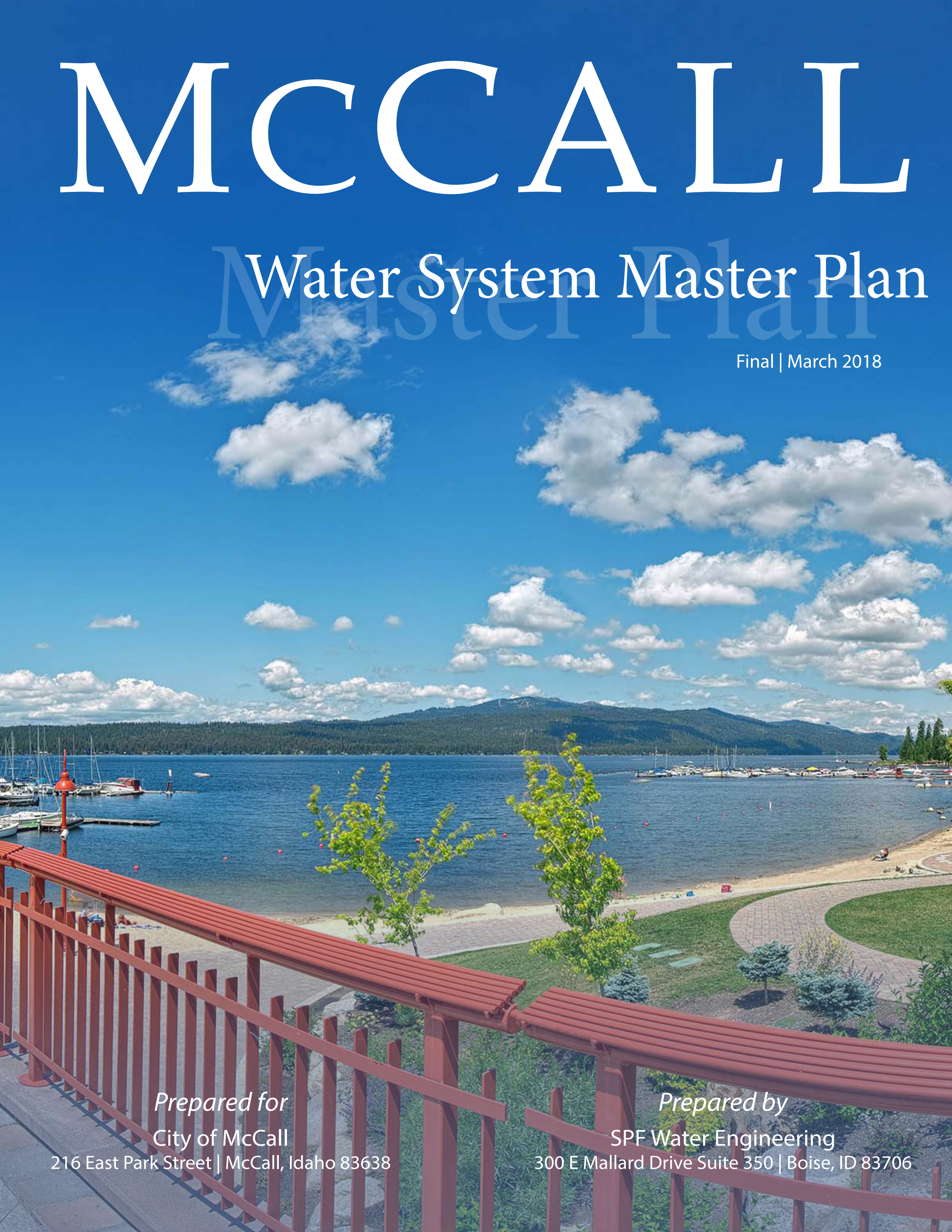
McCALL

Water System Master Plan

Final | March 2018



Prepared for

City of McCall
216 East Park Street | McCall, Idaho 83638

Prepared by

SPF Water Engineering
300 E Mallard Drive Suite 350 | Boise, ID 83706

City of McCall
2017 Water System Master Plan

Prepared for

City of McCall
216 East Park Street
McCall, Idaho 83638

Prepared by

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APPROVED

By: C. Gary Carroll, P.E.
State of Idaho
Department of Environmental Quality

Date: Mar 19, 2018

March 16, 2018

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City of McCall

SPF WATER ENGINEERING

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1445 North Orchard • Boise, Idaho 83706 • (208) 373-0550
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C.L. "Butch" Otter, Governor
John H. Tippets, Director

March 20, 2018

The Honorable Jackie Aymon
Mayor, City of McCall
216 E. Park Street
McCall ID 83638

RE: DWG-162-2016-1 City of McCall 2017 Water Master Plan (McCall, Valley County)
DEQ Approval

Dear Mayor Aymon:

The Idaho Department of Environmental Quality (DEQ) has reviewed the City of McCall 2017 Water Master Plan (Facility Plan). The Facility Plan appears to meet State of Idaho standards and is approved based on the conditions listed below.

PROJECT SPECIFIC CONDITIONS:

A. This approval is for the Facility Plan only. Please submit a Preliminary Engineering Report (PER) to DEQ for review and approval prior to preparing and submitting detailed plans and specifications for any of the Facility Plan improvements. Detailed plans and specifications cannot be reviewed until the PER is approved; furthermore, no construction can begin until the detailed plans and specifications have been reviewed and approved by DEQ.

Please note that if at some time in the future, the City of McCall applies for a DEQ State Revolving Fund (SRF) loan to help pay for any of the recommended capital improvements in this Facility Plan, it will be necessary for the City of McCall to fulfill the requirements of a SRF loan. This could possibly include the preparation of an environmental information document.

Please contact me with any questions at (208) 373-0117 or via e-mail at gary.carroll@deq.idaho.gov.

Sincerely,

C. Gary Carroll, P.E.
Boise Regional Office

Enclosures: Stamped as Approved City of McCall Water Master Plan Title Page

ec: Nathan Stewart, P.E., City of McCall (w/enclosure)
Eric Landsberg, P.E., SPF Water Engineers (w/enclosure)
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2018AGD1600

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Acknowledgements

Appreciation is expressed to everyone who contributed to completion of the McCall Water Master Plan.

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Melanie Holmes, Council Member
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Executive Summary

The City of McCall owns and operates a water system that provides water service to over 3,200 service connections and a service population that can exceed 20,000 during peak usage. The purpose of this Water Master Plan is to provide the City of McCall a comprehensive planning document with information and recommendations necessary for the responsible management of the water system.

This plan reviews existing population and water demands, and uses available data to project future water demand over a 20-year planning horizon. The facilities for water supply, treatment, storage, and distribution are evaluated with regard to Idaho Department of Environmental Quality (IDEQ) regulatory requirements.

Overview of Existing System

Payette Lake is the source of supply for the system, and provides consistently high quality raw water. Existing water system facilities include the following:

- Two raw water pumping stations
- Water treatment plant
- Two treated water storage tanks
- Three booster pump stations
- Nine pressure zones
- 19 pressure reducing valve stations, and
- 89.6 miles of distribution system piping.

Water Requirements

- Average day demand (ADD) for the system is 1.1 million gallons.
- Maximum day demand (MDD) is 2.83 million gallons.
- Peak hour demand (PHD) is 5.34 million gallons.
- Over the past 18 years, maximum day demand increased at an annualized rate of 3.1%.
- Water demands are projected to increase at a rate of 3% annually over the 20-year planning period. Current and projected water demands are shown in Table 1.

Table 1. Water Demand Projections.

Year	Equivalent Residential Units (ERU)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Peak Hour Demand (mgd)
2017	4551	1.10	2.81	5.34
2022	5276	1.28	3.26	6.19
2027	6116	1.48	3.78	7.18
2032	7090	1.71	4.38	8.32
2037	8220	1.99	5.08	9.64

1. ERU = equivalent residential unit, a unit of water system capacity defined as the average demand of single family dwellings.
2. mgd = million gallons per day.

Summary of System Evaluation Results

Overall, the water system facilities are in good condition and have adequate capacity to meet current water demands and IDEQ regulations. Major pumping, treatment, and storage facilities all meet current standards. However, some distribution system piping is undersized and incapable of delivering fire flow in certain areas of the system. These deficiencies have been identified and prioritized for future pipeline upgrade projects.

As water demands increase over the 20-year planning horizon, facility improvements will be needed to provide increased water delivery capacity. In addition, as facilities continue to age, upgrades will be necessary to maintain the required level of service.

Capital Improvement Plan

Section 8 includes a detailed capital improvement plan to address existing deficiencies and future needs. An estimated $11.7 million worth of water system improvements are identified over the next 10 years (2018-2027) in 2017 dollars.

- Distribution system piping upgrades are the largest category of projected capital improvements. Twenty-eight pipeline upgrade projects have been identified, comprising 43,000 linear feet (9% of the distribution system), at an estimated cost of $7.7 million over the next 10 years.
- The City will need to construct additional storage by 2026 in order to meet storage requirements for peak hour demand and fire flow. A 1.0-million-gallon storage tank is included in the CIP at an estimated cost of $2.2 million.
- Water treatment and pumping capital expenditures are estimated to be $795,000 over the next 10 years.

- Additional firm raw water pumping capacity will be needed by 2019, and can be achieved by installing a standby generator at the Davis Beach Pump Station or upgrading the third pump at Legacy Park Pump Station.
- Maximum day demand is projected to exceed the capacity of the water treatment plant in the year 2039. Planning, land acquisition, design, and construction of a new water treatment plant are projected to occur between 2029 and 2038. The timing and cost for this major capital expenditure should be monitored and adjusted in future Master Plans as the City grows and water demands increase.

Summary

Overall, the water system is in good condition and is able to meet existing water demands. The City is fortunate to have an abundant source of high quality water in Payette Lake. Major capital projects undertaken during the past 25 years have the City well situated to meet current and future water needs. The water treatment plant has adequate capacity to meet maximum day demand through 2039 (at projected growth rates). Additional water storage capacity will be needed by 2026 to meet peak demand and fire flows. The largest current need is distribution system piping upgrades to meet fire flow requirements and replace aging infrastructure.

Upon completion of the Water Master Plan, the City will conduct a water rate study to evaluate water rate structures to support system operations, maintenance, and capital improvement needs. The capital improvement plan will be updated annually during the annual budget cycle, and the Water Master Plan will be updated every five years to reflect actual system growth and update system facility needs.

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1. SERVICE AREA AND POLICIES

This section describes the existing water system service area, anticipated future service area, water rate structure, and City policies related to the water system.

1.1. Service Area

The City of McCall supplies water to approximately 3,300 residential and commercial connections, with a total permanent service population of approximately 3,100 residents within the incorporated City area. McCall has a large proportion of second homes, hotels, and rental properties because it is a popular resort destination. Second homes account for 71% of the total housing units. The number of second home housing units increased 128% from 2000 to 2014[1]. The water system must accommodate large influxes of visitors during the summer peak season, the Winter Carnival, holidays, and weekends. Figure 1 shows the municipal boundary and the municipal water service area. Boundaries were provided by the City of McCall.

1.2. Topography, Geology, and Soils

McCall is located on the western edge of Valley County, Idaho and situated on the southern shore of Payette Lake. The topography of the city is mountainous and generally slopes towards the southwest. Elevations range from a high of about 5,510 feet in the west side higher-pressure zones to a low of about 4,925 feet at the McCall RV Park, located at the south end of the system.

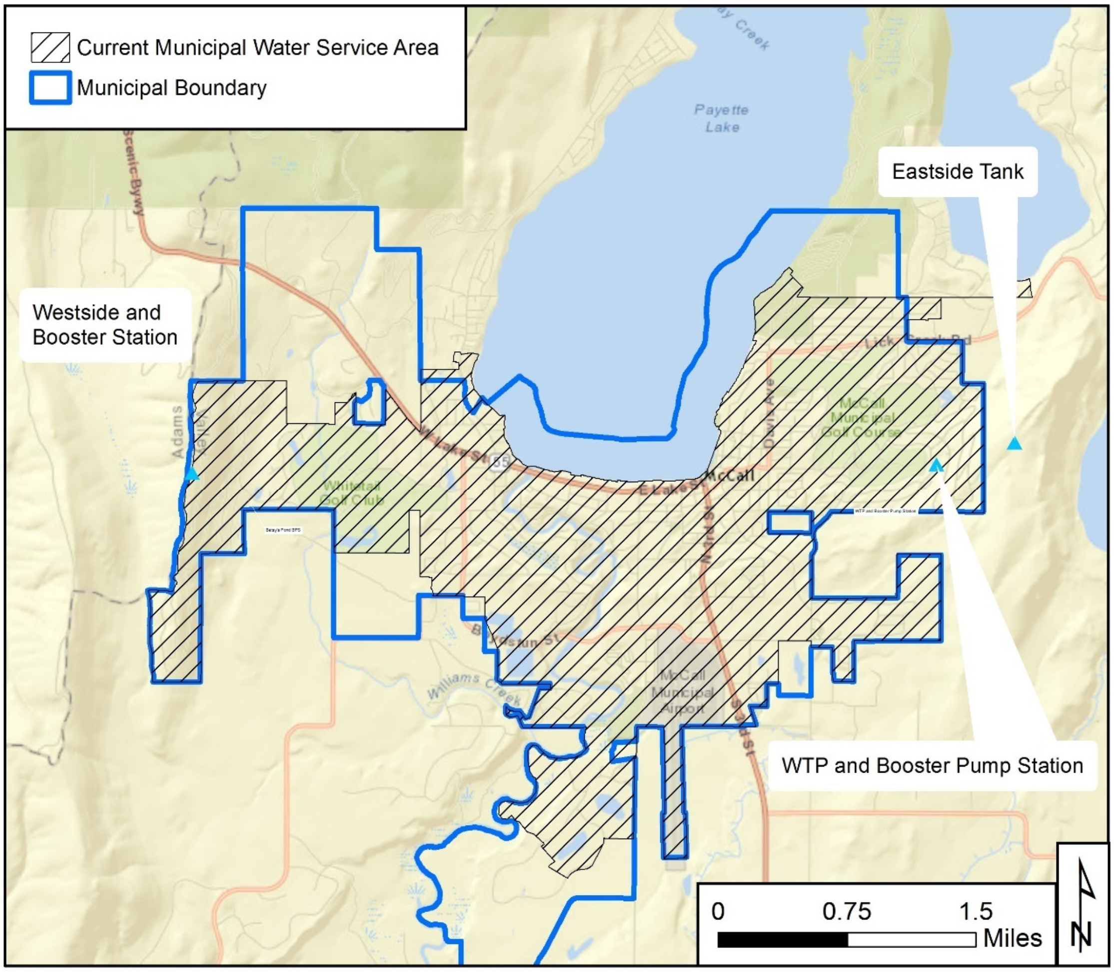
According to the Geologic Map of Valley County, Idaho[2], the city is underlain by quaternary moraine and glaciofluvial outwash. McCall is situated at the end of Long Valley, a major tectonic and structural feature of west central Idaho. There are three major rock groups including: The Cretaceous Idaho batholith, the Triassic-Jurassic metamorphosed island-arc sedimentary and volcanic rocks of the Seven Devils Group and the Miocene flood-basalt flows of the Columbia River Basalt Group. A geological Map is provided in Appendix G.

According to the Soil Survey of Valley County Area, Idaho, parts of Adams and Washington Counties[3], soils underlying the service area are mainly classified as

[1] McCall in Motion (Draft), McCall Area Comprehensive Plan, Existing Conditions. 2016: 68-69.
[2] R.S. Lewis, "Valley County, Idaho", *Digital Atlas of Idaho*, http://imnh.isu.edu/digitalatlas/counties/valley/Valley.pdf
[3] 2008, Soil Survey of Vlley County Area, Idaho, Parts of Adams and Washington Counties, United States Department of Agriculture, Soil Conservation Service.

archabal loam with 4 to 12 percent slopes and McCall complex with 5-50 percent slopes. The soil series typically includes a surface layer of silty sand, silty pebbly sand, sandy gravel, local silt, and clay. The underlying material (Below 1 meter) consists of silty sandy gravel and gravelly coarse sand. A soil map and is located in Appendix G.

Figure 1. Municipal Service Area.



1.3. Surface and Groundwater Hydrology

The McCall service area is adjacent to the Payette Lake and Payette River. The Payette Lake is the sole source of raw water supply for the City and the water quality is very good with consistently low turbidity and total organic carbon levels. For the year 2016, turbidity ranged from 0.12 to 1.36 nephelometric turbidity units (NTU), with an average of 0.27 NTU. Raw water pH ranged from 5.9 to 7.6, with an average of 6.7. Raw water temperature ranged from 4.3 to 10.5 degrees Celsius, with an average of 7.1 degrees Celsius. Average raw water alkalinity and hardness were 7.4 and 3.2 mg/L as $CaCO_3$, respectively.

Groundwater availability in the McCall area is quite variable due complex surface geology. Figure 2 is a surficial geologic map[4] of the municipal water service area. The surficial geologic map for Long Valley is located in Appendix G.

- The core of the service area consists primarily of recessional moraine deposits (map unit Qgr), which do not form productive aquifers. Wells completed in these areas generally produce less than 50 gpm.
- The northeast portion of the service area (in the vicinity of the municipal golf course) and the southern portion of the service area (near and west of the airport) are underlain by glacial outwash deposits (map unit Qgo). Glacial outwash deposits consist primarily of sand and gravel, and form productive aquifers. Properly completed wells in these areas produce yields of several hundred gallons per minute.
- The west and southeast sides of the service area are covered by glacial till deposits (map unit Qgt). Similar to the recessional moraine deposits, the till does not contain productive aquifers.

The glacial deposits are underlain by low permeability bedrock consisting of basalt or granite.

[4] Breckenridge, R.M., K.L. Othberg, 2006, Surficial Geologic Map of Long Valley, Valley County, Idaho, Idaho Geological Survey Geologic Map 68.

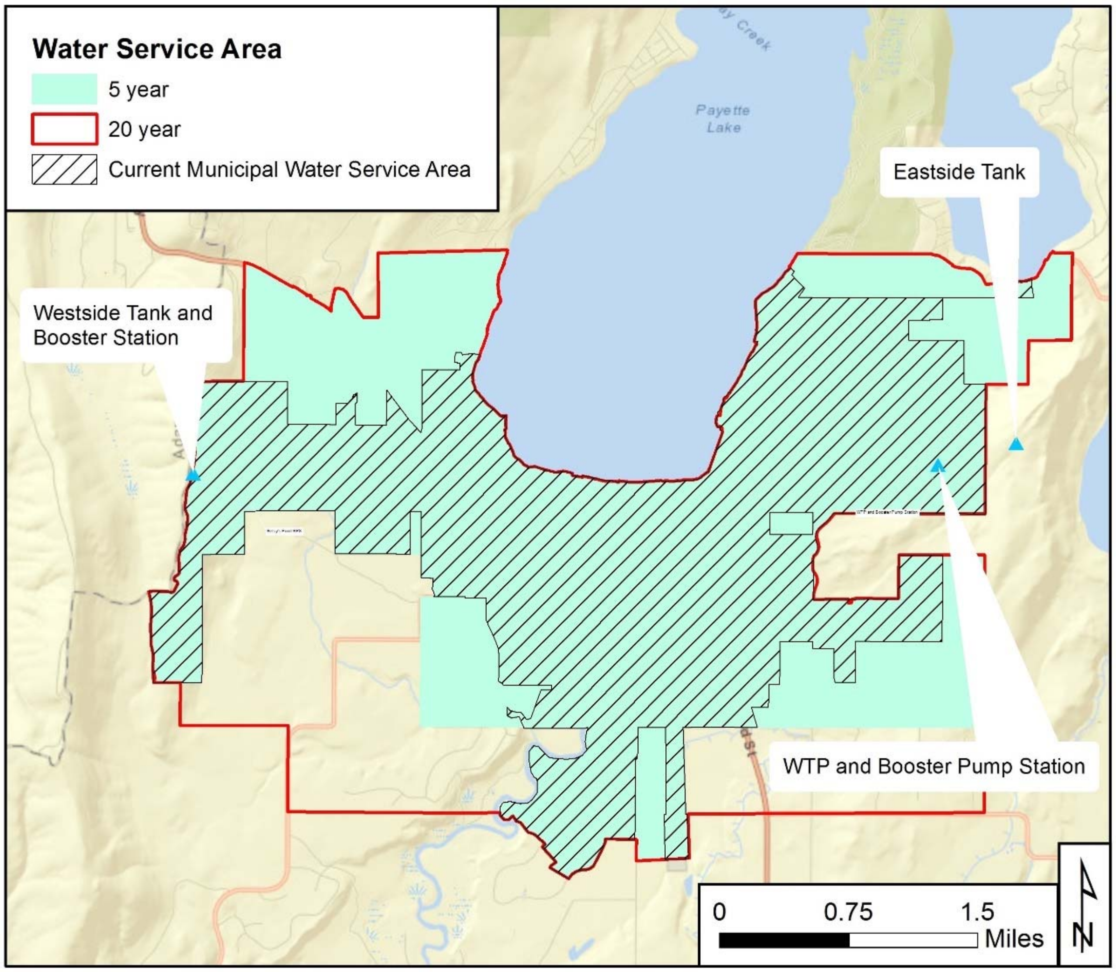
Figure 2: Surficial Geology of Water Service Area

In general, groundwater levels in the McCall areas are stable. Depths to groundwater vary from near ground surface near the lake or river, to more than 100 feet in some upland areas.

1.4. Future Planning Service Area

The 5-year and 20-year planning boundaries are presented in Figure 3. These boundaries were recently updated as part of the 2017 McCall Area Comprehensive Plan Update. The planning areas primarily focus on development south of the existing municipal boundary. In addition, growth is also anticipated in the northeast, northwest, and southwest areas of the system. Infill within the current service area is ongoing and expected to continue where undeveloped land is available and zoning allows for increased density. Projected water system demands are presented in Section 3 and system requirements to meet projected future demands are evaluated in Section 5.

Figure 3. Future Planning Areas.



1.5. Land Use

The McCall area includes a mix of agricultural, residential, recreational, industrial, and commercial land use areas. The McCall in Motion, McCall Area Comprehensive Plan designates land use areas and area zoning. A list of current land use includes: 28.71% single-family residential, 0.85% multifamily, 5.05% commercial, 0.3% parks, 4.56% civic/institutional, 17.2% agricultural/grazing lands, and 50.3% open space.

1.6. Housing, Industrial, and Community Development

The water system serves residential, commercial, and industrial connections. Approximately 12% of connections are commercial or industrial.

1.7. Socioeconomic Profile

According the census of 2015, there were approximately 3,481 households and 3,106 people residing in the City of McCall. The 2015 median income for a household in the city was estimated to be $49,141. As a resort community, approximately 73% of the homes are second residences. According to the census of 2010, the racial makeup of the city was 93.6 percent White, 0.7 percent American Indian, 0.1 percent Black or African American, 0.5 percent Asian, 3.6 percent from other races, and 1.4 percent from two or more races. The gender makeup at the time was 51.7 percent male and 48.3 percent female. Additional socioeconomic information is provided in the 2017 McCall Area Comprehensive Plan Update.

1.8. Utlity Use

The utilities utilized by the water system include wastewater and electricity. Electricity is provided by Idaho Power and wastewater is provided by Payette Lakes Water and Sewer District. Power is used for facility pumps and the water treatment plant and wastewater is used for water treatment plant waste.

1.9. Energy Production and Consumption

The water system includes 21 pumps. The water facilities operate using electricity from Idaho Power. The water treatment plant, Legacy Park Pump Station, Westside Booster Pump Station, and Knowles Road Booster Pump Station have standby generators. The proposed addition of VFDs at the Legacy Park Pump Station should help decrease energy demands from the water system.

1.10. Cultural Resources

Based on a review of records at the Idaho State Historic Preservation Office (SHPO), there are no previously recorded archaeological resources within the service area. There are, however, many historical buildings including: Elo School, Hill, Matt N., Homestead Barn, Koski, Charles Homestead, McCall District Administration Site, Rice Meeting House, Southern Idaho Timber Protective Association (SITPA) Building, and the Wargelin, Nickolai, Homestead. Historical buildings will not be impacted by the proposed improvements discussed in Section 9.

1.11. Climate

The climate in McCall is influenced by the mountains, lakes, altitude, and latitude. Temperatures in the summer average 80 degrees (high) and 43 degrees (low). The winter brings average temperatures of 30 degrees (high) and 13 degrees (low). The average annual snowfall in McCall is 138 inches.

1.12. Proximity to Sole Source Aquifer

The EPA Region 10 Sole Source Aquifer Program indicates there are no sole source aquifers in the water system service area.

1.13. Floodplains and Wetlands

There are floodplains located along the Payette River and Lake based on an evaluation of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps panel numbers 1602200304A and 1601750002A. The floodplains are in Zone A and Zone AE. These areas will be inundated by a 100-year flood. According to the map there are no known customers located within these area, but there are three pipelines that cross the river. These pipelines are not included in the CIP pipeline improvements.

Based on a review of the USFWS National Wetland Inventory Maps there are wetland areas within the water service area. The wetland areas include freshwater emergent wetlands, freshwater forested/shrub wetlands, freshwater ponds, riverines, and lakes. The majority of wetlands are located at the golf course, adjacent to the river or lake, or in parks. There are some wetlands located in residential and commercial areas. Proposed pipelines improvements are not currently planned in wetland areas. If pipeline improvements are added that will impact wetland areas, the City will follow all requirements and obtain a U.S. Army Corps of Engineers permit as needed. Floodplain and wetland maps are provided in Appendix G.

1.14. Wild and Scenic Rivers

Based on the list of National Wild and Scenic Rivers, the North Fork of the Payette River is listed as a scenic river. Planned improvements do not impact Wild and Scenic Rivers.

1.15. Fauna, Flora, and Natural Communities

The service area is primarily mature mixed coniferous forest dominated by firs (Abies sp.) and ponderosa pine (Pinus ponderosa). The grass and shrub communities are dominated by Idaho fescue, bluebunch, wheatgrass, stiff sagebrush, mountain big sagebrush, and bitterbrush. The Payette National Forest is habitat for fifteen sensitive species of milkvetch, onion, camas, phlox, saxifrage, and monkeyflower.

The service area supports general wildlife species including deer, small animals, and birds. Threatened species in Valley County include bull trout, Canada lynx, northern Idaho ground squirrel, and the North American wolverine (proposed threatened).

1.16. Prime Agriculture Farmlands Protection

Approximately 17.2% of the existing land within the City's impact area is used for agricultural purposes. Additional agriculture land is located south of the service area. According to the United States Departments of Agriculture (USDA) Web Soil Survey land within the service area is not rated prime farmland.

1.17. Air Quality and Noise

The City of McCall is located in a geographic region that generally enjoys good air quality. Air quality is monitored year-round by the McCall monitoring station located within the City. There are annual impacts to the City's air quality from forest fires.

Noise in the City area is generally limited to normal traffic and commercial activities.

1.18. Public Health and Water Quality Considerations

The City of McCall releases an annual drinking water quality report and routinely monitors for constituents according to State and Federal Laws. The drinking water routinely exceeds all requirements.

The most recent sanitary survey conducted by IDEQ in May 2017 is included in Appendix G. No significant deficiencies were noted. Three general deficiencies were indicated as follows:

1. The Betsy Pond booster controls and vault are not protected form vandalism, trespassing, or sabotage. Please protect with fencing, or otherwise, to limit access to system components.

   Improvements to Betsy's Pond booster station are planned to address this issue and are included as Item #18 in the Capital Improvement Plan.

2. There are fire hydrants provided that are connected to water mains smaller than six (6) inches in diameter, and therefore are not in accordance with IDAPA 58.01.08.542.06. The system's ability to provide adequate fire flow should be evaluated. (No action required at this time.)

   Section 4.5.4.1 and Figure 15 of this Master Plan identify 14 fire hydrants connected to water mains less than 6 inches in diameter. It is recommended that hydrant tests be performed on these hydrants to verify available flow, and that all dead end 4-inch pipe supplying hydrants should be replaced with 8-inch pipe.

3. All dead end water mains are not equipped with a means to flush, as required by IDAPA 58.01.08.542.09. (No action required at this time.) If dead ends result in degraded water quality or customer complaints, City of McCall will need to address the issue.

As stated in the sanitary survey, if dead ends result in degraded water quality or customer complaints, City of McCall will need to address the issue. No complaints have been received related to dead end water mains as of this time.

There are no known impaired water bodies within the service area. In general, the proposed improvements will have very little direct or indirect impacts to surface or groundwater quality.

1.19. Water Rate Structure

Base rates for the City of McCall are determined by the user water classification and meter diameter. Rates are shown in Table 2. Water Classifications include Class A (Private Residences), Class B (Industrial and Commercial Users), Class C (Unmetered Accounts), and Non-residents. For each Class A and B user, there is a consumption rate in addition to the base rate, in the amount of $0.71 per thousand gallons of water delivered to the premises. Non-Resident users are charged 150% of the residential rates contained in Resolution No. 06-17.

Table 2. McCall 2016 Water Usage Rates.

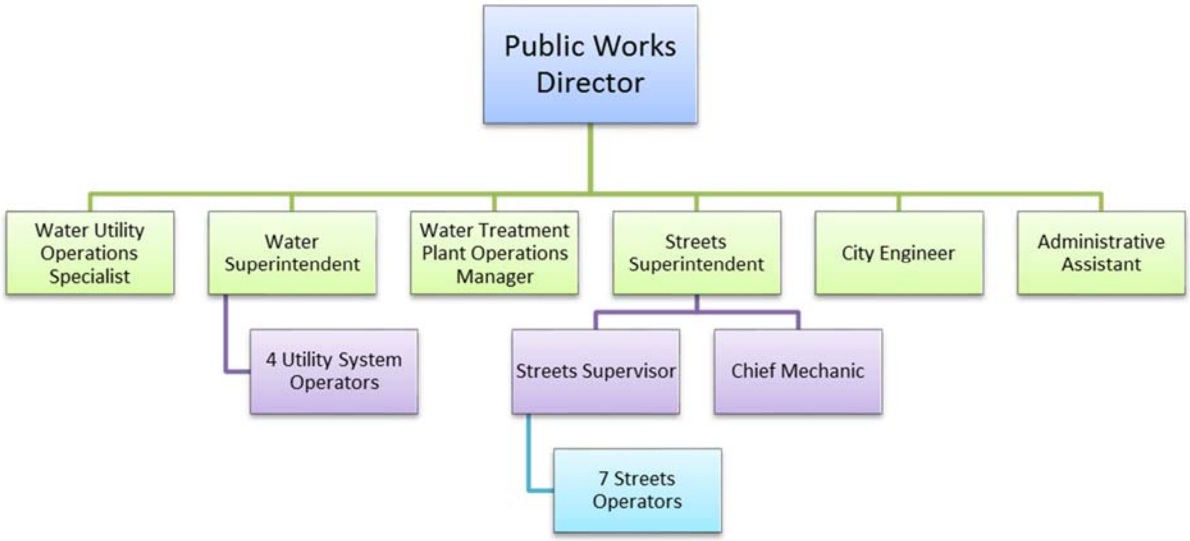
Water Classification	Meter Diameter (inches)							
	5/8 or 3/4	1	1 1/2	2	3	4	6	8
Class A	$33.70	$67.40	$134.80	$269.60	$539.20	$977.30	$2,156.80	$3,841.80
Class B	$37.70	$75.40	$150.80	$301.60	$603.20	$1,093.30	$2,412.80	$4,297.80
Class C	$68.32	$136.64	$273.28	$546.56	$1,093.12	$1,981.28	$4,372.48	$7,788.48
Non-Residents	$50.55	$101.10	$202.20	$404.40	$808.80	$1,465.95	$3,235.20	$5,762.70

Note: Rates shown are monthly charges.

As examples of total monthly water bills, a Class A 5/8-inch diameter meter user using up to 1,000 gallons per month would pay water fees of $33.70; if using 10,000 gallons per month would pay $40.80; if using 50,000 gallons per month would pay $69.20; and if using 100,000 gallons per month would pay $104.70.

1.20. Water Department Management Structure

The McCall water treat system is designated Class II and the distribution system is designated Class II by IDEQ. The Responsible Charge Operator for the treatment system is Matthew Dellwo, and the substitute RCO is Stacy LaFay. The RCO for the distribution system is Kurt Mohler, and the substitute RCO for distribution is Stacy LaFay. A complete list of current operator licenses is included in Appendix A. Water Department reports to the City's Public Works Director.


Public Works Director
Water Utility Operations Specialist
Water Superintendent
Water Treatment Plant Operations Manager
Streets Superintendent
City Engineer
Administrative Assistant
4 Utility System Operators
Streets Supervisor
Chief Mechanic
7 Streets Operators

2. EXISTING WATER SYSTEM FACILITIES

2.1. Sources of Supply

Payette Lake is the sole source of raw water supply for the City. There are two raw water intake and pumping facilities, the Legacy Park Pump Station and the Davis Beach Pump Station. Table 3 presents more information regarding capacities of the raw water pumping facilities. The raw water intake pump stations supply the Water Treatment Plant through a 16-inch diameter carbon steel pipe. The intake piping is shown in Figure 4.

The Legacy Park Pump Station has standby power, two 75-hp pumps (1,265 gpm each) and one 50-hp pump (861 gpm). The two 75-hp pumps were recently rebuilt and the firm capacity of the pump station increased from 1,743 gpm to 2,176 gpm. The capacity is based on pump testing. The pump station does not have a flow meter. The Legacy Park intake piping is located 80 feet below the water surface and provides the best water quality year-round.

The Davis Beach Pump Station is used during the summer to meet increased demands. The pump station does not have back-up power. The pumping facility consists of one 45-hp pump, one 60-hp pump, and one 75-hp pump. The pump station does not have a flow meter. The depth of the intake is 30 feet below the water surface. Water quality can be affected by algae and turbidity, especially during the summer. Although water quality is generally very good, Legacy Park is the primary supply during summer due to the superior water quality.

Table 3. Raw Water Pumping Facilities.

Parameter	Value
LEGACY PARK PUMP STATION	
Number of Pumps	3
Pump Capacities	861, 1,265, 1,265 gpm
Firm Capacity(1)	2,126 gpm
Standby Power(2)	Yes, all 3 Pumps
Intake Depth	80 ft.
DAVIS BEACH PUMP STATION	
Number of Pumps	3
Pump Capacities	695, 695, 868 gpm
Firm Capacity	0 gpm (no stanby power)
Standby Power	No
Intake Depth	30 ft.

Note: (1) Firm capacity calculated with largest unit out of service.
(2) Standby power provided by 200kW Diesel generator.

2.2. Water Treatment Plant

The McCall Water Treatment Plant (WTP) is an in-line filtration plant treating water from Payette Lake. Phase I of the WTP was constructed in 1997 and included chlorination, storage, and pumping. Phase II of WTP involved construction of the filtration facilities and achieved substantial completion in December 2002.

The treatment train consists of prechlorination, soda ash feed for pH and alkalinity control, coagulation, deep-bed monomedia filtration, and disinfection with sodium hypochlorite which is generated on site. The WTP currently employs both a coagulant and a filter aid for chemical pretreatment. Design criteria for the WTP are listed in Table 4. The WTP has a nameplate capacity of 5.9 mgd, and a firm capacity of 5.3 mgd when accounting for backwash.

2.2.1. WTP and Filter Optimization

The overall condition of the WTP is very good. The concrete filter basins, CT basin, and clearwell are in good condition, and the major mechanical systems including process piping, valves, pumps, and blowers are also in good condition. Ancillary equipment including chemical feed systems, instrumentation, and Supervisory Control and Data Acquisition (SCADA) system are near the end of their respective service lives as would be expected of a 15-20 year old treatment facility. The City has recently replaced most on-line instrumentation including turbidimeters, particle counters, pH meters, and chlorine analyzers. The City plans to replace the on-site sodium hypochlorite generation system and the soda ash feeder in 2018 (CIP Projects #1 and #8). And the City plans to upgrade the system wide SCADA system in 2019 (CIP Project #10).

As part of this Water Master Plan, the operation of the WTP was reviewed and steps were taken to optimize the treatment process and filter performance. Staff had complained of slimy buildup in the filter basins and on-line instrument tubing. After a review of existing chemical feed rates, the City tested reducing feed rates for the primary coagulant and filter aid polymer. First, the feed rate for polyaluminum chloride (PACl), the primary coagulant, was gradually reduced in incremental steps. Total reduction of 40% was achieved without negatively impacting filter performance. Then, reduction of the filter aid polymer feed rate was tested by reducing the feed rate in small incremental steps. The filter aid polymer feed rate was reduced by a total of 50% while filtered water turbidity actually improved slightly. In addition, the slimy buildup in the filter basins and instrument tubing has been eliminated, and filter run times are longer due to reduced rate of headloss buildup.

Filtered water quality has historically been excellent for the WTP, owing both to the excellent raw water quality with consistently low turbidity and the deep-bed, coarse, monomedia filter design. Filtered water turbidity was consistently below 0.02 nephelometric turbidity units (NTU). After optimizing the primary coagulant and filter aid polymer doses, filtered water turbidity was actually reduced and is now consistently below 0.015 NTU during the middle of filter runs.

As a result of the lower coagulant and filter aid feed rates, the filter headloss buildup rate was also reduced as noted above. This has allowed the City to extend filter run times during the summer and to backwash each filter every two days instead of every day. This has provided more flexibility in plant operations and no longer does staff need to backwash a filter during peak hour demand each the morning. The City plans to conduct a filter audit in 2020 to evaluate the condition of the filter media and underdrain system. However, filter performance at this time is excellent with respect to filtered water turbidity, headloss buildup, and filter run times.

Table 4. WTP Summary.

Parameter	Value[1]
Type of Treatment	In-Line Filtration
Flash Mix Type	Pump Diffusion
Firm Capcity	5.3 MGD
Filters	
No.	2
Surface Area, ea	256 ft^2
Filter Area Total	512 ft^2
Filtration Rate	4 gpm/ft^2
Maximum Filtration Rate	8 gpm/ft^2
Filter Medium	Anthracite
Media Depth	90 in
Media Effective Size	1.2 mm
Uniformity Coefficient	<1.4 mm
Under Drain Type	Nozzle
Backwash Rate	24 gpm/ft^2
Air Scour Rate	4 $scfm/ft^2$
Surface Wash Rate	4 gpm/ft^2
Chlorine Contact Tank	
CT Volume	308,000 gal
Available Chlorine Contact Time (T10)	37 min
Clearwell	
Clearwell Volume	384,000 gal
Finished Water Pumping Station	
Total Number of Pumps	6
VFD Driven Pumps (Distribution System)	2
Capacity (ea.)	1100 gpm
Constant Speed Pumps (Distribution System)	2
Capacity (ea.)	800 gpm
Distribution Firm Pumping Capacity[2]	2,700 gpm
Pumps to Eastside Tank	2
Capacity (ea.)	640 gpm

Notes: (1) Data from Water Treatment Plant Record Drawings.
(2) Firm pumping capacity calculated with largest unit out of service.

2.3. Storage Facilities

There are two water storage reservoirs in the distribution system, the Eastside Tank and the Westside Tank. They are both buried, cast-in-place concrete tanks. Current water storage tank requirements and total available storage is shown in Table 5. Additional information is located in Appendix A.

Table 5. Current Water Storage Tank Requirements.

Category	Eastside Tank	Westside Tank	Comments
Operational Storage	142,170 gal	54,330 gal	Eastside Tank: 13.5-15.5 ft Westside Tank: 12.5-14.5 ft
Equalization Storage	0 gal(1)	0 gal	Firm pumping capacity > PHD
Fire Storage	540,000 gal (3,000 gpm for 3 hrs)	210,000 gal (1,750 gpm for 2 hrs)	
Standby Storage	0 gal	0 gal	Eastside: Standby Power Westside: Standby Power
Dead Storage	187,660 gal	22,640 gal	Eastside: 18.5" btm / 12" top Westside: 4" btm / 6" top
Total Required Storage	869,830 gal	277,910 gal	
Total Available Storage(2)	1,173,000 gal	407,000 gal	

Notes:

1. Operational storage is based on actual tank level setpoints that start and stop the pump stations that fill the tanks.
2. Equalization storage is not required because firm pumping capacity exceeds peak hour demand.
3. Standby storage is not required because standby power is provided for the pump stations.

In addition to the two raw water intake pump stations and the WTP, the City operates three booster pump stations. The booster pump stations (BPS) are located on the west side of the system. The pumping facility locations are shown in Figure 4.

2.3.1. Knowles Road Booster Pump Station

The Knowles Road Booster Pump Station (Knowles BPS) consists of three pumps (225 gpm, 550 gpm, 1,490 gpm) that provide domestic supply and fire flow for the West of River Pressure Zone. Knowles BPS pumps water from a dedicated 12-inch line on Lakeside Avenue that connects to the Main Pressure Zone on the East Side of the system. This booster pump station has a backup generator and meets IDEQ requirements. With the addition of a backup generator installed in 2013, the fire flow pump (1,490 gpm) is no longer required to provide fire flow and could be replaced with a smaller pump (550 gpm). Knowles BPS has a firm capacity of 775 gpm. Demand on the West Side of the distribution system is met by Knowles BPS and the Westside Tank. Demands are projected to exceed supply capacity in 2037 (see Section 5 for more detail). At that time additional supply could be provided by upgrades to Knowles BPS, construction of a new booster pump station, or additional storage capacity.

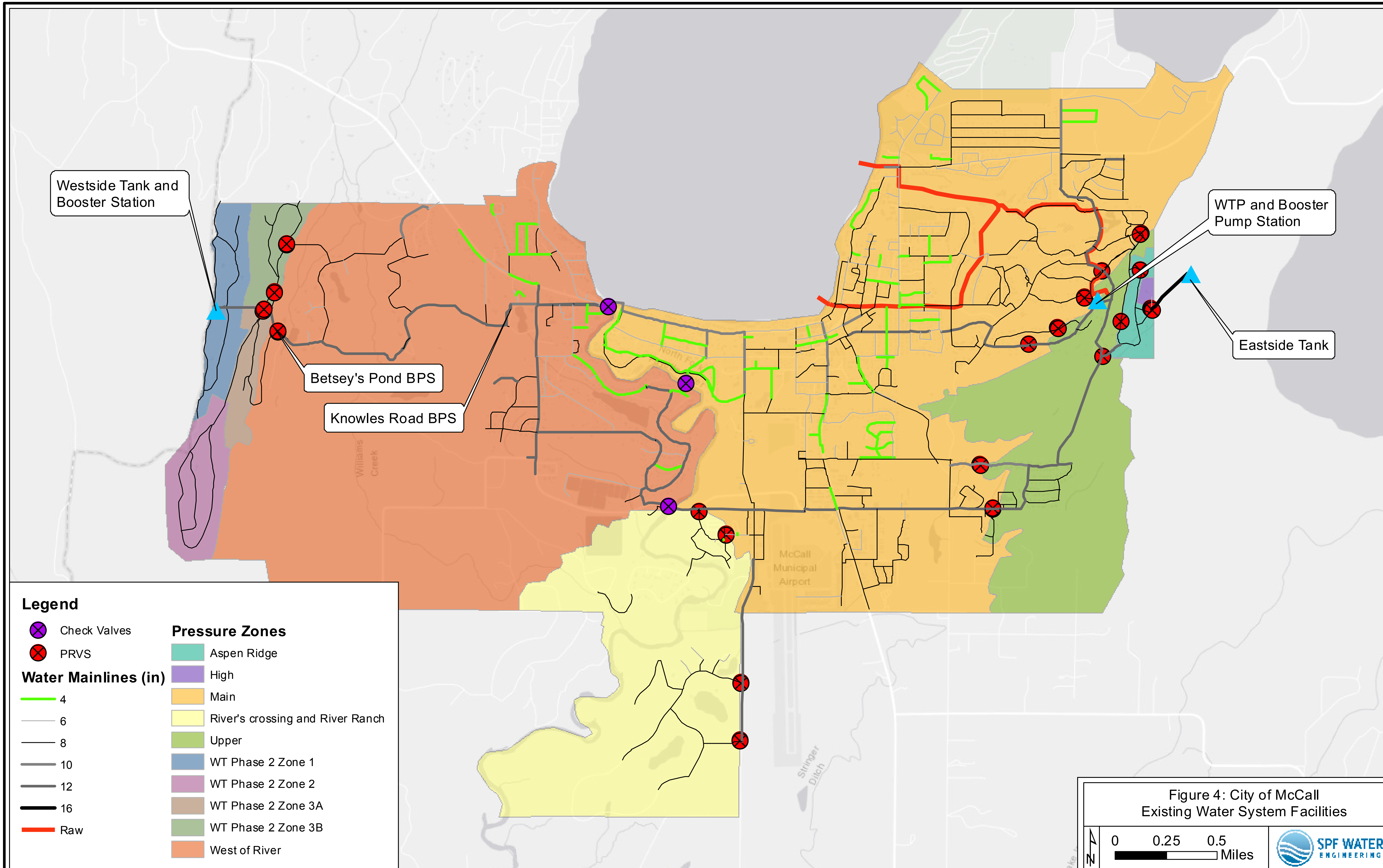


Figure 4: City of McCall
Existing Water System Facilities

2.3.2. Betsy's Pond Booster Pump Station

The Betsy's Pond Booster Pump Station (Betsy's BPS) consists of two constant speed pumps (15 hp, 100 gpm) that supply water to the Westside Tank through a dedicated 12-inch supply line. This booster pump station meets IDEQ requirements.

2.3.3. Westside Booster Pump Station

The Westside Booster Pump Station (Westside BPS) consists of four pumps (1.5 hp (15 gpm), two 5 hp (50 gpm), 100 hp (1,500 gpm)) that provide domestic supply and fire flow to the WT Phase 2, Zone 1. Currently this BPS only serves a few residences. To meet IDEQ requirements for fire flow redundancy this booster pump station needs to add a backup fire flow pump. The firm capacity of this booster pump station is discussed in Section 5. Additional information is provided in Appendix A.

