City of Willamina
Water Master Plan
FINAL
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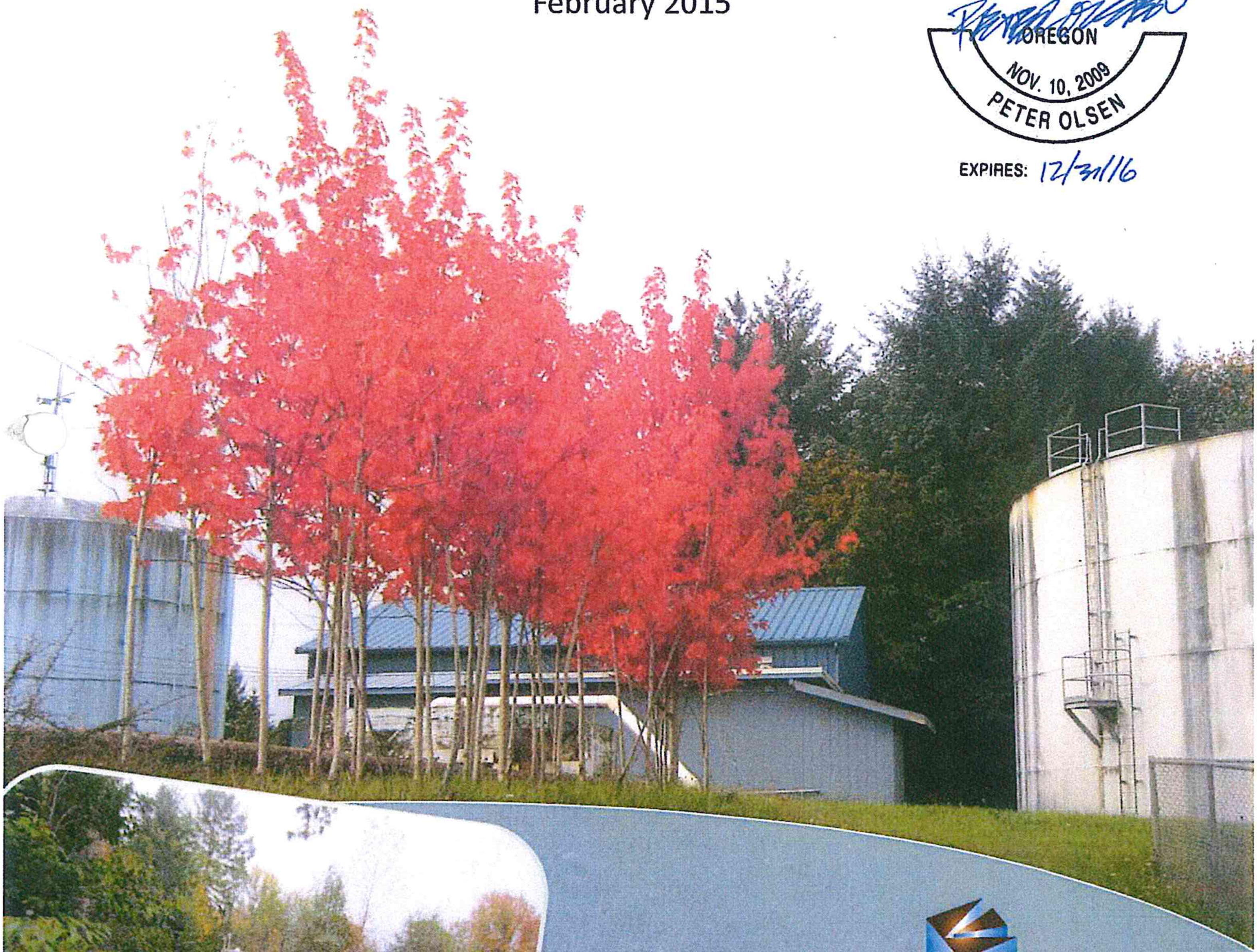

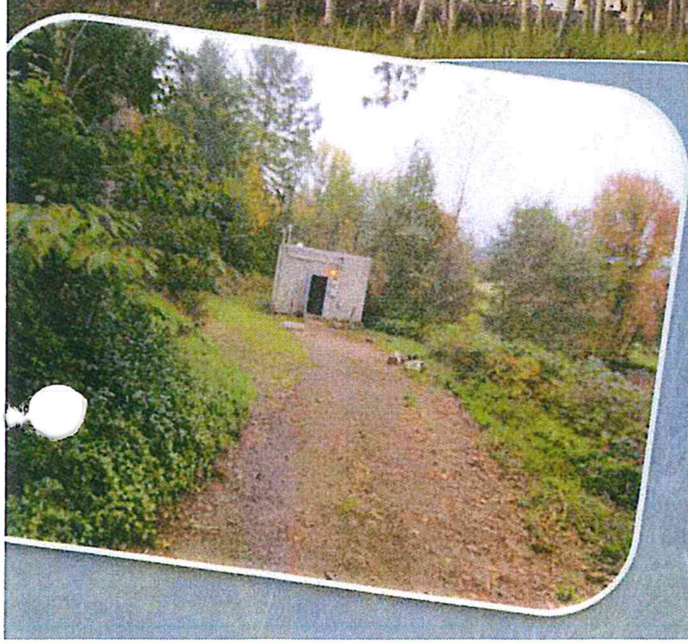

KELLER associates

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Water Master Plan

City of Willamina, Oregon

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ACRONYMS, ABBREVIATIONS, AND SELECTED DEFINITIONS

AC	asbestos cement
ACH	aluminum chlorohydrate
cfs	cubic feet per second
CI	cast iron
CIP	Capital Improvement Plan
DHS	Department of Human Services
DI	ductile iron
EDU	equivalent dwelling unit
EFA	Economic and Financial Analysis
ft	feet (or) foot
FY	fiscal year
Gal	gallon
gpcd	gallons per capita per day
gpm	gallons per minute
HVAC	heating, ventilating and air conditioning
HGL	hydraulic grade line
hp	horsepower
in	inch
ISO	Insurance Services Office
KW	Kilowatt
MCC	motor control center
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
NSF	National Sanitation Foundation
OAR	Oregon Administrative Rules
OWRD	Oregon Water Resources Department
PLC	programming logic control
PRV	pressuring reducing valve
psi	pounds per square inch
PSU	Portland State University
PVC	polyvinyl chloride plastic
SCADA	supervisory control and data acquisition
SDC	system development charge
SEC	U.S. Securities and Exchange Commission
UGB	urban growth boundary
VFD	variable frequency drives
WMP	water master plan or water management plan
WMCP	water management and conservation plan
WTP	water treatment plant
WTPFPS	water treatment plant facilities planning study
WWTP	wastewater treatment plant

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1.0 INTRODUCTION

1.1 EXISTING SYSTEM OVERVIEW

The City of Willamina owns and operates a water system that serves approximately 2,025 residents and the Willamina Lumber Mill just outside the city limits. Source water is conveyed from Willamina Creek to the City's water treatment plant. The treatment plant had its last major upgrade in 1998. The treatment process consists of chemical addition, flocculation, settling, and filtering.

From the water treatment plant, water is delivered to City residents through a network of pipelines in four pressure zones. One zone is directly served by ground level reservoirs, and the other three are served either directly or indirectly through booster pump stations. In addition to the Hill Drive Reservoir, there are two reservoirs located at the water treatment plant site. All reservoirs combined provide a total of approximately 1.65 MG of storage.

1.2 PURPOSE AND NEED

This master plan report presents findings and recommendations relating to the Willamina municipal potable water system. The plan was commissioned by the City in an effort to determine the current state of the water system and to plan for future needs. The planning study is intended to replace previous water system planning efforts and provide a progress report for the 2009 Water Management and Conservation Plan (WMCP). Funding for this Master Plan is provided by a Community Development Block Grant through the Infrastructure Finance Authority of the Oregon Business Development Department.

A review of the fundamental planning elements such as population, water supply and demand, development and household densities, and fire flow requirements is presented, as well as an analysis of the system, followed by a summary of recommendations and a capital improvement plan. Figures and supporting data for the information presented in this report have been included in the appendices for reference.

1.3 ACKNOWLEDGEMENTS

Keller Associates gratefully recognizes all those who have provided their support and assistance in the completion of this study. Keller Associates has worked as part of a technical review committee (involving key City staff and City Council members) to understand the challenges facing the system and to develop practical, cost-effective solutions. Members of the technical review committee include:

- Sue Hollis, City Recorder
- Jeff Brown, Public Works Director
- Debbie Bernard, City Office Coordinator
- Corey Adams, Mayor
- Rita Baller, City Council
- Allan Bramall, City Council
- Gary Hill, City Council
- Ila Skyberg, City Council
- Jeri St Onge, City Council
- Laurie Toney, City Council
- Kevin Dobie, Willamina School District
- Robert A., Willamina School District
- Dennis Ulrich, Planning Commission
- Dave Meier, West Valley Fire Department
- Steve Candela, Oregon State Fire Marshall
- Rolly Heuser, Willamina Business Group Economic Improvement District

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2.0 PLANNING CRITERIA

This section summarizes the planning criteria by which the system is evaluated and needed improvements are identified. These criteria include population, development densities, potable water demands, land use, and other factors affecting the water system.

2.1 STUDY AREA

The study area encompasses the existing Urban Growth Boundary (UGB) and a small area outside of the UGB, Willamina Lumber's Mill, which is currently serviced by the water system. The study area is illustrated in Figures 1 and 2 in Appendix A. The City reports that, as a condition of one of the City's water rights, expansion of the water system to new users outside of City limits is not allowed.

2.2 LAND USE AND DESIGN DENSITIES

Land use assumptions for existing and future development were based on the City of Willamina Comprehensive Plan, Willamina development code, and current zoning map. Figure 1 illustrates the existing zoning.

Design densities refer to anticipated maximum development densities for residential land use within the study area. These densities serve as the basis for estimating potable water demands in areas yet to be developed. Table 2.1 presents anticipated household densities for residential areas within the City. The residential housing densities (dwelling units per acre of land) are derived from the City of Willamina Development Code.

TABLE 2.1: Design Densities

Land Use Designation	Land Use Area	Design Density
R-1	Single Family	5 Dwellings / Acre
R-2	1-3 Family	6 Dwellings / Acre
R-3	Multi-Family	11 Dwellings / Acre

2.3 POPULATION PROJECTIONS

Table 2.2 summarizes historical and projected populations used for this planning effort. Growth rates were obtained from *Population Forecasts for Yamhill County, its Cities and Unincorporated Areas 2011-2035*, which was completed by Portland State University (PSU) Population Research Center (2012). This study provided population projections for the Urban Growth Boundary (UGB) including residents outside the city limits, and those within city limits but outside the Yamhill County limits. This distinction is necessary because the city limits include areas from both Yamhill and Polk Counties. Keller Associates used the growth rates from the population forecast to project future populations based on the 2012 PSU certified population. The city population in 20 years (2034) is projected to be 2304; population projections for other years are shown in Table 2.1.

2.3.1 Buildout

Keller Associates used the 2010 US Census data statistic of 2.89 people per household and the 2034 projected population to calculate that 97 dwelling units would be needed to provide for the increase in population for 20 years. This increase in dwellings can be accommodated by the undeveloped area within the UGB with less than one dwelling per acre average, less than design residential densities. Thus, buildout is not expected to occur during the planning period. The undeveloped areas within the current UGB provide sufficient area for the City to grow to its projected 20-year population.

TABLE 2.2: Existing & Future Populations

Year	Source	Population	Projected / Reported
1940	Comprehensive Plan	667	Reported
1950	Comprehensive Plan	1082	Reported
1960	Comprehensive Plan	954	Reported
1970	Comprehensive Plan	1193	Reported
1980	Comprehensive Plan	1749	Reported
1990	Comprehensive Plan	1700	Reported
2000	US Census	1844	Reported
2010	US Census	2025	Reported
2011	PSU	2025	Reported
2012	PSU	2025	Reported
2013	PSU*	2025	Projected
2018	PSU**	2112	Projected
2023	PSU**	2176	Projected
2028	PSU**	2232	Projected
2033	PSU**	2291	Projected
2034	PSU**	2304	Projected

* No estimate published yet, assume population is the same as it has been for the last 3 years
**Projected using PSU grow th rate and 2012 certified poulation

2.4 PRESENT AND FUTURE WATER DEMANDS

2.4.1 Present Demands

Table 2.3 shows the historical per capita demand data for January 2010 through August 2013 along with the design demands that were used for evaluating the existing system. Supporting data can be found in Appendix B.

Historical data from the SCADA system was used to determine the annual average, minimum month, maximum month, maximum day, and peak hour water system demands. Other data considered for analysis included consumption data and production data. The consumption data is recorded once a month for all metered customers. The data set was adjusted to account for a known water meter reading error explained in more detail under "meter inaccuracies" in section 2.4.2.

