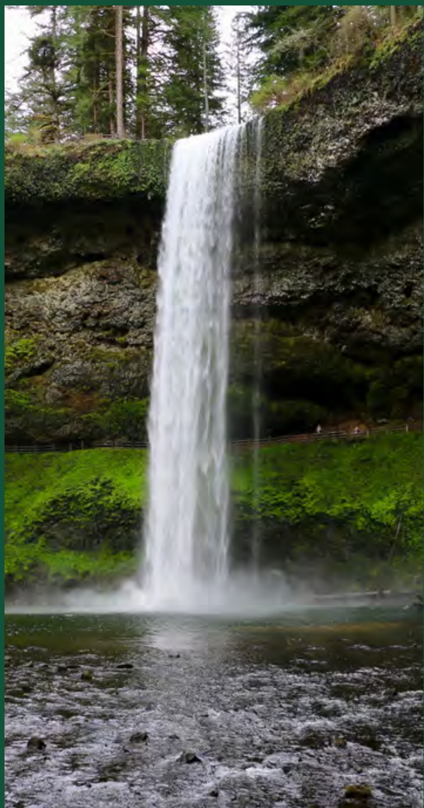
City of Silverton



Water Master Plan

January 28, 2021

Public Works Department - Engineering
306 S. Water Street
Silverton, OR 97381
Phone: 503-873-8679
Email: bstepp@silverton.or.us

CITY OF SILVERTON
EST 1854
OREGON'S GARDEN CITY

PUBLIC HEALTH DIVISION
Drinking Water Services
Kate Brown, Governor

Oregon Health Authority

800 NE Oregon Street, #640
Portland, OR 97232-2162
Phone: 971-201-9794
Fax: 971-673-0694
www.healthoregon.org/dwp

March 19, 2021

Bart Stepp, PE
City Engineer
City of Silverton
Via email

Re: **2021 Master Plan (PR#30-2021)**
City of Silverton (PWS ID#00823)
Concurrence with Master Plan

Dear Bart:

Thank you for your submittal to the Oregon Health Authority's Drinking Water Services (DWS) of plan review information for the 2021 Water Master Plan for the City of Silverton. On February 5, 2021, our office received a copy of the master plan. A plan review fee of $4,125 was received on March 1, 2021.

The Master Plan represents a 20-year planning horizon out to the year 2041. The plan includes a system goals and description, future demand estimates, engineering evaluation, evaluations of options to meet future demand, financing, and a list of recommended projects and cost estimates. A seismic risk assessment and mitigation plan is required and was included. Upon review of the Master Plan, it appears the elements listed in Oregon Administrative Rules (OAR) 333-061-0060(5) have been addressed.

Please note that OAR 333-061-0060 contains plan submission and review requirements for all major water system additions or modifications. Construction plans and specifications must be submitted to and approved by DWS before construction begins If you have any questions, please feel free to call me at (971) 201-9794.

Sincerely,

Carrie Gentry, PE
Regional Engineer
Drinking Water Services

ec: Chantal Wikstrom, OHA/DWS

Silverton Water Master Plan

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Silverton Water Master Plan

1 INTRODUCTION

1.1 BACKGROUND

The City of Silverton owns and operates a water system that serves approximately 10,500 residents primarily within Silverton's city limits. Water is conveyed from Abiqua Creek and Silver Creek to the City's Water Treatment Plant. Water from the two sources is mixed prior to treatment. The treatment plant consists of two parallel treatment systems dating back to the 1950s and 1980s. Both treatment systems include conventional filtration, and all water is treated with an on-site chlorine generation system.

From the Water Treatment Plant, water is delivered to customers via a network of pipelines. Booster facilities pump water to upper pressure zones. Three reservoirs provide 4.45 million gallons of storage.

1.2 PURPOSE AND NEED

This report presents findings and recommendations relating to the Silverton Water Master Plan. This report incorporates findings from previously completed planning studies that include:

1. Silverton Water Master Plan, adopted by City Council on August 01, 2011
2. Water Management and Conservation Plan (WMCP), adopted by City Council on February 1, 2016
3. Water Treatment Plant Facility Plan (WTPP), adopted by City Council on December 5, 2016
4. 2018 Updated Source Water Assessment for Silverton, completed by the Department of Environmental Quality (DEQ)
5. 2019 System Development Charge Update (SDCU), incorporated by City Council via Resolution 19-34 on August 5, 2019

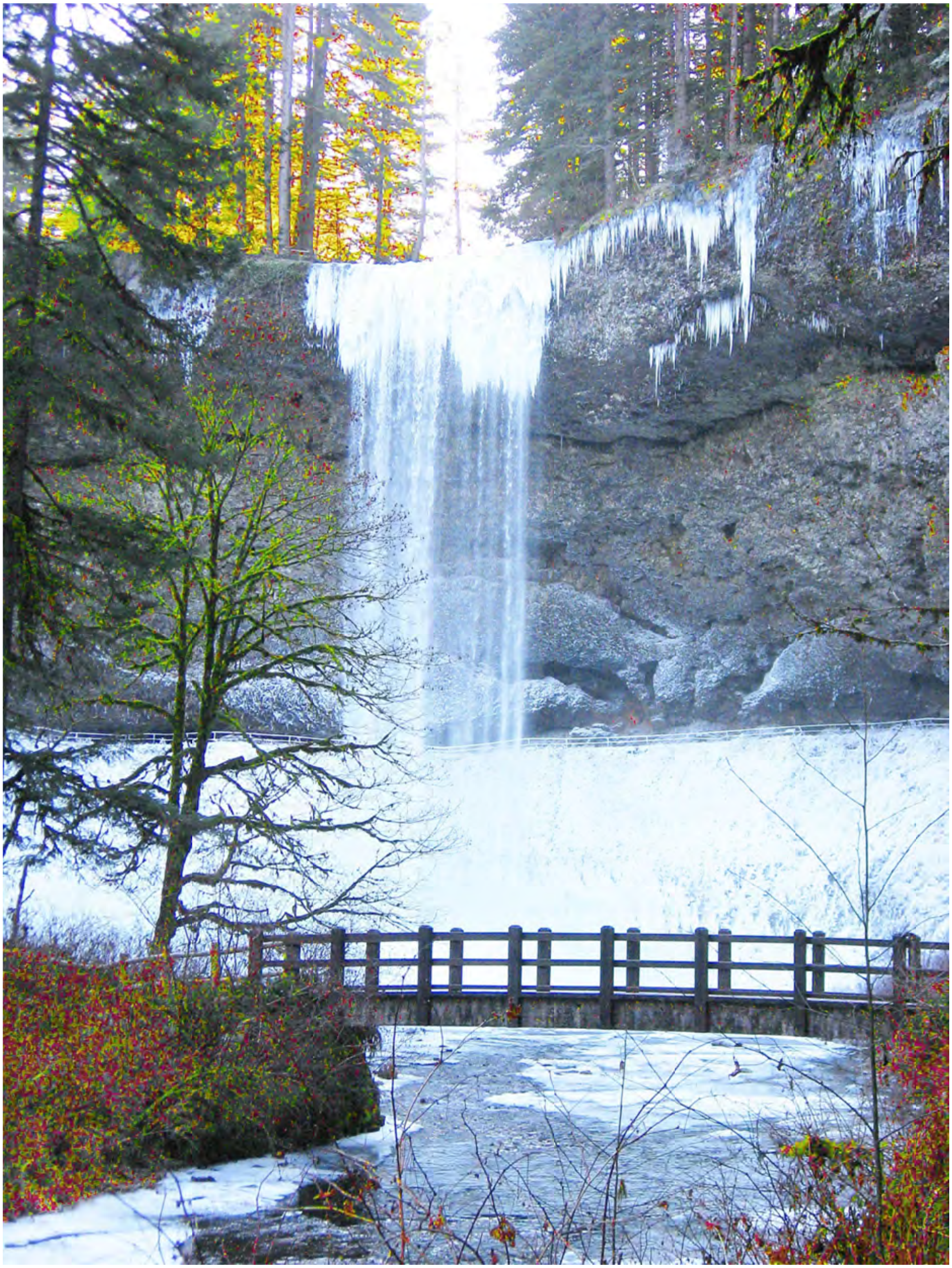
This plan includes a review of fundamental planning elements such as population, water supply and demand, development and household densities, an analysis of the water system, followed by a summary of the capital improvement plan and a financial review of the water system. Figures and supporting data for the information presented in this report have been included in the appendices for reference. While this plan has population and demand projections out to 2055, this plan is intended to have a 20-year planning period to 2041. The Capital Improvement Plan projects identified if completed will satisfy the needs of the 20-year period, but additional improvements may be needed to meet 2055 demands.

1.3 ACKNOWLEDGEMENTS

The City of Silverton (the City) recognizes all those who have provided their support and assistance in the completion of this study. The City would also like to provide a special thank you to Keller Associates. The organization and much of the information in this plan came from the 2011 Water Master Plan completed by Keller Associates. Staff and others who have worked on this plan include the following:

- *Keller Associates,* Salem, Oregon Engineering Consultant
- *Petra Schuetz*, City of Silverton Public Works Director
- *Travis Sperle,* City of Silverton Maintenance Division Supervisor
- *Chelsea Starner,* City of Silverton Public Works Coordinator
- *Steve Starner,* City of Silverton Water Quality Division Supervisor

- *Bart Stepp*, City of Silverton City Engineer
- *Megan Talmage*, Former City of Silverton Engineering Technician



Silver Falls State Park

2 DESIGN CRITERIA

2.1 GENERAL

This chapter details the design criteria used to establish standards by which the system is evaluated and serve as the basis for identifying needed improvements. These criteria include an evaluation of population, development densities, potable water demands, land use, and other factors affecting the water system.

2.2 POPULATION PROJECTIONS

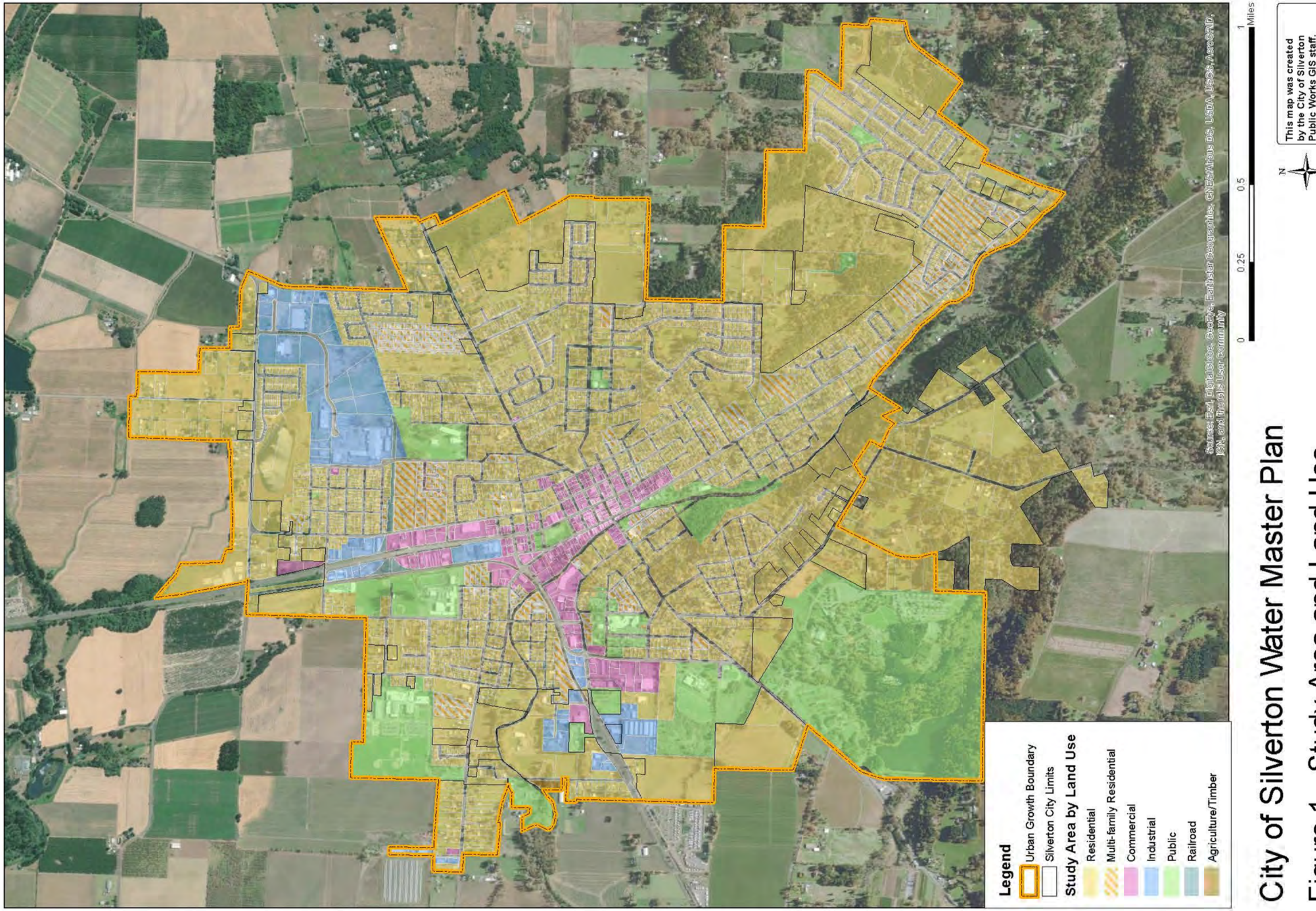
Table 2.1 summarizes existing and future populations used for this planning effort, and compares them with the populations used in the 2016 WMCP. Population projections reflect the Marion County adopted forecasts based on the published values from the Portland State University (PSU) Population Research Center dated July 1, 2019. These values are different than the population projections in the 2011 Water Master Plan (WMP) and the 2016 WMCP. Those plans used the 2008 PSU forecast. This plan uses the 2017 PSU forecast. The 2017 PSU projections assume an annual average growth rate of 1.4% from 2017-2035 and a growth rate of 0.8% from 2035-2067. The 2011 WMP used a growth rate of 1.5% and the 2016 WMCP assumed a growth rate of 1.3%. This is why the 2016 WMCP has lower populations in 2020-2035 but a higher population in 2055. The 2055 population of this plan is about the same as the 2035 population of the 2011 Water Master Plan.

Table 2.1 – Existing & Future Populations

Year	2011 Water Master Plan	2016 WMCP Population	2020 Water Master Plan Population
2009	9,600		
2015		9,590	
2019			10,380
2020	12,423	10,536	10,701
2025		11,239	11,545
2035	15,532	12,789	13,076
2040			13,759
2055		16,558	15,631

2.3 STUDY AREA

Figure 1 on the next page illustrates the study area used for this planning study. The study area includes Silverton's Urban Growth Boundary (UGB), the different land uses in Silverton, along with areas inside Silverton that are outside the UGB. Areas inside city Limits that are outside the UGB were annexed because the wells on those properties were running dry and the owners needed access to water.



City of Silverton Water Master Plan

Figure 1 - Study Area and Land Use

2.4 LAND USE AND DESIGN DENSITIES

Existing and future land use assumed for the study area is shown in Figure 1. Land use assumptions for future development were developed in conjunction with the Community Development Director and public works staff.

