	38%
2014	27%
2015	26%
Average	33%

Known sources for unaccounted water may be characterized into four categories: (1) unmetered authorized use (fire fighting, system flushing, and City construction); (2) unmetered unauthorized use (water theft); (3) apparent water loss (inaccurate meters); and (4) real water loss (system leaks & main breaks). It is believed that apparent and real water losses represent the majority of unaccounted water in the system. The City doesn't currently record water used for flushing lines, but they also report that that is not preformed very often.

Even 26% water loss is considered excessive. Municipalities should take efforts to reduce loss to 10% according to State standards. Due to current water technology, water loss is difficult to achieve below 10%, so that is the threshold the State strives for every community to meet.

For additional information on unaccounted water in the system, see Section 5.4 of the City's *Water Master Plan*.

10.2.4 Water System Infrastructure

The City of Falls City's water system includes its raw water supply intakes, slow sand filtration treatment plant, treated water storage reservoir, and approximately 3 miles of transmission and 12.6 miles of distribution pipelines. A schematic drawing showing the location of the City's water system infrastructure is provided in Figure 1 in Appendix A. A brief description of these components is provided in Table 10-5.

Table 10-5 – City of Falls City's Water System Infrastructure Summary

Infrastructure	Description	Capacity
Teal Creek	Intake Box	449 gpm
Glaze Creek	Intake box	898 gpm
Water Treatment Plan	3 cell slow sand filtration treatment system includes chlorination and a chlorine contact chamber	390 gpm
Treated Storage Reservoir	Welded Steel Tank	600,000 gallons
Piping Network	Various piping material ranging in size from 1" to 12" diameter	Varies

Section 4 of the City's *Water Master Plan* provides detailed description of the system existing water system infrastructure with further analysis of performance and condition of each component provided in Section 7.

10.3 WATER CONSERVATION ELEMENT

Water conservation consists of any beneficial reduction in water losses, waste, or consumption. As a result of effective conservation, water providers can avoid, downsize, or postpone system expansion projects. Capital costs, maintenance costs, financing costs, and many other expenses may be reduced by effectively practicing conservation within the water system. Additional benefits for the environment include: restoring streamflows to support aquatic life, providing recreational opportunities, and maintaining water quality.

The City's existing water supply is sufficient to meet current and 2035 annual and maximum daily demands of the water system. However, peak demands are approaching the capacity limits of the treatment plant. Water loss due to leaks and breaks in mainlines is known to be a significant problem. The goal of the City's conservation plan is to reduce the amount of unaccounted water in the system by improving water usage accounting and decreasing the amount of real water loss occurring through broken and leaking pipes.

10.3.1 Current Conservation Measures

This WMCP represents is the City's first formal program to actively pursue conservation measures within the service area. The City has, however, carried out several activities to reduce water loss in the system and improve source management. These efforts have primarily focused on decreasing the amount of water loss within the system by repairing known leaks and replacing old water lines.

Leak Detection

The state requires a leak detection survey when Cities don't make the 10% unaccounted for water goals. The City has had trouble with surveys not producing any results this in the past, but newer technology has come out in the last 20 years that will likely produce better results.

10.3.2 Water Use & Reporting

Water-use reporting in the City is done in compliance with OAR 690-085. The report is submitted annually by December 31st on the form provided by WRD using the "Flow Meter Method" approved by OAR 690-085-0015.

An influent flow meter at the WTP measures water diverted from the City's water sources. This totalizing meter is mostly read on a daily basis by the plant operator. Due to having only one operator, sometimes there are days were it is not recorded, so the two days are averaged from the difference in totalizer values for two days. There have been no withdrawals in the last 5 years that were not recorded.

10.3.3 Rate Structure & Metering

Water Rates

The City's current water rates are primarily based upon meter size and zoning. The City bills using a fee structure in which metered customers are charged a base rate plus an additional usage fee for consumption exceeding 5,000 gallons per month. Currently, it is not an equitable system because larger meters get charged more per gallon, even with the same usage, so changes have been proposed. It has also been proposed to reduce the allowance from 5,000 gallons to 3,000 gallons.

The City currently bills customers on a monthly schedule. This billing frequency will not change in the foreseeable future. The City's existing computer system and billing software do not allow the City to provide customers with consumption history.

Customer Meters

Water meters are installed on nearly all connections. Only two City parks are connected to the system without a meter. Many of the existing water meters have not been replaced since their original installation in 1993, in most cases, over 20 years ago.

The City plans to install metered service connections to the Upper Park and disconnect the connection at Faye Wilson Park so all connections will be metered.. This work should be completed by the year 2018.

10.3.4 Water Audit

The City performed its first water audit as part of this study to track the amount of unaccounted water in its system. Audits should continue on an annual basis. These audits include tabulations of total water produced (based on WTP effluent meter) and metered customer water usage (based on billing records). The City utilizes water for sampling and flushing activities required to properly maintain and operate its water system. This water should be quantified by the City and included in its water audits.

When an audit results in an unacceptable level of unaccounted volume of water, the City will take the appropriate steps to identify the source of unaccounted water. These steps may include testing customer meters and implementing a leak detection program.

10.3.5 Meter Testing, Maintenance, & Replacement

Water Treatment Plant Meter

The City meters raw water as it enters and exits the WTP facility. These meters are not normally calibrated, however if one is found to be malfunctioning it is immediately replaced.

Customer Meters

Currently, customer meter testing and maintenance is performed on an "as needed" basis. Many of the City's existing meters have been in service for over 20 years. It is typically recommended that service meters be replaced on an interval of 10-20 years. Water meters become damaged and inefficient as they age. The result of aging or poor quality meters is inaccurate meter readings. Old meters will typically read lower use quantities than are actually occurring. These inaccurate readings result in lost revenue, misleading information for water audits, more difficult leak detection, and other associated problems. Within the next few years, the City plans to develop a schedule to replace all of its existing service meters on a 20-year cycle.

