

CITY OF REVELSTOKE

# WATER MASTER PLAN

DECEMBER 23, 2022





# WATER MASTER PLAN

CITY OF REVELSTOKE

PROJECT NO.: 211-09492-00  
DATE: DECEMBER 23, 2022

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## EXECUTIVE SUMMARY

The City of Revelstoke water system serves a base population of approximately 8,000 in 3100 residences. It consists of 8 pressure zones, 5 storage reservoirs, and includes approximately 150 km of watermain. The City can be crudely characterized by three main regions i.e., Central Revelstoke, South Revelstoke/RMR and Big Eddy.

The City currently has three different water models: (1) Central/North Revelstoke, (2) Revelstoke Mountain Resort (RMR)/South Revelstoke, and (3) Big Eddy. WSP has recently developed the Big Eddy and RMR water models as part of separate projects with the City. Concurrently, development at Johnson Heights (in Central Revelstoke) is underway.

The City of Revelstoke utilizes two water supply sources to provide potable water throughout the community. The majority of the City is supplied by water that comes from the Greeley Creek watershed, located east of Revelstoke behind Mt. Mackenzie. The water supply is supplemented by Golf Course well No.1 which is located on the south bank of the Columbia River at the City Golf Course. The total potential available water supply capacity for the City excluding the Big Eddy region is 245 L/s with both Greeley Creek WTP and wells combined.

The Greeley Creek Water Treatment Plant (WTP) was designed in the 1990s and has an existing capacity of 175 L/s. Treated water is stored at the Greeley Creek WTP Clearwell that delivers water to the South Revelstoke area via a 450 mm transmission main. The 450 mm transmission main runs along the Trans Canada Highway into the City. The secondary water source comes from the Golf Course well No. 1 with an available pumped capacity of 70 L/s.

Having multiple water supply sources helps improve reliability and resiliency of the water system operation in the City, especially in the event of natural disasters, treatment plant issues, or other unforeseeable challenges that cause the primary source of water inoperable. The secondary source of water provides redundancy to the City's water supply system which is critical for promoting the wellbeing of communities and economies.

The Big Eddy system is supplied water from two wells at the west end of the area. The wells were constructed and commissioned in 1980 and are housed in two separate pump house structures. Both the wells have a combined capacity of 18.9 L/s and typically each of the pumps within the wells operate at 12.6 L/s separately (WSP 2017). Chlorinated water from the wells is pumped into the distribution network and up to the two Big Eddy Reservoirs.

There are four pump stations in the City: Arrow Heights Pump Station, Monashee Booster Pump Station, the Golf Course Well Pump Station, and Big Eddy Well Pump Station.

This WMP combined all the water models into a single model and determined the required capacity of both existing and proposed water distribution infrastructure to support the population growth envisioned in the 2040 Official Community Plan (OCP). The design criteria were in accordance with the City of Revelstoke Subdivision, Development and Servicing Bylaw No.1846.

WSP conducted a water bylaw review and recommend using the Maximum Day Demand (MDD) rate of 1000 L/cap/day for Baseline Population and 600 L/BU/day for Seasonal Population for 2040 scenario. This provides a future demand of 299 L/s in the City for the MDD scenario. Correspondingly, the Average Day Demand (ADD) and Peak Day Demand (PHD) can be derived from the MDD using peaking factors.

Currently, in terms of available water supply to the City, the existing Greeley Creek Treatment Plant has a capacity of 175 L/s, with an additional potential additional capacity of 70 L/s (pump design point) from the Golf Course well. The total potential available water supply capacity is therefore 245 L/s. The Golf Course well has potential to expand to 105 L/s with the addition of a new well pump, which would provide a total of 280 L/s and is sufficient to meet build-out MDD of entire City (minus Big Eddy). However, the Golf Course well will require additional treatment to remove manganese and iron, and UV disinfection before its expansion. Expansion of the Greeley WTP is not recommended given the potential of the Golf Course well to supplement future demand. At the other side of the City, wells at Big Eddy have a capacity of 18.9 L/s, compared to an estimated MDD of 13.9 L/s.

The existing hydraulic model of the City's water distribution system was updated using Bentley WaterCAD to combine three existing different water models: Central/North Revelstoke, RMR/South Revelstoke, and Big Eddy. The City's GIS database and LIDAR as provided by the City were the primary sources of data used for the model

update. Other assumptions were based on the City's Subdivision, Development and Servicing Bylaw and the Water Demands Bylaw update.

Two data sources were analysed to determine existing flows i.e., Big Eddy wells and Greeley Creek WTP/golf course wells. Future population was estimated by adding future development projections, confirmed by emails to the existing 2020 estimates. This includes significant developments in Johnson Heights, South Revelstoke, RMR, and hotels along the Trans Canada Highway. Future demand associated with this added population have been estimated assuming demand (L/capita/day) from the City's Water Demands Bylaw update.

