CITY OF CASCADE LOCKS
WATER SYSTEM MASTER PLAN

P.W.S. ID. 41-00172

RECOMMENDATIONS AND IMPROVEMENTS TO MEET
SIX YEAR REQUIREMENTS - 2013 TO 2019
TWENTY YEAR REQUIREMENTS - 2013 TO 2033

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Executive Summary

The City of Cascade Locks (City) is located in the northwest corner of Hood River County. The municipal water system serves the entire City. The vast majority of the system lies within the city limits and the recognized Urban Growth Boundary. Only the system's two current reservoirs lie outside these areas. The City of Cascade Locks water system provides water to the commercial, residential, and Port industrial areas. The water system currently serves a residential population of approximately 1,200. The residents within the water system service boundary are provided water through approximately 420 accounts with an additional 76 non-residential services.

The following is a breakdown for quick review of some of the key items within the Master Plan. These include the City of Cascade Locks water system's water quality and service goals, as summarized in a vision statement; present and future water deficiencies; the engineer's recommendations for achieving the goals and correcting the deficiencies; and a recommended implementation schedule and financing program for construction improvements.

PURPOSE AND INTENT

The purpose of this Water System Master Plan (WSMP or Plan) is to conduct an in-depth analysis of the existing City of Cascade Locks water system, including an inventory of the existing infrastructure capabilities and deficiencies, and to prepare a recommended list of corrective measures and improvements, together with cost estimates for the selected improvements to the system. These improvements will be based upon reasonable residential, commercial/industrial and public sector growth within the current, 6-year and 20-year planning periods. The Plan shall also include an evaluation of the existing structures and possible methods of financing.

MASTER PLAN PROCESS

As stated in the "Purpose and Intent" paragraph of this section, the purpose of the Master Plan is to identify the capabilities and conditions of the existing infrastructure and then make recommendations for necessary or desired improvements to the system based upon deficiencies

and growth projections. In order to adequately address these issues, it is first useful to identify all of the information that was prepared in the past for the system, including any "as-built" drawings, any previous Master Plans, interviews with past and present system operators, and recollections of the contractors that may have done work on the system. After the system has been adequately mapped and its individual components identified, it is then possible to conduct a detailed analysis of the system to locate any low pressure areas, inadequate flow areas, or other deficiencies that may exist within the system. Based upon these deficiencies, a list of corrective measures and items to be addressed will be prepared as a part of the Water System Master Plan.

This process shall also include input from the local community and water system users. Their input is extremely helpful in identifying other problems that may be overlooked during the analysis and inventory process. With all of the above collected information, it is then possible to detail the existing infrastructure, including its capabilities and deficiencies, and, with the help of the City of Cascade Locks council members and staff, prepare a list of reasonable corrective measures and improvements for the water system, together with alternatives and cost estimates for the improvements. With this information, the City has some choices from an economic standpoint as to how it will proceed with the improvements. In addition, this Master Plan will also touch on the financial aspects of any projects that are recommended and evaluate the existing financial reserves and loan capabilities of the revenue based water system.

WATER QUALITY AND SERVICE GOALS

It is the goal of the City's water system to provide excellent customer service while furnishing a superior water product meeting all standards for quality, flow, and pressure. The City strives to provide these quality services in an effective and efficient manner at an affordable price.

SYSTEM DEFICIENCIES

Overall, the City of Cascade Locks water system is in fair operating condition. Under optimum conditions, the system is marginally able to meet the water demands of its customers, but lacks sufficient infrastructure to facilitate growth and does not have the ability to delivery adequate fire flows to critical areas within the City. In the course of the Master Plan study, there were a number of things that, if improved within the system, would aid the City in meeting the goals outlined above now and in the future.

The City has provided minimal maintenance to its water system and has lacked funding to provide any significant improvements for more than 20 years. The last major improvement projects undertaken by the City was the development of Well #2 and the Frontage Road mainline and meter installation in the early 1990s. The primary deficiency of the current water system lies within the distribution system. However, this is not meant to downplay the significant deficiencies that are created by insufficient storage and, to a lesser extent, source capacity. The following improvement recommendations consist primarily of upgrades and replacements related to all three noted deficiencies; distribution system, storage and source capacity. The key upgrades include replacement of Dry Creek Reservoir and much of the old 2" to 6" lines existing in the system within Wa-Na-Pa Street. Other upgrades include the installation of a new waterline in Forest Lane which will allow sufficient fire flow and provide for current and future consumers in the Port of Cascade Locks Industrial Park. These upgrades, accompanied by the upgrade of Well #1 and an additional well to increase the source capacity of the system, make up most of the key improvements recommended within this Master Plan.

RECOMMENDED IMPROVEMENTS

To correct the above listed deficiencies, the following list of recommendations for system improvements has been developed. Projects are listed according to their tentative ranking of importance as determined by the Engineer and the City of Cascade Locks.

1. Dry Creek Reservoir replacement with a new 480,000 gallon Crystal Springs Tank

2. Forest Lane water main loop

3. Wa-Na-Pa Street water main replacement

4. & 5. Expansion/upgrade of source capacity

6. Ruckel Street water main replacement

7. Forest Lane water main replacement

8. Oxbow Tank recoating

In the WSMP, each of these improvements is discussed in detail with a cost estimate. The Plan also includes a more exhaustive list of recommended improvements to the system. With implementation of these items, the City will be able to continue its progress in reaching its water quality and service goals. As previously mentioned, the ranking of the improvements is tentative and can be impacted by available funding and development pressures.

IMPLEMENTATION SCHEDULE

It is recommended that the City undertake, as soon as reasonably possible, the Dry Creek Reservoir replacement, the Forest Lane water main loop, and the Wa-Na-Pa Street mainline replacement projects. These areas are liabilities to the City due to abnormal leakage problems, difficult to repair mainline locations and fire flow limitations in the commercial downtown corridor and Port areas. The remaining items on the list may be undertaken by City as time and resources allow. The City may also wish to research financing in order to bundle all of the recommended improvements into one project.

FINANCING PROGRAM

For the majority of its history, the City of Cascade Locks system improvements have been funded by system reserves that were developed through water sales. Waterlines were also extended through private development by those being served. With the magnitude of the pending projects, it is likely that the City will have to look for loans and/or grants from the various regulatory agencies. Financing is further discussed within the applicable section of this report.

Chapter One

WATER SYSTEM INFORMATION AND BASIC PLANNING DATA

LOCATION AND CLIMATE

The City of Cascade Locks is located in northwest Hood River County, approximately 30 miles east of Troutdale/Portland metropolitan area, and approximately 20 miles west of the City of Hood River, shown in Figure 1 **(please note that all Figures, Exhibits, and Appendices are located at the back of the Plan)**. Cascade Locks sits on the south shore of the Columbia River, just upriver from the Bonneville Dam. The average elevation within the City is approximately 150 feet above Mean Sea Level (MSL); however, this varies from 335 feet MSL at the locations of the existing reservoirs to 95 feet MSL near the Columbia River. The Cascade Locks area receives approximately 78 inches of rainfall per year and has a fairly temperate climate due to its proximity to the river.

SYSTEM OWNERSHIP

The City of Cascade Locks is an Oregon municipal corporation incorporated in 1935. The City is governed by a mayor/city council government with a city administrator handling the day-to-day operations of the corporation. The City's current population is approximately 1,200. Generally, the City has been experiencing a slow, steady growth of around 1.5%± per year over the last 20 years. A short growth spurt was experienced in 2005 through 2008 that has leveled off since then. The Cascade Locks area consists of a diverse mixture of single and multi-family residential consumers with a few commercial and industrial water users. The majority of commercial/industrial water uses are located on Wa-Na-Pa Street and in the Industrial Park near the northeast corner of town. Except for the Industrial Park and downtown corridor, most other areas within the city limits are almost exclusively single-family and multi-family residential services. The service area of the City's water system encompasses all lands within the City Urban Growth Boundary encompassing approximately 1,430 acres. The two existing reservoirs that serve the City's water system lie outside of the city limits and Urban Growth Boundary on lands under jurisdiction of Hood River County in the Columbia Gorge National Area.

BACKGROUND

The City of Cascade Locks began providing drinking water for the citizens of Cascade Locks when they incorporated and took over operations of the water system infrastructure that was previously constructed by the Army Corps of Engineers. Parts of the original water system that remain today include the reservoir on Dry Creek with approximately 7,300 feet of 8-inch transmission main and a diversion dam on Dry Creek, which is currently not in use or diverting any surface water. The City water system has approximately 490 active accounts. The City has water rights to approximately 17.0 cfs of total allowed water appropriation. However, the City primarily uses the two water rights certificates associated with Well #1 and Well #2 for municipal purposes. These certificates allow 4.0 cfs (2.59 mgd) of appropriation. Both wells are located on Northeast Herman Creek Lane, approximately 875 feet north of Forest Lane. The two wells are currently capable of pumping a total of approximately 940 gallons per minute and are the only source of water for the City water system at this time.

Storage within the City of Cascade Locks water system is provided by two reservoirs – Dry Creek Reservoir and Oxbow Tank. Both share the same maximum water elevation of approximately 364.5 feet above Mean Sea Level. Oxbow is a field coated welded steel water tank with a base elevation of 333.5 feet and is the newer of the two reservoirs, being completed in 1969. Dry Creek Reservoir is constructed of cast-in-place concrete with a wood framed roof and was built sometime in the 1890s. Dry Creek Reservoir is the shorter of the two tanks having a base elevation of 356 feet above Mean Sea Level. Oxbow Tank and Dry Creek Reservoir have approximate capacities of 350,000 gallons and 250,000 gallons, respectively.

The present distribution system consists of multiple pipe sizes of all types, varying from 1” to 12”, including dipped and wrapped steel, ductile iron, cast iron, P.V.C., and asbestos cement. There are currently numerous major ongoing problems within the distribution system with the most significant being unaccounted for water loss due to leakage. There is currently approximately 74,700 lineal feet of waterline within the system and the average pipe age is over 50 years. A significant percentage of the water system transmission mains to and from Dry Creek Reservoir consist of asbestos cement and cast iron pipe, which are in various stages of deterioration.

The system requires improvements such as increasing overall pipe diameter on the main lines to improve fire flows and replacement of aging waterlines to reduce leakage.

CURRENT USAGE

The City of Cascade Locks has a plentiful supply of water and very solid water rights. Like many areas within the State of Oregon, the City of Cascade Locks is seeing some development pressure, which in Cascade Locks is currently commercial/industrial in nature. The majority of the service area is zoned for residential usage but there is a significant amount of land zoned both industrial and commercial. Most of the commercially zoned area is already developed. Given the lack of available commercial ground it is somewhat unlikely that a large commercial water user would locate into this area; however, there is an abundance of land for potential large commercial/industrial water users to locate within the service area. Growth is likely to be slow but steady in the form of single-family, multi-family residential, and commercial development. Continued development will certainly require the system to consider upgrades to its distribution system and source capacity.

CURRENT POPULATION, NUMBER OF SERVICES, AND WATER USE

The entire City of Cascade Locks water system currently has approximately 1,200 people within its service boundary. The City presently has 493 accounts consisting of all types—residential, commercial/industrial, and public. Single-family residential represents the majority of the service accounts, although there are a significant number of multi-family residential units with fewer commercial and public accounts included in this number.

The City has been keeping track of water production and usage for decades. However, in reviewing records it was noted that there are deficiencies and/or misrepresentations within both documents. The biggest inconsistencies come from the well production records. It is likely that the cause of these is the aging source meters that were read inconsistently. The City installed new source meters in late 2011. The source production records, when compared to the City billing records, tend to be well correlated since the installation of the source meters and, therefore, the data was used from the period of April 2011 through March 2013 for purposes of this report and is shown in the following table.

TABLE 1 Water Billed vs. Production Volumes (in 1,000 of gallons)				
MONTH	**BILLED**	**PRODUCED**	**LOSS**	**% LOSS OF PRODUCTION**
April 2011	2696			
May 2011	3684			
June 2011	5079			
July 2011	6037			
August 2011	6852			
September 2011	6601			
October 2011	3814			
November 2011	2298	5660	3362	59.4
December 2011	2861	9263	6402	69.1
January 2012	2607	9796	7189	73.4
February 2012	2327	9040	6713	74.3
March 2012	2133	9438	7305	77.4
April 2012	2455	6151	3696	60.1
May 2012	4000	7247	3247	44.8
June 2012	5194	9105	3911	43.0
July 2012	6121	9519	3398	35.7
August 2012	6353	15347	8994	58.6
September 2012	5490	9275	3785	40.8
October 2012	4276	6082	1806	29.7
November 2012	2481	5185	2704	52.2
December 2012	2623	5621	2998	53.3
January 2013	2996	5584	2588	46.3
February 2013	2560	5161	2601	50.4
March 2013	2536	5453	3564	58.4
AVERAGE	**3919.8**	**7857.3**	**3937.5**	**50.1**

Over this period, the average monthly water use has been 3,920,000 gallons. The maximum month demand over that same period has been just over 6.85 million gallons. Based on the two years of usage records and the total number of accounts, the Average Daily Demand (ADD) is approximately 170.2 gallons per day per Equivalent Residential Unit (ERU). The Maximum Month Average Demand (MMAD) is 277 gallons per day per ERU. The summer months tend to peak at approximately three times as much water usage as the winter months. Overall, the average water use within the City of Cascade Locks is substantially less than the statewide average of approximately 350 gallons per day per ERU. This may be somewhat attributable to

the substantial rainfall the City receives and its proximity to the base of a north facing slope, thus limiting its southern exposure.