10.3.6 Pipeline Replacement & Repair

The City should establish a waterline repair/replacement budget. Line repair and replacement should begin by targeting the most problematic sections of the system as determined by the results of the systematic leak detection program. The Capital Improvement Plan (CIP) developed in Section 8 of the City's *Water Master Plan* recommends replacing all of the existing AC pipelines as well as undersized lines. Refer to Figure 11 in Appendix A for recommenced distribution line replacements. It is anticipated that replacing these pipelines will significantly reduce the amount of water loss in the system as well as improving system performance.

10.3.7 Public Education

Public education is an important component of the City's overall water conservation program. The following public education measures are planned:

- Offer free leak detection tests to residential customers who suspect a leak. City staff will help determine the location of the leak if the leak is outdoors.

- The City should develop free brochures with conservation information including tips on water saving irrigation techniques, methods to reduce consumption indoors, and list of helpful websites. These brochures should be available at City Hall and should also be included annually with water billings.

10.3.8 Summary of 5-Yr Benchmarks

A summary of the planned water conservation measure implementation benchmarks are presented in Table 10-6.

Table 10-6 – Summary of Conservation Measures to be Implemented

Conservation Measures	Deadline	Frequency
Meter All Connections	2017	NA
Water Audit	Current	Annual
Develop Meter Testing/Replacement Program	2020	As Needed
Leak Detection of Distribution Mains	2017	As Needed
Implement Waterline Replacement/Repair Program	2020	Ongoing
Residential Leak Detection Assistance	Current	As Needed
Include Water Conservation Brochures w/ Water Bill	2020	Annually

10.4 WATER CURTAILMENT ELEMENT

The Oregon Water Resource Department requires every WMCP to include a water curtailment element per OAR 690-086-0160. Water curtailment plans are designed to help water suppliers in the event of a short-term water emergency. These plans aim to minimize the impacts of a short-term water shortage by reducing water demand using a combination of voluntary and mandatory water conservation and restriction measures. These measures become progressively more severe as the water emergency level increases.

Water curtailment should not be confused with water conservation. Curtailment is a response to a short term water supply emergencies and these measures are enacted only as long as the emergency exists. In contrast, water conservation focuses on measures that reduce the City's long-term water loss, wastes, and consumption.

The City currently does not have an ordinance for declaring water emergencies. Although the State does not require such legislation, this may limit the City's ability to effectively enact water saving measures necessary during water shortages. In the absence of a City ordinance, water emergencies will be declared by mayoral authority based on the recommendation of the Public Works Department.

10.4.1 System Vulnerability

The City relies on surface water to supply its water system. Surface water can be susceptible to seasonal water quality and quantity problems that may impair the availability of raw water for the City's drinking water system. Additionally, mechanical or structural failure of the water system infrastructure may also restrict the City's ability to meet customer demands.

In the years following the treatment plant upgrade, Falls City has not experienced any natural or mechanical disasters that have caused a severe water shortage. However, poor water quality conditions, watermain breaks, and intake line vulnerability have made meeting peak water demands difficult for short periods.

Water System Supply

The City has experienced disruptions of it raw water supply in the past. These episodes have been short-lived and primarily mitigated by using stored water in either the City's treated water storage reservoir. These episodes do, however, act as a warning of potential future problems with the City's raw water supply.

The raw water supply line from the creeks has several issues that could potentially eliminate supply to the City for long periods of time. The pipe itself is aging and in unknown condition in most places along the line. The line is so old that antiquated surveying technologies may have mis-represented the location of lines, and it is possibly outside of easements in some locations. In many locations it is not exactly known where the water line is. In other locations, the location is known, but it is difficult or impossible to access due to the terrain. If the line breaks in one of these areas, it could take quite a while to fix. The screen on each of the Teal Creek intake has holes large enough to pass small rocks and leaves which could clog the pipe. The water quality of Teal Creek is unusable in winter, and Glaze Creek has very little flow (much less than demands) in the summer.

The City is currently exploring options for a third water source that is closer to the WTP. A recommendation for an intake study is proposed in the attached water master plan.

Water System Infrastructure

In addition to the limitations of the City's water supply sources, aging infrastructure is also vulnerable to failures that may impact the system's ability to meet critical demands.

Water Treatment Plant: The City's WTP was constructed in the 1990s and is functioning well. With continued maintenance, it is expected to run for years to come. The WTP also has a treatment capacity which is sufficient for current peak demands.

Distribution System: Many sections of the City's distribution system are older, and constructed with asbestos cement pipe. Leaking water mains are common and typically go undiscovered. Large breaks also occur several times per year. In addition to pipe age and material, the pressure in the system is well in excess of 140 psi, which worsens the possibilities of water main breaks. As a result, water loss in the system is high.

Table 10-7 provides a summary of the key components of the City of Falls City's water system and lists associated problems and/or concerns.