The hydraulic model was used to assess the existing and future hydraulic performance of the water network under ADD, MDD, and PHD conditions. In addition, fire flows coincident to MDD condition were also assessed. A total of 17 scenarios were analysed, details of which are as follows:

- 2020 Scenario without Improvements (4 scenarios; ADD, MDD, PHD and MDD+FF)
- 2040 Scenario without Improvements (4 scenarios)
- 2020 Scenario with Improvements (4 scenarios)
- 2040 Scenario with Improvements (4 scenarios)
- An additional scenario to review the hydraulic level of service (HLoS) of the Greeley Creek transmission main from the Greeley Creek Water Treatment Plant (WTP) to the TCH reservoir.

An assessment of the storage capacities of the City's reservoirs was conducted to determine if they meet the storage requirements. The TCH and Arrow Heights reservoirs were found to be deficient. Through cascading of the future Johnson Heights reservoir into the TCH reservoir, this deficiency can be resolved. Similarly, the deficiency in the Arrow Heights reservoir can be rectified through cascading of the future RMR reservoir into the Arrow Heights pressure zone.

An assessment of the network available pressures experienced under PHD condition was conducted. The majority of the nodes experiencing pressure under 40 psi were addressed with the improvements recommended, reducing the pressure deficient nodes from 21 to 2. The number of nodes experiencing pressure between 120 psi and 130 psi were not considered to be excessively above the standards. As such, the pressures at these nodes were kept consistent with the 2040 scenario without improvements. The number of nodes experiencing pressure above 130 psi accounted for only 0.6% of the entire nodes in the system. These exceedances could be due to inaccuracies in LiDAR elevation data.

The 2040 fire flow conditions with improvements were acceptable, as only 0.6% of the nodes within the entire system have fire flows that do not meet the requirements.

Cost estimates provided in the Capital Projects List have been prepared based on unit cost rates from relevant past projects and from the unit rates provided by the City based on previous projects, adjusted to 2022 dollars. Most of the existing system deficiencies can be addressed through the addition of a new pressure zone in the area south of the Trans Canada Highway and North of the Illecillewaet River. The new pressure zone would include a new Johnson Heights reservoir and the associated pump station to convey water to the Johnson Heights reservoir which ultimately feeds the JH pressure zone by gravity. The Johnson Heights reservoir will be supplied water by a new pump station connected to the Greeley Creek Transmission Main. The new pump station is proposed adjacent to the new Johnson Heights Reservoir. This pump station will fill the JH reservoir. Per the analysis, the JH pump station should be able to supply 27L/s @ 20m Total Dynamic Head (TDH). The transmission main has been identified for upgrades with twinning it with a 500 mm Transmission main, which would run approximately 8.5 km.

To improve system operation resiliency and redundancy in Arrow Heights Pump Station and Reservoir service area, a third pump and a backup generator are recommended for implementation. The third pump would allow the station to provide sufficient capacity when the largest pump is out of service, while the backup generator would allow the station to retain its firm capacity during periods of power outage.

Treatment projects consist of upgrades to the Golf Course well to meet future MDD. The upgrades are manganese and iron removal, UV disinfection, and a new well pump. The total estimate for these upgrades is \$7,735,000 (2022 dollars).

Additionally, localized upgrades ranging from high priority (impacts more than 4 properties), medium priority (impacts 2-3 properties), and low priority (impacts 1-2 properties) are recommended. These include valve closures, upsizing, replacing, and installing new watermains across all pressure zones.

Following these upgrades, the system will satisfy the fire flow requirements by zoning as well as achieve adequate pressures. The total estimated cost for the recommended upgrades (including treatment) is \$35,782,000 (2022 dollars).

Implementation of water meters can have a significant impact on reducing water consumption as well as providing environmental benefit by reduced water consumption. Generally, the industrial, commercial, and institutional (ICI) facilities use more water and have higher flows than residential, and so a larger meter would be required to achieve accurate readings. The City should require meters to be installed within an accessible insulated chamber for all ICI connections and requires positive displacement meters for connections less than 50mm. Under the assumption that the City will install meters in all unmetered connections, the capital costs for meter and meter box installations for all unmetered ICI properties is estimated to be in the range of \$898,110 (2022 dollars). These costs can be deferred to the ICI customer.

An estimated 33% water savings could be potentially achieved on the 310 ICI connections. These connections represent approximately 9% of the City's annual water use, resulting in an overall water savings of 3% for the City.

# 1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the City of Revelstoke (“City”) to update their Water Master Plan (WMP). The update and analysis of the City’s water model will be carried out to develop the list of improvement projects and servicing strategies required for future growth throughout the City.

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## 1.1 BACKGROUND AND PURPOSE

The City currently has three different water models: (1) Central/North Revelstoke, (2) Revelstoke Mountain Resort (RMR)/South Revelstoke, and (3) Big Eddy. WSP has recently developed the Big Eddy and RMR water models as part of separate projects with the City and its developers.