POPULATION PROJECTION

The City of Cascade Locks has enjoyed a long and colorful history. Lewis and Clark first visited the area in 1805 on their legendary expedition. However, the Native American legend, "Bridge of the Gods", predates mans' presence here by more than 30 millennia. The area was a travel hazard to early pioneers. In 1878, the United States government decided to construct a canal and locks at the site to enable river traffic to move easily upriver. However, construction was not completed until 1896. By 1893 there were about 1,000 inhabitants, many living in tents, shacks, and other temporary buildings. There were many saloons established and it was during this time that the community was frequently called "Whiskey Flat". After the construction of the locks, the town became known as Cascade Locks. In 1937, the U.S. Army Corps of Engineers opened the newly constructed locks at Bonneville Dam, just three miles downriver from Cascade Locks, and the old locks were submerged. The population of the town peaked during the period of time when the old locks were still functioning and Bonneville Dam was under construction with a population of more than 2,000[1]. The following table summarizes the City's population from 1980 to present.

TABLE 2
Population History

YEAR	CASCADE LOCKS	HOOD RIVER COUNTY
1980	838	15,835
1990	930	16,903
2000	1,115	20,411
2010	1,145	22,385

The City of Cascade Locks is located directly off of Interstate 84, adjacent to the Columbia River, and is home of the southern terminus of the Bridge of the Gods, which is a connecting route into the State of Washington. There is a variety of commercial activity available in the community, along with a post office and volunteer fire department. The town boasts both a community water system and wastewater collection/treatment system. There is not a defined

[1] City of Cascade Locks Comprehensive Plan – 2001

centralized storm drain system in the community. The City's incorporated boundary encompasses approximately 1,430 acres. However, as of 2001, only approximately 620 acres of this had been developed. A rendering of the City's Comprehensive Plan Map is shown as Figure 2.

In 2008 the City participated in a Hood River County Coordinated Population Forecast prepared by ECONorthwest, which suggested an Annual Average Growth Rate (AAGR) of 2.0%, in contrast to the Oregon Office of Economic Analysis (OEA) forecast of 1.29%. The current City Council determined that both the 2.0% and 1.29% growth rates were aggressive in comparison to the current trends and, therefore, elected to use a growth rate of 1.0% for residential population and 0.5% growth rate on commercial and industrial applications. Thus, the population projection for the City of Cascade Locks based upon all three sources is reported in the following table:

TABLE 3
Population Projection

YEAR	CITY COUNCIL (1.0%)	ECONORTHWEST (2.0%)	OEA (1.29%)
2013	1,200	1,211	1,236
2019	1,274	1,363	1,348
2033	1,464	1,764	1,643

If there are no changes in rural lifestyle demand and industrial development, these population projections are likely realistic. The City has experienced growth spurts that correspond to overall economic trends.

Chapter Two

DESCRIPTION OF WATER SYSTEM

INVENTORY OF EXISTING FACILITIES

Storage

The primary storage components of the City of Cascade Locks water system consist of two reservoirs, the 250,000 gallon Dry Creek Reservoir and the 350,000 gallon Oxbow Tank. Dry Creek Reservoir was constructed sometime in the 1890s. It is a partially below grade concrete basin with a concrete floor and walls, rectangular in shape, and covered by a wood framed roof. Dry Creek Reservoir is 9.5 feet deep, 37.6 feet wide, and 95.7 feet long, both width and length being outside dimensions. Oxbow Tank is field coated welded steel, cylindrical in shape, and was constructed in 1969. Oxbow Tank is 32 feet tall and has an outside diameter of 43.7 feet. Both reservoirs are currently in working condition but Dry Creek Reservoir is in need of being replaced. The reservoir itself and the transmission line are extremely old and pose security, health, and safety risks. Both reservoirs have a maximum water elevation of approximately 364.5 feet (MSL).

Distribution System

The City of Cascade Locks distribution system contains approximately 74,700 feet of distribution water main consisting primarily of dipped and wrapped steel, ductile iron, cast iron, P.V.C., and asbestos cement. The pipe types are also of various sizes ranging from 3/4" service lines to 12" mains. The distribution system also includes approximately 85 fire hydrants and over 100 gate valves. In April 2013, there were around 493 active metered services.

Wells

The City of Cascade Locks has two operational wells, Well #1 is the northernmost of the two wells on Herman Creek Lane and is capable of approximately 450 gallons per minute (gpm). The wellhead is located in a CMU building above grade that also houses a source meter on the discharge of Well #1 and all telemetry equipment to active the wells upon demand at the Oxbow Tank. The well was drilled in 1969 to a depth of 92.5 feet and has a 14" casing with a

Worthington 8” line shaft turbine pump and Westinghouse motor with the following specifications:

50 HP / 3 Phase / 460 Volt / 1800 RPM / Frame No. 364UP

Well #2 is 70 feet south of Well #1 and located in an underground precast concrete vault. It has a pumping capacity of approximately 490 gallons per minute, but is limited by the pump and in turn the borehole size (8”), which limits going to a larger pump. It was drilled in 1969 to a depth of 100 feet and has a submersible Berkeley pump with Franklin Electric Co. motor with the following specifications:

Berkeley Pump Model 7T60-500 / 60 HP / 3 Phase / 460 Volt
Franklin 6” Diameter Motor Model 236-61960 / 60 HP / 3 Phase / 460 Volt

Well logs for both wells are included in Appendix “A”.

Service Types

Of the 493 current service users, there are approximately 417 single-family residential consumers served through a meter and 3/4” service. The remaining commercial/industrial, multi-family, school, church, or governmental have services ranging in size from 3/4” to 4”. The size and location of the metering of these services varies with the particular entity involved.

Water Rights

The City of Cascade Locks has three water right certificates and two permits with a total appropriation amount of 17.0 cubic feet per second. The primary groundwater rights are in Certificate 41302 and Permit G-12666. These two rights allow for the diversion of water up to 4.0 cfs of water. All water right information is provided in Appendix “B”.

EXISTING SERVICE AREA CHARACTERISTICS

The existing service area consists of approximately 1,430 acres of land. The City’s water distribution system lies entirely within the City of Cascade Locks Urban Growth Boundary and city limits with the only exception being the two reservoirs that lie just south of these boundaries.

The system map in Figure 3 shows the major components of the City of Cascade Locks water system. The map also shows the current City of Cascade Locks city limits and Urban Growth Boundary lines.

The City's water system is composed of one pressure zone with services ranging varying from 90 to 250 feet in elevation, with most services in the 110 foot to 150 foot MSL range. This singular pressure zone is served by the previously mentioned two reservoirs, making up a total of 600,000 gallons storage capacity. These reservoirs have the same approximate overflow elevation and feed the system concurrently. Static service pressures within the system vary from a low of approximately 50 psi, along the southeast side of the system near the reservoirs, to highs of over 110 psi on the northwest side of the system. The City's system also provides water to one booster pump system located on Moody Street directly below the Harmony Heaven subdivision. However, this booster pump station is not active due to lack of housing construction and, therefore, no demand for water in that area.

SYSTEM DESIGN STANDARDS

The City of Cascade Locks adopted design and construction standards for its water system in 2005, a copy is provided in Appendix "C". As a matter of practice, A.P.W.A. and A.W.W.A. standards are utilized and all current water main installation consists of C900-DR18, rubber-ring joint PVC pipe. Separate meters are required for each user with service lines of C901-SDR9 polyethylene CTS pipe. Wherever possible, main extensions are to be located in existing rights-of-way. Where necessary on private property, easements for these locations are required prior to installation and acceptance of the new line.

It is recommended that the design standards be reviewed and possibly modified based on current City policy. Some things to be considered are:

1. Compliance with the Department of Human Services (Drinking Water Program) requirements for community water systems of less than 500 connections users.

2. Future main extensions be not less than 8 inch in size unless it can be absolutely determined that a smaller diameter will provide ultimate development service for the area

to be served. These criteria would include that the flow rate in the main will never exceed 7 feet per second velocity with smaller diameter pipework, and such smaller pipe will meet the following City established Fire Flow requirements for a two-hour duration:

Residential:	1,500 gpm
Downtown/Commercial:	2,000 gpm
Industrial Park:	2,500 gpm

3. Construction Standards of the American Public Works Association (APWA) and American Water Works Association (AWWA) for water systems shall be adhered to.

WATER QUALITY ANALYSIS

The City of Cascade Locks consistently samples the raw water from its wellheads to ensure that the domestic service it provides complies with maximum contaminant levels and action levels contained within the Oregon Administrative Rules (OAR). Oregon Administrative Rules, Sections 333-061-0025 through 333-061-0061, govern water quality law for the State of Oregon. Items covered by these OAR Sections include the responsibility of the water suppliers, maximum containment levels, treatment requirements and performance standards for ground water, and for corrosion control. They also cover sampling and analytical requirements, reporting and record keeping, public notice requirements, and variances.

Chemical Analysis

In accordance with the aforementioned OARs, the City was required to commence initial monitoring of inorganic chemicals, organic chemicals, Sulfate, Nitrate, Nitrites, and Sodium, beginning on January 1, 1993. This initial monitoring was to be completed by December 31, 1993. The City performed this initial round of monitoring in October 1993 with all chemical constituent results under regulatory limits. The various chemical constituents monitored under the generalized inorganic and organic chemical status are to have follow-up monitoring done, generally, on a three-year cycle. There are exceptions to this rule; namely, the lead and copper rule or if a positive sample of any of the chemical constituents is noted. The City is current and in compliance with all State of Oregon testing requirements. This includes lead and copper, radiological and disinfection byproducts.

The following table lists the results of the most recent testing for Wells #1 and #2 at their common entry point into the system (EP-A).

TABLE 4
Latest Chemical Results

Chemical Constituent	MCL (mg/l)	Source ID	Results	Sample Date
Inorganic Chemicals				
Antimony	0.006	EP-A	ND	8/1/2002
Arsenic	0.010	EP-A	ND	2/5/2009
Asbestos	7 MFL	DIST-A	ND	4/23/2013
Barium	2.0	EP-A	0.0005	8/1/2002
Beryllium	0.004	EP-A	ND	8/1/2002
Cadmium	0.005	EP-A	ND	8/1/2002
Chromium	0.100	EP-A	ND	8/1/2002
Copper	1.3	DIST-A	1.1000	9/25/2012
Cyanide	0.200	EP-A	ND	8/1/2002
Fluoride	4.0	EP-A	ND	8/1/2002
Lead	0.015	DIST-A	0.0026	9/25/2012
Mercury	0.002	EP-A	ND	8/1/2002
Nickel	0.100	EP-A	ND	8/1/2002
Nitrate (as N)	10.0	EP-A	0.1400	4/23/2013
Nitrite (as N)	1.0	SRC-AA	ND	5/7/2012
Total Nitrate+Nitrite (as N)	10.0	SRC-AA	0.1600	5/7/2012
Selenium	0.050	EP-A	ND	8/1/2002
Thallium	0.002	EP-A	ND	8/1/2002
Synthetic Organic Chemicals				
Alachlor (Lasso)	0.002	EP-A	ND	7/16/2012
Atrazine	0.003	EP-A	ND	41106
Benzo(a) pyrene	0.0002	EP-A	ND	7/16/2012
Carbofuran	0.040	EP-A	ND	7/16/2012
Chlordane	0.002	EP-A	ND	7/16/2012
Dalapon	0.200	EP-A	ND	7/16/2012
Dibromochloropropane	0.0002	EP-A	ND	7/16/2012
Dinoseb	0.007	EP-A	ND	7/16/2012
Diquat	0.020	EP-A	ND	7/16/2012
Di(2-ethylhexyl) adipate	0.400	EP-A	ND	7/16/2012
Di(2-ethylhexyl) phthalate	0.006	EP-A	ND	7/16/2012
Endothall	0.100	EP-A	ND	7/16/2012
Endrin	0.002	EP-A	ND	7/16/2012
Ethylene Dibromide	0.00005	EP-A	ND	7/16/2012
Glyphosate	0.700	EP-A	ND	7/16/2012
Heptachlor	0.0004	EP-A	ND	7/16/2012
Heptachlor epoxide	0.0002	EP-A	ND	7/16/2012
Hexachlorocyclopentadiene	0.050	EP-A	ND	7/16/2012
Lindane (gamma-BHC)	0.0002	EP-A	ND	7/16/2012
Methoxychlor	0.040	EP-A	ND	7/16/2012
Oxamyl (Vydate)	0.200	EP-A	ND	7/16/2012