2.4. Distribution System

The distribution system consists of approximately 90 miles of pipeline ranging in size from 4 inches to 16 inches in diameter. The distribution piping and the pump and storage facility locations are shown in Figure 4. Pipe materials consist of PVC, ductile iron, and carbon steel. There are some original lines in the system made of transite. The majority of piping in the system is 6-inch and 8-inch diameter. The dividing line between the West Side of the system to the East Side of the system is the Payette River. The water system piping crosses the Payette River in three locations: Deinhard Lane, Mather Road/Rio Vista, and Lake Street. Check valves at these crossings prevent the flow of water back to the Main Pressure Zone. Sections 4 and 5 discuss the results of hydraulic modeling and the needed improvements within the distribution system. Table 6 summarizes the pipeline information for the system.

Table 6. Summary of Distribution Pipes.

Diameter (inches)	Length (feet)	Length (miles)
4	46,275	8.76
6	93,657	17.74
8	234,864	44.48
10	13,850	2.62
12	65,717	12.45
16	18,398	3.48
Total	**472,761**	**89.54**

Source: City of McCall Hydraulic Model.

2.4.1. Pressure Zones

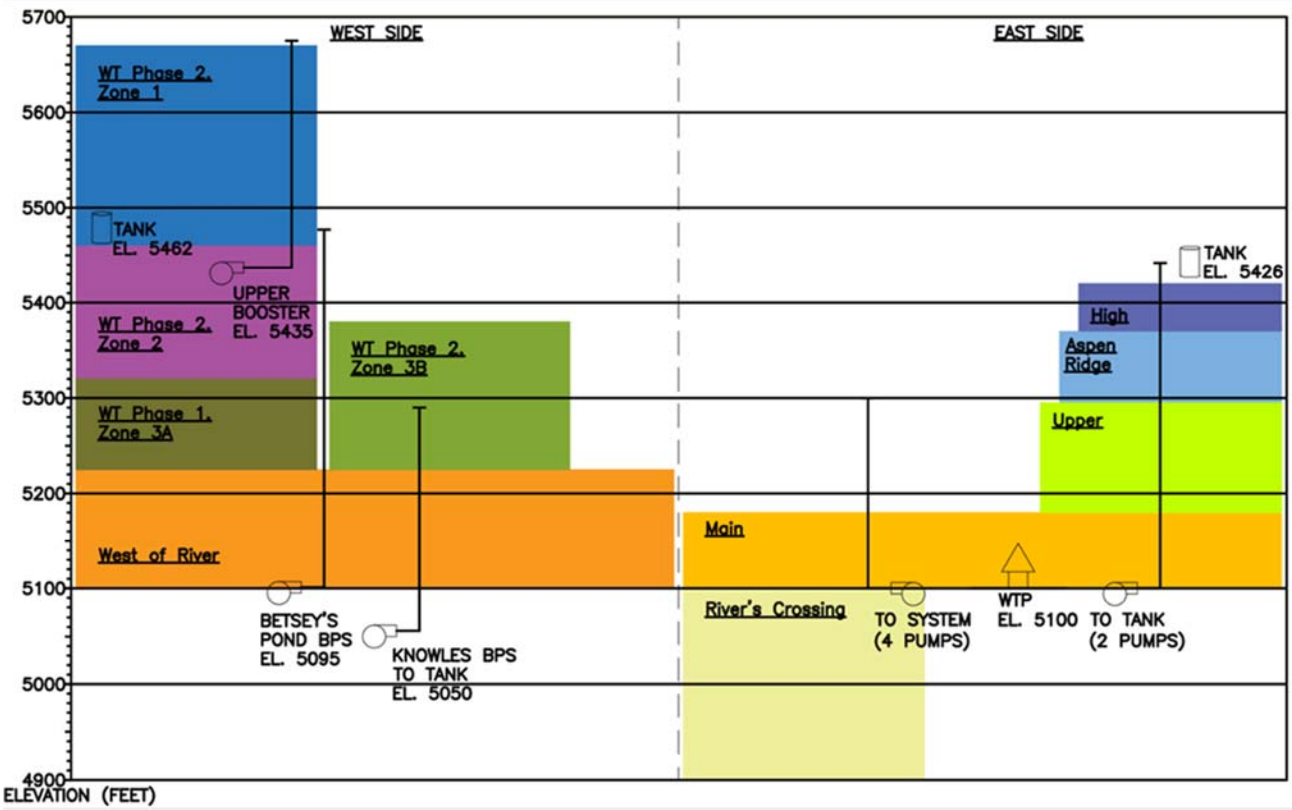
The existing water distribution system in McCall consists of ten pressure zones: five pressure zones on the east side and five pressure zones on the west side. The pressure zone and pressure reducing valve (PRV) locations are shown in Figure 4. The WTP directly serves the Upper Pressure Zone and is operated to maintain a pressure of 88 psi. A summary of the pressure zones including nominal hydraulic grade line (HGL) and the distribution supply is listed in Table 7. The distribution supply includes PRVs, Booster Pump Stations, and the Water Treatment Plant. There is a total of 36 PRVs at 20 locations within the system. PRV settings are discussed in Section 4.

Table 7. Pressure Zones.

Pressure Zone	Nominal HGL (feet)	Supply
East Side		
High	5,340	Eastside Tank
Aspen ridge	5,370	Heavens Gate PRV
Upper	5,295	South Loop, Quakey, and Majestic View PRVs; WTP Distribution Pumps
Main	5,180	Penstemon, Fireweed, Bitteroot, Majestic, Aspen Ridge, School, and Floyde PRVs
River's Crossing and River Ranch	5,112	River Ranch and RV Park PRVs
West Side		
West of River	5,225	Knowles BPS, Whitetail PRV #4, and Whitetail PRV #5
WT Phase 2, Zone 1	5,663	Westside Booster Station
WT Phase 2, Zone 2	5,460	Whitetail PRV #3
WT Phase 2, Zone 3A	5,319	Whitetail PRV #2
WT Phase 2, Zone 3B	5,383	Whitetail PRV #1

The schematic drawing in Figure 5 shows the pressure zones in the distribution system. The figure shows the elevation of all distribution facilities and the hydraulic grade lines that the pressure zones serve. The pumps represent the pumping facilities and the elevation (HGL) to which water is pumped.

Figure 5. City of McCall Pressure Zone Schematic.



2.5. SCADA System

The City's Supervisory Control and Data Acquisition (SCADA) system allows for the water system to be controlled automatically and monitored remotely. Data are tracked, control setpoints are changed, and alarm conditions are reported using the SCADA system. The SCADA system was installed in the early 2000s at the time the WTP was constructed, and is in need of evaluation and upgrades. There are limited SCADA infrastructure/monitoring stations on the west side of the system and accurate data are needed to confirm the capacity analysis described in Section 5. Improving data collection on the West Side will give greater insight to the capacity limitations and future facilities needed on the west side. The Capital Improvement Plan presented in Section 8 includes a SCADA Upgrade project in the near future that will address SCADA deficiencies.

3. WATER SUPPLY REQUIREMENTS

3.1. Definition of Terms

Consumption. Consumption refers to the actual volume of water used by customers measured at their connections to the water distribution system. Consumption is typically measured in cubic feet (cf) or gallons (gal). Consumption includes residential, commercial, industrial, and other municipal uses and the largest component of consumption is typically irrigation demand during the summer.

Demand. Demand is defined as the quantity of water obtained from the water supply source during a given time period. For this report, *demand* refers to the total system demand which is the total amount of water required to meet domestic, commercial, industrial, irrigation, and other public uses, and to provide for firefighting and other miscellaneous applications. Demands are typically quantified in terms of flow rates, such as million gallons per day (mgd) or gallons per minute (gpm). Demand categories pertinent to the analysis and design of water systems are as follows:

- **Average Day Demand (ADD):** The total quantity of water use from all sources of supply as measured over a calendar year divided by three hundred sixty-five days.
- **Maximum Day Demand (MDD):** The highest quantity of water that is used over a twenty-four-hour period, excluding unusual events or emergencies.
- **Peak Hourly Demand (PHD):** The highest quantity of water that is used during any single hour from all sources of supply including water treatment plant production and flow from storage reservoirs.

Demands are typically quantified in units of million gallons per day (mgd). The following conversion factors are used to determine flow rates in other units:

- 1 mgd = 694 gallons per minute (gpm) = 1.55 cubic feet per second (cfs)
- 1 gpm = 1,440 gallons per day (gpd)
- 1 cfs = 449 gpm = 0.648 mgd

Number of Connections. A connection is defined as an average customer water service connection. The connection does not distinguish between single family, multifamily, commercial or industrial use. For the purposes of the Water Master Plan, the number of connections is equal to the number of individual water meters (or customer accounts) tracked by the Water Department utility billing database.

Equivalent Residential Units (ERUs). A unit of water system capacity defined as the average demand of single family dwellings. A multi-unit housing complex or commercial facility could represent several ERUs as determined by water usage compared to water demand of the average single-family dwelling. For the purposes of the Water Master Plan, the number of ERUs is equal to the number of base rates billed to the Water

Department customers. One ERU represents the typical demand of a 3/4-inch water meter connection.

Peaking Factors. Peaking factors are defined as the ratio between ADD and other demand parameters, such as MDD and PHD. As an example, MDD might have a peaking factor (MDD/ADD) of 2.4 (i.e., MDD is 2.4 times ADD). These factors can be used as a comparison between systems, or a way to estimate MDD or PHD if only ADD is available.

Production. Production is the amount of water produced from the water treatment plant not including water used for backwashing filters.

Summary of Existing Data. Existing water production data and water billing data were provided by City staff. Some historical water use data were obtained from previous water Facility Plans including the *City of McCall 2001 Water System Master Plan, McCall Water Facility Plan 2008 Addendum, and 2012 Capital Improvement Program Update.*

3.2. Historical Water Production and Demand

Historical water production data for 1999 through October 2017 were evaluated and are summarized in Table 8. The data show that the average daily demand (ADD) has increased during this time period at a rate of 2.2% per year. Maximum day demand (MDD) has increased during this same time period at a rate of 3.1% per year. Discussions with City planning staff indicate that water use patterns are changing. More irrigation systems are being installed and utilized. There has been a move towards a higher yearly occupancy of residential units with the growth and opportunities provided by online rental applications. The City implemented water conservations measures in 2015 with alternating irrigation days.

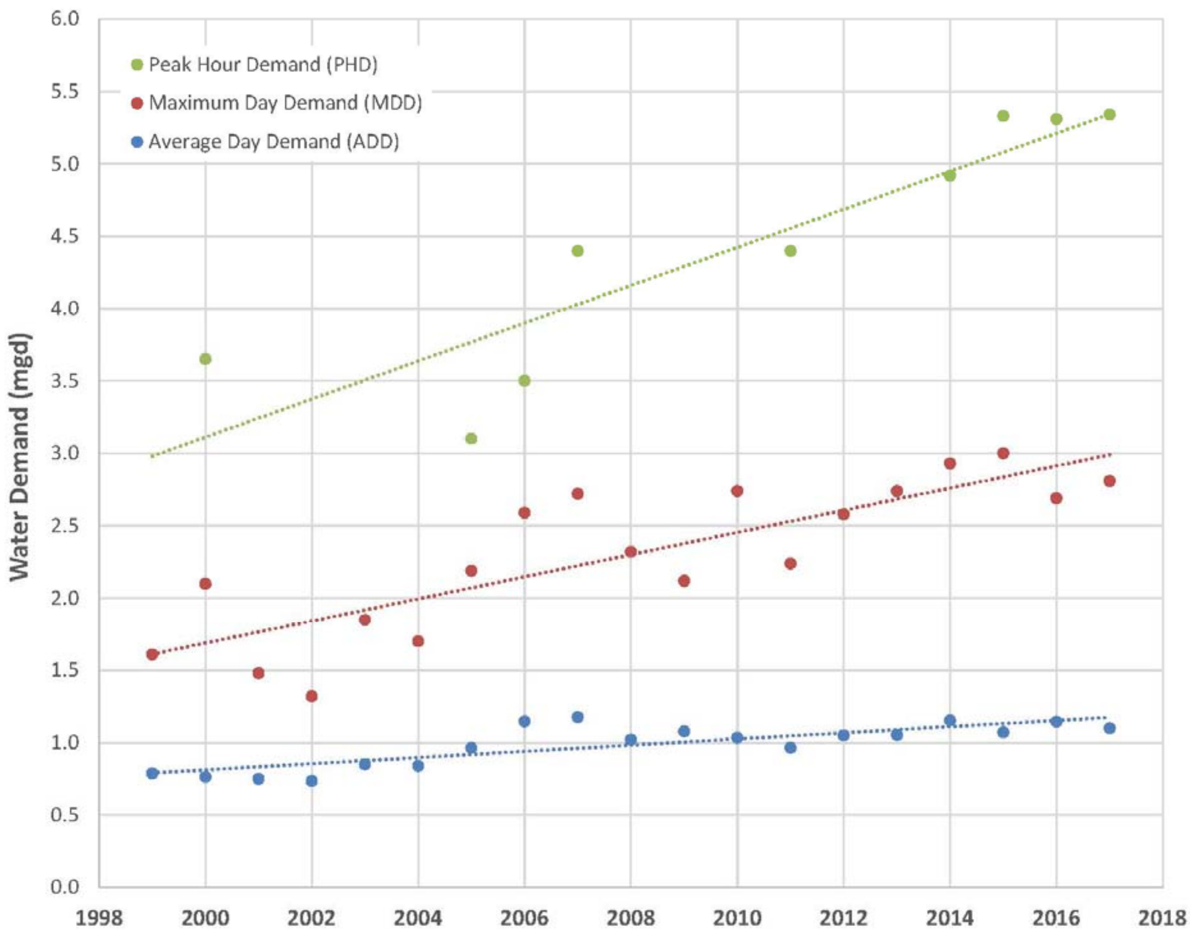
Table 8. Historical Water Production (1999-2017) Measured at Water Treatment Plant.

Year	Connections	ERUs	Total Annual Demand (MG)	ADD (mgd)	MDD (mgd)	PHD (mgd)	Average Demand per Connection (gpd)	Average Demand per ERU (gpd)
1999	2058	2753	287.0	0.79	1.61	ND	382	286
2000[6]	ND	ND	279.0	0.76	2.10	3.65	ND	ND
2001	ND	ND	273.4	0.75	1.48	ND	ND	ND
2002	ND	ND	267.7	0.73	1.32	ND	ND	ND
2003	ND	ND	310.0	0.85	1.85	ND	ND	ND
2004	ND	ND	307.4	0.84	1.70	ND	ND	ND
2005[7]	2190	2930	351.5	0.96	2.19	3.1	440	329
2006[7]	2638	3529	418.5	1.15	2.59	3.5	435	325
2007[7]	2774	3711	429.3	1.18	2.72	4.4	424	317
2008	ND[2]	ND	373.5	1.02	2.32	ND	ND	ND
2009	ND	ND	393.1	1.08	2.12	ND	ND	ND
2010	ND	ND	377.1	1.03	2.74	ND	ND	ND
2011	3013	4244	351.9	0.96	2.24	4.4	320	227
2012	3033	4264	383.9	1.05	2.58	ND	346	246
2013	3091	4331	384.2	1.05	2.74	ND	341	243
2014	3119	4361	420.6	1.15	2.93	4.92	369	264
2015	3159	4407	391.0	1.07	3.00	5.33	339	243
2016	3212	4507	418.9	1.14	2.69	5.31	356	254
2017[9]	3248	4551	402.1	1.10[9]	2.81	5.34	342[9]	235[9]
5 yr Ave (2013-2017)	3166	4431	403	1.10	2.83	5.23	349	248
Annual % Change (1999-2017)	2.6%	2.8%	1.9%	1.9%	3.1%	2.3%	-0.6%	-1.1%

1. ERU = Equivalent Residential Unit, values estimated based on current ratio of ERU per connection.
2. MG = million gallons.
3. mgd = million gallons per day.
4. gpd = gallons per day.
5. ND = no data available.
6. Data for year 2000 from City of McCall Water System Master Plan, 2001 Revision.
7. Data for years 2005-2007 from McCall Water Facility Plan, 2008 Addendum.
8. Data for 2011-2017 collected from SCADA and City as part of this Water System Master Plan, 2017.
9. 2017 Annual Demand and ADD estimated using actual SCADA data through October 31, 2017 and historical trends for November and December usage from 2012-2016.

Figure 6 shows average day demand (ADD), maximum day demand (MDD), and peak hour demand (PHD) for the time period from 1999 through October 31, 2017. For the five-year time period from 2013 through 2017, the average ADD was 1.10 mgd, the average MDD was 2.83 mgd, and the average PHD was 5.23 mgd.

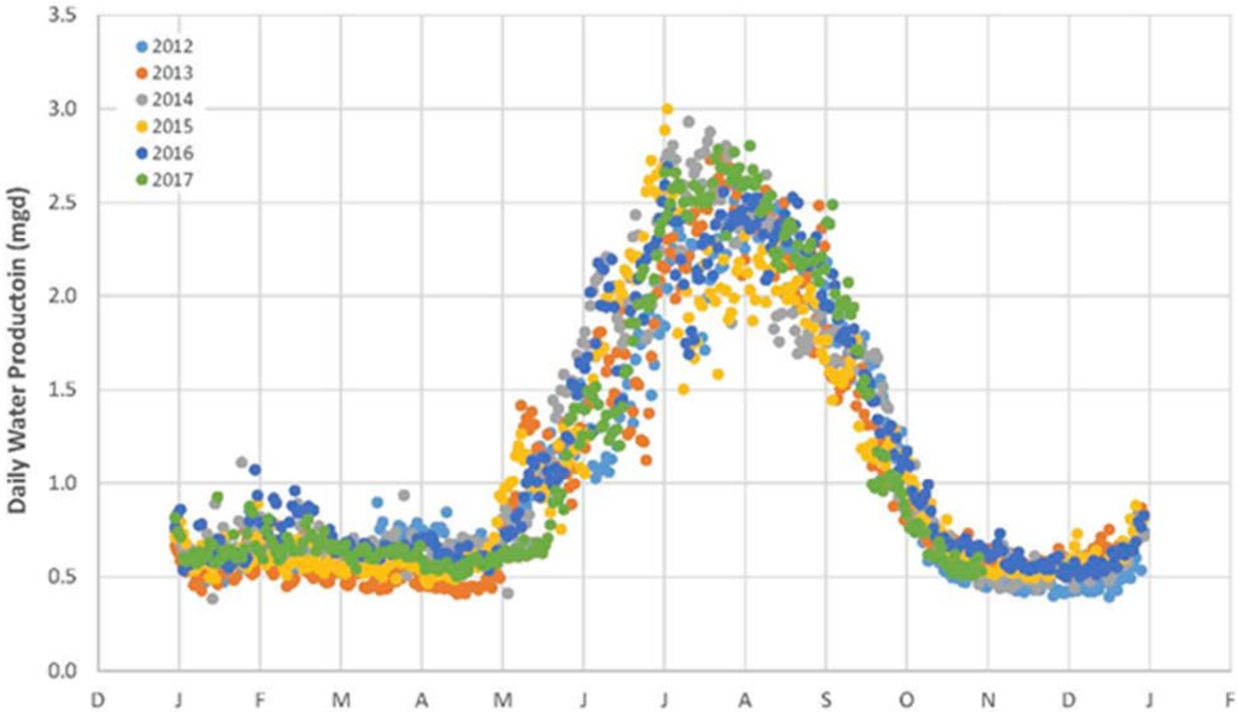
Figure 6. Historical Water Demand.



Note: Average Day Demand for 2017 is projected based on data through October 31, 2017.

Daily water production from the water treatment plant for 2012 through 2017 is shown in Figure 7. Peak water use for McCall has historically been during the months of July and August with Maximum Day Demand often occurring during the July 4th holiday, with similar peaks of water use on weekends in July and August. Peak water use during the day occurs consistently between the hours of 5:00 a.m. and 8:00 a.m., when irrigation demands are highest.

Figure 7. Daily Water Treatment Plant Production (2012-2017).



3.3. Unit Water Demands per Connection and ERU

Table 9 shows actual ADD, MDD, and PHD per connection and per ERU over the three-year period from 2014 through 2016. Average demand per ERU has dropped slightly over the past 17 years from 286 gal/ERU to 257 gpd/ERU, which equates to an average annual change of -0.5%. Data are based on actual production from the WTP.

Table 9. Unit Demands (2013-2017).

Year	Connections /ERUs	ADD		MDD		PHD	
		gpm	gpd	gpm	gpd	gpm	gpd
DEMAND PER CONNECTION							
2013	3091	0.24	341	0.62	886	ND	ND
2014	3119	0.26	369	0.65	939	1.10	1577
2015	3159	0.24	339	0.66	950	1.17	1687
2016	3212	0.25	356	0.58	837	1.15	1653
2017	3248	0.24	339	0.60	865	1.14	1644
5-Year Average	3248	0.24	349	0.62	896	1.14	1640
DEMAND PER ERU							
2013	4331	0.17	243	0.44	633	ND	ND
2014	4361	0.18	264	0.47	672	0.78	1128
2015	4407	0.17	243	0.47	681	0.84	1209
2016	4507	0.18	254	0.41	597	0.82	1178
2017	4551	0.17	242	0.43	617	0.81	1173
5-Year Average	4431	0.17	249	0.44	640	0.81	1172

1. ERU = Equivalent Residential Unit, values estimated based on current ratio of ERUs per connection.
2. ADD = Average Day Demand
3. MDD = Maximum Day Demand
4. PHD = Peak Hour Demand
5. gpm = gallons per minute
6. gpd = gallons per day
7. Average Day Demand values for 2017 estimated based on data through October 31, 2017.

3.3.1. Maximum Day Demand per ERU

Maximum day demand per ERU is an important value for water system planning. The average MDD per ERU over the five-year period from 2013 through 2017 was 640 gpd as shown in Table 9.

This value is used for determining remaining ERU capacity within the water system and for determining declining ERU balances for facilities. See Section 5 for capacity analysis and current ERU declining balances for system facilities This value can also be used as a metric for assessing capitalization fees for proposed developments.

3.4. Water Demand Peaking Factors

Demand data are used to calculate peaking factors for maximum day demand (MDD/ADD) and peak hour demand (PHD/ADD). Peaking factors are used to project future usage for the water system. Peaking factors calculated based on water usage data from 2011 through 2016 are shown in Table 10.

Table 10. Water Demand Peaking Factors.

Year	ADD (mgd)	MDD (mgd)	PHD (mgd)	MDD/ADD	PHD/ADD
1999	0.79	1.61		2.05	
2000	0.76	2.10	3.65	2.75	4.79
2001	0.75	1.48		1.98	
2002	0.73	1.32		1.80	
2003	0.85	1.85		2.18	
2004	0.84	1.70		2.02	
2005	0.96	2.19	3.10	2.27	3.22
2006	1.15	2.59	3.50	2.26	3.05
2007	1.18	2.72	4.40	2.31	3.74
2008	1.02	2.32		2.27	
2009	1.08	2.12		1.97	
2010	1.03	2.74		2.65	
2011	0.96	2.24	4.40	2.32	4.56
2012	1.05	2.58		2.46	
2013	1.05	2.74		2.60	
2014	1.15	2.93	4.92	2.54	4.27
2015	1.07	3.00	5.33	2.80	4.98
2016	1.14	2.69	5.31	2.35	4.64
2017	1.10	2.81	5.34	2.55	4.85
Average	1.08	2.71	5.06	2.52	4.66

1. ADD = Average Day Demand
2. MDD = Maximum Day Demand
3. PHD = Peak Hour Demand
4. ND = No Data Available
5. Average Day Demand for 2017 estimated based on data through October 31, 2017.

The average MDD peaking factor for the time period from 1999 through 2017 was 2.5, and has ranged between 1.8 and 2.8. The average PHD peaking factor was 4.7, and has ranged from 3.05 to 4.98. These peaking factors are typical for water systems in similar climates that provide the majority of residential and municipal irrigation supply. Note that PHD data from 2005 through 2007 are considerably lower than the rest of the data, and may have been calculated differently. MDD/ADD peaking factors typically range from 2 to 3, and PHD/ADD peaking factors typically range from 4 to 6.

It should be noted that peak hour demand is driven primarily by irrigation, and if meeting peak hour demand becomes challenging at some point in the future, irrigation practices could be modified by conservation requirements. However, achieving a PHD peaking factor less than the 4.0, the low end of the typical range, would be challenging.

3.5. Unaccounted for Distribution System Water

Unaccounted for water is the difference between the volume of water delivered to the distribution system and the volume of water that is sold to customers. It can be expressed as the volume of unsold water or expressed as a percentage of total water produced. Unaccounted for water can be lost to leaks, unauthorized use, unmetered or inaccurate meter connections, data handling errors, or water used for flushing mains, fighting fires, water provided for construction and other unmetered uses such as storage tank overflows, water treatment plant bypasses, sewer cleaning, and street cleaning. Managing water loss is important as it is costly and wastes natural resources.

The City recently changed their billing system and therefore water meter usage data are only available for the last four years. The accuracy of the data before that time is in question. Table 11 shows the volume of water produced, volume of water metered to customers, volume and estimated cost of unsold water, and the total percent unaccounted for water for the time period of April 2013 through December 2016.

Table 11. Unaccounted for Water (April 2013 to December 2016).

Year	Water Produced (MG)	Water Metered (MG)	Volume of Unsold Water (MG)	Value of Unaccounted for Water[2]	Unaccounted for Water (%)
2013	336[1]	274[1]	62[1]	$44,000[1]	18%
2014	421	326	95	$67,500	23%
2015	410	331	79	$56,100	19%
2016	420	349	71	$50,400	17%
TOTAL	1,587	1,280	307	$153,500	19% av.

1. Data for partial year, April-December 2013.
2. Assumed production cost of $0.71/1,000 gallons.

Typical unaccounted-for water rates across the United States range from 10 to 20%, with higher values seen for older system with older distribution system piping. The average across the United States is reported to be 16% (USEPA, 2013). Unaccounted water rates less than 10% are considered very good.

The City should attempt to identify and reduce unaccounted for water. All treated water should be metered even if the property owner is not billed.

Potential causes of unaccounted for water include:

- large meters underreporting low flows,
- water withdrawn from hydrants for fire protection and construction purposes,
- unmetered accounts,
- illegal/unmetered connections,
- and leaking mains and services.

A leak survey in older and high-pressure areas may be beneficial for identifying and reducing unaccounted for water usage.

3.6. Water Demand Projections

Water demand projections provide an estimate of future water use and are used in the planning process to identify capital improvement projects and the timing and cost of these projects. Water demand projections rely on important assumptions regarding population growth, per capita consumption, and seasonal peaking factors. While past water usage data can inform future water demand projections, trends invariably change over time and future demands can be difficult to predict. Still, demand projections are essential for planning water system improvements and budgeting for projects in order to meet future demands.

The average annual increase in ADD for the time period from 1999 through 2017 was 2.2%, and the average annual increase in MDD was 3.1%. Because water system facilities must be sized with capacity to supply MDD, a 3% annual increase in demand is used for projections in this analysis. The recently completed McCall Comprehensive Plan is also using a growth rate of 3% for future planning purposes.

Figure 8 and Table 5 present demand projections for the 20-year planning horizon from 2018 through 2037.

Figure 8. Water Demand Projections.

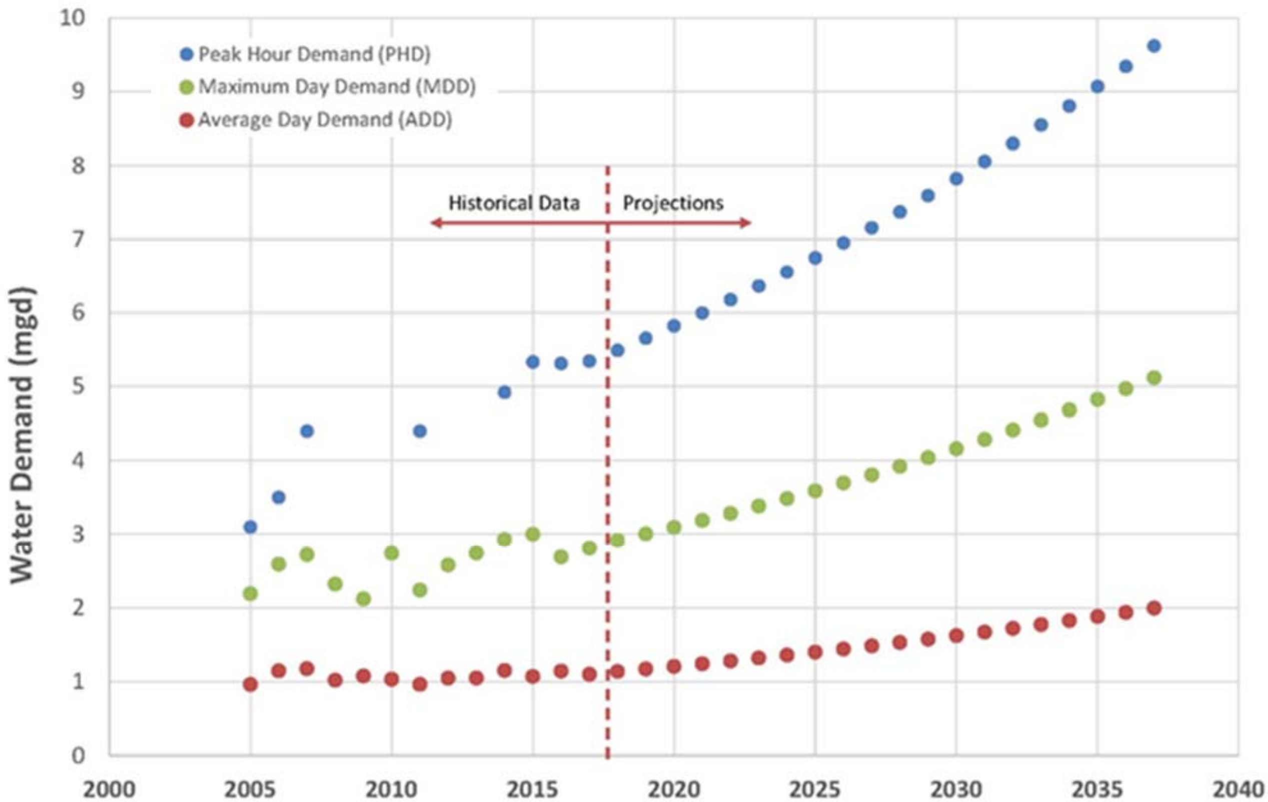


Table 12. 20-Year Water Demand Projections.

Year	ERU	Average Day Demand (ADD) (mgd)	Maximum Day Demand (MDD) (mgd)	Peak Hourly Demand (PHD) (mgd)
2017	4551	1.10	2.81	5.34
2018	4688	1.13	2.89	5.50
2019	4828	1.17	2.98	5.67
2020	4973	1.20	3.07	5.84
2021	5122	1.24	3.16	6.01
2022	5276	1.28	3.26	6.19
2023	5434	1.31	3.36	6.38
2024	5597	1.35	3.46	6.57
2025	5765	1.39	3.56	6.76
2026	5938	1.44	3.67	6.97
2027	6116	1.48	3.78	7.18
2028	6300	1.52	3.89	7.39
2029	6489	1.57	4.01	7.61
2030	6683	1.62	4.13	7.84
2031	6884	1.66	4.25	8.08
2032	7090	1.71	4.38	8.32
2033	7303	1.77	4.51	8.57
2034	7522	1.82	4.64	8.83
2035	7748	1.87	4.78	9.09
2036	7980	1.93	4.93	9.36
2037	8220	1.99	5.08	9.64

1. Assumes annual growth rate of 3.0% for ERUs, ADD, MDD, and PHD.
2. Average Day Demand for 2017 estimated based on data through October 31, 2017.

Average day demand is used in this plan to evaluate annual water right diversion volumes. Maximum daily demand is used to evaluate the sizing of intake facilities, water treatment plant, storage reservoirs, intake pumping facilities, certain finished water pumping facilities, and water rights for withdrawal. Peak hourly demand is used to evaluate the sizing of the distribution system, storage reservoirs, and certain finished water pumping facilities.

4. WATER SYSTEM ANALYSIS

This section describes the hydraulic analysis and assessment of the City of McCall existing water distribution system. The model was created to check specific scenarios required by the Idaho Department of Environmental Quality (IDEQ) and to analyze needed improvements to the system. Findings from the modeling analysis and recommendations are summarized below.

4.1. Computer Model Development

For this project, a new City of McCall hydraulic model was created using WaterCAD V8i (Select Series 4) format, the most current hydraulic software produced by Bentley Systems Inc. Key goals of the modeling work included:

- Create an up-to-date, calibrated, steady-state hydraulic water model for the City of McCall water system.
- Check if the following meet IDEQ requirements.
  - Static pressures
  - Peak hour pressures
  - Existing fire flow availability

Recommended improvements are provided to meet requirements.

4.2. Regulations and Analysis Criteria

The Idaho Department of Environmental Quality (DEQ) has regulatory authority over public and private potable water systems in the State of Idaho. The rules pertinent to drinking water systems are described in the Idaho Administrative Procedure Act (IDAPA 58 Title 01 Chapter 08).

Although no velocity criteria are regulated by IDEQ, the City would like to maintain velocities in new developments below 10 ft/s under fire flow conditions and 6 ft/s under PHD conditions. Velocities that exceed these criteria indicate areas where piping is undersized. The velocity criteria serve as a guideline during analysis and in prioritizing future growth. The fire flow scenario discussed in this report uses a velocity constraint of 12-ft/s in order to prioritize existing system improvements.

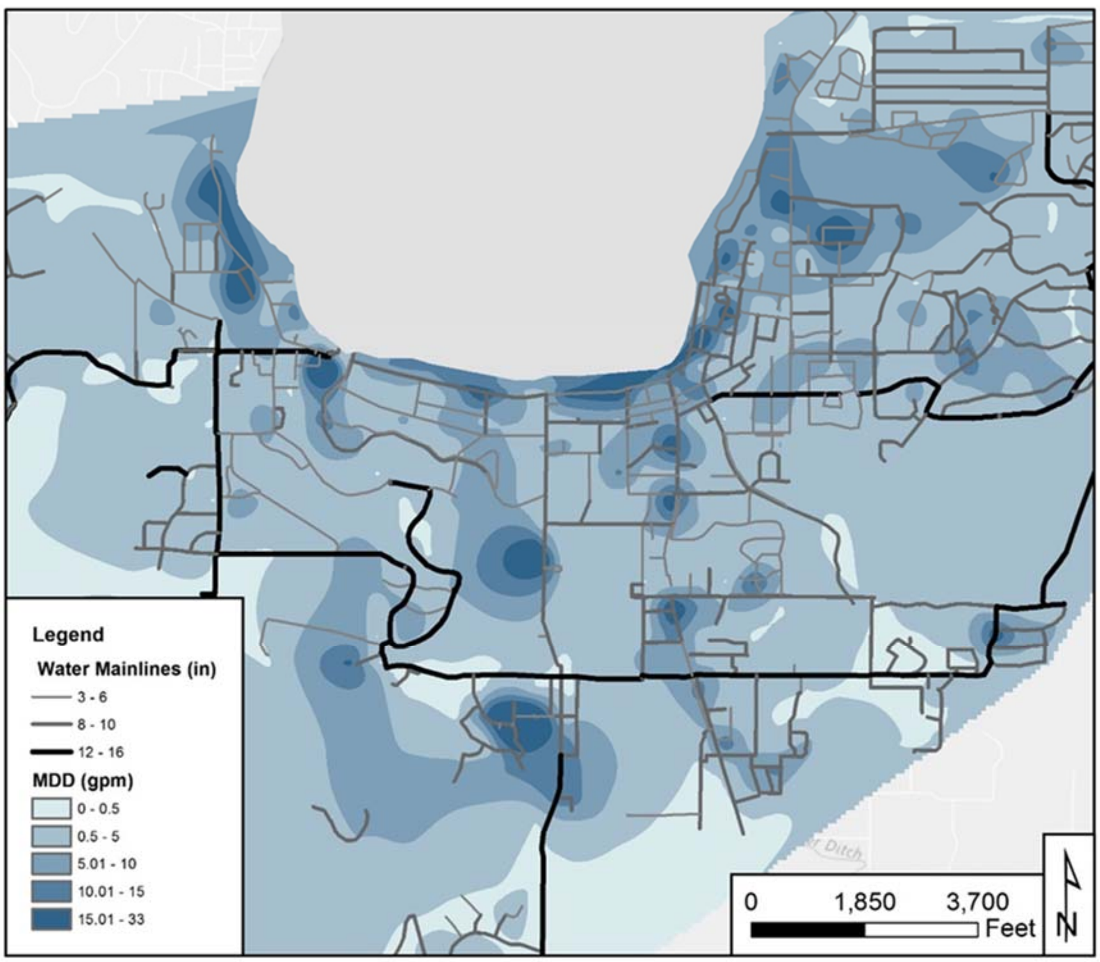
4.3. Demand Allocation

The McCall water system demands were allocated throughout the system based on meter and parcel data from July 2015 billing records. Maximum Day Demand (MDD) and Peak Hour Demand (PHD) were calculated using SCADA water production data from 2014 to 2017.

4.3.1. Current (2017) Demand

To assign demands as accurately as possible, demands were allocated within the distribution system model based on July 2015 meter billing and parcel data supplied by the City. The percentage of monthly total use was calculated for each meter in the July 2015 billing data. The 2015 - 2017 average MDD of 1,965 gpm and PHD of 3,700 gpm from the SCADA information were then multiplied by the calculated 2015 meter percentage to obtain the MDD and PHD for each meter in the hydraulic model. The meter demands were spatially distributed to the hydraulic model junction nodes. The MDD distribution is shown in Figure 9. The demand distribution shows the that the largest water users are located in the downtown core, McCall RV Park, properties along Warren Wagon Road, and hotels/condos.

Figure 9. MDD Distribution.



4.4. Model Calibration

The hydraulic model is a steady state model that takes a “snap shot” in time of how the system is operating. Field data were collected by conducting hydrant flow tests, reviewing SCADA data, reviewing operator notes on PRV settings, and learning about the water system operations. Model calibration involves adjusting model parameters in order to match the field data.

Hydrant flow tests consist of recording static pressure at a hydrant and then measuring the residual pressure to obtain the pressure drop that occurs when the hydrant is flowing. Hydrant flow testing was performed by city water system operations personnel and SPF staff at nine locations on June 22, 2016 and November 29, 2016. The test locations are shown in Figure 10 and Appendix C. The operations personnel documented each flow test on the hydrant flow result sheet and SCADA screen shots were taken during the test. The tests were done using a 2-inch Pitotless Nozzle manufactured by Hydro Flow Products, Inc.

The hydrant flow results sheet also includes the estimated flow at 20 psi and the estimated pressure at a flow of 1,500 gpm for the test hydrants. These calculations do not apply to the tests west of the river (Hydrant Test 1 and 2) because fire flow is boosted at Knowles BPS and these calculations do not take into account the additional pressure added to the system from Knowles BPS. Hydrant Test 4 was not used during calibration because the PRVs at the River’s Crossing and River Ranch pressure zone were not correctly operating and introduced error into the test. This pressure zone is controlled by two PRVs and fire flow is available from the 12-inch line traveling south on Mission St.

The hydrant flow result sheets used for model calibration are included in Appendix C. A summary of the hydrant flow test data that were used for model calibration are shown in Table 13 (June 22, 2016) and Table 14 (November 29, 2016).

Figure 10. Hydrant Test Locations.

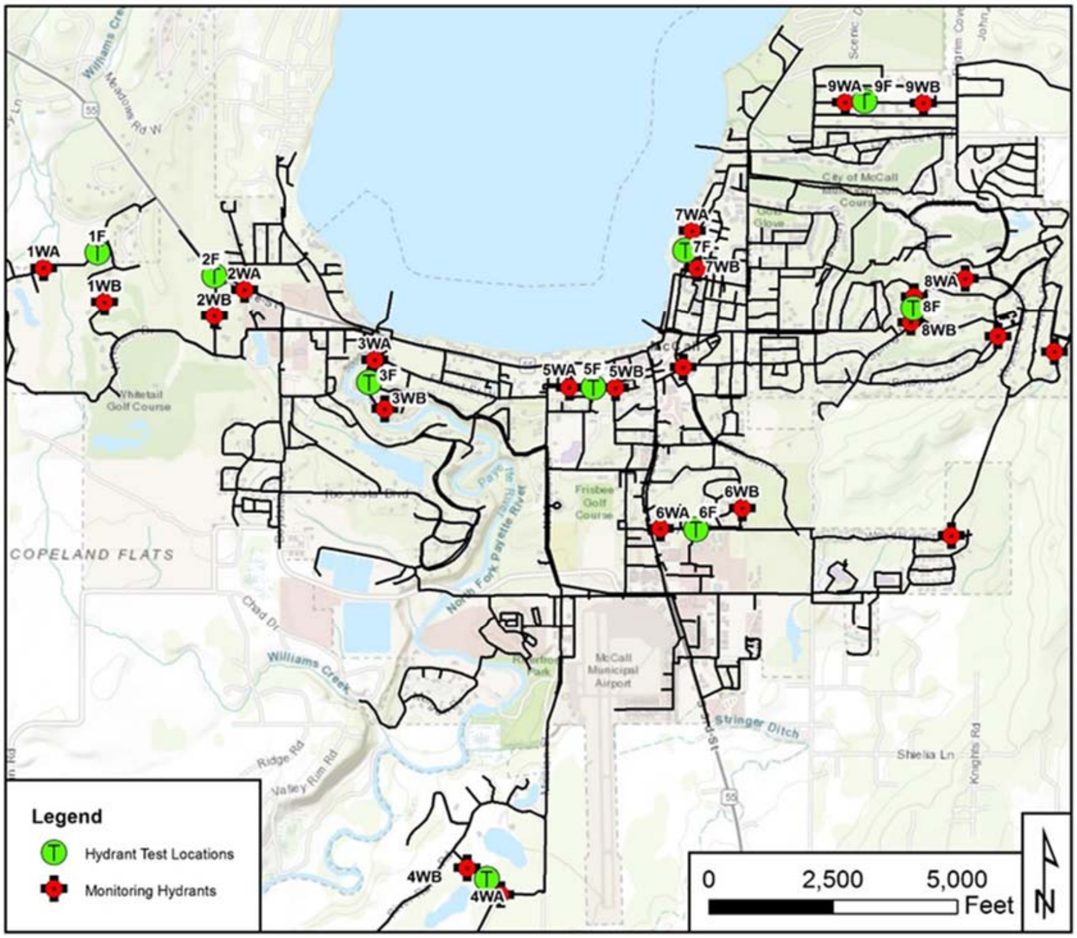


Table 13. June 2016 Hydrant Test Results.

		Static Test	Flow Test - June 22nd, 2016				
Pressure Zone	Test Hydrant	Static Pressure	Flow, gpm	Witness Hydrant A	Residual Pressure	Witness Hydrant B	Residual Pressure
High	1F	56	604	1WA	60	1WB	45
High	2F	72	680	2WA	62	2WB	53
Main	3F	79	698	3WA	64	3WB	71
Main	5F	68	732	5WA	65	5WB	60
Main	6F	43	795	6WA	49	6WB	45
Main	7F	75	643	7WA	66	7WB	65
Main	8F	54	825	8WA	56	8WB	45
Main	9F	69	584	9WA	60	9WB	59

Table 14. November 2016 Hydrant Test Results.

		Static Test	Flow Test - November 29th, 2016				
Pressure Zone	Test Hydrant	Static Pressure	Flow, gpm	Witness Hydrant A	Residual Pressure	Witness Hydrant B	Residual Pressure
Pressure Zone	Test Hydrant	Static Pressure	Flow, gpm	Witness Hydrant A	Residual Pressure	Witness Hydrant B	Residual Pressure
Main	5F	83	732	5WA	84	5WB	76
Main	6F	53	795	6WA	69	6WB	62
Main	8F	60	825	8WA	64	8WC*	45

The facility PRV settings used for model calibration are shown in Table 15. PRV settings were provided by Levi Brinkley at the City of McCall staff and may change throughout the year. The model PRV elevations were based on the City's GIS 2-foot contours and construction plans. Upstream pressure differences are shown in Table 15. The greatest PRV pressure differential is at Whitetail #5 (7 psi) and Fireweed (10 psi). Additional field verification may be needed at these PRVs to improve the hydraulic model. The observed and simulated residual pressure values are shown in Table 16.

Table 15. Provided and Simulated PRV Settings.

Valve							
Name	Main Valve Size (in)	Bypass Valve Size (in)	Main Valve Pressure Setting (psi)	Bypass Valve Pressure Setting (psi)	Actual Upstream Pressure (psi)	Simulated Upstream Pressure (psi)	Upstream Pressure Differential (psi)
Whitetail #1	8	1.5	91	96	156	157	1
Whitetail #2	8	1.5	72	76	140	140	0
Whitetail #3	8	1.5	129	134	140	140	0
Whitetail #4	8	2	40	44	100	96	-4
Whitetail #5	8	2	60	64	102	109	7
Bypass	6	2	62	67	110	110	0
School	8	3	44	50	92	93	1
Floyde	6	2	44	48	90	91	1
Bitterroot	8	N/A	45	N/A	86	91	5
Fireweed	6	2	42	45	82	92	10
Penstemon	6	2	40	42	100	98	-2
Majestic and Bitterroot	8	3	40	45	92	96	4
River's Ranch	8	3	62	67	-	96	
RV Park	6	2	55	60	98	100	2
Heaven’s Gate	N/A	N/A	31	35	58	56	-2
Aspen Ridge	8	3	50	55	98	99	1
Quakey Lane	8	N/A	42	N/A	80	78	-2
South Loop	8	N/A	43	N/A	80	79	-1
Majestic Cul de Sac	8	N/A	42	N/A	78	77	-1

Table 16. Observed and Simulated Hydrant Test Pressures.

Hydrant	Date (2016)	Average Flow Rate	Static Pressure Observed (psi)	Static Pressure Simulated (psi)	Change in Static Pressure Over Observed	Residual Pressure Observed (psi)	Residual Pressure Simulated (psi)	Change in Residual Pressure Over Observed	Observed Pressure Drop Comparison (psi)	Simulated Pressure Drop Comparison (psi)
1	22-Jun	604	56	58	1.0	45	55	1.2	11	3
2	22-Jun	680	72	76	1.1	53	56	1.1	19	20
3	22-Jun	698	79	87	1.1	71	83	1.2	8	4
5	22-Jun	732	68	79	1.2	60	73	1.2	8	6
6	22-Jun	795	43	54	1.3	45	57	1.3	-2	-3
7	22-Jun	643	75	83	1.1	65	75	1.2	10	8
8	22-Jun	825	54	62	1.1	45	58	1.3	9	4
9	22-Jun	584	69	79	1.1	59	73	1.2	10	6
5	29-Nov	732	83	84	1.0	76	75	1.0	7	9
6	29-Nov	584	53	58	1.1	62	58	0.9	-9	0
8	29-Nov	662	60	67	1.1	46	59	1.3	14	8

As shown in Table 16, all the model results are within 10 psi of the observed field data. Unknown demand distribution at the time of hydrant tests can account for the majority of the pressure differences.