In evaluating instantaneous demands, the flow meter data recorded by the City's SCADA system was used. This meter, located on the 12-inch pipe leaving the reservoirs to the distribution system, captures real time system water usage (with the minor exception of eight homes and a church, which are serviced by the unmetered 6th St. Booster Station that draws water upstream of the meter). A 24-hour moving average over the entire metered data set was used to determine the maximum day demands for each year. Peak hour demands were calculated by finding the maximum value of a 60-minute running average on the maximum day of each year. The design values were selected based on the minimum, maximum, or average of each year, using only those years that provided sufficient data.

The selected maximum day and peak hour result in a peaking factor (peak hour divided by maximum day) of 1.7, which is consistent with similar water systems. Water demands per capita include demands from residential, commercial, industrial and institutional users. The demands also include unaccounted-for water (e.g. water loss, flushing, and unmetered usage).

TABLE 2.3: Existing Water Demand (gallons per capita per day)

Demand Scenario	2010	2011	2012	2013*	Design Values 2010-2013
Annual Average (gpcd)	109	119	127	139	118
Min Month (gpcd)	96	91	106	115	91
Max Month (gpcd)	139	156	171	169	171
Maximum Day (gpcd)	193	206	211	219	219
Peak Hour (gpcd)	307	266	295	373	373

*Partial Year

** The population for years 2010-2012 remained unchanged at 2025. Since the 2013 population estimate is not yet published, pop. 2025 was used for all years

Chart 2.1 and Table 2.4 show a comparison of Willamina's typical water use to other communities in the region. Overall, Willamina's water use is similar to comparable communities. Amity is a good example of a similar neighboring community with a comparable population and water demands. Some of the higher per capita usage reported in other communities reflects a larger commercial/industrial base.

CHART 2.1: Comparison of Per Capita Water Consumption

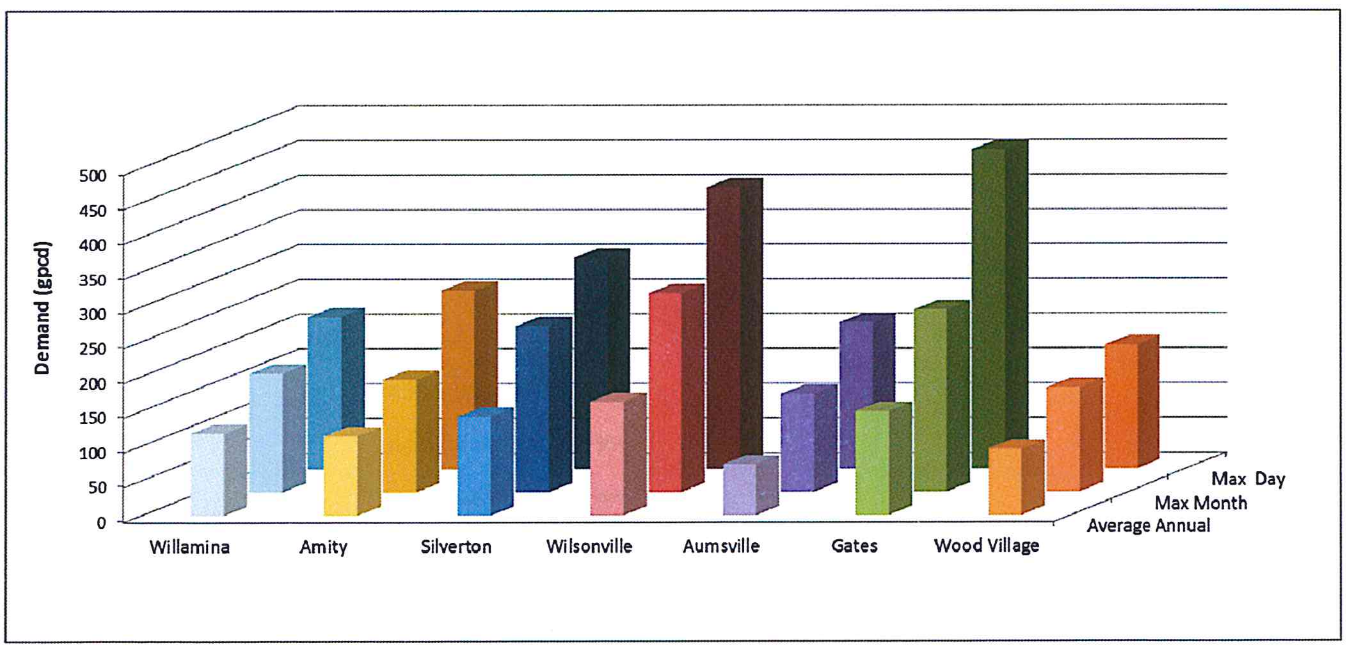


TABLE 2.4: Comparison of Per Capita Water Consumption

Demand (gpcd)	Willamina	Amity[1]	Silverton[2]	Stayton[3]	Wilsonville[4]	Aumsville[5]	Gates[6]	Wood Village[7]
Average Annual	118	114	142	309	163	73	149	95
Max Month	171	162	239		286	141	262	150
Max Day	219	257	304	752	405	210	459	178

1. From 2013 Amity Water Master Plan
2. From August 2011 Silverton Water Master Plan.
3. From May 2012 Stayton Water Model Distribution Systsem CIP update tech memo and PSU certified population estimate.
4. From 2011 Demand Analysis
5. From 2014 Aumsville Water Master Plan Update
6. From January 2012 Demand Analysis
7. From 2014 Wood Village Water Master Plan Update

Chart 2.2 shows monthly metered water consumption for 2010-2013, prorated to match the calendar months. Peaks correspond to summer months, when demands are almost double the winter demands. Increases during the summer periods correspond to typical residential and commercial irrigation usage. The mill's usage varies from month to month, and does not appear to be related to time of year or irrigation usage.

An estimate of irrigation usage is found in Table 2.5, which compares wet season (November-May) usage with dry season usage (June - October). The average wet season usage is estimated as the base water used without irrigation. The wet season average was subtracted from the monthly usage in the dry season to estimate how much is used for irrigation in each month. On an annual basis, approximately 19 percent of the water is used for irrigation. However, during the month of August, closer to half of the water usage is estimated to be used for irrigation.

CHART 2.2: Monthly Metered Water Consumption (gallons)

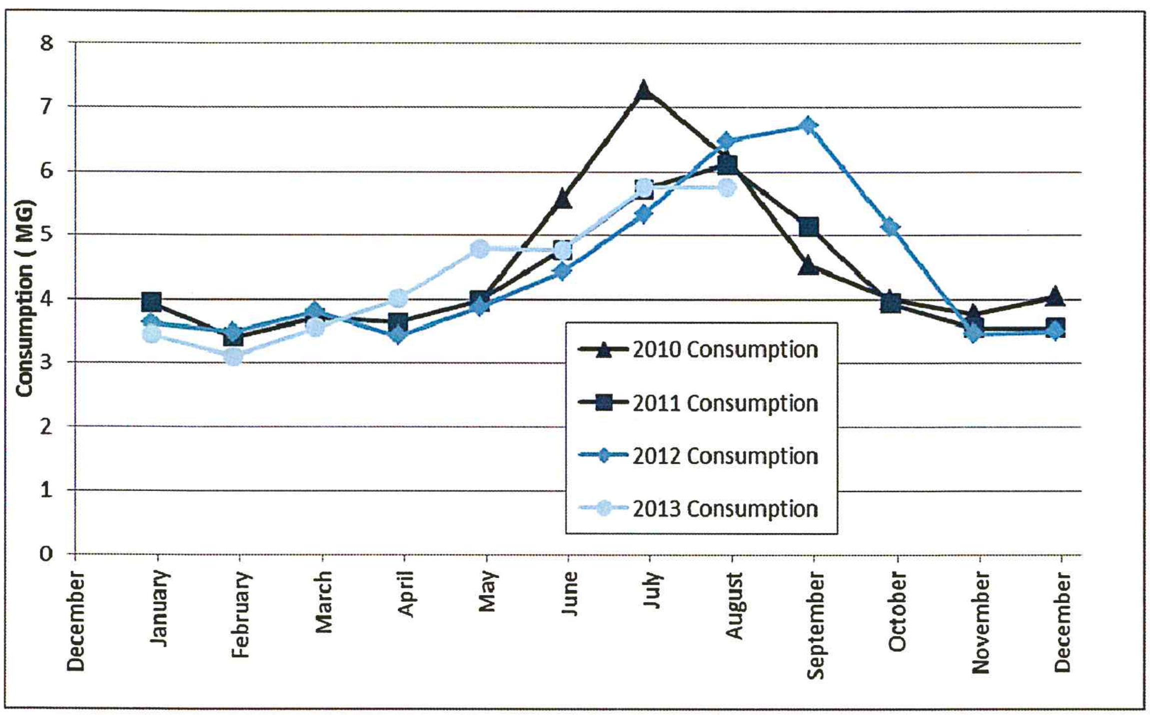


TABLE 2.5: Estimated Irrigation Usage

Period	3- year Consumption Average (MGM) Aug.2010-July 2013	Estimated Irrigation Usage (MGM) **	% Irrigation Usage
January	3.7	0.0	0%
February	3.3	0.0	0%
March	3.7	0.0	0%
April	3.7	0.0	0%
May	4.2	0.6	14%
June	4.7	1.1	24%
July	5.6	2.1	38%
August	6.3	2.9	46%
September	5.5	2.0	37%
October	4.4	0.8	18%
November	3.6	0.0	0%
December	3.7	0.0	0%
Wet Season*	3.7	0.0	0%
Total**	52.2	10.2	19%

* The wet season consists of the water usage months and assumes no irrigation use during that time.
** Includes estimated 0.7 MG irrigation for unmetered park as estimated by City distributed with the same % per month as residential

Chart 2.3 shows the breakdown of water consumption by user category for the study period of May 2010 – August 2013. On average, approximately 70% of all water metered can be attributed to single family and multifamily residential usage. Willamina Lumber used an average of 19% for the 2010 – 2013 period, with a maximum annual percentage of 28% of the City's consumption for the year 2012.

CHART 2.3: Water Usage by User Category

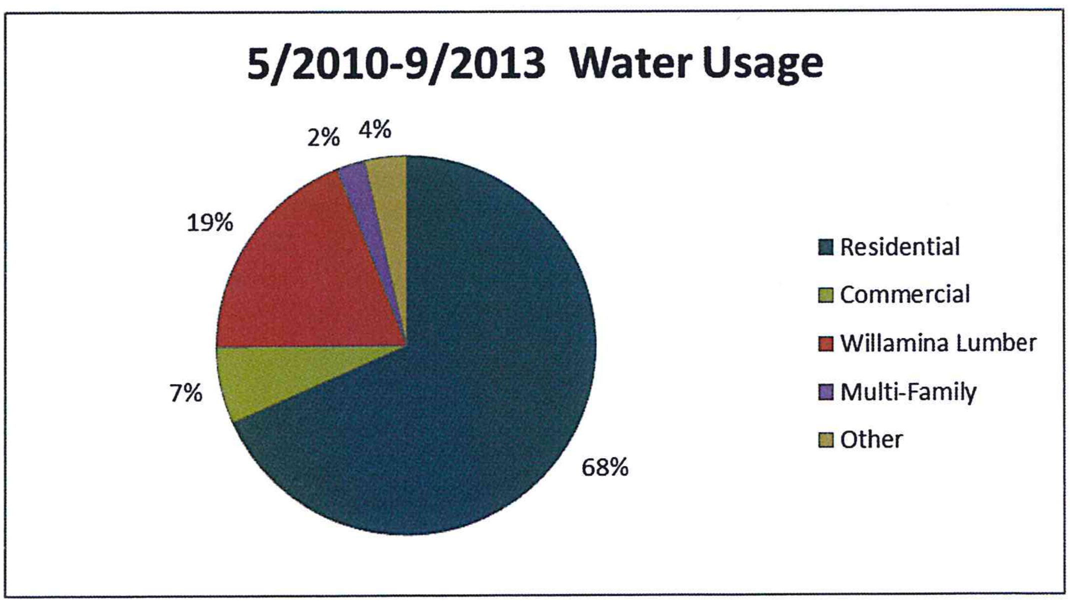
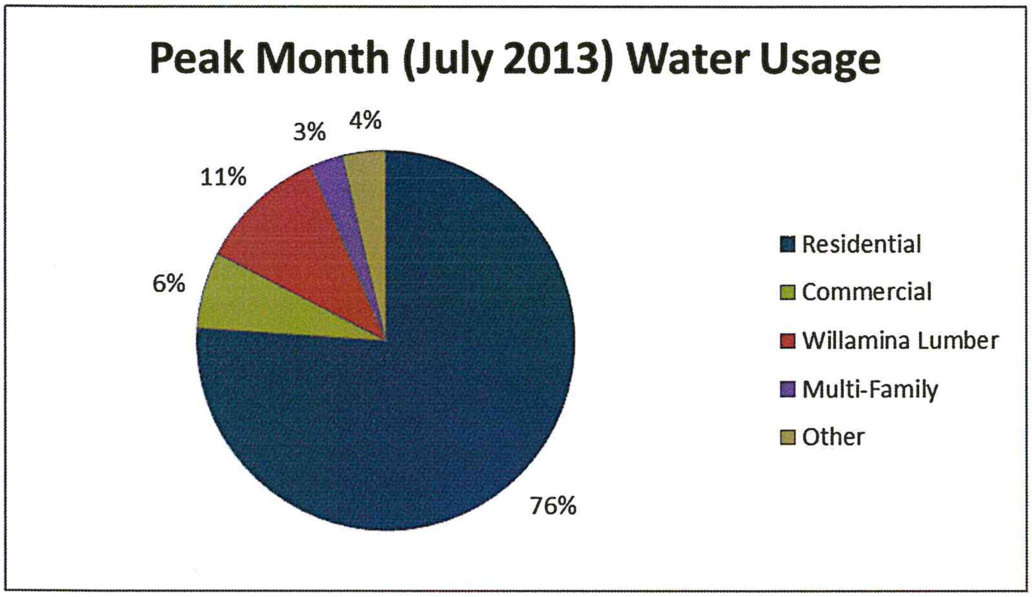


Chart 2.4 shows a breakdown of water consumption during July, the maximum month usage in 2013. As expected, there is slightly more residential use during this time resulting from irrigation.