TABLE 4 Latest Chemical Results				
Chemical Constituent	**MCL (mg/l)**	**Source ID**	**Results**	**Sample Date**
Picloram	0.500	EP-A	ND	7/16/2012
Polychlorinated Biphenyls (PCB's)	0.0005	EP-A	ND	7/16/2012
Pentachlorophenol	0.001	EP-A	ND	7/16/2012
Simazine	0.004	EP-A	ND	7/16/2012
Toxaphene	0.003	EP-A	ND	7/16/2012
2,4-D	0.070	EP-A	ND	7/16/2012
2,4,5-TP Silvex	0.050	EP-A	ND	7/16/2012
Volatile Organic Chemicals				
Benzene	0.005	EP-A	ND	12/6/2011
Carbon tetrachloride	0.005	EP-A	ND	12/6/2011
cis-1,2-Dichloroethylene	0.070	EP-A	ND	12/6/2011
Dichloromethane	0.005	EP-A	ND	12/6/2011
Ethylbenzene	0.700	EP-A	ND	12/6/2011
Monochlorobenzene	0.100	EP-A	ND	12/6/2011
o-Dichlorobenzene	0.600	EP-A	ND	12/6/2011
p-Dichlorobenzene	0.075	EP-A	ND	12/6/2011
Styrene	0.100	EP-A	ND	12/6/2011
Tetrachloroethylene (PCE)	0.005	EP-A	ND	12/6/2011
Toulene	1.0	EP-A	ND	12/6/2011
trans-1,2-Dichloroethylene	0.100	EP-A	ND	12/6/2011
Trichloroethylene (TCE)	0.005	EP-A	ND	12/6/2011
Vinyl chloride	0.002	EP-A	ND	12/6/2011
Xylenes (total)	10.0	EP-A	ND	12/6/2011
1,1-Dichloroethylene	0.007	EP-A	ND	12/6/2011
1,1,1-Trichloroethane	0.200	EP-A	ND	12/6/2011
1,1,2-Trichloroethane	0.005	EP-A	ND	12/6/2011
1,2-Dichlorethane	0.005	EP-A	ND	12/6/2011
1,2-Dichloropropane	0.005	EP-A	ND	12/6/2011
1,2,4-Trichlorobenzene	0.070	EP-A	ND	12/6/2011
Radionuclides				
Gross Alpha (excl. Radon and Uranium)	15 pCi/L	SRC-AA	ND	12/6/2011
Combined Radium (-226 & -228)	5 pCi/L	EP-A	ND	7/16/2012
Uranium	30 ug/L	EP-A	ND	11/5/2013
Disinfection Byproducts				
Total Trihalomethanes (TTHM)	0.080	DIST-A	0.0023	9/23/2013
Haloacetic Acids (HAA5)	0.060	DIST-A	ND	9/23/2013

The State does not currently require an analysis of water samples for secondary contaminants unless there have been incidents:

1. Where there have been user complaints of taste, odor, or staining;

2. Where treatment is proposed in the contaminant level, as necessary, to determine degrees of treatment; or

3. Where the Oregon Drinking Water Program determines the levels are unacceptable.

The City has not sampled water for secondary contaminants for over 10 years.

Microbiological Analysis

The Bacteriological Maximum Contaminant Levels (MCL) for all public water systems are as follows:

1. The MCL is based on the presence or absence of total coliforms in a sample rather than coliform density. For a system that collects fewer than 40 samples per month, total coliform positive samples shall not exceed one sample collected during a month.

2. Any fecal coliform, positive repeat sample, *E. coli* repeat sample, or any total coliform positive repeat sample following a fecal coliform positive or *E. coli* positive routine sample shall be a violation of the total coliform MCL. Public notification for this potential acute health risk is described in OAR 333-061-0042.

3. All public water systems must determine compliance with MCL for total coliforms in sub-sections 4(a) and (b) of the rule on a monthly basis. The containment levels for secondary contaminants are applicable to all public water systems.

In the 12-year period running from January 1, 2002, to January 1, 2014, the City has had only five instances of coliform presence in routine testing, all of which returned absent results upon retesting. This is indicative of improper sampling procedure and not water contamination. A copy of the City's Coliform Monitoring Plan is included in Appendix "D".

Regulatory

At this time, the City is under no enforcement action, but is in violation for source sampling. The City is not considered a significant non-complier. A copy of the City's latest sanitary survey conducted by Hood River County is included in Appendix "E".

The quality of the water from the City's wells is considered good. The water has no significant problems with turbidity, color, or taste. There have been no problems in meeting bacteriological samplings and chemical constituents are substantially less than required by the Oregon State Health Division and EPA Maximum Contaminant Level standards for potable water supplies.

Other Analysis

The City is required to monitor for lead and copper, radionuclides, arsenic, nitrate, nitrite, asbestos, and disinfection by-products. Depending upon the constituent, monitoring is done either at individual services or at the entry points of the source water into the system. The results of all tests conducted have easily met the Federal Guidelines.

Testing Schedule

The following table provides a full list of the City's standard Water Quality monitoring requirements.

TABLE 5
Testing Schedule

TEST GROUP	SAMPLES REQUIRED	SAMPLING INTERVAL	START	END	NOTES
Asbestos, Dist	1	9 years	01/01/2002	Open	Schedule reflects monitoring reduction granted
Lead & Copper	10	3 years	01/01/2002	Open	Sample between June 1 and September 30
Stage 2 DBP	2	Yearly	01/01/2014	Open	Sample in September
Arsenic	1	9 years	01/01/2011	Open	Schedule reflects monitoring reduction grant
IOC	1	9 years	01/01/2011	Open	Schedule reflects monitoring reduction granted
Nitrate	1	Yearly	01/01/2002	Open	
Nitrite	1	9 years	01/01/2002	Open	Schedule reflects monitoring reduction granted
RAD – Gross Alpha	1	9 years	01/01/2008	Open	
RAD – Radium 226/228	1	6 years	01/01/2014	Open	
RAD – Uranium	1	Quarterly	01/01/2011	Open	
SOC	1	3 years	01/01/2002	Open	
Volatile Organics	1	3 years	01/01/2002	Open	

Consumer Confidence Reports

Rules enacted by EPA under the Clean Water Act require water purveyors to provide to their users an annual report outlining source, testing, and other information about the system. Specific requirements to be included in the report are as follows:

1. The source(s) of drinking water (springs, wells, rivers, etc.).

2. A brief summary of the susceptibility to contamination of the source water based upon the source water assessments as they are completed by the state.

3. Instructions on obtaining a copy of the water system's source water assessment.

4. A table showing the highest level of any contaminant detected in their drinking water plus EPA's health based standard (maximum contaminant level) for that contaminant for comparison and the probable source of the contaminant.

5. The water system's compliance with other drinking-water-related rules including monitoring.

6. An educational statement for vulnerable populations. Individuals who have suppressed immune systems caused by chemotherapy, organ transplant, AIDS, etc. fall into this category.

7. Educational information on nitrate, arsenic, or lead where the contaminants are detected above 50 percent of EPA's maximum contaminant levels.

8. The phone numbers for additional sources of information available from the water system's staff or EPA's Safe Drinking Water Hotline (800) 426-4791.

9. The rule specifies how the data is to be presented, with specific instructions for reporting and explaining results for turbidity, lead and copper, total and fecal coliform, cryptosporiduium, radon, arsenic, nitrate and any other contaminants.

The first Consumer Confidence Report was to be published by October 19, 1999 for the calendar year of 1998 and by July 1 each year thereafter for each subsequent calendar year. The report must be mailed or otherwise delivered to each of the system customers and also, by good faith effort, to reach any non-bill paying customers by posting on the internet, advertising in the news media, publishing a copy of the report in the local newspaper, posting it in public places, posting in libraries and schools, and other similar activities.

For water systems serving less than 10,000 but not less than 500 persons, which is the category that Cascade Locks falls in, the report must be published in at least one local newspaper. It should also notify all of its customers of the availability of the report. This could be in the form of a note in the water bill, an ad in the newspaper with the publication, or any other means approved by the State of Oregon. The water system must, upon request, either fax or otherwise deliver a copy of the report to the person making such a request. The City currently is in compliance with CCR requirements.

SERVICE AREA POLICIES

The City of Cascade Locks currently has some policies in place to govern service within its municipal water system. In general, the request for water is provided by a direct service by the City. There are no satellite services nor does Cascade Locks take part in wholesaling or "wheeling" of water. Ordinances No. 330, No. 371, No. 387, and No. 415 are the primary means for governing the water system. These ordinances are included in Appendix "F" but are paraphrased below:

Direct Connection

It is the City's intent to provide water to all customers through a direct connection. The City charges for all costs associated with the water service connection, commonly known as a "hook-up fee". Existing connections will be updated with new meters and service lines with costs borne by the City as they are renewed. The land owner would be required to provide the backflow prevention device if deemed necessary.

Design and Performance Standards

The City of Cascade Locks has adopted standards for its public works. The water system section closely follows the American Public Works Association (APWA) and American Water Works Association (AWWA) as its minimum design and construction standards. With adoption of these standards, and City review and approval of all proposed new construction or upgrades, the City is able to control new development in its distribution system. All plans and specifications for new construction would be reviewed in accordance with OAR 333-601-0060 and approved by the Oregon Drinking Water Program prior to construction. The completed work will then be accepted by the City after Certification of Completion by an Oregon Registered Professional Engineer.

Surcharge For Outside Customers

The City currently has no services outside of its existing service boundary, the reason being that City policy is to serve only new users that are within the City's current boundary.

Formation of Local Improvement Districts

Local Improvement Districts (LID) are a mechanism by which individual property owners can request a public facility, be it water, sewer, or street improvement, from the responsible government entity and agree that they, the property owner, will pick up the costs. There is some latitude in the way a successful formation of a LID is determined. Primarily they are controlled by State statute. However, the City can be aggressive or non-aggressive in the way it determines whether or not a project may proceed by requiring a more significant percentage involved to vote no or remonstrate against the project.

Oversizing Policy

The City has an ordinance requiring a developer to pay the actual cost difference between a standard 6" main and the water main actually installed based upon the requirements of that specific development. In addition, the City may examine the need to oversize for future capacity to serve the system users. If this is determined necessary by the City Engineer, then the City may participate in the improvement to the extent of the oversizing if warranted. Oversizing for system wide improvements can be done through System Development Charges (SDC).

A System Development Charge is a State mandated process by which municipalities determine the necessary capacities of their various systems, albeit water, sewer, streets, or parks; determine where oversizing of the system is needed; and then assess the cost of the oversizing as the development in that municipality occurs. The System Development Charges normally fall into two different categories: reimbursement of existing debts, or as part of a Capital Improvement Plan (CIP) for upgrade of existing systems. The easiest of the two categories to understand is that of a Capital Improvement method of determining System Development Charges. The following is an outline of how a Capital Improvement debt can be paid for by System Development Charges.

Assume that the needed Capital Improvements for the City of Cascade Locks distribution system total $500,000. This cost would be to maintain current service levels to the existing users. Because we know that additional development will occur, and that the additional development will cause improvements to be needed, we estimate the total project will then be $600,000, with the oversizing costing approximately $100,000, to serve the future demand. That $100,000 can be assessed in the form of a SDC on the future development. This does not automatically mean that the future development will pay for it because the debt is incurred by the existing residents, but the formula for SDCs would provide for payment of that debt as development occurs within the service area. This is a simplification, but one that can be easily explained to the prospective new users of the system.

The costs of doing the construction of the service connection, normally called "hookup fees," being the labor and materials, is a direct cost to the property owners gaining the service, not a part of the System Development Charge. A separate and distinct construction cost based on time and materials is billed to the individual property owner or developer or a subdivision. This would include the meter, meter box, the tap on the water main, and installation of the service line from the water main to the property line. All appurtenant devices, including a backflow preventer, would go to the individual property owner as an actual cost, in addition to the SDC.

Cross Connection Control Program Extension Policy

The Oregon Administrative Rules, Chapter 333-061-0025, require that any water supplier is responsible for conducting an active program for systematically identifying and controlling cross

connection. The City currently has a policy in place for cross connections, which is actively enforced. Ordinance No. 387 has been in effect since 2006**.** A copy of the current cross connection ordinance is included in Appendix "E". This is a very important part of managing a water system. Ninety percent (90%) of contaminated drinking water is the result of a backflow incident caused by cross connection. Simply put, a cross connection is any actual or potential link between potable water and non-drinking substances. Attachments at the end of a garden hose to use antifreeze flush kits or fertilizer and weed killer sprayers can result in these harmful substances being siphoned into the water supply if the right hydraulic conditions exist.

Besides being required by the Oregon Drinking Water Program, having unprotected cross connections can cause serious illness and can be extremely costly due to the extensive flushing of water mains and home service lines that may, or may not, sufficiently remove the contaminated materials to within acceptable limits. Therefore, it is very important the City continues to aggressively enforce and maintain its cross connection control program and continues to ensure that no contamination of the distribution system occurs.

CONDITIONS OF SERVICE

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

1. Routinely collect and submit water samples for laboratory analysis at the frequencies prescribed by OAR 333-061-0036;

2. Take immediate corrective action when the results of analysis or measurements indicate that Maximum Contaminant Levels have been exceeded and report the results of this analysis as prescribed by OAR 333-061-0040;

3. Continue to report, as prescribed by OAR 333-061-0040, the results of analysis or measurements which indicate that Maximum Contaminant Levels have not been exceeded;

4. Notify all customers of the system, as well as the general public in the service area, when the Maximum Contaminant Levels have been exceeded;

5. 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;

6. Maintain monitoring and operating records and make these records available for review when the system is inspected;

7. Maintain a working pressure of at least 20 pounds per square inch (psi) at all service connections at all times;

8. Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken;

9. Conduct an active program for systematically identifying and controlling cross connections;

10. Submit to the Division, for review and approval, plans prepared by a professional engineer registered in Oregon before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement;

11. Assure that the water system is in compliance with OAR 333-061-0205 relating to certification of water system operators;

12. Providing a Consumer Confidence Report on an annual basis that describes and reports on water quality parameters in the previous year.