Concurrently, development at RMR and Johnson Heights (in Central Revelstoke) is underway, therefore, representations of those development areas within this WMP should be seen as preliminary. This WMP will combine all the water models into a single model and determine the required capacity of both existing and proposed water distribution infrastructure to support the population growth envisioned in the 2040 Official Community Plan (OCP).

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## 1.2 SCOPE OF WORK

The scope of work for the City’s WMP is as follows:

- Gather and review all existing information related to water supply, such as studies, reports, drawings, water quality data, etc. from the City.
  - Update and review the water network model using latest data and assess the influence of the existing population and demands on the water model.
  - Estimate future demand, assuming population increase and future land use from the City’s 2040 OCP.
  - Conduct a capacity assessment with respect to the City’s design criteria to identify existing and future deficiencies.
  - Recommend improvements to meet the City’s criteria and accommodate 2040 OCP growth.
  - Review of a preferred ICI water metering strategy.
  - Review of Water Bylaw #1846 and recommend changes for the estimation of actual per capita demands.
- 

## 1.3 DATA COLLECTION AND INFORMATION REVIEW

Historical data, water system information, and previous studies that have been reviewed during the development of this report include, but are not limited to:

- Hydrants/ Pipes/Land Use Shapefiles. City of Revelstoke. Email dated August 19, 2021.
- South Revelstoke Water Modelling – Reservoir Volume Assessment for Future Buildout Scenario Memorandum. WSP Canada 2021.
- Bed Unit Calculation Criteria (for Mackenzie Village) Technical Memorandum. WSP Canada 2021.
- Bed Unit Calculation Criteria (for RMR) Technical Memorandum. WSP Canada 2021.
- Revelstoke Mountain Resort 685M Reservoir Northland Properties Drawing Set. WSP Canada 2021.
- MISPR – Water Infrastructure Sizing Design Memorandum. WSP Canada 2021.
- City of Revelstoke Johnson Heights Neighbourhood Infrastructure Assessment Report. WSP Canada 2021.
- City of Revelstoke – 2020 Water Model Update Technical Memorandum. WSP Canada 2021.
- City of Revelstoke Subdivision, Development and Servicing Bylaw No. 1846. City of Revelstoke. 2021.

- RMR Booster Station 2 Maximum Daily Demand Calculations. WSP Canada 2020.
- Populations and Housing Draft Report. Rennie Consulting Services. 2020.
- LIDAR Data. City of Revelstoke. 2020.
- Revelstoke Mountain Resort Base Area Land Use Plan Drawing. Ecosign Mountain Resort Planners 2019.
- RMR Master Plan Update Report. Harry Measure and Associates. 2019.
- Water Risk Assessment Report. McElhanney Consulting Services 2018.
- Revelstoke Mountain Resort Monashee Estates Road Record Drawings. CREUS Engineering 2015.
- City of Revelstoke Arrow Heights Water Supply Pumping Station IFC Drawings. Dayton & Knight 2004.
- Drilling, Installation and Testing of Test Production Well TW02-3 for the City of Revelstoke, BC. Golder 2002.

## 2 EXISTING WATER SYSTEM

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### 2.1 WATER SYSTEM OVERVIEW

The City of Revelstoke water network serves over 8,000 permanent residents living within the City. The water network currently consists of 8 pressure zones, 5 storage reservoirs, and includes approximately 150 km of watermains (including Big Eddy system). The City can be roughly characterized into two systems and three main areas i.e., Central Revelstoke, South Revelstoke/RMR and Big Eddy. Two rivers cross the City and acts as a boundary between the three main areas. The Illecillewaet River runs east-west through the City separating the Central and South Revelstoke areas whereas, the Columbia River runs north-south and separates Big Eddy region (in the west) from the rest of Revelstoke (in the east).

Central Revelstoke (north of Illecillewaet River and east of Columbia River) is the oldest part of the City, with water infrastructure constructed dating back to early 1900s. Some major developments are currently planned for the area, including the Johnson Heights development as well as the development of Tourist Commercial (i.e., Hotels) along the Trans Canada Highway.

South Revelstoke (south of Illecillewaet River and east of Columbia River) is currently experiencing growth pressures through new developments and is anticipated to develop significantly during the next several decades until the next OCP in 2040. These developments are scattered throughout the South Revelstoke and includes the Revelstoke Mountain Resort (further discussed in following sections).

The Big Eddy area is defined as the portion of the City west of Columbia River and south of Highway 1. The Big Eddy water system consists of approximately 12 km of watermain operating as one pressure zone. The primary raw water source is from two groundwater wells on the western end of the water network. These wells pump via a dedicated main up to the Big Eddy Reservoir in the southwest portion of the water network. A large portion of the water system has been upgraded over the past 4 years. These upgrades primarily included watermains, addition of a third well, and a second reservoir at the Big Eddy Reservoir site (WSP, 2021).