Design densities refer to anticipated development densities for residential land use within the study area, and the average household density. These densities serve as the basis for estimating potable water demands in areas yet to be developed. Table 2.2 presents design densities per gross acre of undeveloped residential zones, as well as residential household densities for Silverton. The residential housing densities are derived from Silverton Municipal Code Title 18, Chapter 2.2.120. The average household density assumed for this study is from US Census household survey data from 2014 – 2018. Using historical household densities is slightly conservative given national trends towards smaller household densities in the future.

Table 2.2 – Design Densities

	Density
Residential 1 (homes/ gross acre)	2 – 6
Residential R-5 (homes/ gross acre)	5 – 10
Residential RM-10 (homes/ gross acre)	10 – 20
Residential RM-20 (homes/ gross acre)	20 – 32
Acreage Residential (homes/ gross acre)	NA
Average Household Density* (People/home)	2.65

*2014 - 2018 U.S. Census data from census.gov

2.5 PRESENT AND FUTURE WATER DEMANDS

Historical production data were used to determine the average annual, average winter, average summer, peak month, and peak day demands. Plant production data was estimated using plant influent data and typical treatment process wasting rates provided by City staff. Peak hour demands were also estimated using a 24-hour demand pattern developed from actual summertime water usage patterns observed in the City's supervisory control and data acquisition (SCADA) data. Supporting data and additional details regarding the development of these system demands can be found in Appendix A.

Water demands from 2017 – 2019 were compared with the water consumption data from 2006 and 2007 used in the 2011 WMP. The highest annual usage of the five years was 2006 and 2007 was third highest usage. Table 2.3 highlights the annual consumption in these years. While the population from 2009 to 2019 increased by 8%, overall water consumption has remained constant or slightly reduced.

Another factor in future water projections is Silverton's largest water user, Bruce Pac, will be closing their facility permanently in December of 2020. In 2019 Bruce Pac represented 12% of the annual consumption for Silverton. Table 2.3 also includes consumption data for 2017-2019 not counting Bruce Pac consumption.

Table 2.3 – Annual Water Consumption Comparison (gallons)

Year	Total Annual Consumption*	Inside Residential Consumption	Inside Commercial Consumption	Outdoor Consumption
2006	435,454,827	292,102,206	134,005,711	9,346,911
2007	407,616,055	286,652,255	112,783,799	8,180,001
2017	403,473,638	263,995,821	116,309,475	11,911,317
2018	431,478,631	281,779,043	121,655,438	13,057,731
2019	405,442,980	268,024,288	107,155,428	12,615,431
2017 w/o Bruce Pac	350,207,025		63,045,554	
2018 w/o Bruce Pac	380,757,013		70,933,820	
2019 w/o Bruce Pac	356,828,852		58,541,300	

- Total consumption is more than the other three columns combined due to some other consumption categories not included in this table.

When comparing 2017 – 2019 consumption to 2006 – 2007, inside residential consumption is decreasing while outdoor irrigation consumption is increasing. The closing of Bruce Pac will also have a significant impact on commercial consumption within Silverton. The average annual consumption without Bruce Pac from 2017 – 2019 is 86% of the 2006 – 2007 average annual consumption. It is not anticipated that another business will take over the Bruce Pac facility with as high a water use so projections in this plan will be based on 2017 – 2019 consumption minus Bruce Pac usage.

Table 2.4 – 2019 Metered Consumption Breakdown in Gallons per Capita per Day (gpcd)

	Single Family Residential	Multi-Family Residential	Commercial/ Industrial (excl. Bruce Pac)	Bruce Pac	Irrigation Usage[5]	Other Metered Usage[6]	Total[7]
Average Annual[1]	63	14	17	14	4	5	117
Average Summer[2]	106	18	22	15	7	10	178
Average Winter[3]	41	11	13	13	3	3	84
Peak Month (August)[4]	121	20	23	16	7	12	199

[1] Assumes 9% of Water Treatment Plant inflow is lost to backwash/rewash (based on data from City).

[2] Include months July – Sept.

[3] Include months Nov, Dec, and Jan.

[4] Assumes 7% of Water Treatment Plant inflow is lost to backwash/rewash during high demand period (based on data from City).

[5] Irrigation usage data is from irrigation specific meters only. Outdoor usage is also recorded in other meter categories.

[6] Other metered usage includes hydrant meters, City facilities, and school district fields.

[7] Total does not include unmetered usage like fire hydrant use, leaks, and illicit uses.

Table 2.4 shows a breakdown of metered water consumption. 77 of the 117 gallons per capita per day (gpcd) average annual water usage come from residential water usage. The 2011 WMP identified a residential usage of 94 gpcd. The lower usage matches with the lower residential consumption shown in Table 2.3. The lower gpcd is consistent with national trends due to factors like higher efficiency plumbing fixtures, smaller residential lots, and more awareness about conservation.

Aerial view of Bruce Pac facility

The City has also steadily increased water rates the last few years to pay for needed maintenance and capital improvements. Higher rates incentivize reduced water consumption by residents and businesses.

12% of the metered consumption comes from Bruce Pac Industries. The closure of Bruce Pac in December of 2020 will lead to a significant drop in water consumption and revenue for the Water Fund.

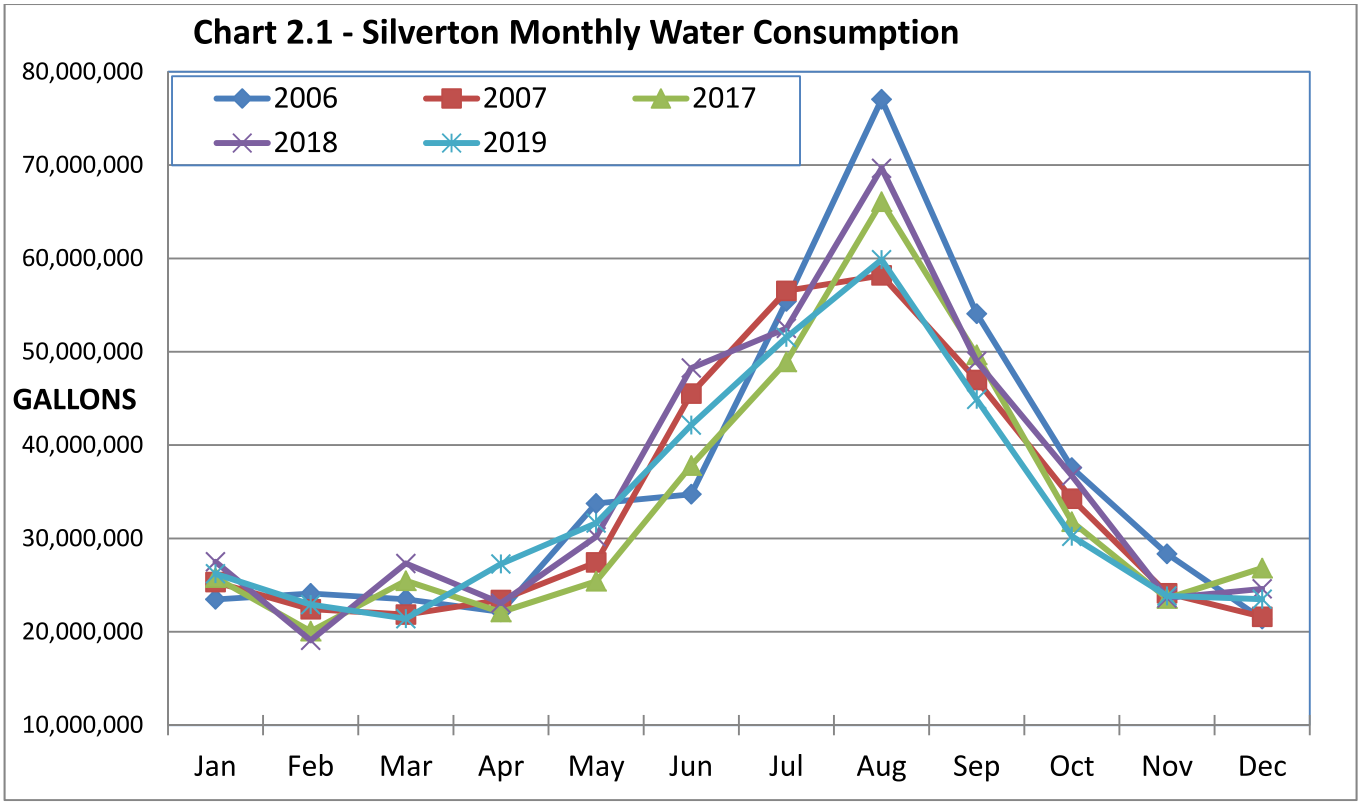
Table 2.5 compares 2017 – 2019 Water Treatment Plant raw water inflow with metered water usage, calculated water plant backwash flow and hydrant flushing estimate to determine the unaccounted for water in the system. This provides an estimate on the amount and percentage of water lost due to leaks, illicit usage, or undercounting by older meters. An Unaccounted for Water rate of less than 10% is good for a public water system.

Table 2.5 – Unaccounted for Water Calculation

Year	WTP Influent flow (MG)	Metered Consumption (MG)	Backwash Flow (MG)	Hydrant Flushing[1] (MG)	Unaccounted for Water (MG)	Unaccounted for Water %
2017	830.1	403.5	278.6	1.2	146.8	17.7
2018	831.3	431.5	297.6	1.2	101.0	12.1
2019	818.2	405.4	272.7	1.2	138.9	17.0
Average	826.5	413.5	283.0	1.2	128.9	15.6

[1] Hydrant flushing assumes 200 hydrants a month and 500 gallons per hydrant flush based on information from Maintenance Division.

Chart 2.1 shows monthly water consumption usage pattern for 2006, 2007, 2017, 2018 and 2019. Peaks correspond to summer demands, where demands are a little more than twice that of winter. Usage patterns have not changed between 2006 and 2019.



Future water demand projections are presented in Table 2.6. Three different scenarios of future demands were developed. The three scenarios are:

1) *Scenario 1 (Low Growth):* Residential per capita demands lower by 5% over the next 10 years and then remain constant as higher rates and smaller lot sizes reduce per capita demands. Commercial demand starting in 2021 is reduced without Bruce Pac and grows at a rate of 1% a year as COVID related changes in business reduce commercial water demand growth. The unaccounted for water percentage is reduced to 10% from the 2019 17% over 10 years.
2) *Scenario 2 (Medium Growth):* Residential per capita demands lower by 3% over the next 10 years and then remain constant. Commercial demand in 2021 is reduced without Bruce Pac but grows at a rate of 2.5% a year after that. The unaccounted for water percentage is reduced to 13% from the 2019 17% over 10 years.
3) *Scenario 3 (High Growth):* Residential per capita demands remain constant throughout the plan and commercial per capita demand increases by 4% a year after taking out Bruce Pac demand in 2021. The unaccounted for water percentage is 16% starting in 2020 and remains constant.

In all scenarios per capita demand for irrigation and other usage remains constant at the 2019 value of 9 gpcd.

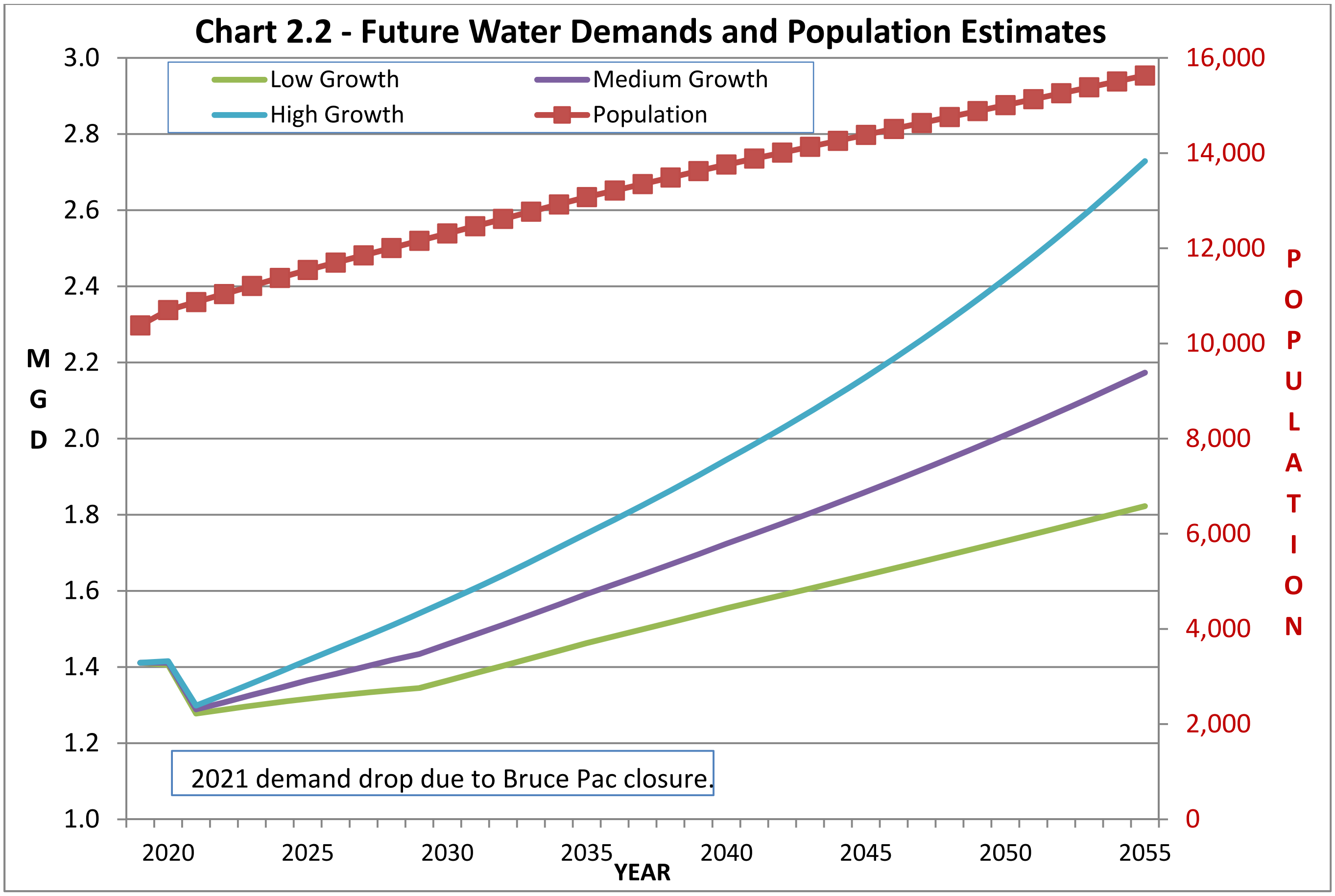
Table 2.6 – Future System Demands (Million Gallons)

Year (Population)	2020 (10,701)	2030 (12,310)	2035 (13,076)	2040 (13,759)	2055 (15,631)
Scenario 1 Average Annual Demand	**1.41**	**1.37**	**1.46**	**1.55**	**1.82**
Scenario 1 Average Summer Demand	2.05	2.04	2.19	2.32	2.71
Scenario 1 Average Winter Demand	1.04	0.98	1.05	1.12	1.32
Scenario 1 Peak Day Demand[1]	3.08	3.06	3.29	3.48	4.07
Scenario 2 Average Annual Demand	**1.41**	**1.46**	**1.59**	**1.72**	**2.17**
Scenario 2 Average Summer Demand	2.05	2.18	2.37	2.56	3.18
Scenario 2 Average Winter Demand	1.04	1.05	1.15	1.25	1.58
Scenario 2 Peak Day Demand	3.08	3.27	3.56	3.84	4.77
Scenario 3 Average Annual Demand	**1.42**	**1.57**	**1.75**	**1.94**	**2.73**
Scenario 3 Average Summer Demand	2.06	2.35	2.60	2.86	3.93
Scenario 3 Average Winter Demand	1.04	1.14	1.27	1.41	2.00
Scenario 3 Peak Day Demand	3.09	3.53	3.90	4.29	5.90

1 Peak Day Demand is estimated at 1.5 times the summer demand.

Chart 2.2 on the next page charts the average annual demand (AAD) of the three scenarios with the population projections from Table 2.1. For a primarily residential community like Silverton, growth rates in water demands will typically track with the population growth. The growth curve of Scenario 1 most closely tracks with the population. Scenario 2 is an aggressive growth rate for the population, but possible if industrial demand for water increases substantially. Scenario 3 does not seem like a reasonable scenario given the reduction in gpcd for residential use and the closure of Bruce Pac.