CHART 2.4: Peak Month Water Usage by User Category



2.4.2 Unaccounted-for Water

Unaccounted-for water refers to the difference in water being produced and the water being metered at the places of use. Sometimes this is referred to as water loss, and it can include unaccounted-for water uses such as hydrant flushing, fire fighting, street cleaning, inaccurate meters, and leaking pipes. If water loss exceeds 10%, Oregon Administrative Rules (OAR Division 86) require that the water supplier implement a leak detection program. These rules require that the program be regularly scheduled and systematic, address distribution and transmission facilities, and utilize methods and technologies appropriate to the supplier's size and capabilities. Tracking water loss and developing a leak detection and repair program is required by, and was addressed in more detail, in the 2009 Water Management and Conservation Plan (WMCP).

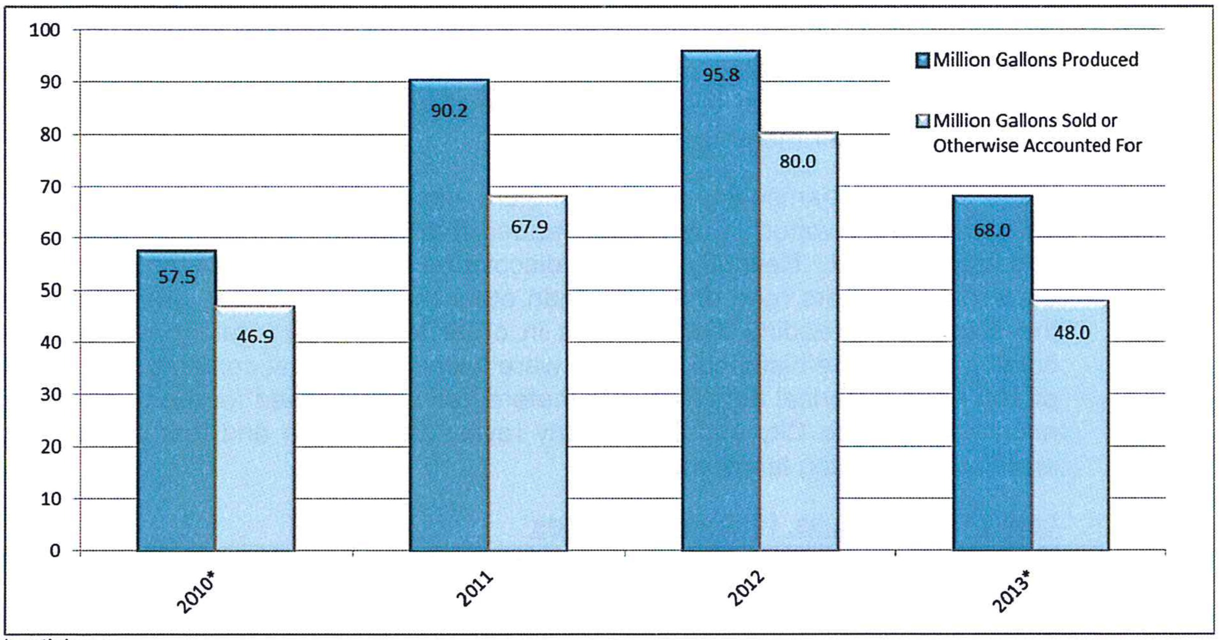
Table 2.6 and Chart 2.5 compare annual water production and water consumption (individual meter data from May 2010 to August 2013) This comparison accounts for the estimated unmetered usage from parks, wastewater treatment plant (WWTP), backwash for the water treatment plant (WTP), line flushing, street sweeping, vactor, bulk water sales, hydrant flushing and fire fighting. The remaining difference between production and consumption accounts for approximately 22% water loss on average.

TABLE 2.6: 2012 Water Loss

Year	Produced (MG)	Accounted for (MG)	Water Loss %
2010*	57.5	46.9	18%
2011	90.2	67.9	25%
2012	95.8	80.0	17%
2013*	68.0	48.0	29%
total	311.5	242.7	22%

*partial year

CHART 2.5: 2012 Monthly Water Production vs. Consumption



*partial year

Potential sources of unaccounted-for water in the Willamina system and their potential for occurrence include the following:

Source	Potential
• Non-City unmetered water users	Low - Moderate
• Water theft	Low
• Meter inaccuracies	Moderate
• Leaky pipes, valves, hydrants, services	Moderate

Unmetered Water Users

There are a few unmetered connections throughout the City. These users are charged at a flat rate regardless of water usage. It is recommended that the City read meters at all connections.

For the unaccounted-for water usage analysis, water usage for the WWTP, backwash for the WTP, water line and hydrant flushing, street sweeping, vactor truck, bulk water sales, firefighting, and unmetered park locations were assumed. Keller Associates recommends the City install meters at the WWTP, backwash for WTP, and unmetered park locations to improve accuracy of tracking water consumption.

Water Theft

Water theft could result from contractors or other water users illegally taking water from the City's system. This could occur at fire hydrants or from illicit connections to the City's mainlines. Water theft from hydrants would likely be observed by City staff if it amounted to significant amounts of water. Illicit connections could potentially be located during a leak detection study, provided that water was being drawn during the study. The probability that water theft accounts for a significant portion of the water loss is believed to be low.

Meter Inaccuracies

In 2003, the City began upgrading all meters to touch read meters. As of spring 2014, approximately 75% of the meters have been replaced. The City should continue these efforts with the remaining meters as part of an ongoing water meter replacement program. At the end of the useful life of meters, they should be replaced. Typical lifespan for a water meter is 20 years.

Meter accuracy, particularly for large meters, can be responsible for large portions of unaccounted-for water. It is recommended that the City periodically test, calibrate, and repair meters. Recently, the City discovered that the meter at the mill and one of the school's meters read differently than other meters in the city, and have changed the process for reading these meters in order to more accurately account for their consumption. The historical readings were lower than actual consumption by a factor of 100. The historical data for these meters has been revised for the purposes of this master plan. The City should regularly review meter data and test meters, with an emphasis on testing larger meters.

Leaky Pipes, Valves, Hydrants, Services

Water loss is often attributed to older, leaky pipes. In a small water system these leaks could account for a significant percentage of the demand within the City, and should be fixed as budget is available. A system-wide leak detection study should be completed every 5 years to determine the locations and magnitude of leaks within the system. Each year, 1/5th of the system would be studied.

2.4.3 Future Demands

Existing and projected future water system demands are presented in Table 2.7. These demands conservatively assume that future demands per capita will be similar to existing demands per capita. If the City implements additional water-saving practices, these demands may decrease. These demands were used as a basis to develop future improvements in the City's water system.

TABLE 2.7: Existing and Future Water System Demands

Year	Design	2018	2023	2033
Population	2025	2112	2176	2291
Average Annual Day (gpm)	166	173	178	188
Min Month (gpm)	128	134	138	145
Max Month (gpm)	240	251	258	272
Max Day (gpm)	307	321	330	348
Peak Hour (gpm)	525	548	564	594

A major developer has expressed interest in constructing a horse racing facility close to Willamina. They have interest in using water from the City. If this occurs, the developer will need to do a planning study (approved by the City engineer) on the effects of the development on the existing system including storage, treatment, intake, and distribution capacities throughout town, and update the CIP. It is likely that major improvements will be needed beyond the CIP in this report to address these demands. In any potential negotiations with large developments, it is recommended that the City consider not only the capital costs of such improvements, but also the operation, maintenance, and replacement costs.

2.4.4 Distribution System Planning Criteria

Planning criteria, including the system performance standards for pressures and flows, are summarized in Table 2.8. For the City of Willamina, the highest flow requirements correspond to a fire flow during maximum day demands.

In evaluating existing residential areas for fire flows, Keller Associates assumed a minimum fire flow requirement of 1,000 gpm for 2 hours while maintaining at least 20 psi in the distribution system. Aside from residential areas, the local fire authority requested that a fire flow capacity of 1,500 gpm be provided for commercial areas, schools, and large churches. The system should be capable of providing these fire flows while also satisfying maximum day demands. For the purposes of this analysis, we assumed that all of the pumps were operational for delivering fire flows to the pressure zones serviced directly by the booster stations.

In addition to design standards for the delivery of flow rates, standards for system pressures are necessary for the normal daily operation of the water system. The aim of pressure standards is to provide safe and reliable service to water users under a variety of system conditions. If pressures are too high, damage can occur within the distribution system and at points of use. If pressures are too low, a variety of issues arise - including potential for backflow contamination, limited water availability, and a lower level of service. The recommended distribution pressure standards for new connections are listed in Table 2.8. Keller Associates recommends that the booster facilities be capable of delivering peak hour demands with one of the main pumps off-line.

Table 2.8 – Distribution System Pressure Standards

System Scenario	Pressure
Minimum Pressures (peak hour)	40 psi
Minimum Pressure (fire)	20 psi
Maximum Pressure (w/o regluators)	80 psi
Maximum Pressure (mainline)	100 psi

2.4.5 Regionalization

Willamina is geographically close to Sheridan and Amity, making regionalization a possibility. An April 2008 Yamhill County Water Supply Analysis Report recommended construction of a reservoir on upper Willamina Creek to supply these three cities. While the need for additional supply is not anticipated for Willamina over the next 20 years, a redundant water source would be beneficial. Another option for regionalization would be to add a metered intertie between Sheridan and Willamina. This connection could be used as an emergency redundant supply for both cities.

An independent evaluation of regionalization is beyond the scope of this project. Since an intertie is not anticipated to be needed within the planning period, this cost has not been included in the CIP.

3.0 EXISTING FACILITIES EVALUATION AND RECOMMENDATIONS

3.1 GENERAL

The City obtains its water from Willamina Creek. It is pumped from the screened intake through a sediment removal system to a sand filter Water Treatment Plant (WTP). Water travels from the WTP to two reservoirs that supply a distribution system with four pressure zones. One pressure zone is gravity fed by the reservoirs at the WTP, and the other three zones and the Hill Drive Reservoir are directly or indirectly supplied by booster stations. (See Figures 3 and 4 in Appendix A for details of the system layout.)

This section summarizes the condition of the City's existing facilities and provides recommendations for improvements. Facilities covered in this section include the surface water intake facility, three storage reservoirs, two booster pump stations, distribution system, and the WTP. Associated costs for the recommended facility improvements are presented in the capital improvement plan found in Section 4.

3.2 EXISTING WATER INTAKE AND SOURCE EVALUATION

This section documents known issues and recommended improvements based on input from City staff and a previous study performed by Shannon and Wilson in 2012. The scope of this study does not include a detailed independent evaluation of the City's intake facility. Recommended improvements should be evaluated in more detail as part of future pre-design efforts. Keller Associates recently prepared a technical memorandum (see Appendix C) to address some immediate concerns. If all of these immediate improvements are incorporated, it is possible (although not probable) that the turbidity problems will be fully resolved, and no further action will be necessary. It is important to incorporate all of the items from the memorandum in the order presented in the memorandum for functional improvements to the system. If the order of implementation is changed, it could alter the effectiveness of the solution.

> <u>Intake Screen</u>. City staff report that the existing intake screen plugs, and passes coarse material through to the water treatment plant. These problems stem from bed load transport in the stream and stream bank stability issues. In 2012, Shannon and Wilson completed an analysis of alternatives to address the functionality of the existing intake screen and recommend improvements. A short-term recommendation was to extend the screens in the downstream direction, and a long-term recommendation was to build a new side channel intake structure.
>
> The existing screen is designed such that it is self-cleaning at high water velocities. The screen location does not have exceptionally high flows, and the problem of low velocities is made worse when the upstream trash rack plugs with debris, causing a dead zone in the vicinity of the intake screen. As an initial step, Keller Associates recommends implementing the recommendations found in the technical memorandum included in Appendix C, which include removing some of the bars from the trash rack to allow more flow over the intake screen. The primary purpose of these short-term recommendations is to provide improved sediment control until the City can secure funding for a new intake. However, in the event that these improvements are able to control sediment for an extended period of time (something the City should continue to monitor closely), a new intake may not be necessary.