Table 10-7 – Water System Vulnerability Assessment

Water System Component	Type	Capacity	Limiting Factor	Associated Problems/Concerns
Glaze Creek Intake	Water Supply	898 gpm (pipe may be smaller)	Water Right/ Transmission Pipe Diameter	Reduced Summer Flow, Transmission Pipe Failure Intake Screen Clogging, Inaccessible
Teal Creek Intake	Water Supply	449 gpm (pipe may be smaller)	Water Right/ Transmission Pipe Diameter	Poor Water Quality in Winter, Intake pipe Clogging, Inaccessible, Transmission Pipe Failure
Raw Water Transmission Line	Water Transmission	NA	Pipe Diameter	Inaccessible, some locations above grade, not necessarily in easements
Water Treatment Plant	Water Treatment	390 gpm	Filtration	NA
Treated Reservoir Tank	Treated Water Storage	600,000 gal	Holding Volume	Limited Capacity, Transmission Pipe Failure
Piping Network	Distribution System	NA	Pipe Diameters	Pipe Leaks & Breaks

10.4.2 Water Curtailment Plan

The goals of the City's water emergency response plan include:

- Minimize the impacts of a short-term emergency water shortage
- Rapidly restore water service after an emergency
- Minimize impact and loss to customers
- Minimize negative impacts on public health and employee safety

- Provide emergency public information concerning customer service

The role of this curtailment plan in meeting these goals is to reduce demand by imposing voluntary and mandatory water curtailment restrictions, which are implemented based on the magnitude of the water emergency. These actions become progressively more severe as the water emergency increases. Three stages or levels have been defined to describe the severity of a water emergency. These stages are described in Table 11-8.

Table 10-8 - Summary of Water Emergency Stages

Stage	Level	Description
1	Mild	Primarily a tool to inform the public that a potential problem exists. The problem may not yet warrant mandatory water curtailment, but does suggest voluntary conservation.
2	Moderate	First level of action for the City to enact mandatory water restrictions. This level would include all planned activities requiring temporary conservation including construction and maintenance activities as well as preparing for expected drought conditions.
3	Severe	A wider range of activities are affected. This is the most restrictive level of mandatory water conservation activities carrying the highest penalties to enforce the curtailment status.

Each level-of-alert is triggered by specific emergency conditions. These trigger are defined control points that eliminate speculation on when to impose restrictions during an emergency. The curtailment plan also allows for a system manager assessment to increase water emergency status.

Alert Stage No. 1: Mild Water Emergency

This stage would be declared if a water shortage or equipment failure poses a potential threat to the ability of the water system to meet the demands of its customers. The intent of this level is to inform the public and ask for voluntary reduction in water use practices. All water conservation at this level is on a voluntary basis with a goal of reducing consumption by 10%. The City should be prepared to provide information and support for this voluntary effort.

Measures associated with this level-of-alert include:

1. Institute a voluntary restricted watering schedule based on odd/even address numbers for residential and business customers. The voluntary schedule shall apply to all residential and commercial lawn watering and other nonessential water uses with exceptions as specified by the City. Customers will be asked to restrict watering to the night hours to avoid loss through evaporation. Customers will also be asked to avoid all outdoor water use during typical times of peak demand (i.e. weekends, mornings, evenings).

2. Disseminate information brochures on conservation methods. Advertising on radio, televisions, newspaper, sandwich boards, signs on City Kiosks and other media will also be

utilized to keep the public updated on the water supply situation. The City will also provide recorded information on the City's Facebook page and school reader board.

3. Request that consumers make efforts to voluntarily reduce water consumption up to 10-percent through personal conservation efforts. This may include the repair of household leaks, installation of low flow fixtures, reduction or elimination of landscape watering, and other conservation efforts.

4. Provide specific notification to major water users asking for voluntary reductions in use and/or deferring nonessential use to off-peak hours.

5. No use of City-supplied water to wash sidewalks, walkways, streets, driveways, parking lots, or other hard surface areas except where necessary for public health or safety.

6. City uses of water for hydrant and water line flushing shall be limited to essential needs.

7. Usage of City-supplied water to wash vehicles shall only be permitted during weekdays.

8. The City should develop a water system reporting sign to indicate the general condition of the City's water supply. Often used to warn of variety levels of fire danger, a properly located reporting sign can send a regular reminder to consumers that the water supply is tenuous. Under Stage One curtailment, the reporting sight should raise the alert that the water is low and remind consumers to use water wisely.

Alert Stage No. 2: Moderate Water Emergency

This stage would be declared if a water shortage or equipment failure poses a serious threat to the ability of the water system to meet the demands of its customers. This level-of-alert includes mandatory water conservation requirements. The City would increase efforts to educate the public about the seriousness of the water supply shortage. Curtailment actions would include mandatory restrictions and no longer rely on voluntary water conservation. The goal of these measures is to reduce consumption by 15%. Measures associated with this level of curtailment include:

1. Stage One curtailment measures 2-6 continued.

2. Watering or irrigating of lawns, landscaping, and gardens may only occur on odd/even weekdays between 6pm and 6am.

3. No use of City-supplied water shall be allowed to clean, fill, or maintain levels in decorative fountains.

4. No use of City-supplied water shall be allowed to wash vehicles including boats.

5. Hydrant and water main flushing shall be done for emergencies only.

6. Restaurants will be required to post drought notices and offer drinking water only upon request. Other high volume water consumers (hotels, recreation centers, etc.) may be required to post drought notices apprising their clientele of the drought conditions.

7. The City reporting sign should indicate the upgrade of severity and further caution consumers about the wise and prudent water use.

Alert Stage No. 3: Severe Water Emergency

This stage could be declared if a water shortage or equipment failure poses a severe and immediate threat to the ability of the water system to meet the demands of its customers. This stage includes additional mandatory conservation requirements brought on by severe or emergency conditions. Curtailment actions and restriction described in Stages One and Two along with provisions to prohibit all nonessential outdoor use would be continued under this stage of emergency. Severe penalties should be enforced for those not abiding by these strict water curtailment actions. The conservation goal for this stage is a 20% reduction in water usage.
1
Curtailment actions associated with this level would include:

1. Stage One curtailment measures 2-5 and Stage Two measures 3-6 continued.

2. All outdoor use prohibited.

3. The City reporting sign should indicate the upgrade of severity and further caution consumers about the wise and prudent water use.

10.4.3 Curtailment Plan Implementation

Implementation program to enact this curtailment plan will adhere to the following steps:

1. <u>Recommend Water Emergency Status</u> - Water treatment plant operators and Public Work Supervisor are best suited to know if the status of the water supply, demand, or production may lead to a water shortage.