To be conservative, this plan will use Scenario 2 demands in determining the adequacy of source, storage, treatment, and distribution system capacities for the water system. Most of the high priority capital projects have not changed since the last plan was completed in 2011, so using this Scenario will not result in significant changes to these projects.



2.6 WATER STORAGE CRITERIA

A detailed storage analysis for Silverton is presented in Chapter 3 of this report. However, general recommendations and definitions for various storage components are presented here.

- *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. Typical operation uses approximately 10% of the total storage volume for operational storage to provide appropriate pump run times and adequate tank mixing.

- *Equalization Storage*: Equalization storage refers to the storage required to meet peak hour demands in excess of the supply capacity. With the plans of a new 2 MGD Water Treatment Plant being online by 2023, no equalization storage is needed throughout the planning period.

- *Fire Protection Storage*: Fire protection storage provides the volume necessary to meet maximum fire demands for the specified duration. The 2011 WMP used a fire flow storage amount of 4,000 gpm for 4 hours. This was based on an entire downtown block of connected buildings being considered one 20,000 square feet structure.

  The distribution system upgrades to provide a flow of 4,000 gpm from 2-3 hydrants is impractical. The current grid of 6" and 8" water mains through downtown would need to be upgraded to 16" or 18" mains and the 12" main from the water plant to downtown would need to be upgraded to probably a 24" main. Those large mains are too costly and impractical for a city this size that has had no growth in water demand over the last 13 years. Oversized water mains would also cause water quality issues because the water stagnates in underused mains.

This plan uses a fire protection storage volume amount of 3,000 gpm for 3 hours. This flow would be required for some industrial uses or large warehouse facilities. This flow is somewhat unrealistic for the 8" and 10" grid system Silverton currently has. But a facility could upgrade water mains around their facility to 12" and possibly get this level of protection from 2-3 hydrants.

- *Emergency Storage*: The City has historically planned on having emergency storage of 2 days of Average Day Demand (ADD). This plan uses the medium growth ADD for this calculation.

2.7 DISTRIBUTION NETWORK CRITERIA

Planning for the distribution network involves establishing performance standards for pressures and flows throughout the system. The design flows through the system are the largest flows reasonably anticipated to occur. For Silverton, these flows result from a fire event during the system's maximum day demand.

In evaluating fire flow for existing residential areas, we assumed a minimum fire flow requirement of 1,000 gpm above 20 psi for 2 hours. It is recommended that homes built after 2009 be provided a minimum fire flow of 1,500 gpm at 20 psi. Aside from residential areas, the fire department assisted in identifying a number of structures within Silverton that have high fire demands.

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 standards for pressure is to provide safe and reliable service to water users under a variety of system conditions. High pressures can damage the distribution system and at points of use. If pressures are too low, a variety of issues arise - including potential for back flow contamination, and low or no water availability. The recommended distribution pressure standards for new connections are listed in Table 2.7.

Table 2.7 – Distribution System Pressure Standards

System Scenario	Pressure (psi)
Peak Hour Demand Event – Minimum	40+
Maximum Day Demand Plus Fire – Minimum	20+
Mainline Pressures – Maximum (w/o special pipe design)	100
Pressures at service w/o Pressure Regulator – Maximum	80

The 2011 WMP completed by Keller Associates analyzed the distribution system using a WaterCAD hydraulic model. Since 2011 Keller Associates has updated that model periodically as expansions of the distribution system occurred to accommodate new subdivisions and commercial projects. Water system demands have not increased since 2011 though, so the priority of the distribution system capital improvements identified in the 2011 plan have not changed. Therefore, this plan will utilize the distribution system Capital Improvement Plan (CIP) identified in the 2011 plan rather than complete another analysis using the same model at the same demands. The only changes to the distribution system CIP in this plan is the costs will be updated to reflect 2020 prices.

3 EXISTING FACILITIES EVALUATION AND ALTERNATIVES

This chapter provides an analysis of the City's existing system components of storage, delivery, and distribution with respect to the design criteria presented in Chapter 2 of this report. Chapter 4 addresses the City's water supply and treatment.

3.1 EXISTING STORAGE EVALUATION

The City has an existing storage volume of 4.45 MG total in three storage reservoirs. The storage component volumes presented here are effective storage volumes, and thus exclude unusable or 'dead' storage.

Old Clearwell

New Clearwell

Table 3.1 – Existing Available Storage

Site	Material	Volume (MG)
Old Clearwell	Buried Concrete	1.0
New Clearwell	Buried Concrete	1.46
High Level	Welded Steel	1.99
Total		**4.45**

High Level

Table 3.2 summarizes the required storage volumes for existing and future conditions. The required storage volumes are based on the storage component requirements presented in Section 2.6 of this report. As can be seen, the existing storage essentially meets the requirements for the existing users. Additional storage needs are anticipated to increase to 1.42 MG by 2055. The majority of the storage requirement corresponds to the two-day average day demand for emergency storage. This is an analysis of the overall water system storage needs. All of the existing reservoirs are on the east side of Silverton. If a storage analysis of individual pressure zones were taken, the west side of the distribution system would have an existing deficit in 2020.

Table 3.2 – Existing and Future Storage Components

Component	2020	2030	2040	2050	2055
Population	10,701	12,310	13,759	15,008	15,631
Equalizing storage[1]	0.21	0.19	0.28	0.38	0.44
Operating storage[2]	0.45	0.45	0.45	0.45	0.45
Fire storage[3]	0.54	0.54	0.54	0.54	0.54
Emergency storage[4]	2.84	2.92	3.45	4.02	4.35
Total Need (MG)	**4.03**	**4.09**	**4.71**	**5.38**	**5.77**
Less existing	(4.45)	(4.45)	(4.45)	(4.45)	(4.45)
Deficit (MG)	**0**	**0**	**0.26**	**0.93**	**1.32**

[1]Equalizing storage accounts for peak hour demands greater than water supply capacity. In 2020 3 MGD is used for existing plants 1 and 2. For 2030 and beyond it is assumed the new treatment plant can supply up to 3.5 MGD to the system.
[2]10% of total existing effective storage. Represents difference between on/off settings and freeboard.
[3]3000 gpm fire demand for 3 hours.
[4]Assumes 2 times the Scenario 2 ADD used in Table 2.6.

3.1.1 Alternatives for Addressing the Storage Shortfall

Alternatives for addressing the City's existing storage shortfall include: doing nothing, reducing peak hour demands, increasing supply, or constructing new storage. This section reviews options under each of these categories.

No Action

If the City were to do nothing, the emergency supply storage need will continue to grow over time, reducing the amount of storage available for providing fire protection and operational storage.

Reduce Peak Hour Demands

Reducing peak hour demand could come in the form of curtailment, changing water usage patterns, and water conservation. A mandatory curtailment plan could be implemented as a means of reducing peak hour demands, which would also reduce the peaking and emergency storage components of the needed storage. Changing periods of peak water usage could be accomplished by irrigating more during daytime hours. One concern with encouraging more irrigation during the daytime (which would reduce the night-time peaking storage required) is that the total water demands could increase as a result of additional evaporation that occurs.

Reduction in peak demands have been happening as a combination of increased housing density, rising water rates, and consumer knowledge about water conservation. As a result Silverton is using the same amount of water as 2006 with a much larger population. Land use zoning that reduces average residential lot size in Silverton and building codes will continue to lower overall water demand per household. Rising water rates will also promote conservation and the reduction of irrigation usage from residential and commercial customers.

Increasing Supply

The existing water rights meet the peak hour demands the City is currently seeing. Reconstruction of the Silver Creek Intake and a new Water Treatment Plant will provide a reliable supply capacity of 4 MGD, helping reduce the need for additional storage over the planning period.

Reducing Unaccounted for Water

The current unaccounted for water amount is around 16%. The City should pursue steps to reduce the unaccounted for water amount to less than 10%. Conducting a leak detection program and fixing the largest leaks that are found would be very beneficial.

The distribution system improvements identified in the Capital Improvement Plan will help reduce leakage and increase fire flows and capacity in the system when old lines are upsized with new lines.

Constructing New Storage

Priority 1 Storage Improvements:

The 2011 Water Master Plan identified the need for a reservoir on the west side of Silver Creek at an elevation that could match the water level elevation of the High-Level Reservoir. In 2016 the City completed a purchase of 2.03 acres off Edison Road NE to be the site for a new reservoir. While the water system as a whole does not have a storage deficit, a new tank at the Edison Road site would provide fire and an emergency storage supply to the distribution system west of Silver Creek. It would also eliminate the long-term storage deficit identified in Table 3.2 through 2050. Because of its elevation, it could service all of the pressure zones in the event of an emergency. A new storage facility at this location will provide needed fire storage to residentially and commercially zoned areas west of Silver Creek.

While the water system as a whole does not have a storage deficit, a new tank at the Edison Road site would provide fire and an emergency storage supply to the distribution system west of Silver Creek.

The Edison Road property was purchased for a 2 MG tank as that was the identified need in the 2011 plan. Due to lower water demand growth and reduced fire storage needs, a 1 MG tank is needed to provide storage needs to 2050. This plan's recommendation is to build a 1 MG tank at the Edison Road site, but with the site designed so a second 1 MG tank could be built there if needed in the future. Past 2050 another 1 MG tank would be needed. Depending on how Silverton grows, the best location could be the Edison Road site or the existing Water Treatment Plant property.

In connection with the new tank, a few other improvements/considerations are recommended:

- Provisions for tank mixing and re-chlorination. This is important considering the longer residence times anticipated in the tank.
- A backup pump capable of delivering backup and additional fire flow to the Edison Road Booster service area.

- A pressure sustaining valve that would protect the Edison Road Booster service area from over-pressurizing in the event that one of the larger pumps were to run unchecked. Flow could be redirected back to the new tank.

- An altitude valve at the existing High Level Reservoir site. The existing High Level Reservoir is anticipated to fill more quickly than the new tank because of its proximity to the High Level Pump House. Control on/off settings for the pumps in the High Level Pump house should be set up to run off of the new tank. The new tank elevation should match the same hydraulic grade of the existing High Level Reservoir.

For budget purposes, the new storage facilities were assumed to be concrete. Concrete will be necessary for buried or partially buried tanks (such as the two existing clear wells). Concrete tanks will also result in lower operational and maintenance costs. Further evaluation of tank materials could be completed during the pre-design phase of completing recommended storage improvements.

3.1.2 Additional Storage Improvements

As part of the 2011 WMP, the City completed an evaluation of existing storage conditions for the High Level Reservoir. A copy of this evaluation along with recommended facility maintenance activities and upgrades can be found in Appendix B.

3.2 BOOSTER PUMPS AND PRESSURE ZONES

Booster Pumps

There are three booster pump stations in Silverton's water system. These are referred to as the High Level Pump House, the Edison Road Booster Pump House, and the Main Street Pump Station.

High Level Pump House

The High Level Pump House, located at the Water Treatment Plant, directly or indirectly serves all of the upper pressure service areas in the water system. This pump station is controlled by the levels in High Level Reservoir. Water Quality Division crew members manually control the booster pumps during backwash cycles at the Water Treatment Plant.

A 2011 evaluation of the High Level Pump House is contained in the Technical Memo found Appendix B. The facility is approximately 30 years old. Two pumps, each with a capacity of approximately 1450 gpm, deliver water to the high level pressure zone. This evaluation recommended a new booster facility as most of the facilities were approaching the end of their design life. The evaluation recommended a new facility with three or more pumps sized so the future peak day

Edison Road Booster Pump House

demand could be met with the largest pump out of service. The facility should also have standby power, flow metering capabilities, and modern electrical and instrumentation components.

The 2011 evaluation noted that the City was planning to replace one of the 150 hp pumps with a 75 hp pump and a VFD. This change did not occur. This facility also has pressure reducing valves to supply water to the medium pressure zone from the high pressure zone. All water supplied to the medium pressure zone is first pumped to the high pressure zone. This layout is antiquated and is very inefficient in terms of energy costs and water movement. A new pump house should be built with the following components:

1. Three pumps for the high level pressure zone of various sizes with variable frequency drives (VFD's) to better match pumping with demand.
2. A pump and VFD that pumps directly to the medium pressure zone. This will reduce energy costs and provide fresher water to the pressure zone.
3. A pressure reducing from the high level to medium pressure zone. This would be utilized when demand is greater than the medium pressure pump or when the pump is down for maintenance.
4. Pressure relief valves from the high and medium zones to the reservoirs on-site that serve the low pressure zone.

The City should look at designing and constructing this new pump station as part of the new Water Treatment Plant being constructed on-site. Constructing this at the same time would provide some economies of scale in construction.

Edison Road Booster Pump House

The Edison Road Booster Pump House pulls water from the high level pressure zone and boosts it to a small service area near Edison Road. A 2011 evaluation along with recommended improvements for this pump station can also be found in Appendix B. None of the suggested 2011 improvements have been completed.

Main Street Pump Station

The Main Street Pump Station is located in a below ground vault and has not been operational for many years. Originally, this facility provided water to an elevated tank that has since been abandoned. The need for this facility has been eliminated by other system improvements but exists as a backup system in case of PRV failures elsewhere. Completion of storage, PRV, and pipeline improvements recommended as part of this Water Master Plan would negate the need for it as a backup system and allow for the removal of this pump station.

Pressure Zones

There are six pressure zones in the Silverton's water system. A seventh zone is used within the Water Treatment Plant site. Table 3.3 lists the pressure zone names, hydraulic grade, and typical pressure range for the zone. Figure 2 on the next page is a map that depicts the locations of the pressure reducing valves and pressure zones within the Silverton.

City of Silverton Water Master Plan

Figure 2 - Pressure Zone Map

Table 3.3 – Pressure Zone Table

Pressure Zone	Target Hydraulic Grade (ft)	Pressure Range
Edison Booster Zone	730	38 - 100 psi
High Level Zone	631	42 – 81 psi
Medium Level Zone	518	40 – 90 psi
Ike Mooney PRV Zone	498	43 – 80 psi
Anderson PRV Zone	490	35 – 91 psi
Low Level Zone	409	38 – 87 psi

1. PRV = Pressure Reducing Valve

Most of Silverton is supplied directly from the clearwells located adjacent to the Water Treatment Plant (Low Level Zone). This service is provided via gravity from the clearwells without pumping.