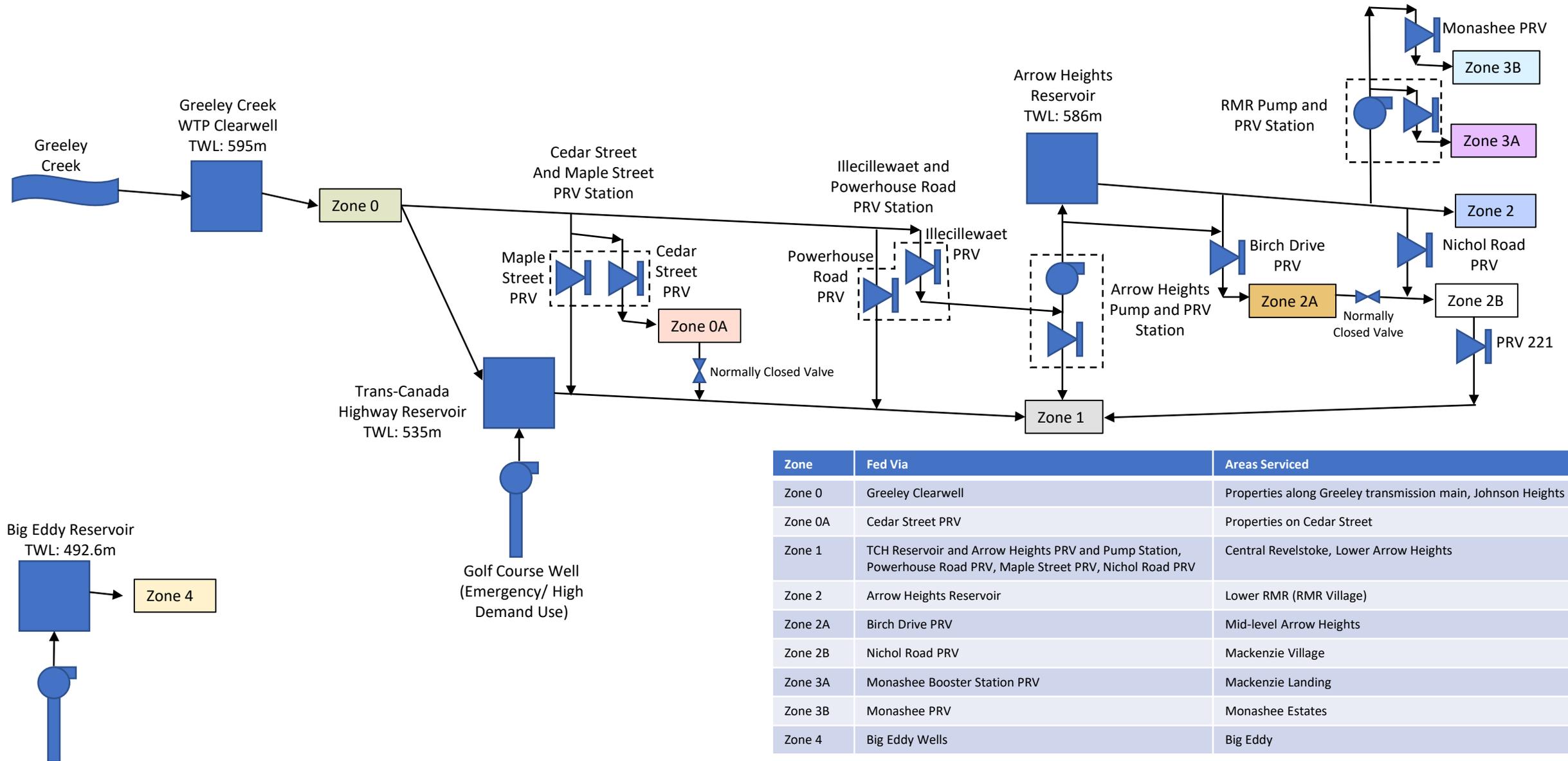
Table 1 provides a summary the existing potable water system components.

**Table 1: Existing Water System Summary**

WATER SYSTEM COMPONENT	QUANTITY
Pressure Zones	8
Supply Sources	3
Storage Reservoirs	5
Pump Stations	4
Pressure Reducing Valves	26
Length of Watermains (km)	154
Fire Hydrants	419

The potable water pipes within the system are typically 100 mm. A hydraulic schematic of the City's distribution system is shown in Figure 1.