Chapter Three

SYSTEM ANALYSIS

WATER DEMAND

The State of Oregon has no adopted guidelines for calculating water demand; therefore, the following calculations were made using the Washington State Department of Health (DOH) "*Water System Design Manual, December 2009*". The present system, with 417 single-family residential services, 44 commercial/industrial (including multi-family), and 32 public/governmental service accounts, is estimated to equal 798 Equivalent Residential Units (ERU) of service.

An ERU is defined as the amount of water used by a typical fulltime single-family residence. The estimated ERUs were determined by adding together the number of single-family residential accounts and an estimated ERU equivalent from multi-family, schools, businesses, churches, and government services. The ERU equivalent for non-single-family services was determined by dividing their average monthly use by the average monthly use of a single-family residence.

TABLE 6
ERU Projection

	2013 SERVICES	2013 ERUs	2019 ERUs	2033 ERUs
Single-Family	417	417	443	509
Commercial/Industrial	44	232	239	256
Public/Governmental	32	149	149	149
Total Estimated ERUs		798	831	914

The calculated Average Day Demand (ADD) is based on actual residential water usage and the estimated number of residential ERUs. Using data from April 2011 through March 2013 (Table 1), based on an average daily residential billed usage of 67,079 gallons and 394 full-time ERUs, this yields an ADD of 170.3 gallons per day per ERU for the City. The Maximum Daily Demand (MDD) is based upon the Maximum Month Average Demand (MMAD) multiplied by a peaking factor. For the two years of records considered, the maximum month billed volume was 6,852,000 gallons in August 2011. Based upon a total of 798 ERUs, this yields a MMAD of

277.0 gallons per day per ERU. The Maximum Daily Demand is the MMAD multiplied by a peaking factor of 1.7, based upon DOH recommendations for water systems in western Washington. Thus, the Maximum Daily Demand for the City of Cascade Locks is 470.9 gallons per day per ERU.

It should be noted that for purposes of this report, the current City distribution system, as shown in Table 1, leaks approximately half of all water pumped into it. This amount of leakage (100% of the billed volume) is excessive and must be reduced. With the improvements recommended, we feel that replacement of approximately 30% of the aging mainlines with newer PVC pipe will help reduce this leakage. However, there are still sections of older pipe within the system; therefore, to be realistic, a leakage amount of 20% was added to the billing based demands identified above. **Thus, the Design ADD is 204.2 gallons per day/ERU. The Design Maximum Daily Demand is increased by the corresponding 20%, and equals 565 gallons per day/ERU.**

The Average Daily Demand figure is below the national average of 300-400 GPD/ERU. The difference between the City of Cascade Locks ADD and the Oregon statewide average of 371 GPD/ERU is equal to approximately 56 gallons per person per day, if it is assumed that there are 3 people per residence.

The Peak Hourly Demand (PHD) flow for a system providing between 251 and 500 ERUs of residential service is determined by the following equation:

$$PHD = \left(\frac{MDD}{1440}\right)((C)(N)+F) + 18$$

where: MDD = 565 GPD/ERU
C = 1.8
N = 798 ERUs
F = 125

Thus for 2013: $$PHD = \left(\frac{565}{1440}\right)((1.8)(798) + 125) + 18 = 631 \text{ gpm}$$

This PHD number appears to be in keeping with the track record of performance in Peak Demand situations for this system. Under normal circumstances, either one of the City's wells will maintain reservoir levels. However, in peak summer usage situations, two wells are required to run at least a portion of the day to maintain reservoir levels. During the wildfire in September 2003, the two wells could not keep up with demand and the City diverted Dry Creek into the system. The minimum acceptable system pressure on all lines is 20 psi measured at the customer's water meter or at the property line in demand situations such as fire flow conditions.

Overall, the City system needs continued work on some important design criteria. Primary among these is a comprehensive valve network that would allow a better isolation of sections of pipeline and also replacement of the distribution main lines. Replacement of the aging and undersized lines will allow for more uniform pressure, increased flows, better overall water quality, and reduced leakage. The valve separation should be limited to 1,000 feet or less, with hydrant spacing to be per Fire Marshal's recommendations, preferably at a spacing not to exceed 500 feet. As has been standard practice, all hydrants should be installed with a gate valve on the lateral.

SYSTEM COMPONENT ANALYSIS

The existing system facilities described in Chapters One and Two of this report are further discussed as follows. Photos of the primary components are included as Exhibit 1 at the end of the Plan.

Source

The current utilized sources of all domestic potable water supply for the City of Cascade Locks are two wells, both located on Herman Creek Lane within the City's service area. The locations of these wells have been previously discussed and can also be seen on the system map (Figure 3). The two wells are capable of combined water production rate of 940 gallons per minute. It is noted that the flow rates in both of the wells is consistent throughout the year with no seasonal variation of production rates.

One design standard for minimum source supply is to provide a volume of 800 gallons per day per Equivalent Residential Unit (ERU) with the pump running a maximum of 18 hours per day.

A study of the City's service accounts yields 798 ERUs for this system, representing a continuous flow of 591 gallons per minute, which is approximately 63 percent of current production capacity. At the year 2033, with 914 estimated ERUs, the minimum standard is a flow of 677 gallons per minute.

Another method of evaluating source supply is to ensure that the source can meet or exceed the Maximum Daily Demand of the system. In this case, the Maximum Daily Demand is 565 gallons per day/ERU, which is less than the 800 GPD/ERU standard outlined above; thus, this condition is met. The second factor is whether or not the supply source can replenish the Fire Suppression Storage within 24 hours. In this case, the Fire Suppression Storage of 600,000 gallons can be replenished in 24 hours with an average pump rate of 417 gallons per minute, which is less than the capacity of either of the two individual wells. Thus, the existing source capacity can both meet the Maximum Daily Demand and replenish the Fire Suppression Storage within a 24 hour period.

Based upon this analysis, the two source wells are marginally adequate to provide the minimum level of source capacity to the system. It is recommended that the combined system source capacity be increased to a minimum of 2,000 gallons per minute. This increased production rate will allow for capacity to provide service under both the minimum design standard requirements noted above and also to meet the projected Peak Hourly Demand in 2033. It also allows for redundancy in the system such as the City needing to remove one of the wells from service for maintenance, etc. It should be noted that a Well Capacity Memo (dated October 25, 2012) provided by Aspect Consulting, LLC, has found that the aquifer yield capacity for either well is in excess of 1,000 gallons per minute with little to no drawdown and the fact that the current wells are limited solely by their existing pump sizes and casing size, in the case of Well #2.

Well #1

Well #1 is located on Herman Creek Lane approximately 875 feet north of the intersection of its intersection with Forest Lane and was drilled in 1969 to a depth of 110 feet. It is cased 14 inches in diameter from 4 feet above to 110 feet below ground surface with perforations at the bottom. The well has a 50 HP Westinghouse motor with vertical shaft turbine pump column and bowls. It is capable of producing approximately 450 gallons per minute.

Well #2

Well #2 is also located on Herman Creek Lane approximately 70 feet south of Well #1 and was drilled in 1969 to a depth of 104 feet with perforations at the bottom. It is cased 8 inches in diameter to a depth of 104 feet. The well has a 60 HP Franklin Electric Co. motor with a submersible pump. It is capable of producing approximately 490 gallons per minute.

Reservoirs, Chlorination, and Booster Pumps

Both of the City's wells deliver their water directly into the system after receiving hypochlorination disinfection at the pump house of Well #1. Water that is not used immediately by demand is conveyed through the system to the two existing reservoirs. There are no direct reservoir feed lines for either of the wellheads. Available information on the components are listed below.

Dry Creek Reservoir

The Dry Creek Reservoir was constructed sometime in the 1890s. It is of concrete construction topped with a wood framed roof and has a nominal capacity of 250,000 gallons. It is rectangular in shape with the following dimensions: 9.5 feet deep, 37.6 feet wide (outside), and 95.7 feet long (outside). As with the other reservoir in the system, it has a maximum water elevation of approximately 364.5 feet, which, with a 9.5 foot deep reservoir, makes an approximate base elevation of 355 feet. There is very little historical information available on any maintenance that has been performed on this reservoir.

Oxbow Tank

The Oxbow Tank is a field coated welded steel reservoir that was constructed in 1969 and has a nominal capacity of 350,000 gallons. It is cylindrical in shape with an outside diameter of 43.7 feet and is 32 feet tall with approximately 1 foot of freeboard. As with the Dry Creek Reservoir, maintenance records are somewhat minimal for this structure. It is believed that the original coatings are still in place for both the interior and exterior of the tank.

Chlorination

Though not required to do so, the City chlorinates all of its water. Chlorination is accomplished by use of metering pumps injecting liquid hypochlorite solution into the water at the wellheads. The metering pumps are electrically activated and run only when the individual wells are in operation. This is an effective way of delivering chlorine to the system for residual disinfection; however, due to the fact that the water is pumped directly to the distribution system without benefit of a properly sized contact chamber, chlorine contact time is minimal. The contact chamber consists of 30 lineal feet of 36" diameter pipe (~1,585 gallons) and then the distribution main. The first actual service is located approximately 100 feet away from the point of chlorination. It is a business fed off of a 4" pipeline that has nominal commercial water demand. Thus, the contact time is approximately 9.7 minutes based upon a demand of 10 gallons per minute through the service pipe and 490 gpm flow through the contact chamber. The other system demands begin to occur near the intersection of Forest Lane and Herman Creek Road, which is approximately 1,000 feet distant from the point of chlorination. The pipe between these two locations is 8" diameter; thus, at the maximum combined well pumping rate of 940 gallons per minute, approximately 4.5 minutes of contact time is achieved to the nearest point of use. Future improvement recommendations to these systems may include either direct reservoir feed lines or a chlorine contact chamber to allow ample disinfection time.

Booster Pump Station

The private developer of Harmony Heaven Subdivision constructed a booster pump station in approximately 2010. This booster pump station solely serves the Harmony Heaven Subdivision, which currently has no homes constructed within it. The booster pump station is housed in a 15 foot by 18 foot CMU above-grade building located on the west side of Moody Street. It houses three centrifugal pumps, two 7-1/2 hp pumps capable of 80 gallons per minute each, and one 40 hp pump capable of 1,000 per minute. The pumps are provided electrical power from the City; however, there is also a fuel fired backup generator with automatic transfer switch that can be used to operate the pump system.

Storage - Minimum Requirements

The capacities of the City's reservoirs are based on the aforementioned information and the following criteria:

1. Operational Storage (OS) – This storage component varies depending upon the system operational requirements. It is directly related to the sensitivity of the control system within the reservoirs; thus, we have utilized 2 feet of elevation in the Oxbow Tank to calculate the Operational Storage.

2. Equalizing Storage (ES) – Required for fluctuation between Peak Hourly Demand and system source capacity.

3. Stand-By Storage (SB) – 48-hours of Average Daily Demand with the largest source out of service.

4. Fire Suppression Storage (FSS)

    - 2,500 gpm for four-hour duration (Industrial Park)
    - 2,000 gpm for two-hour duration (Commercial areas)
    - 1,500 gpm for two-hour duration (Residential areas)

There is no Dead Storage (DS) in the system due to the fact that both reservoirs will provide adequate working pressure even when empty. It should be noted, however, that due to the height difference between the Dry Creek Reservoir and the Oxbow Tank, the Dry Creek Reservoir runs dry after approximately 360,000 gallons of water has been used, while the Oxbow Tank still contains approximately 240,000 gallons of water. This water is then marginally usable by the system users at the west end of the town due to the small connecting pipe sizes involved. Hence, one of the reasons why having two different sized and configured reservoirs is a detriment to the system.

1. For this study, we utilized an Operational Storage (OS) of 2 feet of water in the Oxbow Tank. This volume (22,400 gallons) will allow normal operating pressure and peak flows for over 35 minutes without necessitating the well pumps to activate. In year 2033, the OS still provides 31 minutes between pump cycles based on the 2033 PHD of 713 gpm.

2. The Equalizing Storage (ES) can be calculated as follows:

$ES = (Qph-Qs)150$

where: Qph is the Peak Hourly Demand or 658 gpm

Qs is the source capacity or 940 gpm (based on Well #1 at 450 gpm and Well #2 at 490 gpm)

$ES_{2013} = (631-940)(150) = -46,350$ gallons

$ES_{2033} = (713-940)(150) = -34,100$ gallons

Since ES is less than zero, 0 gallons will be utilized for the Equalizing Storage necessary.

3. The Standby Storage (SB) is determined by the number of supply sources. Based on the City's two wells, the volume necessary is the greater of either:

$SB_1 = 2[(ADD) - 1440(Qs)]$

or

$SB_2 = 200$ gallons/ERU * #ERUs

where: ADD is the Average Daily Demand

(204.2 gallons per day per ERU * 798 ERU)

Qs is the sum of all supply sources minus the largest available source (450 gpm)

$SB_1 = 2[(204.2 \text{ gpd/ERU}*798\text{ERU}) - 1440(450 \text{ gpm})] = -970,097$ gallons

Or $SB_2 = 200$ gallons/ERU(798 ERU) = 159,600 gallons

Therefore, with the greater of the two numbers being used, the Standby Storage required in 2013 will be 159,600 gallons. In 2033, it will be 182,800 gallons.

4. The Fire Suppression Storage (FSS) is based on the fire flow and duration. The various types of usages in the City require different fire flows based on the Oregon Structural Specialty Code and Oregon Fire Code. The lowest flow is 1,500 gpm for two hours for residential areas. The highest flow is 2,500 gpm for four hours in the Industrial Park. For purposes of this report the highest flow will be used.