The High Level Zone draws water from the WTP clearwells and is pressurized from the High Level Pump house. The 2 MG High Level reservoir, located on Eastview Lane, serves the High Level Zone directly and the down-gradient zones indirectly. Pressures are reduced from High Level Zone to serve the Medium Level Zone, Ike Mooney PRV Zone, and the Anderson PRV Zone. Pressures are increased from the High Level Zone through the Edison Booster Pump Station to supply the Edison Booster Zone.

Each of the PRV stations that establish a grade for a zone consists of a primary PRV and a secondary PRV. The primary PRV setting is the normal operating grade for that zone. The secondary PRV setting is approximately 10 psi lower than the primary PRV, and is used in high demand scenarios (such as fire flow conditions) when the primary PRV's flow capacity is insufficient to keep up with the demand.

At the intersection of Phelps Street and McClaine Street is a check valve that separates the Low and Medium Level Zones. In the event of loss of pressure in the Medium Level Zone that reduces pressure below the Low Level pressure, the check valve will open and allow water from the Low Level up to the Medium Level Zone. This could occur as a result to high fire flow demands or a large line break in the Medium Level Zone.

3.3 DISTRIBUTION SYSTEM EVALUATION

Keller Associates completed an evaluation of the distribution system using a hydraulic model for the 2011 Water Master Plan. Since that plan water demand in the system has been stagnant, and very few of the recommended improvements in that plan were completed. Rather than completing another distribution system analysis, the Distribution System CIP (Capital Improvement Plan) from that plan will be used as the CIP for this plan. The only changes in the CIP were removing a couple projects that had been completed and updating all of the project costs to reflect 2020 dollars. The remaining text italicized in Section 3.3 and 3.3.1 describe the modeling process completed and are straight from the 2011 plan.

A hydraulic computer model of the City's distribution system was created in conjunction with this study using data extracted from the City's existing GIS database. The hydraulic modeling software used for this study is Bentley's WaterCAD v8i.

Significant effort on the City's part was put forth to improve the attributes and integrity of the GIS database prior to the creation of the model. The City's existing 2-ft contours were used as the source for *the modeled elevation. The elevation data was added to the model through an automated terrain modeling process and manually checked for accuracy. Additional model input data such as pump curves, operational controls, component set points, and other data was gathered by City staff and incorporated into the hydraulic model.*

Water consumption records from City's billing database was exported and joined to the GIS water meter database. This allowed for a more accurate allocation of the existing system water demands.

The future water system demands were allocated in the water model according to the planned land use and the respective development densities of undeveloped areas within the study area. The City provided information on vacant parcels within the city limits with utility services readily available, and developable land within the city limits that may require utility and access work as part of development. These two types were assumed to be the first to be developed in the future and their cumulative area accommodated nearly all of the new population up to year 2020.

Of the 461 acres of undeveloped land outside the city limits but within the urban growth boundary, 259 acres are needed to accommodate the added population by 2035.

Water demands were allocated to these areas using Theissen polygons intersecting the land use polygons. The allocation was accomplished through an automated process in the water modeling software and the demands were back-checked for accuracy.

Upon completion of the model construction process, City staff collaborated to calibrate the hydraulic model to actual field conditions. This process consisted of simultaneously collecting and recording multiple parameters from more than 60 points throughout the water system over several days of fieldwork. As discrepancies were identified between field and observed data, additional testing was conducted until the source of the discrepancies was identified and accounted for. The end result of this effort is a highly refined and very well calibrated model that will not only serve for the present evaluation and planning needs, but can be used on an ongoing basis by the City in a number of ways to assist in implementing future projects.

This calibrated computer model of the water system can continue to serve as a valuable and cost-effective system planning and management tool for the City. It is highly recommended that the City update the model every one to three years to reflect changes in the physical attributes and usage patterns of the water system. Typically these updates can be accomplished for about $5,000, depending on the amount of growth that has occurred and if additional analysis is desired. For many communities ongoing costs for updating the model and evaluating development impacts are charged to the development at the time of preliminary plat or final plat review.

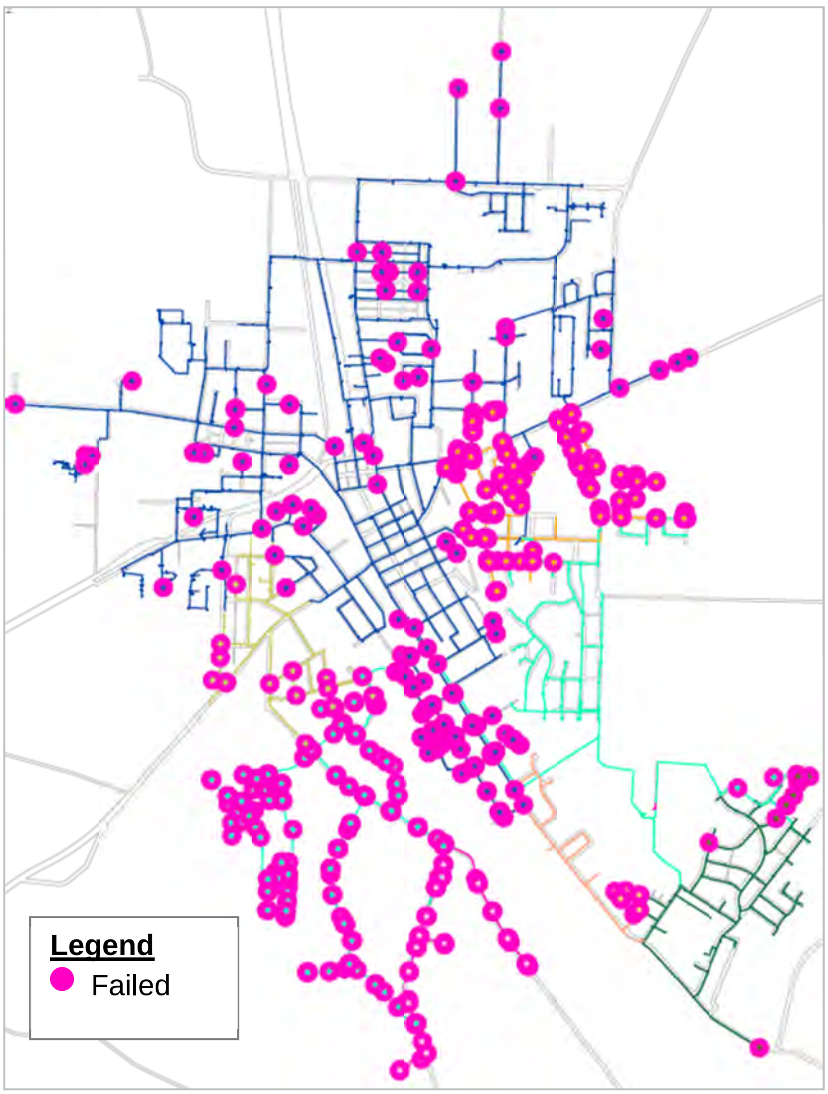
3.3.1 System Evaluation and Results

With the calibrated model, the current distribution system has been evaluated for compliance with the pressure and flow standards presented in Section 2.6 of this report. The following sections summarize the analysis results.

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. These site specific fire flow requirements can be found in Appendix C. A minimum commercial fire flow of 2500 gpm at 20 psi was selected as the default for the model evaluation if no specific fire flow requirement was identified by the local fire *authority. Service lines, transmission lines, or dead end lines without hydrants or within 300 ft of another node capable of providing fire flow were eliminated from the fire flow evaluation.*

Under maximum day demands with the largest pump offline, and the fire flow requirements stated, the system was tested with the criterion of system pressures not dropping below 20 psi. The water model evaluates each node 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 3 highlights the modeled nodes in the water system that do not meet Maximum Day Demand plus Fire requirements. Appendix C contains the detailed model results report for this and all other model evaluations discussed in this section.

Figure 3 – Locations not Meeting Maximum Day Demand plus Fire Requirements

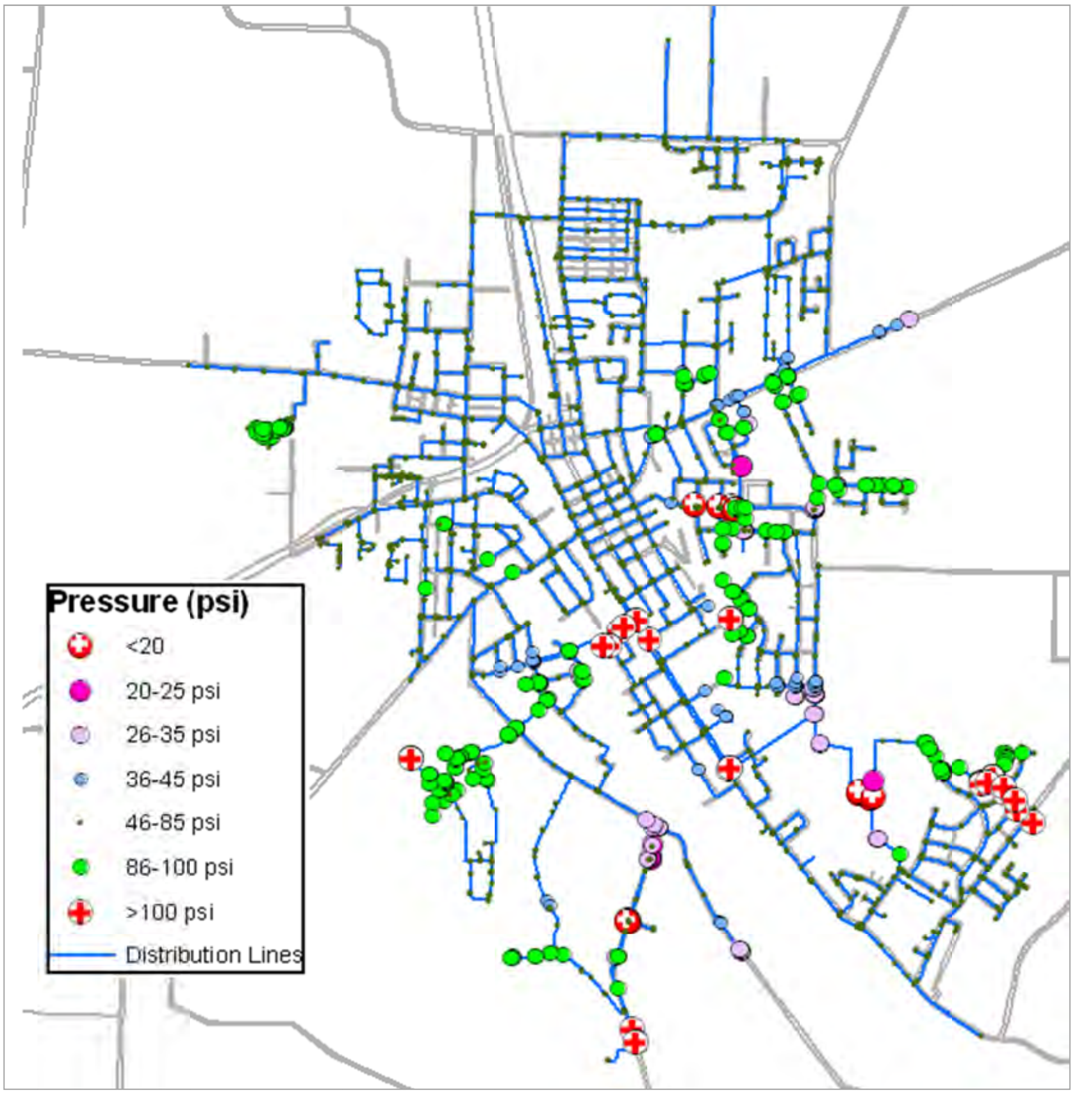


Areas of inadequate fire protection are primarily a result of undersized lines, inadequate transmission, lack of system looping, and low system pressures in some locations. Inadequate transmission and a lack of storage on the west side of Silverton account for many of the highlighted locations in southwest

Silverton. Local undersized pipelines (typically older pipelines, 2 inches to 6 inches in diameter) account for many of the areas not meeting fire protection in the downtown and lower parts of the city.
Peak Hour Demand

The system was also modeled under peak hour demands to check for pressures in the system against the selected pressure standards. Figure 4 highlights the system locations with various pressure ranges.

Figure 4 - System Pressures under Peak Hour Demands

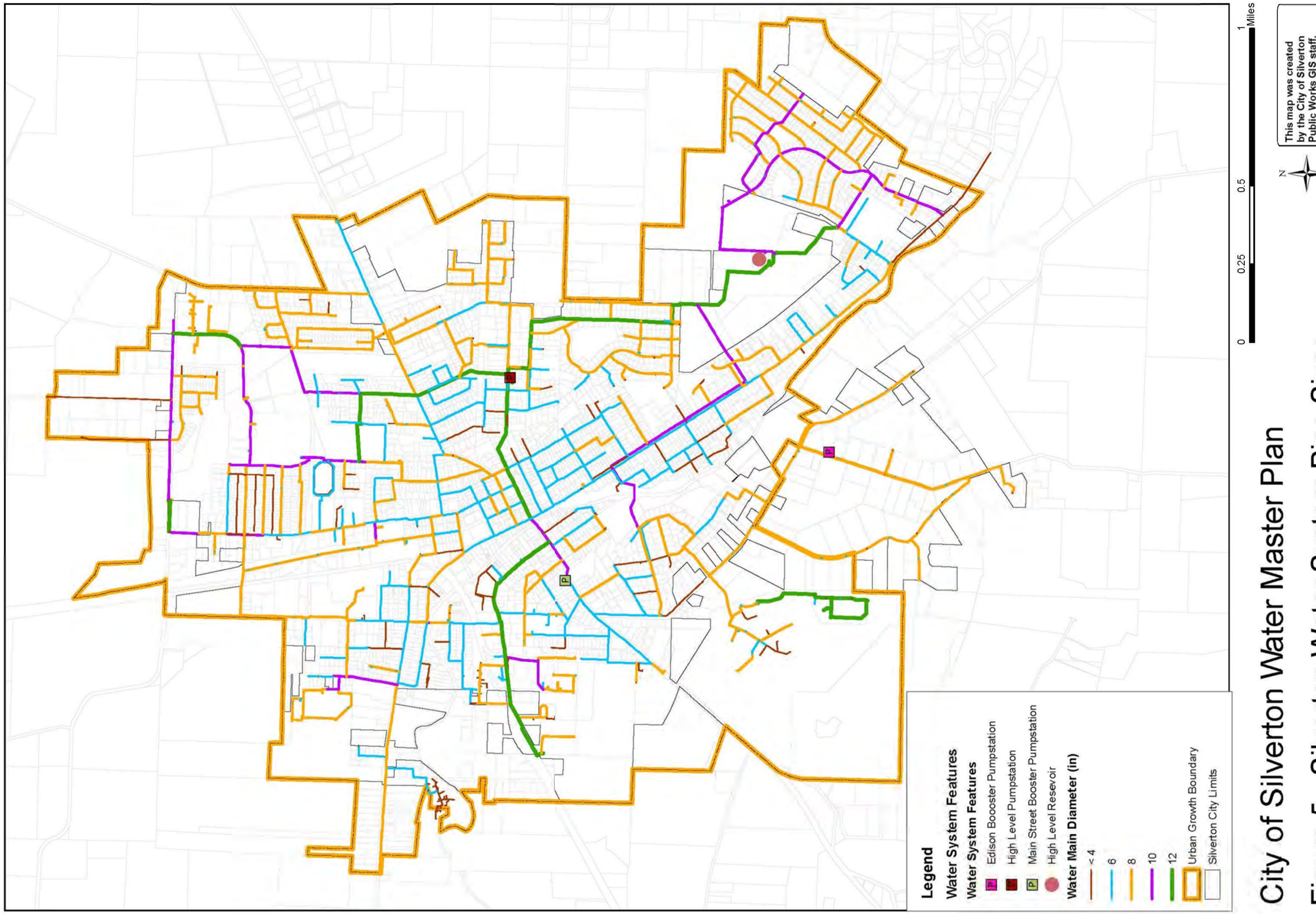


Unwanted Pipe Materials and Older Lines

The distribution system contains problematic steel and asbestos cement pipe materials. These materials tend to cause operation and maintenance problems (low pressures, leaky pipes, poor fire protection, poor water quality) for Silverton's system and have been targeted for replacement in the capital improvement plan. Additionally, some older portions of the system (Main, Lewis, and Jersey Streets east of Water Street) with cast iron pipe material are believed to be tuberculated.