2. <u>Pass Emergency Resolution</u> - Based on Public Works's recommendation the Mayor and/or City Council will pass a resolution declaring a water emergency and the curtailment plan would become effective immediately.

3. <u>Plan Enactment</u> – The various departments with the City will work in cooperation to ensure the curtailment plan is abided. The Public Works department will direct all operation and will ensure the management of City facilities and water supply meet the plans requirements. City administration will be responsible for public awareness, including distributing informative brochures, posting signs and spearheading media campaign.

The City will continue to review this curtailment plan and update it as necessary. As part of this process, the City may consider adopting a *Water Curtailment Ordinance*.

Table 10-9 - Curtailment Plan Matrix

Alert Stage Level	Triggers	Goal	Curtailment Actions
Level 1 - Water Alert	• Demand: > 60% of system operating capacity • Recommendation of water plant operator	Public Awareness and 10% reduction in consumption	1. Institute a voluntary restricted watering schedule based on odd/even address numbers for all customers. 2. Disseminate information brochures on conservation. 3. Request customers voluntarily reduce consumption. 4. Request major users defer nonessential consumption to off-peak hours. 5. Hydrant and water line flushing only for essential needs. 6. Prohibit washing of sidewalks, streets, etc. except for public safety. 7. Restrict vehicle washing to weekdays. 8. Reporting sign should alert that the water supply is low.
Level 2- Moderate	• Demand: > 85% of system operating capacity • Recommendation of water plant operator	15% reduction in consumption	1. Continue Level 1 curtailment measures 2. Mandate restrictions on all lawn watering and other nonessential uses of water 3. Prohibit filling and cleaning decorative fountains 4. Prohibit all vehicle washing 5. Hydrant and water main flushing shall be done for emergencies only. 6. Businesses will be required to post drought notices 7. Reporting sign should indicate the upgrade of severity.
Level 3 - Severe	• Demand: > 90% of system operating capacity • Recommendation of water plant operator	20% reduction in consumption	1. Continue all Level 1 and 2 actions 2. Prohibit all nonessential outside water use. 3. The City reporting sign should indicate the upgrade of severity and further caution consumers about the wise and prudent water use.

10.5 WATER SUPPLY ELEMENT

10.5.1 Future Service Area & Population Projection

There is no anticipated expansion of the City of Falls City's urban growth boundary (UGB) within the 20-year planning period. The general customer characteristics of the community are also expected to remain constant.

Population Projection

Future population in the City was projected based on information obtained from the *City of Falls City Wastewater Facilities Plan*. That plan used the City's adopted average annual population growth within the City of Falls City of 1.5% per year. Based on this rate, the population should increase to 1280 residents by the year 2035. This represents a growth of 330 persons or an average of 16.5 persons per year over the next 20 years. It should be noted that in last five years, the population has only increased by 0.3% total. This population figure will likely provide a conservative plan for future growth. See Section 2.3 of the City's *Water Master Plan* for additional information on forecasted system population growth.

Table 10-10 – 20-Yr Projected Population[1]

Year	Population
2015	950
2035	1280

[1] Based on an AAGR of 1.5%

10.5.2 Future Water Demand Projections

Future water demands for the City of Falls City were calculated in Section 5.5 of the City's *Water Master Plan*. These demands were projected on the assumption that the primary factor influencing future water demand (growth) would continue to increase. Under this scenario future annual water demand would increase from 44 million gallons to approximately 55 million gallons by 2035.

The above scenario assumes the City takes no action in addressing deficiencies related to its piping systems. With current unaccounted water nearing 26% of system production, it is believed a large portion is a result of water loss through leaking and broken waterlines. Section 8.1 of the City's *Water Master Plan* makes recommendations to replace portion of the system that are believed to be in the poorest condition.

In addition to implementing a rigorous pipeline replacement program, Section 8.1 also recommends installing meters at currently unmetered customers and replacing old meters. It is believed that a portion of the unaccounted water currently in the system is due to inaccurate meter readings. Replacing meters will not only provide the City with better accounting of water usage, but may also increase revenues for the water system as customers are fully charged for their usage. Furthermore, improved customer meter accuracy will help encourage conservation.

It is the goal of the pipeline replacement program to further reduce the level of unaccounted water in the system to 10%. Reducing water loss in the system would result in a decrease in total water demands over the 20-year planning period.

10.5.3 Ability of Existing Water Infrastructure to Meet Future Demands

In order to provide long-term planning of the City's water resources, it is necessary to assess existing supply's and infrastructure's ability to meet future system demands. This will enable the City to begin planning and secure funding if large improvements are needed. The treatment plant, intake, storage reservoir, and water rights are currently sized to be able to handle the projected 2035 demands.

10.5.4 Water Rights Perfection Schedule & Green Light Water Request

The City has seven water rights. Five of these water rights are already certified by the State.

The water right for rattling spring (S42509) was voluntarily cancelled on June 12, 1985.

The City desires to certificate the Berry Creek water right (S35222). They are looking to gain a backup source of water that is closer to their treatment plant with a more reliable raw water line, so a water rights transfer will be needed. The City would like to request green light water for this purpose, based on unreliability of existing facilities. The existing raw water line was originally constructed in 1915, some portions are above ground, and some portions of the pipe are in unknown locations possibly out of the prescribed easements. All of these problems could result in disaster if there was a failure in the water line, it could be a very long time before the problem could be found, and even longer until it gets fixed. The capital improvement plan of this report recommends an intake study to finalize the location of the proposed intake and to where the transfer will occur.