FSS = 2,500 gpm * 240 min = 600,000 gallons

By summing the four individual volumes identified above, the storage capacity currently necessary for the City of Cascade Locks is 782,000 gallons. This can be reduced by the lesser of either of the Standby Storage or the Fire Suppression Storage. This reduction is known as "Nesting". The concept is that it would be extremely unlikely for both the Standby Storage and the Fire Suppression Storage to both be utilized at the same time. Therefore, unless otherwise prohibited by either the City Council or Fire Authority, the concept of Nesting can be utilized to reduce the storage capacity requirement to 622,400 gallons. This still exceeds the 600,000 gallons currently available to the system. A major component of the remaining storage is the Fire Suppression Storage and currently the City is only capable of providing approximately 1,500 gpm for a two-hour duration. Thus, reducing the current storage necessary to about 362,000 gallons based on the limited fire flow.

CAPACITY SUMMARY

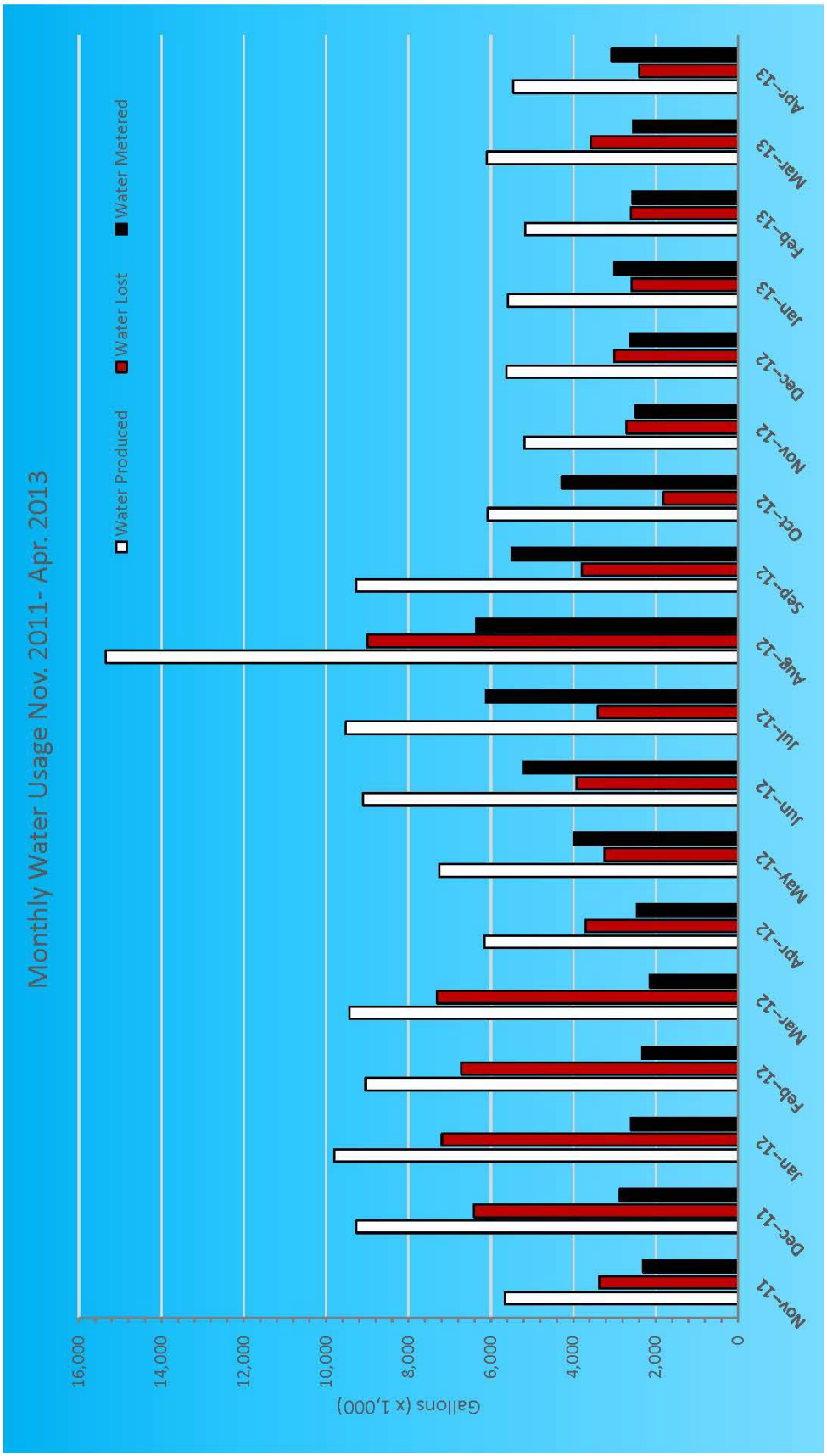
Utilizing the projected populations and Equivalent Residential Units, the following table illustrates the anticipated Average Daily Demand, Maximum Day Demand, Peak Hour Demand, and required storage for both the six-year and twenty-year planning cycles.

TABLE 7 Capacity Analysis – Billed + 20%			
YEAR	**2013**	**2019**	**2033**
Calculated Population	1200	1274	1464
Calculated ERUs (Single-Family Residences)	417	443	509
Calculated ERUs (Others)	381	388	405
TOTAL ERUs	798	831	914
Leakage Factor (Assume 20% Leakage after Improvements)	1.2	1.2	1.2
Average Daily Demand (ADD--gallons per day per ERU)	204.2	204.2	204.2
Average Daily Demand (ADD--gallons per day)	162,982	169,722	186,674
Maximum Month Average Demand (MMAD--gallons per day per ERU)	332.4	332.4	332.4
Maximum Day Demand (MDD--gallons per day per ERU)	565.0	565.0	565.0
Maximum Day Demand (MDD--gallons per day)	450,906	469,552	516,451
Peak Hourly Demand (PHD--gallons per minute)	630.7	654.0	712.6
Allowable # of ERU's based on Annual Average Day Demand (EQN 6.3)	5024	5024	5024
Allowable # of ERU's based on Peak Day (EQN 6.4)	1816	1816	1816
Required Storage Components			
Operational (OS)	22,400	22,400	22,400
Equalizing (ES)	0	0	0
Stand-By (SB)	159,600	166,200	182,800
Fire Suppression (FSS)	180,000	600,000	600,000
Total Required Storage (no Nesting of SB and FSS)	362,000	788,600	805,200
Minimum Required Storage (Nesting of SB and FSS)	202,400	622,400	622,400

Distribution Pipework

The entire system consists of approximately 74,700 lineal feet of water distribution piping of various types and sizes. Approximately 15% of the system is PVC, 10% is dipped and wrapped steel, 15% is ductile iron, and the remaining 60% is cast iron with a minor amount of asbestos cement. A breakdown by pipe size shows that approximately 43% of the system is 8” diameter or larger, with approximately 57% of the piping being 6” diameter and smaller. Almost all of the pipe ranging from 2 inches to 6 inches in diameter is over 40 years old. In many cases, these pipes are deficient because of size and age and are likely substantial contributors to the leakage problems. Also of note, the transmission main connecting the Dry Creek Reservoir to the distribution system is a significant portion of the asbestos cement pipe within the system. This pipe is no longer used in construction of water distribution systems. Past testing has not indicated adverse impacts from this pipe type nor has the water been shown to be corrosive to the pipe; however, as the pipe continues to age it may develop into a problem for the distribution system.

In recent years, the City of Cascade Locks has seen substantial ongoing issues from leakage and water loss. After comparing source production records versus "billed for" volumes from November 2011 through March 2013, on average the City pumps 7.857 million gallons (MG) per month and bills for 3.920 MG per month. This means approximately 3.938 MG are lost and/or unaccounted for every month resulting in roughly 100% in extra expenditures/lost revenue due to leakage. Well meters are new within the last two years. However, the previous source meters were inaccurate and displayed incorrect pumped quantities. An initial assumption has been that a significant portion of the water loss is due to a multitude of small leaks in the old dipped and wrapped steel lines on the hillside nearest Dry Creek Reservoir. The old pipe within this area of the system has had ongoing leak repair. Excavations to repair leaks show significant decay in the old pipe. Many times when maintenance is required, the closing of valves necessary to repair damaged portions of pipe results in damage in other areas due to the increased pressure. City staff has invested significant time in attempting to solve and/or reduce the system's water loss levels. Still, with the time invested, the water loss numbers remain vexing and require immediate resolution. It is recommended the City conducts leak detection surveys utilizing reputable firms in order to reduce continuing water and profit losses. The following graph provides an illustration of the City's water loss over the last couple years.


Monthly Water Usage Nov. 2011- Apr. 2013
Water Produced
Water Lost
Water Metered
Gallons (x 1,000)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Nov--11
Dec--11
Jan--12
Feb--12
Mar--12
Apr--12
May--12
Jun--12
Jul--12
Aug--12
Sep--12
Oct--12
Nov--12
Dec--12
Jan--13
Feb--13
Mar--13
Apr--13

SYSTEM MODELING

The City of Cascade Locks distribution system is what can be termed as a partially looped system. The majority of the water mains within the distribution system are looped. However, the primary system loops are with 2, 4, and 6 inch mains. This statement is accurate for both the downtown corridor and older residential areas. Newer subdivisions typically have a minimum 8" diameter water main. The Port Industrial Park is fed by one long dead-end line consisting of 6 and 8 inch pipe. Within the main City system, the primary feed lines run within the main roadways of Wa-Na-Pa Street, Forest Lane, and Frontage Road. This provides for good overall distribution of water within the system with the only exception being the Industrial Park area.

The system is capable of providing the required Peak Hourly Demand anywhere in the system. However, in most cases, adding required fire flows on the east and west ends of the City result in low or negative pressures and excessive velocities in parts of the system. These problems are caused by both undersized waterline in the downtown corridor and the long, dead-end, undersized waterline stretching to the Industrial Park. The dead-end line stretching to the Industrial Park not only limits flow, but can also create insufficient movement of water within the system resulting in stagnation.

The distribution system consists of one pressure zone. Due to insufficient distribution pipe size and lack of looping, extra infrastructure is required to deliver sufficient service pressure to the Harmony Heaven Subdivision. The solution was to serve the 30 lots in this subdivision with a booster pump station to provide working pressures for domestic use and fire flows.

The main components of the City of Cascade Locks water system were modeled in WaterCAD. WaterCAD is a computer simulation model that allows the user to input system components including source capacity, transmission mains, storage, and distribution mains, along with specific demand locations and flows. The software then runs various scenarios to identify deficiencies within the system. The model for the City was generated utilizing all pipe sizing above 6 inches and the 2 inch mainlines within Wa-Na-Pa Street. The total pipeline in the model was estimated at approximately 85% of the total distribution system, along with all 12" diameter and larger pipes, pump stations, storage facilities, and control valves. The system was modeled utilizing an Extended Period Simulation (EPS) with the various different fire flows and durations

distributed throughout the respective areas. In addition, these fire flows were set to occur at the same time as when the peak of the Maximum Daily Demand diurnal curve is reached. This typically began at 6:00 a.m. and lasted the duration of the fire flow whether it be two-hours or four-hours. The Peak Hourly Demand without fire flow was also modeled; however, this scenario had lesser effect on the system than the fire suppression flow occurring during the Maximum Daily Demand. Therefore, all results of testing were based upon the Maximum Daily Demand with fire flow scenario. The model was run with both well pumps operational at a combined pump rate of 940 gallons per minute. The possibility exists that one pump may be out of service or damaged under extreme conditions. In this case, the remaining existing pump capacity is not sufficient for either the current or future demands under the scenarios modeled. For this reason, the recommendation is for the system to develop a minimum of 2,000 gallons per minute flow rate. This would require an additional well of 1,000 gallons per minute capacity. Thus, even with the largest well out of service, the two remaining wells would be able to keep up with flow. It is also highly recommended that the capacity of Well #1 be increased to 1,000 gallons per minute since this would be a fairly simple operation and would increase the total source capacity to 2,500 gallons per minute.

The model was calibrated based upon system pressures monitored by City staff during average day flows as compared to the modeled pressures. Modeling of the existing system components indicates that the maximum fire flow achievable by the current system is approximately 1,500 gallons per minute for a duration of two-hours. After that, the Dry Creek Reservoir is empty due to its shallow depth and the well pumps cannot keep up with the Maximum Daily Demand occurring with the fire flow and allow for refilling of the reservoirs. The system basically is "starved" of water, which in turn causes low pressures within upper regions of town, possibly even incurring negative pressures and back siphonage from residents.

Based upon the system deficiencies, Tenneson Engineering, working with the City staff, developed four possible improvement options to the system. These options are briefly described as follows:

Option 1 (Estimated Cost = $1,411,600)

A new 480,000 gallon tank near the Dry Creek Reservoir location to replace it and new water main from the Dry Creek tank to the Harmony Heaven booster pump station. This will require the Harmony Heaven booster pump station to remain in service. Components and cost estimate are shown in Figure 4.

Option 2 (Estimated Cost = $2,279,100)

This will replace the Dry Creek Reservoir with a new 480,000 gallon tank at approximately elevation 330 feet on the road leading to Dry Creek Reservoir. In addition, it will replace existing mainlines within Ruckel Street, Adams Avenue, and Wa-Na-Pa Street to the Bridge of the Gods. This option will require the Harmony Heaven booster pump station to remain in service. This option is shown in Figure 5.