To simulate pressure losses experienced in the field, the City had to significantly restrict flows in the water model. Buildup of material in the pipeline was confirmed by field staff who report that pipe corrosion can also cause aesthetic water quality concerns.

Silverton Main Street



City of Silverton Water Master Plan

Figure 5 - Silverton Water System Pipe Sizes

3.3.2 Fire Hydrants

There are approximately 600 fire hydrants distributed throughout the water system. In general, there should not be more than 500 feet between hydrants in order to provide fire protection without the need to run excessive fire hoses during a fire event. This maximum distance requires a radius of 250 feet around each hydrant. The radii of the hydrants in the system should overlap for good coverage. Gaps, or areas where radii do no overlap, are areas of inadequate fire protection.

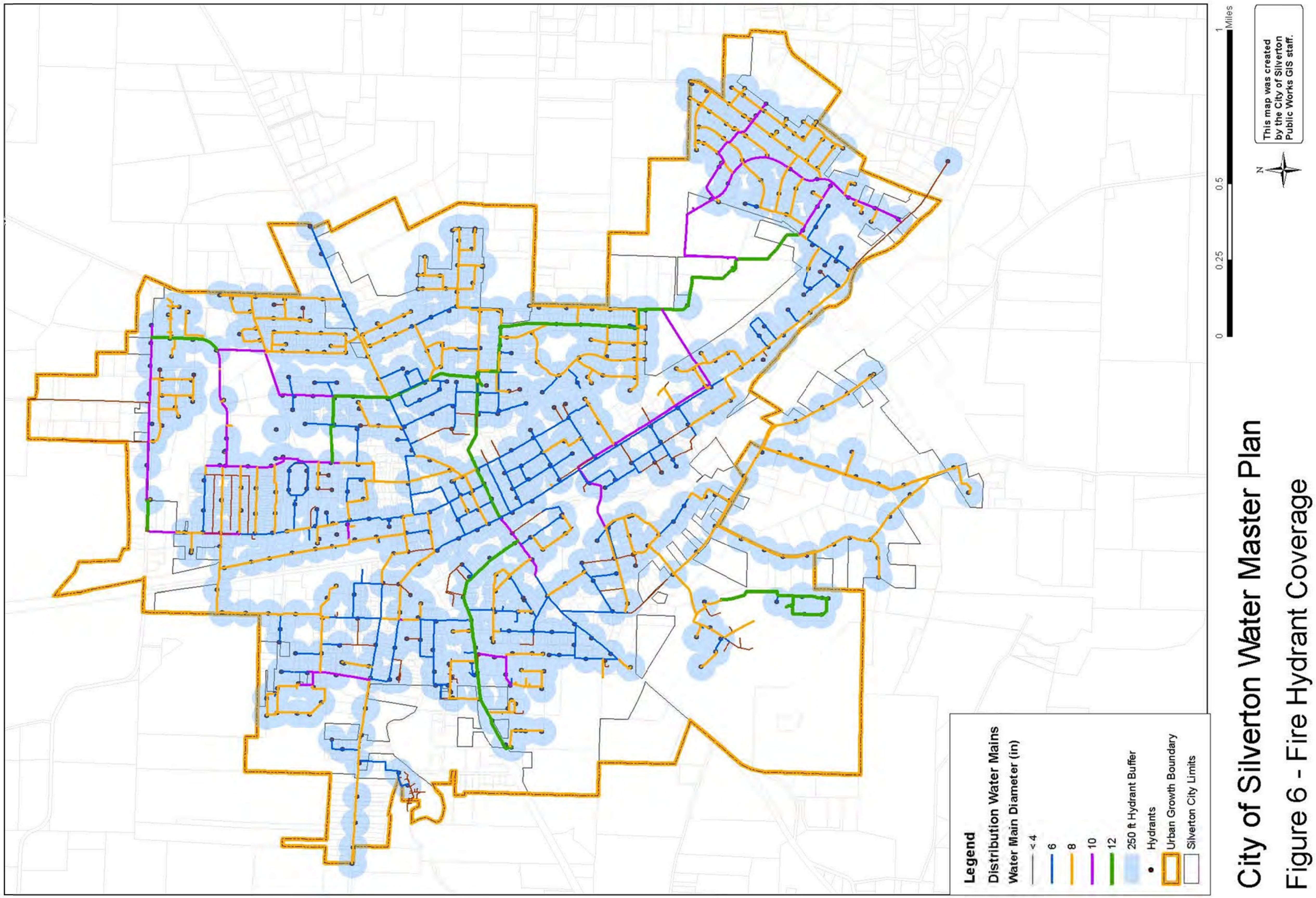
The City has a flushing program where about 200 hydrants a month are flushed for 3 – 5 minutes to maintain water quality and hydrant operations. The City also completed a hydrant painting project in 2020 for all hydrants.

City of Silverton Public Works employee flushing a fire hydrant

With the available hydrant location data, a 250 foot radius was created around each hydrant to check the general coverage throughout the system. This method applies only for a general check because it does not account for local obstructions that might inhibit actual coverage. Figure 6 illustrates the hydrant coverage based on a 250 foot radius for each hydrant. As seen in Figure 6, there are gaps in hydrant coverage. Some of the Priority 1 capital improvements are targeted at eliminating some of the most critical coverage gaps.

3.3.3 Operation & Maintenance

The City exercises all valves annually. Broken valves and hydrants are placed on a list for replacement and City crews work on repairs throughout the year. All pressure reducing valves are rebuilt and set biannually. Backflow assemblies are tested and repaired as needed on an annual basis. Meter repairs/replacements are an ongoing activity consuming approximately five days per month. City staff have also expressed a desire to have more funds available for distribution repairs and replacements.


Legend
Distribution Water Mains
Water Main Diameter (in)
< 4
6
8
10
12
250 ft Hydrant Buffer
Hydrants
Urban Growth Boundary
Silverton City Limits
0
0.25
0.5
1
Miles
N
This map was created by the City of Silverton Public Works GIS staff.
City of Silverton Water Master Plan
Figure 6 - Fire Hydrant Coverage

3.4 DISTRIBUTION SYSTEM IMPROVEMENTS

General Improvements

In addition to system pressures and flows, an evaluation of system redundancy revealed areas of concern. Large areas (including the Anderson PRV Zone, Edison Booster Zone, and the portion of the High Level Zone west of Silver Creek) in the system are currently supplied by a single line that crosses Silver Creek. In the event of a rupture at any point along that single line, numerous services would be without water until a repair could be made. The hospital area is one location in particular with this concern.

Critical redundancy needs were considered to be the highest priority among the *distribution system* improvements. Along with the storage, pumping, and operational improvements, the recommended distribution improvements are illustrated in Figures 7 and 8 in Chapter 5, and are further explained in the CIP project sheets in Appendix F.

General Improvements for Fire Protection

The areas in the system with inadequate fire flow were evaluated and prioritized with input from City staff and the local fire authority. The fire flow improvements are targeted to provide target fire flows of 1,000 gpm in residential areas and 2,500 gpm in commercial areas. Site specific fire flow requirements identified by the local fire authority for industrial or large commercial facilities may require more than 2,500 gpm. These improvements are also illustrated in Figures 7 and 8 in Chapter 5.

Improvements to Address Low and High Pressures

There are currently areas throughout the distribution system that have unacceptably high or low pressures. For areas of low pressure, some operational changes to the pressure regulator valve settings or moving some services to the next higher pressure zone have been included in the priority improvements. For areas with high pressures, individual pressure regulators could be employed (the City recommends that individual pressure regulators be required on all new construction where pressures are anticipated to exceed 80 psi).

3.5 REGIONALIZATION AND SERVICE TO MOUNT ANGEL

Mt. Angel is approximately 4 miles north of Silverton. Mt. Angel’s water supply comes from groundwater and is not treated. Previous plans have looked at a potential intertie with Mt. Angel. At the time of those plans, Mt. Angel had several industrial users who accounted for a large portion of their water use. Those industrial users no longer use Mt. Angel water, however, and Mt. Angel water demands are less than they were 10 years ago. The Mt. Angel Public Works Superintendent stated Mt. Angel’s source capacity is twice as much as their current water demands.

The City of Silverton will be applying for grant funds in 2020 to complete a feasibility study for an ASR (Aquifer Storage and Recovery) project. That study would look at potential benefits for Mt. Angel as well as Silverton if the ASR project is completed.

Mt. Angel has sufficient water for their needs within the current planning period, so this plan will assume that Silverton will not supply any water to Mt. Angel. If a completed ASR study indicates a benefit to Mt. Angel, and Mt. Angel is interested in being part of a regional project, then this plan will be updated accordingly.

4 WATER TREATMENT FACILITIES EVALUATION

4.1 OVERVIEW AND BACKGROUND

In 2016 Keller Associates completed a Water Treatment Plant Facility Plan for the City of Silverton. This plan is included in Appendix G. The plan provided a detailed analysis of the capacities and deficiencies of the source water intakes, transmission lines, and Water Treatment Plant facilities. A 20-year Capital Improvement Plan identified seven needed improvements as listed in the table below.

Table 4.1 – Water Source and Treatment Facility Improvements

ID#	Project Name	Project Description	Cost (2020 Dollars)
1A	Silver Creek Pump Station	New Pump Station and Transmission Lines	3,500,000
1B	Abiqua Intake	Remove intake, dam, and fish ladder, and replace with new intake upstream in creek bottom	8,200,000
1C	Backwash	Backwash evaluation and NPDES Permit	$25,000
1D	New Water Treatment Plant	Replace Plants 1 and 2 with new 4.0 MGD WTP	$5,800,000
2A	Abiqua Intake Line	Replace 1,100 feet of 14" Steel Transmission Line near WTP with 20" Ductile Iron Main	$705,000
3A	WTP Expansion (Beyond Planning Period)	Expand plant capacity to 5.0 - 6.0 MGD	TBD

Since 2016 the City has progressed on the design of improvements for the Silver Creek Pump Station, Abiqua Intake, and WTP expansion. Some of these projects have changed from what was recommended, however, due to changes in growth projections and City goals. This section will describe what the current goal is for each project and how it may differ from what was proposed in the 2016 plan.

The City of Silverton's WTP is located near the intersection of E. Main St. and S. Ames St. The WTP receives raw water from Abiqua Creek (primary source) and Silver Creek (secondary source). The plant uses conventional treatment techniques (e.g. coagulation, sedimentation, filtration) to treat the water to a level that meets the requirements of the Safe Drinking Water Act and the Oregon Health Authority standards for potable water (OAR 333-061-0030 and 0032). The WTP is arranged in a campus that includes two independent water treatment facilities. Also located on the campus are two reservoirs (1.0 MG and 1.5 MG) that provide the primary storage and contact time for the treated water as well as the backwash water supply for the old plant (new plant receives backwash water from the High Level Reservoir via the distribution system). The storage reservoirs provide water to the clear well zone (aka low zone) by gravity, and to the upper pressure zones via the High Level Pump House.

4.2 SOURCE WATER

The source water is comprised of two creeks (Abiqua and Silver Creek) that feed from different watersheds. This configuration makes the Silverton water supply less vulnerable to an event within one of the watersheds that would significantly alter the water quality being delivered to the treatment facility. While this provides some level of protection to Silverton, it also creates a unique challenge to the operation of the plants. The water sources, while similar, also have unique characteristics that change the treatment approach within the plant.

4.2.1 Abiqua Creek Facilities (Table 4.1 Projects 1B & 2a)

Water from Abiqua Creek is conveyed by gravity directly to the WTP. The City's Abiqua water right was established in 1916 (the oldest on the creek), and is for 10.0 cfs (or 6.5 MGD). The intake screen, installed in 2001, has a maximum "through slot" velocity of 0.78 ft/sec, an Oregon standard "approach" velocity of 0.4 ft/sec, and a theoretical 6.5 MGD flow rate. Immediately downstream of the screen is the transmission pipeline to the WTP pretreatment, 7 miles in length, with a theoretical flow capacity of 7.4 cfs (or 4.8 MGD). The transmission pipeline diameter reportedly varies in size from 20" to 24", with the smaller 20-inch line limiting the transmission capacity. Improvements to the pipeline have been made over the years, with the most recent completed in 1994.

The fish ladder was constructed in the 1950's. A study of the fish ladder was completed in May of 2008 by the engineering firm Black and Veatch. The conclusion of the study was that the fish ladder is in poor condition and does not meet current fish passage criteria. The City is not required to make fish ladder improvements until such time as a project to improve or modify the Abiqua Dam is undertaken.

Abiqua Creek Facility

The intake at Abiqua Creek reportedly suffers from sediment build-up and blinding due to leaves during the fall season. Additionally, the intake is at risk of plugging with leaves during power outages, because the cleaning mechanism used to clear the screens does not have an emergency power supply.

2016 Facility Plan Recommendations: The plan recommended the City complete a major upgrade of the intake including emergency generator, SCADA upgrades, new fish ladder, screens, and basin upgrades.

2020 Project Update: The City received a grant to study a project involving removal of the dam, fish ladder, intake structure, and settling basin. They would be replaced by extending the intake upstream into the middle of the creek with a self-cleaning screen. This would provide new fish habitat upstream of the dam and simplify the operation and maintenance for the City. Based on the age of the existing structures and condition of the fish ladder, upgrading the existing facility does not make economic sense.

4.2.2 Silver Creek Facilities (Table 4.1 Project 1A)

The Silver Creek water right, established in 1911, is for 5 cfs (or 3.2 MGD). The current measured pump capacity of the intake is 2.3 MGD with both pumps running, and 1.7 MGD with a single pump running. The City has a water right to use 14 cfs (9.0 MGD) of the water stored in the Silverton Reservoir. The 14 cfs can be released from the reservoir and diverted from the current intake on Silver Creek, but is limited to 1,300 Acre-feet per year. The intake is reportedly old and in poor condition. Preliminary engineering evaluations were completed by Tetra Tech for a project to increase the size of the 2,200-foot long 12-inch pipeline from Silver Creek to the WTP site, to 18 inches, and increase the intake pump capacity to provide a total of 8.5 cfs (5.5 MGD) to the WTP.