SECTION 10

Water Management and Conservation Plan

Section 11

Rate Analysis

It is important that the City charge the actual cost of providing water service to its customers. This will ensure sufficient revenue is obtained to cover the cost of operating the system, as well as providing funds for future investments. The US Environmental Protection Agency (EPA) refers to this concept as "full-cost pricing." Ideally, full-cost pricing:

- Ensures rates are a sufficient and stable source of funds. Charging for the full cost for water service will ensure system's financial health, enabling the City to provide safe drinking water now and in the future.

- Provides information on costs to customers. How much customers are asked to pay sends a signal about the value of the product they are purchasing. Charging the full cost of the provided water service will help customers recognize the value of the service and be more mindful of their water use.

The key to full-cost pricing is developing a sound financial plan. The main components of financial plans include projecting the system's total operational cost (revenue requirements) over a long-term period and comparing that to the expected revenues during the same period.

11.1 EXISTING RATES

11.1.1 Water Rates

The City's current water rates were established by Resolution 02-2017. The rates includes seven types of customer rates based on whether or not a customer is residential, bulk, residential commercial, or non-residential commercial and whether or not the user is within City limits. Additional information on the City's current water rate structures are provided below. There are also tiers within each type for meter size.

<u>Metered Connections</u>

All metered connections are subject to a monthly base fee based on the customer's meter size and property type. The current system is complicated. However, in order to keep long term tracking in the billing software, the City prefers to retain the large number of available categories. The pricing can however be more equitable between categories.

Some customers are charged a multiplier of meter fees if they are connected to more than one residence or building. The rate structure should be changed to bill each meter per structure that is used a residence or business separately for all properties. So, for example, if a duplex is connected to the same meter their rate would be doubled and their usage allowance would also double. The same would be true for a larger multi-family complex based on the number of dwellings in that location.

In addition to these fees, a $10 capitol improvement fee is added to the bill of all connections that have water and/or sewer. This is split by the sewer improvements and water improvements. A residential commercial designation pays twice, once for residential, and once for the commercial portion. A backflow testing fee is included from July 1, 2014-June 30, 2018.

Table 11-1 – Residential-Inside City Limits (RI)

Meter Size	Consumption Allowance	Monthly Base Fee
5/8”	5,000 gal.	$41.96
1”	5,000 gal.	$64.64
1½”	5,000 gal.	$72.58
2”	5,000 gal.	$86.18
3”	5,000 gal.	$106.60
4"	5,000 gal.	$151.96
Overage: $2.55 per 1,000 gal.		

Table 11-2 – Residential-Outside City Limits (RO)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8”	5,000 gal.	$47.06	$0.0094
1”	5,000 gal.	$69.74	$0.0139
1½”	5,000 gal.	$77.68	$0.0155
2”	5,000 gal.	$92.42	$0.0185
3”	5,000 gal.	$111.70	$0.0223
4"	5,000 gal.	$157.06	$0.0314
Overage: $2.84 per 1,000 gal.			$0.0028

Table 11-3 – Residential/Commercial-Inside City Limits (RCI)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8”	5,000 gal.	$64.64	$0.0129
1”	5,000 gal.	$87.32	$0.0175
1½”	5,000 gal.	$96.39	$0.0193
2”	5,000 gal.	$108.86	$0.0218
3”	5,000 gal.	$129.28	$0.0259
4"	5,000 gal.	$174.64	$0.0349
Overage: $3.12 per 1,000 gal.			$0.0031

Table 11-4 – Residential/Commercial-Outside City Limits (RCO)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8”	5,000 gal.	$69.74	$0.0139
1”	5,000 gal.	$92.42	$0.0185
1½”	5,000 gal.	$101.49	$0.0203
2”	5,000 gal.	$113.97	$0.0228
3”	5,000 gal.	$134.38	$0.0269
4"	5,000 gal.	$179.74	$0.0359
Overage: $3.12 per 1,000 gal.			$0.0031

Table 11-5 – Non-Residential Commercial-Inside City Limits (NCI)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8”	5,000 gal.	$64.64	$0.0129
1”	5,000 gal.	$87.32	$0.0175
1½”	5,000 gal.	$96.39	$0.0193
2”	5,000 gal.	$108.86	$0.0218
3”	5,000 gal.	$129.28	$0.0259
4"	5,000 gal.	$174.64	$0.0349
Overage: $3.12 per 1,000 gal.			$0.0031

Table 11-6 – Non-Residential Commercial-Outside City Limits (NCO)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8”	5,000 gal.	$69.74	$0.0139
1”	5,000 gal.	$92.42	$0.0185
1½”	5,000 gal.	$101.49	$0.0203
2”	5,000 gal.	$113.97	$0.0228
3”	5,000 gal.	$134.38	$0.0269
4"	5,000 gal.	$179.74	$0.0359
Overage: $3.12 per 1,000 gal.			$0.0031

Table 11-7 – 2 Meters-Outside (2MO)

Meter Size	Consumption Allowance	Monthly Base Fee	Cost Per Gallon
5/8"	5,000 gal.	$79.38	$0.0159
Overage: $2.55 per 1,000 gal.			$0.0026

11.1.2 System Development Charges

A system development charge (SDC) is a fee imposed on new development intended to recoup new development's fair share of completed and/or future system improvements. A City's SDC is able to be used for saving for future improvements or reimbursing for improvements that were oversized in anticipation of development.

The City has elected to have a connection fee as opposed to an SDC. Due to the slow projected population growth, there are only a small number of expected future connections expected. This results in only $159,000 in expected total revenue over the next 20 years. The City's current connection fee structure is outlined in resolution 02-2017. The fee is $1,250 for a simple connection, and $1,500 for a complex connection. Additional fees apply fees apply if the connection is greater than 20 ft. long which covers costs of materials and labor to install. These fees are charged only for the material and labor costs of connecting a connection to the system, and do not add revenue to the system

11.2 CURRENT SYSTEM FINANCIALS

Cost for routine system operation and maintenance, including personnel, testing, utilities, etc. are funded by the City's *Water Fund Budget.* The primary funding mechanisms for the *Water Fund Budget* is revenue generated by the system's monthly billings and other user fees.