Summary

The water system has an abundance of pressure and during simulated fire flow pressures within the system do drop significantly (below 30 psi). The close comparison of observed pressure drop to simulated pressure drop indicates that the water model has been appropriately calibrated. The overall confidence level of the model is high.

Although there is confidence in the calibration results, model calibration is an ongoing process and any changes in demand, settings or infrastructure must be updated within the model, and additional hydrant test should be conducted each year to validate the model.

4.5. Current (2017) Conditions Evaluation

The calibrated hydraulic model was set up to analyze distribution system performance under three scenarios as required by IDEQ rules; (1) Static Pressure, (2) Peak Hour Demand, and (3) Maximum Day Demand plus Fire Flow. Table 17 shows the IDEQ Rules that must be met for water distribution systems. Table 18 summarizes McCall water demands calculated from SCADA water production data and used in the model analysis. Table 19 provides a summary of McCall's sources of supply.

Table 17. IDEQ Rules for Water Distribution Systems.

Water Operating Condition	IDAPA 58.01.08 Citation	Hydraulic Analysis Criteria
Static Pressure	552.01.b.vi.	Maximum pressure of 100 psi and ordinarily less than 80 psi.
Peak Hour Demand	552.01.b.viii. 552.01.b.v.	Pressure greater than 40 psi throughout the system with both operational storage and equalization storage exhausted.
Maximum Day Demand + Fire Flow	552.01.b.i.	Minimum Fire Flow & Pressure > 20 psi throughout the system.

Table 18. 2017 McCall Water Demands.

McCall Water Demands (4551 ERUs)			
	Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
System-Wide	764	1,950	3,700
Per ERU	0.17	0.43	0.81

Table 19. McCall Sources of Supply.

Parameter	Value
WTP FINISHED WATER PUMP STATION	
VFD Driven Pumps	2
Capacity (ea.)	1,100 gpm
Constant Speed Pumps	2
Capacity (ea.)	800 gpm
Constant Speed Pumps to East Tank	2
Capacity (ea.)	640 gpm
Firm Pumping Capacity(1)	3,980 gpm
KNOWLES ROAD BOOSTER STATION	
Total Pumps	3
Pump Capacities	1500, 550, 225 gpm
Firm Capacity	775 gpm
BETSY'S POND BOOSTER STATION	
Total Pumps	2
Pump Capacities	100 gpm each
Firm Capacity	100 gpm
WESTSIDE BOOSTER STATION	
Total Pumps	4
Pump Capacities	15, 50, 50, 1,500 gpm
Firm Capacity	115 gpm

The current (2017) model, in addition to all existing pipelines and facilities, includes the following facility assumptions:

- Water Treatment Plant booster pumps maintain 88 psi.
- Table 20 and Table 21 show the reservoir water elevations and volumes used in the model analysis.

Table 20. Current Westside Tank Volumes.

Westside Tank Volumes				
Description	Elevation		Volume (gal)	Notes
	Bottom	Top		
Base	5,462.00	5,462.00	-	
Dead Storage (Bottom)	5462	5462.33	9,050	.33 feet at bottom
Fire Storage	5,465.47 (1,500 gpm for 2 hours)	5,472.10	180,000 (1,500 gpm for 2 hours)	4,000 gpm for 4 hours (6.63 feet)
	5,464.37 (1,750 gpm for 2 hours)		210,000 (1,750 gpm for 2 hours)	1,750 gpm for 3 hours (7.73 feet)
Standby Storage	5,472.10	5,474.50	65,380	8 hours of ADD (2.4 feet)
Equalization/ Operational Storage	5,474.50	5,476.50	54,330	2 feet
Dead Storage (Top)	5,476.50	5,477.00	13,580	0.5 feet
Total	-	-	407,480	

Table 21. Current East Tank Volumes.

East Tank Volumes				
Description	Elevation		Volume (gal)	Notes
	Bottom	Top		
Base	5,426.00	5,426.00	-	
Dead Storage (Bottom)	5426	5427.54	109,600	1.54 feet at bottom
Fire Storage	5,436.97 (1,500 gpm for 2 hours)	5,439.50	180,000 (1,500 gpm for 2 hours)	1,500 gpm for 2 hours (2.53 feet)
	5,436.55 (1,750 gpm for 2 hours)		210,000 (1,750 gpm for 2 hours)	1,750 gpm for 2 hours (2.95 feet)
	5,436.12 (2,000 gpm for 2 hours)		240,000 (2,000 gpm for 2 hours)	2,000 gpm for 2 hours (3.38 feet)
	5,435.28 (2,500 gpm for 2 hours)		300,000 (2,500 gpm for 2 hours)	2,500 gpm for 2 hours (4.22 feet)
	5,431.90 (3,000 gpm for 3 hours)		540,000 (3,000 gpm for 3 hours)	3,000 gpm for 3 hours (7.60 feet)
	5430.64 (3,500 fpm for 3 hours)		630,000 (3,500 fpm for 3 hours)	3,500 fpm for 3 hours (8.86 feet)
Standby Storage	-	-	-	Standby Power
Equalization/ Operational Storage	5,439.50	5,441.50	142,170	2 feet
Dead Storage (Top)	5,441.50	5,442.50	71,100	1 feet
Total	-	-	1,172,900	

Note: Levels taken from operational data (dead storage and equalization/operational storage), and calculations that reflect the current system.

4.5.1. Current (2017) Static Pressure Evaluation

A model scenario was created to test the system pressures with full tanks (i.e., tank level at top of operational storage), no system demand, and no operating pumps. The system pressures in this scenario are based on the maximum hydraulic gradeline (HGL) in the respective pressure zone based on the tank level or the Pressure Reducing Valve (PRV) HGL serving the pressure zone. The WTP was off during this scenario. The Westside Booster Pump Station was turned on to pressurize the WT Phase 2 Zone 1 pressure zone.

Static pressures west of the river ranged from 51 psi to 112 psi (WT Phase 2 Zone 2). The Whitetail subdivision requires that individual PRVs be installed at homes where pressures are too high. Pressures are as low as 6 psi near the Westside Tank, but this tank connection line does not directly serve customer water meters, and does not need to meet the listed IDEQ pressure requirements. Pressures are as high as 164 psi upstream of Betsy's Pond Booster Station and upstream PRVs, but do not directly serve customer water meters, and do not need to meet the listed IDEQ pressure requirements.

Locations of pressures greater than 100 psi include:

- Residential customers in the WT Phase 2 Zone 2 Pressure Zone (Lupine Lane). The residential customers are supplied through the Whitetail PRV #3. PRV settings and upstream pressure match data provided by the City.
- Residential customers in the WT Phase 2 Zone 3A pressure zone (Song Sparrow Court). Static pressures in the model may be higher due to the difference of 7 psi in the upstream pressure at the Whitetail PRV #5. Elevations from the Whitetail plans did not reflect the provided upstream pressure. The 7-psi difference reflects a 16-foot vertical error.
- Residential customers in the West of River Pressure Zone near Rio Vista Road, Chula Road, and Cammy Drive. The model simulates pressures of 110 psi.
- Residential and commercial customers in the West of River Pressure Zone at the eastern end of Owen Drive and Whipkey Street. The model simulates pressures ranging from 104 psi to 107 psi.
- Commercial customers in the West of River Pressure Zone (W Lake St, west of check valve). When Knowles Booster Pump Station is active, pressures are below 100 psi.

Static pressures east of the river ranged from 43 psi (downstream of PRVs) to 119 psi (Boydstun Street, East of check valve).

Locations of pressures greater than 100 psi include:

- 12-inch line West of the RV Park Bypass PRV. This line does not appear to serve current customers. Pressure upstream of the Bypass Valve is 110 psi.

Static pressures are shown in Figure 11.

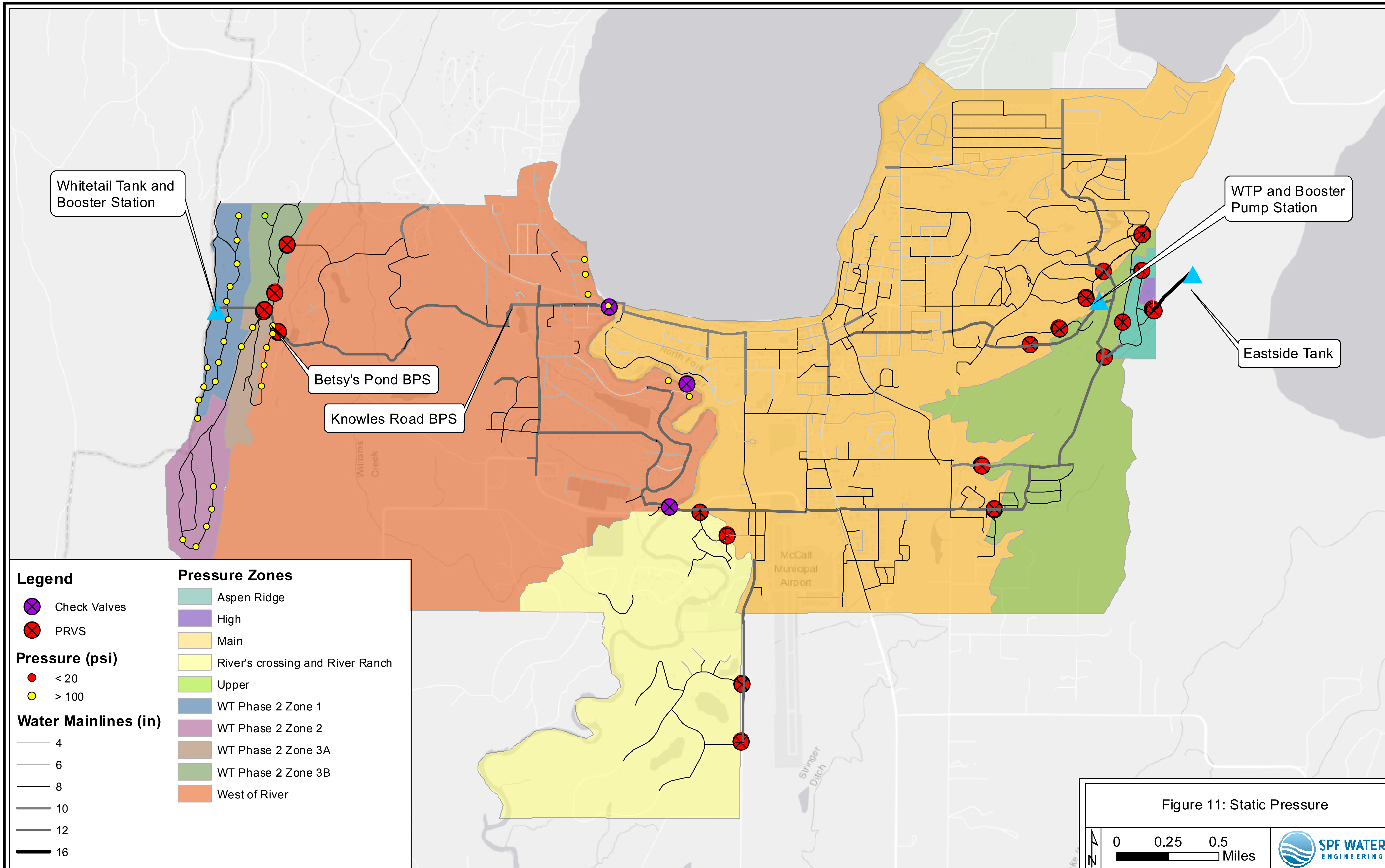


Figure 11: Static Pressure

4.5.1.1. Static Pressure Recommendations

Areas with high static pressure need to be field verified at individual connections during a time of low demand before accurate recommendations can be provided. Surveyed elevations of PRV Stations and customer connections located along the lake and river will assist in recommendations for PRV settings and future infrastructure. Recommendations for high pressure areas include:

- Static pressures at residential customers in the Whitetail pressure zones should be field tested to verify model results. The steep terrain and available elevation data can result in a significant vertical error. PRVs can be adjusted as customers are added to each zone.
- High pressures near Rio Vista Boulevard have been reported and the model simulates a maximum pressure of 110 psi. Static pressures should be monitored and field verified.
- High pressures on Owen Drive and Whipkey Street should be monitored and field verified. Customers may need pressure reducing devices at individual service connections.

4.5.2. Current (2017) Peak Hour Demand (PHD)

The PHD condition represents the maximum volume of water delivered to the system during any single hour during the year. The peak hour demand for McCall from the 2015-2017 SCADA data was 3,700 gpm. PHD velocities greater than 6-ft/s indicate the water main is undersized.

The Idaho Drinking Water Rules require "…elevated storage tanks, pressure calculations during peak hour demand shall be based on the lowest water level after both operational storage and equalization storage have been exhausted." (IDAPA 58.0.108 Section 552. Paragraph 01.b.viii.) The existing system configuration during this scenario is based on the following pump and tank operation:

- East Reservoir water surface elevation = 5,439.50 feet (Bottom of equalization/operational storage).
- Westside Reservoir water surface elevation = 5,474.5 feet (Bottom of equalization/operational storage).
- The WTP was operating as a tank to maintain a pressure of 88 psi at the 12-inch line directly south of the plant.

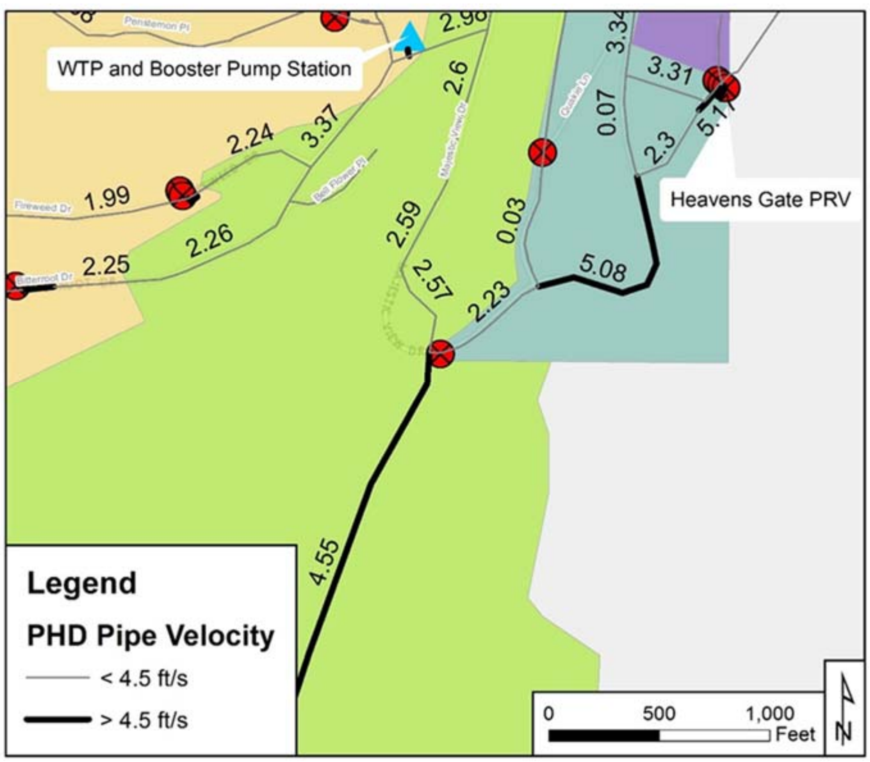
Table 22. 2017 PHD Scenario Source Contributions.

Source	Status	Model HGL (ft)	Flow Out (gpm)
Eastside Tank	On	5,439.50	1,545
Westside Tank	On	5,474.50	445
Knowles Booster	On	5,188.69	355
Betsy's Pond Booster	On	5,475.10	760
WTP	On	5,313.47	2,475

Note: HGL=Hydraulic Grade Discharge.

System pressures west of the river for this demand condition range from 36 to 110 psi (Whitetail Pressure Zones) and the maximum pipeline velocity is 2.67 ft/s. The west side of the system has an approximate peak hour demand of 750 gpm. Pressures in the WT Phase 2 Zone 2 and WT Phase 2 Zone 3A exceed 100 psi, but these pressures are controlled by PRVs and settings will be adjusted as the demand increases. Pressures are as low as 5 psi near the Westside Tank, but this tank connection line does not directly serve customer water meters, and does not need to meet the listed IDEQ pressure requirements.

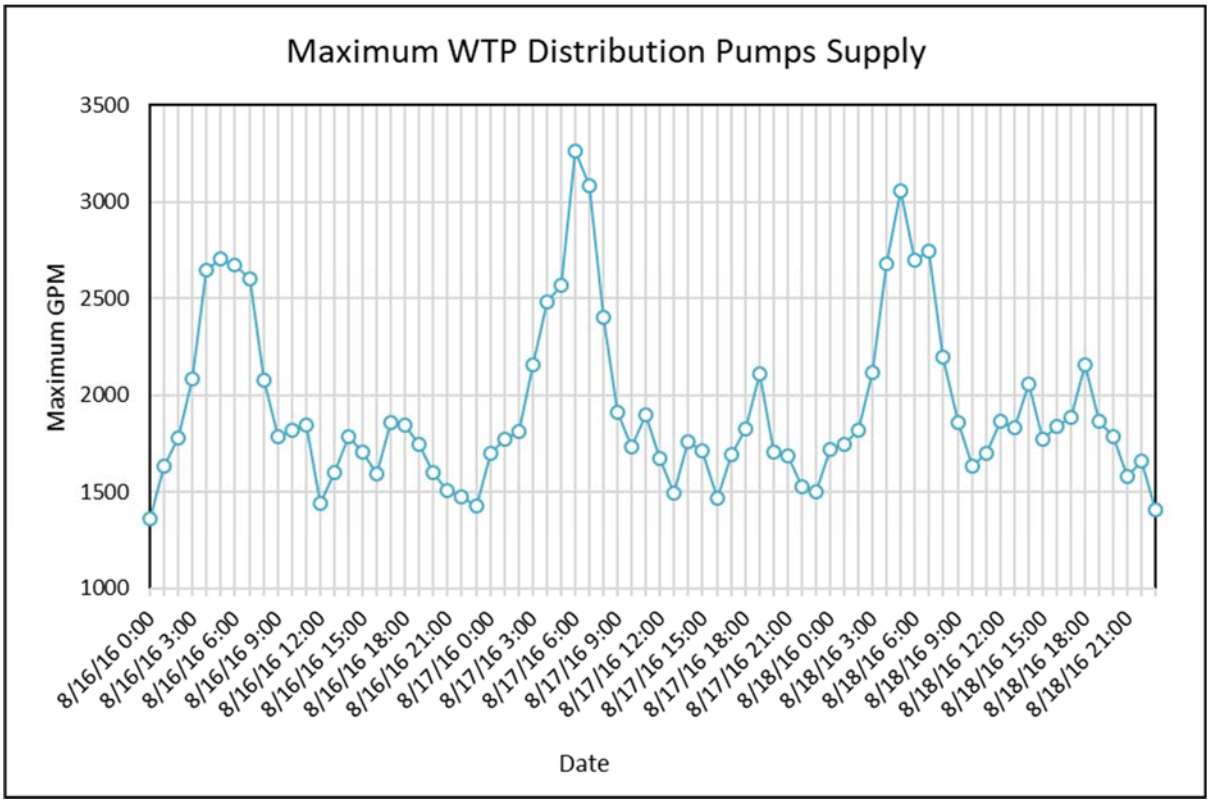
Figure 12. PHD Velocities from the Eastside Tank.



System pressures east of the river for this demand condition range from 33 to 110 psi (West of RV Park Bypass PRV) and the maximum pipeline velocity is 5.17 ft/s. The highest velocities seen in the system are downstream of the Heavens Gate PRVs and are displayed in Figure 13. Figure 13 highlights the pipelines with velocities greater than 4.5 ft/s. 4.5-ft/s is used to indicate pipelines that are nearing the 6-ft/s threshold as these pipelines exceed 6-ft/s in the future 20-year projection discussed in Section 5. The east side of the system has an approximate peak hour demand of 2,950 gpm. Pressures below 40 psi are located downstream the Majestic and Bitterroot PRV and do not directly serve customer meters.

The City reported low pressures (40 psi near the Hospital, static is 84 psi) in the downtown area during the peak summer demand. During PHD conditions, the model only simulates a pressure drop of approximately 10-15 psi. Although dates of occurrence could not be confirmed, SCADA data were reviewed for the WTP distribution pumps and a three-day period (August 16th – 18th) is summarized in Figure 13. Scenarios were created by placing random large demands (4,000 gpm) around the city and manipulating the WTP and tank level to match SCADA scenarios and pressure drops of approximately 30 - 40 psi could be simulated downtown (main pressure zone) under extreme conditions. If the majority of the PHD is distributed in the west side of the city and the downtown (within main pressure zone) area it is possible to simulate the low pressures reported. Further investigation is needed for accurate recommendations, but low pressures could be the result of city WTP operations and the age of piping.

Figure 13. Maximum WTP Distribution per Hour.



4.5.2.1. <u>PHD Pressure Recommendations</u>

Areas with high static pressure correlate with areas of high PHD pressure and hold the same recommendations. Further investigation into low downtown pressures is recommended. The City has purchased pressure loggers and is recording pressures during the 2017 peak season. Pressure loggers should be placed at reported areas of low pressure and all valves should be exercised to verify they are open. Pressure loggers can be used to prioritize pipe improvements to address low pressure conditions that are verified.

4.5.3. Current (2017) Maximum Day Demand (MDD) Plus Fire Flow

To determine whether the water system can provide the flows required for firefighting, the hydraulic model was run under MDD conditions plus fire flow while maintaining 25 psi at all service connections. Note that the IDEQ requirement is to maintain a minimum 20 psi residual pressure throughout the system during fire flow, however 25 psi has been used in the modeling scenarios to provide a factor of safety. The fire flow scenario was run under a velocity constraint of 12 ft/s.

For systems with a gravity tank, the Idaho Drinking Water Rules require "…pressure calculations during fire flow demands shall be based on the lowest water level after operational storage, equalization storage, and fire suppression storage have been exhausted." (IDAPA 58.0.108 Section 552. Paragraph 01.b.viii.) The existing system configuration during this scenario is based on the following pump and tank operation:

- East Reservoir water surface elevation = bottom of storage segment
  - 5,436.97 feet – 1,500 gpm requirement
  - 5,436.55 feet – 1,750 gpm requirement
  - 5,436.12 feet – 2,000 gpm requirement
  - 5,435.28 feet – 2,500 gpm requirement
  - 5,431.90 feet – 3,000 gpm requirement
- Westside Reservoir water surface elevation = bottom of storage segment
  - 5,465.47 feet – 1,500 gpm requirement
  - 5,464.37 feet – 1,750 gpm requirement
- The WTP was operating as a tank to maintain a pressure of 88 psi at the 12-inch line directly south of the plant.

The fire flow analysis routine simulates a single fire at a time for each designated model junction node. Minimum fire flow requirements were obtained from the 2012 Capital Improvement Program Update and confirmed with Garret de Jong at McCall Fire and EMS. Fire flow requirements and the available fire flow are summarized in Table 23.

The International Fire Code requirement is that fire flow for "one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet shall be 1,000 gallons per minute." While the ultimate goal for the McCall water system is to provide a minimum 1,500 gpm fire flow everywhere, in areas with homes less than 3,600 square feet fire-flow calculation area, 1,000 gpm fire flows meet code requirements (International Fire Code, Appendix B).

Figure 14 identifies the available fire flows for hydrants throughout the water system. The majority of hydrants that do not meet fire flow requirements are located on 4-inch lines or dead end 6-inch lines. (No upgrades are recommended for 6-inch dead ends located in residential areas as they meet the International Fire Code 1,000 gpm fire flow requirement. Dead-end 4-inch and 6-inch lines providing fire flow to commercial areas should be upgraded to a minimum of 8-inch. It is standard practice for cities to have a minimum requirement of 8-inch main lines for new construction. The City has a long-term program to replace all 4-inches pipelines that provide fire flow to hydrants. It is recommended all small diameter pipes be replaced with a minimum of 8-inch pipes in order to provide adequate fire flow for future demands. Small diameter pipes have been prioritized by their age and fire flow availability. A large map is provided in Appendix C.

4.5.4. High Fire Flow Areas

Certain commercial areas in town have fire flow requirements greater than 1,500 gpm due to the larger size of the structures or building material. The Payette National Forest Administration is located on the Westside, but is served from 12-inch pipeline from the Main Pressure Zone. These locations are identified in Table 23. The table also identifies locations where these requirements are not being met (highlighted in red).

Table 23. Fire Flow Requirements and Available Fire Flow.

Stories	Owner	Address	Fire Flow Requirement (gpm)	Available Fire Flow (gpm)
-	1,500 gpm requirement	-	1,500	See Figure 6
1	McCall Self Storage Center	163 Thula St.	3,000	3,200
2	Grant, Daniel	106 Park St.	3,000	3,100
2	The Mill Supper Club	324 N. 3rd St.	2,500	2,840
2	McCall Mall	317-334 E. Lake St.	2,000	2,060
2	Craig Allen	401 S. Mission St.	2,000	2,200
1	Patrick Phillips	135 Commerce St.	2,000	2,830
1	Kirkland Cabinets	105 E. Jacob St.	1,750	2,745
1	McCall Breakfast Lodge	1007 W. Lake St.	1,750	1,360
1	Western Collision	95 E. Jacob St.	1,750	2,420
2	Si Bueno	335 Deinhard Ln.	1,750	2,500
3	Fred Muller (Yacht Club)	203 E. Lake St.	1,750	3,150
3	Comstock & Craig Inc.	319 3rd St.	1,750	2,760

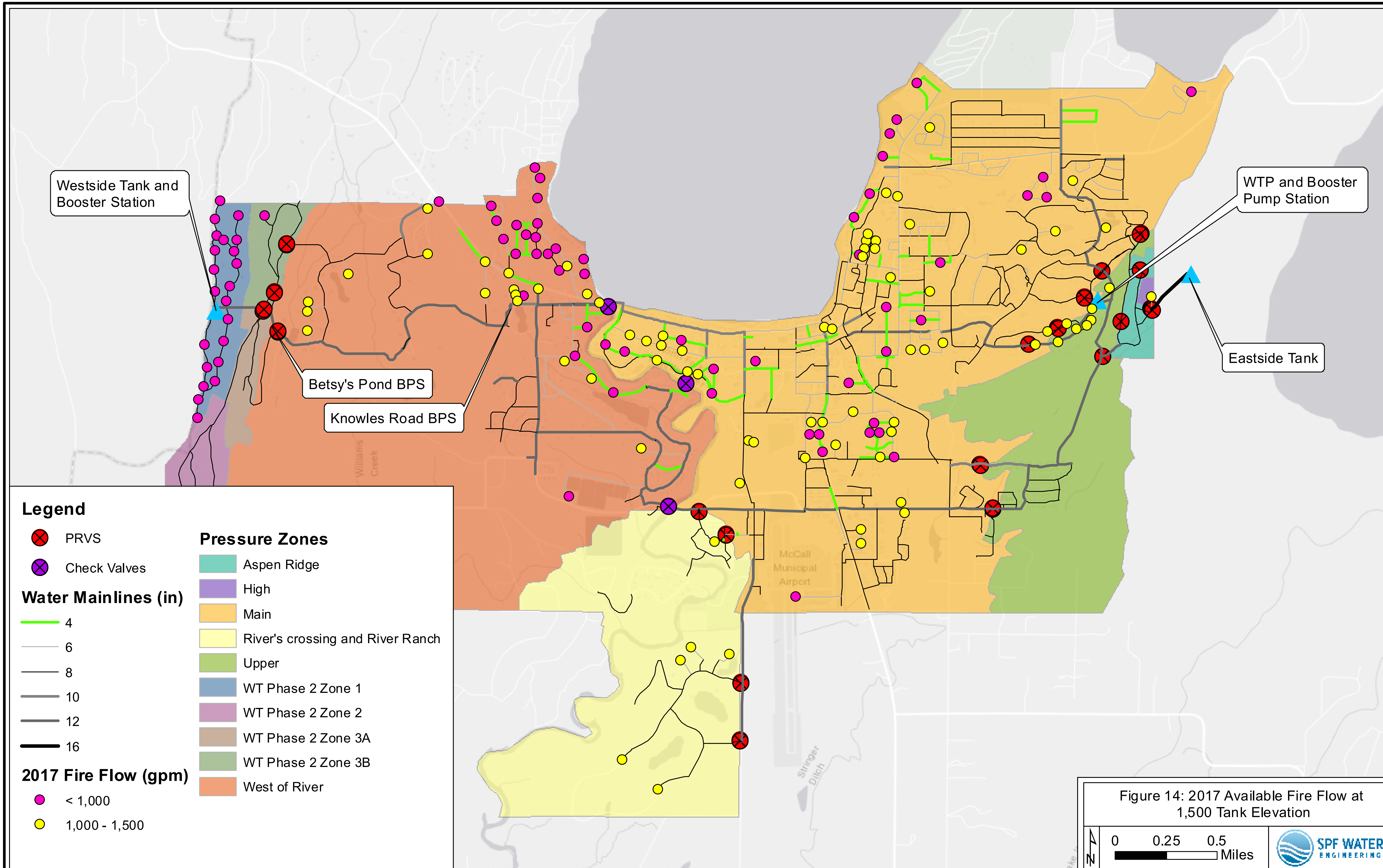


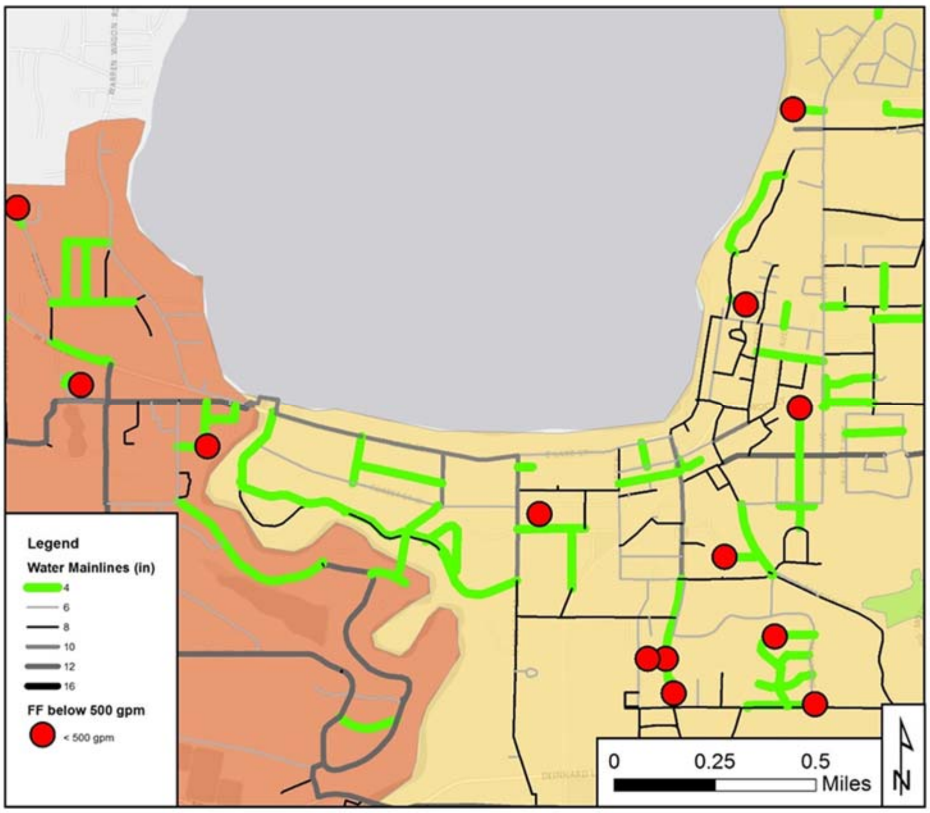
Figure 14: 2017 Available Fire Flow at 1,500 Tank Elevation

4.5.4.1. Fire Flow Recommended Improvements

Fire Flow Below 500 gpm

There are 14 hydrants that have less than 500 gpm available for fire flow. Hydrant tests should be performed on these hydrants to verify available flow. All hydrants are on dead end 4-inch pipes. All dead end 4-inch pipe should be replaced with 8-inch pipe. Mainline locations where fire flow is below 500 gpm are shown in Figure 15.

Figure 15. Water Mains with Available Fire Flow Below 500 gpm.



Note: Hydrants noted in red.

Priority Fire Flow

A list of needed pipe upgrades is located in Appendix D. Upgrades were prioritized based on the available fire flow, age of the pipe, material, and city preference. Section 8 describes the City's Infrastructure Replacement Plan to upgrade these water mains over time. The City plans to upgrade 1% of system water mains annually and will put reasonable effort to prioritize replacing main lines that do not meet fire flow requirements. The Capital Improvement Plan in Section 8 identifies the main lines the City plans to upgrade from 2018 to 2024.

4.6. Summary and Recommendations

Areas with high static pressure need to be field verified at individual connections during a time of low demand before accurate recommendations can be provided. Surveyed elevations of PRV Stations and customers located along the lake and river will assist in preparing recommendations for PRV settings and future infrastructure.

Recommendations for high pressure areas include:

- Static pressures at residential customers in the Whitetail pressure zones should be field tested to verify model results. The steep terrain and available elevation data can result in a significant vertical error. PRVs can be adjusted as customers are added to each zone.
- High pressures near Rio Vista Boulevard have been reported and the model simulates a maximum pressure of 110 psi. Static pressures should be monitored and field verified. Construction of pressure reducing valve stations is recommended to reduce pressures in the area.
- High pressures on Owen Drive and Whipkey Street should be monitored and field verified. Customers may need pressure reducing devices at individual service connections. All static pressures within service areas were between 40 and 80 psi.

4.6.1. Peak Hour Pressures

Peak hour pressures within service areas were between 40 and 83 psi (just above the pressure reducing stations). The system meets IDEQ requirements for peak hour demand pressures.

4.6.2. Fire Flow Availability

Existing fire flow availability was better than anticipated. We recommend the City continue to upgrade the existing 4-inch lines as identified in Figure 15 and Appendix C.

4.6.3. Additional Recommendations

- Continue to fine-tune PRV settings to allow optimal flows throughout the water distribution system. We recommend a topographical survey of all PRV stations, Booster Pump Stations, WTP, and Tanks to provide accurate as-built elevation data for the hydraulic model. Due to the high pressures at the river and lake, we recommend an additional study in order to optimize the WTP and pressure zones.
- Add all PRV stations to SCADA system to allow pressure monitoring.

- Continue to add to and update the hydraulic model as water facilities are added to the system and development occurs. Provide as-built drawings to verify survey elevations for all new developments.
- Document all reports of low or high pressures and monitor areas with pressure loggers.

5. ANALYSIS OF FUTURE WATER SYSTEM NEEDS

5.1. Source and Storage Capacity Analysis

5.1.1. Source Capacity

The two raw water intake pumping facilities have a firm capacity of 2,126 gpm (3.06 mgd). Davis Beach Pump Station is excluded from the firm capacity because it does not have standby power. The remaining ERU balance for the raw water pump stations is 233 ERU.

If additional ERUs are needed, the City can upgrade the smaller pump at Legacy Beach Pump Station or add standby power to Davis Beach Pump Station.

5.1.2. Water Treatment Plant Capacity

The Water Treatment Plant has an ERU capacity of 8,229. The remaining ERU balance is 3,678.

5.1.3. Storage Capacity

The City has a water storage requirement of 1.34 MG. The existing Westside and Eastside tanks provide a total available storage volume of 1.58 MG. The remaining storage capacity includes 129,000 gallons in the Westside Tank and 213,000 gallons in the Eastside Tank. The available storage can be used as equalization storage if the PHD demand exceeds the water system's pumping capacity at Knowles Road BPS and the WTP distribution pumps. The equalization storage can account for an increase in PHD of approximately 500 gpm on the west side and 880 gpm on the east side. Although there is available storage, the Eastside Tank is constrained by undersized mainlines and the full capacity cannot be utilized. These mainlines are discussed in Section 5.3.1 and Section 5.4.1. A large portion of the future demand on the system is projected to be located in the southern portion of the Main Pressure Zone and the existing distribution lines will not be capable of providing PHD and fire flow from the Eastside Tank or the Water Treatment Plant.

Additional storage volume could be obtained at the Eastside tank by replacing the 18.5" high outlet with a 4-inch silt stop to gain 86,000 gallons of additional storage. This is only recommended if tank utilization is increased with mainline improvements.

Additional storage will be required in 2026 based on water demand projections. The amount of additional storage required in 2026 is approximately 6,500 gallons. The amount of additional storage required is projected to increase by approximately 55,000 gallons per year, each year after 2026. A new water storage tank project is included in the Capital Improvement Plan in Section 8. Appendix I includes a detailed analysis of future year-by-year water storage requirements.

Table 24. Current Water Storage Tank Requirements

Category	Eastside Tank	Westside Tank	Comments
Operational Storage	142,170 gal	54,330 gal	Eastside Tank: 13.5-15.5 ft Westside Tank: 12.5-14.5 ft
Equalization Storage	0 gal	0 gal	Firm pumping capacity > PHD
Fire Storage	540,000 gal (3,000 gpm for 3 hrs)	210,000 gal (1,750 gpm for 2 hrs)	
Standby Storage	0 gal	0 gal	Eastside: Standby Power Westside: Stanby Power
Dead Storage	187,660 gal	22,640 gal	Eastside: 18.5" btm / 12" top Westside: 4" btm / 6" top
Total Required Storage	869,830 gal	277,910 gal	
Total Available Storage(3)	1,173,000 gal	407,000 gal	

Notes:

1. Operational storage is based on actual tank level setpoints that start and stop the pump stations that fill the tanks.
2. Equalization storage is not required because firm pumping capacity exceeds peak hour demand.
3. Standby storage is not required because standby power is provided for the pump stations.

5.1.4. Pumping Capacity

The water system has a firm pumping capacity of 6.8mgd (4,755 gpm) and a 2017 PHD of 5.34 mgd (3700 gpm). There is a remaining capacity of 1.46 mgd (1,000 gpm) before equalization storage in the tank is needed. Westside Tank equalization is required in 2026. The pump capacity (without equalization storage) ERU balance is approximately 500 ERUs.

The Idaho Drinking Water Rules require "Each booster pumping station shall contain not less than two (2) pumps with capacities such that peak hour demand, or a minimum of the maximum day demand plus equalization storage, can be satisfied with any pump out of service. See Subsection 501.18 for general design requirements concerning fire flow capacity. (IDAPA 58.0.108 Section 541. Paragraph 04.c.)

5.1.4.1. Knowles BPS

Knowles BPS has a firm capacity of 775 gpm and serves the westside of the system. The westside of the system has a current PHD of approximately 630 gpm to 740 gpm. Knowles BPS is deficient in accurate SCADA data due to the flow meter not accounting low flows and an accurate PHD cannot be determined. The CIP in Section 8 recommends SCADA and flow meter improvements. These improvements will allow the city to accurately plan for an expansion of Knowles BPS or the addition of a new BPS on the westside. Meter data shows that the PHD per ERU could be higher on the westside of the system compared to the eastside. When the average calculated PHD per ERU rate (0.81 gpm) is applied to the calculated ERUs, the estimated PHD is 630 gpm. Calculation using meter usage estimated the demands to be approximately 740 gpm. For the declining capacity calculation, 740 gpm is used as a conservative approach. Discussions with City staff indicated that this demand appears to be high in comparison to what is seen in the field. With this approach there is approximately 40 ERUs remaining on the westside without utilizing equalization storage. When equalization storage is included there are an approximate ERU balance of 615 (including approximately 500 gpm from tank).

5.1.5. Declining Balance Evaluation Summary

Table 25. Declining Balance Summary

Declining Balance Evaluation			
Water Demand Factors			
CURRENT SYSTEM ERUs (2017)	4,551	ERU	
MAXIMUM DAY DEMAND	1,965	gpm	5-year average
	2.83	mgd	5-year average
MDD per ERU	640	gpd	5-year average
PHD per ERU	0.81	gpm	5-year average
Raw Water Pumping Stations			
Legacy Park Pump Station Firm Capacity	2,126	gpm	One pump out of service
Davis Beach Pump Station Firm Capacity	0	gpm	No standby power; can add 3160 ERUs with standby power
Total Firm Capacity	2,126	gpm	
	3.06	mgd	
Total ERU Capacity	4,784	ERU	

Declining Balance Evaluation			
ERU Remaining Balance	233	ERU	Can add 900 ERUs by upgrading 3rd pump @ Legacy
Raw Water Pipeline			
16"	4,500	gpm	Estimated based on hydraulic calculations
	6.5	mgd	Estimated based on hydraulic calculations
ERU Capacity	10,130	ERU	Estimated based on hydraulic calculations
ERU Remaining Balance	5,579	ERU	Estimated based on hydraulic calculations
Water Treatment Plant			
Total Filter Capacity	4,096	gpm	At 8 gpm/ft^2 filtration rate
	5.9	mgd	At 8 gpm/ft^2 filtration rate
Backwash Volume	140,000	gpd	Two backwashes per day
Time for Backwash Cycle	60	min	
Total WTP Filter Capacity	3,657	gpm	
	5.3	mgd	
Finished Water Pump Station	3,980	gpm	
	5.7	mgd	
ERU Capacity	8,229	ERU	
ERU Remaining Balance	3,678	ERU	
Knowles Road Booster Pump Station			
Firm Capacity	775	gpm	
Total ERU Capacity	957	ERU	Based on PHD
West Side ERUs	914	ERU	Based on Meter Billing Data
ERU Remaining Balance	43	ERU	
ERU Balance with Westside Equalization Storage	658	ERU	614 ERUs Available

5.2. Future Model Demand Allocation

The City's growth generally drives future increases in water system demands. Two types of growth are anticipated within the City of McCall – (1) geographic expansion of the city limits and (2) infill of developable areas. The estimated increase in water system demands for these two types of growth, and how these increases are allocated to the locations where growth will most likely occur, is described in this section.

5.2.1. Service Area Expansion

The areas available for development in the City of McCall are described in the 2017 McCall Area Comprehensive Plan Update.[5] The City's 5-year annexation plan includes annexation north along Payette Lake. This area is currently served by the Payette Lakes Recreational Water and Sewer District and the City's water system expansion is not anticipated to expand into in these areas. The City's 10-year annexation plan includes annexation southwest of the existing service area. This area is west of the Payette River and would likely be incorporated into the West side of the water system. The City's 20-year annexation plan includes annexation to the southeast of the existing service area. This area would likely be incorporated into the Main Pressure Zone and the River's Crossing and River's Ranch Pressure Zone. The creation of a new pressure zone will likely be needed depending on where development occurs.

5.2.2. Redevelopment Areas

The areas of redevelopment within the existing service area that could impact the water system is the infill of vacant parcels, multiple family homes and condominiums, and commercial or industrial customers. The 2037 future model assumes 95% of empty residential parcels are built out including the Whitetail Development. The comprehensive plan notes potential housing locations within the West of River and Main Pressure Zones, with the majority located in the Rio Vista Blvd area.

5.2.3. Future Water Demands

The projected demands per pressure zone are shown in Table 28.

Table 26: Projected Future Demands

	ERU			PHD (gpm)			MDD		
	2017	2025	2037	2017	2025	2037	2017	2025	2037
Eastside									
High	2	10	14	2	8	11	1	4	6
Aspen ridge	19	30	46	16	24	37	8	13	20
Upper	148	180	183	120	147	149	63	77	79
Main	3,510	4,220	6,086	2,860	3,436	4,956	1,505	1,810	2,611
River's Crossing	65	81	141	53	66	115	28	35	60

[5] McCall in Motion (Draft), McCall Area Comprehensive Plan, Dive Deep. 2016.

Eastside Total	3,744	4,521	6,469	3,051	3,681	5,268	1,605	1,939	2,776
Westside									
West of River	743	1,100	1,556	605	896	1,267	318	472	668
WT Phase 2, Zone 1	24	50	64	19	41	52	10	21	27
WT Phase 2, Zone 2	2	30	46	2	24	37	1	13	20
WT Phase 1, Zone 3A	0	10	18	0	8	15	0	4	8
WT Phase 2, Zone 3B	5	20	37	4	17	30	2	9	16
Westside Total	774	1,210	1,720	630	986	1,401	332	519	738
Water System Total	4,518	5,732	8,190	3,681	4,667	6,669	1,937	2,458	3,514

5.3. NEAR-TERM (2025) CONDITIONS EVALUATION

The 2017 hydraulic analysis resulted in a list of deficient pipelines that did not meet the fire flow requirements. Scenarios for near-term (2025) peak hour demand and fire flow availability analyses do not include these pipeline improvements as the City is implementing an annual pipe replacement program to replace these mainlines overtime. The same tank level, pump operation settings, and fire flow requirements were used in the 2025 analyses as were used in the 2017 analyses.

5.3.1. Near-Term (2025) Peak Hour Demand (PHD)

The PHD condition represents the maximum volume of water delivered to the system during any single hour during the year. The peak hour demand for McCall was estimated at 4,667 gpm. PHD source contributions are shown in Table 27. The WTP distribution pumps have reached its firm capacity of 2,700 gpm.

Table 27. 2025 PHD Scenario Source Contributions.