# Revelstoke Existing Water System Schematic



Zone	Fed Via	Areas Served
Zone 0	Greeley Clearwell	Properties along Greeley transmission main, Johnson Heights
Zone 0A	Cedar Street PRV	Properties on Cedar Street
Zone 1	TCH Reservoir and Arrow Heights PRV and Pump Station, Powerhouse Road PRV, Maple Street PRV, Nichol Road PRV	Central Revelstoke, Lower Arrow Heights
Zone 2	Arrow Heights Reservoir	Lower RMR (RMR Village)
Zone 2A	Birch Drive PRV	Mid-level Arrow Heights
Zone 2B	Nichol Road PRV	Mackenzie Village
Zone 3A	Monashee Booster Station PRV	Mackenzie Landing
Zone 3B	Monashee PRV	Monashee Estates
Zone 4	Big Eddy Wells	Big Eddy

Big Eddy Wells



Figure no. 1  
Date: Nov 29, 2022

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## 2.2 EXISTING WATER SUPPLY, TREATMENT AND STORAGE

The City of Revelstoke utilizes two water supply sources to provide potable water throughout the community. The majority of the City is supplied by the water that comes from the Greeley Creek watershed, located east of Revelstoke behind Mt. Mackenzie (Dayton & Knight Ltd., 2007). The watershed covers almost 50 sq. km and is in an area of some of the highest snowfall depths in North America. It varies in elevations from about 670 m at the intake to a maximum of 2500 m at Ghost Peak. Snowmelt collects in the Greeley Creek and then flows into the Illecillewaet River (City of Revelstoke, 2012).

The Greeley Creek Water Treatment Plant (WTP) was designed in the 1990s and has an existing capacity of 175 L/s. The Greeley WTP has the potential to add two more trains, and a capacity of 70 L/s, but would require increasing the Greeley Creek water license and expansion to the existing building. Treated water is stored at the Greeley Creek WTP Clearwell that delivers water to the South Revelstoke area via a 450 mm transmission main. The 450 mm transmission main runs along the Trans Canada Highway into the City. At Oak Drive the main branches into two directions:

- South to Powerhouse Road where its further splits into two directions:
  - One 400 mm main continues south of the Illecillewaet River to service South Revelstoke, and the other 250 mm main continues east, north of the Illecillewaet River to service Central Revelstoke.
- East to the Trans Canada Highway Reservoir, north of the Illecillewaet River, to service Central Revelstoke.

The TCH Reservoir is located north of the City on Highway 1 and the AH Reservoir is located east of the City just south of Illecillewaet River. The TCH reservoir was constructed in 2011 and the AH reservoir was constructed in 2004. Both of these reservoirs have a design life of 75 years.

The water supply is supplemented by two groundwater wells, Well No. 1 is located on the south bank of the Columbia River at the City Golf Course and Well #2 is located on the south bank of the Illecillewaet River. Well #2 is understood as not currently connected to the water system due to water quality issues (Dayton & Knight Ltd., 2007). The Golf Course well is able to provide an additional pumped water capacity of 70 L/s to the City's water system but has not been used in recent years unless required due to summer water demand peaks. The Golf Course Well has high concentrations of Iron and Manganese, and will require treatment on a regular basis for the removal of such contaminants.

The total potential available water supply capacity for the City's main water network is 244 L/s with both Greeley Creek WTP and the Golf Course well combined.

Further south of the AH Reservoir, within the Revelstoke Mountain Resort (RMR) aggressive growth and development is planned as per the Draft Resort Lands Master Plan dated March 16, 2020. This will result in a potential future RMR Reservoir, and upgrades to the Monashee Booster Station to pump water up to the RMR Reservoir. The design for the RMR Reservoir, Monashee Booster Station and PRV setting upgrades are currently ongoing.

The Big Eddy system is supplied water from two wells at the west end of the area. The wells were constructed and commissioned in 1980 and are housed in two separate pump house structures. Both the wells have a combined capacity of 18.9 L/s and typically each of the pumps within the wells operate at 12.6 L/s separately (WSP 2017). Chlorinated water from the wells is pumped into the distribution network and up to the two Big Eddy Reservoirs. The first reservoir was constructed in 1980 and the second reservoir was constructed in 2018; each have an approximate capacity of 1,400 m<sup>3</sup> respectively (WSP 2017).

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## 2.3 EXISTING PUMP STATIONS

There are four water pump stations in the City, namely the Arrow Heights Pump Station, Monashee Booster Pump Station, the Golf Course Well Pump Station, and Big Eddy Well Pump Station. The Arrow Heights PS has two pumps that are used to fill the Arrow Heights Reservoir. It was constructed in 2004 and has a design life of 50 years.

The Monashee Booster Pump Station was constructed in 2008 by RMR for the City and has a design life of 50 years. Currently, this Pump Station provides water supply to connections within Mackenzie Landing and Monashee Estates and contains two domestic pumps and one fire pump. The Big Eddy pumps were constructed in 1980 along with the wells and have a design life of 50 years. It is used to pump chlorinated water from the wells up into the Big Eddy Reservoir.

The Golf Course production well (Well No. 1) was installed in 2002, followed by the installation of a 70 L/s well pump. The design life and actual installation data are unknown, but the pump is approximately 20 years old.