In addition to the *Water Fund Budget*, the City also maintains a *Utility Reserve Fund*. Monies in this account are primarily used for emergencies, capital repairs, and system upgrades. Resources for this fund include utility capital improvement fees assessed each month to each user on top of water and sewer rates. This fund is shared with the sewer system

11.2.1 Expenditure Requirements

Required expenditures for the City's water system include cost to cover normaloperation and maintenance (O&M) costs as well as necessary funds to pay for emergency repairs, save for future improvements, and services and to repay existing debt obligations.

Operation & Maintenance Requirements

Operations and maintenance (O&M) costs are the costs required to operate and maintain the water system. Associated costs include personnel, utilities, system maintenance and supply, services, and fees. The City of Falls City includes O&M costs in its *Water Fund Budget*. Table 10-8 lists the total system O&M budget for the fiscal years 2013-14 through 2016-17.

Table 11-8– Water System Operational & Maintenance Costs

Description	Fiscal Year			
	2013-14	**2014-15**	**2015-16**	**2016-17**
Personal Services				
Salaries	$39,812	$55,814	$56,000	$58,240
Payroll Expenses	$7,610	$8,518	$13,500	$14,200
Benefits	$15,110	$20,886	$20,000	$21,000
Subtotal	*$62,532*	*$85,218*	*$89,500*	*$93,440*
Materials & Services				
Operational Supplies	$20,561	$26,100	$30,000	$30,000
Equipment O&M	$6,725	$12,000	$15,000	$15,000
Education/Training/Dues	$308	$1,000	$1,500	$1,500
Professional Services	$39,551	$3,190	$100,000	$100,000
Utilities	$4,388	$5,000	$6,500	$6,500
Uniforms & Protective Gear	$82	$250	$300	$1,500
Utilty Rebates & Incentives	$0	$100	$100	$200
Miscellaneous	$122	$100	$0	$362
Building & Improvements	$0	$0	$7,500	$15,000
Equipment -operations			$10,000	$14,000
Debt Repayment	$65,473	$65,473	$65,473	$65,473
Subtotal	*$137,210*	*$113,213*	*$236,373*	*$249,535*
TOTAL O&M REQUIREMENTS	**$199,742**	**$198,431**	**$325,873**	**$342,975**

NOTE: The reported data for fiscal year s 2015-16 and 2016-17 is the based on adopted budget numbers, whereas the rest of the reported data for other fiscal years are actual expenditures

Replacement Costs

Replacement costs consist of costs associated with replacement of the existing system at the end of its useful life. The following table shows the useful life and replacement costs and cost/ year. This is what the City should be saving each year to replace the item at the end of its useful life. At this time, only the fire hydrant replacement costs should be added to the rates, because the others are capital improvements recommended in this plan, and are already considered in the rate increases for the capital improvements.

Table 11-9– Replacement Costs

Item	Number	Life Span	Replacement Cost	Cost/Year
Fire hydrants	47	20 years	$4,500	$10,575
6" and smaller pipe	41,529	75 years	$90	$49,835
8" pipe	15,485	75 years	$110	$22,711
10" pipe	19,536	75 years	$140	$36,467
12" pipe	5,792	75 years	$170	$13,129
water meters	445	15 years	$500	$14,833
			total	$147,550

11.2.2 System Revenue

User rates and the capital improvement fund are the primary mechanism used to fund the City's water systems. Additionally, the City can transfer money from its *Utility Reserve Fund* to supplement the water system.

Table 11-10– Water System Revenue

Description	Fiscal Year			
	2013-14	**2014-15**	**2015-16**	**2016-17**
Customer Revenue				
User Rates	$247,531	$260,577	$265,000	$267,592
Late Fees	$4,352	$4,045	$4,000	$4,639
Backflow Testing	$9,543	$11,969	$10,800	$10,800
Subtotal	*$261,426*	*$276,591*	*$279,800*	*$283,031*
Transfers				
General Fund	$0	$0	$0	$0
Transfer from Utility Reserve	$0	$0	$60,000	$50,000
Subtotal	*$0*	*$0*	*$60,000*	*$50,000*
TOTAL REVENUE	**$261,426**	**$276,591**	**$339,800**	**$333,031**

NOTE: The reported data for fiscal year s 2015-16 and 2016-17 is the based on adopted budget numbers, whereas the rest of the reported data for other fiscal years are actual expenditures

11.2.3 System Financial Analysis

A basic financial analysis of the City's water system is presented in Table 11-11. This analysis compares the total system costs with total revenues. As this table shows, spending in the system varies dramatically from year to year depending on the needs of the system. the two most recent years have included some major equipment purchases at the treatment plant and paying for the water master plan. Overall, the City tries to maintain a balance of just above $200,000 in reserve. Most years there is a surplus with the current rate structure and no capital improvements.

Table 11-11 – Comparison of System Expenditures & Revenue

Fiscal Year	Total Costs	Customer Revenue	Surplus (Deficiency)	Transfers	Total Revenue	Surplus (Deficiency)
2013-14	$199,742	$261,426	**$61,684**	$0	$261,426	**$61,684**
2014-15	$198,431	$276,591	**$78,160**	$0	$276,591	**$78,160**
2015-16	$325,873	$279,800	**($46,073)**	$60,000	$339,800	**$13,927**
2016-17	$342,975	$283,031	**($59,944)**	$50,000	$333,031	**($9,944)**

NOTE: The reported data for fiscal year s 2015-16 and 2016-17 is the based on adopted budget numbers, whereas the rest of the reported data for other fiscal years are actual expenditures

11.3 POTENTIAL IMPACT OF PROPOSED IMPROVEMENTS ON SYSTEM FINANCIALS

Section 7 of this *Water Master Plan* provides a detailed analysis of the City's water system and proposes several improvement alternatives to resolve key deficiencies. Implementing these recommendations will have an impact on the overall financial situation of the water system. Specifically, system alternatives will have an impact on required O&M costs (materials, chemical usage, repairs, etc.) or on required revenue.