Raw Water Pump Station. The existing raw water pump station consists of two pumps, a wet well, and a compressed air system for cleaning the intake screen. The pumps alternate lead/lag position. The City reports that when both pumps are running, the flow exceeds the capacity of the treatment plant. To remedy this, the flow is throttled down through a Cla-Val so the flows do not exceed the capacity of the filters at the WTP.

Variable frequency drives on the pump motors would be a more energy-efficient way to provide flow control. The ability to control the flow through VFDs would also alleviate some of the treatment capacity issues at the treatment plant when turbidity is high.

There is a pressure vessel on site that has been abandoned for a long time. City staff report that it is the standpipe associated with the old sediment removal system, but it was likely a surge protection device. The pressure vessel should be rehabilitated and used.

Problems the City would like to address in this area include the following:

- The wet well is in decent condition, but should be upgraded with fall protection for the access opening.
- The vent on the building entry door is rusted and should be replaced.
- The aboveground piping in the raw water pump station needs to be recoated.
- The compressed air system in the pump station is functional, but the tank is too small and should be replaced.

Sediment Removal System. The existing sediment removal system (disk filter) consists of a NETAFIM ARKAL-SPIN KLIN. It replaced the old sediment removal system (Lakos separator) in approximately 2006-2007.

The 80 mesh, 200 micron size of the sediment removal system is not designed to handle the much coarser materials that come out of Willamina Creek, causing problems to the strainer such as valves sticking open. When the existing sediment removal system gets clogged, it can be backwashed using pressure washing or internal backwashing to temporarily alleviate the clogging problems, but it quickly reclogs. A new sediment removal system that is designed for the coarser sediment gradation found in Willamina Creek is recommended to decrease the frequency of clogging.

A temporary solution would be to refurbish and reinstate the Lakos separator upstream of the existing disk filter. Details of this recommendation are discussed further in Appendix C.

Portions of the existing sediment removal building are held together with duct tape, and others are falling apart. Demolition of the building is recommended. An addition to the wet well/pump building should be constructed to house the new sediment removal system when a permanent solution is installed.

Modifications to the old pre-sedimentation basin at the treatment plant should be undertaken to plumb it back into the system and add new transfer pumps. This may help the filters to process a higher rate of flow during high turbidity events in Willamina Creek.

Power source. The power source for the intake facility is separate from the City's system, and frequently loses power supply. The City uses a mobile generator in times of power loss to run the intake facility. Whenever there is a temporary loss in power, the pumps have to be manually reset. The electrical components should be upgraded to allow the equipment to automatically reset following temporary losses in power. A permanent generator with enclosure should be installed on site.

Cleaning Vault. The vault outside the wet well building was intended to be used for cleaning the wet well. The invert of the suction line in the wet well is located approximately 1.5 feet above the bottom of the wet well, which does not allow for proper drainage of the wet well and removal of accumulated material. The City currently uses and wishes to continue using a vactor truck to empty the wet well for maintenance, therefore capital improvements on the cleaning vault are not recommended at this time.

Summary of Recommended Improvements:

- Install fall protection equipment for the wet well access.
- Recoat aboveground pipes in the raw water pump station.
- Replace the main entry door in the raw water pump station.
- Replace the compressed air tank in the raw water pump station.
- Install an on-site stand-by generator.
- Complete electrical improvements including generator and transfer switch installation, and building wiring installation and reconfiguration.
- Add VFDs and associated SCADA controls for wet well pumps.
- Incorporate interim intake, raw water, and treatment plant improvements outlined in the technical memorandum in Appendix C. After implementation of all of the items recommended, re-evaluate the system to determine if further improvements are necessary. If problems still exist or are likely to exist, replace existing intake based on recommendations from the 2012 Shannon and Wilson evaluation.
- Rehabilitate the pressure vessel to allow for a soft start of the raw water pumps.
- Add on to existing intake building to provide space for sediment remover.
- Replace sediment remover.

3.3 WATER TREATMENT PLANT

Water passes from the raw water pump station and strainer to the treatment facilities, including two sand filtration trains, a clearwell, and finish water pumping to the two on-site aboveground reservoirs. Disinfection is achieved via flow-paced chlorine addition, and soda ash is added for pH control. The most recent water treatment plant improvements were completed in 1998.

Keller Associates visited the treatment plant site and interviewed City staff in an effort to understand the key issues at the WTP. The scope of this study does not include a comprehensive evaluation of water quality and treatment processes. The following are known deficiencies and descriptions of existing conditions identified by the City, and associated recommendations. Keller Associates recommends that the planning assumptions, recommendations, and costs be reevaluated as part of pre-design for any upgrade. A WTP Facilities Planning Study should be completed in the next 5 years to provide a more detailed analysis of issues experienced at the WTP and recommended improvements.

Chlorine Room. The existing chlorine room was constructed on top of the old filter tanks in the old treatment plant building. It contains two chemical pumps that supply a sodium hypochlorite solution to the water being treated.

Problems the City would like to address include the following:

- The electrical outlet for these pumps is activated when the clear well pumps turn on. The City reports that approximately every three to four months, the chemical pumps do not turn on when they should. To remedy this, the City would like to incorporate a red hat solenoid valve to control flow of the sodium hypochlorite and improve the current system.
- The chemical pumps are reportedly not sized properly, and should be replaced.
- The louver for the exhaust system needs repair or replacement.
- The building has no mechanical HVAC system except a small wall unit heater, and as a result receives poor ventilation. Due to the angle of the sun, a window covering is desired. The City would like to upgrade their current window covering (which is a piece of plywood), and install an HVAC system.

Clearwell Room.
The clearwell room consists of two clearwell pumps and the clearwell. The clearwell pump motors were recently refurbished. The existing capacity of clearwell pump 1 is 420-430 gpm; clearwell pump 2 is 405-410 gpm; and both pumps together are 835-840 gpm.

Problems the City would like to address include the following:

- The manual disconnect of clearwell pump 1 does not work, and needs to be evaluated and repaired.
- There was a cut made in the roof of this room so pumps could be hoisted out for repairs. This cut was not repaired well and should be repaired properly.
- There is an electrical junction box in this room that is missing a cover plate.
- The wiring from the float switch is out in the open in a large coil. The length of the wires cannot be reduced due the way the system programming was designed. An enclosure should be placed around these wires so they are not in the way and do not become a potential safety hazard if uncoiled.
- There are holes in the wall for sample lines; these should be run through conduits through the wall that are properly sealed.
- There is a masonry block-sized hole in the exterior wall of the building that is no longer needed. This hole should be patched.
- The windows need to be removed and replaced due to corrosion.

Control Room. This room houses the controls and readouts for the tanks and pump stations. Instrumentation in this room also reports intrusion alarms on the old treatment plant, the new treatment plant, and the 6th Street pump station.

The room appears to need only normal maintenance and upkeep. City staff report only one item needing attention: the dialer equipment is functional but is not dependable. It is not programmed and set up correctly, resulting in the shutoff alarm condition failing to trigger a call out.

Effluent Flow Meter and Exterior of Old WTP. The effluent flow meter outside the old treatment plant is a ultrasonic -type polysonic meter which records total flow.

Problems the City would like to address in this area include the following:

- The existing meter must be zeroed out every 3-6 months. This will be fixed by replacing the meter with one that has more digits in the readout screen.
- The fittings and meter should be replaced with new coated fittings.
- The cinder block paving surrounding the foundation of the old chlorine shed associated with the original treatment plant is uneven, which causes a potential tripping hazard. It should be removed and replaced with either gravel or new concrete pavement.
- There are also exposed wires exiting the building, which need to be enclosed in conduits.

Chemical. Willamina uses soda ash, aluminum chlorohydrate (ACH) in the treatment process. Soda ash (6%) is added with two chemical pumps prior to filtration and one pump post-filtration. The ACH-polymer blend (1.5%) is used during the fall season.

Currently there is no secondary containment around the plant chemicals. Secondary containment should be provided around all the chemical storage containers. This could be completed by constructing a concrete curb around the containers that would be of sufficient height to store the volume of the chemicals in the totes.

The chemical metering pumps are situated at a relatively high elevation when compared with other treatment processes. It would also be advantageous to lower the elevation of the chemical metering pumps to reduce the risk of losing suction prime.

Backwash. The backwash for the filters is taken out after the existing effluent flowmeter with no other flowmeter in the system, so there is currently no way to directly meter backwash. The flow is estimated using a formula derived from the total effluent produced. For tracking and analysis purposes, it would be beneficial to have SCADA data of backwash amounts.

The backwash cycle is currently triggered by runtime of the filters. After 12 hours of operation, the backwash cycle runs. The original intent of the design was for backwash to be triggered by head loss across the filter. This system was removed after one year of operation due to excessive backwashing.

The stem for the backwash valve actuator is also broken and needs to be replaced.

Backwash Ponds. The existing backwash ponds do not allow enough detention time for debris to settle out. This is due to short-circuiting of the pond during the backwash process. City staff report that the state limits for water quality may be exceeded with the existing layout of the backwash ponds.

Access to the ponds for maintenance is difficult with a standard backhoe due to the small size of the ramp. A smaller unit is used to stockpile solids after cleaning out the ponds. Keller Associates recommends the City consider expanding the ponds to help mitigate short-circuiting of the ponds.

Miscellaneous Condition Items:

- The memory module needs better labeling.
- The PLC needs to be reprogramed or updated. The City is not sure what the triggers are, but the PLC has malfunctioned 4 times in the past 4 years.
- The raw water pumps in auto mode remain on all the time, due to a programming glitch.

- There are problems with air entering through the sample lines for the combined turbidity meter. These lines should be repaired or replaced.
- The Cla-Vals on the filter discharge line were recently rebuilt.
- City staff reports that the clarifier air intake used to take on water due to a timing issue related to the actuated valves. This timing issue prevents the air lines from maintaining positive pressure. Since recently fixing the check valve, the City no longer reports an issue.
- There are no reported issues with the raw water turbidity equipment, air pressure system, backwash pumps, surface wash pumps, soda ash and polymer addition systems, MCC electrical system, or treatment plant building (e.g. structure, exhaust, HVAC).

Plant Capacity. Table 3.1 summarizes the reported total and firm capacities at the treatment plant. The firm capacity at the plant refers to what could reliably be delivered in the event that the pump or treatment component with the greatest capacity is offline. The treatment plant's firm capacity is approximately 350 gpm. This is equal to the projected 2033 peak day demand. While no major facility expansions have been included in this master plan, Keller Associates recommends that the City review the desired membrane filters when it becomes necessary to replace the existing filters. It may be that new filters with higher flux rates (and increased capacity) will be available that could fit within the existing footprint.

TABLE 3.1: Treatment Plant Capacities

Plant Component	Total Capacity*	Firm Capacity
Raw Water Pumps (gpm)	700+	400+
Clearwell (gpm)	835	405
Filters (gpm)	700	350
Limiting Flow (gpm)	**700**	**350**
2033 Max Day Demand (gpm)	**348**	**348**

*as reported by City

Summary of Preliminary Recommendations (to be refined by future planning / predesign):

Not all of these items are considered capital improvements. Some items are maintenance items, and therefore may not be included in the CIP.

- Complete a Facilities Planning Study for the WTP within the next 5 years.
- Patch existing holes in walls and the roof of buildings. If wires or sample lines pass through walls, encase them in conduit to extend through walls.
- Place exposed wires and cables in conduits outside of building, and house sensor cable in an enclosure.
- Install red hat valve and controls to the disinfection system.
- Replace sodium hypochlorite chemical pumps.
- Replace the louvers for the exhaust system in the old treatment plant building.
- Install exhaust fans in chlorine and clearwell rooms
- Install a window covering in the old treatment plant window. Replace windows in older portion of the building.
- Install a cover on the electrical junction box in the clearwell room.

- Place an enclosure around wires for float switch.
- Replace corroded windows in the old treatment plant building.
- Evaluate and repair the manual disconnect for clearwell pump 1.
- Replace clearwell discharge pipe, replace clearwell discharge flow meter, and add 3 separate meters and connections to SCADA downstream of the backwash supply connection for each of the existing treatment trains and one future train.
- Reprogram dialer equipment.
- Remove and repair old chlorine shed foundation pad, and replace with gravel or concrete.
- Add secondary containment to chemical storage areas.
- Lower elevation of chemical metering pumps to reduce the risk of losing suction prime.
- Replace backwash valve actuator.
- Refurbish existing sedimentation basin and add associated transfer pumps.
- Expand backwash ponds.
- Upgrade existing PLC and software.
- Update labeling in memory module.
- Repair sample lines for the turbidity meter to reduce air entry into the system.