Silver Creek also includes a reservoir which is operated and maintained by the City. In 2019 a bathymetric survey was done on the reservoir. The survey found the City has around 750 acre-feet of storage above the dam. An evaluation of the reservoir was not completed as part of this master plan update.

2016 Facility Plan Project 1A: This project included a replacement of the existing intake with a new intake with a generator and control upgrades. The project also included upgrading the existing 12 transmission main from the east end of Lane Street to the water treatment to a new 18" ductile iron transmission main.

2020 Project Update: The City received a $2.3 Million Economic Development Assistance grant to complete this project. The design for this project will be completed in 2021. Construction is scheduled to start in 2021 and be complete in 2022. This project would consist of a new intake structure, emergency power on-site, pumps with variable frequency drives, and all new electrical and control system. In addition 1,700 feet of transmission line would be upsized from 12" to 18" to provide more capacity within the transmission line.

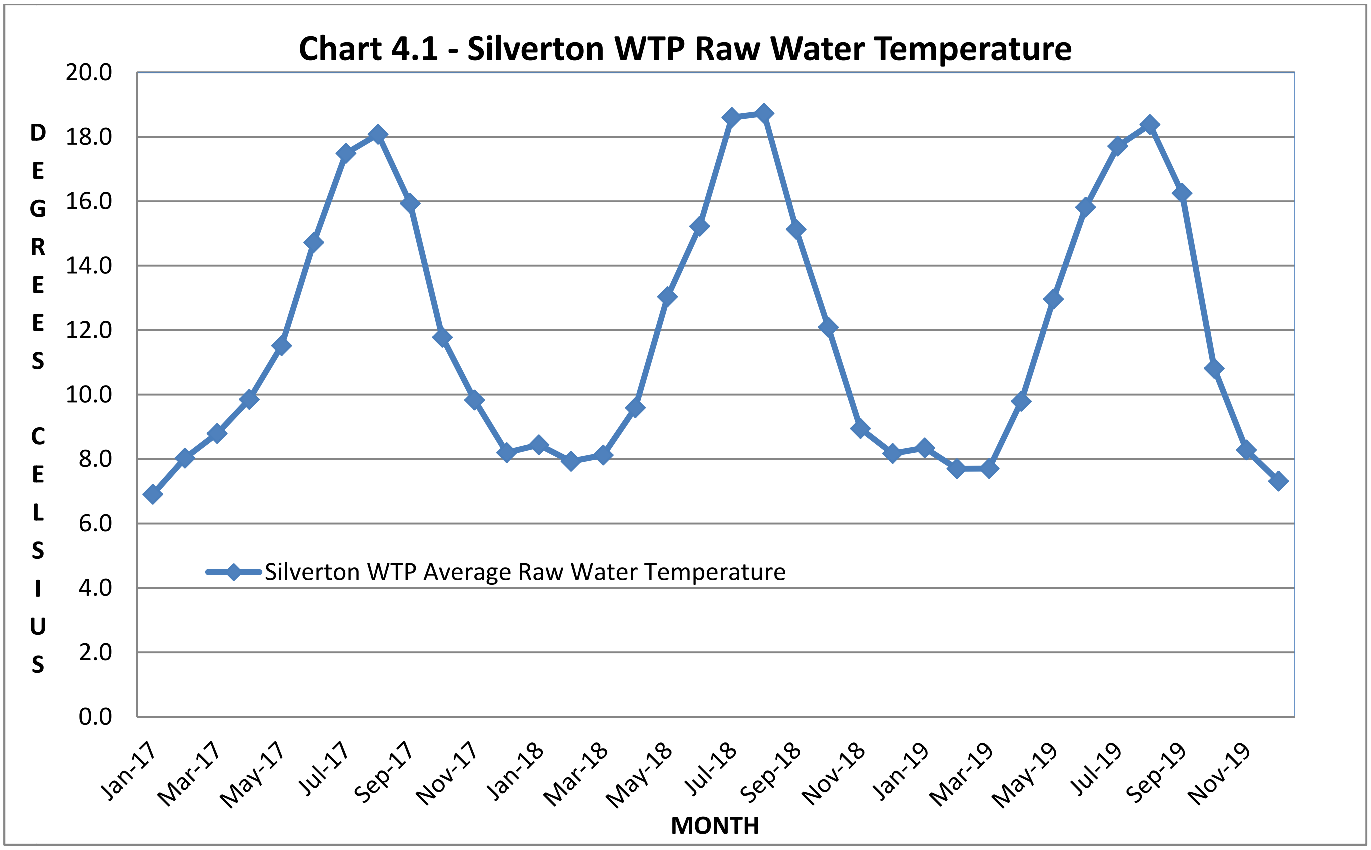
Silverton Reservoir

4.2.3 Source Water Quality

The City's primary and preferred source is Abiqua Creek, a perennial stream with good water quality. If flow in Abiqua Creek diminishes or has high turbidities, the City switches to water from Silver Creek.

The Abiqua water source does not have a reservoir to store water for use throughout the year. The lack of storage within this watershed reduces the risk of production of disinfection byproducts. It also, however, fails to provide for settling of winter and spring turbidities. High turbidities can be experienced from Abiqua Creek during the late fall, winter, and spring rainy season. The City then switches to the Silver Creek source which is downstream from the reservoir that provides stability from turbidity spikes. Turbidities from both sources are generally lower than 5 NTU. Higher turbidity events generally correspond to the rainy season. From 2017 – 2019 the highest turbidity recorded at the Water Treatment Plant was February of 2017, when the turbidity spiked at 45.8 NTU. The next highest turbidity recorded was 18.8 in June of 2017.

Chart 4.1 shows the raw water temperature for the influent into the Silverton WTP. Temperatures are generally below 10^{o}C (50^{o}F) in the winter, with daily lows dipping below 5^{o}C (41^{o}F). Summer temperatures generally exceed 15^{o}C (59^{o}F) with peak day temperatures exceeding 20^{o}C (68^{o}F).



Silver Creek produces good quality water, with no complaints of color, taste, or odor. The upstream reservoir is believed to provide a "wide spot" to slow the water velocity of the creek, allowing some of the sediment to settle. Algae growth is not a concern within the Silver Creek watershed because of its relatively small storage volume and because shadowing of the reservoir does not allow for significant growth of algae.

Silver Creek – Downtown Silverton

Both sources of water experience seasonal variations in water characteristics, including temperature, turbidity, total organic carbon, alkalinity, pH, and color are monitored. These tests are used to monitor incoming water quality to allow operators adjust coagulation and filtration schemes to produce the best water quality. The following discussions explain the rationale for monitoring these parameters.

Cold temperatures will significantly slow the reaction time of the coagulant, and can cause the formation of flocculation particles late in the treatment process. The action that is typically taken to prevent this is to reduce the flow rate within the plant to allow the coagulant the necessary time to react and flocculate. If this condition is not recognized or if the City's demand requires a higher production rate from the plant, the result can be the formation of flocculation particles within the filters and clearwells which lead to violations of turbidity limits, and complaints of cloudy or dirty water. The plant staff has indicated that, in the current plant configuration, the water becomes difficult to treat when the water is at or below 6 degrees Celsius (43 degrees Fahrenheit).

Along with cold temperatures during the winter and spring months the sources see an increase in turbidity due to high rainfall. Spring rainfall brings high turbidity, which means the treatment process must be optimized for turbidity removal. The flows are typically still low, but the effect of the cold temperatures on the coagulation chemistry compounds the difficulty of removal of turbidity and dissolved organic contaminants.

The fall season (particularly November) brings the most difficult treatment conditions. Fall rains in the Cascade region of the state begin to wash dissolved organic materials from the fresh blanket of leaves on the forest floor. Humic and fulvic acids that exist in the organic materials are leached into the water as predominately dissolved acids. At the same time, the water is typically moderate in temperature and relatively clear (devoid of turbidity).

The operators will likely find it challenging to adjust the chemistry of the water to enhance the removal of the dissolved acids. This typically requires adjustment of pH, stabilization of the alkalinity, and careful dosing of coagulant through a process known as enhanced coagulation. The organic acids that are dissolved in the water have the potential to impart taste, odor, and color to the water, all of which are considered aesthetic secondary drinking water standards. The consequence of inadequate treatment during these water conditions is the formation of disinfection by-products (DBPs) by the disinfection process. Monitoring of raw water total organic carbon (TOC) will provide the operator with data to help adjust the plant operation to optimize TOC removal.

The City does a good job of treating the raw water to remove TOC and avoid the formation of DBPs. TOCs, in this case organic acids, are considered DBP precursors because of their reaction with chlorine and bromine and the carcinogenic nature of the chemicals that are formed by this reaction. DBPs fall into two categories, total trihalomethanes (TTHM) and haloacetic acids (HAA5). Table 4.1 is a summary of the City's sampling results for DBPs since 2018.

Table 4.2 – Disinfection By-Product Sampling Results (Finished Water)

Sample Date and DBP	Maximum Contaminant Level (MCL), mg/L	Measured Concentration, mg/L	Maximum Contaminant Level (MCL), mg/L	Measured Concentration, mg/L
4/06/20 TTHM (trihalomethanes)	0.080	ND (Non-Detect)		
4/06/20 HAA5 (haloacetic acids			0.060	0.00499
10/21/19 TTHM (trihalomethanes)	0.080	0.0102		
10/21/19 HAA5 (haloacetic acids			0.060	0.0141
4/09/19 TTHM (trihalomethanes)	0.080	ND (Non-Detect)		
4/09/19 HAA5 (haloacetic acids			0.060	0.00629
10/22/18 TTHM (trihalomethanes)	0.080	0.00423		
10/22/18 HAA5 (haloacetic acids			0.060	0.00981
4/17/18 TTHM (trihalomethanes)	0.080	ND (Non-Detect)		
4/17/18 HAA5 (haloacetic acids			0.060	0.00557
Average (% of MCL):		0.00289 (3.6%)		0.00815 (13.6%)

4.3 TREATMENT FACILITIES (Table 4.1 Projects 1C, 1D, 3A)

Silverton has two treatment facilities at the WTP site, Plant 1 and Plant 2. Silverton's two plants operate independent of each other. Plant 1 was constructed in 1957 with upgrades in 1962 and 1972, and PLC upgrades in 1994 (note – typical PLC life is 20 years). Plant 2 was constructed in 1982. This section will describe each treatment plant and identify areas where further analysis is warranted.

Since the last Water Master Plan the treatment capacities of both plants have been reduced due to age of the facilities and operator experience. Plant 1 is only operated in the summer and has a capacity of 1.5 MGD. The 2011 Plan stated it had a summer capacity of 2.5 MGD. Plant 2 has a summer capacity of 2.5 MGD rather than the 2011 Plan capacity of 3.5 MGD.

The City's staff has established a maximum flowrate during the summer months which is the most treatable time of year. The plants seasonal treatment capacities (as reported by City staff) are summarized in Table 4.2.

Table 4.3 – Seasonal Treatment Capacity vs. Peak Day Demands

Description	Summer Flow (MGD)	Fall/Winter/Spring Flow (MGD)
Plant 1 Treatment Capacity	1.5	0
Plant 2 Treatment Capacity	2.5	2.5
Total Treatment Capacity	4.0	2.5
Less Backwash*	(0.2)*	(0.175) **
Effective Treatment Capacity	3.8	2.325

*Assumes 5 % based on typical conditions during peak summer demands.
**Assumes 7% based on typical conditions during peak non-summer demands.

When compared to future (2055) Scenario 2 peak day demands 4.77 MGD, the existing treatment plants do not have adequate capacity to meet projected summer demands. They do meet the current peak demands of the City.

4.3.1 2020 New Treatment Plant Recommendation

The 2016 Water Treatment Facility Plan in Appendix G provides a detailed analysis of both treatment plants and possible alternatives. The preferred option in that plan was to construct a 4.0 MGD enhanced clarification filtration plant and to demolish Plant 1 and Plant 2. Since that time the City has completed the following steps:

1) Purchased property adjacent to the existing water treatment facility to provide space for a new Water Treatment Plant.
2) Completed a treatment system analysis and pilot test for the preferred package plant system which is a Trident Plant by Westech Engineering.
3) The City hired a consultant in 2020 to complete the design for the new treatment plant by 2021. This new plant would include a new control room for the water system, emergency generator, new electrical and control system for the plant. The scope would also include an analysis of backwash discharge improvements to be completed.
4) Construction of the new Water Treatment Plant and demolition of the old plants will be separate projects. Demolition would occur later when the space was needed for other uses. Keeping Plant 2 operational would provide a backup system and the Plant 1 basins may be able to be used for the backwash of the new treatment facility.

The project schedule would be to go out to bid in early 2022 for construction in 2022 and 2023 provided sufficient funding is secured.

The reduction in water demand growth has spread out when an expansion of the 4.0 MGD treatment plant will be needed. For this Water Master Plan 20-year period an expansion is not anticipated but higher than expected growth could require an expansion in 15 – 20 years.

Silverton Water Treatment Plant

4.3.2 Treatment Plant Clearwells

Currently Silverton relies on two reservoirs to provide clearwell storage to the treatment processes. Clearwell storage is an important part of a treatment facility that has to be managed to be available to the treatment process. The clearwell provides backwash water to the plants either through pumping or by gravity through elevated storage. Since a certain volume of treated water has to be maintained to allow the filters to be cleaned when needed, this capacity is not available to the system to meet demands.

The second major role the clearwell storage capacity provides is contact time (CT) for the disinfection chemical. The disinfectant is required to be held in contact with the drinking water supply for a calculated amount of time at a determined concentration in order to inactivate bacteriological contaminants. This time varies with water pH and temperature, and must be met before the water reaches the first customer.

The allocation of storage volumes within a reservoir that is also serving as a clearwell includes volume reserved for backwash and volume for CT. The volume required for backwashing is calculated based on past plant performance; the CT volume requires tracer study of the reservoir. The tracer study defines the flow characteristics of the reservoir and must be completed independently for each reservoir. At the time this plan was completed, the City was planning on conducting a tracer study, but had not yet completed it. EPA has developed general tables that are conservative for various levels of baffling. These tables recommend percentages of clearwells that can be considered for CT credit based on the configuration of inlet, outlet, and baffling.

Recommendations:

Priority 1 Improvements (0-5 Years):

- Complete tracer study during summer (peak flow) and winter (cold temperature) seasons

- Develop an operational plan or install baffling within the clearwell reservoirs to accommodate CT based on the tracer study results. Coordinate any clearwell improvements with Priority 2 storage recommendations.

- Look at piping arrangements as part of the new Water Treatment Plant to provide contact time prior to filtered water entering the reservoirs.

4.4 WATER SYSTEM SURVEY

The Oregon Health Authority, Drinking Water Services, completed the last survey for the City Water System on December 10, 2019. The findings of this survey were documented in a letter to the City dated January 13, 2020 (see Appendix E for copy). The survey identified the following significant deficiencies and rule violations:

1. Monitoring for combined filter effluent (CFE) turbidity at the old plant is not sampled from the correct location.
2. A tracer study of the reservoirs needs to be done.
3. The hatches at the 1.5 MG treatment plant reservoir are not secured or protected from potential contaminant sources.
4. Major modifications (Three waterlines: Steelhammer Road, Steelhammer subdivision, and Castlebrook Estates) placed into use without final approval.