## 2.4 EXISTING PRESSURE REDUCING STATIONS

The City of Revelstoke is divided into eight pressure zones. Table 2 summarizes the existing pressure zones within the City and their respective hydraulic grade line (HGL).

**Table 2: Pressure Zones**

PRESSURE ZONE	HGL (m)
Zone 0	594.6
Zone 0A	565.3
Zone 1	569.6
Zone 2	584.6
Zone 2A	561.2
Zone 3A	613.5
Zone 3B	638.1
Zone 4	491.6

As part of the Water Regulations Bylaw, the City requires all service connections to the City's water system to have a pressure reducing valve where the service line enters into the premises. There are nine pressure reducing stations within the City. Elevations of the PRVs and their valve settings are summarized in Table 3.

**Table 3: Existing PRV Stations**

PRV STATION	ELEVATION (m)	VALVE DIA. (mm)	HGL SETPOINT (m)	PRESSURE SETPOINT (PSI)
Arrow Heights PRV Lag	471.3	200	535.4	91.0
Birch Drive PRV Lag	493.6	150	555.7	88.0
Birch Drive PRV Lead	493.6	80	560.6	95.0
Cedar Street PRV Lag	511.1	150	565.4	77.0
Cedar Street PRV Lead	511.1	75	565.4	77.0
Illecillewaet PRV 1	455.6	200	596.5	200.0
Illecillewaet PRV 2	452.0	300	569.6	167.0
Maple Street PRV	511.0	150	540.6	42.0
Monashee Estates PRV Lag	638.1	250	693.1	78.0

<b>PRV STATION</b>	<b>ELEVATION (m)</b>	<b>VALVE DIA. (mm)</b>	<b>HGL SETPOINT (m)</b>	<b>PRESSURE SETPOINT (PSI)</b>
Monashee Estates PRV Lead	638.1	150	697.3	84.0
Nichol Road PRV Lag	494.8	250	553.9	84.0
Nichol Road PRV Lead	494.8	100	556.1	87.0
Powerhouse Road PRV	452	150	537	120
RMR Booster Station PRV Lag	557.3	200	608.6	73.0
RMR Booster Station PRV Lead	557.3	50	613.6	80.0

### 3 DESIGN CRITERIA

The design criteria used to review the system’s minimum and maximum service pressures, maximum velocity, available fire flows, storage volumes, and other standards are outlined in this section. The design criteria are in accordance with the City of Revelstoke Subdivision, Development and Servicing Bylaw No.1846.

Table 4 provides a summary of the design standards utilized.

**Table 4: Design Criteria**

DESIGN PARAMETER	VALUE	
Design Pressures	Maximum Pressure – 120 psi	
	Minimum Pressure – 40 psi	
Fire Flow Demand <sup>1</sup>	Land Use	Fire Flow (L/s)
	Single, two dwelling, and modular housing	60
	Three and four plex housing	90
	Apartments, row housing, commercial, institutional	150
	Industrial	225
Population Density	<b>Baseline Population:</b> Single Family – 3.0 people/unit Multi Family/Mobile Home – 2.0 people/unit Industrial – 50 people/ha Commercial – 75 people/ha <b>Seasonal Population:</b> 2.0 bed units (BU) per room	
Per Capita Demand (Refer to Section 4 for additional information)	<b>L/capita/day Demands for Baseline Population:</b> ADD – 600 L/capita/day MDD – 1,000 L/capita/day (1.67*ADD) PHD – Peaking Factor (PF)*ADD Where, PF: 4.44 for Single Family Homes 2 for Multifamily/Mobile Homes 1.8 for Commercial/Industrial <b>L/BU/day Demands for Seasonal Population:</b> ADD – MDD/1.67 MDD – 600 L/BU/day PHD – 2*ADD	

DESIGN PARAMETER	VALUE
Maximum Design Velocity	Pump Supply, Reservoir and Trunk Mains – 2.0 m/s During PHD – 2.0 m/s Under Fire Flow Conditions – 4.0 m/s
Minimum Pipe Diameter (When replaced)	200 mm
Hazen-William's 'C' Values	PVC, HDPE – 130 DI, CI, AC, GI – 110 -2.5 for every decade of service +10 for any main $\geq$ 300mm in diameter
Reservoir Storage Requirement	Total Storage Requirement = A+B+C A – Fire Storage B – Equalization Storage (25% of MDD) C – Emergency Storage (25% of A + B)

**Notes:** 1. In accordance with “Water Supply for Public Fire Protection – A Guide to Recommended Practice 1999” published by Fire Underwriters Survey.