3.4 DISTRIBUTION SYSTEM DESCRIPTION, PLANNING CRITERIA, AND MODEL DEVELOPMENT

3.4.1 Existing Conditions

The existing distribution system is comprised of 12 miles of pipelines, 79 fire hydrants, three control valves, and two normally closed isolation valves with four pressure zones. The most prominent pipe materials in the system are polyvinyl chlorine (PVC) and asbestos cement (AC). Figures 3 and 4 in Appendix A show the existing system layout, pipe sizes, and pipe materials. Figure 5 in Appendix A shows the fire hydrant coverage in the system.

TABLE 3.2: Distribution System Pipe Material

Pipe Diameter (in)	Pipe Material					Total by Diameter (ft)	% of Total
	PVC	Asbestos Cement	Ductile Iron	Cast Iron	Steel		
2"	5897	0	0	0	0	5897	9.21%
4"	1222	6147	0	0	0	7368	11.51%
6"	7049	12506	72	0	0	19628	30.66%
8"	12276	12271	1188	34	0	25769	40.25%
10"	240	0	2645	390	0	3275	5.12%
12"	327	1687	0	0	69	2084	3.25%
Total by Material (ft)	*27,010*	*32,612*	*3,906*	*423*	*69*	*64,020*	*100.00%*
% of Total	*42.19%*	*50.94%*	*6.10%*	*0.66%*	*0.11%*	*12.13*	*Miles*

The elevation within the existing service area varies from 220 feet to 460 feet, requiring multiple pressure zones to service the users. The existing distribution system consists of four pressure zones, which are illustrated in Figure 6 and summarized below. The hydraulic grade line (HGL) is a measurement that reflects the sum of the elevation and pressure. For service areas where the elevation is higher, a higher HGL is required.

TABLE 3.3: Pressure Zones

Name	Source	HGL (ft.)
Zone 1	6th Street Booster Station	496
Zone 2	WTP Tanks	417
Zone 3	Hill Drive Tank	495
Zone 4	Hill Drive Booster Station	560

The existing control valves act only as isolation valves. Keller Associates recommends that the City repair or replace these valves so the system can function as intended. Additional control valves between pressure zones have been added in the capital improvement plan (CIP) to provide additional reliability to the distribution system.

3.4.2 Model Development and Calibration

A hydraulic model of the existing distribution system was created in conjunction with this study, using distribution system data provided by the City and elevation and mapping data from GoogleEARTH. The hydraulic modeling software used for the analysis was Bentley's WaterCAD v8i.

Elevation information was added to the model through an automated terrain modeling process, and manually checked for accuracy. Additional model input data from pump curves, operational controls, record drawings, and data gathered by City staff was incorporated into the hydraulic model. Water consumption records from the City's billing database were utilized to assign relative demands throughout the system in the hydraulic model, based on land use type and location. This allowed for a more accurate allocation of the existing system water demands.

Keller Associates collaborated with City staff in calibrating the hydraulic model to field conditions. Several hydrant flow tests were completed in the field to evaluate static conditions and measure flows and associated pressure drops in the system. The field measurements were compared with model results to determine whether the model simulated field conditions. The field test data correlated well to model results, giving confidence in the analysis and recommendations presented in this report. The only test location that did not closely simulate field conditions was in Zone 4 where suitable field data from the pump station was not available. Refer to Appendix D for calibration details.

3.5 DISTRIBUTION SYSTEM ANALYSIS RESULTS AND RECOMMENDATIONS

With the calibrated model, the current distribution system was evaluated against the planning criteria. The following sections summarize the analysis results.

3.5.1 Minimum Month Demand

Figure 7 in Appendix A highlights the system locations with various pressures under minimum month demand conditions. When pressures range from 45 psi to 80 psi, the standards for a minimum month are met. Some locations within the study area are outside this range.

3.5.2 Peak Hour Demand

The system was also modeled under peak hour demands to check for pressures in the system against the planning criteria.

Figure 8 in Appendix A highlights the system locations with various pressures under peak hour demand conditions. When pressures range from 45 psi to 80 psi the standards for a peak hour event are met. There are several areas with pressures below 45 psi. The low pressures in these areas are not a result of pipeline bottlenecks, but are a result of the node elevation and associated pressure zone servicing the users.

3.5.3 Maximum Day Demand plus Fire Demands

The model was populated with fire flow demands for areas with specific requirements identified by the local fire authority. Under maximum day demands and the stated fire flow requirements, the system was evaluated with the criterion of system pressures not dropping below 20 psi. The water model evaluates each pipe junction individually under maximum day demands with the specific fire flow requirement for that node, while considering pressures at other nodes in the system. The analysis is steady state, and assumes adequate fire storage is provided to support the design durations. Figure 9 in Appendix A highlights the modeled nodes in the water system that do not meet maximum day demand plus fire requirements, and Figure 10 of Appendix A displays the available fire flow at each modelled node. Appendix D contains the model results report for this and other pertinent model evaluations.

Areas of inadequate fire protection are primarily a result of elevation, insufficient pumping capacity, undersized lines, inadequate transmission, and lack of system looping.

3.5.4 Pipe Material Considerations

Steel and asbestos cement pipe make up 51% of the distribution system. Steel and asbestos cement pipe materials are generally the older and more problematic components of a distribution system, tending to cause operation and maintenance problems (low pressures, leaky pipes, poor fire protection, and poor water quality). The City should target these pipe materials for replacement before other pipeline materials. We also recommend that the City evaluate and monitor the condition of the cast iron pipe and consider replacing this pipe as required.

In locations where the CIP recommends changing the zone of a pipe to a higher pressure zone, evaluation and potential replacement of the AC pipe is also recommended.

3.5.5 Hydrant Coverage

There are reportedly 79 fire hydrants distributed throughout the water system. In general, there should be less than 600 feet between hydrants in order to provide adequate fire protection coverage.

Figure 5 in Appendix A illustrates the existing and future hydrant coverage based on a 300-foot radius for each hydrant. These future hydrants were added to eliminate the most critical coverage gaps. The phasing of these future hydrants is addressed in the capital improvement plan. Priorities were assigned based on the distance to the nearest existing hydrant and density of uncovered structures. Hydrants located on or near pipelines that are recommended to be replaced or upsized are included in the associated pipeline CIP estimate.

3.5.6 Distribution System Recommendations

Upon completing the evaluation of the existing distribution system, several improvements have been identified to correct existing deficiencies (e.g. low pressures, insufficient fire flow supply, and problematic pipe materials). Improvements have been prioritized into three major groups – Priority 1, 2, and 3.

Priority 1 improvements are intended to correct immediate concerns, and include improvements such as providing increased operating pressures to areas where normal operating pressures are below 40 psi and areas with the most critical fire flow deficiencies. Priority 1 improvements also include operational changes and capital improvements to booster stations and PRVs.

Priority 2 improvements include less urgent pipeline improvements that are located in areas where bottlenecks still exist but the fire flow is greater than 900 gpm. The City hopes to implement these improvements within the next 5 to 10 years.

Priority 3 improvements are located in areas that need additional fire hydrants on lines that are not currently large enough to support them, and improved transmission for water quality and looping reasons. These improvements should be completed by 2033.

Improvements addressing problems stemming from pipe materials should be addressed as part of an ongoing pipeline replacement program. These improvements may have a minimal effect on available fire flows and system pressures but are intended to address ongoing asset replacement needs. For planning purposes, Keller Associates recommends the City adopt a pipeline replacement program that targets the replacement of all AC, cast iron, and steel pipe in the system within the next 40 years. This would require an average of about 850 feet of pipeline per year at an annual cost of approximately $103,000.

The following paragraphs describe the recommended distribution system improvements included in the CIP. (These improvements are in addition to pumping and storage facility improvements described later.) These improvements are illustrated in Figure 11 in Appendix A. Additional project details and planning level cost information can also be found in Appendix E.

Priority 1 Improvements

- Install a new 10-inch pipeline connecting dead end lines on the north side to the high school.
- Rezone areas with low pressures to receive flow from the 6th Street Booster Station.
- Replace all AC pipe in the new pressure zone fed from the 6th Street Booster Station.
- Add a loop from Willamina Drive to Main Street.
- Replace the existing control valve on Pioneer Avenue with a valve that will act as a pressure sustaining and pressure reducing valve.
- Replace existing isolation valve on Pioneer Drive with a pressure sustaining valve.
- Install additional fire hydrants.

Priority 2 Improvements

- Replace existing 4-inch pipelines on Fir Street and Oak Street with 8-inch pipelines.
- Install additional hydrants.

Priority 3 Improvements

- Replace undersized lines on Willamina Drive, Maple Street, Hill Drive, Ivy Street, and Yamhill Street with an 8-inch pipeline.
- Construct additional pipelines for looping.
- Install additional fire hydrants.
- Replace the existing control valve on Maple Street with a valve that will act as a pressure sustaining and pressure reducing valve.

3.6 FUTURE DEMANDS ANALYSIS AND RESULTS

Future demands were distributed in areas where the City expects growth to occur. Residential growth is anticipated to occur in the Pacific Hills sub-division, Highland sub-division, the area north of the existing development between the WTP and the school, and on the southwest side of town between Hill Drive Reservoir and Pioneer Drive. Commercial growth is anticipated to occur in the existing commercial zone. The City does not anticipate that an additional large industrial user will be added to the system during the planning period.

In evaluating the future needs, it should be noted that the recommended priority improvements were sized to provide sufficient pressures and flows to handle the anticipated increase in demands. To service future development areas, conceptual pipeline layouts (illustrated in Figure 11 in Appendix A) were used in the model to check pressures and available flow. The pipeline locations for the future loops are approximate, and should be evaluated further and refined as development occurs. Figures 12-14 in Appendix A show available fire flow and pressures after priority improvements have been installed.

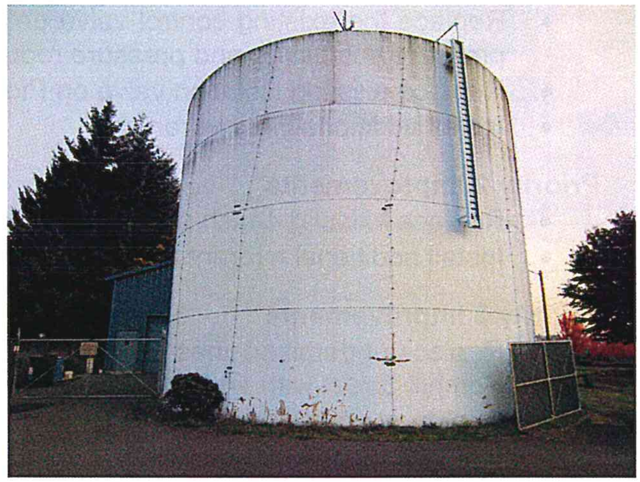
3.7 EXISTING STORAGE EVALUATION

3.7.1 Existing Reservoir Conditions

The city has three storage reservoirs. The oldest tank is a 250,000-gallon tank constructed in 1958 adjacent to the WTP. A 1,000,000-gallon tank was subsequently built in 1980 at the same general location and hydraulic grade line. Another 400,000-gallon tank was built in 1998 on the south side of town (fed by the Hill Drive booster station). All water passes through one of the reservoirs at the treatment plant after being pumped out of the clearwell. The main city service area or pressure zone (Zone 2) is fed by gravity from the treatment plant reservoirs. Two small zones (Zones 1 and 4) are fed by these reservoirs via the Hill Drive booster station and the 6th Street booster station. The 400,000-gallon reservoir is also fed by the Hill Drive booster station, via an electrically controlled valve. The 400,000-gallon reservoir then services pressure Zone 3 by gravity.

1958 Welded Steel Tank (at WTP site)

The 1958 reservoir is a welded steel tank with a nominal storage capacity of 250,000 gallons. An interior inspection of the tank was completed in January of 2008. A copy of this report is located in Appendix F. Based on this inspection and observations made by Keller Associates during our site visit, the following deficiencies and recommendations were identified:



Deficiencies

- The exterior of the tank has experienced damage to the paint, including paint peeling, direct strikes from a backhoe, and corrosion where coating has been removed.
- The inspection report indicates the interior of the tank is in good condition.
- Portions of the bottom of the steel tank are in direct contact with soil, which can accelerate corrosion.
- The Christmas lights on the tank are secured with tape, which has removed coating in places as it has fallen off.
- The exterior access ladder does not meet current security and safety standards.
- There is a third party antenna on top of the tank that is no longer used and needs to be removed.
- The top hatch is missing a seal, and has no intrusion switch.
- The overflow pipe is severely corroded.
- The exterior level indicator is not functioning, and there is no electronic measuring device connected to the City's SCADA system from this tank, making it difficult to know exactly how much water is in the tank without entering the tank.

Recommendations

- Remove exterior corrosion and patch coating in those areas.
- Regrade the ground adjacent to the tank to keep storm water and soil away from the base of the tank. Remove any accumulated vegetation and soil in contact with the steel portion of the tank annually.
- Change the manner in which the Christmas lights are secured to the tank, and patch areas with damaged coating.
- Replace the existing exterior ladder system with one meeting current safety and security standards.
- Remove the third party antenna and surrounding wiring from the tank.
- Install a seal and an intrusion switch on the top hatch.
- Complete tank inspections and interior/exterior cleaning every three to five years.
- Replace overflow pipe.
- Add an electronic measuring instrument (pressure transducer or ultrasonic sensor) to the tank and connect to the City's SCADA system.