Option 3 (Estimated Cost = $2,269,400)

This will involve decommissioning of the Dry Creek Reservoir and construction of a new 480,000 gallon tank at the Crystal Springs location in the southwest end of town. It will also involve a new mainline connection to the water system serving Harmony Heaven and would involve mainline replacement within Ruckel Street, Adams Avenue, and Wa-Na-Pa Street to the Bridge of the Gods. This option would allow abandonment of the Harmony Heaven booster pump station and is shown in Figure 6.

Option 4 (Estimated Cost = $1,931,400)

Option 4 will replace the Dry Creek Reservoir with a new 480,000 gallon tank at the Crystal Springs location in the southwest corner of the City, along with a mainline connection to the water distribution system at Harmony Heaven. In addition, it replaces the mainline in Wa-Na-Pa Street from the Bridge of the Gods to Forest Lane. This option would also allow for abandonment of the Harmony Heaven booster pump station and is shown in Figure 7.

Summary

As noted, these four options were modeled utilizing the established fire flows of 2,500 gpm within the Port Industrial Park, 2,000 gpm in the downtown corridor area, and 1,500 gpm within any of the residential areas. The models utilized a maximum source pump capacity of 940 gpm,

equating to the capacity of the existing two wells, assumed that the tank water levels were full at 12:01 a.m. that day of beginning the scenario and the proposed 480,000 gallon tank was modeled with the overflow elevation equal to that of the Oxbow Tank, a 32.5 foot height with a 50 foot nominal diameter, and an approximate usable volume of 466,700 gallons. Results of these models are shown in the following tables, which identify the maximum velocity within the pipe under these certain flow conditions at noted areas, the minimum pressure at selected services within the service boundary, and the minimum reservoir water level within the 48-hour extended period simulation.

TABLE 8
Tank Water Level Data for Options #1 - #4

FIRE FLOW			OPTION #1 WITH B.P.S.		OPTION #2 WITH B.P.S.		OPTION #3 WITHOUT B.P.S.		OPTION #4 WITHOUT B.P.S.	
Location (ID)	Rate (GPM)	Duration (HRS)	Dry Creek Tank (FT)	Oxbox Tank (FT)	Dry Creek Tank (FT)	Oxbow Tank (FT)	Crystal Springs Tank (FT)	Oxbow Tank (FT)	Crystal Springs Tank (FT)	Oxbow Tank (FT)
H-62 H-63	1250 1250	4	342.2	339.1	341.9	339.9	342.6	338.1	342.7	337.9
H-6	2000	2	344.8	360.3	345.6	360.0	347.5	360.5	347.3	360.7
H-8	2000	2	344.8	360.3	345.6	360.0	347.6	360.4	347.4	360.6
H-39	2000	2	352.7	356.1	352.1	356.7	353.4	355.1	353.4	355.2
H-71	1500	2	-	-	-	-	349.8	361.5	349.7	361.5
H-70	1000	2	353.8	361.5	351.6	361.5	353.2	361.4	353.1	361.5
H-65	400	4	358.9	361.0	359.0	360.9	358.8	361.1	358.6	361.1
H-58	1500	2	356.2	356.4	356.0	356.2	356.4	356.2	356.3	356.1
H-68	1000 1500	2	354.4	361.5	353.4 349.5	361.5 361.2	355.3 352.0	361.5 360.8	355.5	361.5
H-14	1500	2	349.5	361.3	349.6	361.2	351.4	361.2	351.2	361.2
Minimum Tank Level (FT)			**342.2**	**339.1**	**341.9**	**339.9**	**342.6**	**338.1**	**342.7**	**337.9**
Minimum Tank Volume (Gals)			**133,696**	**62,252**	**129,215**	**71,146**	**139,671**	**51,136**	**141,165**	**48,913**
Minimum System Volume (Gals)			**195,949**		**200,360**		**190,807**		**190,078**	

TABLE 9 Service Pressure Data for Options #1 - #4										
FIRE FLOW			**OPTION #1 WITH B.P.S.**		**OPTION #2 WITH B.P.S.**		**OPTION #3 WITHOUT B.P.S.**		**OPTION #4 WITHOUT B.P.S.**	
Location (ID)	**Rate (GPM)**	**Duration (HRS)**	**Service Location**	**Minimum Pressure (PSI)**	**Service Location**	**Minimum Pressure (PSI)**	**Service Location**	**Minimum Pressure (PSI)**	**Service Location**	**Minimum Pressure (PSI)**
H-62 H-63	1250 1250	4	J-248	29.8	J-264	22.3	J-264 J-248	22.8 28.7	J-264 J-248	22.8 28.6
H-6	2000	2	J-56	44.9	J-103	45.6	J-264 J-248	24.9 47.6	J-264 J-248	24.8 45.6
H-8	2000	2	J-56	45.0	J-103	46.0	J-264 J-248	24.9 47.5	J-264 J-248	24.9 45.5
H-39	2000	2	J-197	28.4	J-197	29.7	J-197 J-264	27.1 27.4	J-264 J-197	27.4 28.0
H-71	1500	2	-	-	-	-	J-264 J-248	21.3 47.6	J-264 J248	21.1 47.7
H-70	1000	2	J-268	27.1	J-268	23.6	J-264 J-272	28.1 38.2	J-248 J-264	25.5 27.3
H-65	400	4	J-502	29.4	J-502	29.1	J-502 J-264	29.0 29.8	J-502 J-264	29.0 29.7
H-58	1500	2	J-248	40.3	J-248	40.7	J-264 J-248	28.7 39.8	J-264 J-248	28.7 39.7
H-68	1000 1500	2	J-233 N/A (FAILS)	27.3 N/A (FAILS)	J-248 J-248	48.2 47.7	J-264 J-264	28.2 26.8	J-233 J-264	21.2 28.3
H-14	1500	2	J-56	47.6	J-248	47.6	J-264 J-248	26.6 46.4	J-264 J-248	26.5 46.5
Minimum Service Pressure			**J-268**	**27.1**	**J-264**	**22.3**	**J-264**	**21.3**	**J-264**	**21.1**

TABLE 10 Pipe Flow Data for Options #1 - #4										
FIRE FLOW			OPTION #1 WITH B.P.S.		OPTION #2 WITH B.P.S.		OPTION #3 WITHOUT B.P.S.		OPTION #4 WITHOUT B.P.S.	
Location (ID)	Rate (GPM)	Duration (HRS)	Location (ID)	Max Velocity (FPS)	Location (ID)	Max Velocity (FPS)	Location (ID)	Max Velocity (FPS)	Location (ID)	Max Velocity (FPS)
H-62 H-63	1250 1250	4	1372'-8" in Port	18	1372'-8" in Port	10-18	1372'-8" in Port	15	1372'-8" in Port	14-18
H-6	2000	2	-	< 7	-	< 7	-	< 7	-	< 7
H-8	2000	2	180'-6" in WaNaPa	13	-	< 7	-	< 7	-	<7
H-39	2000	2	2047'-6" Forest Lane	< 9	2047'-6" Forest Lane	8-9	2047'-6" Forest Lane	8-9	2047'-6" Forest Lane	7-9
H-71	1500	2	-	-	-	-	-	< 7	-	< 7
H-70	1000	2	2235'-4" & 6" WaNaPa & Port	11-15	2235'-4" & 6" WaNaPa & Port	11-19	2235'-4" & 6" WaNaPa & Port	11-19	992'-4" & 6" WaNaPa & Port	12-14
H-65	400	4	1989'-4" to Forest Service	10	1989'-4" to Forest Service	10	1989'-4" to Forest Service	10	1989'-4" to Forest Service	10
H-58	1500	2	-	< 7	-	< 7	-	< 7	-	< 7
H-68	1000 1500	2	2090'-4" Mobile Park	9-16 N/A (FAILS)	-	< 7 < 7	-	< 7 < 7	2090'-4" in Mobile Park	10-16 N/A (FAILS)
H-14	1500	2	896'-6" In-Town Residential	< 10	896'-6" In-Town Residential	< 10	896'-6" In-Town Residential	~10	896' - 6" I	~10

The location nodes identified in the tables are shown on the System Map included as Figure 3. All of these options require a new 12” waterline within Forest Lane extending from Herman Creek to the Industrial Park. While all of these options meet the minimum requirements for the system improvements, it is noted that Option 4 provides the most return for the City in that it is approximately $350,000 less than the two most costly options (Option 2 and Option 3) but allows the elimination of the most amount of existing waterline (approximately 15,000 lineal feet). In addition, it provides for the ability to eliminate the Harmony Heaven booster pump station, which Option 1 (least cost option) would still require to be in place in order to provide service pressure. Being able to decommission the booster pump and perhaps re-use the components elsewhere would be beneficial to the City by simplifying the system and requiring one less element to maintain. Also Option 4 eliminates all of the 8” steel and 10” asbestos cement piping to and from Dry Creek Reservoir and a majority of the older cast iron 2”, 4”, and 6” lines within Wa-Na-Pa Street. Thus, with replacement of approximately 20% of the pipeline, it is anticipated that the unaccounted for water loss volumes will be greatly reduced by this improvement.

SUMMARY OF SYSTEM DEFICIENCIES

Pumping Capacities

Existing pump facilities are in fair operating condition and are adequate to meet current use demands. However, the current wells provide no backup or redundancy for the system and Well #2, being located in an underground vault, poses serious health and safety risks to anyone requiring entrance for maintenance and other purposes. The current capacities of these pumps are barely sufficient in the 20-year planning period assuming both are operational and can pump 24-hours a day. This statement is heavily dependent on the possibility of commercial/industrial development and will be driven by the requirements of future consumers. The City should plan for the upgrade of Well #1 to 1,000 gpm and the construction of a 1,000 gpm well in order to leave Well #2 as purely a backup source.

Water Treatment

At the current time, water treatment facilities with the City are minimal. The discharge lines of Well #1 and Well #2 join before connection to the City distribution system. Chlorine is applied by use of a metering pump injecting liquid hypochlorite immediately following the transmission line connection. This is a safe and effective way of achieving disinfection by chlorination. However, due to the lack of transmission main from the wells to the reservoirs, the Contact Time (CT) is extremely limited. Fortunately the City is not required to provide chlorination. They do so simply to maintain a system residual, which has been detected at all coliform sampling locations, ranging from 0.2 mg/l to 0.5 mg/l; thus, chlorination is being achieved throughout the system.

Storage

The water storage capacity of the City is marginal at the present time and will require upgrade before both the 6-year and 20-year planning period deadlines. Dry Creek Reservoir is approaching 120-years old and is in need of replacement. The reservoir's capacity is lacking, the security is a liability, and the transmission line is presumably a large contributor to the water loss throughout the system. It is recommended that the 250,000 gallon Dry Creek Reservoir be replaced by the proposed 480,000 gallon Crystal Springs Tank and the transmission lines to Dry Creek Reservoir be abandoned.

Oxbow Tank is approaching 50 years of age and should have a detailed examination done of its interior and exterior coatings. Coating is an essential part of the tank, protecting the steel from moisture and corrosion; thus, the better the coating is the better protection and longevity.

Distribution Network

The current pipe distribution network for the City is adequately meeting normal and peak supply demands. However, when a fire flow demand is added within the downtown corridor or the industrial park, the distribution system fails resulting in negative pressures and high velocities. Most of the residential areas in the center of town located between the two reservoirs marginally meet fire flow requirements. With exception of recent upgrades, most all the pipe in the network is typically over 40 years of age. Also, the majority of key distribution mains within the system are severely undersized, typically 2" to 6" in diameter. All of the substandard size and older pipe lines must be considered for replacement. A higher priority would be the abandonment of transmission main to Dry Creek Reservoir and the replacement of the 2" and 6" mains in Wa-Na-Pa Street, which currently serve the downtown commercial district. Another equally high priority for improvement of the distribution network would be the installation of a 12" main in Forest Lane to increase fire flows to the Port Industrial Park. This improvement is somewhat development driven and would require immediate installation following the commitment of a large water consumer in the Port area. The priority list is approximate and maintenance issues such as frequent leak repair may dictate the replacement order.

As part of the distribution network, the City should be routinely operating all valves within the system, along with flushing of the fire hydrants. Currently, this work is done in a haphazard manner as time and conditions allow. However, it is important, due to the age of the system, that these components be regularly operated and maintained to assure they are kept in proper working condition.

The City should also begin budgeting for a leak detection study to be done on all remaining water mains within the system. This work may not have to be done within the 6-year planning cycle; however, the need for this study will be driven upon the leakage reduction obtained by the abandonment of the waterlines to the Dry Creek Reservoir and replacement of the water mains in Wa-Na-Pa Street.

Facility Maintenance

The existing structures within the City system vary greatly in overall condition. The City staff maintains the facilities well and show a high degree of pride associated with keeping them in good operating condition. However, many structures and facilities within the system are very old and require replacement versus further maintenance or upgrades. The following is a listing of the major structures within the system and their overall condition.

Dry Creek Reservoir

Dry Creek Reservoir is approaching 120-years of age and is in serious need of replacement. Its age and current condition coupled with the age and high probability of leakage in the connecting transmission main make it the highest priority for facility replacement throughout the system.

Oxbow Tank

The Oxbow Tank is in need of investigation regarding the condition of its interior and exterior coating systems. It is likely this reservoir will require recoating, both interior and exterior, within the 20-year planning period.