## 4 EXISTING WATER BYLAW REVIEW

Currently, per the City of Revelstoke water bylaw, the per capita demands are outlined as:

- ADD = 900 L/capita/day
- MDD = 2,400 L/capita/day
- PHD = 4,000 L/capita/day

However, in reviewing the water bylaws of the nearby communities and discussions with the City during the kickoff meeting, WSP understands that these values are conservative in nature (especially for use in a water master plan) and the city is looking for a more accurate estimate. As such, WSP have reviewed the past data and several reports to analyze the per capita demands. Reports reviewed in this context are:

- Population and Housing Projections, Rennie, December 2020
- Revelstoke Water Model Update Report, WSP, January 2021
- Comprehensive Water Conservation and Supply Plan, The Resort Municipality of Whistler, September 2015
- Technical Memo # 1, Bed Unit Calculation Criteria, WSP, March 2020
- Design Guidelines for Rural Residential Community Water Systems, Government of British Columbia, 2012

The existing water bylaw for the City suggests that all future demand should be calculated on per capita basis. However, the City of Revelstoke is unique in the sense that it is a resort community which sees a large seasonal/transient population influx each year. Therefore, the current population can be divided in two categories i.e., Usual Residents (Baseline Population) and Shadow Population + Tourists (Seasonal Population).

Several reports were analyzed, namely the abovementioned Whistler Conservation Plan, Bed Unit Calculation Criteria and Design Guidelines for Rural Residential Community water systems to get an idea of how similar community calculate demand for seasonal population. All the literature suggest that the seasonal population's demand should be calculated using a bed unit method. This method assumes 2 beds per room in hotel/resort. Each report suggests a L/BU/day number based on the historical data. These are as follows:

- Technical Memo # 1. Suggests 600L/BU/day as MDD criterion for hotel/resorts. This technical memo looked at the bed unit criterion from Whistler Resort community. Whistler standards recommended a 500 L/BU/day for peak summer season and 700 L/BU/day for peak winter season i.e., skiing. Whistler has arrived at this number using the early 2000's flow data. This memo uses an average number of 600 L/BU/day for the entire year.
- Whistler Water Conservation and Supply Plan. Suggests 500L/BU/day for each bed unit. Post 2000, Whistler has analyzed the historical flow data till 2015 and compared it with seasonal population to estimate this number. Whistler found that the design demand is decreasing with time. As such, the previous L/BU/day of 500 and 700 for summer and winter season respectively was replaced with 500 L/BU/day for the entire year, be it summer or winter.
- Design Guidelines for Rural Residential Community Water Systems. Suggests 230 L/BU/day as MDD criterion for indoor usage in recreational resorts.

Of the three reports analysed, the seasonal population consumption rate is understood to be in the range of 230-600 L/BU/day.

Having reviewed the L/BU/day consumption rates from different reports, WSP devised a methodology to use the existing "knowns" i.e. historical MDD demands in the City for the pre-2020 period (115.1 L/s MDD flow from the flow meter data as assessed during the Revelstoke Water Model Update Report, WSP, 2021) and the 2020 population (baseline + seasonal) from the populations housing projections report (Rennie, 2020) in conjunction with the 230-600L/BU/day seasonal consumption rate range to arrive at three different MDD per/capita demand criteria.

From the population and housing report (Rennie, 2020), the 2020 population is confirmed as:

- Baseline: 8,260 people (usual residents)
- Seasonal: 9,000 bed units (shadow population + tourists)

Using these numbers, three scenarios were analyzed:

- Assuming 230 L/BU/day.  $(230 \text{ L/Bu/day} \times 9,000 \text{ bed units}) / 86,400 = 23.96 \text{ L/s}$ 
  - MDD Flow (from model update report using historical flows, WSP, 2021) = 115.1 L/s
  - Remaining flow from Baseline Population of 8,260 people =  $115.1 - 23.96 = 91.14 \text{ L/s} \rightarrow 91.14 / 8260 \times 86400 = 953.35 \text{ L/cap/day MDD}$
- Assuming 500 L/BU/day.  $(500 \text{ L/Bu/day} \times 9,000 \text{ bed units}) / 86,400 = 52.08 \text{ L/s}$ 
  - MDD Flow (from model update report using historical flows, WSP, 2021) = 115.1 L/s
  - Remaining flow from Baseline Population of 8,260 people =  $115.1 - 52.08 = 63.02 \text{ L/s} \rightarrow 63.02 / 8260 \times 86400 = 659.16 \text{ L/cap/day MDD}$
- Assuming 600 L/BU/day.  $(600 \text{ L/Bu/day} \times 9,000 \text{ bed units}) / 86,400 = 62.05 \text{ L/s}$ 
  - MDD Flow (from model update report using historical flows, WSP, 2021) = 115.1 L/s
  - Remaining flow from Baseline Population of 8,260 people =  $115.1 - 62.05 = 52.6 \text{ L/s} \rightarrow 52.6 / 8260 \times 86400 = 550.20 \text{ L/cap/day MDD}$

Of the three cases analyzed, the MDD consumption rate of 230 L/BU/day, for the seasonal population, resulted in the most conservative MDD consumption rate (953.35) per capita for the baseline population. In reality, the MDD consumption rate of the seasonal population is expected to be a lot higher than 230 L/BU/day (Whistler Conservation Plan, similar resort community), which means that the MDD per capita rate of 953.35 L/cap/day is still conservative but more realistic than the existing 2,400 L/cap/day outlined in the current bylaw. Therefore, future flow estimates are calculated using an approximate MDD rate of 1000 L/cap/day. It should be noted that the 230 L/BU/day is deemed as an unrealistic consumption rate (at the moment) for the seasonal population of the City. This 230 L/BU/day is used only for the calculation of the MDD consumption rate of 950 L/cap/day for the baseline population and should not be used for calculation of future flows.