1980 Welded Steel Tank (at WTP site)

This welded steel reservoir has a nominal size of 1,000,000 gallons, and is in need of significant improvements. An interior inspection of the tank was completed in January of 2008. Based on this inspection and observations made by Keller Associates, the following deficiencies and recommendations were identified:

Deficiencies

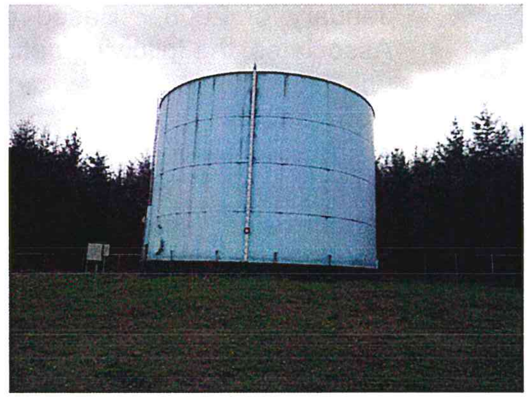
- The exterior of the tank is severely damaged by corrosion, especially on the roof.
- The interior of the tank is severely damaged by corrosion.
- The ladder has a landing, but no safety cage.
- Portions of the bottom of the steel tank are in direct contact with soil, and portions of the foundation interface with the tank are buried. This can accelerate corrosion.
- Corrosion has occurred as a result of a contractor welding a piece of steel to the tank.
- Bolts on both access hatches are heavily corroded.
- There is a severe corrosion pit adjacent to the access hatch.
- The vent is missing bolts and a gasket.
- The conduit for the level transducer is not sealed.
- There are standing pools of water on top of the roof.

Recommendations:

- Recoat the exterior of the tank within the next few years. The coating has deteriorated beyond the point where one can simply remove corrosion in selected areas, and patch; a full recoating procedure is required.
- Replace the existing interior coating with an NSF-approved epoxy as suggested in the tank inspection report in January 2008.
- Replace the existing exterior ladder system, or make upgrades to existing ladder so it will meet existing safety standards.
- Valves should be exercised on a regular basis.
- Regrade the ground adjacent to the tank to keep storm water and soil away from the base of the tank. Remove any accumulated vegetation and soil in contact with the steel portion of the tank annually.
- Replace bolts on hatches and the vent with stainless steel bolts, and/or coat new bolts.
- Provide proper seal for the penetration in the top hatch for the transducer conduit.
- Monitor the roof for changes in the water pooling; re-coating may need to be performed at a higher frequency.

1998 Welded Steel Tank (Hill Drive)

This welded steel reservoir has a nominal size of 400,000 gallons, and is in relatively good condition. It is fed by the Hill Drive Booster Station. The tank is isolated from the pump station with a Cla-Val that opens when the water level in the tank drops below 26.5 feet and closes when the level reaches 31.0 feet.



An interior inspection of the tank was completed in January of 2008. Based on this inspection and observations made by Keller Associates, the following deficiencies were identified:

Deficiencies

- The exterior of the tank has experienced minor corrosion, primarily in the form of small pitting and corroded bolts around the base and access hatches.
- The opening for the vent has openings that are too large, which could allow bugs and debris to enter the tank.
- The transducer cable draws moisture, so a desiccant is used.
- Debris has accumulated on the foundation, and plants are growing around the base of the tank.

Recommendations

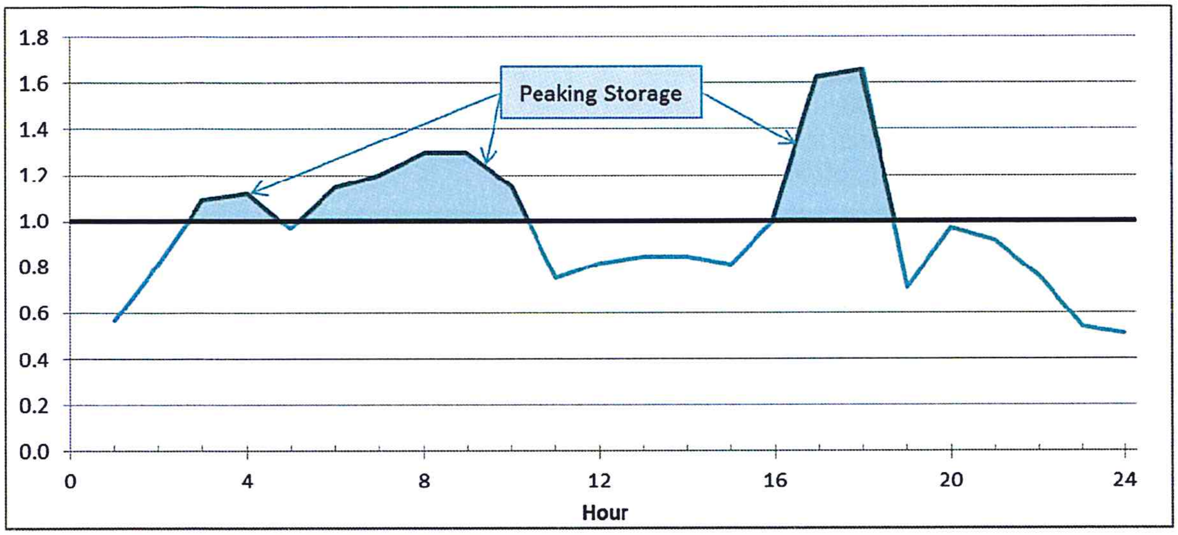
- Replace corroded bolts around base of tank and on access hatches with stainless steel bolts and coat new bolts.
- Patch locations with pitting corrosion.
- Replace existing mesh on vent with a finer mesh.
- Remove plants from tank foundation.
- Plan on recoating the interior and exterior of the tank within the planning period (2023 to 2033).

3.7.2 Storage Volume Planning Criteria

Equalization Storage

Equalization storage, or peaking storage, refers to the storage required to meet peak hour demands in excess of the supply pumping capacity. For planning purposes, the supply pumping capacity is assumed to be equal to the average maximum daily demand. Chart 3.1 illustrates the peaking storage from the water usage pattern developed using peak summer data for Willamina. The curve is a normalized unit curve, so a value of 1.0 (or the black line) represents flows equal to the average flow. The blue line illustrates how the demands vary over the course of a summer day. The average demand for the day is exceeded from 3:00 a.m to 10:00 a.m. with the exception of 5:00 a.m. where it is nearly the average. Another peak occurs in the evening from 4:00 p.m. to 6:00 p.m. The peak hour demand is approximately 1.7 times the average demand for the day and occurs around 6:00 p.m. The blue shaded area illustrates periods when the demand exceeds the daily average.

CHART 3.1: Diurnal Water Usage Pattern (Unit Curve)



Operational Storage

Operational storage is the volume of water drained from the reservoirs during normal operation before the water sources begin pumping to refill the reservoir. This value can be changed using the City's SCADA controls for the WTP reservoirs. In the case of the Hill Drive Reservoir, the Cla-Val must be adjusted to change this setting. Keller Associates typically recommends using a minimum of 10% of the total storage volume for operational storage to provide appropriate pump run times and adequate tank mixing. Currently the City uses 5% of the WTP reservoirs for operational storage during normal operation, allowing the tanks to drain 1.5 feet before turning the treatment plant on and filling the reservoirs. The Hill Drive Reservoir begins to fill when levels drop 4.3 feet below full volume, which accounts for about 15% of the storage in that reservoir. The current average operational storage for all three tanks is about 8% of the total storage.

Fire Storage

Fire protection storage provides the volume necessary to meet maximum fire demands for the specified duration. A 1,500 gpm fire demand with a pumping duration of two hours is recommended by the local fire authority for the City of Willamina. This corresponds to a fire storage volume of 180,000 gallons.

Emergency Storage

Emergency storage is intended to provide water during emergency conditions when the water supply could be interrupted. There are no specific regulatory requirements that clearly define what this volume must be for each community, although Ten States Standards recommends a minimum volume equivalent to the average day demand. Given the more vulnerable nature of surface water supplies, many communities with surface water treatment facilities choose to provide 2+ days of average day demand. For this planning effort, a recommended emergency storage volume equal to three times the average day demand was used. This volume is not "nested" or overlapping with fire storage, but is provided in addition to the other storage components. This results in a more conservative total storage calculation.

3.7.3 Available vs. Needed Storage

Existing and future storage capacity needs are presented in Table 3.4. The total storage required is anticipated to increase from 1,040,000 gallons to 1,137,000 gallons by 2033. The analysis performed indicates that there is an existing surplus of 497,000 gallons, and by the end of the 20-year planning period, the City would still have a surplus of 400,000 gallons.

It should be noted that, should a large industry or commercial facility that required more than 1500 gpm fire protection hook up to the system, the need for additional storage could change. An alternative to providing additional storage is to require buildings to have sprinkler systems that will decrease outside fire demands to a level of 1500 gpm or below.

TABLE 3.4: Existing and Future Storage Needs

Storage Component	Year 2013	Year 2033
Operating Storage[1] (GAL)	157,000	157,000
Peaking Storage[2] (GAL)	24,000	27,000
Fire Storage[3] (GAL)	180,000	180,000
Emergency Storage[4] (GAL)	717,000	811,000
Total Storage Required (GAL)	*1,078,000*	*1,175,000*
Storage Available (GAL)	*1,575,000*	*1,575,000*
Storage Surplus (GAL)	**497,000**	**400,000**

1. Recommended operating storage is 10% of effective volume. Existing operating storage matching targeted operation levels used in 2013 is 8% of effective volume.
2. Based on the peak day w ater usage pattern
3. Assumes 1500 gpm for 2 hours (typical amount supplied by similar tow ns in the area).
4. Assumes 3 times the average demand

3.8 PUMP STATION EVALUATIONS

3.8.1 Hill Drive Pump Station

The Hill Drive Booster Station consists of two VFD-driven pumps that serve as the primary supply for the pressure zone, and a fire pump that provides emergency supply. It is a Hydronix package booster station with other more recent modifications. These modifications include replacing the control system as well as a rebuild of one of the pumps.

All alarms from the pump station SCADA are sent to the WTP computer, but the SCADA system does not have the capability of changing pump controls remotely. The lead pump targets a discharge pressure of 105 psi. The lag pump turns on at 90 psi and off at 100 psi. The two primary delivery pumps alternate lead/lag position. The fire pump turns on when the discharge pressure drops to 45 psi.

The pump station has no flow monitoring and limited SCADA. The pump station also has no pressure relief valve that would alleviate excessively high pressures that could result if a pump were to fail to ramp down when it was supposed to. A flow meter should be installed in this pump station and be connected to the SCADA system along with the pressure gages, to aid future water system analyses. The pumps are approximately 30 years old, and little data is available from the manufacturers. The facility is reaching the end of its useful life.

If there is a power bump, the station has to be reset manually. There is no backup power onsite. The pump station should be updated to reset automatically as well as provide an onsite generator for backup power.

Summary of Recommendations:

Keller Associates recommends that the entire facility be replaced with a newer, modern facility that includes the following features: Updated controls and VFDs, flow and pressure monitoring, and SCADA integration with the City's system allowing for additional monitoring and pump control. The facility should also be equipped with a pressure relief, backup power with automatic transfer switch, and a new building. The pump station should be replaced by the end of the planning period with a few interim improvements such as a new meter vault on the pump station discharge and a pressure relief component. Pressure relief could be provided at the booster station or by modification/addition of a control valve at the Hill Drive Reservoir. A flow meter and associated SCADA should be installed in the near future to aide system tracking and future planning efforts.

3.8.2 6th Street Pump Station

The 6th Street Pump Station was constructed in 1998. Originally it was intended to serve approximately 90 units in the northern area of the city. The pump station currently services eight homes and a church.

The pump station consists of a jockey pump, two main pumps, one fire pump, a low pressure by-pass (which allows the WTP tanks to feed the zone if no pumps are functioning), a Cla-Val (which provides a small amount of presure relief), and a small pressure surge tank. The City reports that this system experiences issues related to water hammer even with the small pressure surge tank. Exposed piping in the pump station is showing signs of deterioration.

On/off controls are provided with mercury-type switches. The one main pump and the jockey pump are controlled on the same switch. They are supposed to alternate, but this process has to be manually controlled.

The phone line for a SCADA system at this pump station is in, but it has not been programmed in at the WTP.

Summary of Recommendations:

- Provide a new surge control vessel and surge control piping.
- Coat exposed piping and bolts, and paint the interior of the building.
- Install a larger capacity fire pump and backup power system. The assumption is that the new pump can be added to the existing manifolds without expansion of the building. If the selected pump will not fit in the building, additional improvements will be necessary.
- Separate controls so each pump has a separate switch. Consider updating the control system to run from a PLC connected to the City's SCADA system. This would allow setpoints to be monitored and adjusted remotely.
- Install new flow meter and pressure transducer. Transmit this data along with alarm conditions to the City's SCADA system.