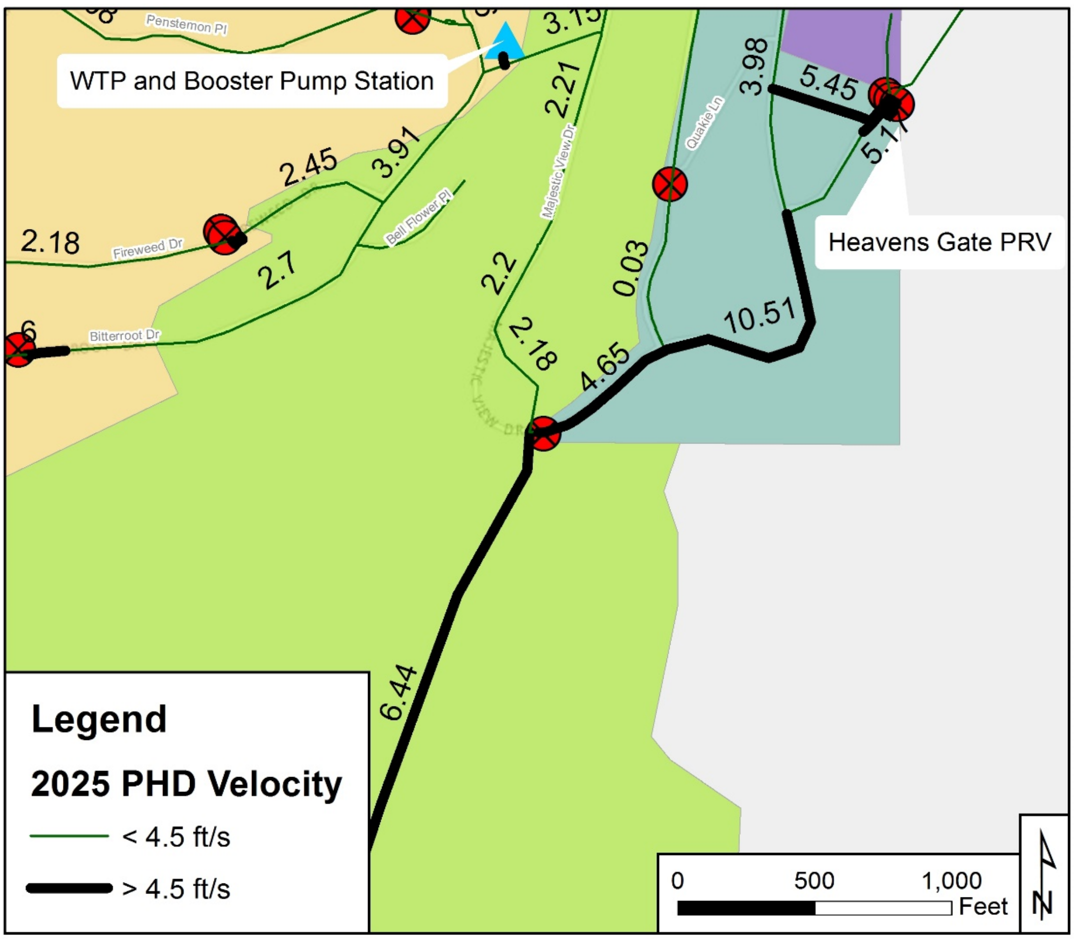
Source	Status	Model HGL (ft)	Flow Out (gpm)
East Tank	On	5,439.50	2,520
Westside Tank	On	5,474.5	420
Knowles Booster	On	5,215*	710
Betsy's Pond Booster	On	5,475.10*	100
WTP	On	5,313.47*	2,700

Note: Hydraulic Grade Discharge.

System pressures west of the river for this demand condition range from 36 to 120 psi (Whitetail Pressure Zones) and the maximum pipeline velocity is 3.08 ft/s. The west side of the system has an approximate demand of 1,000 gpm. Pressures in the Whitetail subdivision exceed 100 psi, but the Whitetail subdivision requires PRVs to be installed on homes where pressures are too high. Pressures are as low as 5 psi near the Whitetail Tank, but this tank connection line does not directly serve customer water meters, and does not need to meet the listed IDEQ pressure requirements.

System pressures East of the river for this demand condition range from 33 to 105 psi (West of RV Park Bypass PRV) and the maximum pipeline velocity is 10.55 ft/s. These high velocities show that the mainlines are undersized for the demand. The east side of the system has an approximate demand of 3,690 gpm. Pressures below 40 psi are located downstream of the Majestic and Bitterroot PRV but these mains do not directly serve customer meters, and does not need to meet the listed IDEQ pressure requirements. High velocities downstream the Heavens Gate PRV are shown in Figure 15. With the WTP distribution reaching firm capacity, additional water is needed from the Eastside Tank causing the higher velocities in Figure 15.

Figure 16. 2025 PHD Velocities from Eastside Tank.



5.3.2. Near-Term (2025) Maximum Day Demand (MDD) Plus Fire Flow

The fire flow availability during the 2025 MDD is similar to the 2017 MDD. There was a approximate 10-20% reduction in available fire flow, but no additional pipe improvements are needed. Residential hydrants located on dead-end 6-inch mainlines have available fire flow nearing the minimum 1,000 gpm required. As demand increases and nears the system capacity these hydrants will likely fall below the 1,000 gpm requirement. Available fire flow during 2025 is shown in Figure 16.

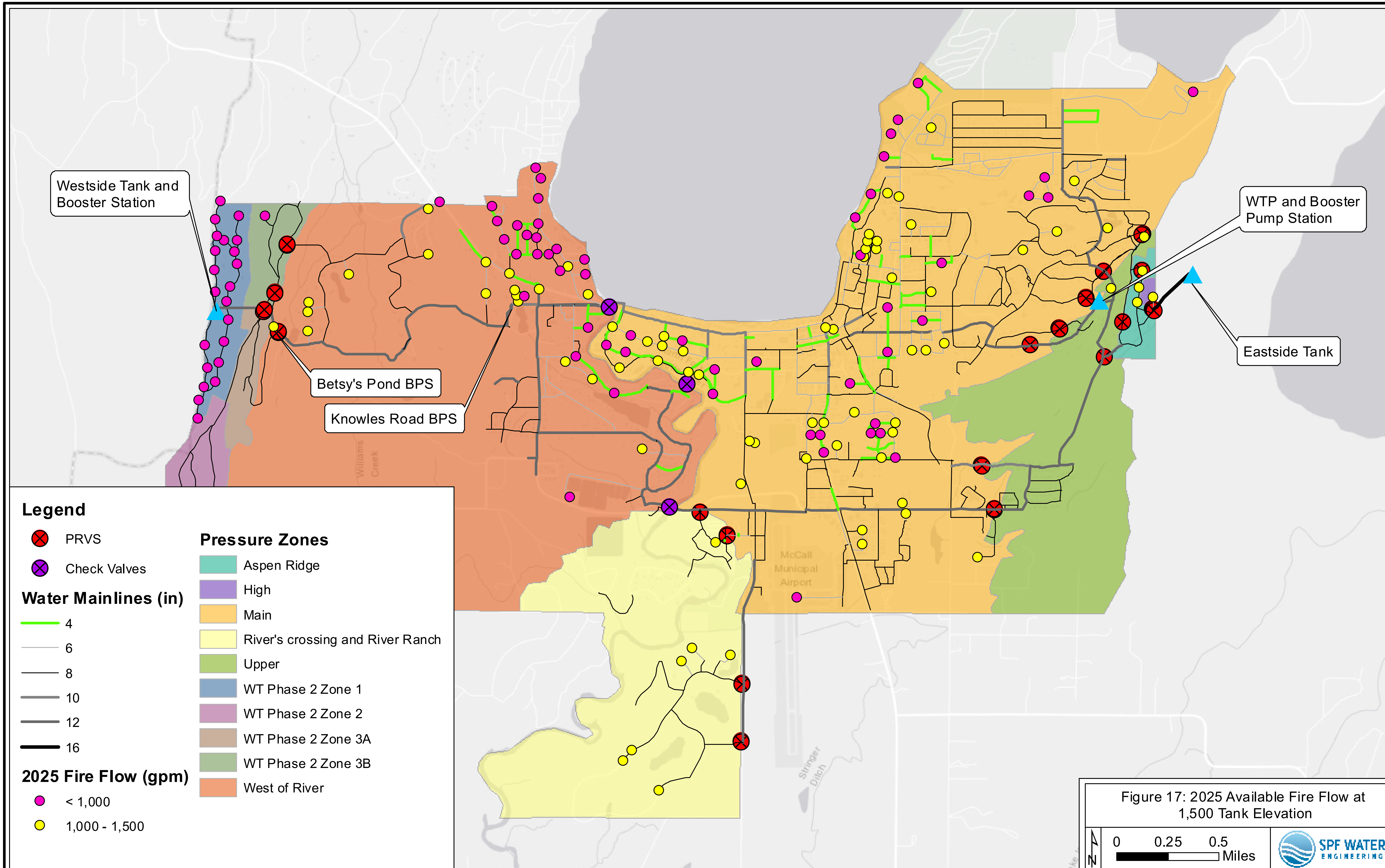


Figure 17: 2025 Available Fire Flow at 1,500 Tank Elevation

5.3.3. Near-Term (2025) Recommendations

Updating the 8-inch mainline segment on Majestic View can alleviate the highest velocities during PHD from 10.55 ft/s to 6.26 ft/s. This upgrade is recommended by 2025 and will provide the City additional time before a new water storage tank is needed in the main pressure zone. As the City implements their annual pipeline replacement program the quantity of hydrants with low fire flow will decrease. The addition of a new storage will alleviate the reduction of available fire flow in dead-end 6-inch mainlines and no improvements are recommended. A pressure zone and WTP plant study is recommended to alleviate higher pressures along the river and lake and as well as evaluate methods to fully utilize the Eastside tank.

5.4. FUTURE (2037) CONDITIONS EVALUATION

The 2017 hydraulic analysis resulted in a list of deficient pipelines that did not meet the fire flow requirements. Scenarios for future (2037) peak hour demand and fire flow availability analyses do not include these pipeline improvements as the City is implementing an annual pipe replacement program to replace these mainlines over time. The same tank level, pump operation settings, and fire flow requirements were used in the 2037 analyses as were used in the 2017 analyses. The demands within the system exceeds the firm capacity of the system and additional source is needed in the main pressure zone and additional booster pumps are required west of the river. This section does not include these additions and is represented as a worst-case scenario if CIP items are not addressed.

5.4.1. Future (2037) Peak Hour Demand (PHD)

The PHD condition represents the maximum volume of water delivered to the system during any single hour during the year. The peak hour demand for McCall was estimated at 8,140 gpm. 2037 PHD source contributions are shown in Table 30.

Table 28. 2037 PHD Scenario Source Contributions.

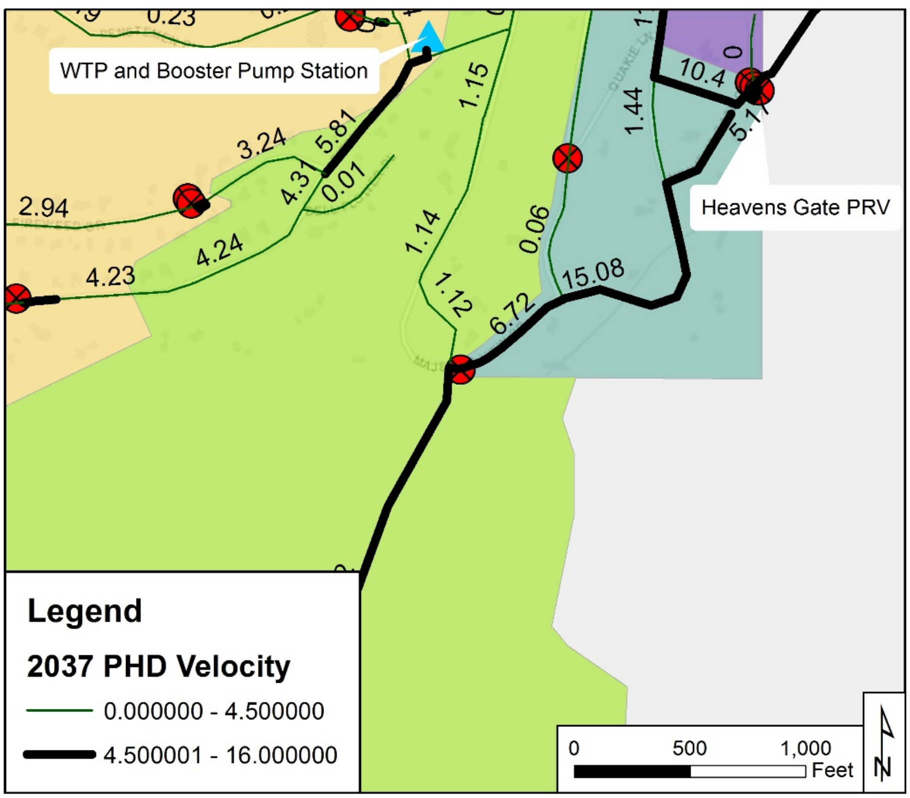
Source	Status	Model HGL (ft)	Flow Out (gpm)
Eastside Tank	On	5,439.50	2,520
Westside Tank	On	5,474.50	1,000
Knowles Booster	On	5,188.69	550
Betsy's Pond Booster	On	5,475.10	100
WTP	On	5,313.47	2,700

Note: HGL=Hydraulic Grade Discharge.

System pressures west of the river for this demand condition range from 36 to 110 psi (Whitetail Pressure Zones) and the maximum pipeline velocity is 5.05 ft/s, which is less than the maximum velocity criteria of 6 ft/s, and is therefore acceptable. The west side of the system has an approximate demand of 1,500 gpm. Pressures in the Whitetail subdivision exceed 100 psi, but the Whitetail Subdivision requires PRVs to be installed on homes where pressures are too high. Pressures are as low as 5 psi near the Whitetail Tank, but this tank connection line does not directly serve customer water meters, and does not need to meet the listed IDEQ pressure requirements.

System pressures east of the river for this demand condition range from 13 (8-inch mainline segment on Majestic View Drive) to 90 psi (West of RV Park Bypass PRV) and the maximum pipeline velocity is 15.08 ft/s. These high velocities show that the mainlines are undersized for the demand. The East side of the system has an approximate demand of 5,200 gpm. Pressure on the East side of the system fall below the 40 psi requirement. This indicated the need for an additional source. High velocities downstream of the Heavens Gate PRV are shown in Figure 17.

Figure 18. 2037 PHD Velocities from Eastside Tank



5.4.2. Future (2037) Maximum Day Demand (MDD) Plus Fire Flow

The fire flow availability during the 2037 MDD is approximately 10-40% lower compared to the 2017 MDD. The largest reductions in available fire flows are located in the downtown area. Fire flows in the downtown area fall below the 1,500 gpm requirement and average approximately 1,400 gpm. This reduction is due to the demand exceeding the water system's capacity and indicates the need for an additional source (WTP, well, or tank). Available fire flow during 2037 is shown in Figure 18. The available fire flow shown in Figure 18 is a worst-case scenario and shows how low available fire flow could be if the City did not implement the CIP upgrades noted in Section 8. If a new storage tank is constructed in 2025 per the CIP, then fire flows will meet or exceed 2017 MDD fire flows discussed in Section 4.5.3.

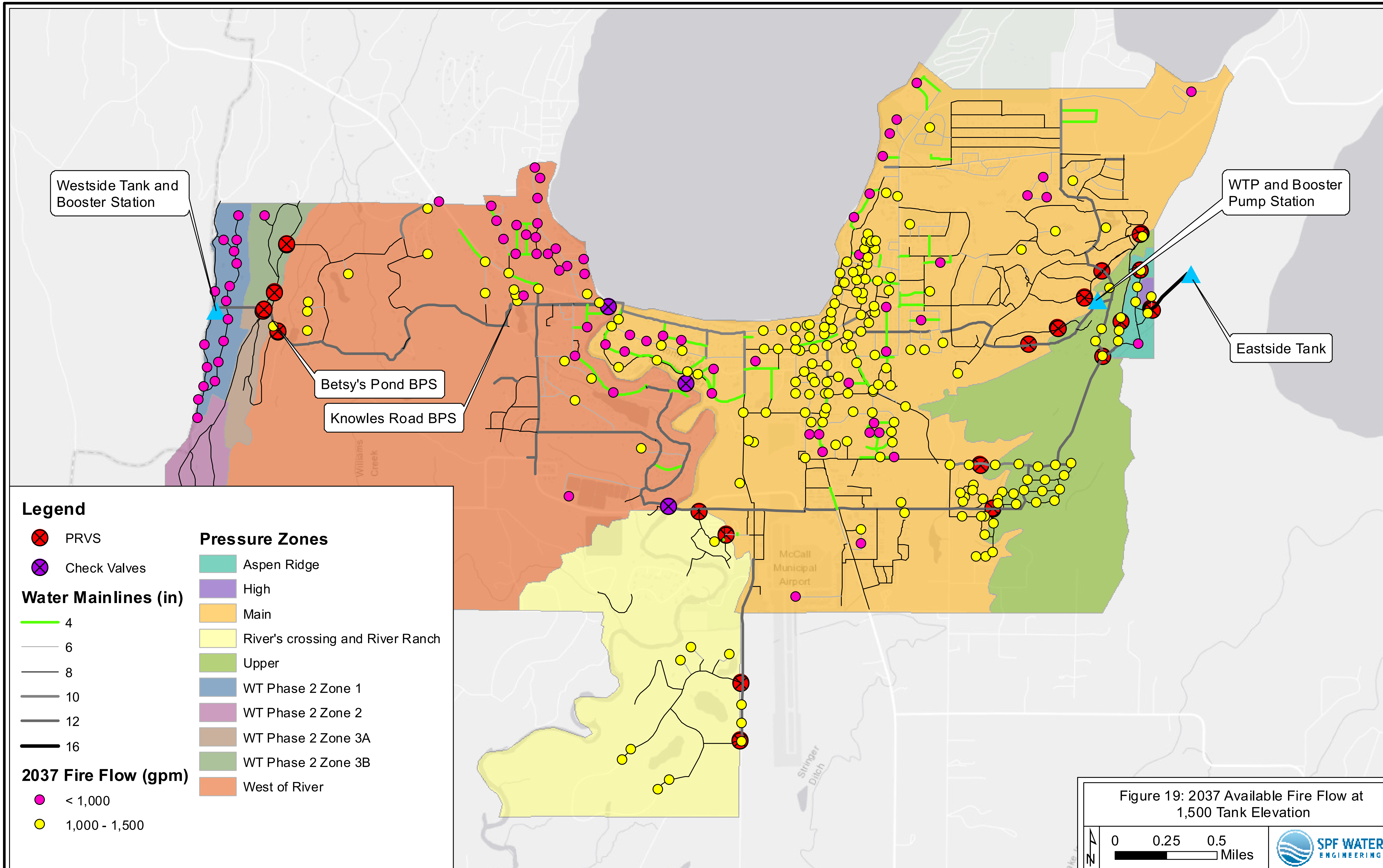


Figure 19: 2037 Available Fire Flow at 1,500 Tank Elevation

5.4.3. Future (2037) Recommendation

Upgrading the 8-inch mainline segment on Majestic View to a 12-inch diameter mainline will reduce the highest velocities during PHD from 15.08 ft/s to 8.75 ft/s. The higher PHD in the 2037 scenarios indicate that a new storage tank is needed before 2037. A pressure zone and WTP plant study is recommended to alleviate higher pressures along the river and lake and as well as evaluate methods to fully utilize the Eastside tank. The addition of a new source will alleviate the reduction of available fire flow in dead-end 6-inch mainlines and water main improvements would be needed. As the City implements their annual pipeline replacement program the quantity of hydrants with low fire flow will decrease.

5.5. FUTURE (2037) CONDITIONS EVALUATION WITH CIP UPGRADES

Scenarios in this Section incorporate recommended upgrades listed in the CIP into the water model. The same existing tank level, pump operation settings, and fire flow requirements were used in this scenario as were used in the 2017 analysis. The existing system is utilized to the firm capacity of each facility or pipeline. The New Main Pressure Zone Tank and booster pump station is located near the airport and the pump station VFDs are set to a minimum pressure discharge of 70 psi. A redundant fire pump is added to the Westside Booster Pump Station.

5.5.1. Future (2037) with CIP Upgrades Peak Hour Demand (PHD)

The PHD condition represents the maximum volume of water delivered to the system during any single hour during the year. The peak hour demand for McCall was estimated at 8,140 gpm. 2037 PHD source contributions are shown in Table 31.

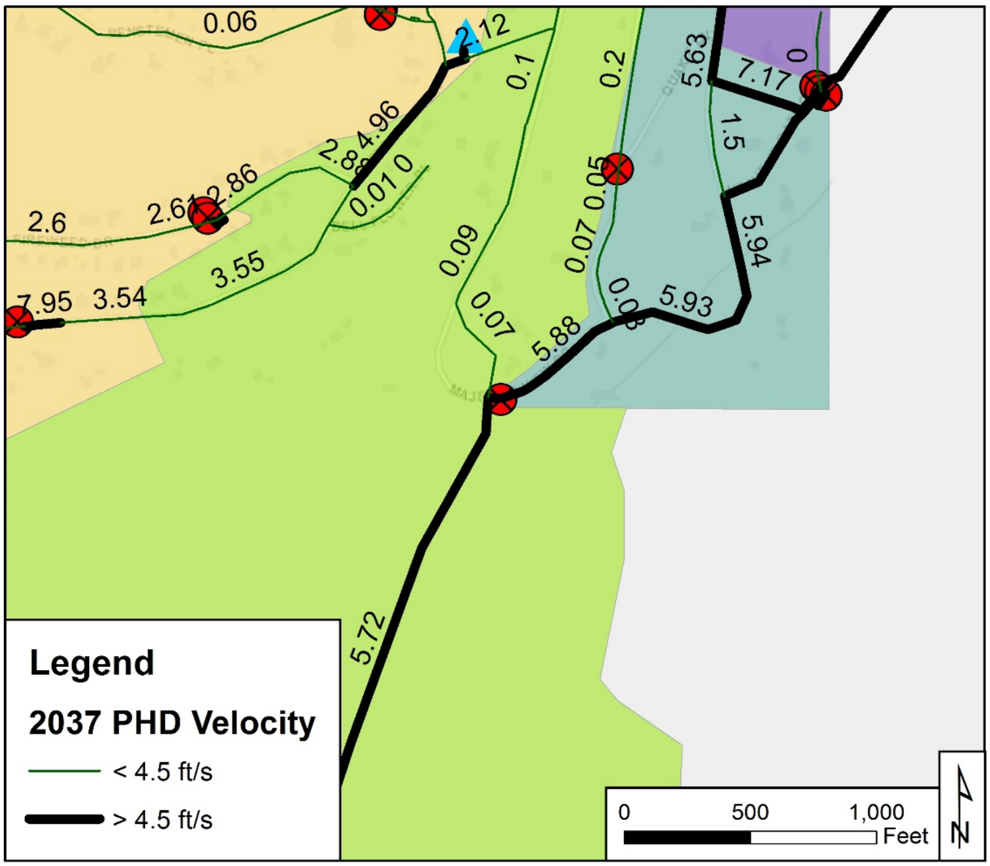
Table 29. Future (2037) with CIP upgrades PHD Scenario Source Contributions

Source	Status	Model HGL (ft)	Flow Out (gpm)
Eastside Tank	On	5,439.50	3,189
Westside Tank	On	5,474.50	1,000
Main Pressure Zone Tank and Booster	On	5,179.92	1,344
Knowles Booster	On	5,188.69	550
Betsy's Pond Booster	On	5,475.10	100
WTP	On	5,313.47	2,700

Note: HGL=Hydraulic Grade Discharge.

System pressures East of the river for this demand condition range from 32 (Heaven's Gate PRV) to 90 psi (West of RV Park Bypass PRV) and the maximum pipeline velocity is 5.94 ft/s. High velocities downstream of the Heaven's Gate PRV are shown in Figure 19. The high velocities can be lowered with adjustments to the VFD's located at the new storage tank and reflect the minimum required of the new storage tank to meet requirements. If both tanks are set to operate with equal supply, velocities are below 1.0 ft/s.

Figure 20. 2037 with CIP Upgrades PHD Velocities from Eastside Tank



5.5.2. Future (2037) with CIP Upgrades Maximum Day Demand (MDD) Plus Fire Flow

Fire flow availability significantly increased with the CIP upgrades. The downtown core pipeline improvements significantly increased the available fire flow. Improved available fire flows are shown in Figure 20.

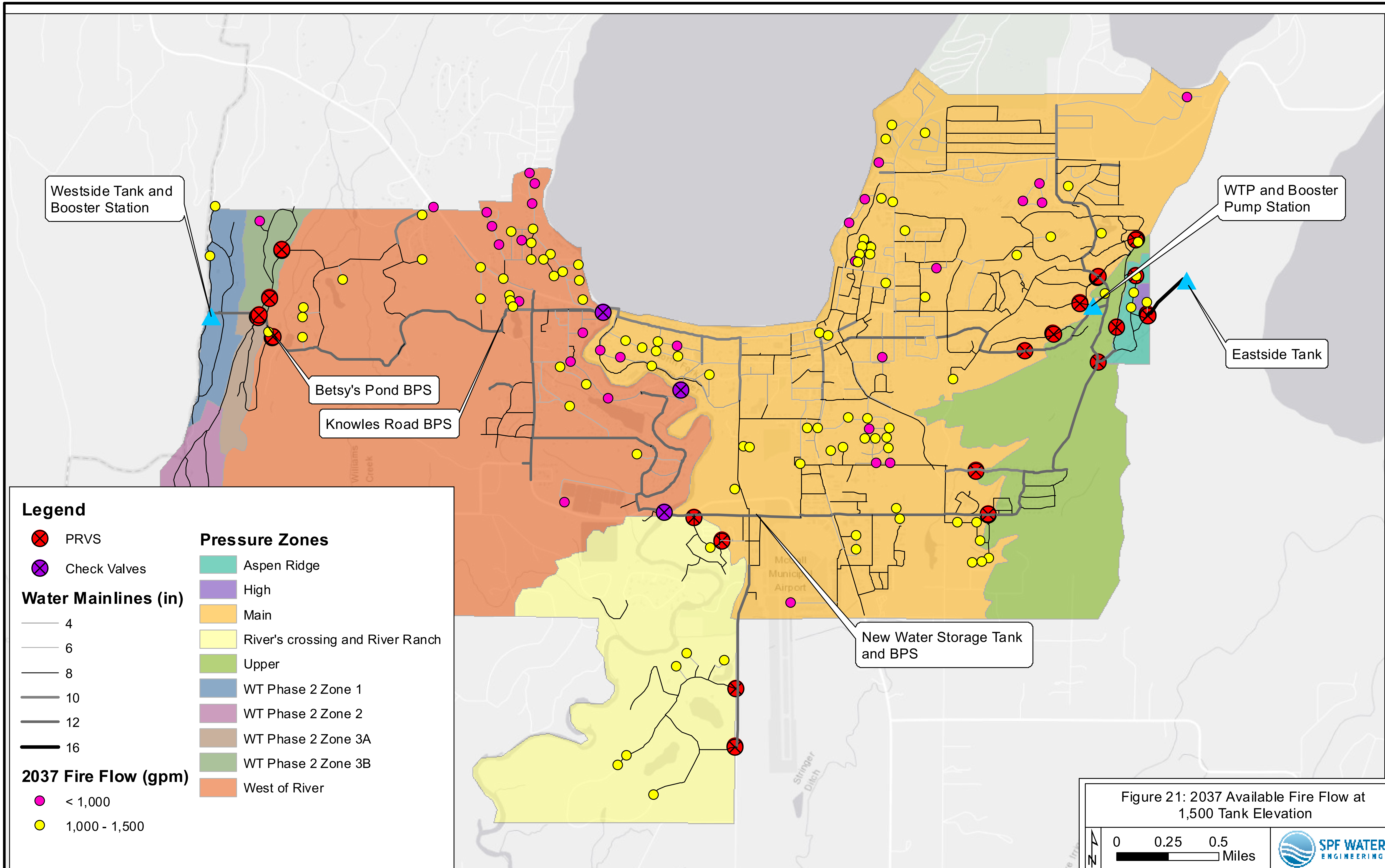


Figure 21: 2037 Available Fire Flow at 1,500 Tank Elevation

5.6. Summary and Recommendations

5.6.1. Peak Hour Pressures and Velocities

- Upgrade 1,100 linear feet of 8-inch Segment on Majestic View Drive to a 12-inch mainline. This upgrade will allow greater utilization of the Eastside tank as well as reduce high velocities seen at PHD.
- A pressure zone and WTP utilization study is recommended to help better utilize the WTP, PRVs, and Eastside Tank.

5.6.2. Fire Flow Availability

- Fire flows will increase as pipelines are upgraded under the Pipeline Replacement Program.
- A new storage tank in the main pressure zone will boost available fire flow within the main pressure zone. Upgrading the 8-inch mainline on Majestic View Drive noted above will increase the fire flow in this area.

6. WATER CONSERVATION PROGRAM

6.1. Current Water Conservation Measures

Water conservation measures are intended to reduce the consumption of water, reduce the loss or waste of water, and improve or maintain the efficient use of water. The City of McCall has implemented numerous conservation measures in recent years that include:

- Installing water meters
- Replacing older meters
- Implementing policies for water use restrictions (e.g., alternate-day irrigation).
- Efficient use of sources of supply though optimization at the treatment plant, and VFD pump controls for better control of flows.
- Consumption based billing

Water conservation measures implemented by the City to date have been effective in reducing water use. The maximum day demand (MDD) has dropped from 451 to 351 gallons per connection over the past 10 years (see Section 3 for more information regarding water demand).

6.2. Future Conservation Measures

The City is interested in implementing additional conservation measures in the future. Focusing on outdoor (irrigation use) conservation will provide the most benefit to McCall as irrigation constitutes the largest category of water use and peak demands due to summer irrigation drive the need for additional future infrastructure. Effective measures to decrease summer irrigation demands will reduce the need for construction of additional peak-capacity infrastructure. These conservation measures may include a combination of the following:

- Metering and tracking of current non-revenue water from sources such as construction water use, bulk water, inaccurate flow meters, leaking water lines and services, filter backwashing, fire hydrant flushing, fire-fighting, public facility use, and city park irrigation.
- Water rate setting that encourages water conservation, using a multi-tiered rate structure. These pricing structures provide financial incentive for all water users to implement and participate in conservation measures. The current rate structure includes a monthly base rate per connection and a consumption rate based on the number of gallons delivered. For a typical residential connection (Class A) with a ¾" diameter meter, the base rate is $33.70 per month and the consumption rate is $0.71/thousand gallons of water delivered. To encourage conservation, the City could consider a tiered rate structure. A rate study is planned in the near future including analysis that will look at projected financial needs, develop rates that are

adequate and equitable, look at overall financial stability of the water system, and provide statistical information describing customer use.

- Optimize water treatment plant operations to extend filter run times and reduce the frequency of filter backwash (on-going)
- Consider filter backwash recycle at the water treatment plant. Recycle could reduce raw water pumping by an estimated 2-3%, but it would not reduce water demand and water facility capacity requirements at the water treatment plant and the distribution system are based on water demand values.
- Public outreach including web page, brochures, education about peak hour usage and ways to reduce peaking factors.
- Use utility bills to communicate usage trends or comparisons to normal usage.
- Implement construction water use management practices (i.e. hydrant meters and fee based water filling station).

By implementing conservation measures that reduce peak hour demand (PHD) and/or maximum day demand, the City can reduce water system capital expenditures by postponing necessary facility expansion projects.

7. WATER RIGHTS

The City of McCall Water Department currently provides potable water to City residents through two pump stations located on Payette Lake. The City also provides water for irrigation of the public golf course from three groundwater wells. The purpose of this section is to:

- Document the City's existing water rights portfolio;
- Determine the adequacy of the City's existing water rights to meet the five-year and twenty-year demand forecasts developed by SPF; and
- Provide a brief discussion of water rights administration in the Payette River Basin.

7.1. Current Water Right Portfolio

7.1.1. Potable Supply - Payette Lake Water Rights

The City is authorized to use three pump stations (near Davis Beach, Legacy Park, and Shore Lodge) for delivery of treated water from Payette Lake to City customers through its municipal supply system[6]. The City's water rights for municipal supply are currently authorized for use within the City's municipal service area identified in Figure 22. If necessary, the municipal supply service area can be amended by notifying the Idaho Department of Water Resources and providing a map of the new boundary.

The City is authorized to divert a total of 11.32 cubic-feet per second (cfs) using the pump stations, a diversion rate of approximately 5,100 gpm. The City's authorized points of diversion are shown in Figure 23. The City's currently-held water rights are summarized in Table 30, and copies of pertinent water right documents are provided in Appendix E.

[6] The pump station near Shore Lodge is currently out-of-service.

Table 30. Water Right Summary.

Water Right No.	Priority Date	Diversion Rate (cfs)	Diversion Rate (gpm)	Combined Use
Payette Lake				
65-10344	6/1/1918	5.13	2,302	
65-10345	6/1/1968	2.31	1,037	
65-12607	3/29/1983	3.88	1,741	
Total for Municipal Use		11.32	5,080	
Groundwater				
65-13119*	11/17/1989	0.28	126	For irrigation: 1.81 cfs, 480 ac-ft, 160 acres
65-13476	8/20/1993	1.81	812	
65-13796	6/29/1998	1.81	812	
Total for Irrigation/Pond Use		1.81	812	

7.1.2. Irrigation Supply - Groundwater Rights.

The water rights in this section are described as important components of the City's water right portfolio, but are not further analyzed because of their limited, non-potable use on the City's golf courses.

The City holds two water rights for three groundwater wells that are used to provide water for non-potable uses on three public nine-hole golf courses (Aspen, Birch and Cedars). The locations of the wells are shown in Figure 23. The City's water rights authorize irrigation of 160 acres of golf course landscaping, and water storage in several ponds for irrigation, recreation and aesthetic purposes.

In addition to the City's water rights, a third right was developed by the McCall Golf Course Foundation for irrigation use (65-13119). This right authorizes irrigation of 8 acres within the 160-acre place of use authorized by the City's water rights. The non-potable water rights used on the City's golf courses are also summarized in Table 30. Pertinent water right documents are attached as Appendix E.

The three golf course water rights authorize the diversion of 1.81 cfs (812 gpm) from three wells for the irrigation of a combined total of 160 acres. The rights are limited to the diversion of 480 ac-ft (156 mgal) annually.

Figure 22. Authorized Place of Use.

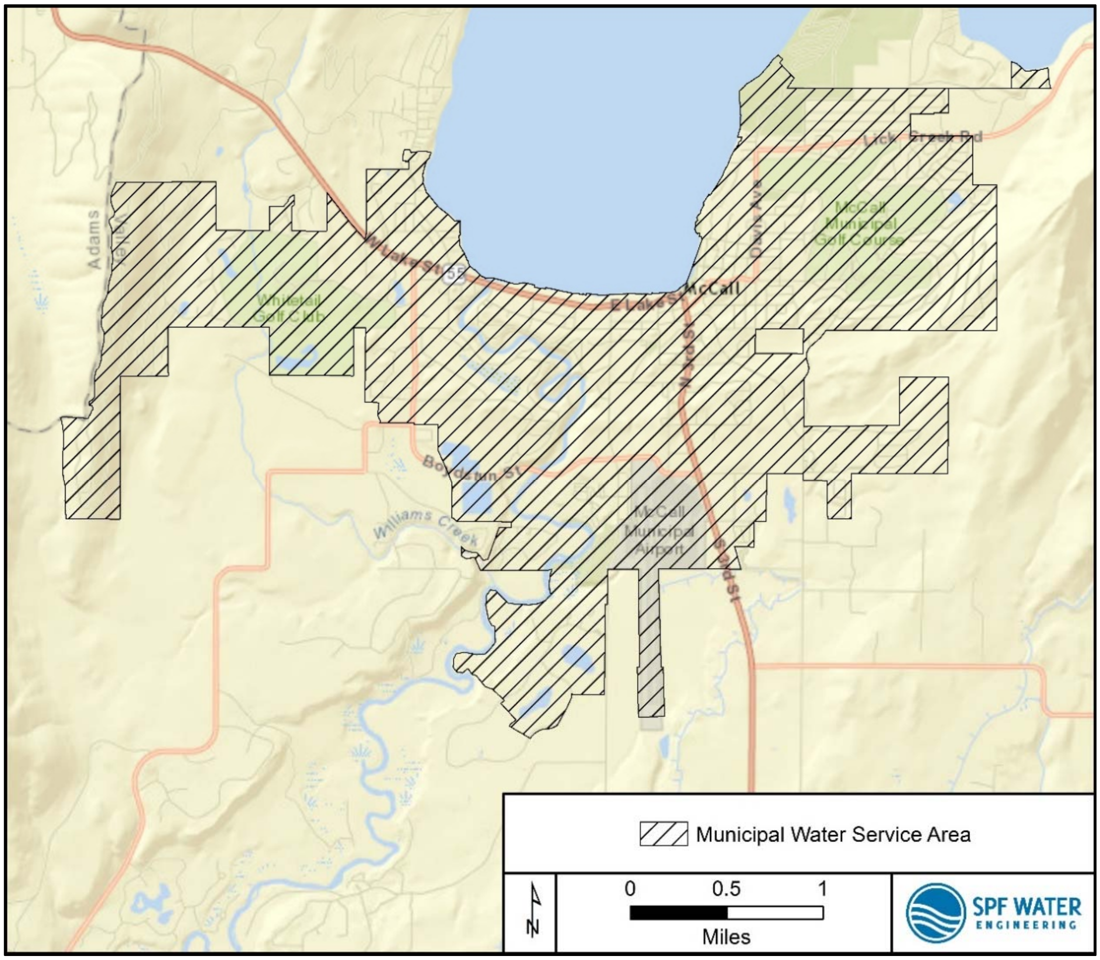
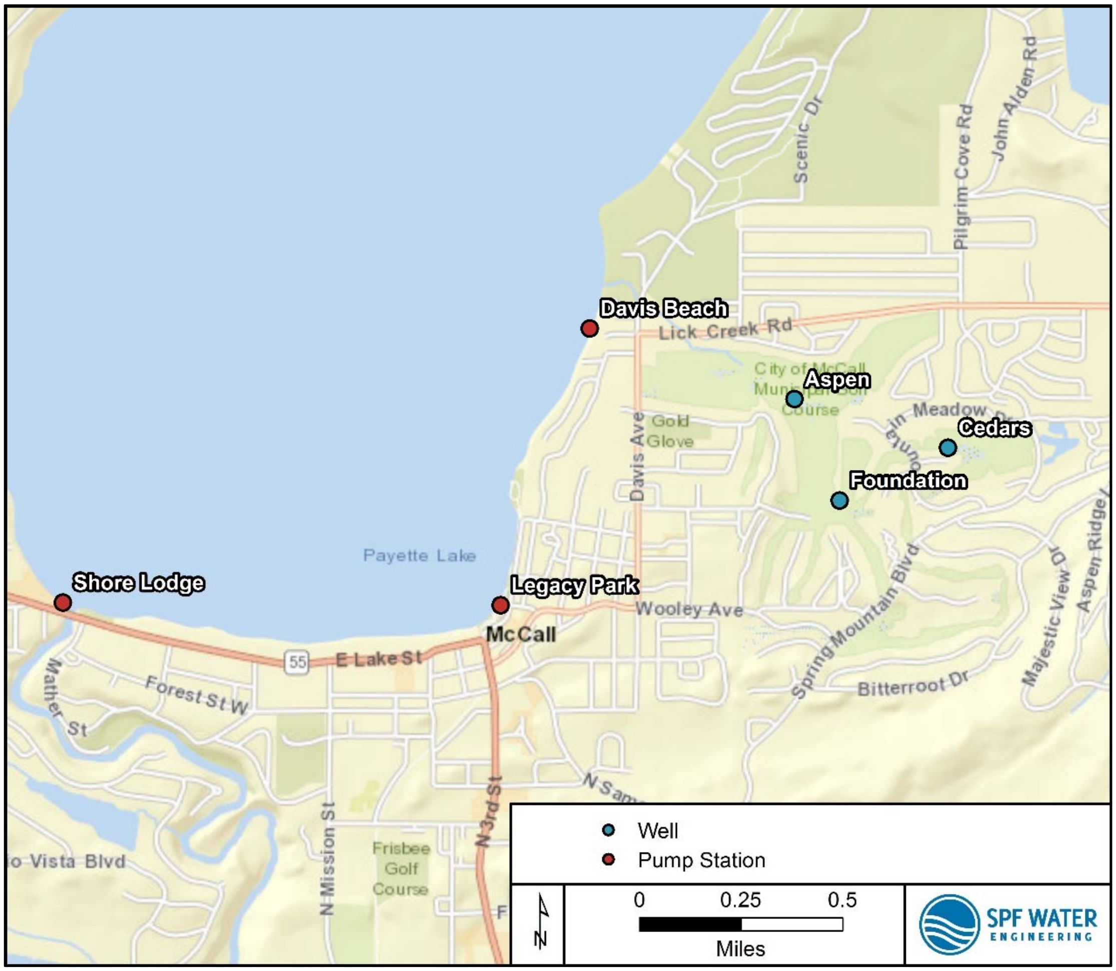


Figure 23. Authorized Points of Diversion.



7.2. Water Rights versus Demand Projections.

This section compares the City's current water right portfolio for potable supply to its current and projected future water needs. This is a comparison between the total diversion quantities authorized by the City's currently-held Payette Lake water rights (Table 31) and calculated demands.

The current maximum day demand (MDD) for the potable supply system is 2.8 mgd[7], compared to 7.3 mgd authorized by existing water rights. Projected MDD will not exceed the existing rights from Payette Lake for 32 years, assuming a 3% annual increase in water demands.

Table 31. Authorized Annual Diversion Volume for Potable Use.

Source	Diversion Rate (cfs)	Diversion Rate (gpm)	Diversion Volume (mgd)
Payette Lake	11.32	5,080	7.30

7.2.1. Five-Year Forecast

The City's MDD in five years (2022) is projected to be 3.3 mgd, which is 45% of the amount authorized by the City's current water rights for potable supply.

Table 32. Projected Demand (3% Annual Demand Increase).

Projection	Maximum Day Demand (MDD) (mgd)
5-year (2022)	3.3
20-year (2037)	5.1
32-year (2049)	7.3

7.2.2. Twenty-Year Forecast

The City's MDD in twenty years (2037) is projected to be 5.1 mgd, which is 70% of the total authorized by City water rights. At the assumed growth rate (3%), the City will not require additional water rights to meet potable demands until 2049.

[7] Current MDD was determined by SPF using 2016 demand data.

7.3. Water Right Administration in the Payette River Basin

Water rights in the Payette River Basin are administered by a watermaster selected by water right holders and appointed by the Director of IDWR[8]. The watermaster is responsible for delivery of water rights from the Payette River and its tributaries based on the prior appropriation doctrine ("first in time is first in right"). In the Payette River Basin, junior priority water rights are curtailed each year in favor of more senior rights. Curtailments occur generally in June or July, depending on priority dates.

The City of McCall holds relatively junior rights in the Payette River Basin, and its rights are subject to curtailment each year. However, storage water in Deadwood Reservoir (the "rental pool") has been available each year to mitigate the City's diversions from Payette Lake and prevent curtailment. The City pays the rental pool for its mitigation water at the end of each year based on actual diversions for that year. This system appears to work well for the City, and will continue to be an adequate response to possible curtailment as long as water is available in the rental pool. The watermaster asserts that rental pool water will be available for the foreseeable future, but the City may wish to consider a more permanent solution than annual rentals from the pool.

[8] The current watermaster is Ron Shurleff.

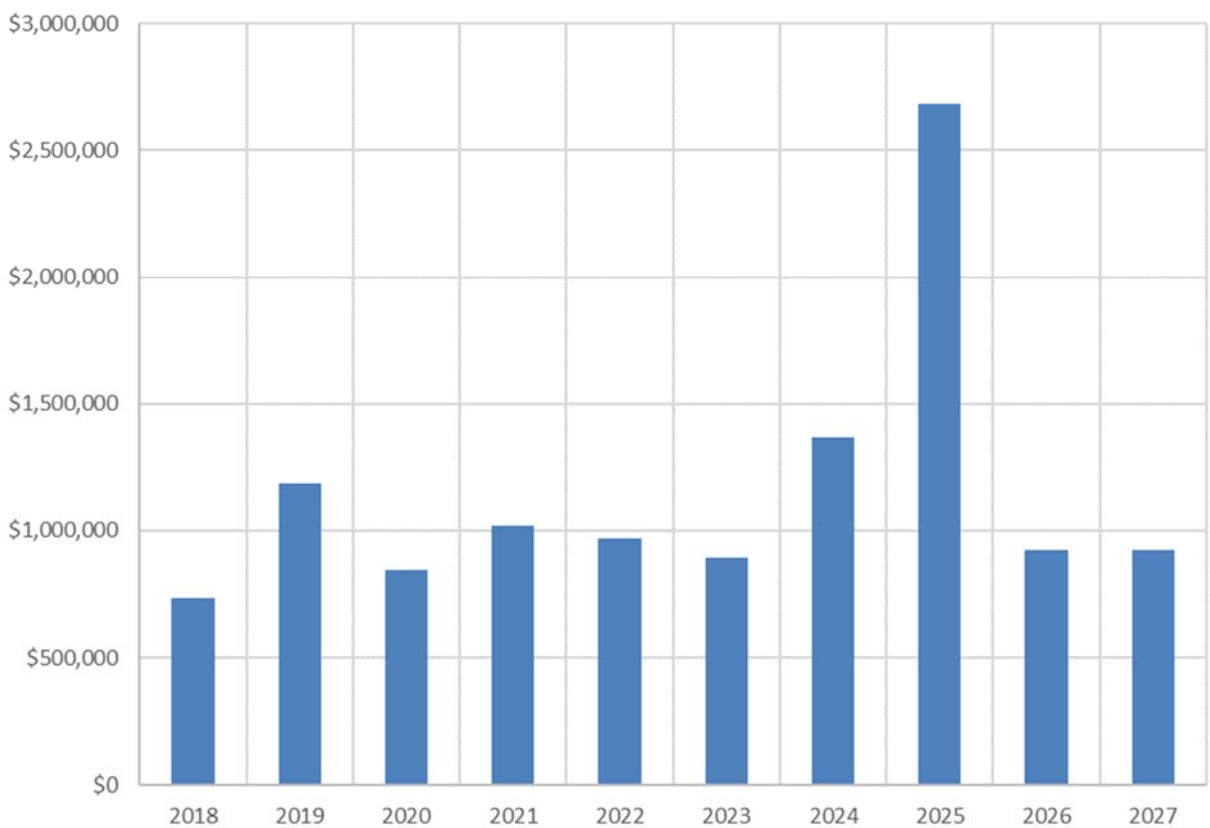
8. Capital Improvements Program

8.1. Capital Improvement Plan (CIP) Overview Section

Previous sections have presented an overview of the existing system, projections of future water demand, and an analysis of existing and future water system requirements for supply, treatment, storage, and distribution facilities. This section summarizes the previously identified system improvement needs. Recommended capital improvement projects are shown in Table 33, and Table 34 presents the 10-year CIP with estimated annual project expenditures.