The following provides a basic analysis of how the priority 1A improvement alternatives would impact the future financial health of the water system. See Section 8 of this document for detailed information on these improvements.

11.3.1 Recommended Alternative Rate Impacts

The "Recommended" alternative includes Priority 1A Improvement projects to the City's water supply, treatment, distribution, and metering systems. See Sections 7 and 8 of the Water Master Plan for additional description of these projects.

It is expected that implementing these improvements will reduce current expenditures required for emergency repairs and services.

The proposed Priority 1A Improvements have an estimated cost of $1.7 million. This analysis evaluates three possibilities: (1) Projects will be funded 100% by a Community Development Block Grant (CDBG), (2) Projects will be funded 100% by a loan; and (3) Projects will be funded 100% by a loan with 30% loan forgiveness. Part of the eligibility requirements for a CDBG is that the system meets the threshold rate criteria. The threshold rate criteria requires the projected annual water rate for the system to be at least 1.25% of the current Median Household Income (MHI) as defined by the most recent American Community Survey (ACS) 5 year estimate. As Table 11-12 shows, the threshold rate for the City is $34.70.

Table 11-12 – Comparison of Current Water Rate to Threshold Rate Criteria

Current "Average" Monthly Water Rate[1]	$49.61
Median Household Income[2]	$33,309
Minimum Eligible Annual Water Rate	$34.70
Required Average Monthly Rate Increase	Not Required

[1] Average monthly water rate based on usage of 7,500 gallons of water as defined by IFA
[2] Based on data reported in 2015 American Community Survey 5-yr estimate

The City's spending history has varied significantly from year to year, some assumptions were needed to be made in order to assess the impact of the Priority 1A Improvements, including the following:

- Personnel cost will increase by approximately 3% per year which is typical of Oregon Communities
- Material & Services cost will increase by approximately 3% per year which is typical of Oregon Communities

- Professional Services will start at $20,000 per year, as estimated by the City, and then increase with approximately 3% per year for inflation
- There will be no change in existing loan payments
- New debt will be funded by 100% grant, or a 20-year loan with 1.5% interest
- Revenue will increase by the estimated population growth rate of 1.5%

11.3.2 Affordability Rate

Based on the financial impact analyses presented above, implementing the proposed system improvements will have a positive impact on the system. To meet the Community Development Block Grant (CGBD) threshold affordability rate criteria the City's "average" residential water rate is required to be $34.70 for $7,500 gal per month per residential user. The cheapest meter is a 5/8" RI meter. If 7,5000 gallons are used in a month, the fee is $49.61. This exceeds the affordability rate, so Falls City does not need to make adjustments to their rates to acquire funding.

11.3.3 Strategies for Rate Increase

Tables 10-13 through 10-15 show several scenarios for funding the proposed priority 1A improvements. The total increase needed per year is shown. If this total is divided out by the number of connections and then added to a 5/8" Residential Inside account, then the user fees will be as shown in the tables. It is assumed for this simple calculation that this fee is added to the base rate, distributed equally among connections.

There are many methods of distributing the total monthly required revenue increase. One way is to distribute it evenly across each connection. Another way is to increase the overall rates by a certain percent. A third method would be to calculate all rates based on an EDU basis. While adding to the base rate is the easiest way to increase the likelihood of receiving enough funds through the water system, increasing the overage charges could also bring revenue into the system while encouraging water conservation.

The current rate structure is not equitable and should be reevaluated by City Council. The base fee for a 4" meter is nearly 3 times what the fee is for a 5/8" meter in some categories. While there is a slight difference in replacement costs for a larger meter, the current payback period for the larger meter is less than a year. With a recommended replacement cycle of 15 years, those users are overpaying significantly for how much water they use. The base fees of the larger meters should be determined by the actual cost of replacing the larger meter over a 15 year period.

Other customers are significantly underpaying. This includes predominantly multifamily properties. The current system adds a multiplier to some properties with more than one family, but not to all. A rate per dwelling or business would be more appropriate for those properties.

One strategy that is helpful for community members to adjust to rate increases is by increasing rates gradually, and before the funds are needed, so they can get accustomed to paying more for water, without an immediate, significant increase.

Ultimately, it is up to the City council how rates are assigned and distributed, but reevaluating the proportions paid by certain meters types could provide a more appropriately distributed water fee.

Table 11-16 shows a summary of rate impacts.

Table 11-13 – Projected System Requirements, Revenue, & Deficiency for 100% Grant Option