3.9 WATER RIGHTS

The City of Willamina has six water rights on Willamina Creek (totaling 3.0 cfs) and one on Lady Creek (1.0 cfs). All water rights are summarized in Table 3.5. Information about the water rights comes from the Oregon Water Resource Department (OWRD).

Only two of the water rights (certificate numbers 86656 and 86657) can be used at the existing intake, to provide a total of 1.15 cfs (516 gpm). These two are junior to water rights at the Mill. However, in certain curtailment situations, municipal rights will displace more senior rights with a different beneficial use to the extent that usage is limited to in-house potable use.

Permit #S23560 has a water right at the old intake location on Willamina Creek, and could be transferred to the new intake location, but it has a priority date of 1955 which is still junior to many other water rights on Willamina Creek. This permit has a completion date of 10/1/2017, and the City will need to prove beneficial use by this date or apply for an extension. If this water right is transferred to the existing intake, the City will have water rights totaling 2.6 cfs, which is greater than the capacity of the treatment plant (1.6 cfs).

The Lady Creek water right (certificate #1018) is not used, and should be transferred to either Willamina Creek (if approved by OWRD) or the South Yamhill River. It is not likely that a new year-round water right will be allowed on Willamina Creek. According to the WMCP, more water rights currently exist for the creek than flows during the low flow period. This Lady Creek water right carries a priority date of 1909, which is relatively senior to many on the creek, and all attempts should be made to keep this water right. However, it is in a different basin than Willamina Creek, so this may make a transfer more difficult.

The City has three other water rights. Certificate #11706 has a point of diversion in the downtown area and a diversion rate of 0.2 cfs. According to OWRD, this right needs no further action at this time. It has been used for pumping by the fire department in the past, and the City wishes to retain this right in its current location. Permit numbers R768 and S15022 are water rights that had a completion date of 10/1/2011, and need to have a Transfer Extension of Time Application form filed with OWRD to prove beneficial use at a later date. The City currently uses these water rights for filling and storage in Huddleston Pond.

TABLE 3.5: Water Rights Summary

Application #	Permit #	Certification #	Transfer #	Source	Location of Diversion	Allowed Rate	Priority Date	Completion Date	Cancelled
S30116	S23560		-	Willamina River	Former Intake	1.45 cfs	7/6/1955	10/1/2017	Non-cancelled
S320	S127	1018	-	Lady Creek	Lady Creek	1.00 cfs	9/22/1909	Completed	Non-cancelled
S14457	S10476	11706		Willamina Creek	Downtown	0.20 cfs	2/15/1932	Completed	Non-cancelled
S18772	S14420	14501	T6752	Willamina Creek	N/A	0.45 cfs *	6/10/1940	Completed	Cancelled
S19368	S15022	41795	T6752	Willamina Creek	N/A	0.90 cfs **	6/13/1941	Completed	Cancelled
R19369	R768	41796	T2346/T10642	Willamina Creek	N/A	20 acre- ft. ***	6/13/1941	Completed	Cancelled
S19368	S15022	67793	T6752/T10642	Willamina Creek	N/A	0.20 cfs **	6/13/1941	Completed	Cancelled
R19369	R768		T10642	Willamina River	Huddleston Pond	20 acre-ft. ***	6/13/1941	10/1/2011 (needs extention to be filed)	Non-cancelled
S19368	S15022		T10642	Willamina River	Huddleston Pond	0.20 cfs **	6/13/1941	10/1/2011 (needs extention to be filed)	Non-cancelled
S19368	S15022	86656	T6752	Willamina River	Current Intake	0.70 cfs **	6/13/1941	Completed	Non-cancelled
S18772	S14420	86657	T6752	Willamina Creek	Current Intake	0.45 cfs *	6/10/1940	Completed	Non-cancelled

* same water right transferred to a new location

** same water right split to two benificial usage types and part of it was transferred to a different location

*** same water right

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4.0 CAPITAL IMPROVEMENT PLAN

4.1 GENERAL

This section provides a capital improvement plan (CIP) for the recommended improvements discussed in Section 3. The CIP includes opinions of probable costs for the recommendations, and are presented in four general categories – Priority 1, 2, and 3 improvements as well as annual improvements/programs. Priority capital improvements are illustrated in Figure 11 in Appendix A.

Priority 1 improvements are intended to correct immediate concerns, such as providing increased operating pressures to areas where normal operating pressures are below 40 psi and areas with the most critical fire flow deficiencies. Priority 1 improvements also include operational changes to booster stations and PRVs.

Priority 2 improvements include less urgent pipeline improvements that are located in areas where bottlenecks still exist but the fire flow is greater than 900 gpm. These improvements are intended to be implemented within the next 5 to 10 years.

Priority 3 improvements include lower priority fire hydrants on pipelines that are intended to improve fire protection, transmission, and looping. These improvements should be completed within the next 20 years.

Annual Costs consist of annual replacement budgets for meters, hydrants, pipelines, tank inspection and cleaning, and leak detection.

4.2 PRIORITY IMPROVEMENTS

The following paragraphs describe each priority improvement identified in Section 3.

Priority 1 Improvements:

Priority 1A - 10-inch Main to High School and Associated Pressure Zone Modifications

This improvement increases pressures and fire flows at the high school, and provides the backbone for future development in the northern area of the City. The project includes new fire hydrants, and a new 10-inch pipeline that extends from the 6th Street Booster Station to the dead end pipelines located in B Street and C Street, and then on to 5th Street. Along 5th Street, the project also replaces the existing AC pipe with a new 10-inch PVC or ductile iron pipeline. The 10-inch line continues from 5th Street to the existing 10-inch leading to the high school on Oaken Hills Drive. This improvement should be completed after Priority 1G improvements have been made to the 6th Street Booster Station.

Priority 1B – Modifying the Pressure Zones for 5th Street and Pacific Hills Drive

This improvement corrects low pressure problems by converting the western portion of 5th Street, and the Pacific Hills subdivision to a higher pressure zone (Zone 1) by addition of a parallel main to the existing 12-inch main entering the system along Churchman Street. This new pipeline will allow the 6th Street Booster Station to service these areas. These improvements should only be completed after Priority 1G improvements have been completed for the 6th Street Booster Station.

Priority 1C – 8-inch Loop Between Main Street and Willamina Drive

This improvement creates a new 8-inch loop from Willamina Drive to the existing dead end pipeline in Main Street to increase fire flows.

Priority 1D – Rehab and Install Control Valves between Existing Zones

This improvement involves replacing the existing isolation valve on Pioneer Drive between Pressure Zones 3 and 4 with a check valve, which will allow the Hill Drive Tank to provide supplemental fire flows in Zone 4. The existing Cla-Val on Pioneer Avenue between Zones 2 and 3 would also be reconfigured/upgraded so that it will operate as a pressure sustaining and pressure reducing valve. These improvements will provide additional fire flow capacity.

Priority 1E – Additional Fire Hydrants

This priority improvement includes adding five fire hydrants to the system where not already associated with other Priority 1 improvement projects.

Priority 1F – Reservoir Improvements

These improvements address deficiencies with the reservoirs. This includes removing corrosion, recoating, and replacing corroded bolts; installing a new pressure relief valve for the Hill Drive Booster Station at the Hill Drive Reservoir; replacing ladders to meet current standards; regrading soil around the bases of reservoirs to discourage vegetation, sediment and water buildup on the steel portion of the tank; installing seals on roof hatches; and replacing the overflow at the 250,000-gallon tank.

Priority 1G – Booster Station Improvements

These improvements consist of adding a flow meter and continuous SCADA capabilities at the Hill Drive Booster Station; and installation of surge control, a flow meter, a pressure transducer, relief piping, an additional fire pump, continuous SCADA, a generator, and a new PLC control system at the 6th Street Booster Station.

Priority 1H – Water Treatment Plant Improvements

These improvements consist of miscellaneous small projects located primarily in the old treatment plant building, and also in other areas of the treatment plant. This includes:

- Modernizing the ventilation,
- Improving control systems,
- Repairing damage to the structure,
- Encasing wire in conduits,
- Replacing the chlorine pumps and valves,
- Installing backwash flow meters,
- Replacing clearwell flow meter,
- Repairing manual shutoff for the clearwell pump,
- Replacing sample lines for turbidity meter,
- Installing secondary containment around chemicals,
- Modifying backwash sediment containment ponds, and

- Refurbishing the pretreatment sedimentation pond and associated piping and pumping.

Priority 1I – Interim Intake Improvements
This improvement consists of cutting out bars in the trash rack upstream of the existing intake, and rehabilitating and installing the old Lakos separator.

Priority 1J – Long-term Intake Improvements
These improvements consist of implementing the recommendations provided in the 2012 Shannon and Wilson intake study report.

Priority 1K – Raw Water Improvements
These improvements consist of miscellaneous projects including:

- Demolition of existing strainer building,
- Extending the existing concrete block building to encase new strainer (sediment removal system),
- Adding a safety grate for fall protection at the wetwell,
- Painting interior piping,
- Installing of a new sediment removal system,
- Updating controls,
- Installing variable frequency drives on pumps, and
- Adding onsite standby power system, including a generator, generator enclosure, and automatic transfer switch.

Priorityies 1L – WTPFPS
This improvement consists of creating a water treatment plant facilities planning study to gain more information on WTP functionality.

Priority 1M – WMCP Update
This improvement consists of updating the Water Management and Conservation Plan.

Priority 1N – Leak Detection Study
This improvement consists of conducting a leak detection study.

Priority 2 Improvements:

Priority 2A - 8-inch Main along Fir Street
This improvement replaces the existing 4-inch line in Fir Street with a new 8-inch pipeline for the section between Barber Avenue and Lamson Avenue, and adds an additional hydrant to provide more fire flow.

Priority 2B - 8-inch Main along Oak Street
This improvement replaces the existing 4-inch line in Oak Street with a new 8-inch pipeline for the section between Barber Avenue and Lamson Avenue, and adds an additional hydrant to provide more fire flow.

Priority 2C – Additional Fire Hydrants

This improvement adds two fire hydrants on Hill Drive.

Priorities 2D – Water Treatment Plant Improvements
This improvement includes miscellaneous updates to the old treatment plant building, including roofing, ceiling repair, doors, roof trim, and painting trim.

Priorities 2E – 10 Year WMP Update
This improvement includes updating this master plan.

Priorities 2F – WMCP Progress Report
This improvement includes writing a 5-year progress report for the WMCP update in priority 1M.

Priority 3 Improvements:

Priority 3A – 8-inch Main along Willamina Drive
This improvement involves the upsizing of the existing main from 4-inch to 8-inch along Willamina Drive from Churchman Street to connect to the Priority 1C improvement. This priority improvement also includes two new fire hydrants. This improvement will increase available fire flows in the area.

Priority 3B – 8-inch Pipeline along Maple Street
This improvement upsizes the existing line from 2-inch to 8-inch along Maple Street from Lamson Street to Barber Avenue, and creates an additional looping connection. It also includes the addition of one fire hydrant. This improvement will increase available fire flows in the area.

Priority 3C - 8-inch Fire Main on Ivy Street
This improvement replaces the existing 4-inch pipeline along the full length of Ivy Street with a new 8-inch pipeline that will provide increased fire flows to the existing fire hydrant at the west end of Ivy Street. This improvement will also increase available fire flows to the surrounding area.

Priority 3D – 8-inch Loop from Yamhill Street to Highway 18 and 8-inch Main to Park
This improvement upsizes the existing line to the park from 2-inch to 8-inch, and adds one new fire hydrant. A new pipeline will be constructed from this upsized pipeline to create a loop with the main along Main Street. This improvement will increase fire flows and provide better water quality by looping a large, formerly dead-end pipeline.

Priority 3E – 8-inch Main along SW Hill Drive
This improvement involves extending a new 8-inch main south on the portion of Hill Drive that runs north-south on the east side of the city, and installing a new fire hydrant. This improvement will increase available fire flows in the area.

Priority 3F – 8-inch Loop from E Street to 4th Place
This improvement includes a new 8-inch pipeline installed between the existing E Street and 4th Place mains. This connects existing dead-end lines to improve water quality.

Priority 3G – 8-inch Loop from Adams Street to Jackson Street

This improvement includes a new 8-inch pipeline installed between the existing pipelines on Adams Street and Jackson Street. This connects existing dead-end lines to improve water quality.

Priority 3H – 8-inch Loop from Willow Lane

This improvement includes a new 8-inch pipeline installed between the existing pipelines on Willow Lane and W Main Street. This connects existing dead ends to improve water quality.

Priority 3I – 8-inch loop from E Street to Highway 18

This improvement includes a new 8-inch pipeline installed between the existing E Street and D Street mains. This pipeline improvement will replace the existing 2-inch mains on the north side of NW Main Street. The project connects an existing dead-end pipeline to improve water quality.