The following section discusses each of the four items identified in the DHS letter referenced above.

Item 1 – Turbidity monitoring for WTP No. 1 appears to be a mixture of the effluent from the two individual filters rather than a “combined” sample. As the flow through the filters may fluctuate, individual filter sampling may not accurately reflect combined turbidity.

Therefore, the “combined” turbidity reporting for WTP No. 1 has been modified to indicate the higher of the effluent turbidity values of the two filters in service. The reporting modification will be in place whenever WTP No. 1 is brought into service.

Item 2 – In 2002, following the completion of construction of the 1.5 MG reservoir, plant operators conducted a chlorine contact time (CT) tracer study, using the fluoride dose as the chemical agent. Using the results of the study, operators worked with the OHD (Scott Curry) to establish a formula to be used for reporting the daily CT. However, the procedures used to conduct the study were not reviewed and approved by the OHD. The City submitted CT study procedures to OHA in 2020 but has not received approval from OHA yet. The City will complete a new CT study once the procedures are approved.

Item 3 – The inspection and access hatches of the 1.5 MG reservoir includes metal tracks designed to collect rainwater and prevent the rainwater from entering the interior of the reservoir where finished drinking water is stored by exiting weep holes. The hatches are normally secured by padlocks and the tracks were clean and well maintained at the time of the Survey. However, the OHD is concerned pests may gain entrance to the reservoir via the weep holes. Therefore, operators have installed steel wool in the weep holes to deter pests but still allow for the drainage of rain water.

Regarding the presence of adequate screening for the 1.5 MG reservoir rooftop vent, please find enclosed a copy of the construction specifications for the reservoir as it pertains to "Vents". A plan to provide a photograph of the screening is still being developed.

Regarding the condition of entrance and inspection hatch for the 2.0 MG steel reservoir, operators climbed to the top of the tank, on February 10, 2020, and verified that the hatch was padlocked and watertight.

Item 4 – The City submitted certification for Castlebrook Estates and is working on certification for the Steelhammer projects.

4.5 SUMMARY OF RECOMMENDED TREATMENT RECOMMENDATIONS

4.5.1 Priority 1 Capital Improvements (next 5 years)

Design and construction of new 4.0 MGD enhanced clarification filtration plant at existing treatment facility site. Project would include new control room, upgraded high level pump station, and other site improvements. The existing treatment Plants 1 and 2 would be decommissioned and not used.

4.5.2 Priority 2 Improvements

Develop an operational plan or install baffling within the clearwell reservoirs to accommodate CT and/or install piping improvements as part of the new treatment plant to increase contact time prior to entering the reservoirs.

4.6 SEISMIC ASSESSMENT OF WATER SYSTEM INFRASTRUCTURE

A seismic risk assessment and mitigation plan for the water system is required by the Oregon Health Authority. This assessment must identify critical facilities, evaluate the likelihood and consequences of failure, and create a mitigation plan to resolve identified vulnerabilities.

4.6.1 Critical Facilities

The facilities identified as critical for operation of the water system are:

1) Abiqua Creek Dam and Intake
2) Abiqua Creek Raw Water Transmission Main
3) Silver Creek Intake
4) Silver Creek Raw Water Transmission Main
5) Water Treatment Plant 1
6) Water Treatment Plant 2
7) Water Treatment Facility Reservoirs
8) High Level Reservoir
9) High Level Pump Station
10) Edison Booster Pump Station
11) Silver Creek Main Crossings
12) Pressure Reducing Valves (PRV's)

Facility items 1 – 7 are critical to operation of the entire distribution system. Items 8 – 12 are critical to specific areas of the distribution system. There are some redundancies in the system. For example there are two water sources with separate transmission lines, two reservoirs at the water treatment facility, and some pressure zones have more than one PRV supplying water.

4.6.2 Critical Facility Evaluation

Abiqua Creek Intake and Transmission Main

The Abiqua Creek Intake and Transmission Main were originally constructed in the 1940's with some transmission main upgrades since then. Upgrades to the intake facility were completed in 2001. The intake and main have not been constructed to current seismic code for critical facilities. A major seismic event could cause severe damage to the dam, intake, and transmission main.

Silver Creek Intake and Transmission Main

The Silver Creek Intake and Main were originally constructed in 1973. One section of the transmission main was upgraded since then. The newer age and location of the facility indicates it could handle a large seismic event better than the Abiqua Creek facilities but some damage could occur.

Water Treatment Plants and Water Treatment Facility Reservoirs

Water Treatment Plants 1 and 2 and two reservoirs are located at the same site. Water Treatment Plant 1 was constructed in the 1940's and plant 2 in 1982. One reservoir was originally constructed in 1927 and the other in 2001. The 1927 reservoir had a new roof installed in 2001. Given their ages the 1927 reservoir and Plant 1 would be the most susceptible to damage in the event of a major earthquake.

High Level Reservoir and Pump Station

The High Level Reservoir and Pump Station were constructed in 1982. The reservoir is steel construction and the pump station is a concrete masonry unit building. The pumps are not operated by variable frequency drives. Both are susceptible to damage in the event of a seismic event.

Edison Booster Station

The Edison Booster Station is a concrete masonry unit building and was constructed in 2004. It pulls water from the high level zone to serve the Edison Booster pressure zone, a small portion of the City distribution system. Considering its age it is less susceptible to seismic events than other facilities. Since it also serves only a small area it is less critical than other facilities that support the entire water system.

Silver Creek Crossings and Pressure Reducing Valves

The City only has three crossings across Silver Creek with the distribution system. Since all source, treatment, and storage facilities are on the east side of Silver Creek, if these mains broke in a seismic event all of the City west of Silver Creek would be without water. None of these crossings have seismic restraints so any sort of significant ground movement could cause a break in these pipes.

4.6.3 Mitigation Plan

Many of the Capital Improvement Program projects mitigate some of the seismic risks of the water system facilities listed above. Completion of all the major projects would result in a fairly resilient water system that includes redundant source, treatment, storage, and distribution facilities.

Abiqua Creek Intake and Transmission Main

The City will be conducting a study in 2021 that looks at the possibility of removing the existing dam and installing a new intake that would be seismically resilient. The new Water Treatment Plant may also result in replacement of the remaining 14" steel pipe in the transmission system to allow for greater capacity of the transmission main. If this project was completed along with the new Silver Creek Intake it would result in two seismically designed sources for the City.

Silver Creek Intake and Transmission Main

In 2021 the City will start construction on a replacement intake for Silver Creek along with 1,700 feet of new transmission main that will increase capacity and the seismic flexibility of the transmission main. The new intake structure will be designed to meet Category V seismic standards of the structural code.

Water Treatment Plants and Water Treatment Facility Reservoirs

In 2021 the City will begin design on a new package Water Treatment Plant housed in a new building built to current seismic standards. The capacity of the new treatment plant will allow the City to mothball Plant 1 and Plant 2 would become the backup treatment facility and would be only used in case of an emergency. The new Water Treatment Plant would be a big step in improving the resiliency of the water system.

High Level Reservoir and Pump Station

Part of the new Water Treatment Plant will include pump and piping upgrades to the high level reservoir pump station, including the installation of variable frequency drives (VFD) on the pumps. This would allow the City to provide service to the high level zone from the VFD pumps alone in case the high level reservoir is not usable due to a seismic event.

Edison Booster Station

The new 1 MG westside reservoir proposed in the CIP would not only provide redundant storage to the west side of the City, it could also provide backup flow to the Edison Zone in case the booster station was offline for a while due to a seismic event.

Silver Creek Crossings and Pressure Reducing Valves

The westside reservoir would provide some temporary redundancy of flow to the west side of the City if the crossings were compromised in an earthquake. The CIP also includes a new crossing of Silver Creek to provide additional distribution connectivity between the distribution systems west and east of Silver Creek.

5 RECOMMENDATIONS AND CAPITAL IMPROVEMENT PLAN

5.1 GENERAL

This section provides a summary of the recommended improvements discussed in Chapters 3 and 4. A Capital Improvement Plan (CIP), which reflects opinions of probable costs for the recommendations and an order of priority, is presented. Detailed cost estimates and project descriptions are in Appendix F.

Figure 7 on the next page shows the locations of the CIP projects. The prioritization schedule in the CIP was established by consulting with City staff and reviewing the 2011 Plan. Priority 1 projects generally correct deficiencies in storage, treatment, pumping, backup/redundancy delivery, distribution pipelines with little anticipated remaining life, and priority commercial fire protection. Priority 2 improvements focus on additional fire protection, improved transmission, additional high maintenance areas, treatment plant improvements, and some additional improvements that will be required to service future growth. Priority 3 improvements are intended to provide a roadmap for future development and pipeline replacement projects, and further improve transmission and fire protection.

5.2 SUMMARY OF RECOMMENDATIONS

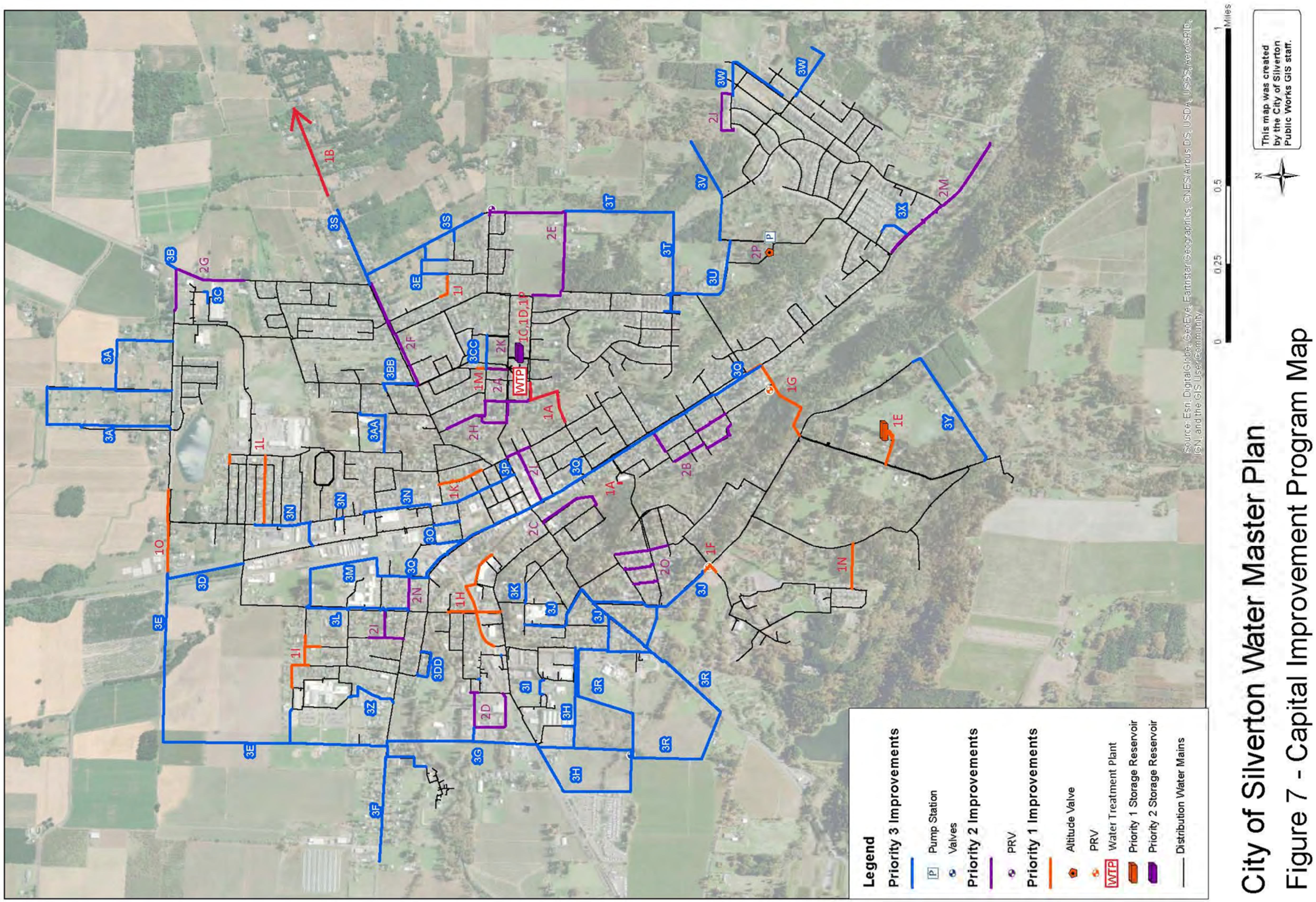
Storage Facilities

The City of Silverton should build a new 1.0 MG tank on the Edison Road property the City owns west of Silver Creek. This will accommodate the projected 2050 storage needs. If storage needs increase more than expected, a second 1.0 MG tank could be built at either the Edison Road site or the water treatment facility site. The best location will be determined based on how the city demands grow. If the growth is predominantly west of Silver Creek, the second 1.0 MG tank should be built at Edison Road. If city growth is primarily east of Silver Creek and at lower elevations a storage tank at the treatment plant site would be best. Future upgrades are also recommended to the existing High Level Reservoir.

Booster Pumping Facilities

The following booster station improvements should be made:

- High Level Pump House - Construct a new booster pumping facility to replace the existing High Level Pump House. This new booster facility should be equipped with 3 or more pumps, have standby power, and serve the future demands for the medium and high level pressure zones.
- Edison Road Booster Pump House - Complete minor upgrades recommended in Appendix B of the 2011 Water Master Plan.
- Pump station at new tank site - Construct a new booster pump providing additional backup supply and fire protection to the Edison Road booster service area. This should be included as part of the new tank project, and could be combined with mixing facilities.
- New Eastview Booster service area pump station – A new booster facility will be required to serve new development near the High Level Reservoir. The booster station will be located near the existing tank and will have a similar hydraulic grade to the Edison Road booster service area.



City of Silverton Water Master Plan

Figure 7 - Capital Improvement Program Map

Distribution Pipelines Improvements

Tables 5.1 and 5.2 identify priority and future distribution pipeline improvements. These pipelines are intended to replace existing undersized and/or old pipelines, improve fire protection, improve transmission, and extend service to new service areas.

This plan recommends that the City work toward establishing an annual pipeline/meter/hydrant replacement program. Assuming an average project cost of $150/foot of waterline and a typical life of 75 years, the City would need to set aside approximately $634,000/year to replace the approximately 60 miles of waterline. Establishing a replacement budget will also enable the City to complete priority 2 and future pipeline replacements/upgrades, and better allow for pipeline projects to be coordinated with street projects.

In addition to these improvements, the City should continue to do the following:

- Periodically complete water system audits to evaluate water loss. If water loss exceeds 10-15%, consider additional leak detection studies

- Continue existing valve exercise, hydrant exercise, PRV and backflow inspections/adjustments, meter repair, and flushing programs

- The SCADA system should be regularly updated and improved. Controls should be reviewed and adjusted from time to time (at least seasonally)

Water Supply and Treatment Improvements

Water supply and treatment improvements were summarized in Section 4.5 of this report.