Well #1

This well is housed within a small building on Herman Creek Lane. In 2008, the wellhead plumbing was replaced and a new meter installed on the outlet pipe to the distribution system. Also upgraded was the electrical service and building interior and exterior. In 2006, a new pump and column pipe were installed in the well. Other than routine maintenance, this facility should not need work in the 20-year planning cycle.

Well #2

This well is located on the same property as Well #1 and is housed within an underground vault. The well was drilled in 1969 but not used until 1992 when the pump, vault, and other infrastructure was installed. It is recommended the well becomes purely a backup/redundant source for the system following the completion of a 1,000 gpm Well #3 sometime in the 20-year planning period.

Harmony Heaven Booster Pump Station

The Harmony Heaven Booster Pump is located within a 15 foot by 18 foot building on the west side of Moody Avenue and was completed in 2010. The building is in good condition and, because the booster pump has never been used, all infrastructure within the building is in like new condition. Following the completion of the proposed Crystal Springs Tank, this booster pump station can be abandoned.

IMPROVEMENTS RECOMMENDED

Upon evaluation of the existing facilities and the aforementioned deficiencies, the following improvements are recommended to enhance the current water system's capabilities and service. Table 11 lists all of the improvements covered in this section with a tentative ranking and an estimate of cost. The ranking is considered tentative only, with development pressures and available funding having influence on the order in which the improvements are conducted. The schedule is intended as a list to choose from and the costs listed are estimates only. If the City should choose to move ahead with any of these projects, it is recommended that a more detailed estimate be prepared based on current design and construction costs. It is recommended that the City uses the *Engineering News Record Construction Cost Index for Seattle* to make periodic updates to these estimates.

TABLE 11
Recommended System Improvements

Suggested Ranking	Project Description	Performed By	Suggested Year	Estimated Cost
Capital System Improvements				
1	Crystal Springs Tank	Contractor	2014	$1,034,543
2	Forest Lane Water Main Loop	Contractor	2014	$415,800
3	Wa-Na-Pa Street Water Main Replacement	Contractor	2014	$896,873
4	Well #1 Upgrade	Contractor	2015	$76,956
5	Well #3 Development	Contractor	2015	$373,890
6	Ruckel Street Water Main Replacement	City or Contractor	2015	$368,078
7	Forest Lane Water Main Replacement	City or Contractor	2015+	$408,375
8	Oxbow Tank Recoating	Contractor	2020+	$161,345
			TOTAL ESTIMATED COST	**$3,735,859**
System Planning and Maintenance				
1	Water Management and Conservation Plan Upgrade	Engineer	2014	$15,000
2	Leak Detection Study	Engineer/Consultant	2015	$50,000
3	Oxbow Tank Inspection	Engineer/Consultant	2015	$2,500
4	Public Works Standards Update	Engineer	2015	$15,000
			TOTAL ESTIMATED COST	**$82,500**

1. **Dry Creek Reservoir Replacement with 480,000 gallon Crystal Springs Tank**

This project involves the construction of a new 480,000 gallon tank at the southwest corner of Cascade Locks and the abandonment of the Dry Creek Reservoir and the existing transmission lines serving it. Along with the construction of the new tank, approximately 1,010 feet of 12" transmission main will be required to connect to the existing system at the intersection of Undine Street and Moody Avenue. More specifically, this recommended project will require all tasks associated with abandonment of approximately 4,850 feet of 8" dipped and wrapped steel and 1,490 feet of 10" asbestos cement waterline pipe. Additionally, Dry Creek Reservoir will need to be decommissioned through the rubblization of the concrete walls, removal and disposal of the wood-framed roof, and burying of all demolished infrastructure. The project will also include all necessary valving and fire hydrants not yet designed.

The primary purpose for this project is to increase storage capacity within the system to achieve required durations of necessary fire flows in the downtown/commercial area of Cascade Locks. However, this project has many other benefits that will contribute to decreased maintenance costs and decreased profit losses for the City. These decreases are achieved by abandoning the oldest and most leak prone 6,340 feet of hillside waterline. The replacement of Dry Creek Reservoir also relieves the City from liabilities resulting from poor security features surrounding the reservoir.

2. **Forest Lane 12" Water Main Loop**

This project involves installing approximately 2,550 feet of 12" water main in Forest Lane from the Forest Lane-Herman Creek Lane intersection east across the Herman Creek Bridge and then through Port property to Cramblett Way. This main will provide a looped and efficient water transmission route to the Industrial Park to help achieve sufficient fire flows and fire flow duration. This improvement will be driven by Port development in the Industrial Park, which is difficult to estimate a timeline for.

3. **Wa-Na-Pa Street Water Main Replacement**

This project will replace the existing 6", 4", and 2" lines with a 12" water main in Wa-Na-Pa Street between the Bridge of the Gods and the Wa-Na-Pa Street-Forest Lane intersection. Completion of this project will require the installation of approximately 3,940 feet of 12" PVC mainline and will effectively abandon approximately 7,540 feet of 6" to 2" waterline. This installation will also allow for improvements in hydrant and valve locations, which will help future workability and maintenance. Additionally, the abandonment of 7,540 feet of waterline will likely decrease the system leakage. This improvement will also require many reconnections to existing main and service lines along the Wa-Na-Pa Street right-of-way.

The primary purpose of this improvement is to provide sufficient fire flows to the downtown corridor and adequate connection from the wells to the new reservoir. When attempting to draw more than 1,500 gpm from fire hydrants on the west end of town, the current system fails – resulting in negative pressures and excessive velocities. Negative pressure and excessive velocities can result in waterline failure and backflow contamination within the system. Upon completion of this project, coupled with the completion of the Crystal Springs Tank, a downtown fire flow of 2,000 gpm will be achievable for a two- hour duration.

4. & 5. **Expansion/Upgrade of Source Capacity**

This project will require the upgrade of Well #1 from a 500 gpm source to a 1,000 gpm source. Improvements will also include the construction of an additional 1,000 gpm Well #3 to replace Well #2 as a full-time source. These two tasks are not required to occur simultaneously. Furthermore, it would be preferred to drill and construct Well #3 prior to the upgrade of Well #1 in order to provide some redundancy to the system, in turn creating a system that is easier to work on and maintain. However, either can be accomplished prior to the other, provided Well #2 can keep up with consumer demands during the upgrade of Well #1. This improvement will also be somewhat development driven. In the event of a large water consumer development, the City will be required to upgrade source capacity in order to adequately serve all consumers.

6. **Ruckel Street Water Main Replacement**

This project will replace the existing waterline in Ruckel Street to its intersection with Wa-Na-Pa Street. It is primarily 4" in size and severely restricts any available fire flows in the large region it serves. Replacement would consist of approximately 2,700 lineal feet of 8" PVC waterline, along with the associated service reconnects and fire renewals.

7. **Forest Lane Water Main Replacement**

This project will involve the replacement of approximately 2,050 lineal feet of existing 6" cast iron waterline from the intersection of Wa-Na-Pa Street and Forest Lane eastward to Hammond Avenue. The new line will consist of 12" PVC and be connected to the remaining waterline in Forest Lane. System modeling shows that after replacement of the water mains in Wa-Na-Pa Street, this existing section of 6" line becomes the constricting component of the distribution system.

Should the City elect to pursue grant or loan funding for these projects, it is recommended all of the projects be bundled together, funded, and installed as one project. The total estimated cost of the capital improvements is about $3,750,000. This investment would replace the majority of the old undersized system lines as well as provide more efficient system operation due to additional looping and valving. These improvements will also improve fire flows throughout the system.

Chapter 4

FINANCIAL STABILITY OF SYSTEM AND RATE STRUCTURE ANALYSIS

FINANCIAL HISTORY

To ascertain how the City's financial management of the water system has been, its annual budget reports from 2004 thru 2013 were reviewed and the annual operating expense and system revenue were derived based upon the actual amounts from 2004 thru 2012, along with the budgeted amounts for the 2012–2013 and 2013–2014 fiscal years. The information is presented in the following table:

TABLE 12
Water Fund Budget

YEAR	REVENUE	EXPENSE	NET	NOTES
2004-05	$299,907.22	$174,873.41	$125,033.81	Actual
2005-06	$279,011.83	$167,716.61	$111,295.22	Actual
2006-07	$361,379.00	$194,322.00	$167,057.00	Actual
2007-08	$349,646.00	$216,181.00	$133,465.00	Actual
2008-09	$217,111.10	$172,703.48	$44,407.62	Actual
2009-10	$200,184.92	$176,537.80	$23,647.12	Actual
2010-11	$198,752.28	$148,705.12	$50,047.16	Actual
2011-12	$201,391.40	$156,260.71	$45,130.69	Actual
2012-13	$187,400.00	$203,671.00	$(16,271.00)	Budget
2013-14	$232,300.00	$184,402.00	$47,898.00	Budget (not used)
Avg 2004-13	$254,975.97	$178,996.79	$75,979.18	
Avg 2008-13	$200,967.94	$171,575.62	$29,392.32	

As can be discerned, the revenue varied widely across the span of 9 years shown. The most dramatic difference is in years 2004 thru 2008 where the average revenue was on order of $300,000, while years 2008 thru 2013 indicate a revenue more on the order of $200,000. This dramatic increase can be attributed to the residential building boom that was going on throughout the region. Also about this time, Cascade Wood Products was shutdown; therefore, the volume of water sold was reduced.

The operating expenses for the 9 year period remain relatively constant with an average of approximately $179,000. The outlying year being fiscal year 2007 – 2008 with an expense of over $216,000.

Thus, looking at fiscal years 2008 thru 2013, the average annual revenue generated by the system is just under $201,000, or approximately $21.00/month/ERU. The average annual operating expense over this same 5 year period is $171,576; thus, it appears that the water system generates just over $29,000 per year on average.

Pursuant to conversations with the City staff, it is noted that the Public Works Department has been understaffed. The City has recommended an additional City Public Works member, a portion of this persons salary could be attributed to the water fund and, therefore, the City should plan on an additional $20,000 per year of operating expense to be attributed to the additional staff member. With this additional cost, the water system will generate less than $10,000 per year on average, leaving little to no funds available for emergencies or preventative maintenance.

RATE STRUCTURE

The City of Cascade Locks utilizes a combination of a meter charge with a consumption cost. As a method of comparison to other water purveyor fees in the local area, their comparative rates are shown in the following table, along with the comparative costs based upon the current average month volume of 5,176 gallons and the maximum month volume of 8,425 gallons/ERU. As noted, the typical single-family residential consumer in the City of Cascade Locks is charged approximately $24.00 per month with a maximum month cost of approximately $32.00 based upon the volumes outlined above. The average monthly water costs for the fourteen water systems identified is $36.72 per month, which is approximately $13.00 or 51% more per month than the residents of Cascade Locks pay. A simple increase of the meter fee to $20.00 per month would bring the average monthly cost to about $33.00 and be within approximately 12% of the fourteen community average. It would also generate an additional $51,000 of revenue per year based upon the 493 services currently in use. The City should consider an annual meter rate increase equal to the Cost-of-Living Index (COLI) and adjusting the consumption rate every five years based on the COLI as well.

TABLE 13 Comparative Water Rates				
WATER PURVEYOR AND RATE DATA DATE	**RESIDENTIAL MONTHLY RATES**	**AVERAGE MONTHLY COST (5176 GALS)**	**MAXIMUM MONTH COST (8425 GALS)**	**AVERAGE DIFFERENCE FROM CASCADE LOCKS**
City of Cascade Locks (06-2013)	$11.38 5/8" meter fee $2.50/1000 gal	$24.32	$32.44	0.0%
City of Bingen (01-2014)	$27.05 3/4" meter fee $1.52/1000 gal	$34.92	$39.86	43.6%
Community of Carson (01-2013)	$33.28 3/4" meter fee w/ 400 C.F. $2.66/100 C.F.	$41.05	$52.60	68.8%
Chenowith Water District (01-2013)	$35.24 3/4" meter fee $1.67/1000 gal	$43.88	$49.31	80.4%
Crystal Springs Water District (7-2013)	$6.25 3/4" meter fee $5.25/1000 gal	$33.42	$50.48	37.4%
Dallesport Water District (??)	$32.00 3/4" meter fee w/ 5000 gal $1.00/1000 gal	$32.18	$35.43	32.3%
City of Hood River (11-2010)	$28.74 3/4" meter fee w/ 5000 gal $1.78/1000 gal	$29.05	$34.84	19.5%
Ice Fountain Water District (01-2014)	$29.96 3/4" meter fee w/ 6000 gal $2.58/1000 gal	$29.96	$36.22	23.3%
Community of Lyle (05-2013)	$22.68 5/8" meter fee $1.06/1000 gal to 8000 gal $1.36/1000 gal over 8000 gal	$28.17	$31.74	15.8%
City of Mosier (??-2006)	$33.21 5/8" meter fee $1.50/1000 gal to 6000 gal $2.00/1000 gal over 6000 gal	$40.97	$47.06	68.5%
City of Stevenson (03-2012)	$19.50 3/4" meter fee w/ 400 C.F. $0.04/C.F.	$31.18	$48.55	28.2%
City of The Dalles (09-2013)	$52.67 3/4" meter fee w/ 10,000 gal $1.60/1000 gal	$52.67	$52.67	116.6%
City of Troutdale (07-2013)	$0.00 meter fee $2.86/1000 gal	$14.80	$24.10	-39.1%
Community of Underwood (01-2013)	$41.88 3/4" meter fee w/ 200 C.F. $2.77/100 C.F. to 1000 C.F. $3.17/100 C.F. to 6000 C.F.	$55.51	$68.04	128.2%
City of White Salmon (02-2013)	$39.00 5/8" meter fee $1.00/1000 gal to 3000 gal $2.00/1000 gal to 7000 gal $3.00/1000 gal over 7000 gal	$46.35	$54.28	90.6%
	AVERAGE	**$36.72**	**$44.65**	**51.0%**

DISTINCTION OF USERS

The City currently does not make a distinction between simple residential use and commercial, industrial, and public uses. The consumer is charged a monthly fee based upon the meter size with the consumed water then being billed at a constant rate of $2.50 per 1,000 gallons no matter the type of user. While this appears to be a reasonable consumption rate based upon the adjacent communities, the City may want to consider a reduced rate for larger industrial users.