Priority 3J – Additional Fire Hydrants

This improvement includes the addition of four new fire hydrants not associated with any other Priority 3 improvement projects.

Priority 3K – Rehab Control Valves between Existing Zones

This improvement consists of reconfiguring the existing Cla-Val on Lamson Street between Zones 2 and 3 so that it will operate as a pressure sustaining and pressure reducing valve.

Priorities 3L – Reservoir Improvements

This improvement consists of painting the interior and exterior of the Hill Drive Reservoir, and removing the antenna from the 250,000-gallon reservoir.

Priorities 3M – Booster Station Improvements

This improvement consists of constructing a new booster station at the Hill Drive Booster Station site.

Priorities 3N – 20-Year WMP

This improvement consists of updating the Water Master Plan.

Priorities 3O – WMCP Update

This improvement consists updating the WMCP from Priority 1M.

In addition, capital costs and priorities relating to the Water Treatment Plant (WTP) should be updated as part of a future facility planning study.

Table 4.1 summarizes the priority improvements recommended for the City of Willamina, and provides an opinion of probable cost for those improvements. Approximately $7.5 million in capital improvements have been identified for the 20-year planning horizon. Costs are shown in 2013 dollars and represent concept level costs that should be updated as part of project pre-design efforts in the future. A more detailed description of these improvements and a breakdown of the cost assumptions can be found in Appendix E.

TABLE 4.1: Capital Improvement Plan – Priority Improvements

ID#	Item Description	Opinion of Probable Cost*
Priority 1 Improvements (by 2018)		
1A	10-inch Main to High School and Associated Rezoning	$793,000
1B	Rezoning 5th Street and Pacific Hills Drive	$459,000
1C	8-inch loop between Main Street and Willamina Drive	$197,000
1D	Rehab and Install Control Valves between Existing Zones	$61,000
1E	Additional Fire Hydrants	$54,000
1F	Reservoir Improvements	$960,000
1G	Booster Station Improvements	$498,000
1H	Water Treatment Plant Improvements	$810,000
1I	Interim Intake Improvements	$25,000
1J	Long-term Intake Improvements	$364,000
1K	Raw Water Improvements	$569,000
1L	WTPFPS	$80,000
1M	WMCP Update	$4,800
1N	Leak Detection Study	$30,000
	Total Priority 1 Improvements	***$4,905,000***
Priority 2 Improvements (by 2023)		
2A	8-inch Main along Fir Street	$202,000
2B	8-inch Main along Oak Street	$198,000
2C	Additional Fire Hydrants	$20,000
2D	Water Treatment Plant Improvements	$71,000
2E	10 Year WMP Update	$80,000
2F	WMCP Progress Report	$6,300
	Total Priority 2 Improvements	***$577,000***
Priority 3 Improvements (by 2033)		
3A	8-inch Main along Willamina Drive	$209,000
3B	8-inch Loop along Maple Street	$109,000
3C	8-inch Main along Ivy Street	$74,000
3D	8-inch Loop from Yamhill Street to Highway 18 and 6-inch Main to Park	$240,000
3E	8-inch Main along SW Hill Drive	$81,000
3F	8-inch Loop from E Street to 4th Place	$65,000
3G	8-inch Loop from Adams Street to Jackson Street	$58,000
3H	8-inch Loop from Willow Lane	$55,000
3I	8-inch loop from E Street to Highway 18	$140,000
3J	Additional Fire Hydrants	$42,000
3K	Rehab Control Valves between Existing Zones	$33,000
3L	Reservoir Improvements	$319,000
3M	Booster Station Improvements	$442,000
3N	20 Year WMP	$80,000
3O	WMCP Update	$6,300
	Total Priority 3 Improvements	***$1,953,000***
	TOTAL (rounded)	**$ 7,435,000**

* All costs in 2013 Dollars. Costs include engineering and contingencies.

4.3 ANNUAL PROGRAMS

As system components reach the end of their useful life, they need to be replaced. Improvements addressing problems stemming from materials and age may have a minimal effect on available fire flows and system pressures, but are part of an ongoing replacement program intended to keep the system functioning properly over the long term. The replacement budget should include allocations for pipes, fire hydrants, and water meters. Money should also be budgeted for leak detection and reservoir cleaning/inspection.

The goal should be to replace all AC and steel pipe in the system with PVC or ductile iron (DI) before replacing PVC and DI pipes. It will take approximately 38 years to replace the AC and steel pipe, after which the existing PVC, ductile iron, and cast iron pipe will be reaching the end of its useful life and should need replacement. This amounts to an average of 854 feet, at an estimated cost of $103,000 per year. All items with recommended replacement budgets are shown in Table 4.2. The annual replacement budget totals $134,000.

TABLE 4.2: Replacement Budgets

Item	Complete Every	Cost/Year
Pipelines	75 year	$ 103,000
Fire Hydrants	50 year	$ 7,000
Water Meters	20 year	$ 12,000
Tank Cleaning and Inspection	3 year	$ 2,000
Leak Detection	3 year	$ 10,000
Total	N/A	$ 134,000

4.4 CONCLUSION

The critical and more urgent issues facing the City's water system include infrastructure repair, increased fire flows, and improved transmission capacity. The City should begin now to secure funding that would allow them to implement the Priority 1 improvements. If grant funds can be secured, Keller Associates would recommend that Priority 2 improvements also be completed at this time. Lower priority improvements can be completed as funding becomes available or in coordination with other improvements or routine replacement. Wherever possible, waterline projects should be coordinated with street repair efforts to minimize the disruption and reduce the overall surface restoration cost.

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5.0 FINANCIAL PLAN, RATE ANALYSIS & SDC UPDATE

5.1 FINANCIAL PLAN

A detailed financial plan developed by Economic and Financial Analysis (EFA) was prepared as part of this master plan. A brief overview of some of the key elements is summarized here (the full report is included in Appendix G).

The financial forecast assumed financing for selected Priority 1 capital projects in this master plan, taking into account current debt service, and current costs of owning and operating the water system. Projects selected to be analyzed were 1H - WTP Improvements, 1I - Intake Improvements, 1J - Raw Water Improvements, and 1K - WTPFPS. Financing is assumed to be 100% by the Oregon DEQ State Revolving Fund. The total annual debt obligation for these improvements was estimated to be approximately $77,000/year.

The City currently cannot incur any new debt or refinance existing debt service until annual audits are up-to-date. The City has hired an accountant to perform these duties.

5.2 RATE ANALYSIS

A copy of the current user rate tables (as of 9/27/2013) can be found in Appendix G. The rates are currently unnecessarily complex and inequitable. Many users of the same type and similar usage are charged different amounts. For the most part, the customers who use the least water subsidize those who use the most, including large industry. To improve the rate structure, a new rate structure has been created based on meter size and consumption, rather than EDUs and subsidies.

Rates are anticipated to decrease initially for all but 67 customers, with residential and restaurant customers seeing the largest reduction in water bills. This will be followed by rate increases in following years as shown in Table 5.1.

Each fiscal year, the City should evaluate the utility's financial performance during the previous year and decide whether to follow or modify previously planned rate increases. Changes in the construction schedule, financing costs, operating costs, or revenues from rates and SDCs may require the City to modify the planned rate increases.

TABLE 5.1: Rate Changes

Fiscal Year	Rate % Increase
2014-2015	Decrease for most customers
2015-2016	9%
2016-2017	16%
2017-2018	14%
2018-2019	8%
2019-2020	5%

5.3 SYSTEM DEVELOPMENT CHARGE (SDC) UPDATE

Recommendations for SDCs were updated in the financial plan. There was not sufficient data to calculate the reimbursement fee (for excess capacity in existing system) without the annual audits. The improvement fee (for excess capacity in proposed capital improvements) was calculated to be a maximum of $3,066.74 for a standard ¾" meter. This is an increase from the existing water SDC of $1500.

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6.0 WATER MANAGEMENT AND CONSERVATION PLAN PROGRESS REPORT

6.1 GENERAL

This section provides a 5-year progress report for the 2009 Water Management and Conservation Plan (WMCP). It also summarizes outstanding items from the WMCP work plan created by Oregon Water Resources Department (OWRD) following their review of the 2009 WMCP.

6.2 OWRD WORK PLAN

The OWRD provided a work plan after reviewing the 2009 WMCP. The items from this work plan are addressed in this section and include a discussion on the most recent water audit, unaccounted-for water, water user profile, leak detection, Water Right Permit S-23560, and bench mark updates.

6.2.1 Water Audit and Unaccounted-for Water

The City has begun tracking water loss by measuring water produced, metering water consumed, and estimating unmetered uses (e.g. park irrigation, wastewater treatment plant operations, line and hydrant flushing, street sweeping, vactor truck usage, bulk water sales, and firefighting). The results of these measurements are summarized in the table below. More information on unaccounted-for water in Willamina can be found in Section 2 of this report.

TABLE 6.1: Water Audit and Water Loss

Year	Diverted from Willamina Creek	Customer Meter (MG)	Backwash (MG)	Unmetered Uses (MG)	Accounted for (MG)	Unaccounted-for-water %
2010*	57.5	43.3	2.7	1.0	46.9	18%
2011	90.2	60.8	6.0	1.1	67.9	25%
2012	95.8	71.5	7.4	1.1	80.0	17%
2013*	68.0	42.5	4.7	0.7	48.0	29%
total	311.5	218.0	20.8	3.9	242.7	22%

*partial year because 2010 established a new billing system, and data analysis took place prior to the end of 2013

6.2.2 Water User Profile

The users in Willamina are primarily residential with schools, a few commercial users and one large industrial facility (Willlamina Lumber). The residential use is for irrigation and household use. The commercial use includes a few restaurants, churches, and other small businesses. Willamina Lumber is a mill, so it uses large quantities of water for production. The City is not aware of any water reuse or recycling program at this time. (For more information on water usage patterns, refer to section 2 of this report.)

6.2.3 Leak Detection

The unaccounted-for water in the City exceeds the recommended 10%; therefore the leak detection program defined in the 2009 WMCP should be implemented in 2015 since it was not started in 2009 as originally planned.

6.2.4 Full Exercise of Water Right Permit S-23560

Water right permit S-23560 allows for 1.45 cfs to be diverted. To date, the maximum flow diverted was 0.41 cfs. The water right will be fully exercised in the year 2143 with the current population projections. If any new industrial facilities are constructed, the water right would be fully exercised much earlier. All water rights are summarized in Table 6.2.

TABLE 6.2: Water Diversions

Permit #	Certification #	Source	Allowed Rate (cfs)	Allowed Rate (GPM)	Priority Date	Max Annual Diversion to date	Average Monthly Diversion (MG) 2010-2013	Average Daily Diversion (MG) 2010-2013	Maximum Instantaneous Diversion to date (GPM)
S127	1018	Lady Creek	1	449	9/22/1909	0	0	0	449
S10476	11706	Willamina Creek	0.2	90	2/15/1932	0	0.00	0.00	90
S14420	86657	Willamina Creek	0.45	202	6/10/1940	129*	7.79	0.26	202
R768		Willamina River	20 acre-ft.	20 acre-ft.	6/13/1941	20 acre-ft.	20 acre-ft.	20 acre-ft.	20 acre-ft.
S15022		Willamina River	0.2	90	6/13/1941	0	0	0	90
S15022	86656	Willamina River	0.7	314	6/13/1941	0	0	0	314
S23560		Willamina River	1.45	651	7/6/1955	0	0	0	184

*from 2009 WMCP

6.3 BENCHMARK PROGRESS REPORT

Table 6.3 shows the recommended benchmarks from the 2009 WMCP, along with the current status for each benchmark.

TABLE 6.3: Benchmark Progress

Bench mark	Status
Meter replacement and upgrade to touch meters	Currently 75% of the City has been upgraded, this is 15% more than at the time of the WMCP
Reservoirs and pump stations regularly visually inspected for leaks.	Daily
Connect water meter to town from WTP reservoirs to SCADA system	Complete
Increasing water rates proportionally with CPIU index of Portland.	Rate study is in progress
Listening for, finding and repairing leaks in service lines particularly in Pioneer Heights	On going
Permanent Solution for Pioneer Heights	Not complete at this time.
Mill efficiency study	Not complete at this time.
Water conservation information in monthly billings at least twice per year.	On going
Water conservation literature available at City Hall.	On going
Full metering of system	Only a few City properties are still unmetered.
Preform an annual water audit	On-going
Estimate unmetered water	On-going
Centralized log book for unmetered water	Not complete at this time.
Test customer and production meters every five years	Not complete at this time.
Annual leak detection studies	Not complete at this time.
10% water loss	Not complete at this time.
Regular visual inspections od water system facilities especially reservoirs to look for leaks.	On-going
Free leak detection test	On-going
Cost of service rate study	In progress
WTP efficiency evaluation	Not complete at this time.
Free residential water audits and water conservation kits.	Not complete at this time.
Reuse of WWTP effluent on a cottonwood plantation.	Not complete at this time.
Reuse of backwash water	Not complete at this time.
Residential reuse literature	Not complete at this time.

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