5.3 CAPITAL IMPROVEMENT PLAN

Over 24 million dollars in high priority capital improvements have been identified for the 25-year planning horizon as shown in Table 5.1. 9 million dollars in second priority improvements are identified in Table 5.2. The Capital Improvement Plan (CIP) summarizes the recommended system improvements that are anticipated to require capital beyond routine maintenance practices. Costs are shown in 2020 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 F of this report.

If Priority 1 improvements are going to be phased over time, The City recommends that Priority 1A-1E improvements (total cost of $19,912,000) be completed first.

Priority 3 improvements listed in Table 5.3 would improve water system fire flows, reduce leakage, and improve system resiliency but are at a lower priority. Many of the Priority 2 and 3 improvements will be triggered by growth and will likely be designed and built by the development community. Refer to Appendix F for more detailed descriptions of assumptions and individual project details.

It is highly unlikely that all of the Priority 1 and 2 improvements will be completed within the 20-year planning period. The costs are too large and there is not enough staff to complete the projects within that time frame. But the City should seek to complete as many of them as possible.

Table 5.1 – Capital Improvement Plan – Priority 1 Improvements

Project Identifier	Priority 1 Improvements	Opinion of Probable Cost
1A	Silver Creek Pump Station – New Intake and Transmission Line Improvements	$3,500,000
1B	Abiqua Intake – Dam Removal and new intake	$8,200,000
1C	Backwash – Backwash Study and NPDES Permit for WTP	$25,000
1D	New Water Treatment Plant – 4.0 MGD Package Plant	$5,800,000
1E	New 1 MG Storage Tank and Booster Pump Station – Edison Road Property	$2,387,000
1F	2nd Supply to Anderson PRV Zone	$153,000
1G	Transmission to West Plateau Service Area	$702,000
1H	Silver Creek Plaza Area Improvements	$694,000
1I	Western Avenue Improvements	$330,000
1J	Breyonna Way Loop	$58,000
1K	N. 3rd Street Improvements	$223,000
1L	Washington and Lincoln Street Improvements	$467,000
1M	Kent Street and Sweden Circle	$35,000
1N	Woodland Drive NE and Oregon Garden/Relocate backflow prevention	$287,000
1O	Hobart Road Improvements	$246,000
1P	New High Level Pump house – Some of this may be done with WTP	$898,000
	TOTAL PRIORITY 1 COST	**$24,005,000**

Table 5.2 – Capital Improvement Plan – Priority 2 Improvements

Project Identifier	Priority 2 Improvements	Opinion of Probable Cost
2A	Abiqua Intake Line – Replace 1,110' of 14" Steel Transmission Line	$705,000
2B	Cowing to Smith Improvements	$588,000
2C	Fiske Street Improvements	$292,000
2D	Industry Way Improvements	$358,000
2E	Pioneer and Evans Valley Improvements	$899,000
2F	Oak Street Improvements	$553,000
2G	Industrial Area Improvements	$480,000
2H	Main and 5th Improvements	$641,000
2I	Well and Orchard Improvements	$286,000
2J	Extend Service to Future Park	$34,000
2K	Future 1 MG Tank	$1,634,000
2L	Lewis Street Improvements	$390,000
2M	Water Street Improvements	$1,110,000
2N	Pine Street Improvements	$178,000
2O	Keene and Ash Street Improvements	$507,000
2P	High Level Tank Improvements	$329,000
	TOTAL PRIORITY 2 COST	**$8,984,000**

Table 5.3 – Capital Improvement Plan – Priority 3 Improvements (City Portion Only)

Project Identifier	Priority 3 Improvements	Opinion of Probable Cost
3A	Setness St, Quarry Ave, and Lanham Lane	$1,432,000
3B	Meridian Rd NE*	$4,000
3C	Commerce Court and Industry Way*	$48,000
3D	N. 1st Street from Jefferson Road to Hobart Road	$334,000
3E	Northwest 12-inch Loop (Hobart Road to Pine Street)*	$149,000
3F	Pine Street from April Ln to Airport Rd.	$739,000
3G	West 12" line from Pine and April Ln, south to Railway Avenue*	$73,000
3H	Low Zone Loop from Westfield and Center westward and north to Railway Ave*	$61,000
3I	10" Connection from Safeway to Fire Department	$70,000
3J	Transmission from New PRV to Anderson PRV Zone	$1,961,000
3K	Cherry Street From Phelps to Welch	$79,000
3L	James St from Western to Pine	$453,000
3M	Loop around old high school site	Privately Funded
3N	N. 2nd from C Street to TJ Lane	$638,000
3O	N. 1st from A to C and Front St from A to C	$205,000
3P	N. 2nd from Main to B St	$311,000
3Q	Water St from Peach - Brown St, then Brown from N Webb to Schlador	$1,912,000
3R	Anderson PRV Zone Loop from Westfield and Center westward and northeast to Westfield and Main*	$77,000
3S	Future Pioneer Rd Alignment from Crestview Dr to Oak St*	$70,000
3T	Future Pioneer Rd Alignment from Skookum Dr and Eastview Lane to Evans Valley Rd*	$54,000
3U	Eastview from Tillicum to Storage Reservoir	$400,000
3V	Booster and eastward extension from Eastview Dr. to Future Booster Service Area*	$90,000
3W	Hawk Dr and Ike Mooney Rd*	$11,000
3X	Extension into Silverton Mobile Home Estates	$333,000
3Y	Sunset Lane from Victor Point to Edison	Privately Funded
3Z	Connection from current High School site through mobile home park to Pine St	$222,000
3AA	Robinson St and Church St	$244,000
3BB	Norway from Chadwick to Oak St	$156,000
3CC	Kent Street from East Park to N. Ames St	$134,000
3DD	Maple Street near Grant and N. Water	$178,000
	TOTAL PRIORITY 3 COST	$10,438,000

* Project cost is the City's cost to upsize the water mains for additional capacity when a developer constructs this project.

Planning elements that serve as the basis for the recommendations contained in this report tend to evolve over time. The City should consider updates to the capital improvement plan every three to five years to reflect changes. Computer model updates should be considered each year. The planning tools created in connection with this study, such as the water model and the utilities base mapping, should be updated every one to three years to reflect repairs, replacements, and other changes to the water system that will inevitably take place. Maintaining the plan and the planning tools will serve as the most effective means for the City to proactively manage this crucial component of their existing infrastructure.

6 FINANCIAL PLAN

6.1 WATER SYSTEM BUDGET REVIEW

Table 6.1 provides a comparison of revenues and expenditures for the City Water Fund since 2018. The 2011 Water Master Plan noted the City had revenue shortfalls in 2008-2009 and 2009-2010. Since then the City has raised rates to better fund the water system. Since 2018 the City has maintained a fund balance of over $1 Million and at the same time was also able to contribute $1.4 Million to the capital projects. The debt consists of a 10-year loan by Citizen's Bank that will be paid off in 2024.

Table 6.1 – Silverton Water Operations Fund Budget

Budget Item	2017-2018	2018-2019	20190-2020	2020-2021 (budget/est.)*
Beginning Fund Balance	$945,183	$1,265,998	$1,961,460	$1,828,437
Annual Revenues	$2,579,542	$2,602,060	$2,645,735	$2,590,791
Total Fund Revenue	$3,524,725	$3,868,058	$4,607,195	$4,419,228
Expenses				
Administration	$1,221,823	$956,381	$1,808,725	$2,683,762
Operations	$290,206	$324,061	$320,985	$661,464
Maintenance	$552,972	$432,430	$455,323	$524,336
Debt	$193,725	$193,725	$193,725	$193,750
Total Expenditures	**$2,258,726**	**$1,906,597**	**$2,778,758**	**$4,063,312**
Ending Fund Balance	**$1,265,999**	**$1,961,461**	**$1,828,437**	**$355,916**
Transfer to Water CIP Fund	$465,000	$82,000	$480,000	$599,600
Transfer to McClaine Imp.	$0	$43,000	$335,623	
Reserve – Future Expenditure				$323,960
Contingency				$583,494

Table 6.2 provides a snapshot of the revenues and expenditures for the Water Capital Fund Budget. The 2020 and 2021 grant and expenditures are related to the design and construction of the Silver Creek Intake Improvements and the design of the new Water Treatment Plant.

Table 6.2 – Silverton Water Capital Project Fund Budget

Budget Item	2017-2018	2018-2019	20190-2020	2020-2021 (budget/est.)*
Beginning Fund Balance	$51,560	$518,982	$615,342	$962,307
Grants	$0	$0	$0	$1,150,000
Interest	$4,722	$14,360	$17,392	$10,250
Water Fund Transfer In	$465,000	$82,000	$480,000	$599,660
Water Imp SDC Transfer in	$0	$0	$0	$1,150,000
Total Fund Revenue	$521,282	$615,342	$1,112,734	$3,872,217
Expenses				
Materials and Services	$0	$0	$0	$500
Design Services	$2,300	$0	$150,427	$579,000
Construction Costs	$0	$0	$0	$3,379,827
Total Expenditures	$2,300	$0	$150,427	$3,959,327
Ending Fund Balance	**$518,982**	**$615,342**	**$962,307**	**($87,710)**

* Additional fund transfers needed to balance this fund in 2021. The beginning fund balance is based on the ending fund balance of 2019-2020 and not the approved budget beginning fund balance.

The City has raised rates steadily the last few years to improve the financial situation of the Water Fund and to complete repairs and capital improvement projects. Table 6.3 provides the current and proposed water rates for residents inside city Limits. Customers located outside city Limits are charged at 1.5 times the residential rates. Increases from year to year are 5 – 8 percent.

Table 6.3 – Silverton Water Master Fee Schedule per Resolution 20-05

BASE CHARGE (per account based on meter size) – All Single-Family Residential inside the City				
Meter Size (inches)	**Rate 07/01/2020**	**Rate 07/01/2021**	**Rate 07/01/2022**	**Rate 07/01/2023**
1 inch and smaller	$18.38	$19.85	$20.84	$21.88
1 ½	$61.24	$66.14	$69.45	$72.92
2	$97.98	$105.82	$111.11	$116.67
3	$195.96	$211.64	$222.22	$233.33
4	$306.18	$330.67	$347.20	$364.56
BASE CHARGE – All Multi-Family Residential, Commercial, and Industrial inside the City				
Meter Size (inches)	**Rate 07/01/2020**	**Rate 07/01/2021**	**Rate 07/01/2022**	**Rate 07/01/2023**
5/8 & 3/4	$18.38	$19.85	$20.84	$21.88
1	$30.62	$33.07	$34.72	$36.46
1 ½	$61.24	$66.14	$69.45	$72.92
2	$97.98	$105.82	$111.11	$116.67
3	$195.96	$211.64	$222.22	$233.33
4	$306.18	$330.67	$347.20	$364.56
Per Dwelling Unit Fixed Cost				
Rate 07/01/2020	**Rate 07/01/2021**	**Rate 07/01/2022**	**Rate 07/01/2023**	
$4.77	$5.15	$5.41	$5.68	
Usage Charge (per 100 cubic feet)				
Rate 07/01/2020	**Rate 07/01/2021**	**Rate 07/01/2022**	**Rate 07/01/2023**	
$3.11	$3.36	$3.53	$3.71	

Rates increased annually by 8% for several years prior to 2020. The City has committed to providing a viable financial system for the water system. This compares to the 2011 Water Master Plan that noted the City had a shortfall in water revenue in 2009 and 2010. Table 6.4 below lists the System Development Charges (SDC's) for the water system based on meter size. In 2019 the City hired Donovan Enterprises to review and update SDC's for all utilities. This study is included in Appendix G. The charges will be increased by the ENR construction cost index July 1 of every year. In 2010 the ¾" SDC was $4,130 so the SDC has doubled in the last 10 years.

Table 6.4 – Water System Development Charges

Meter Size	Reimbursement Fee	Improvement & Administrative Fee	Total
¾"	$1,357	$6,928	$8,285
1"	$2,261	$11,547	$13,808
1.5"	$4,522	$23,095	$27,617
2"	$7,235	$36,952	$44,187
3"	$13,566	$69,284	$82,850
4"	$22,611	$115,473	$138,084
6"	$45,221	$230,946	$276,167
8"	$72,354	$369,513	$441,867

Using the average annual single family usage of 63 gallons per capita per day from Table 2.4, the average monthly rate for a single family home of 3 people is $41.95 in 2020. The 2011 Water Master Plan calculated that the average annual monthly user rate to support the water system and pay for all Priority 1 improvements was $39.86. That average monthly user rate rises to $48.98 when inflation since 2011 is factored in, which is 16.8% higher than the average monthly rate of $41.95. While the City is providing much better funding for the system than in 2011, paying for needed improvements will still require significant outside funding like the EDA grant Silverton received for the Silver Creek Intake.

User rates and SDC charges need to pay for increasing operation and maintenance costs, to fund priority capital improvement plans, and to begin pipeline upgrades.

6.2 OUTSIDE FUNDING OPPORTUNITIES

Below is a list of outside funding programs for water system improvements the City would be eligible to use. When planning the funding of capital projects the City should evaluate these programs first before pursuing bonds or open market loans.

Safe Drinking Water State Revolving Loan Fund

The Oregon Health Authority, Drinking Water Services, administers the Safe Drinking Water Revolving Loan Fund (SDWRLF). This program provides loans to eligible projects. Interest rates are based on municipal bond rates with repayment terms up to 20 years. There is an annual application process and loan applications are competitively scored based on a variety of criteria. The highest scoring applications are awarded funding until the annual amount available is reached. Any project requesting $6 Million or more requires review and approval from the Drinking Water Advisory Committee, which is made up of 15 members of different stakeholder groups to advise and assist Drinking Water Services on policies.

Community Development Block Grant

Community Development Block Grants (CDBG) are from the Department of Housing and Urban Development (HUD). Grants are provided for infrastructure in low – moderate income areas. Large capital projects that serve the whole City would not be eligible, but distribution system improvement projects in lower income areas of the City may qualify. This is typically a competitive application process every year and would require a 10 – 25% match from the City.

Economic Development Assistance

Economic Development Assistance (EDA) grants are from the Department of Commerce and are used to support projects that will promote economic development and jobs. The City has received a $1,150,000.00 EDA grant for the design and construction of the Silver Creek Intake and Transmission Line Project. The City has committed to a match of $1,150,000 for this grant.

Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publicly-owned facilities that support economic and community development in Oregon. The program is administered by the Oregon Infrastructure Finance Authority. Applications are accepted year round and loan funding up to $10 million is available with low interest rates and 30-year terms. Grant funding is available for projects that have a firm business commitment that create eligible jobs.

6.3 CONCLUSION

This chapter provides a snapshot of current funding mechanisms to determine whether they support the operation of the water system and completing identified upgrades needed to provide a safe and reliable supply of water to Silverton. Current revenues provide sufficient funding for operation and maintenance costs and a portion of the capital project needs. But internal revenue streams are not enough to pay for all the needed capital projects.

The critical and urgent issues facing the City's water system include a new treatment plant, source of supply upgrades, additional storage, added system redundancy, fire flows, and improved transmission capacity. The City has begun to implement some Priority 1 projects outlined in the capital improvement plan like the Silver Creek Intake and Water Treatment Plant Design. Completing these projects will require outside funding in some form. The City should pursue grants and low interest loans where feasible. Lower priority improvements can be completed as funding becomes available or in coordination with other improvements or routine replacement. The SDWRLF and the SPWF are the most likely candidates for large projects like the Water Treatment Plant or new reservoir.