Figure 24 presents the 10-year CIP budget in graphical format to illustrate the year-to-year variability. For example, fiscal year 2025 is projected to have much higher capital costs due to construction of a new water storage tank.

Figure 24. 10-Year Water System Capital Improvement Plan.



While the Capital Improvement Plan provides a structured outline for the order in which the improvements are recommended, it is important to note that the order should be viewed as flexible and dynamic. For example, some improvements may be scheduled to coordinate with other projects such as roadway resurfacing or new commercial developments. All pipeline projects will be reviewed for coordination with other potential utility projects (e.g. sewer, power, gas, etc.) and transportation projects that have the potential to impact roadways. The urgency and timing of some water system improvements are growth dependent. Should the City of McCall grow more rapidly than assumed, these project timelines would need to be accelerated.

All project descriptions and cost estimates represent planning level accuracy and opinions of costs. Detailed design criteria should be developed during the design phase of each improvement project. The final cost of projects will vary depending on actual labor and material costs, site conditions, competitive market conditions, regulatory requirements, project schedule, and other factors. Because of these factors, project feasibility and risks should be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding. Cost estimates have been developed at a conceptual level, or Class 5 as defined by the Association for the Advancement of Cost Engineering International (AACEI). Cost estimates at this level have an expected accuracy range of -30% to +50%.

The Capital Improvement Plan includes two types of projects: Water Facilities and the Distribution System Replacement Plan. Using these two categories is important to ensure that upgrades are planned for both types of facilities, and in particular that hidden assets, especially water mains, are not neglected.

The Water Facilities category includes raw water pump stations, the water treatment plant, storage tanks, booster pumping stations, and pressure reducing valve stations. Planning for new facilities and upgrades to existing facilities in this category is based on condition and capacity, and is done on a project by project basis in the 10-year CIP, which is updated annually. Facility service life expectancy for these facilities ranges from 50 to 100 years, and varies based on factors including original quality of construction and frequency of renovation. Mechanical and controls equipment in these facilities must be upgraded more frequently on a case by case basis with projects identified in the CIP.

The Distribution System Replacement Plan includes water mains, hydrants, and water meters. Because water mains are buried and out of sight, they are often neglected and upgraded only upon failure. This type of deferred maintenance can result in an aging system that is more prone to failure and may not have adequate capacity to deliver required flows. The City of McCall has taken a proactive approach to distribution system upgrades and established a Distribution System Replacement Plan. Planning for this category of facilities is based on replacing a certain percentage of the system each year: 1% of water mains, 2% of hydrants, and 5% of water meters. By following this plan, the facilities will not exceed their anticipated life cycles of 100 years for water mains, 50 years for hydrants, and 20 years for water meters.

Table 33. 20-Year Water System Capital Improvement Plan

SPF WATER ENGINEERING

Table 33
City of McCall
20-YEAR CAPITAL IMPROVEMENT PLAN FOR WATER SYSTEM

PROJECT : Water System Master Plan
JOB # : 608.0160
LOCATION : McCall, ID

AACE ESTIMATE CLASS : 5
DATE : 12/28/2017
BY : EL/BP

NO.	DESCRIPTION	COST	COMMENTS	FY
1	REPLACE SODIUM HYPOCHLORITE GENERATION SYSTEM AT WTP	$90,000	Replace existing on-site sodium hypochlorite generation system	2018
2	WTP RAW WATER CHLORINATION SYSTEM	$20,000	Install prechlorination system at WTP and remove gasseous chlorine at Legacy Park and Davis Beach (depending upon test results)	2018
3	WATER RATE STUDY	$40,000	Conduct water rate study to establish rates to fully support operations and maintenance of the water system	2018
4	WTP VALVE AND ACTUATOR REPLACEMENT	$100,000	Replace valves and actuators at WTP	2018-2027
5	WTP PUMPING AND PRESSURE ZONE STUDY	$20,000	Evaluate system modifications to pump directly from WTP into the Main Pressure zone	2018
6	REPLACE POLYMER FEEDERS AT WTP	$60,000	Replace two existing polymer feeders	2018
7	SCADA SYSTEM UPGRADES	$200,000	Install and program new SCADA system	2019
8	DAVIS BEACH PUMP STATION STANDBY POWER	$120,000	Install standby power genset at Davis Beach Raw Water Pump Station	2019
9	LEGACY PARK PUMP ST STRUCTURAL REPAIR & BLDG RENNOVATION	$80,000	Structural repair and rennovation of pump station including roof replacement and siding	2019
10	LEGACY PARK PUMP STATION VFDs	$45,000	Install VFDs on 3 pumps at Legacy Beach Raw Water Pump Station. Idaho Power incentive program could cover a significant portion of cost.	2019
11	BETSY'S POND BOOSTER STATION UPGRADE	$40,000	Provide weather protection and improve access	2020
12	WTP FILTER PERFORMANCE AUDIT	$10,000	Evaluate filter performance, filter media, and filter underdrains	2020
13	LEAK DETECTION TESTING	$20,000	Unaccounted for water is 19% of total production	2021
14	INSTALL REDUNDANT FIRE PUMP AT WEST UPPER PUMP STATION	$80,000	Provide redundant fire flow supply.	2021
15	CONSTRUCT 1 MG WATER STORAGE RESERVOIR	$2,200,000	Construct 1.0 MG water storage reservoir	2026
16	WTP ALTERNATIVES EVALUATION FOR ADDITIONAL CAPACITY	$50,000	Evaluate alternatives for additional water supply: expand existing WTP, construct new WTP, or develop groundwater. Start when MDD reaches 4 mgd; current MDD is 2.8 mgd.	2029
17	ACQUIRE LAND FOR NEW WTP (IF NEW WTP SELECTED)	$500,000	Site for new WTP (approximately 5 ac)	2032
18	CONSTRUCT NEW WTP (OR EXPAND EXISTING)	$15,000,000	New 5 mgd in-line filtration WTP expandable to 10 mgd	2035-2038
	WATER SYSTEM INFRASTRUCTURE REPLACEMENT PLAN			
RP1	WATER MAIN ANNUAL REPLACEMENT PLAN	$847,000	Replace 1% of system water mains annually	Annual
RP2	FIRE HYDRANT ANNUAL REPLACEMENT PLAN	$69,300	Replace 2% of fire hydrants annually (14-15 hydrants per year)	Annual
RP3	WATER METER ANNUAL REPLACEMENT PLAN	$40,300	Replace 5% of water meters annually (161 meters per year)	Annual
	TOTAL ANNUAL REPLACEMENT PLAN	$956,600		

This cost estimate reflects our professional opinion of accurate costs at this time based on current conditions at the project location. This estimate is subject to change through the project planning and design process. Actual construction cost will depend on the cost of labor, materials, equipment, and services provided by others, contractor's methods of determining prices, competitive bidding and of labor, materials, equipment, and services provided by others, contractor's methods of determining prices, competitive bidding and market conditions.

Table 34. 10-Year Water System Capital Improvement Plan

ID	PROJECT	COST 2017 USD	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
1	REPLACE HYPOCHLORITE SYSTEM AT WTP	$90,000	$90,000									
2	WTP RAW WATER CHLORINATION SYSTEM	$20,000	$20,000									
3	WATER RATE STUDY	$40,000	$40,000									
4	WTP VALVE AND ACTUATOR REPLACEMENT	$100,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
5	IDAHO ST/BROWN DR WATER MAIN	$285,000	$285,000									
6	DOWNTOWN CORE WATER MAIN DESIGN	$50,000	$50,000									
7	JASPER SUB WATER MAIN DESIGN	$65,000	$65,000									
8	REPLACE POLYMER FEEDERS AT WTP	$60,000	$60,000									
9	WTP PUMPING AND PRESSURE ZONE STUDY	$20,000	$20,000									
10	REPLACE VEHICLE 36	$30,000	$30,000									
11	SCADA SYSTEM UPGRADES	$200,000	$24,000	$176,000								
12	DAVIS BEACH PUMP STATION STANDBY POWER	$120,000		$120,000								
13	LEGACY PARK PUMP ST BUILDING UPGRADES	$80,000		$80,000								
14	DOWNTOWN CORE PHASE 1 WATER MAIN	$250,000		$250,000								
15	JASPER SUB WATER MAIN	$375,000		$375,000								
16	NORTH 3RD/SUNSET/COLORADO DESIGN	$60,000		$60,000								
17	LEGACY PARK PUMP STATION VFDs	$45,000		$45,000								
18	BETSY'S POND BOOSTER STATION UPGRADE	$40,000			$40,000							
19	WTP FILTER PERFORMANCE AUDIT	$10,000			$10,000							
20	INSTALL FLOW METERS AT LEGACY & DAVIS RWPS	$30,000			$30,000							
21	DOWNTOWN CORE PHASE 2 WATER MAIN	$200,000			$200,000							
22	NORTH 3RD/SUNSET/COLORADO WATER MAIN	$340,000			$340,000							
23	MATHER/BRUNDAGE WATER MAIN DESIGN	$45,000			$45,000							
24	DAVIS/UNIVERSITY WATER MAIN DESIGN	$70,000			$70,000							
25	ALPINE/WOOLEY WATER MAIN DESIGN	$30,000			$30,000							
26	LEAK DETECTION TESTING	$20,000				$20,000						
27	REDUNDANT FIRE PUMP AT WEST UPPER PUMP ST	$80,000				$80,000						
28	MATHER/BRUNDAGE WATER MAIN	$200,000				$200,000						
29	DAVIS/UNIVERSITY WATER MAIN	$380,000				$380,000						
30	ALPINE/WOOLEY WATER MAIN	$160,000				$160,000						
31	WASHINGTON/COLORADO WATER MAIN DESIGN	$25,000				$25,000						
32	TIMM/SUNSET/ALLEN WATER MAIN DESIGN	$55,000				$55,000						
33	PLACID WATER MAIN DESIGN	$20,000				$20,000						
34	WASHINGTON/COLORADO WATER MAIN	$140,000					$140,000					
35	TIMM/SUNSET/ALLEN WATER MAIN	$320,000					$320,000					
36	PLACID WATER MAIN	$100,000					$100,000					
37	WEST LAKE/BOYDSTON WATER MAIN DESIGN	$55,000					$55,000					
38	SADDLE HORN/BUCK BOARD/BRIDAL PATH DESIGN	$75,000					$75,000					
39	REPLACE VEHICLE 26	$40,000					$40,000					
40	CONSTRUCT 1 MG WATER STORAGE RESERVOIR	$2,200,000					$200,000		$240,000	$1,760,000		
41	WEST LAKE/BOYDSTON WATER MAIN	$250,000						$250,000				
42	SADDLE HORN/BUCK BOARD/BRIDAL PATH MAIN	$420,000						$420,000				
43	BROKEN REIN/WILD HORSE/BUCK BOARD DESIGN	$70,000						$70,000				
44	MATHER/BRUNDAGE WATER MAIN DESIGN	$75,000						$75,000				
45	REPLACE VEHICLE 10	$30,000						$30,000				
46	BROKEN REIN/WILD HORSE/BUCK BOARD MAIN	$390,000							$390,000			
47	MATHER/BRUNDAGE WATER MAIN	$425,000							$425,000			
48	MAJESTIC VIEW WATER MAIN	$232,000							$232,000			
49	REPLACE VEHICLE 29	$35,000							$35,000			
50	ANNUAL WATER MAIN REPLACEMENT	$847,000								$847,000		
51	ANNUAL WATER MAIN REPLACEMENT	$847,000									$847,000	
52	ANNUAL WATER MAIN REPLACEMENT	$847,000										$847,000
	SUBTOTAL	$10,993,000	$694,000	$1,116,000	$775,000	$950,000	$940,000	$855,000	$1,332,000	$2,617,000	$857,000	$857,000
RP1	ANNUAL FIRE HYDRANT REPLACEMENT BUDGET		$69,300	$69,300	$69,300	$69,300	$69,300	$69,300	$69,300	$69,300	$69,300	$69,300
RP2	ANNUAL WATER METER REPLACEMENT BUDGET[(1)]	$40,300	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	TOTAL	$11,686,000	$763,300	$1,185,300	$844,300	$1,019,300	$1,009,300	$924,300	$1,401,300	$2,686,300	$926,300	$926,300
	AVERAGE ANNUAL CIP BUDGET	$1,168,600										

(1) Annual water meter replacement funded from Water Department Operations and Maintenance Budget.

8.2. Distribution System Infrastructure Replacement Plan

As with most cities, much of the water system infrastructure is aging and some facilities are beyond their useful life. An infrastructure replacement plan is necessary to keep pace with the aging system and proactively replace older and undersized infrastructure.

Based on the records of pipe materials and sizes, it is recommended that the City replace 1.0% of the water mains annually. This equates to approximately 4,800 LF of pipe replacement per year. Main lines less than 6 inches in diameter and materials prone to corrosion and failure are recommended to be the primary focus of the pipeline replacement program. These materials include galvanized steel, asbestos cement, and cast iron. The estimated cost of the pipeline replacement program is approximately $847,000 annually. Figure 25 shows the pipeline upgrade projects planned for the next seven years, 2018-2024.

Figure 25. Pipeline Upgrades 2018-2024.

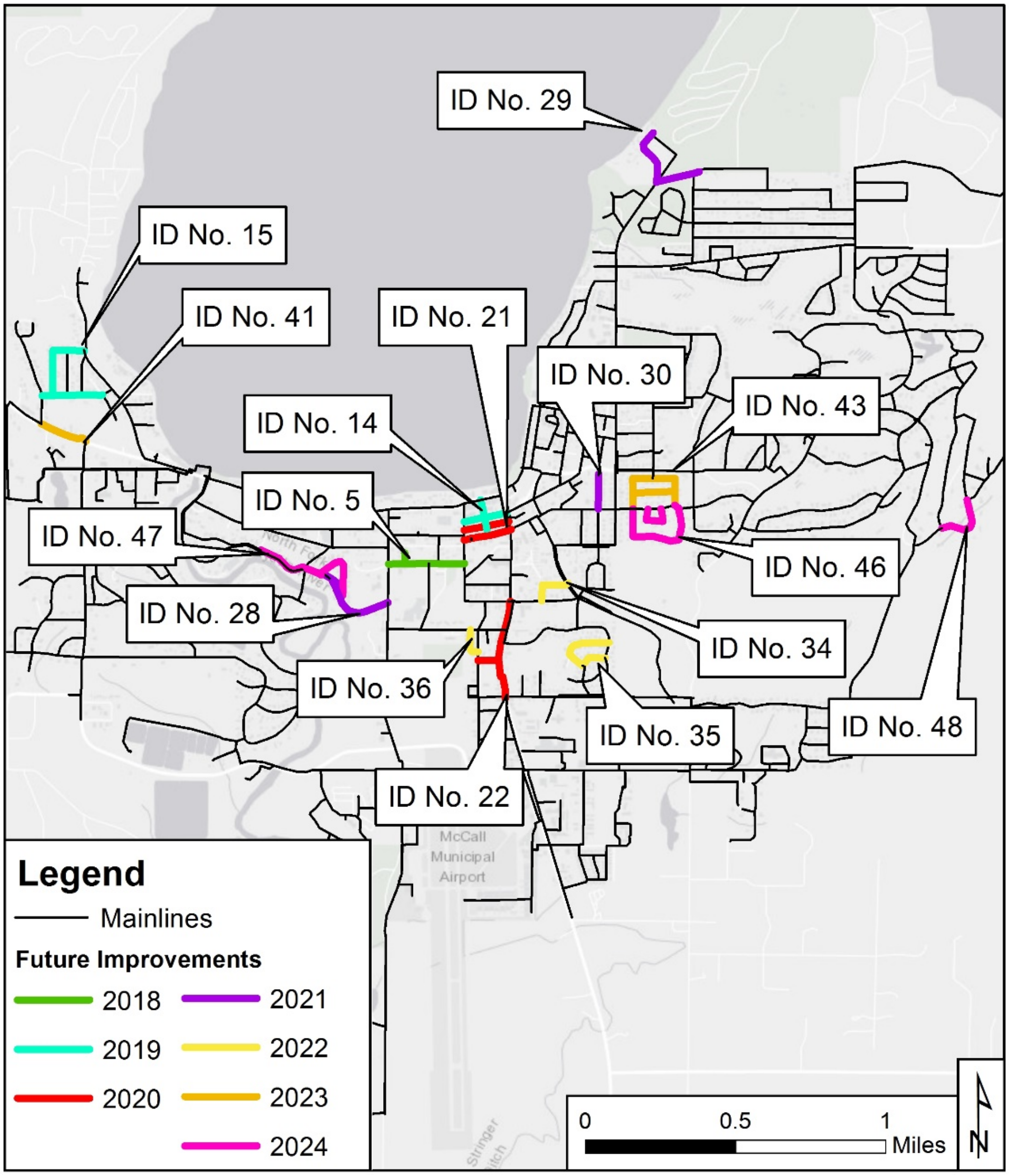


Table 35 presents an estimate of the total water system replacement value. While this estimate is conceptual in nature, the total replacement value of the system is estimated to be approximately $115 million. Typical water system facilities have an intended life cycle between 50 and 100 years. Using 75 years as an estimated average life cycle, the annual replacement cost to maintain the overall average age of the system is approximately $1,500,000. If investment in facility replacement is less, then the average age of system components increases over time.

Table 35. Estimate of System Replacement Value.

PROJECT :	City of McCall Water Master Plan	**AACEI ESTIMATE CLASS :**	4
JOB # :	608.0160	**DATE :**	11/16/2017
LOCATION :	Valley County, ID	**BY :**	EL
		REVIEWED :	BP

NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE	VALUE
WATER TREATMENT FACILITIES					
1A	WATER TREATMENT PLANT, IN-LINE FILTRATION	5.6	MGD	$3,000,000	$16,800,000
PUMP STATIONS					
2A	LEGACY PARK RAW WATER PUMP STATION	2,625	GPM	$400	$1,050,000
2B	DAVIS BEACH RAW WATER PUMP STATION	2,260	GPM	$400	$904,000
2C	KNOWLES ROAD BOOSTER PUMP STATION	1,975	GPM	$300	$593,000
2D	BETSY'S POND BOOSTER PUMP STATION	200	GPM	$1,000	$200,000
2E	WHITETAIL BOOSTER PUMP STATION	1,615	GPM	$300	$485,000
	PUMP STATIONS TOTAL REPLACEMENT VALUE				***$3,232,000***
WATER STORAGE RESERVOIRS					
3A	HEAVEN'S GATE (EASTSIDE) TANK	1,173,000	GAL	$2.00	$2,346,000
3B	WHITETAIL TANK	407,000	GAL	$2.25	$916,000
	WATER STORAGE RESERVOIRS TOTAL REPLACEMENT VALUE				***$3,262,000***
TRANSMISION AND DISTRIBUTION PIPING					
4A	4-INCH DIA PIPING ALL MATERIAL TYPES	46,280	LF	$153	$7,081,000
4B	6-INCH DIA PIPING ALL MATERIAL TYPES	93,660	LF	$164	$15,360,000
4C	8-INCH DIA PIPING ALL MATERIAL TYPES	234,860	LF	$176	$41,335,000
4D	10-INCH DIA PIPING ALL MATERIAL TYPES	13,850	LF	$192	$2,659,000
4E	12-INCH DIA PIPING ALL MATERIAL TYPES	65,720	LF	$211	$13,867,000
4F	16-INCH DIA PIPING ALL MATERIAL TYPES	18,400	LF	$238	$4,379,000
	TRANSMISSION AND DISTRIBUTION PIPING TOTAL REPLACEMENT VALUE				***$84,681,000***
DISTRIBUTION SYSTEM FACILITIES					
5A	PRESSURE REDUCING VALVE STATIONS	19	EA	$120,000	$2,280,000
5B	FIRE HYDRANTS	722	EA	$4,800	$3,466,000
5C	WATER METERS (ALL SIZES)	3,225	EA	$450	$1,451,000
	DISTRIBUTION SYSTEM FACILITIES TOTAL REPLACEMENT VALUE				***$7,197,000***
	TOTAL WATER SYSTEM REPLACEMENT VALUE				**$115,200,000**

This cost estimate reflects our professional opinion of accurate costs at this time based on current conditions at the project location. This estimate is subject to change through the project planning and design process. Actual construction cost will depend on the cost of labor, materials, equipment, and services provided by others, contractor's methods of determining prices, competitive bidding and market conditions.

In addition to water lines, the water system is comprised of other components, all of which require life-cycle replacement. Table 36 presents replacement frequencies and estimated budgets for replacement of water mains, fire hydrants, and water meters.

Table 36. Recommended Water Infrastructure Replacement Plan.

Component	Current System Total	Average Life Cycle	Annual Replacement	Annual Budget
Water Mains	472,770 LF	100 yrs	4,730 LF	$847,000[(1)]
Fire Hydrants	722 ea.	50 yrs	14-15	$69,300[(1)]
Water Meters	3225 ea.	20 yrs	161	$40,300[(1)]
		Total Annual Infrastructure Replacement Plan		$956,600

(1) Annual replacement budgets based on replacing 1% of distribution piping per year, 2% of hydrants per year, and 5% of water meters per year.

The City is planning to conduct a water rate study in 2018 (CIP Project No. 3) to evaluate rate structure and levels to support the necessary costs of operating and maintaining the water system.

8.3. Capital Project Funding Sources

The City currently intends to fund the majority of capital improvements identified in the CIP through water rates and fees. Potential exceptions include large capital projects such as the water storage tank projected for the year 2025 and the water treatment facility projected for 2035-2038. Several potential funding sources are available for these types of water system projects including the IDEQ Drinking Water Revolving Loan Fund, the USDA Rural Development Program, and the Department of Commerce Community Development Block Grant Program. These funding sources should be investigated further during the planning phase for these large capital projects. In addition, these programs should be taken into consideration during the Water Rate Study that the City is planning to conduct in 2018.

9. REFERENCES

City of McCall, Capital Improvement Program Update, SPF Water Engineering, December 5, 2012.

City of McCall Water Master Plan, 2008 Addendum, CH2M Hill Corporation, October 30, 2008.

City of McCall Water System Master Plan, 2001 Revision, Holladay Engineering Company, December 20, 2001.

Idaho Rules for Public Drinking Water Systems, Idaho Administrative Procedures Act, Section 58.01.08.

International Fire Code, International Code Council, Incorporated, 2015 Edition.

McCall in Motion, McCall Area Transportation Master Plan, Public Draft, September 2017.

McCall in Motion, McCall Area Comprehensive Plan, Volumes 1-6, 2017.

Water Meters: Selection, Installation, Testing and Maintenance, Fifth Edition, American Water Works Association (AWWA), 2012.

APPENDIX A: WATER FACILITY DATA

City of McCall
PUBLIC WORKS

CITY OF McCALL WATER & WASTEWATER CERTIFICATIONS

The following individuals are certified with the State Board of Idaho Bureau of Occupational Licenses:

		License #	Expiration Date	Responsible Charge (RC)
Brinkley, Levi	**Drinking Water Distribution I** *(03/04)* **Drinking Water Treatment I** *(06/00)* **Wastewater Collection I** *(06/01)*	**DWD1-13043 DWT1-10232 WWC1-10231**	**5-21-18 5-21-18 5-21-18**	
Dellwo, Matthew	**Drinking Water Treatment Operator-III (3/15) Wastewater treatment operator III (6/15) Wastewater Treatment operator/land application (7/10)**	**DWT3-20316 WWT3-20470 WWTLA-17415**	**10-2-18 10-2-18 10-2-18**	**RC – Water Treatment**
LaFay, Stacy	**Wastewater treatment Operator III (7/14) Drin king Water Treatment Operator lll (10/14) Wastewater Treatment Land Application Drinking Water Distribution Operator II (9/17)**	**WWT3-19524 DWT3-20039 WWTLA-18718 DWD2-21651**	**8-13-18 8-13-18 8-13-18 8-13-19**	**Substitute RC – Water Treatment Substitute RC – Water Distribution**
Jessen, Duane	**Wastewater collection Operator 1(8/12) Drinking Water Distribution Operator I (4/12)**	**WWC1-18381 DWD1-18870**	**10-18-18 10-18-18**	
Mohler, Kurt	**Wastewater Collection Operator III (3/2015) Drinking Water Distribution Operator II (1-15)**	**WWC3-20402 DWD2-20118**	**5-15-18 5-15-18**	**RC – Water Distribution**
Bauer, Richard	**Wastewater Collection Operator 1(12/13) Drinking Water Distribution Operator 1(11/14)**	**WWCI-19552 DWD1-19860**	**6-1-18 6-1-18**	
Lee, Michael	**Water Distribution Operator 3 Water Treatment Operator 3 (Both of the above certifications are through the State of California Water Resources Control Board)**	**34548 30540**		

*Certified licenses in the State of California, endorsement by the IBOL is pending

Legacy Beach Raw Water Pump Station

Summary:

Legacy Beach has three intake pumps and an emergency power generator. The pump station has a prechlorination system that chlorinates water to reduce algae growth between the intake and the Water Treatment Plant. The booster station feeds into a 10-inch pipe to the Water Treatment Plant.

Location:	Legacy Park - E Lake St.		
Latitude:	44 °	54 '	44.52 "
Longitude:	116 °	5 '	50.98 "
Ground Elevation:	5,005 ft		
Equipment Elevation:	5,010 ft		

Pump 1:	**hp:**	50
	Model:	
	Nominal Flow:	861 gpm
	VFD?:	No
Pump 2:	**hp:**	75
	Model:	
	Nominal Flow:	1,265 gpm
	VFD?:	No
Pump :	**hp:**	75
	Model:	
	Nominal Flow:	1,265 gpm
	VFD?:	No

Legacy Beach Raw Water Pump Station

Davis Beach Raw Water Pump Station

Summary:

Davis Beach has three intake pumps. The pump station is located along the Payette Lake at Davis Beach and can be accessed through a small trail off Lick Creek Road. The pump station is not used in winter because of limited access. The pump station does not have a flow meter or a back up generator.

Location:	Davis Beach Park - Hemlock St. and E La		
Latitude:	44 °	55 '	19.81 "
Longitude:	116 °	5 '	34.25 "
Ground Elevation:	5,000 ft		
Equipment Elevation:	5,005 ft		

Pump 1:	**hp:**	40
	Model:	
	Nominal Flow:	695 gpm
	VFD?:	No
Pump 2:	**hp:**	60
	Model:	
	Nominal Flow:	695 gpm
	VFD?:	No
Pump :	**hp:**	75
	Model:	
	Nominal Flow:	868 gpm
	VFD?:	No

Davis Beach Raw Water Pump Station

City of McCall

Water Treatment Plant

Summary:
There are six water pumps at the WTP that provide water to the Upper Pressure Zone and the Eastside Tank. Four water pumps at the WTP provide water to the Upper Pressure Zone from the clearwell. These pumps have different capacities that provide various combinations to supply the distribution system with the desired flow rate. The four pumps are operated to maintain a pressure of 88 psi outside the treatment plant. Two water pumps at the WTP deliver water to the Eastside tank through a designated 12-inch. The water treatment plant has backup power.

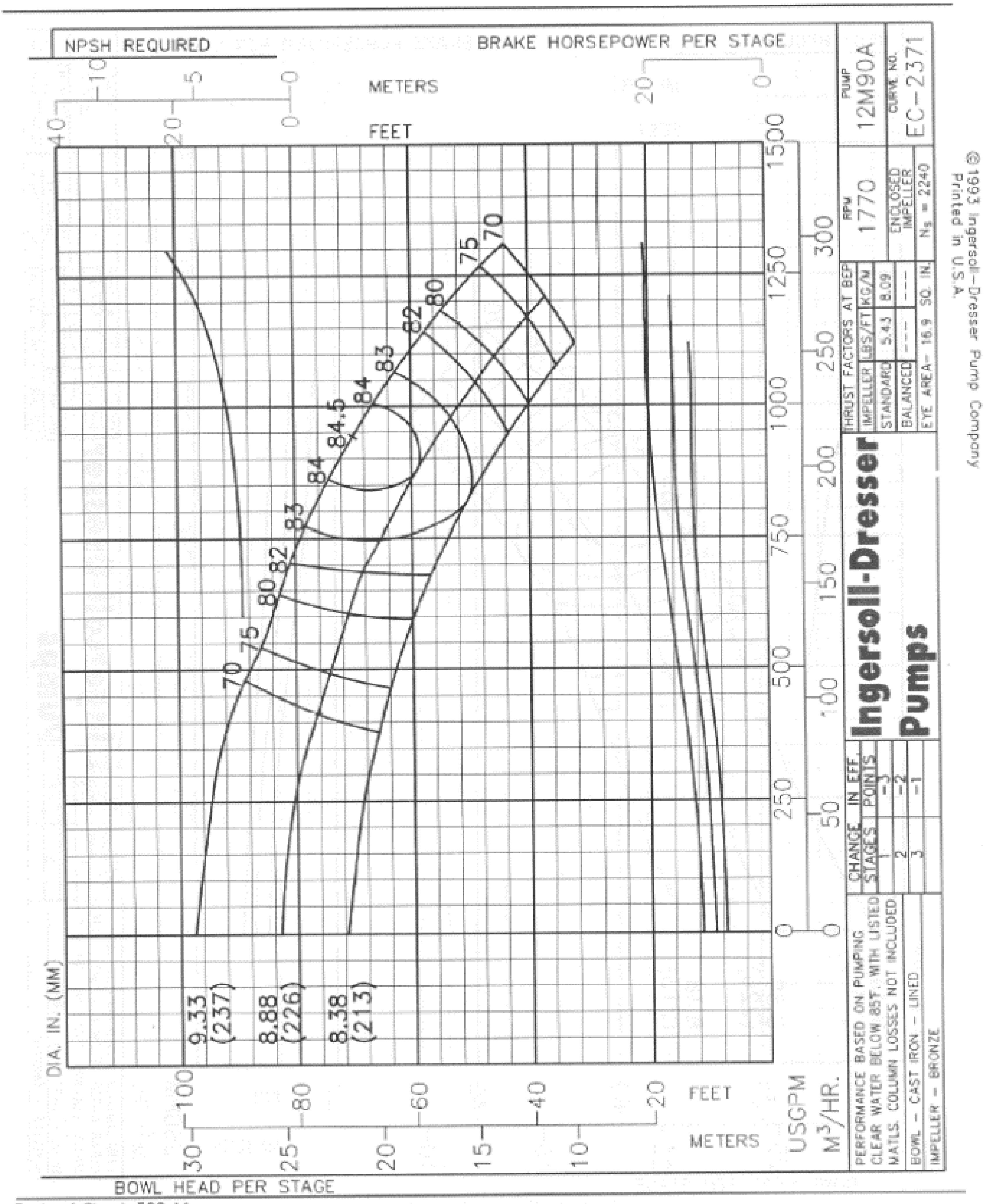
Location:	Lichen Ln		
Latitude:	44 °	54 '	47.02 "
Longitude:	116 °	4 '	12.32 "
Ground Elevation:	5,125 ft		

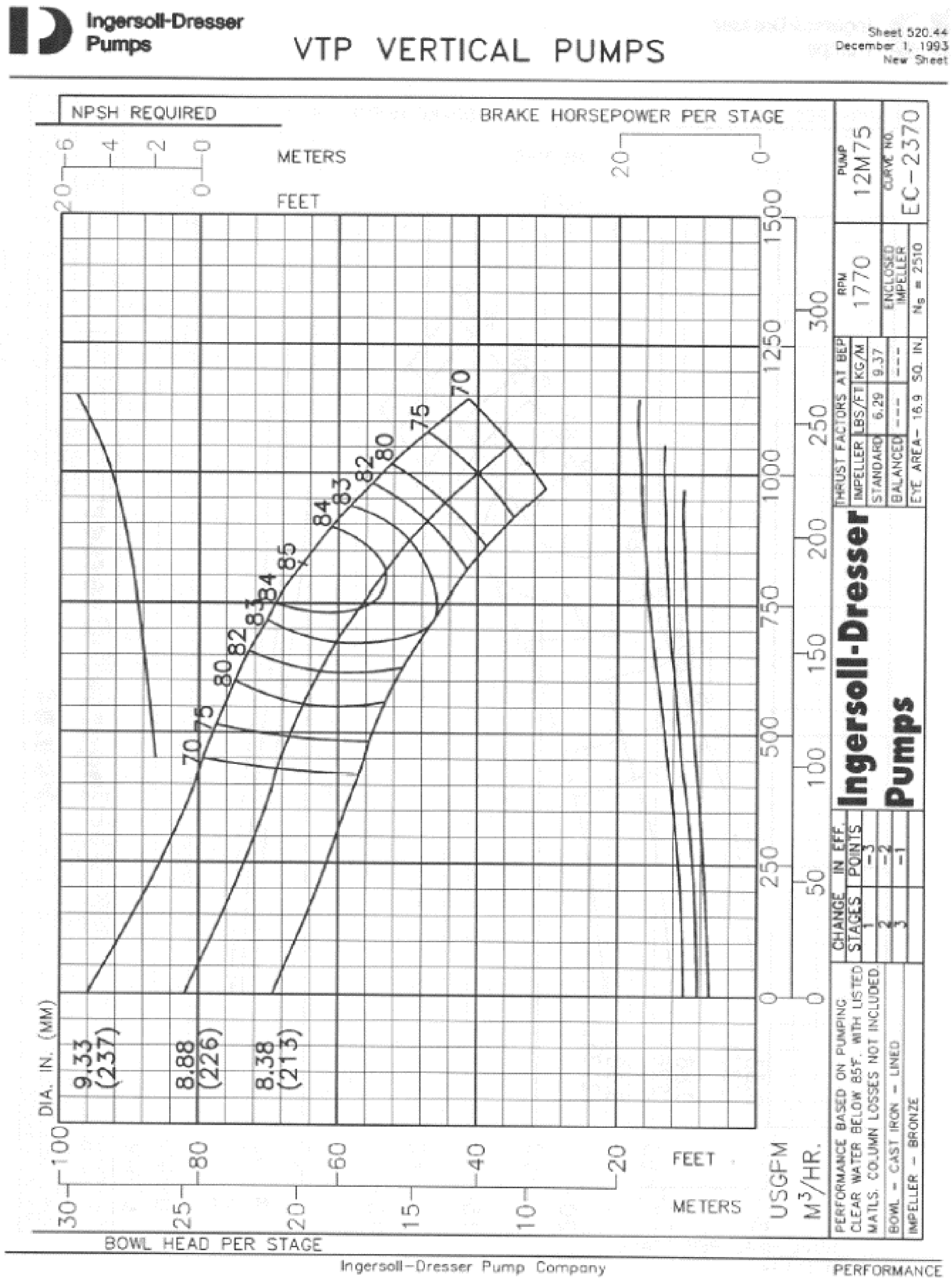
Pump 1 (to tank):	**hp:**	75
	Model:	Ingersoll-Dresser 12M75-4, 3 Stage, 1,800 rpm
	Nominal Flow:	640 gpm
	VFD?:	No
Pump 2 (to tank):	**hp:**	75
	Model:	Ingersoll-Dresser 12M75-4, 3 Stage, 1,800 rpm
	Nominal Flow:	640 gpm
	VFD?:	No
Pump 3 (distribution):	**hp:**	60
	Model:	Ingersoll-Dresser 12M75-4, 3 Stage, 1,800 rpm
	Nominal Flow:	800 gpm
	VFD?:	No
Pump 4 (distribution):	**hp:**	60
	Model:	Ingersoll-Dresser 12M75-4, 3 Stage, 1,800 rpm
	Nominal Flow:	800 gpm
	VFD?:	No
Pump 5 (distribution):	**hp:**	75
	Model:	Ingersoll-Dresser 12M90-4, 3 Stage, 1,800 rpm
	Nominal Flow:	1,100 gpm
	VFD?:	Yes
Pump 6 (distribution):	**hp:**	75
	Model:	Ingersoll-Dresser 12M90-4, 3 Stage, 1,800 rpm
	Nominal Flow:	1,100 gpm
	VFD?:	Yes

Water Treatment Plant


CAUTION
THIS EQUIPMENT IS
CONTROLLED AUTOMATICALL
AND MAY START
AND STOP AT ANY TIME

Ingersoll-Dresser Pumps




Ingersoll-Dresser Pumps
VTP VERTICAL PUMPS
Sheet 520.44
December 1, 1993
New Sheet
NPSH REQUIRED
METERS
FEET
BRAKE HORSEPOWER PER STAGE
PUMP 12M75
RPM 1770
CURVE NO. EC-2370
ENCLOSED IMPELLER
THRUST FACTORS AT BEP
IMPELLER LBS/FT KG/M
STANDARD 6.29 9.37
BALANCED --- ---
EYE AREA- 16.9 SQ. IN.
CHANGE IN EFF.
STAGES POINTS
1 -3
2 -2
3 -1
DIA. IN. (MM)
9.33 (237)
8.88 (226)
8.38 (213)
USGFM
M3/HR.
BOWL HEAD PER STAGE
PERFORMANCE BASED ON PUMPING CLEAR WATER BELOW 85°F. WITH LISTED MAT'LS. COLUMN LOSSES NOT INCLUDED
BOWL - CAST IRON - LINED
IMPELLER - BRONZE
Ingersoll-Dresser Pumps
Printed in U.S.A.
Ingersoll-Dresser Pump Company
PERFORMANCE

Eastside Tank

Summary:
The Eastside tank has a volume of one million gallons and is supplied by two fixed-drive pumps through a designated 12-inch mainline from the water treatment plant. The tank suppplies domestic and fire flow demands to the east side of the water system. The tank was brought online in 2006 and has a diameter of 110-feet and a maximum height of 16-feet. It is the sole water source for the High and Aspen Ridge pressure zones.

Location:	Northeast of High Pressure Zone		
Latitude:	44 °	54 '	62.63 "
Longitude:	116 °	3 '	41.25 "
Ground Elevation:	5,426 ft		

Westside Tank

Summary:
The Westside tank has a volume of 400,000 gallons and is fed by a designated 12-inch mainline from the West of River pressure zone. The tank suppplies domestic and fire flow demands to the west side of the water system. The tank was brought online in 2007 and has a diameter of 68-feet and a maximum height of 15-feet. This tank was designed for the Whitetail Development with limited storage available for fire flow peaking demands in the West of River pressure zone.

Location:	Migratory Bridge Way		
Latitude:	44 °	54 '	44.94 "
Longitude:	116 °	9 '	22.41 "
Ground Elevation:	5,060 ft		

Westside Tank

Knowles Booster Station

Summary:
Knowles Booster Station consists of of three pumps that provide domestic and fire supply from the Main pressure Zone (east of river) to the West of River Pressure Zone through a dedicated 12-inch pipe. Knowles Booster Station has a 150 KW backup generator. The BPS operates to maintain pressure of 80 psi.

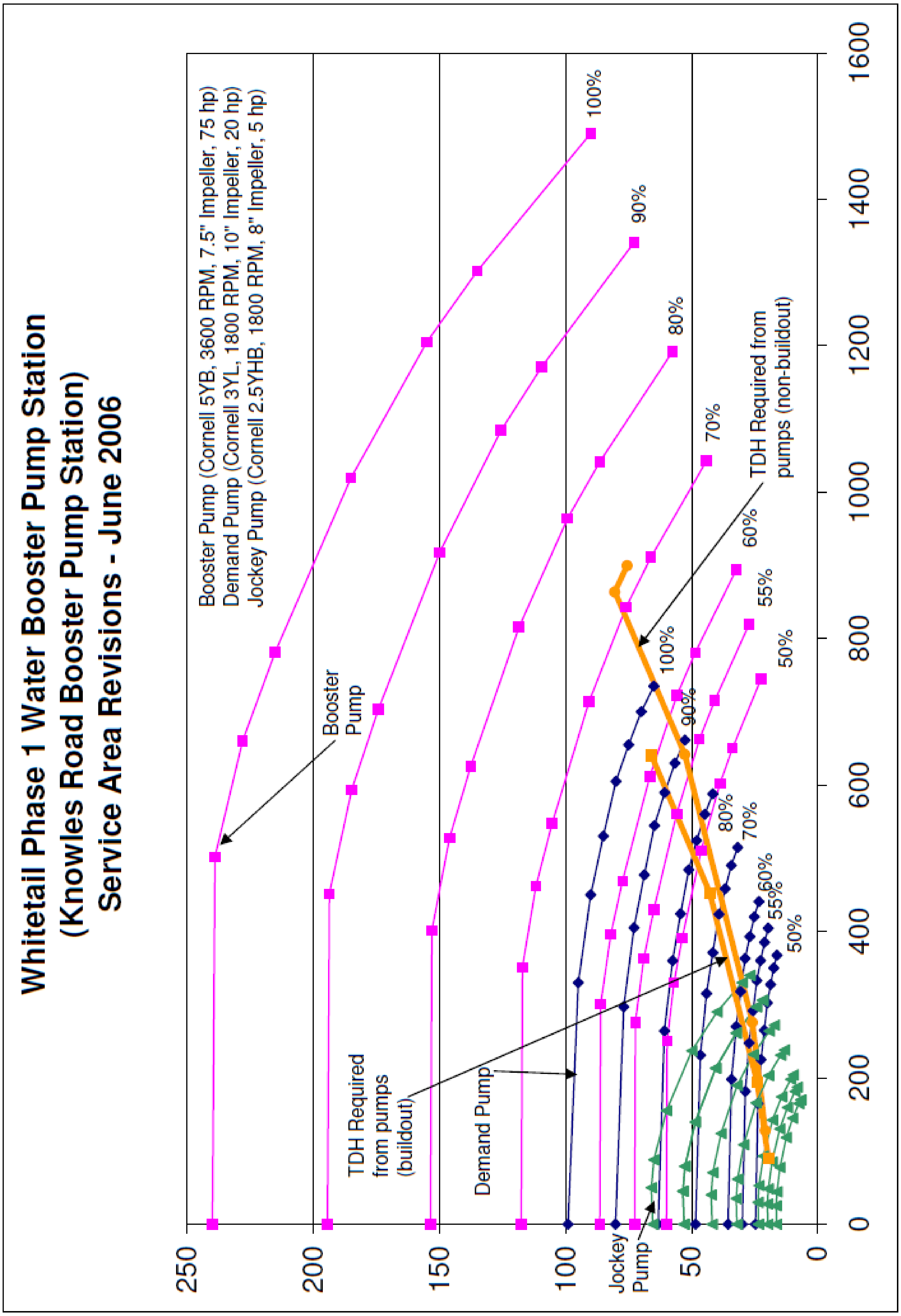
Location:	Lakeside Ave		
Latitude:	44 °	54 '	43.08 "
Longitude:	116 °	7 '	46.01 "
Ground Elevation:	5,060 ft		
Equipment Elevation:	5,063 ft		

Pump 1:	**hp:**	5
	Model:	Cornell 2.5YHB, 1800 RPM, 8" Impeller
	Nominal Flow:	225 gpm
	VFD?:	Yes
Pump 2:	**hp:**	20
	Model:	Cornell 3YL, 1800 RPM, 10" Impeller
	Nominal Flow:	550 gpm
	VFD?:	Yes
Pump 3 (Fire):	**hp:**	75
	Model:	Cornell 5YB, 3600 RPM, 7.5" Impeller
	Nominal Flow:	1,490 gpm
	VFD?:	Yes

Knowles Booster Station

City of McCall

Knowles Booster Station



City of McCall

Betsy's Pond Booster Station

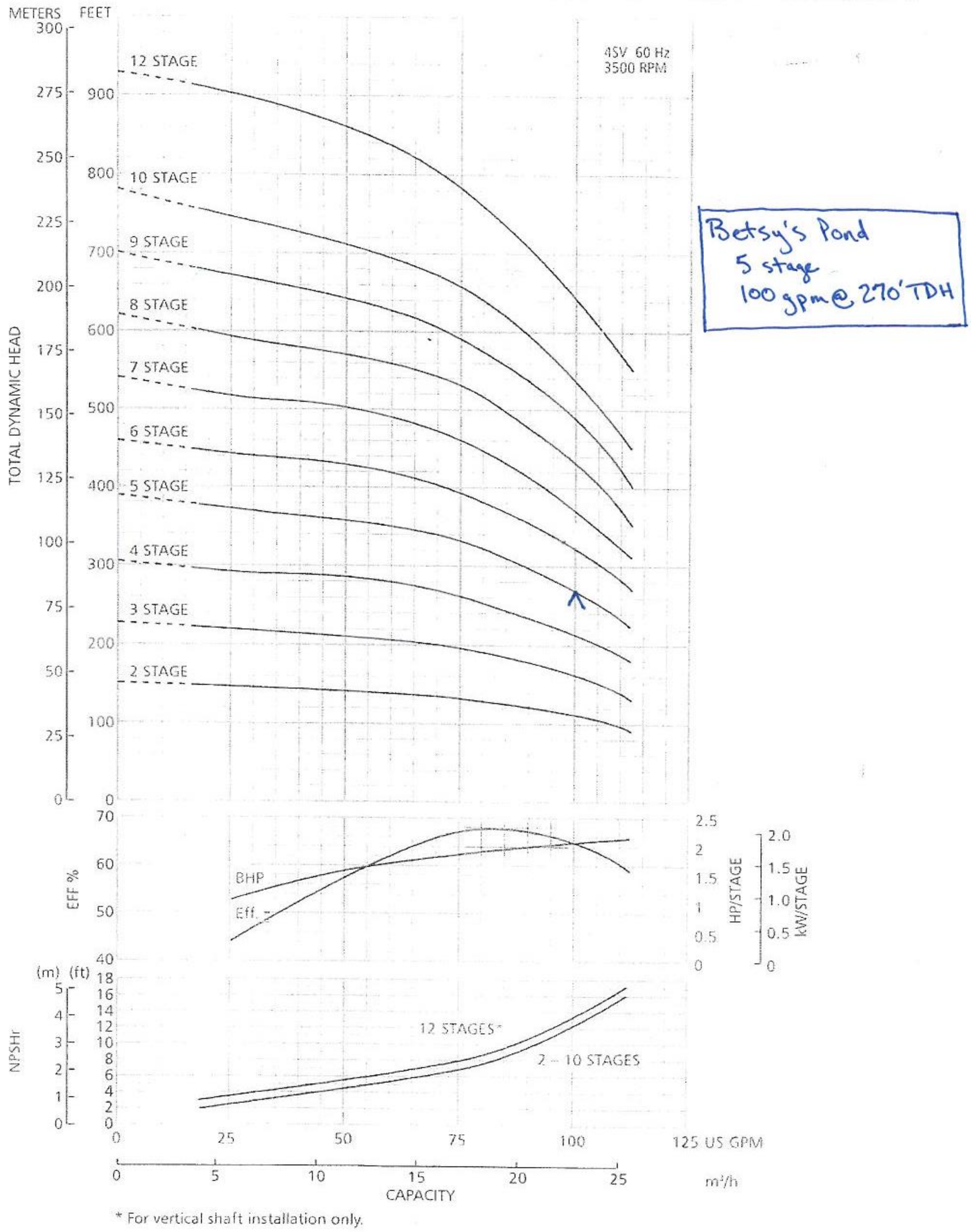
Summary:

Betsey's Pond Booster Station consists of of two pumps that supply water from the West of River pressure zone to the Whitetail tank through a dedicated 12-inch supply pipe. The pumps operate based on the Whitetail tanks levels with a discharge pressure of approximately 60 to 64 psi. The pumps operate at a 91% efficiency. The Booster Station does not require a back-up generator because there is adequate capacity and it does not not directly supply domestic or fire flow.