PROJECT FINANCING

As evidenced by the City's financial records, any large projects contemplated for this system must be a cost borne by the user. The cost can either be funded through a reserve within the water system fund or through a combination of grants and loans obtained from outside sources. Due to the fact that the City has approximately $3.75 million worth of projects identified and a Water Fund account balance of approximately $75,000, it is recommended that the City search for funding sources that are available. The City has a few options for funding including the Safe Drinking Water Revolving Loan Fund administered by the Oregon Infrastructure Finance Authority (IFA), the Special Public Works Fund administered by the IFA, or a Rural Development Initiative financing package. These loan packages have interest rates ranging from 1% to 5% and various financing scenarios are presented in the table below.

TABLE 14
Financing Scenarios

		County:	**Hood River**	**Statewide**			
		Population:	1,200	3,919,025			
		% LMI:	37.50%				
Compliance Issue? (Y/N)	N	MHI	$41,019.00	$50,036.00	81.98% of State		
Number Jobs Created	0	County Unemp.	5.60%	7.00%	80.00% of State	**Per EDU**	
		Distress #	N/A		Threshold Rate @ 1.25% MHI	**$42.73**	
		# EDUs*	798		Residential rate - (7500 gal/month)	**$30.13**	
		Annual O&M	$171,576.00		O&M per EDU per mo.	**$17.92**	
		Current debt pmt	$0.00		Existing debt pmt/EDU/mo.	**$0.00**	
Total Project Cost $3,750,000		**FINANCING SCENARIOS**					

Type	**Award**	**Loan**	**Grant**	**Local Match**	**Annual Debt Payment**	**Rate ***	**Term (years)**	**Total of payments**	**Monthly Debt per EDU**	**Total Estimated Monthly Bill**	**Notes**
W/W	$0	$0	$0	$0	$0.00	0.00%	25	$0.00			Not Eligible-In Compliance
SDWRLF	$3,750,000	$3,500,000	$250,000	$0	$135,618.40	1.00%	30	$4,068,551.89	**$14.16**	**$32.08**	Below Threshold Rate
SDWRLF-2	$3,750,000	$3,750,000	$0	$0	$145,305.42	1.00%	30	$4,359,162.74	**$15.17**	**$33.09**	Below Threshold Rate
SPWF	$3,750,000	$3,187,500	$0	$562,500	$226,160.96	5.00%	25	$5,654,023.94	**$23.62**	**$41.53**	Below Threshold Rate
CDBG	$0	$0	$0	$0	$0.00	0.00%	20	$0.00			Not Eligible-LMI<51%
USDA**	$3,750,000	$2,812,500	$937,500	$0	$138,893.68	2.75%	30	$4,166,810.44	**$14.50**	**$32.42**	Below Threshold Rate
USDA-2**	$3,750,000	$3,750,000	$0	$0	$185,191.58	2.75%	30	$5,555,747.25	**$19.34**	**$37.26**	Below Threshold Rate

Notes: *Estimated rates; Direct rates are set quarterly. Oregon Bond Bank rates are set at time of the Bond Sale. ** USDA/RUS Payment includes 10% Annual Debt Service; **These Scenarios are ESTIMATES ONLY and should not be considered actual rates, costs, or funding commitments.**

As noted, each of the three options has their own challenges. All of them would have an estimated monthly water bill of less than the threshold rate and, therefore, would likely not have a grant funding component. In addition, the Special Public Works Fund would pay no more than

85% of the project total. Therefore, additional funds, either local or other agencies, would have to be acquired for the match. The Special Public Works Fund has a higher probability of award if it can be demonstrated that new jobs will be created with the system improvements. It should be noted that based upon the operating expense records that the typical monthly operation and maintenance costs per ERU is approximately $18.00. This amount should be increased by a minimum of $3.00 per month per ERU to account for the additional Public Works staff proposed. Any of the scenarios will have monthly debt payments between $14.00 and $23.00 per ERU. Thus, City residents should recognize that rates are likely to climb to between $35.00 and $45.00 per month. This is near the recognized threshold rate of 1.25% of the Median Household Income (MHI), which is equal to $42.73 per month.

SYSTEM DEVELOPMENT CHARGES

It is beyond the scope of this Plan to complete a detailed System Development Charge analysis until the City establishes the final commitments for financing of the improvements. When this determined, the City should prepare an updated System Development Charge Ordinance for the water system, establish an appropriate System Development Charge fee, and evaluate if their current hookup fee is sufficient. The System Development Charge and the hookup fee are two entirely different revenue sources for each new connection to the system. A System Development Charge, as explained earlier in this report, should be used to finance the cost of improving the system based on a sound analysis of the future cost of the system. The City currently charges time and materials for a service connection fee for each hookup and considers than adequate to cover the cost of construction of the service pipe, meter, and all appurtenant devices to provide service to the users property line. The waterline from the meter to the structure is ordinarily at the property owner's expense and typically done by a licensed plumber.

Chapter 5

WATER CONSERVATION AND RIGHTS ANALYSIS

The State of Oregon Administrative Rules (OAR) Chapter 690, Division 86, encourages each municipality to formulate and adopt a Water Management and Conservation Plan (WMCP). The City of Cascade Locks adopted a Water Management and Conservation Plan that was submitted to the Oregon Water Resources Department in November 2004. This WMCP currently needs to be updated; however, much of the information within the document is still pertinent and is summarized below. An adopted WMCP is a potential requirement of agencies funding future capital improvement projects and may be required when administrative transactions are completed with the Water Resources Department.

In its standard operating procedures, the City does employ several effective methods of limiting water use. Conservation of water is an ongoing issue with the community.

WATER USE MONITORING

The City water system uses wells and pumps to provide municipal water to the entire service area. It has a series of cross-checks to monitor water use. Each of the well pump motors has a run time meter. Additionally, there is a functioning and calibrated water meter on the system supply main from each wellhead. All individual services in the entire water system have a water meter on the service line. There are no known unmetered users within the system.

The City currently reads all of its meters each month. These readings are reviewed against one another and the prior month's reading to detect any line leakage, water loss, or other problems. The City believes it complies with the measurement standard of the State's Annual Use Reporting Program.

CONSERVATION MEASURES

The City instituted metering of the system in 1993. All services in place at that time and those added as the system developed have been metered. Metering of the system serves as an effective measure to conserve water use by requiring the consumers to pay for each and every unit of water

they utilize. This has curtailed excessive landscape irrigation and other such activities over the longterm. There are no official records as to the amount of savings accomplished by metering; however, the use of meters has provided the City with a reliable tool for monitoring water use in the system. With meters at both the source and the services, the City is able to calculate and compare water production versus water billed.

It should be noted that the City bills for approximately 3.92 million gallons of water per month; however, they produce more than 7.86 million gallons per month. The difference, approximately 3.94 million gallons per month, is lost and/or unaccounted for water. Due to the fact that the source meters are new and the service meters are relatively recent, it is the opinion of City staff that the majority of this loss is through leakage of the old distribution mains, primarily the pipe lines that serve the Dry Creek Reservoir. In addition, there are numerous locations within town where the old steel pipe has been exposed and is in poor condition. Thus, conventional conservation measures at homes are not likely to achieve measureable results until the line leakage is resolved. Currently, the typical single-family residence utilizes only 170 gallons per day, which is approximately half of the statewide average. Thus, it is demonstrative that the City residents are not wasting water.

The following is a listing of potential conservation measures. Some of these are currently in place, while some of them may be enacted as a future water conservation method.

Rate Structure to Encourage Conservation

The City utilizes a consumptive rate schedule so that the more water that is used, the more the consumer pays. An alternative to this method would be a tiered rate structure whereby the lower volumes of water utilized are charged a lesser rate, while as use increases the rate increases as well to provide a monetary penalty to customers who use excessive amounts of water. A drawback to this rate structure is the fact that the average daily use is so low, the tiered structure would have to start at an abnormally low volume such as 1,000 or 2,000 gallons per month for a base rate and escalating from there.

System-Wide Old Line Replacement Program

The City typically repairs leaks as they are identified; however, they do not have a program in place to replace the aging lines. The City is encouraged to replace waterlines when it is determined the loss exceeds 15% of the total water produced. Currently, the loss exceeds 50% of the total water produced. The improvements identified within the Master Plan will abandon a significant amount (approximately 20%) of the existing old waterline and will replace another 10% of the older lines. The City should also plan on preparing an annual budgetary line item for in house replacement of aging waterlines. An aggressive pipe replacement policy will help to curtail water loss.

Annual Water Audit

The City currently complies with this requirement and reviews the use of its water on a monthly basis. All water sources and services, as mentioned prior, are currently metered.

Meter Program

All services are currently metered within the water system. The City should conduct a random sample and testing of existing water meters within their system to determine the need for meter replacement schedule. Typically meters have a service life of approximately 10 to 15 years; thus, the customer meters, at this point, are likely needing replacement.

WATER RIGHTS

The current water rights owned by the City of Cascade Locks include three certificates, two permits covering two surface water sources, and two wells. The water rights are summarized in the following table.

TABLE 15
Water Rights

CERTIFICATE NUMBER	USE	PRIORITY DATE	AMOUNT	POINT OF USE
Certificate 12131	Municipal	November 15, 1935	2.0 cfs	Dry Creek
Certificate 11816	Industrial Manufacturing and Sprinkling	January 22, 1937	1.0 cfs	A Spring
Permit S-18134	Municipal	January 19, 1948	10.0 cfs	Dry Creek
Certificate 41302	Municipal	March 5, 1969	0.50 cfs	Well #1
Permit G-12666	Municipal	May 6, 1991	3.5 cfs	Wells #1 & #2

Discussion

The listed certificates and permits cover the City's two wells, Dry Creek Diversion, and a spring. The following is a discussion of what is known of each of these rights and recommendations for future actions affecting them.

- **Certificate 12131**

  This certificate of water right was issued to "The Town of Cascade Locks". This certificate has a priority date of November 15, 1935. It is for municipal use in the amount of 2.0 cfs (898 gpm or 1.29 mgd). This water right should be looked at for potential use in the near future. If no use is going to be made, the water right should be leased instream. The leased years count as years of use to eliminate a potential non-use issue.

- **Certificate 11816**

  This certificate of water right was issued to "City of Cascade Locks". This certificate has a priority date of January 22, 1937. The use is listed as Industrial, Manufacturing, and Sprinkling in the amount of 1.0 cfs (449 gpm or 0.65 mgd). This water right should be looked at for potential use in the near future. If no use is going to be made, the water right should either be canceled to remove it from the records or looked to see if it can be leased instream. The leased years count as years of use to eliminate a potential non-use issue.

- **Permit S-18134**

  This is a permit, meaning that this is a water right which has been applied for and approved for development but not yet fully perfected and a certificate of water right issued. This permit has a priority date of January 19, 1948 for municipal use. The source of water is Dry Creek. The current completion date for perfection of this water right is October 1, 1995. An extension of time limits to complete development was filed with Oregon Water Resources Department on March 1, 2004. The City is waiting for OWRD to process the extension request. Once the extension is processed, a review of the future on this water right needs to be made. If no future expansion is going to be made, then a Claim a Beneficial Use can be made to prove up on the portion developed and processed to a

certificate of water right. This will complete this right. The Certificate can be then leased instream to protect for some future need.

- **Certificate 41302**

  This certificate is for the use of Well #1 for the Municipal use. The quantity of water allowed is 0.50 cfs (224 gpm, 0.32 mgd). The priority date is March 5, 1969. No current recommendation for modifying this right.

- **Permit G-12666**

  This is a permit, meaning that this is a water right which has been applied for and approved for development but not yet fully perfected and a certificate of water right issued. This permit has a priority date of May 6, 1991 for municipal use. It covers Wells #1 and #2. The current completion date for perfection of this water right is October 1, 1999. An extension of time limits to complete development was filed with Oregon Water Resources Department on March 1, 2004. The City is waiting for OWRD to process the extension request.

Summary

The City's water rights total 17 cubic feet per second with 13 cfs from surface water sources and 4 cfs from the two groundwater wells. The two groundwater wells are the water supply currently serving the system. The water right on these two wells (4 cfs) provides for a maximum withdrawal of 2,585,088 gallons per day, which is more than 5 times the estimated amount of water utilized in 2033 during the Maximum Daily Demand (516,451 gallons). Thus, it is apparent that the current groundwater rights provide for a sufficient supply of water to the City of Cascade Locks for the foreseeable future. The surface water rights should be maintained by the City and either leased back for instream purposes or possibly negotiated for a possible offset for the to be determined fish persistence conditions that are involved with Permit G-12666.