Description	rate or amount	Fiscal Year									
		2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
System Requirements											
Personnel Services	3%	$96,243	$99,130	$102,104	$105,168	$108,323	$111,572	$114,919	$118,367	$121,918	$125,576
Materials & Services	3%	$86,584	$89,181	$91,857	$94,613	$97,451	$100,374	$103,386	$106,487	$109,682	$112,972
Professional Services	3%	$20,000	$20,600	$21,218	$21,855	$22,510	$23,185	$23,881	$24,597	$25,335	$26,095
Existing Debt Repayment	$0	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473
New Debt Repayment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fire hydrant Replacement	3%	$10,575	$10,892	$11,219	$11,556	$11,902	$12,259	$12,627	$13,006	$13,396	$13,798
Subtotal		*$278,875*	*$285,277*	*$291,871*	*$298,663*	*$305,659*	*$312,864*	*$320,286*	*$327,931*	*$335,804*	*$343,914*
System Requirements											
Customer Revenue	1.5%	$287,276	$291,586	$295,959	$300,399	$304,905	$309,478	$314,121	$318,832	$323,615	$328,469
Utility Reserve Fund	1.5%	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076
Subtotal	*$0*	*$309,353*	*$313,662*	*$318,036*	*$322,475*	*$326,981*	*$331,555*	*$336,197*	*$340,909*	*$345,691*	*$350,545*
REVENUE SUPLUS		**$30,478**	**$28,385**	**$26,164**	**$23,812**	**$21,322**	**$18,690**	**$15,911**	**$12,978**	**$9,887**	**$6,631**
CONNECTIONS	1.5%	**403**	**409**	**415**	**421**	**428**	**434**	**441**	**447**	**454**	**461**
5/8" RI METER FEE		**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**	**$49.61**

Table 11-14 – Projected System Requirements, Revenue, & Deficiency for 100% Loan Option

Description	rate or amount	Fiscal Year 2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
System Requirements											
Personnel Services	3%	$96,243	$99,130	$102,104	$105,168	$108,323	$111,572	$114,919	$118,367	$121,918	$125,576
Materials & Services	3%	$86,584	$89,181	$91,857	$94,613	$97,451	$100,374	$103,386	$106,487	$109,682	$112,972
Professional Services	3%	$20,000	$20,600	$21,218	$21,855	$22,510	$23,185	$23,881	$24,597	$25,335	$26,095
Existing Debt Repayment	$0	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473
New Debt Repayment	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812	$96,812
Fire hydrant Replacement	3%	$10,575	$10,892	$11,219	$11,556	$11,902	$12,259	$12,627	$13,006	$13,396	$13,798
Subtotal		*$375,687*	*$382,089*	*$388,683*	*$395,475*	*$402,471*	*$409,677*	*$417,098*	*$424,743*	*$432,616*	*$440,726*
System Requirements											
Customer Revenue	1.5%	$287,276	$291,586	$295,959	$300,399	$304,905	$309,478	$314,121	$318,832	$323,615	$328,469
Utility Reserve Fund	1.5%	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076
Subtotal		*$309,353*	*$313,662*	*$318,036*	*$322,475*	*$326,981*	*$331,555*	*$336,197*	*$340,909*	*$345,691*	*$350,545*
REVENUE SURPLUS		**($66,334)**	**($68,427)**	**($70,648)**	**($73,000)**	**($75,490)**	**($78,122)**	**($80,902)**	**($83,834)**	**($86,925)**	**($90,181)**
CONNECTIONS	1.5%	**403**	**409**	**415**	**421**	**428**	**434**	**441**	**447**	**454**	**461**
MONTHLY INCREASE/ACCOUNT		**$14**	**$14**	**$14**	**$14**	**$15**	**$15**	**$15**	**$16**	**$16**	**$16**
5/8" RI METER FEE		**$63.33**	**$63.55**	**$63.79**	**$64.05**	**$64.32**	**$64.61**	**$64.91**	**$65.23**	**$65.57**	**$65.92**

Table 11-15 – Projected System Requirements, Revenue, & Deficiency for 30% Forgiveness Loan Option

Description	rate or amount	Fiscal Year									
		2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
System Requirements											
Personnel Services	3%	$96,243	$99,130	$102,104	$105,168	$108,323	$111,572	$114,919	$118,367	$121,918	$125,576
Materials & Services	3%	$86,584	$89,181	$91,857	$94,613	$97,451	$100,374	$103,386	$106,487	$109,682	$112,972
Professional Services	3%	$20,000	$20,600	$21,218	$21,855	$22,510	$23,185	$23,881	$24,597	$25,335	$26,095
Existing Debt Repayment	$0	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473	$65,473
New Debt Repayment	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768	$67,768
Fire hydrant Replacement	3%	$10,575	$10,892	$11,219	$11,556	$11,902	$12,259	$12,627	$13,006	$13,396	$13,798
Subtotal		*$346,644*	*$353,046*	*$359,640*	*$366,432*	*$373,427*	*$380,633*	*$388,055*	*$395,699*	*$403,573*	*$411,683*
System Requirements											
Customer Revenue	1.5%	$287,276	$291,586	$295,959	$300,399	$304,905	$309,478	$314,121	$318,832	$323,615	$328,469
Utility Reserve Fund	1.5%	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076	$22,076
Subtotal		*$309,353*	*$313,662*	*$318,036*	*$322,475*	*$326,981*	*$331,555*	*$336,197*	*$340,909*	*$345,691*	*$350,545*
REVENUE SURPLUS		**($37,291)**	**($39,384)**	**($41,604)**	**($43,957)**	**($46,446)**	**($49,078)**	**($51,858)**	**($54,790)**	**($57,882)**	**($61,137)**
CONNECTIONS	1.5%	**403**	**409**	**415**	**421**	**428**	**434**	**441**	**447**	**454**	**461**
MONTHLY INCREASE/ACCOUNT		**$8**	**$8**	**$8**	**$9**	**$9**	**$9**	**$10**	**$10**	**$11**	**$11**
5/8" RI METER FEE		**$57.32**	**$57.63**	**$57.96**	**$58.30**	**$58.66**	**$59.03**	**$59.42**	**$59.82**	**$60.23**	**$60.67**

Table 11-16 – Rate Summary

Scenario	Increases		Total 5/8" RI Bill	
	2018 bill	2027 bill	2018 bill	2027 bill
100% loan	$14	$16	$63.33	$65.92
100% grant	$0	$0	$49.61	$49.61
70% loan 30% forgiveness	$8	$11	$57.32	$60.67