Location:	Osprey View Dr and Growley Ln			
Latitude:	44 °	54 '	38.57 "	
Longitude:	116 °	9 '	10.27 "	
Ground Elevation:	5,098 ft			
Equipment Elevation:	5,090 ft			

Pump 1:	**hp:**	15
	Model:	Goulds Pump, 4SV, 5-stage, 3500 rpm,
	Nominal Flow:	100 gpm
	VFD?:	No
Pump 2:	**hp:**	15
	Model:	Goulds Pump, 4SV, 5-stage, 3500 rpm,
	Nominal Flow:	100 gpm
	VFD?:	No

4SV Curve



* For vertical shaft installation only.

City of McCall

Westside Booster Station

Summary:

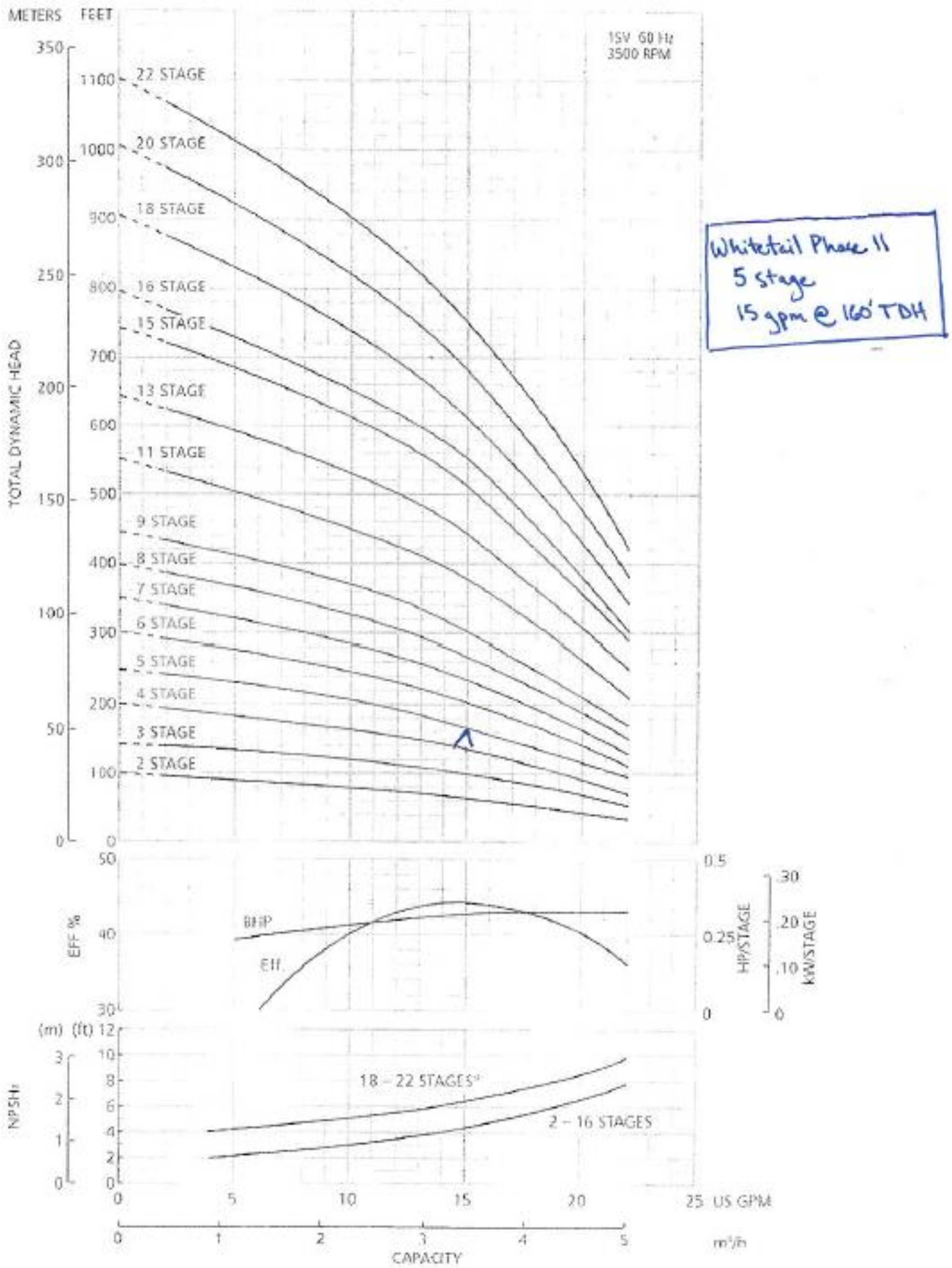
This Booster Station is the only source supplying the WT Phase 2, Zone 1 Pressure Zone. The station includes 4 pumps; a jockey pump, two demand pumps, and a fire pump. The BPS has a 474 kW backup generator.

Location:	Lichen Ln		
Latitude:	44 °	54 '	43.19 "
Longitude:	116 °	9 '	28.75 "
Ground Elevation:	5,425 ft		
Equipment Elevation:	5,430 ft		

Pump 1:	**hp:**	1.5
	Model:	Goulds 1SV, 5 Stage, 3500 rpm
	Nominal Flow:	15 gpm
	VFD?:	Yes
Pump 2:	**hp:**	5
	Model:	Goulds 3SV, 4 Stage, 3500 rpm
	Nominal Flow:	50 gpm
	VFD?:	Yes
Pump :	**hp:**	5
	Model:	Goulds 3SV, 4 Stage, 3500 rpm
	Nominal Flow:	50 gpm
	VFD?:	Yes
Pump 4 (Fire):	**hp:**	100
	Model:	Goulds AC Series 8100 Model 8X8X17F
	Nominal Flow:	1,500 gpm
	VFD?:	No

Westside Booster Station - Pump Curve

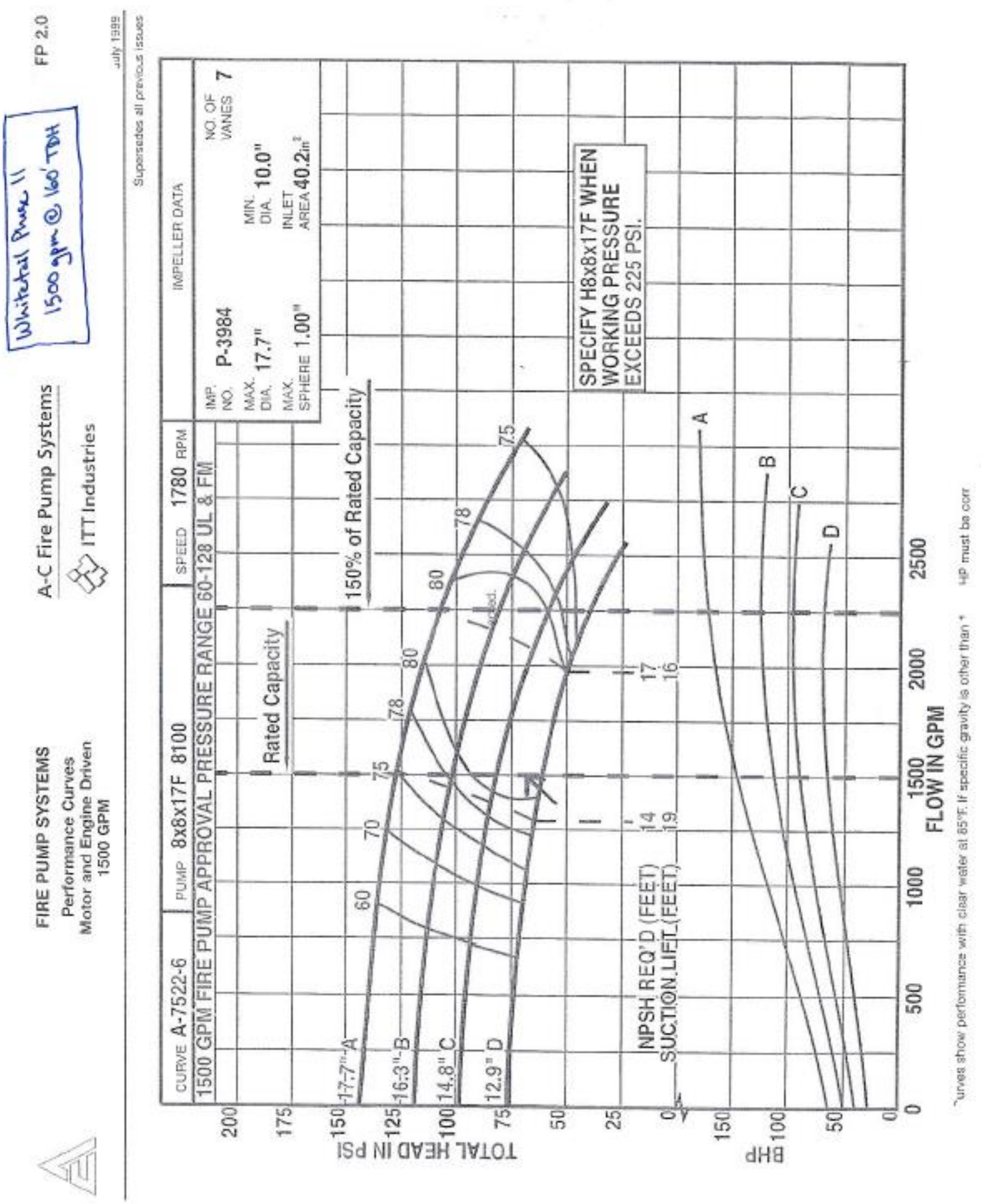
1SV Curve 3500 RPM



* For vertical shaft installation only.

GOULDS PUMPS 19

Westside Booster Station - Pump Curve



APPENDIX B: WATER SYSTEM SUSTAINABILITY

The City of McCall has undertaken efforts to incorporate sustainable practices in its operations and maintenance plans and procedures and in this Water Master Plan. Current city practices that support sustainability of the system include the following:

1. The City maintains a drinking water system capital replacement fund to which the City regularly contributes.
2. Consumption-based pricing for water. The current rate structure includes a base charge and a consumption charge. The City is planning to conduct a rate study after the Water Master Plan is complete to evaluate future rate structures to support the Capital Improvement Plan and ensure that water rates are set to fund the full cost of water delivery and encourage conservation.
3. The City utilizes and maintains a system wide Supervisory Control and Data Acquisition (SCADA) system. As noted in the Capital Improvement Plan in Section 8, the City is planning a complete upgrade of the SCADA system in 2018-2019 to update the system and provide more control and data acquisition features.

The following sustainability practices are addressed in this Water System Master Plan:

1. *Investigate replacing existing broken water meters, upgrading to smart meters, or installing leak detection equipment.*

   The City installed water meters for all connections starting in 1995. Since that time, they have verified the accuracy of a sample of the residential meters in 2005 and found no change in the accuracy of the meters from installation. In recent years the City has started to replace the original meters, and the Capital Improvement Plan includes $40,300 annually to replace approximately 160 meters. This constitutes replacement of 5% of system meters per year to maintain a 20-year meter life cycle.

   AWWA Manual of Water Supply Practices M6 for Water Meters, recommends an ongoing testing program for meters, especially for larger meters as errors in their registration has a greater effect on revenues. The City has a meter testing and replacement program for water meters 1 ½" and larger. replacing the older irrigation meters with more accurate meters to provide a more accurate measure of low flows.

   The City is planning, as part of their conservation program, to install meters on the remaining unmetered water uses. This will provide the City with another tool for identifying unaccounted for water use.

2. *Investigate energy savings from enhanced use of Variable Frequency Drives (VFDs).*

   The Capital Improvement Plan includes a project to investigate and install variable frequency drive (VFD) motor upgrades at the Legacy Park Pump Station. These pumps convey raw water from Payette Lake to the water treatment plant. Currently the flow rate is controlled by adjusting a jet valve at the treatment plant. In discussions with staff it was reported that the valve is set at approximately 10-15% open during lower flow in the winter and approximately 30-40% open during the summer.

   The pumps were originally designed to supply full capacity of the treatment plant at 6.0 mgd, and at that flow rate over 200 feet of head is required to overcome elevation and friction losses. The plant currently operates at an average of 1.1 mgd up to a peak day of 2.8 mgd and requires approximately 100 feet of head.

Installing VFD at the pump station would result in lower power consumption. The first step in the project will be field testing of the pumps to create pump curves for analysis of VFD operation.

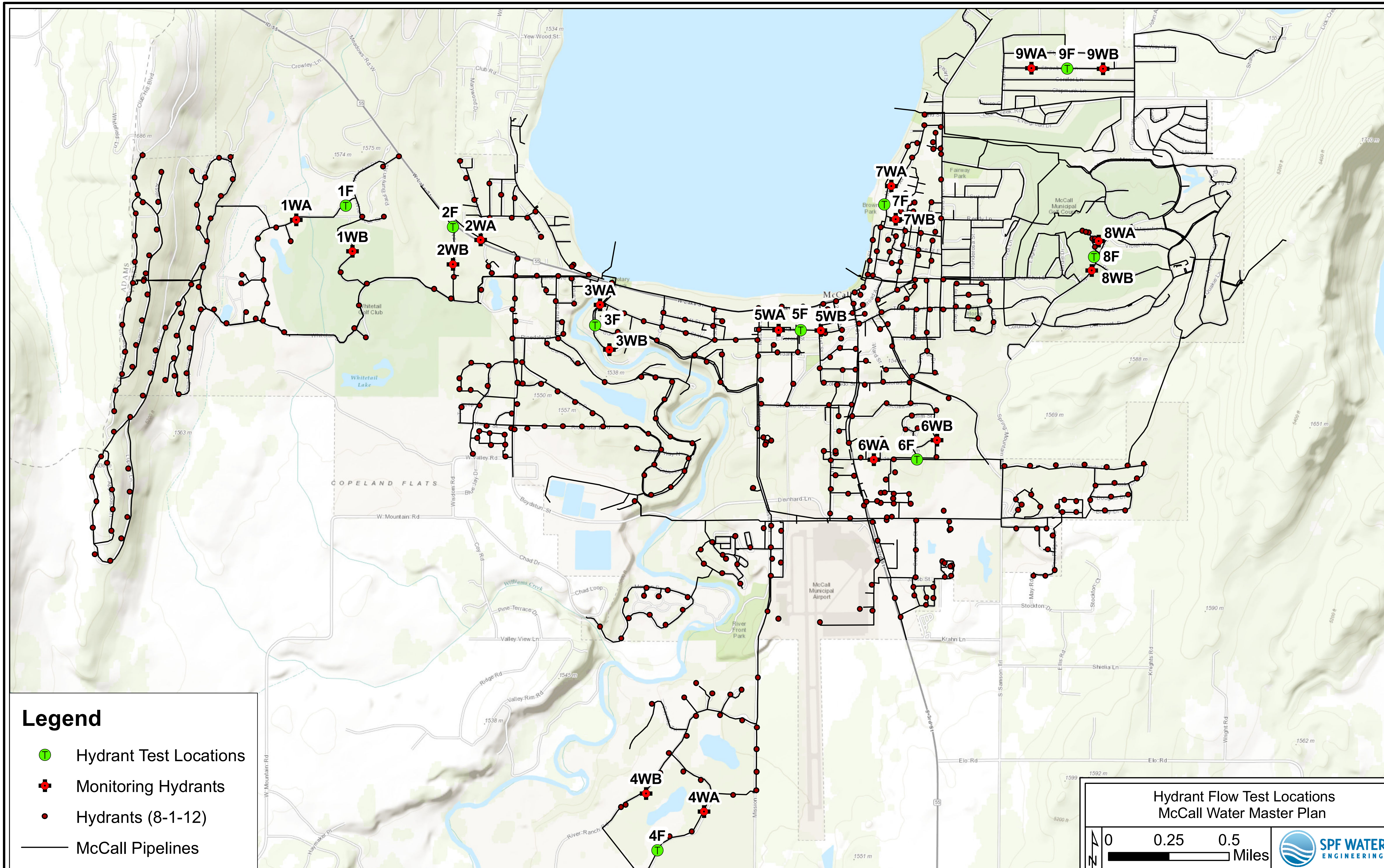
3. *Trenchless or low-impact construction technology.*

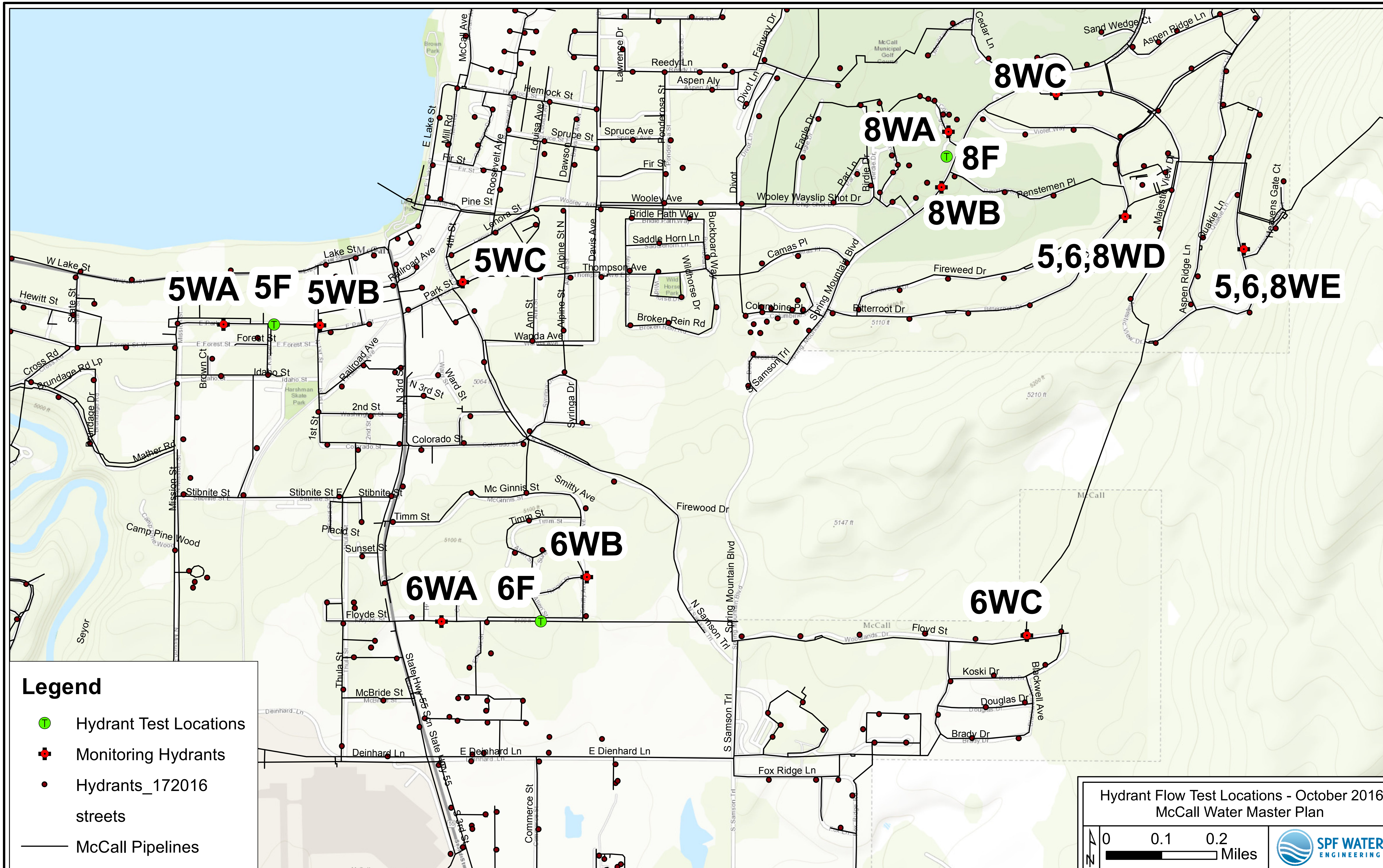
Trenchless pipeline construction is a method of installing, repairing and replacing underground waterline with fewer trenches. Some examples of this construction method include tunneling, boring, jacking, pipe bursting, horizontal directional drilling, and coating and lining systems. Trenchless pipeline construction has the advantage of an environmentally friendly activity with less disruption, a smaller affected area, and minimum excavation. The greatest benefit for trenchless pipeline construction for water distribution pipe installation is in situations where it is undesirable to cut through pavement or to close portions of a roadway such as busy roadways and highways, roadways with new pavement, crossing of rail lines, or crossing of waterways.

Cost and life-cycle costs is often the most important selection criteria. Things to take into consideration when evaluating trenchless pipeline construction projects include:

- Existing services, valves, and fire hydrants that have to be reconnected
- Existing utilities, or rock can interfere or become a problem
- Pipe burst usually allows for one increase in size pipe but no greater

APPENDIX C: HYDRAULIC MODEL


Legend
Hydrant Test Locations
Monitoring Hydrants
Hydrants (8-1-12)
McCall Pipelines
1WA
1F
1WB
2F
2WA
2WB
3WA
3F
3WB
4WB
4WA
4F
5WA
5F
5WB
6WA
6F
6WB
7WA
7F
7WB
8WA
8F
8WB
9WA
9F
9WB
COPELAND FLATS
Whitetail Golf Club
Whitetail Lake
McCall Municipal Airport
River Front Park
McCall Municipal Golf Course
Fairway Park
Hydrant Flow Test Locations
McCall Water Master Plan
0
0.25
0.5
Miles
SPF WATER ENGINEERING



Hydrant Flow Test Locations - October 2016
McCall Water Master Plan
SPF WATER ENGINEERING
0 0.1 0.2 Miles
N
Legend
Hydrant Test Locations
Monitoring Hydrants
Hydrants_172016
streets
McCall Pipelines
5WA
5F
5WB
5WC
6WA
6F
6WB
6WC
8WA
8F
8WB
8WC
5,6,8WD
5,6,8WE
W Lake St
Hewitt St
State St
Forest St
E Forest St
Idaho St
Brown Ct
Cross Rd
Brundage Rd Lp
Brundage Dr
Mather Rd
Mission St
Stibnite St
Stibnite St E
Camp Pine Wood
Seyor
Lake St
Railroad Ave
Park St
1st St
2nd St
N 3rd St
N 3rd St
Ward St
Colorado St
Timm St
Placid St
Sunset St
Floyde St
Thula St
McBride St
Deinhard Ln
E Deinhard Ln
E Dienhard Ln
State Hwy 55
S 3rd St
Commerce St
Mc Ginnis St
Smitty Ave
Firewood Dr
Syringa Dr
Wanda Ave
Ann St
Alpine St
Alpine St N
Davis Ave
Thompson Ave
Broken Rein Rd
Wildhorse Dr
Buckboard Way
Saddle Horn Ln
Bridle Path Way
Wooley Ave
Lenora St
4th St
Pine St
Fir St
Roosevelt Ave
Mill Rd
E Lake St
McCall Ave
Hemlock St
Louisa Ave
Spruce St
Dawson
Spruce Ave
Fir St
Ponderosa St
Lawrence Dr
Reedy Ln
Aspen Aly
Divot Ln
Divot
Fairway Dr
Eagle Dr
Par Ln
Birdie Dr
Wooley Wayslip Shot Dr
Cedar Ln
Sand Wedge Ct
Aspen Ridge Ln
Penstemen Pl
Camas Pl
Columbine Pl
Spring Mountain Blvd
Samson Trl
Fireweed Dr
Bitterroot Dr
Majestic View Dr
Quakie Ln
Heavens Gate Ct
Aspen Ridge Ln
N Samson Trl
Floyd St
Koski Dr
Blackwell Ave
Douglas Dr
Brady Dr
S Samson Trl
Fox Ridge Ln
McCall

Hydrant Tests - June 22, 2016

Flow Test Hydrant	Flowing Hydrant								WA					WB				
	Flow Rate (gpm)	**Flow Rate at 20 psi**	**Pressure @ 1,500 gpm**	**Stc. PSI**	**HGL (ft) (model)**	**Nozzle PSI**	**HGL (ft) (model)**	**Elevation**	**Stc. PSI**	**HGL (ft) (model)**	**Rsdl. PSI**	**HGL (ft) (model)**	**Elevation**	**Stc. PSI**	**HGL (ft) (model)**	**Rsdl. PSI**	**HGL (ft) (model)**	**Elevation**
1	604	n/a	n/a	56	5,158.81	15	5,117.81	5,102.81	62	5150.06	60	5148.06	5,088.06	60	5137.59	45	5138.44	5,093.44
2	680	n/a	n/a	72	5,133.09	19	5,080.09	5,061.09	76	5121.8	62	5107.8	5,045.80	70	5057.7	53	5130.59	5,077.59
3	698	2053	46	79	5,081.33	20	5,022.33	5,002.33	75	5078.31	64	5067.31	5,003.31	80	5105.42	71	5058.7	4,987.70
5	732	1926	38	68	5,087.96	23	5,042.96	5,019.96	74	5088.2	65	5079.2	5,014.20	65	5132.91	60	5085.42	5,025.42
6	795	n/a	49	43	5,122.55	14	5,093.55	5,079.55	58	5103.38	49	5094.38	5,045.38	53	5072.76	45	5112.91	5,067.91
7	643	1614	27	75	5,085.99	26	5,036.99	5,010.99	74	5081.85	66	5073.85	5,007.85	75	5136.31	65	5084.76	5,019.76
8	825	1691	27	54	5,120.44	17	5,083.44	5,066.44	56	5110.92	56	5110.92	5,054.92	50	5075.08	45	5106.31	5,061.31
9	584	1378	12	69	5,089.93	28	5,048.93	5,020.93	70	5090.97	60	5080.97	5,020.97	65	65	59	5084.08	5,025.08

Simulated

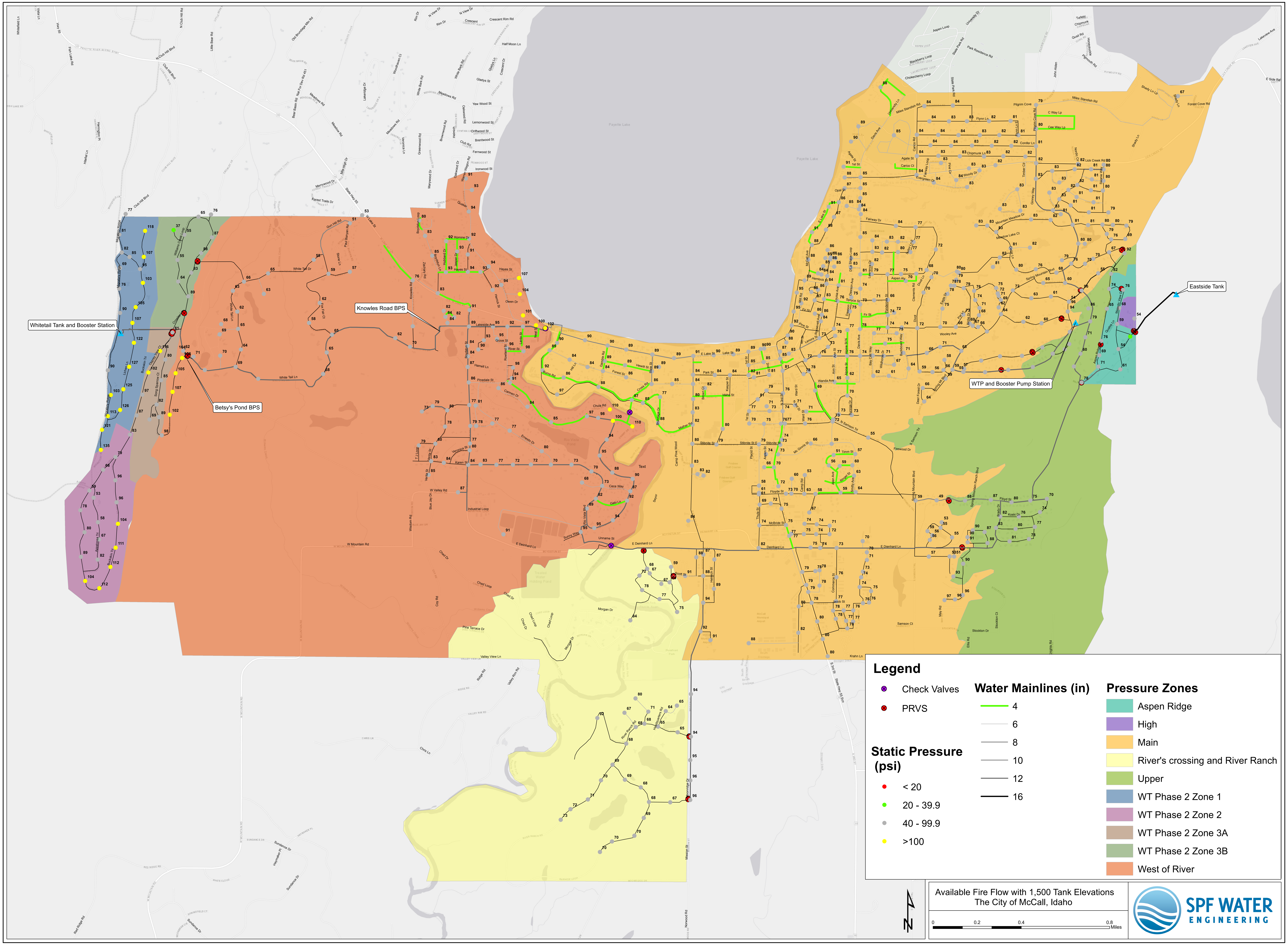
Flow Test Hydrant	Flowing Hydrant								WA					WB				
	Flow Rate (gpm)	**Flow Rate at 20 psi**	**Pressure @ 1,500 gpm**	**Stc. PSI**	**HGL (ft) (model)**	**Rsdl PSI**	**HGL (ft) (model)**	**Elevation**	**Stc. PSI**	**HGL (ft) (model)**	**Rsdl. PSI**	**HGL (ft) (model)**	**Elevation**	**Stc. PSI**	**HGL (ft) (model)**	**Rsdl. PSI**	**HGL (ft) (model)**	**Elevation**
1	604	n/a	n/a	58	5,160.81	49	5,151.81	5,102.81	62	5150.06	56	5144.06	5,088.06	65	5158.44	55	5148.44	5,093.44
2	680	n/a	n/a	76	5,137.09	55	5,116.09	5,061.09	83	5128.8	66	5111.8	5,045.80	69	5146.59	56	5133.59	5,077.59
3	698	n/a	n/a	87	5,089.33	75	5,077.33	5,002.33	80	5083.31	72	5075.31	5,003.31	92	5079.7	83	5070.7	4,987.70
5	732	n/a	n/a	79	5,098.96	75	5,094.96	5,019.96	79	5093.2	75	5089.2	5,014.20	77	5102.42	73	5098.42	5,025.42
6	795	n/a	n/a	54	5,133.55	51	5,130.55	5,079.55	69	5114.38	67	5112.38	5,045.38	59	5126.91	57	5124.91	5,067.91
7	795	n/a	n/a	83	5,093.99	77	5,087.99	5,010.99	84	5091.85	78	5085.85	5,007.85	79	5098.76	75	5094.76	5,019.76
8	643	n/a	n/a	62	5,128.44	57	5,123.44	5,066.44	64	5118.92	62	5116.92	5,054.92	60	5121.31	58	5119.31	5,061.31
9	825	n/a	n/a	79	5,099.93	74	5,094.93	5,020.93	79	5099.97	74	5094.97	5,020.97	77	5102.08	73	5098.08	5,025.08

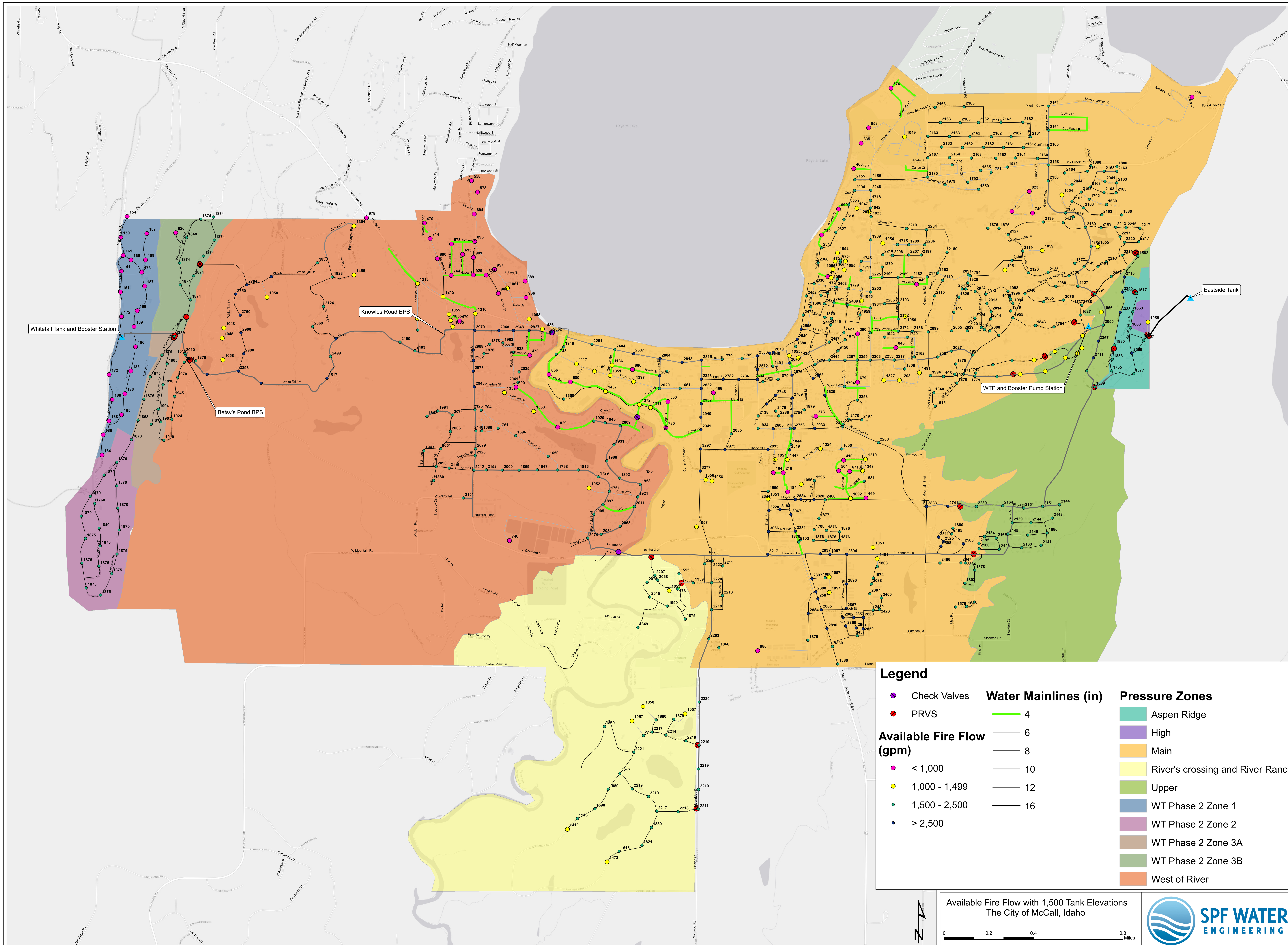
Hydrant Tests - November, 29, 2016

Flow Test Hydrant	Flowing Hydrant								WA					WB (test 8 - 8C)				
	Flow Rate (gpm)	Flow Rate at 20 psi	Pressure @ 1,500 gpm	Stc. PSI	HGL (ft) (model)	Nozzle PSI	HGL (ft) (model)	Elevation	Stc. PSI	HGL (ft) (model)	Rsdl. PSI	HGL (ft) (model)	Elevation	Stc. PSI	HGL (ft) (model)	Rsdl. PSI	HGL (ft) (model)	Elevation
5	732	2398	57	83	5,061.09	22	5,041.96	5,019.96	85	5099.2	84	5098.2	5,014.20	78	5145.91	76	5,101.42	5,025.42
6	584	n/a	105	53	5,061.09	13.5	5,093.05	5,079.55	70	5115.38	69	5114.38	5,045.38	62	5123.31	62	5,129.91	5,067.91
8	662	1167	-4	60	5,061.09	18	5,084.44	5,066.44	65	5119.92	64	5118.92	5,054.92	56	5,117.31	46	5107.31	5,061.31

Simulated Hydrant Tests - November, 29, 2016

Flow Test Hydrant	Flowing Hydrant								WA					WB (test 8 - 8C)				
	Flow Rate (gpm)	Flow Rate at 20 psi	Pressure @ 1,500 gpm	Stc. PSI	HGL (ft) (model)	Nozzle PSI	HGL (ft) (model)	Elevation	Stc. PSI	HGL (ft) (model)	Rsdl. PSI	HGL (ft) (model)	Elevation	Stc. PSI	HGL (ft) (model)	Rsdl. PSI	HGL (ft) (model)	Elevation
5	732	n/a	n/a	84	5,061.09	77	5,096.96	5,019.96	84	5098.2	78	5092.2	5,014.20	82	5149.91	75	5100.42	5,025.42
6	584	n/a	n/a	58	5,061.09	53	5,132.55	5,079.55	73	5118.38	68	5113.38	5,045.38	63	5124.31	58	5125.91	5,067.91
8	662	n/a	n/a	67	5,061.09	59	5,125.44	5,066.44	71	5125.92	65	5119.92	5,054.92	65	5,126.31	59	5120.31	5,061.31


Whitetail Tank and Booster Station
Knowles Road BPS
Betsy's Pond BPS
Eastside Tank
WTP and Booster Pump Station
Legend
Check Valves
PRVS
Static Pressure (psi)
< 20
20 - 39.9
40 - 99.9
>100
Water Mainlines (in)
4
6
8
10
12
16
Pressure Zones
Aspen Ridge
High
Main
River's crossing and River Ranch
Upper
WT Phase 2 Zone 1
WT Phase 2 Zone 2
WT Phase 2 Zone 3A
WT Phase 2 Zone 3B
West of River
Available Fire Flow with 1,500 Tank Elevations
The City of McCall, Idaho
0 0.2 0.4 0.8 Miles
N
SPF WATER ENGINEERING



Whitetail Tank and Booster Station
Betsy's Pond BPS
Knowles Road BPS
Eastside Tank
WTP and Booster Pump Station
Legend
Check Valves
PRVS
Available Fire Flow (gpm)
< 1,000
1,000 - 1,499
1,500 - 2,500
> 2,500
Water Mainlines (in)
4
6
8
10
12
16
Pressure Zones
Aspen Ridge
High
Main
River's crossing and River Ranch
Upper
WT Phase 2 Zone 1
WT Phase 2 Zone 2
WT Phase 2 Zone 3A
WT Phase 2 Zone 3B
West of River
Available Fire Flow with 1,500 Tank Elevations
The City of McCall, Idaho
0 0.2 0.4 0.8 Miles
N
SPF WATER ENGINEERING

APPENDIX D: MASTER PIPE IMPROVEMENT LIST

Pipe Upgrade Priority List							
Pipe Diameter (in)	Pipe Material	Pipe Length (ft)	Age	Street Location	Existing Low Fire Flow (gpm)	Priority Level (5-High, 1-Low)	Estimated Replacement Cost[1]
4		190	Oldest 50+ Years	Brown Dr	468	5	35,000
4	CIP	1,162	Oldest 50+ Years	Burns Rd / Mather Rd	656	5	211,000
4	CIP	1,314	Oldest 50+ Years	Mather Rd	730	5	238,000
4	Transite	1,570	Oldest 50+ Years	N 3rd St	184	4	285,000
4	CIP	235	Oldest 50+ Years	Sunset St	184	4	43,000
4	CIP	620	Oldest 50+ Years	Alpine St	390	4	113,000
4	CIP	562	Oldest 50+ Years	University Ln	574	4	102,000
4	CIP	1,030	Oldest 50+ Years	University Ln	574	4	187,000
6	CIP	934	Oldest 50+ Years	Davis Ave	574	4	170,000
4	CIP	792	Oldest 50+ Years	Hubard Dr	673	4	144,000
4	CIP	292	Oldest 50+ Years	Romine Dr	673	4	53,000
4	CIP	263	Oldest 50+ Years	Romine Dr	673	4	48,000
4	CIP	268	Oldest 50+ Years	Hayes St	744	4	49,000
4	CIP	256	Oldest 50+ Years	Hayes St	744	4	47,000
4	CIP	182	Oldest 50+ Years	Hayes St	744	4	33,000
4	CIP	740	Oldest 50+ Years	Saddlehorn Ln	846	4	134,000
6	CIP	1,354	Oldest 50+ Years	W Forest St	1117	4	246,000
4	CIP	856	Oldest 50+ Years	Mather Rd	1311	4	155,000
6	CIP	1,208	Oldest 50+ Years	W Forest St	1351	4	219,000
6	DI	689	Oldest 50+ Years	Davis Ave		4	125,000
6	DI	625	Oldest 50+ Years	Davis Ave		4	114,000
6	CIP	640	Oldest 50+ Years	Davis Ave		4	116,000
4	CIP	458	Oldest 50+ Years	Washington St	373	3	83,000
4	CIP	1,107	Oldest 50+ Years	Timm St / Alpine St	410	3	201,000
4	CIP	400	Oldest 50+ Years	Diamond St	466	3	73,000
4	CIP	306	Oldest 50+ Years	Boydstun Loop	470	3	56,000
4	CIP	394	Oldest 50+ Years	River St	470	3	72,000
4	CIP	309	Oldest 50+ Years	Allen Ave	504	3	56,000
4		1,075	Oldest 50+ Years	Brundage Dr	550	3	195,000
6	CIP	264	Oldest 50+ Years	Warren Wagon Rd	558	3	48,000
6	CIP	180	Oldest 50+ Years	Westshore Pl	578	3	33,000
4	CIP	464	Oldest 50+ Years	Sunset St	671	3	84,000
4	CIP	622	Oldest 50+ Years	Alpine St	679	3	113,000
4	CIP	895	Oldest 50+ Years	Burns Rd / Mather Rd	680	3	162,000
6	CIP	1,248	Oldest 50+ Years	Warren Wagon Rd	694	3	226,000
4	CIP	787	Oldest 50+ Years	Jasper Dr	695	3	143,000
6	CIP	675	Oldest 50+ Years	Boydstun Ln	714	3	123,000
4	CIP	1,399	Oldest 50+ Years	E Lake St	720	3	254,000
6	CIP	1,726	Oldest 50+ Years	Timber Cir	731	3	313,000
6	CIP	774	Oldest 50+ Years	Timber Cir	731	3	141,000
6	PVC	2,606	Oldest 50+ Years	Waste Water Treatment Plant	746	3	472,000
4	CIP	2,365	Oldest 50+ Years	Rio Vista Blvd	829	3	429,000
6	CIP	424	Oldest 50+ Years	Boydstun Ln	890	3	77,000
6	CIP	866	Oldest 50+ Years	Warren Wagon Rd	895	3	157,000
4	CIP	360	New	Hayes St	929	3	66,000
6	CIP	351	Oldest 50+ Years	Warren Wagon Rd	957	3	64,000
6	CIP	349	Oldest 50+ Years	Owen Dr	966	3	64,000
6	CIP	1,861	Oldest 50+ Years	Buckboard Way / Broke Rein Rd / Bay Colt Way	1208	3	337,000
4	CIP	877	Oldest 50+ Years	W Lake St	1215	3	159,000
4		878	Oldest 50+ Years	Idaho St		3	159,000
4	DI	317	Oldest 50+ Years	2nd St		3	58,000
4	DI	408	Oldest 50+ Years	US Bank Alley		3	74,000
4	DI	394	Oldest 50+ Years	Thrift Store Alley		3	72,000
6	PVC	169	Oldest 50+ Years	2nd St		3	31,000
8	DI	322	Oldest 50+ Years	1st St		3	59,000
8	PVC	499	Oldest 50+ Years	E Park St		3	91,000
8	DI	239	Oldest 50+ Years	1st St		3	44,000
4	CIP	624	Oldest 50+ Years	Wooley Ave		3	114,000
4	CIP	707	Oldest 50+ Years	State St		3	128,000
4	CIP	545	Oldest 50+ Years	Cross Rd		3	99,000
4	CIP	499	Oldest 50+ Years	Mather Rd		3	91,000
6	DI	719	Oldest 50+ Years	1st St		3	131,000
6	DI	759	Oldest 50+ Years	Colorado St		3	138,000
6	DI	296	Oldest 50+ Years	1st St		3	54,000
6	DI	178	Oldest 50+ Years	Hemlock St		3	33,000
6	DI	142	Oldest 50+ Years	1st St		3	26,000
6	CIP	803	Oldest 50+ Years	Washington St		3	146,000

Pipe Upgrade Priority List

Pipe Diameter (in)	Pipe Material	Pipe Length (ft)	Age	Street Location	Existing Low Fire Flow (gpm)	Priority Level (5-High, 1-Low)	Estimated Replacement Cost[1]
6	DI	638	Oldest 50+ Years	Hemlock St		3	116,000
6		197	New	Ponderosa State Park Loop	835	2	36,000
6		633	New	Ponderosa State Park Loop	835	2	115,000
6		332	New	Ponderosa State Park Loop	835	2	61,000
6		279	New	Ponderosa State Park Loop	835	2	51,000
6		89	New	Ponderosa State Park Loop	835	2	17,000
4	PVC	852	Old 20+ Years	Aspen Alley	849	2	155,000
4	DI	1,149	Old 20+ Years	Hewitt St	886	2	208,000
6	PVC	508	Old 20+ Years	Whipkey St	889	2	92,000
8	PVC	500	New	Herrick St	901	2	91,000
8	C900	694	New	Boydstun St	909	2	126,000
6	PVC	1,191	Old 20+ Years	SVC Road	980	2	216,000
6	C900	240	Oldest 50+ Years	Dawson Ave	1045	2	44,000
6	PVC	510	Oldest 50+ Years	Cece Way	1052	2	93,000
6	CIP	272	Oldest 50+ Years	Suiter Ln	1054	2	50,000
6	CIP	1,188	Oldest 50+ Years	W Lake St / Warren Wagon Rd	1061	2	216,000
6	CIP	376	Oldest 50+ Years	Warren Wagon Rd	1061	2	69,000
4	CIP	619	Oldest 50+ Years	Gamble Rd	1186	2	113,000
6	CIP	675	Oldest 50+ Years	W Lake St	1213	2	123,000
6	CIP	1,097	Oldest 50+ Years	Knowles Rd	1213	2	199,000
6	CIP	2,430	Oldest 50+ Years	McGinnis St	1219	2	440,000
4	CIP	918	Oldest 50+ Years	Mather Rd	1372	2	167,000
6	CIP	1,742	Oldest 50+ Years	Bay Colt / Bridle Path Way / Buckboard Way		2	316,000
6	CIP	1,293	Oldest 50+ Years	Davis Ave		2	235,000
6	CIP	497	Oldest 50+ Years	Davis Ave		2	90,000
6	CIP	620	Oldest 50+ Years	Davis Ave		2	113,000
6	CIP	533	Oldest 50+ Years	Davis Ave		2	97,000
6	CIP	711	Oldest 50+ Years	Wildhorse Dr		2	129,000
4		323	New	Whitetail - Unnamed Road	1055	1	59,000
6		413	New	Whitetail - Unnamed Road	1055	1	75,000
8	PVC	143	Old 20+ Years	Ponderosa Ave		1	26,000
4	CIP	192	Oldest 50+ Years	Alley off N Mission St		1	35,000
4	CIP	565	Oldest 50+ Years	Between Cammy and Cross		1	103,000
4	CIP	329	Oldest 50+ Years	Spruce St		1	60,000
4	CIP	444	Oldest 50+ Years	Wanda Ave		1	81,000
4	CIP	292	Oldest 50+ Years	Louisa Ave		1	53,000
4	CIP	867	Oldest 50+ Years	Floyde St		1	157,000
4	CIP	263	Oldest 50+ Years	Ringle St		1	48,000
4	CIP	528	Oldest 50+ Years	Moore Ave		1	96,000
4	GAL	615	Oldest 50+ Years	Carico Ct		1	112,000
4	CIP	2,133	Oldest 50+ Years	Cee Way Loop		1	387,000
4	CIP	810	Oldest 50+ Years	Gabi Ln		1	147,000
4		1,076	Oldest 50+ Years	W Lake St		1	195,000
4	CIP	482	Oldest 50+ Years	Ringel St		1	88,000
4	Transite	274	Oldest 50+ Years	Reedy Ln		1	50,000
4	CIP	1,046	Oldest 50+ Years	N Samson Trl		1	190,000
4	CIP	268	Oldest 50+ Years	Allen Ave		1	49,000
4	CIP	218	Oldest 50+ Years	Spruce St		1	40,000
4	CIP	327	Oldest 50+ Years	Spruce St		1	60,000
4	CIP	384	Oldest 50+ Years	Shore Lodge		1	70,000
4	CIP	173	Oldest 50+ Years	Neal St		1	32,000
4	CIP	792	Oldest 50+ Years	High School		1	144,000
4	CIP	349	Oldest 50+ Years	Cammy Dr		1	64,000
4	CIP	576	Oldest 50+ Years	N 3rd St		1	105,000
4	CIP	139	Oldest 50+ Years	Cammy Dr		1	26,000
6	CIP	1,334	Oldest 50+ Years	E Lake St		1	242,000
6	CIP	625	Oldest 50+ Years	Ann St		1	114,000
6	CIP	1,520	Oldest 50+ Years	Lick Creek Rd		1	276,000
6	CIP	539	Oldest 50+ Years	Between N Samson Trl and McGinnis St		1	98,000
6	CIP	666	Oldest 50+ Years	N Samson Trl		1	121,000
6	CIP	1,401	Oldest 50+ Years	Evergreen Dr		1	254,000
6	CIP	252	Oldest 50+ Years	Spruce Ln		1	46,000
6	CIP	278	Oldest 50+ Years	Pine Cir		1	51,000
6	CIP	468	Oldest 50+ Years	Woody Dr		1	85,000
6		850	Oldest 50+ Years	Fairway Loop		1	154,000
6	CIP	4,349	Oldest 50+ Years	Pilgrim Cove to Shady Ln Loop		1	788,000
6	CIP	698	Oldest 50+ Years	Cece Way		1	127,000

Pipe Upgrade Priority List

Pipe Diameter (in)	Pipe Material	Pipe Length (ft)	Age	Street Location	Existing Low Fire Flow (gpm)	Priority Level (5-High, 1-Low)	Estimated Replacement Cost[1]
6	CIP	2,349	Oldest 50+ Years	Ernesto Dr / Gena Way		1	426,000
6	CIP	663	Oldest 50+ Years	Ernesto Dr		1	121,000
6	CIP	222	Oldest 50+ Years	W Lake St		1	41,000
6	CIP	255	Oldest 50+ Years	Pinedale St		1	47,000
6	CIP	1,116	Oldest 50+ Years	Carmen Dr		1	202,000
6	CIP	541	Oldest 50+ Years	Ernesto Dr		1	98,000
6	CIP	448	Oldest 50+ Years	Pinedale St		1	82,000
6		562	Oldest 50+ Years	Between Ernesto Dr and Gena Way		1	102,000
6	CIP	398	Oldest 50+ Years	Smitty Ave		1	73,000
6	CIP	257	Oldest 50+ Years	Smitty Ave		1	47,000
6	CIP	663	Oldest 50+ Years	Davis Ave		1	121,000
6	CIP	175	Oldest 50+ Years	Pine Cir		1	32,000
6	DI	1,081	Oldest 50+ Years	Wanda Ave		1	196,000
6		1,104	Oldest 50+ Years	Shady Ln Loop		1	200,000
6	CIP	257	Oldest 50+ Years	Lick Creek Rd		1	47,000
6	CIP	1,102	Oldest 50+ Years	Lick Creek Rd		1	200,000
6	CIP	690	Oldest 50+ Years	Davis Ave		1	125,000
6	DI	389	Oldest 50+ Years	E Lake St		1	71,000
6	DI	401	Oldest 50+ Years	Lenora St		1	73,000
6	CIP	416	Oldest 50+ Years	Boydstun Loop		1	76,000
6	CIP	345	Oldest 50+ Years	Rowland St		1	63,000
6	CIP	374	Oldest 50+ Years	Rowland St		1	68,000
6	CIP	329	Oldest 50+ Years	Rowland St		1	60,000
6	CIP	861	Oldest 50+ Years	Evergreen Dr		1	156,000
6	DI	371	Oldest 50+ Years	Lenora St		1	68,000
6	DI	301	Oldest 50+ Years	E Lake St		1	55,000
6	CIP	210	Oldest 50+ Years	Rowland St		1	39,000
8	CIP	973	Oldest 50+ Years	Reedy Ln		1	177,000
8	CIP	1,521	Oldest 50+ Years	Fairway Dr		1	276,000
8	CIP	1,461	Oldest 50+ Years	Suiter Ln		1	265,000
8	CIP	377	Oldest 50+ Years	Reedy Ln		1	69,000
8	CIP	359	Oldest 50+ Years	Suiter Ln		1	65,000
8	CIP	1,344	Oldest 50+ Years	Lick Creek Rd		1	244,000
	Total	117,120				Total	$21,287,000

[1] Cost estimates are calculated from linear-foot estimates shown in Table 36.

APPENDIX E: WATER RIGHTS DOCUMENTS

2000 OCT 31 PM 02:00
DISTRICT COURT - SRBA
TWIN FALLS CO., IDAHO
FILED ____________

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE
STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA	)	PARTIAL DECREE PURSUANT TO
	)	I.R.C.P. 54(b) FOR
Case No. 39576	)	
	)	Water Right 65-10344

NAME AND ADDRESS: CITY OF MC CALL
PO BOX 2720
BOISE, ID 83701

SOURCE: BIG PAYETTE LAKE TRIBUTARY: PAYETTE RIVER, NORTH FORK

QUANTITY: 5.13 CFS

PRIORITY DATE: 06/01/1918

POINT OF DIVERSION: T18N R03E S04 LOT 03 (SWSE) Within Valley County
S08 LOT 02 (SENW)
S09 LOT 02 (NESW)

PURPOSE AND PERIOD OF USE:

PURPOSE OF USE	PERIOD OF USE	QUANTITY
Municipal	01-01 TO 12-31	5.13 CFS

PLACE OF USE:
OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

THIS PARTIAL DECREE IS SUBJECT TO SUCH GENERAL PROVISIONS NECESSARY FOR THE DEFINITION OF THE RIGHTS OR FOR THE EFFICIENT ADMINISTRATION OF THE WATER RIGHTS AS MAY BE ULTIMATELY DETERMINED BY THE COURT AT A POINT IN TIME NO LATER THAN THE ENTRY OF A FINAL UNIFIED DECREE. I.C. SECTION 42-1412(6).

RULE 54(b) CERTIFICATE

With respect to the issues determined by the above judgment or order, it is hereby CERTIFIED, in accordance with Rule 54(b), I.R.C.P., that the court has determined that there is no just reason for delay of the entry of a final judgment and that the court has and does hereby direct that the above judgment or order shall be a final judgment upon which execution may issue and an appeal may be taken as provided by the Idaho Appellate Rules.

B Wood
Barry Wood
Administrative District Judge
Presiding Judge of the
Snake River Basin Adjudication

2000 OCT 31 PM 02:00
DISTRICT COURT - SRBA
TWIN FALLS CO., IDAHO
FILED ____________

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA	)	PARTIAL DECREE PURSUANT TO
	)	I.R.C.P. 54(b) FOR
Case No. 39576	)	
	)	Water Right 65-10345

NAME AND ADDRESS: CITY OF MC CALL
PO BOX 2720
BOISE, ID 83701

SOURCE: BIG PAYETTE LAKE TRIBUTARY: PAYETTE RIVER, NORTH FORK

QUANTITY: 2.31 CFS

PRIORITY DATE: 06/01/1968

POINT OF DIVERSION: T18N R03E S04 LOT 03 (SWSE) Within Valley County
S08 LOT 02 (SENW)
S09 LOT 02 (NESW)

PURPOSE AND PERIOD OF USE:

PURPOSE OF USE	PERIOD OF USE	QUANTITY
Municipal	01-01 TO 12-31	2.31 CFS

PLACE OF USE:

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

THIS PARTIAL DECREE IS SUBJECT TO SUCH GENERAL PROVISIONS NECESSARY FOR THE DEFINITION OF THE RIGHTS OR FOR THE EFFICIENT ADMINISTRATION OF THE WATER RIGHTS AS MAY BE ULTIMATELY DETERMINED BY THE COURT AT A POINT IN TIME NO LATER THAN THE ENTRY OF A FINAL UNIFIED DECREE. I.C. SECTION 42-1412(6).

RULE 54(b) CERTIFICATE

With respect to the issues determined by the above judgment or order, it is hereby CERTIFIED, in accordance with Rule 54(b), I.R.C.P., that the court has determined that there is no just reason for delay of the entry of a final judgment and that the court has and does hereby direct that the above judgment or order shall be a final judgment upon which execution may issue and an appeal may be taken as provided by the Idaho Appellate Rules.

B Wood

Barry Wood
Administrative District Judge
Presiding Judge of the
Snake River Basin Adjudication

2000 NOV 03 PM 02:00
DISTRICT COURT - SRBA
TWIN FALLS CO., IDAHO
FILED ____________

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA)	PARTIAL DECREE PURSUANT TO
)	I.R.C.P. 54(b) FOR
Case No. 39576)	
)	Water Right 65-12607

NAME AND ADDRESS: CITY OF MC CALL
PO BOX 2720
BOISE, ID 83701

SOURCE: BIG PAYETTE LAKE TRIBUTARY: PAYETTE RIVER, NORTH FORK

QUANTITY: 3.88 CFS

PRIORITY DATE: 03/29/1983

POINT OF DIVERSION: T18N R03E S04 LOT 03 (SWSE) Within Valley County
S08 LOT 02 (SENW)
S09 LOT 02 (NESW)

PURPOSE AND PERIOD OF USE:

PURPOSE OF USE	PERIOD OF USE	QUANTITY
Municipal	01-01 TO 12-31	3.88 CFS

PLACE OF USE:

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

THE AVAILABILITY OF WATER FOR THIS RIGHT IS SUBJECT TO ALL PRIOR WATER RIGHTS OF LAKE RESERVOIR COMPANY.

THIS PARTIAL DECREE IS SUBJECT TO SUCH GENERAL PROVISIONS NECESSARY FOR THE DEFINITION OF THE RIGHTS OR FOR THE EFFICIENT ADMINISTRATION OF THE WATER RIGHTS AS MAY BE ULTIMATELY DETERMINED BY THE COURT AT A POINT IN TIME NO LATER THAN THE ENTRY OF A FINAL UNIFIED DECREE. I.C. SECTION 42-1412(6).

RULE 54(b) CERTIFICATE

With respect to the issues determined by the above judgment or order, it is hereby CERTIFIED, in accordance with Rule 54(b), I.R.C.P., that the court has determined that there is no just reason for delay of the entry of a final judgment and that the court has and does hereby direct that the above judgment or order shall be a final judgment upon which execution may issue and an appeal may be taken as provided by the Idaho Appellate Rules.

B Wood

Barry Wood
Administrative District Judge
Presiding Judge of the
Snake River Basin Adjudication

IRRIGATION WATER RIGHT DOCUMENTS

State of Idaho
Department of Water Resources

WATER RIGHT LICENSE

WATER RIGHT NO. 65-13119

Priority: November 17, 1989 | Maximum Diversion Rate: 0.28 CFS
Maximum Diversion Volume: 24.0 AF

This is to certify, that MC CALL GOLF COURSE FOUNDATION
PO BOX 187
MC CALL ID 83638 has complied with the terms and conditions of the permit, issued pursuant to Application for Permit dated November 8, 1989; and has submitted Proof of Beneficial Use on August 12, 1992. An examination indicates that the works have a diversion capacity of 0.300 cfs of water from a GROUNDWATER source, and a water right has been established as follows:

BENEFICIAL USE	PERIOD OF USE	RATE OF DIVERSION	ANNUAL VOLUME
IRRIGATION	04/15 to 10/15	0.28 CFS	24.0 AF

LOCATION OF POINT(S) OF DIVERSION: NENW , Sec. 10, Township 18N, Range 03E
VALLEY County

PLACE OF USE: IRRIGATION

TWN RGE SEC		ACRES	ACRES	ACRES	TOTAL
18N 03E 10	NENW	8			8

Total number of acres irrigated: 8

CONDITIONS OF APPROVAL AND REMARKS

1. The maximum diversion volume is defined as the maximum allowable volume of water that may be diverted annually from the source under this right. The use of water confirmed by this right is limited to the amount which can actually be beneficially used. The maximum diversion volume may be adjusted to more accurately describe the beneficial use or to implement accepted standards of diversion and use efficiency.
2. This water right is appurtenant to the described place of use.
3. This right is subject to all prior water rights and may be forfeited by five years of non-use.
4. Modifications to or variance from this license must be made within the limits of Section 42-222, Idaho Code, or the applicable Idaho law.
5. This right when combined with all other rights shall provide no more than .04 cfs per acre nor more than 3.0 afa per acre for the lands above.

State of Idaho
Department of Water Resources

WATER RIGHT LICENSE

WATER RIGHT NO. 65-13119

This license is issued pursuant to the provisions of Section 42-219, Idaho Code. Witness the seal and signature of the Director, affixed at Boise, this 8TH day of NOVEMBER, 1995.

Acting for KARL J. DREHER, Director

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13476

Priority: August 20, 1993

Maximum Diversion Rate: 1.81 CFS
Maximum Diversion Volume: 505.0 AF

It is hereby certified that CITY OF MC CALL
216 EAST PARK ST
MC CALL ID 83638 has complied with the terms and conditions of the permit, issued pursuant to Application for Permit dated August 20, 1993; and has submitted Proof of Beneficial Use on September 30, 1996. An examination confirms water is diverted from:

SOURCE
GROUND WATER

and a water right has been established as follows:

BENEFICIAL USE	PERIOD OF USE	DIVERSION RATE	ANNUAL DIVERSION VOLUME
DIVERSION TO STORAGE	01/01 to 12/31	1.81 CFS	
IRRIGATION FROM STORAGE	04/15 to 10/31		25.0 AF
RECREATION STORAGE	01/01 to 12/31		25.0 AF
IRRIGATION STORAGE	01/01 to 12/31		25.0 AF
IRRIGATION	04/15 to 10/31	1.81 CFS	480.0 AF

LOCATION OF POINTS OF DIVERSION:

GROUND WATER SW1/4SW1/4 Sec. 3, Twp 18N, Rge 03E, B.M., VALLEY County
GROUND WATER NW1/4NE1/4 Sec. 10, Twp 18N, Rge 03E, B.M., VALLEY County
GROUND WATER NE1/4NW1/4 Sec. 10, Twp 18N, Rge 03E, B.M., VALLEY County

PLACE OF USE: IRRIGATION FROM STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											18.0	19.0					37.0
18N 03E 4																20.0	20.0
18N 03E 9	1.0																1.0
18N 03E 10		14.0	5.0		20.0	25.0	13.0	10.0	11.0					4.0			102.0

Total Acres: 160

PLACE OF USE: RECREATION STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											X	X					
18N 03E 10	X	X															

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13476

PLACE OF USE: IRRIGATION STORAGE

Twp	Rge	Sec	NE				NW				SW				SE				
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N	03E	3											X	X					
18N	03E	10	X	X															

PLACE OF USE: IRRIGATION

Twp	Rge	Sec	NE				NW				SW				SE				
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N	03E	3											18.0	19.0					37.0
18N	03E	4																20.0	20.0
18N	03E	9	1.0																1.0
18N	03E	10		14.0	5.0		20.0	25.0	13.0	10.0	11.0					4.0			102.0

Total Acres: 160

CONDITIONS OF APPROVAL

1. Rights 65-13119, 65-13476 and 65-13796 when combined for irrigation purposes, shall not exceed a total diversion rate of 1.81 cfs, a total annual maximum diversion volume of 480.0 af at the field headgate, and the irrigation of 160 acres.

2. This right when combined with all other rights shall provide no more than 0.02 cfs per acre nor more than 3.0 afa per acre at the field headgate for irrigation of the place of use.

3. This right when combined with all other storage rights shall provide no more than 5.0 afa per acre at the field headgate for irrigation of the place of use.

4. The following rights are diverted through points of diversion described above: 65-13476 & 65-13796. Right No. 65-13119 is also diverted from point of diversion located in NENW, S10, T18N, R03E.

5. Recreation storage use is for fishing.

6. Rights 65-13476 and 65-13796 authorize the diversion of an annual total of 65 acre feet to be used for the initial filling of multiple ponds (40 acre feet capacity) and for partial refill of the ponds (25 acre feet). Each right covers a portion of the capacity volume and a portion of the refill volume.

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13476

7. After specific notification by the Department, the right holder shall install a suitable measuring device or shall enter into an agreement with the Department to use power records to determine the amount of water diverted and shall annually report the information to the Department.

8. The issuance of this right does not grant any right-of-way or easement across the land of another.

This license is issued pursuant to the provisions of Section 42-219, Idaho Code. The water right confirmed by this license is subject to all prior water rights and shall be used in accordance with Idaho law and applicable rules of the Department of Water Resources.

Signed this 16th day of January, 2014.

John Westra

JOHN WESTRA
Western Regional Manager

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13796

Priority: June 29, 1998

Maximum Diversion Rate: 1.81 CFS
Maximum Diversion Volume: 520.0 AF

It is hereby certified that CITY OF MC CALL
216 EAST PARK ST
MC CALL ID 83638 has complied with the terms and conditions of the permit, issued pursuant to Application for Permit dated June 29, 1998; and has submitted Proof of Beneficial Use on November 18, 2003. An examination confirms water is diverted from:

SOURCE

GROUND WATER

and a water right has been established as follows:

BENEFICIAL USE	PERIOD OF USE	DIVERSION RATE	ANNUAL DIVERSION VOLUME
IRRIGATION FROM STORAGE	04/15 to 10/31		40.0 AF
RECREATION STORAGE	01/01 to 12/31		40.0 AF
DIVERSION TO STORAGE	01/01 to 12/31	1.81 CFS	
IRRIGATION STORAGE	01/01 to 12/31		40.0 AF
IRRIGATION	04/15 to 10/31	1.81 CFS	480.0 AF

LOCATION OF POINTS OF DIVERSION:

GROUND WATER SW1/4SW1/4 Sec. 3, Twp 18N, Rge 03E, B.M., VALLEY County
GROUND WATER NW1/4NE1/4 Sec. 10, Twp 18N, Rge 03E, B.M., VALLEY County
GROUND WATER NE1/4NW1/4 Sec. 10, Twp 18N, Rge 03E, B.M., VALLEY County

PLACE OF USE: IRRIGATION FROM STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											18.0	19.0					37.0
18N 03E 4																20.0	20.0
18N 03E 9	1.0																1.0
18N 03E 10		14.0	5.0		20.0	25.0	13.0	10.0	11.0					4.0			102.0

Total Acres: 160

PLACE OF USE: RECREATION STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											X	X					
18N 03E 10	X	X															

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13796

PLACE OF USE: IRRIGATION STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											X	X					
18N 03E 10	X	X															

PLACE OF USE: IRRIGATION

Twp Rge Sec	NE				NW				SW				SE				
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
18N 03E 3											18.0	19.0					37.0
18N 03E 4																20.0	20.0
18N 03E 9	1.0																1.0
18N 03E 10		14.0	5.0		20.0	25.0	13.0	10.0	11.0					4.0			102.0

Total Acres: 160

CONDITIONS OF APPROVAL

1. Rights 65-13119, 65-13476 and 65-13796 when combined for irrigation purposes, shall not exceed a total diversion rate of 1.81 cfs, a total annual maximum diversion volume of 480.0 af at the field headgate, and the irrigation of 160 acres.

2. This right when combined with all other rights shall provide no more than 0.02 cfs per acre nor more than 3.0 afa per acre at the field headgate for irrigation of the lands above.

3. This right when combined with all other storage rights shall provide no more than 5.0 afa per acre at the field headgate for irrigation of the place of use.

4. The following rights are diverted through points of diversion described above: 65-13476 & 65-13796. Right No. 65-13119 is also diverted from point of diversion located in NENW, S10, T18N, R03E.

5. Recreation storage use is for fishing.

6. Rights 65-13476 and 65-13796 authorize the diversion of an annual total of 65 acre feet to be used for the initial filling of multiple ponds (40 acre feet capacity) and for partial refill of the ponds (25 acre feet). Each right covers a portion of the capacity volume and a portion of the refill volume.

7. After specific notification by the department, the right holder shall install a suitable measuring device or shall enter into an agreement with the department to determine the amount of water diverted from power records and shall annually report the information to the department.

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 65-13796

8. This right does not grant any right-of-way or easement across the land of another.

9. When ordered by the Director, the right holder shall provide mitigation acceptable to the Director to offset depletion of lower Snake River flows needed for migrating anadromous fish. The amount of water required for mitigation, which is to be released into the Snake River or a tributary for this purpose, will be determined by the Director based upon the reduction in flow caused by the use of water pursuant to this right. Any order of the Director issued in accordance with this paragraph shall be in conformance with applicable rules allowing the right holder due process as the need for mitigation and the amount of mitigation are determined.

This license is issued pursuant to the provisions of Section 42-219, Idaho Code. The water right confirmed by this license is subject to all prior water rights and shall be used in accordance with Idaho law and applicable rules of the Department of Water Resources.

Signed this 16th day of January, 2014.

John Westra

JOHN WESTRA
Western Regional Manager

APPENDIX F: CROSS CONNECTION CONTROL PROGRAM

APPENDIX F

CROSS CONNECTION CONTROL PROGRAM

The City of McCall maintains a Cross Connection Control Program established by City Code Sections 5 and 8. Pertinent sections of City Code are presented below:

6-2-170: METER REQUIRED:

All water service connections shall be metered with a water meter at or near the curb stop between the curb stop and the improvements on the premises, in a meter pit meeting the standard established by the Public Works Department, and equipped with a remote electronic data transmission device.

(A) The City shall install meters on all existing services not currently metered. The owner of the premises to which the service is provided or to be provided shall permit City crews to enter the premises for purposes of making the installation at a reasonable time during City working hours; any owner who fails to cooperate with the City in this regard shall, at the option of the City, be subject to:

1. Disconnection of the service; or

2. Billing for the water service at twice the average bill for users of the same class and/or to prosecution.

(B) All construction to which a service connection is made after the effective date hereof shall be equipped at the owner's expense with:

1. A water meter meeting City specifications located in the meter pit; and

2. A remote, electronic data transmission device also meeting City specifications. Such specifications shall be obtained from the Public Works Director.

(C) All water use connections or taps to the user service shall be drawn downstream (on the user side) of the meter, including, but not limited to, lawn irrigation. Existing taps on services positioned upstream of the meter shall be modified at owner expense to comply with this subsection.

(D) Cross-connections are strictly prohibited, and any service with a cross-connection or potential cross-connection shall be protected by a backflow prevention device acceptable to the Public Works Director.

8-8-3: CROSS-CONNECTIONS:

No water service connection to any premises shall be installed or continued in use by the purveyor unless the water supply is protected by backflow prevention devices as may be required by this Chapter. The installation or maintenance of a cross-connection which will endanger the water quality of the potable water supply of the City shall be unlawful and is prohibited. Any such cross-connection now existing or hereafter installed is hereby declared to be a public nuisance and the same shall be abated. The control or elimination of cross-connections shall be in accordance with this Chapter, together with the latest addition of appropriate manuals of standard practice pertaining to cross-connection control approved by the Idaho State Department of Health. The Building Official shall have the authority to establish requirements more stringent than State regulations if he deems that the conditions so dictate. The purveyor shall adopt rules and regulations as necessary to carry out the provisions of this Chapter.

8-8-4: USE OF BACKFLOW PREVENTION DEVICES:

(A) Backflow prevention devices shall be installed at the ties on the premises or the materials used in connection with service connection or within any premises where, in the judgment of the purveyor, the nature and extent of activities, or the materials stored on the premises, would present an immediate and dangerous hazard to health and/or be deleterious to the quality of the water should a cross-connection occur; even though such cross-connection does not exist at the time the backflow prevention devices shall be installed under circumstances including but not limited to the following:

1. Premises having an auxiliary water supply, unless the quality of the auxiliary supply is in compliance with Idaho State Department of Health regulations and is acceptable to the purveyor.

2. Premises having internal cross-connections that are not correctable, or intricate plumbing arrangements which make it impracticable to ascertain whether or not cross-connections exist.

3. Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist.

4. Premises having a repeated history of cross-connections being established or reestablished.

5. Premises on which any substance is handled under pressure so as to permit entry into the public water supply or where a cross-connection could reasonably be expected to occur. This shall include the handling of process waters and cooling waters.

6. Premises where materials of a toxic or hazardous nature are handled in such a way that if back siphonage should occur, a serious health hazard might result.

7. The following types of facilities will fall into one of the above categories where a backflow prevention device is required to protect the public water supply. A backflow prevention device shall be installed at these facilities unless the purveyor and Building Official determine that no hazard exists:

    (a) Hospitals, mortuaries, clinics

    (b) Laboratories

(c) Metal plating industries

(d) Piers and docks

(e) Sewage treatment plants

(f) Food or beverage processing plants

(g) Chemical plants using a water process

(h) Petroleum processing or storage plants

(i) Radioactive material processing plants or nuclear reactors

(j) Others specified by the Idaho State Department of Health

8. Other premises, as specified by the Building Official where backflow prevention devices are required to protect the public water supply.

(B) The type of protective device required shall depend on the degree of hazard which exists:

1. An air-gap separation or a reduced pressure principal backflow prevention device shall be installed where the public water supply may be contaminated with sewage, industrial waste of a toxic nature, or other contaminant which could cause a health or system hazard.

(a) In the case of a substance which may be objectionable but not hazardous to health, a double check valve assembly, air-gap separation, or a reduced pressure principal backflow prevention device shall be installed.

(C) Backflow prevention devices required by this Chapter shall be installed at the meter, at the property line of the premises when meters are not used, or at a location designated by the purveyor. The device shall be located so as to be readily accessible for maintenance and testing, and furthermore, where no part of the device will be submerged.

(D) Backflow prevention devices required by this Chapter shall be installed under the supervision of, and with the approval of the purveyor.

(E) Any protective device required by this Chapter shall be a model approved by the Building Official. A double check valve assembly or a reduced pressure principal backflow prevention device will be approved if it has successfully passed performance tests of the University of Southern California Engineering Center or the testing laboratories satisfactory to the State of Idaho and the Building Official. These devices shall be furnished and installed by and at the expense of the customer.

(F) Backflow prevention devices installed pursuant to this Chapter, except atmospheric vacuum breakers, shall be inspected and tested annually, or more often if necessary. Inspections, tests and maintenance shall be at the customer's expense. Whenever the devices are found to be defective, they shall be repaired, overhauled or replaced at the customer's expense.

Inspections, tests, repairs and records thereof shall be accomplished under the purveyor's supervision by certified testers.

(G) No underground sprinkling device will be installed without adequate backflow prevention devices at the point from which the water for irrigation is taken from the public water supply.

(H) Failure of the customer to cooperate in the installation, maintenance, testing or inspection of backflow prevention devices required by this Chapter shall be grounds for the termination of water service to the premises, or, in the alternative, the installation of an air-gap separation at the customer's expense.

8-8-5: CROSS-CONNECTION INSPECTION:

(A) No water shall be delivered to any structure hereafter built within the City or within areas served by City water until the same shall have been inspected by the purveyor for possible cross-connection and been approved as being free of same.

(B) Any construction for industrial or other purposes which is classified as hazardous facilities pursuant to subsection 8-8-4(A)7 of this Chapter, where it is reasonable to anticipate intermittent cross-connections, or as determined by the Building Official shall be protected by the installation of one or more backflow prevention devices at the point of service from the public water supply or any other location designated by the purveyor.

(C) Inspections shall be made periodically of all buildings, structures, or improvements of any nature now receiving water through the City's system, for the purpose of ascertaining whether cross-connections exist. Such inspections shall be made by the purveyor.

8-8-6: INSTALLATION PERMITS:

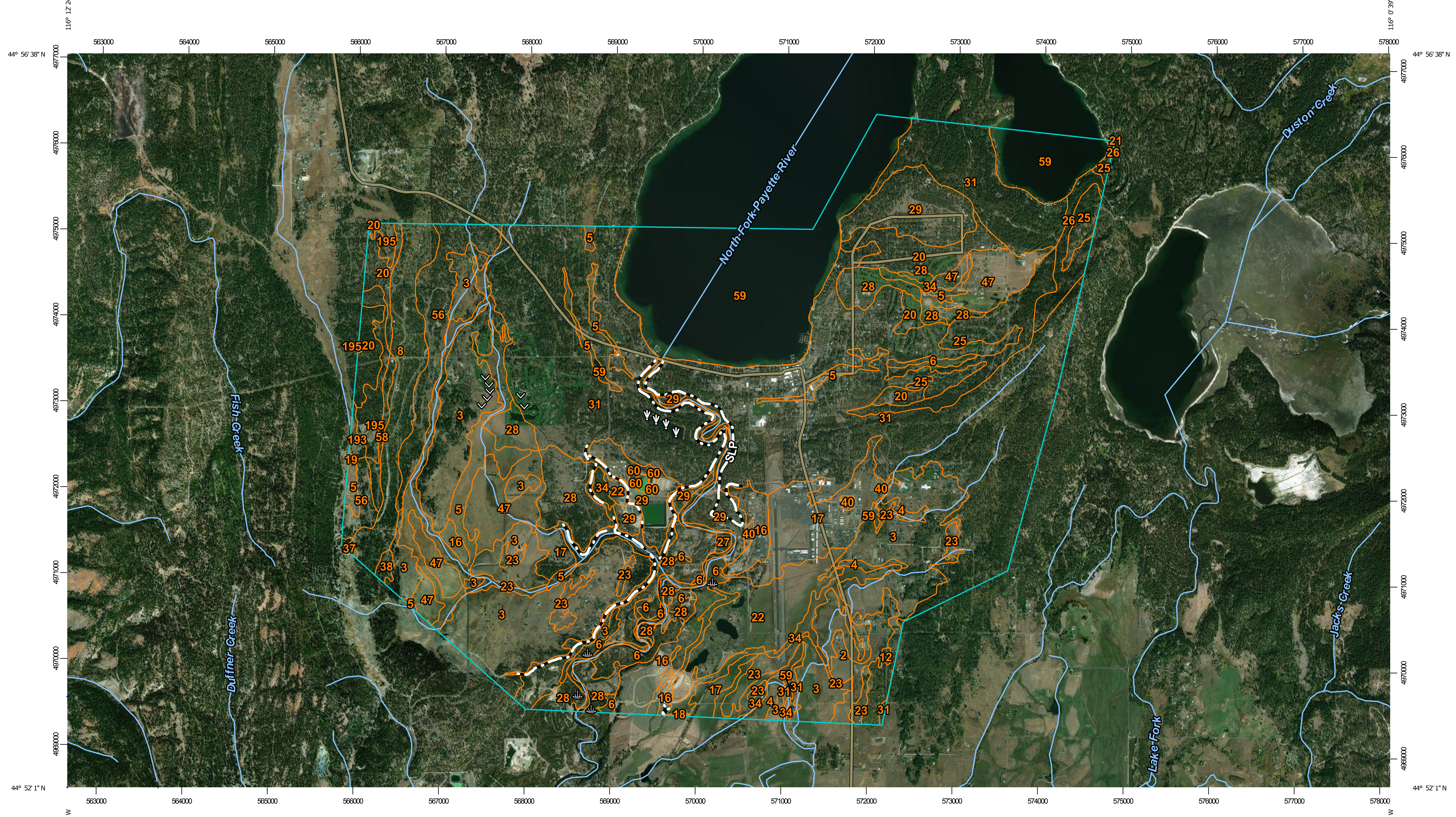
If cross-connection control devices are found to be necessary, the owner of the property served must apply to the purveyor for a specific installation permit.

8-8-7: ADDITIONAL REMEDIES:

In the event an improper cross-connection is not corrected within the time limit set by the Building Official or in the event the purveyor is refused access to any property for the purpose of determining whether or not cross-connections exist; delivery of water to the property shall cease until the deficiency is corrected to the purveyor's satisfaction. In addition, the purveyor may affect the necessary repairs or modification at the expense of the property owner and refuse delivery of water to the property until the cost thereof shall have been paid.

APPENDIX G: ENVIRONMENTAL CONDITIONS

Soil Map—Adams-Washington Area, Parts of Adams and Washington Counties, Idaho; and Valley Area, Idaho, Parts of Adams and Valley Counties



Map Scale: 1:41,600 if printed on B landscape (17" x 11") sheet.

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 2000, 4000, 8000, 12000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Adams-Washington Area, Parts of Adams and Washington Counties, Idaho
Survey Area Data: Version 13, Sep 13, 2017

Soil Survey Area: Valley Area, Idaho, Parts of Adams and Valley Counties
Survey Area Data: Version 15, Sep 11, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 4, 2012—Nov 15, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Blackwell clay loam, 0 to 5 percent slopes	2.0	0.0%
20	Bluebell cobbly loam, 5 to 35 percent slopes	118.6	1.1%
193	Swede loam, 4 to 12 percent slopes	15.7	0.1%
195	Ticanot very cobbly loam, 4 to 65 percent slopes	104.9	0.9%
Subtotals for Soil Survey Area		**241.1**	**2.1%**
Totals for Area of Interest		**11,274.7**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Archabal loam, 2 to 4 percent slopes	100.0	0.9%
3	Archabal loam, 4 to 12 percent slopes	1,549.8	13.7%
4	Archabal loam, 12 to 20 percent slopes	55.0	0.5%
5	Blackwell clay loam	411.5	3.6%
6	Blackwell mucky silt loam	147.6	1.3%
8	Bluebell cobbly loam, 5 to 35 percent slopes	315.9	2.8%
12	Cabarton silty clay loam	5.5	0.0%
16	Donnel sandy loam, 0 to 2 percent slopes	225.0	2.0%
17	Donnel sandy loam, 2 to 4 percent slopes	363.0	3.2%
18	Donnel sandy loam, 4 to 12 percent slopes	1.3	0.0%
20	Duston sandy loam, 0 to 2 percent slopes	196.9	1.7%
21	Duston sandy loam, 2 to 4 percent slopes	0.0	0.0%
22	Gestrin loam, 0 to 2 percent slopes	313.2	2.8%
23	Gestrin loam, 2 to 4 percent slopes	164.2	1.5%
25	Jugson coarse sandy loam, 5 to 30 percent slopes	285.6	2.5%
26	Jugson coarse sandy loam, 30 to 60 percent slopes	96.5	0.9%
27	Jurvannah sandy loam	9.1	0.1%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28	Kangas coarse sandy loam	527.6	4.7%
29	Kangas fine gravelly loamy coarse sand	456.8	4.1%
31	McCall complex, 5 to 50 percent slopes	3,519.1	31.2%
34	Melton loam	229.5	2.0%
37	Nisula loam, 4 to 12 percent slopes	5.0	0.0%
38	Nisula loam, 12 to 20 percent slopes	13.7	0.1%
40	Pits, gravel	11.8	0.1%
47	Roseberry coarse sandy loam	398.4	3.5%
56	Swede silt loam, 12 to 20 percent slopes	280.2	2.5%
58	Tica very cobbly loam, 4 to 65 percent slopes	37.8	0.3%
59	Water	1,302.1	11.5%
60	Miscellaneous water	11.3	0.1%
Subtotals for Soil Survey Area		**11,033.6**	**97.9%**
Totals for Area of Interest		**11,274.7**	**100.0%**

Disclaimer: This Digital Web Map is an informal report and may be revised and formally published at a later time. Its content and format may not conform to agency standards.

Surficial Geologic Map of Long Valley, Valley County, Idaho

Roy M. Breckenridge and Kurt L. Othberg

2006

Scale 1:50,000

Contour Interval 120 feet
Supplemental 40 foot contours in the valley

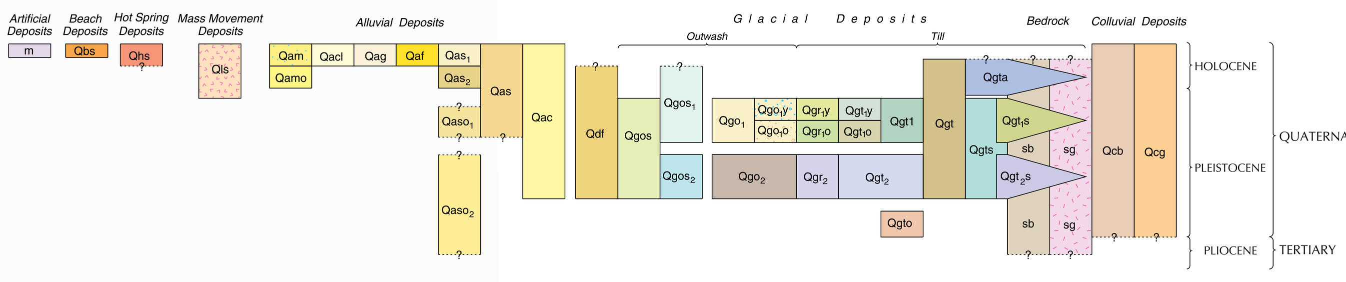
INTRODUCTION

The surficial geologic map of Long Valley provides basic data on the geologic materials found at the surface and shallow subsurface, and is essential for planning. The information is directed at a broad range of specialists concerned with land development and its consequences as population increases place greater demands on the region's natural resources. Details from the map assist, for example, in assessing slope stability, foundation design, sewage drainage, solid waste sites, and the factors affecting recharge of the potable ground-water supply. The information depicted at this scale furnishes a useful overview of the area's geology but is not a substitute for site-specific geotechnical evaluations. All soil-series names are taken from Rasmussen (1981).

Long Valley is bounded on the west by the West Mountains, a block of tilted Columbia River basalt and metamorphic and granitic rocks, and on the east by the Salmon River Mountains of the Idaho batholith. The valley floor is about 4800 feet in elevation and the adjacent glaciated mountains rise above 7000 feet. The Payette Lakes are dammed behind a sequence of Pleistocene end moraines and outwash forms the valley floor from McCall to Cascade Reservoir. The reservoir is separated from Cascade city by a fault block of the Idaho batholith. West and south of the fault block the geology is dominated by valley alluvium and mountain-slope colluvium derived from the Idaho batholith.

The placer deposits of Long Valley were studied in the 1950s by D.L. Schmidt and J.H. Mackin. Geology depicted is based partly on their mapping (Schmidt and Mackin, 1970). Colman and Pierce (1981, 1983) used weathering-rind dating techniques to subdivide the glacial sequence and estimate the numerical ages of Schmidt and Mackin's units but did not map the quadrangle. The landforms and surface deposits of the area were described by Othberg (1987). This map subdivides the glacial stratigraphy based on genesis, geomorphology, texture and relative age of the surficial units. The map uses terminology of Schmidt and Mackin (1970) and the Rocky Mountain Glacial model (Mears, 1974), not because the units are directly correlated to the type localities, but because of the informal relationship to equivalent units in Idaho. At this time we have not applied new names based on the ages proposed by Colman and Pierce (1981, 1983), but their equivalents are listed in the map unit descriptions.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

MAN-MADE DEPOSITS

m **Made land (Holocene)**—Mixed deposits of man-made fill. Mostly coarse boulder ballast, cobbles, and boulders. Made land includes highway and railroad fills, constructed levees, earth-fill dams, and an area of placer-mine tailings near Big Creek that are being excavated for sand and gravel.

LAKE DEPOSITS

Qbs **Beach deposits (Holocene)**—Coarse sand to silty sand. Forms newly accreted beaches, bars, and spits in areas of lower wave energy along the shore of Cascade Reservoir. Thickness less than 10 feet.

HOT-SPRING DEPOSITS

Qhs **Hot spring deposits (Holocene)**—Primarily carbonate-rich precipitates that form by the evaporation of hot-spring water. Includes tufa, a thin, spongy and porous surface deposit; and travertine, a dense banded deposit. Thickness unknown.

ALLUVIAL DEPOSITS

Qam **Alluvium of mainstreams (Holocene)**—Variable clayey silt, silty sand, gravelly sand and sandy gravel form the flood plain of the North Fork of the Payette River, Lake Fork, Gold Fork, and Boulder Creek. Gravel clasts are rounded to subrounded. Bedding distinct to indistinct in sand and gravel and thin to medium in silt and clay. Soil series include the Blackwell, Donnel, Kangas, Melton, and Roseberry. Thickness 2-10 feet.

Qag **Alluvial gravel deposits (Holocene)**—Mostly silty sandy gravel. Cobble- to large boulder gravel forms low terrace just above the flood plain of the North Fork of the Payette and Lake Fork. Rounded and subrounded gravel clasts derived from intrusive granitic rocks and extrusive basalts. Mostly consists of reworked Pleistocene glacial deposits. Soil series include the Donnel and Kangas. Thickness 5-10 meters (16 -33 feet).

Qacl **Alluvium, fine grained (Holocene)**—Silt, clay, and organic muck of alluvium in ponds and depressions in glacial deposits or scoured in bedrock. Soils primarily Blackwell series . Thickness 1-3 meters.

Qamo **Older alluvium of mainstreams (Holocene)**—Primarily Stratified sand of pre-modern channel and flood-plain deposits. Forms low terrace with river-cut edge. Soil series include the Donnel, Duston, and Roseberry. Thickness more than 20 feet.

Qaf **Alluvial-fan deposits (Holocene)**—Silty sand, coarse sand, and gravelly sand. Stratified to crudely bedded. Forms low-relief fans at mouths of steep, narrow valleys draining the east side of Crown Point. Has potential for flooding during snow melt or thunderstorms. Thickness 2-20 feet.

Qac **Alluvium and colluvium (Holocene and Pleistocene)**—Silty sand to pebbly coarse sand. Poorly stratified to massive. Forms fans and aprons in foot slopes and gently sloping granitic colluvial slopes. Locally includes old erosion surfaces, lag deposits, and tors. Soil series include the Archabal, Gestrin, Shellrock, and Takeuchi. Thickness 2-20 feet.

Sidestream alluvium North Fork Payette River tributaries downstream of Cascade Reservoir.

Qas1 **Alluvium of side streams (Holocene)**—Stratified silt, clay, and silty sand. Buries sand of older terrace alluvium. Typically confined to narrow drainageways that are incised into older alluvium. Seasonally saturated and has potential for flooding. Soil series include the Blackwell, Cabarton, and Melton. Thickness 2-10 feet.

Qas2 **Older alluvium of side streams (Holocene)**—Statified sand, pebbly sand, and pebble gravelof pre-modern channel and flood-plain deposits. Forms low terrace with river-cut edge in the valleys of Big Creek and Clear Creek.

Qaso1 **Alluvium of lower side-stream terraces (late Pleistocene)**—Stratified fine to coarse sand. Forms broad terrace east and north of Cascade. Steam-cut terrace scarp bordered by meanders and meander scars of North Fork of Payette River. Terrace surface somewhat dissected and is seasonally saturated in lower topographic positions. Soil series include the Donnel and Roseberry. Thickness more than 20 feet.

Qaso2 **Alluvium of higher side-stream terraces (pre-late Pleistocene)—**Silty, clayey sand grading downward into stratified medium to coarse sand. Forms dissected terrace characterized by low undulating topography. Edge of terrace is diffuse and irregular owing to local erosion graded to younger stream systems. Soil primarily Archabal. Thickness 10 feet to more than 100 feet.

Qas **Alluvium of side streams, undivided (Holocene and Pleistocene)**—Variable clayey silt, silty sand, coarse sand, and pebbly sand that form narrow channels, flood plains, and low terraces. Soil series include the Archabal, Blackwell, Gestrin, and Melton. Thickness 2 feet to more than 10 feet.

GLACIAL AND RELATED DEPOSITS

Qdf **Debris-fan deposits (Holocene and Pleistocene)**—Pebbles, cobbles, and boulders in a silty sand matrix. Poorly to crudely sorted; angular to subrounded clasts of basalt and granitic rocks. Debris flows and alluvium derived from steep slopes where complex glacial and periglacial processes interact. Soil series include the McCall and Nisula. Thickness 5-50 feet.

Qgta **Alpine till deposits (Holocene and late Pleistocene)**—Coarse, stoney, unsorted, unstratified, sandy cobble- to boulder till and protalus deposited by latest Pleistocene and neoglacial glaciers. Includes protalus deposits. These glaciers postdated the latest glacial maximum represented by moraines in the valley. Mostly restricted to alpine cirques about 1950 meters (6400 feet) elevation and above. Soil series include the McCall. Thickness 1-10 meters (33 feet).

Qgt1y **Younger till deposits of late-Pleistocene glaciation**—Surface**:** Cobbly and bouldery sand; grayish brown, and brown. Below 1 meter: loose to compact till; consists of gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Forms the youngest and least weathered lateral and end moraines that were deposited during the late Wisconsin, younger Pinedale glacial recession. Equivalent to till of Pilgrim Cove age of Coleman and Pierce (1983). Soil series include the the McCall. Thickness 1-10 meters (3-33 feet).

Qgr1y **Younger recessional, ice contact and stagnation deposits of late-Pleistocene glaciation**—Surface: Cobbly and bouldery sand; grayish brown, and brown. Below 1 meter: loose to compact till; consists of gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Forms the youngest and least weathered recessional and ice contact sediments that were deposited during the late Wisconsin, younger Pinedale glacial recession. Soil series include the McCall, Melton, and Roseberry. Thickness up to 25 meters (80 feet).

Qgo1y **Younger outwash of late-Pleistocene glaciation**—Coarse sand with a silty fine sand matrix. Forms partially drowned terrace formerly above the modern flood plain. Outwash graded to late Wisconsin, younger Pinedale glaciation moraines in the McCall quadrangle. Soil series include the Donnel and Roseberry. Thickness more than 10 feet.

Qgt1o **Older till deposits of late-Pleistocene glaciation**—Surface: Cobbly and bouldery silty sand; grayish brown, yellowish brown and brown. Below 1 meter: massive, loose to compact till; consists of gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Forms sharp- crested lateral and end moraines deposited during the early Wisconsin, older Pinedale glaciation. Gravel clasts primarily subangular to angular; many faceted. Equivalent to till of McCall age of Colman and Pierce (1983). Soil series include the McCall and Jugson. Thickness 40 feet to more than 100 in lateral moraines.

Qgr1o **Older recessional, ice contact and stagnation deposits of late-Pleistocene glaciation**—Surface: silty sand, silty pebbly sand, sandy gravel, local silt, and clay, pale brown, yellowish brown and dark brown Grades laterally into and includes water-laid till and ice contact and meltwater deposits. Unstratified to stratified and angular to subrounded clasts. Forms hummocky stagnation moraine, with closed depressions and immature drainage, and recessional moraines with subdued crests deposited during the early Wisconsin, older Pinedale glaciation. Occasional very large boulders mainly basalt. May include till of Williams Creek age of Colman and Pierce (1983). Equivalent to till of McCall age of Colman and Pierce (1983). Soil series include the McCall. Thickness 20 feet to more than 80 feet.

Qgo1o **Outwash of older late-Pleistocene glaciation**—Surface: silty sand, silty pebbly sand, sandy gravel, local silt, and clay, pale brown, yellowish brown and dark brown (locally mottled: gray, yellow, brown, and olive). Below 1 meter: (primarily gravel) silty sandy gravel and gravelly coarse sand; granule- to small boulder-sized clasts; Forms large outwash plain graded to early Wisconsin, older Pinedale glaciation end moraines in McCall (*Qgr1o*). Equivalent to outwash of McCall age of Colman and Pierce (1983). Soil series include the Roseberry. Thickness 20 feet to more than 40 feet.

Qgt1 **Till deposits of late-Pleistocene glaciation, undivided**—Surface: Cobbly and bouldery silty sand; grayish brown, yellowish brown and brown. Below 1 meter: massive, loose to compact till; consists of gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Gravel clasts primarily subangular to angular; many faceted. May be equivalent to till of Williams Creek age of Colman and Pierce (1983). Soil series include the McCall, Naz, and Quartzberry. Thickness 20 feet to more than 80 feet.

Qgt1s **Scattered till deposits of late-Pleistocene glaciation**—Mostly loose gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Occasional very large boulders on bedrock and in till. Extent of till is discontinuous in steep-mountain bedrock terrain. Density of clast pattern on map indicates relative distribution and thickness on bedrock. Soil series include the McCall. Thickness 2-20 feet.

Qgo1 **Outwash of late-Pleistocene glaciation, undivided**—Coarse sand with a silty fine sand matrix. Forms outwash plain above the modern flood plain probably graded to older or younger Pinedale end moraines in the McCall quadrangle. Soil series include the Donnel and Roseberry. Thickness 10 feet to more than 30 feet.

Qgos1 **Outwash side-stream deposits of late-Pleistocene glaciation, undivided—**Mostly brown to gray silty sand. Becomes gravelly upslope closer to glacial source area. Deposited by meltwater streams from West Mountain glaciers of probable Wisconsin age. May include outwash from neoglacial ice. Includes minor, mostly inset Holocene stream channels and alluvium. Soil series include the Gestrin series, but characteristics trend toward Nisula because of component of basalt detritus. Thickness 5-50 feet.

Qgt2 **Till deposits of pre-late Pleistocene glaciation**—Surface: cobbly and bouldery silty clay and clayey silt; brown and dark brown. 0.5-2 meters: gravelly sandy clayey silt and gravelly clayey silty sand; pebble-to boulder-sized gravel dark brown, brown, and yellowish brown. Below 2 meters: massive unsorted till; consists of gravelly silty sand; pebble to boulder-sized gravel clasts; brown and gray. Gravel clasts primarily subangular to angular; many faceted. Forms large massive lateral and end moraines deposited during pre-Wisconsin, Bull Lake glacial advances. Equivalent to till of Timber Ridge age of Colman and Pierce (1983). Soil series include the McCall. Thickness 40 feet to more than 80 feet.

Qgr2 **Recessional, ice contact and end moraine deposits of pre-late Pleistocene glaciation**—Surface: cobbly and bouldery silty clay and clayey silt; brown and dark brown. 0.5-2 meters: gravelly sandy clayey silt and gravelly clayey silty sand; pebble-to boulder-sized gravel dark brown, brown, and yellowish brown. Below 2 meters; massive unsorted till: consists of gravelly silty sand; pebble to boulder-sized gravel clasts, brown and gray. Grades laterally into and includes water-laid till and ice contact and meltwater deposits. Unstratified to stratified and angular to subrounded clasts. Occasional very large rounded boulders of basalt and granite. Forms hummocky stagnation moraine, with closed depressions and immature drainage, and recessional moraines with subdued crests deposited during pre-Wisconsin, Bull Lake glaciation. Soil series include the Archabal. Thickness variable to tens of meters.

Qgt2s **Scattered till deposits of pre-late Pleistocene glaciation**—Mostly loose cobbly silty sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Occasional very large boulders on bedrock and in till. Extent of till is discontinuous in steep-mountain bedrock terrain. Density of clast pattern on map indicates relative distribution and thickness on bedrock. Probably deposited during pre-Wisconsin, Bull Lake glacial advances. Soil series include the Bluebell and Swede. Thickness 2-20 feet.

Qgo2 **Outwash deposits of pre-late Pleistocene glaciation**—Surface: silty clan and clayey silt; brown and dark brown. 0.5-2 meters; sandy clayey silt, clayey silt, clayey silty sand, and pebbly sand; dark brown, brown, and yellowish brown. Below 2 meters: silty sand, sand, and pebbly sand; brown , pale brown, and light gray. Pebble clasts, rounded to subrounded. Forms flat to gently undulating remnants of a broad plain of outwash graded to end moraine deposits of pre-Wisconsin, Bull Lake glaciation (*Qgt2* and *Qgr2*). Includes narrow dissected channels of younger ages. Soil series include the Archabal. Thickness 10 feet to more than 40 feet.

Qgos2 **Outwash side-stream deposits of pre-late Pleistocene—**Silty, clayey sand grading downward into stratified medium to coarse sand. Forms dissected terrace characterized by low undulating topography. Edge of terrace is diffuse and irregular owing to local erosion graded to younger stream systems. Probably deposited during pre-Wisconsin, Bull Lake glaciation. Soil series include the Archabal and Nisula. Thickness10-60 feet.

Qgt **Till deposits of Pleistocene glaciations, undivided**—Surface: cobbly and bouldery silty sand to silty clay; grayish brown to dark brown. Below 1 meter: massive, loose to compact till; consists of gravelly coarse sand with a silty fine sand matrix; pebble-to boulder-sized gravel; grayish brown and gray. Gravel clasts primarily subangular to angular; many faceted. Forms subdued to sharp-crested lateral moraines deposited during West Mountain glacial advances that may include pre-Wisconsin, early Wisconsin, and late Wisconsin glaciations. In alpine areas, includes local post-glacial periglacial, felsenmeer, and protalus deposits.

Qgts **Scattered deposits of till, undivided (Pleistocene)**—Mostly brown to gray silty, sandy gravel. Gravel is pebble-to boulder-sized clasts of basalt and granitic rocks. Extent of till is discontinuous in steep-mountain bedrock terrain. Common bedrock outcrop. Grades and interfingers downslope with debris-fan deposits (*Qdf*). Includes boulder block fields of frost-wedged and fractured granitic rocks. In alpine areas, includes local post-glacial periglacial, felsenmeer, and protalus deposits. Soil series include the Byron, Pyle and McCall. Thickness 2-20 feet.

Qgos **Outwash side-stream deposits, undivided (Pleistocene)**—Mostly brown silty to clayey sand. Becomes gravelly upslope where unit grades and interfingers with debris-fan deposits (*Qdf*). Deposited by meltwater streams from West Mountain glaciers. Includes minor, mostly inset Holocene stream channels and alluvium. Unit mostly submerged in Cascade Reservoir. Soil series include the Nisula. Thickness 5-50 feet.

Qgto **Older glacial deposits (early Pleistocene and Pliocene?)**—Cobbly and bouldery silty clay and clayey silt; brown and dark brown. Mostly till(?) deposits. Unsorted to moderately sorted, sandy pebble- to boulder gravel. Rounded to sub-rounded granitic clasts and sub-rounded to subangular basalt clasts. Thickness unknown.

MASS MOVEMENT DEPOSITS

Qls **Landslide deposits (Holocene and Pleistocene)**—Unsorted and unstratified cobbles and boulders mixed with silt and clay comprised of fragments of till and colluvium derived from the slope failure. In addition to the landslide deposit, the unit includes the landslide scarp and the headwall (steep area adjacent to and below the landslide scarp) from which material broke away (see Symbols).

COLLUVIAL DEPOSITS

Qcb **Colluvium derived from basaltic rocks (Holocene and Pleistocene)**—Mostly cobbly, angular gravel with a matrix of fine sand, silt, and clay. Derived from the Columbia River Basalt Supergroup. Soils primarily Bluebell, Demast, Sudduth, and Tica series . Thickness 2-10 feet.

Qcg **Colluvium derived from granitic rocks (Holocene and Pleistocene)**—Mostly sandy grus derived from the Idaho batholith. Common outcrops of weathered granite and gneiss. Locally includes old erosion surfaces, lag deposits, and tors. In alpine areas, includes periglacial deposits. Soil series include the Bryan, Jugson, Koppes, Ligget, Naz, Pyle, Quartzburg, Shellrock, and Swede. Thickness 2-10 feet).

BEDROCK

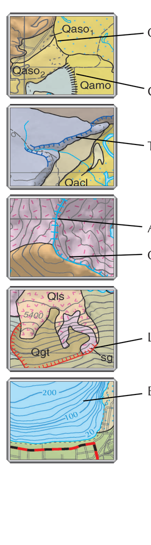
Extrusive Rock

sb **Ice-scoured basalt bedrock and colluvium (Holocene and Pleistocene)**—Soil series in colluvium includes the Tika.

Intrusive Rock

sg **Ice-scoured granitic bedrock and colluvium (Holocene and Pleistocene)**—Soil series in colluvium include the Pyle.

SYMBOLS



Contact: Line showing the approximate boundary between one map unit and another. The location accuracy of an approximate contact is more than 80 feet on the ground.

Gradational contact.

Terrace scarp: Ticks on lower side.

Arete: Ticks on both sides.

Cirque headwall: Ticks on glaciated side.

Landslide scarp: Ticks show top of scarp.

Bathymetric contours in feet (Idaho Department of Environmental Quality, ca. 2000). Accuracy of the bathymetry data are unknown and are presented here to show the glacial geomorphology of the lake basin. Bathymetry should not be used for navigational purposes.

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Breckenridge, R.M., and K.L. Othberg, Surficial geologic map of the McCall quadrangle, Blaine County, Idaho: Idaho Geological Survey, Digital Web Map 35, scale 1:24,000.

Colman, S.M., and K.L. Pierce, 1981, Weathering rinds on basaltic and andesitic stones as a Quaternary age indicator, Western United States: U.S. Geological Survey, Professional Paper 1210, 56 p.

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Field work conducted 2003-2005.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program.

Digital capture, layout, and digital cartography by Loudon R. Stanford, Jesse S. Bird, Dean L. Garwood, and Jane S. Freed at the Idaho Geological Survey's Digital Mapping and GIS Lab.

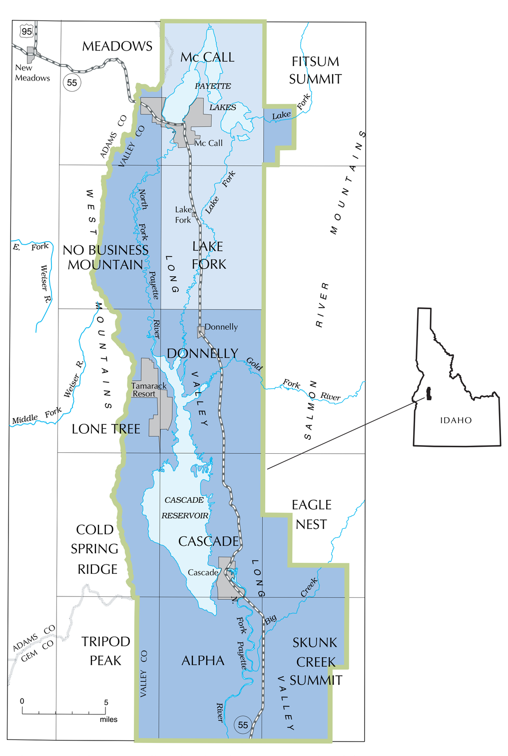
Projection: Idaho State Plane Coordinate System, central zone, 1927 North American Datum.

Base built from U.S. Geological Survey 1:24,000-scale Digital Line Graph and Geographic Name Information System data. Contours from U.S. Geological Survey tagged vector contours (1:24,000).

Note on printing: The map is reproduced at a high resolution of 600 dots per inch. The inks are resistant to run and fading but will deteriorate with long-term exposure to light.

PDF map (Acrobat Reader) may be viewed at www.idahogeology.org.

Map Version 9-18-2006.



Index map of the Long Valley showing the area mapped and the location of 7.5 minute quadrangles. Light blue quadrangles available as individual maps (see references).

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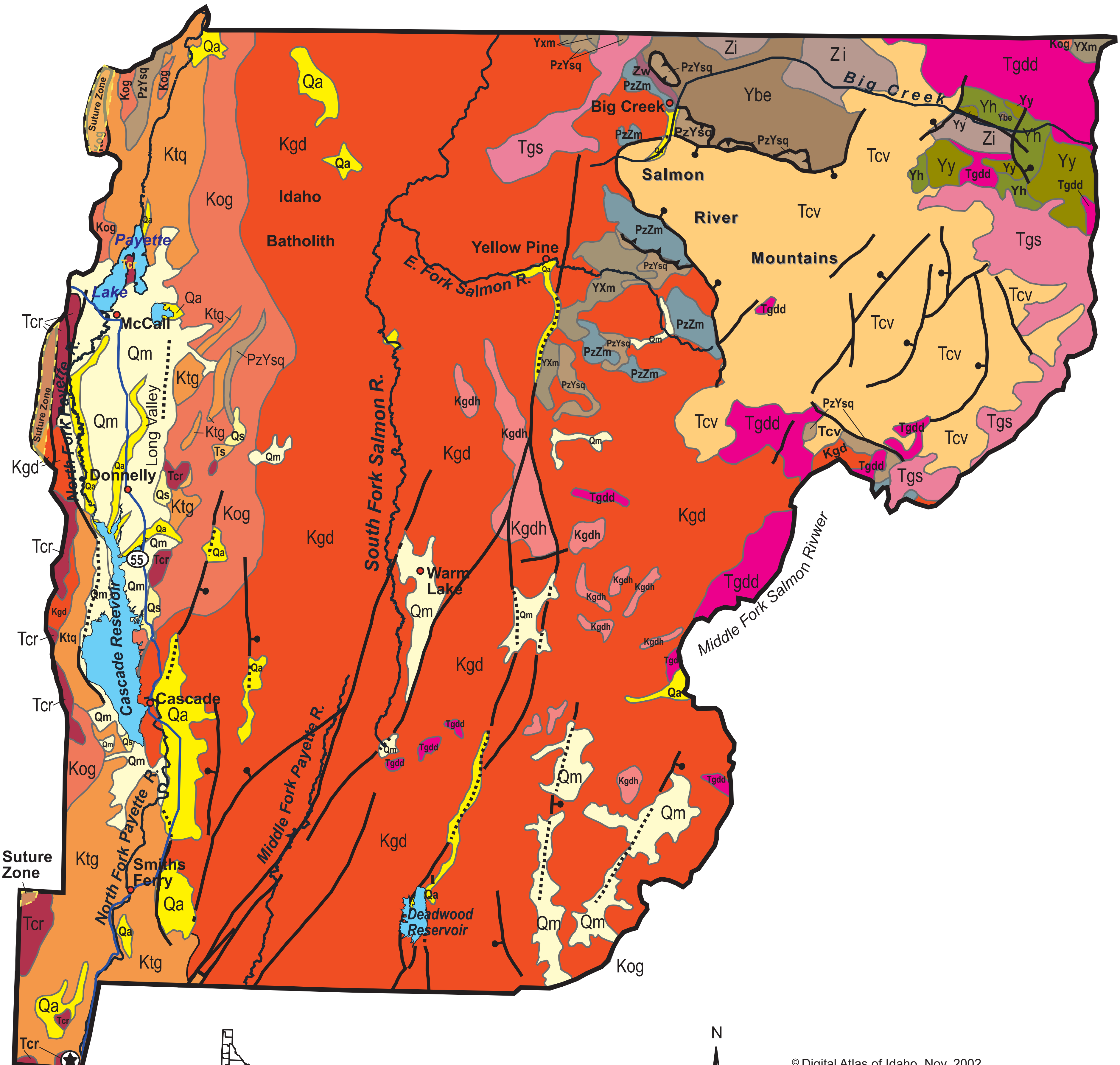
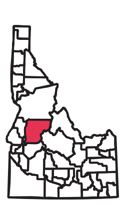
University of Idaho, Moscow, Idaho 83844-3014

Valley County,
Idaho





N

0 5 10 miles

0 8 16 kilometers

© Digital Atlas of Idaho, Nov. 2002
http://imnh.isu.edu/digitalatlas
Compiled by Reed Lewis,
Idaho Geological Survey
http://www.idahogeology.org

Symbols

- Yp — Geologic unit contacts with unit designation.
- Normal fault: certain; dashed where approximately located; dotted where concealed.
- Thrust fault: certain; dashed where approximately located; dotted where concealed.
- Detachment fault: certain; dashed where approximately located; dotted where concealed.
- Anticline: trace of axial plane: large arrow indicates direction of plunge.
- Syncline: trace of axial plane: large arrow indicates direction of plunge.
- Overturned anticline: trace of axial plane.
- Overturnedsyncline: trace of axial plane.
- Location of ISU Rockwalk rock from each county.
- Cities
- Feature location

Roads
- 15 Interstate Route
- 95 U.S. Route
- 1 State route

Valley County

Valley County covers a huge area in central Idaho, from Long Valley and McCall east to the Middle Fork of the Salmon River. The South Fork of the Salmon divides the county in two, flowing north toward the Main Salmon river, which is north across the border in Idaho county. The Payette River drains southward in the western part of the county.

On the extreme northwest are accreted terrane rocks west of the Idaho suture zone.

East of the suture are Cretaceous tonalites and orthogneiss of the Idaho batholith, which pass eastward to granodiorite that underlies the bulk of the county. A few inliers of Proterozoic and Paleozoic sedimentary rocks remain, as roof pendants to the batholith.

On the northeast is a downdropped block, the Thunder Mountain caldera, filled with Eocene Challis volcanic group rocks. North of this block of volcanic rocks is a northwest trending belt along Big Creek that exposes Mesoproterozoic Belt Supergroup strata and unique Neoproterozoic intrusive rocks.

Miocene and younger north-striking faults, part of the Basin and Range system, cut the batholith of the central part of the county, and form the Long Valley graben near Cascade Reservoir and Payette Lake.

Geology near McCall

Three major rock groups are exposed near McCall, Idaho. These include: the Cretaceous Idaho batholith, the Triassic-Jurassic metamorphosed island-arc sedimentary and volcanic rocks of the Seven Devils Group and the Miocene flood-basalt flows of the Columbia River Basalt Group. Several structural features are prevalent in the area and most likely control along with the past glaciation the geomorphology in the region.

Structurally, McCall is situated at the end of Long Valley, a major tectonic and structural feature of west central Idaho. The West Mountain escarpment is the high ridge formed along the west side of the Long Valley fault. West Mountain and Long Valley are part of a group of linear north-south ranges and valleys formed by block faulting during the late Tertiary and Quaternary. As West Mountain rose and Long Valley subsided, as much as 7,000 feet of alluvium accumulated in the valley (Idaho Geological Survey website .)

Glacial deposits are divided into two categories on the basis of origin. "Till" is unsorted, rounded glacial sediments which commonly form moraines. Moraines can be one of four types. “Lateral” moraines are formed from the large accumulations of unsorted debris at the glacier-valley wall interface. “Medial” moraines form when two glaciers merge, and their lateral moraines are incorporated into the center – or medial portion – of the glacier, much like when two streams come together. A “Terminal” moraine is one that marks the furthest advance of the glacier; each farther-reaching advance wipes out the previous terminal moraine. “Recessional” moraines mark periods when the glacier is retreating – that is, the end of the glacier (the snout) where moraine is being deposited is short of the terminal glacier. It is important to remember, however, that even when a glacier is retreating the ice and sediment movement is always forward. In terms of glacial sediment transport, a glacier is not unlike a conveyor belt that can lengthen and shorten as conditions mandate.

The second category of glacial deposit is not formed by flowing ice, but flowing water and is referred to as outwash. "Outwash" is deposited by meltwater discharging at the base of glaciers. Outwash from glaciers commonly forms expansive braided stream networks downvalley from glaciers and differ from moraines in that outwash sediments are well-sorted. For further information on glaciers and glacial geomorphology, please visit the USGS website .

Glacial features can be found around the area as most of the broad, high elevation region north of McCall was buried by an ice cap during the Pleistocene. Payette Lake and Little Payette Lake were formed as a result of glaciation in the region as valley glaciers carved the basin and deposited the moraines which impound the lakes. Other glacial geomorphic features, such as cirques – the alpine headwalls where glaciers begin – and medial moraines, around the area are visible in the landscape. An example would be Timber Ridge which formed originally as a large prominent medial moraine. Meltwater streams from these glaciers coursed across the valley depositing thick deposits of sand and gravel that can be seen as high terraces above the Payette River. These terraces are relict valley floors that have been incised as the post-glacial climate has changed and discharges in the Payette drainages have diminished.

See Winston et al. article in Guidebook to the Geology of Eastern Idaho.

Tamra Schiappa and P.K. Link, 10/02

Qa	Quaternary alluvial deposits
Qm	Quaternary moraine (unsorted boulders, cobbles and sand) and glaciofluvial outwash (bedded stream deposits formed from streams draining active glacial ice).
Qs	Quaternary surficial cover, including colluvium, fluvial, alluvial fan, lake, and windblown deposits. Included fluveolian cover on Snake River Plain, (Snake River Group).
Tcr	Miocene basalt (Columbia River Basalt Group); flood basalt, extensively exposed in western Idaho; fed by fissures, many of which are near the Idaho-Oregon border. Flowed eastward up valleys cut into the Idaho mountains.
Tcv	Eocene Challis Volcanic Group, volcanics and volcaniclastics; Older andesitic lavas, intermediate age dacite lava and tuff and younger rhyolite flows and tuffs; 51 to 44 Ma. (Includes Potato Hill and Kamiah volcanics of northern Idaho).
Tgs	Eocene granite, pink granite, syenite, rhyolite dikes, and rhyolitic shallow intrusive; last phase of the Challis magmatic event (46 to 44 Ma). Forms craggy scenic mountain landscape in central and northern Idaho.
Tgdd	Eocene granodiorite and dacite porphyry intrusive, also includes diorite and, in northern Idaho, minor granitic rock; intermediate phase of Challis magmatic event (50 to 46 Ma). Summit Creek stock.
Kog	Cretaceous orthogneiss, and foliated granodiorite and granite (includes mylonitic plutonic rocks in western Idaho suture zone); deformed early phases of the Idaho batholith.
Kgdh	Cretaceous granitic rocks of the hornblene-biotite suite; granite, granodiorite and megacrystic granodiorite. Potassium (K) rich. Age about 80 to 90 Ma.
Ktg	Cretaceous tonalite and quartz diorite; hornblende and biotite bearing early phases of the Idaho batholith. Intruded about 90 to 95 Ma.
Kgd	Cretaceous granitic rocks of the 2 mica suite. Idaho batholith and related plutons; granite and granodiorite that contains both muscovite and biotite. Sodium (Na) rich. Intruded between 80 and 65 Ma.
PzZm	Paleozoic/Neoproterozoic metasedimentary rocks, mainly quartzose sandstone (includes formation of Leaton Gulch).
PzYsq	Paleozoic/Mesoproterozoic schist and quartzite; age uncertain.
Zi	Neoproterozoic dioritic and syenitic intrusive rocks along Big Creek, west of the Middle Fork of the Salmon River; about 600 to 700 Ma.
Zw	Windermere Supergroup (metasedimentary and metavolcanic rocks in Big Creek area and northern Idaho).
Ybe	Belt Supergroup undivided; contains siltite, argillite, sandstone (quartzite) and minor conglomerate in Lemhi Range and near Salmon; includes Meadow Creek metamorphic sequence east of Elk City in the Clearwater River drainage.
Yh	Hoodoo Quartzite (Ravalli Group); light-colored feldspathic sandstone, cross bedded.
Yy	Yellowjacket Formation in the type area near Yellowjacket Mine, Bighorn Crags, and west to town of Big Creek. Contains siltite, calc-silicate rocks, and fine sandstone.
YXm	High-grade metamorphic rocks (schist, gneiss, quartzite, calc-silicate rocks); includes Elk City metamorphic sequence and related rocks, Syringa metamorphic sequence, and Priest River metamorphic complex.

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1445 North Orchard • Boise, ID 83706 • (208) 373-0550
www.deq.idaho.gov

C. L. "Butch" Otter, Governor
John H. Tippets, Director

June 19, 2017

City of McCall
ID4430033
Attn: Nathan Stewart
PO Box 216
Boise, ID 83638

Subject: Sanitary Survey conducted on May 11, 2017

Dear Mr. Stewart:

We recently conducted a Sanitary Survey for City of McCall. I am enclosing a list of findings for your system.

Please consult with the Department of Environmental Quality (DEQ) within 30 days regarding any significant deficiencies identified in this written notification, as required by IDAPA 58.01.08. After consultation and agreement between the PWS and DEQ, please provide the regulating agency a written corrective action plan addressing all significant deficiencies.

All new water systems, or modifications to existing water systems, must be submitted to DEQ in a preliminary engineering report and approved by DEQ prior to the submittal of plans and specifications, as required by IDAPA 58.01.08.503.01.

Following approval of the preliminary engineering report, plans and specifications must be submitted to and approved by DEQ prior to construction of new public water systems, or modifications of existing public water systems, as required by IDAPA 58.01.08.504.

Thank you for your help in completing the sanitary survey. Please contact me at (208) 373-0457 or via e-mail at Richard.lee@deq.idaho.gov.

Sincerely,

Richard Lee

Richard Lee
Drinking Water Analyst, Boise Region

Enclosures: Required and recommended improvements

ec: Matthew Dellwo, Designated Operator
TRIM 2107ACA4532

RE: Enhanced Sanitary Survey conducted on May 11, 2017

You will find a list of the deficiencies and recommended improvements for your system summarized below.

Significant Deficiencies

None

Deficiencies

Pump House:

Please continue to monitor the integrity of the Legacy Intake building and immediately repair if its condition worsens.

Distribution:

The Betsy Pond booster controls and vault are not protected from vandalism, trespassing, or sabotage.
-Please protect with fencing, or otherwise, to limit access to system components.

There are fire hydrants provided that are connected to water mains smaller than six (6) inches in diameter, and therefore are not in accordance with IDAPA 58.01.08.542.06. The system's ability to provide adequate fire flow should be evaluated. **(No action required at this time)**

All dead end water mains are not equipped with a means to flush, as required by IDAPA 58.01.08.542.09. **(No action required at this time)**
-If dead ends result in degraded water quality or customer complaints, City of McCall will need to address the issue.

Recommendations

Managerial:

The Total Coliform Rule (TCR) Sample Site Plan does not meet the minimum requirements, as required by IDAPA 58.01.08.100.01. which incorporates by reference 40 CFR 141.21. **(Action Required)**
-Please create a sample site plant that meets the requirements of the Revised Total Coliform Rule (information is on DEQ Drinking Water Switchboard website).

DEQ recommends the owner/operator consider confined space entry requirements to protect personnel and visitors, per IDAPA 58.01.08.501.14. DEQ does not enforce Occupational Safety & Health Administration (OSHA) regulations. Water system owner/operators should refer to OSHA's confined space resources when developing and implementing a comprehensive confined space entry program.

OSHA website: www.osha.gov/SLTC/confinedspaces/index.html

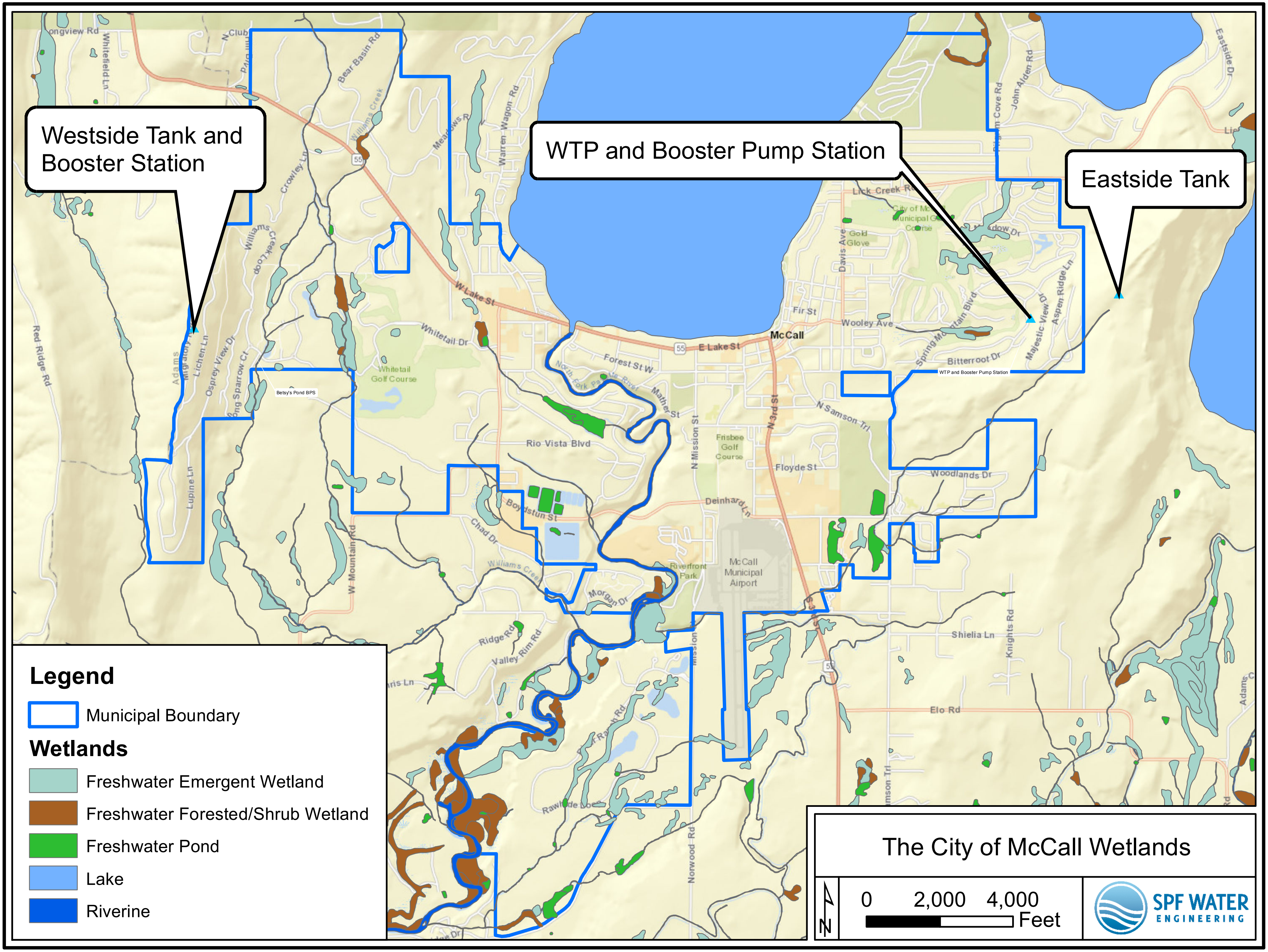
OSHA – Boise Area Office
1150 North Curtis Road, Suite 201
Boise, Idaho 83706
(208) 321-2960
(208) 321-2966 Fax

Thank you for your time and cooperation in the completion of this survey. If you have any questions, please contact me at (208) 373-0457 or via e-mail at Richard.lee@deq.idaho.gov.

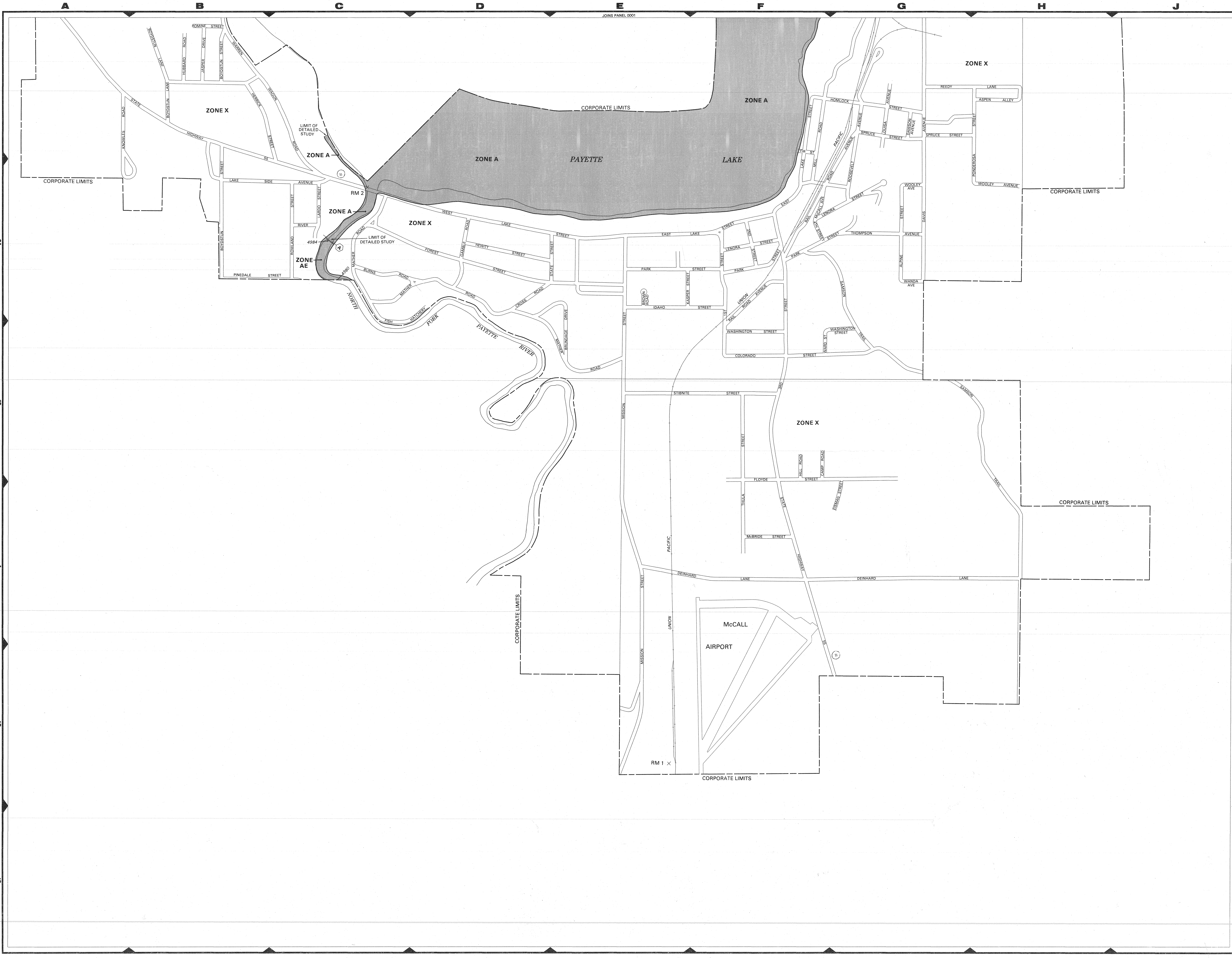
Sincerely,

Richard Lee

Richard Lee
Drinking Water Analyst



Westside Tank and Booster Station
WTP and Booster Pump Station
Eastside Tank
Legend
Municipal Boundary
Wetlands
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Riverine
The City of McCall Wetlands
0 2,000 4,000 Feet
N
SPF WATER ENGINEERING
McCall
W Lake St
E Lake St
Whitetail Golf Course
McCall Municipal Airport
Frisbee Golf Course
Riverfront Park
Rio Vista Blvd
Deinhard Ln
N Mission St
N 3rd St
N Samson Trl
Floyde St
Woodlands Dr
Bitterroot Dr
Wooley Ave
Fir St
Lick Creek Rd
Shiela Ln
Elo Rd
Knights Rd
Red Ridge Rd
W Mountain Rd
Boydstun St
Chad Dr
Morgan Dr
Ridge Rd
Valley Rim Rd
Betsy's Pond BPS



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE A0** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

Elevations reference marks are described in the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index

MAP REPOSITORY

City Hall
212 Park Street
McCall, Idaho 83638
(Maps available for reference only, not for distribution.)

INITIAL IDENTIFICATION:
SEPTEMBER 5, 1975

FLOOD HAZARD BOUNDARY MAP REVISIONS:

FLOOD INSURANCE RATE MAP EFFECTIVE:
APRIL 17, 1989

FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
McCALL,
IDAHO
VALLEY COUNTY

PANEL 2 OF 2
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
160175 0002 A

EFFECTIVE DATE:
APRIL 17, 1989

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE A0** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain.
- **ZONE D** Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 Base Flood Elevation Line; Elevation in Feet*

D — D Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*

RM7 X Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

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Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

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For adjoining map panels see separately printed Map Index

MAP REPOSITORY
County Building Officials Office
Courthouse Annex
108 West Spring Street
Cascade, ID 83611
(Maps available for reference only, not for distribution)

INITIAL IDENTIFICATION:
SEPTEMBER 5, 1990

FLOOD HAZARD BOUNDARY MAP REVISIONS:

FLOOD INSURANCE RATE MAP EFFECTIVE:
SEPTEMBER 5, 1990

FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

VALLEY COUNTY, IDAHO
(UNINCORPORATED AREAS)

PANEL 304 OF 1025
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
160220 0304 A

EFFECTIVE DATE:
SEPTEMBER 5, 1990

Federal Emergency Management Agency

APPENDIX H: CORRESPONDENCE FROM FIRE CHIEF

December 27, 2017

Nathan T. Stewart, P.E.
McCall Public Works Director
216 East Park St.
McCall, ID 83638

RE: McCall Water Master Plan 2017

Dear Nathan,

After reviewing the McCall Water Master Plan, I agree with the fire flows presented. As you know, the City of McCall's water system is very important to the fire district and all our customers who rely on it for fire protection.

The fire district is graded every eight years by the Idaho Survey and Ratings Bureau. Fire departments are rated on a 1-10 scale, 1 being the best, 10 being the worst. Currently, the City of McCall is rated as a protection class 3, the same as the City of Boise, which has a significant impact on the insurance premiums that homeowners and business pay to protect their properties. 40% of the rated score is based on the city water system so maintaining a good rating is a shared responsibility between the fire district and the City of McCall.

The concerning part of the report is the forecasted decrease in fire flows due to the annual increase in demand, if no water system improvements are made. If the infrastructure is not upgraded to meet demand, fire flows will decrease which could not only be problematic when we have a fire, but it could also increase our protection class rating which will increase insurance premiums for all our constituents who reside or own property in McCall.

Thank you for compiling the detailed report and for the giving the fire district the opportunity to comment on it. We fully support the city moving forward with the outlined upgrades to the water infrastructure.

Sincerely,

Garrett de Jong
Assistant Chief, McCall Fire & EMS

201 Deinhard Lane • P.O. Box 1597 • McCall, Idaho 83638 • (208) 634-7070 • Fax: 634-5360
www.mccallfire.com

APPENDIX I: EASTSIDE TANK STORAGE ANALYSIS

City of McCall
East Side Storage Requirements

DEMAND AND FIRM PUMPING CAPACITY				EASTSIDE TANK STORAGE REQUIREMENTS							
YEAR	PHD (mgd)	PHD (gpm)	Firm Pumping Capacity (gpm)	Operational Storage (gal) (1)	Equalization Storage (gal) (2)	Fire Storage (gal) (3)	Standby Storage (gal) (4)	Dead Storage (gal) (5)	Total Storage Required (gal)	Total Storage Available (gal)	Storage Deficit (gal)
2018	5.50	3,819	3,980	142,170	0	540,000	0	187,660	869,830	1,172,900	
2019	5.67	3,934	3,980	142,170	0	540,000	0	187,660	869,830	1,172,900	
2020	5.83	4,052	3,980	142,170	25,938	540,000	0	187,660	895,768	1,172,900	
2021	6.01	4,174	3,980	142,170	69,700	540,000	0	187,660	939,530	1,172,900	
2022	6.19	4,299	3,980	142,170	114,775	540,000	0	187,660	984,605	1,172,900	
2023	6.38	4,428	3,980	142,170	161,202	540,000	0	187,660	1,031,032	1,172,900	
2024	6.57	4,561	3,980	142,170	209,022	540,000	0	187,660	1,078,852	1,172,900	
2025	6.76	4,697	3,980	142,170	258,277	540,000	0	187,660	1,128,107	1,172,900	
2026	6.97	4,838	3,980	142,170	309,009	540,000	0	187,660	1,178,839	1,172,900	5,939
2027	7.18	4,984	3,980	142,170	361,263	540,000	0	187,660	1,231,093	1,172,900	58,193
2028	7.39	5,133	3,980	142,170	415,085	540,000	0	187,660	1,284,915	1,172,900	112,015
2029	7.61	5,287	3,980	142,170	470,522	540,000	0	187,660	1,340,352	1,172,900	167,452
2030	7.84	5,446	3,980	142,170	527,621	540,000	0	187,660	1,397,451	1,172,900	224,551
2031	8.08	5,609	3,980	142,170	586,434	540,000	0	187,660	1,456,264	1,172,900	283,364

Notes:

1. Operational Storage is based on tank level settings of 13.5-15.5 feet. At 13.5 feet, the WTP tank fill pump station is called into service to fill the tank. At 15.5 feet the pump station is shut off.
2. Equalization storage is defined as storage of finished water in sufficient quantity to compensate for the difference between a water system's maximum pumping capacity and peak hour demand. Peak hour demand is projected to exceed firm pumping capacity in 2020. Peak demand typically occurs in the morning between 4:00 am and 10:00 am. This analysis uses 6 hours of peak hour demand as an estimate of the peak demand to calculate required equalization storage. THis is likely a conservative estimate, since peak hour is higher than peak 6 hour demand, but a reasonable estimation for determining equalization storage required.
3. Fire storage is based on the highest fire flow requirement which is 3,000 gpm for 3 hours, or 540,000 gallons.
4. Standby storage is not required because the Water Treatment Plant finished water pumping facilities have standby power.
5. Dead storage includes 18.5 inches at the tank bottom and 12 inches at the top of the tank.