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## 4.1 FUTURE FLOW CALCULATIONS – ULTIMATE BUILDOUT SCENARIO

Baseline and seasonal population from the future growth areas (confirmed via emails) was added to the existing 2020 numbers. This includes all the developments in Johnson Heights, South Revelstoke, Revelstoke Mountain Resort, and hotels along highway. The final tally for buildout scenario is as follows:

Baseline:  $8,260 + 4,622 \text{ people} = 12,882 \text{ people}$

Seasonal:  $9,000 + 12,522 \text{ bed units} = 21,522 \text{ bed units}$

(These numbers assume that all the future growth areas are fully utilized in the peak season i.e., the total number of beds available will be occupied in the peak season)

Using the conservative case of 1000 L/cap/day and the range of 500-600 L/BU/day, two scenarios were analyzed:

- Best-Case Scenario. 1000 L/cap/day and 500 L/BU/day.
  - 1000 L/cap/day x 12,882 people / 86400 = 149.10 L/s MDD for baseline population of 12,882 people
  - 500 L/BU/day x 21,522 beds / 86400 = 124.55 L/s MDD for seasonal population of 21,522 people
  - Total flow required:  $149.10 + 124.55 = 273.65 \text{ L/s}$
- Conservative-Case Scenario. 1000 L/cap/day and 600 L/BU/day.
  - 1000 L/cap/day x 12,882 people / 86400 = 149.10 L/s MDD for baseline population of 12,882 people
  - 600 L/BU/day x 21,522 beds / 86400 = 149.45 L/s MDD for seasonal population of 21,522 people
  - Total flow required:  $149.10 + 149.45 = 298.55 \text{ L/s}$

Although the 2,400 L/cap/day will yield the most conservative results it should be noted that these results represent the theoretical maximum, and not necessarily a realistic scenario. The 1000 L/cap/day MDD consumption rate determined from the field flows tested with meters and latest housing projections is still conservative but appears to be the more realistic approach.

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## 4.2 RECOMMENDATIONS

WSP is of the opinion that the City should document the population from the future growth areas in the coming years and monitor demands coming from the Greeley Creek Treatment Plant. A focused audit and program to clearly determine the MDD per capita demand and bed unit water usage rate should also be implemented. These confirmed unit demands, and populations should be consistently used to determine the MDD per capita requirements. The estimated MDD per capita rate should be compared with the assumptions in this WMP, to validate the results. Meanwhile, for the model loading and water master plan, we suggest using the **MDD rate of 1000 L/cap/day for Baseline Population and 500 L/BU/day for Seasonal Population for estimating water demands under the 2040 scenario**. This provides a future demand of 274 L/s in the City for the MDD scenario as shown in the section above. A major consideration for why the value was also chosen as upon detailed development of water demands for all project future developments parcel-by-parcel for the modelling exercise in Section 7, the final MDD was estimated at 277 L/s. Correspondingly, the ADD and PHD can be derived from the MDD using the peaking factors listed in Table 4.

This approach is not as conservative as using the 2400 L/cap/day value from the bylaw but appears a more realistic approach for estimation of future demands at the moment for the purpose of the water master plan. This approach was discussed with City staff and judged as an appropriately conservative approach.

# 5 MODEL UPDATES AND SCENARIO DEVELOPMENT

## 5.1 INFRASTRUCTURE UPDATES

The existing hydraulic model of the City’s water distribution system was updated using Bentley WaterCAD to combine three existing different water models: Central/North Revelstoke, South Revelstoke/RMR, and Big Eddy. The City’s GIS database and LIDAR as provided by the City via email dated August 19, 2021 was the primary source of data used for the model update. Other assumptions were based on the City’s Subdivision, Development and Servicing Bylaw and the Water Bylaw Review in the previous section.

Watermains in the City’s distribution network were modelled as pipes with pressure drops due to friction estimated using the Hazen-William equation. The existing pipe lengths, diameters and materials were cross referenced with the information contained within the data supplied by the City and updated accordingly. The majority of the City’s 154 km potable water distribution network consists of Polyvinyl Chloride (41%) and Asbestos Cement (31%), followed by Ductile Iron (9%) and Cast Iron (5%), as shown in Figure 2. The most common pipe sizes within the distribution network are 150 mm (47%), followed by 200 mm and 300 mm as illustrated in Figure 3.

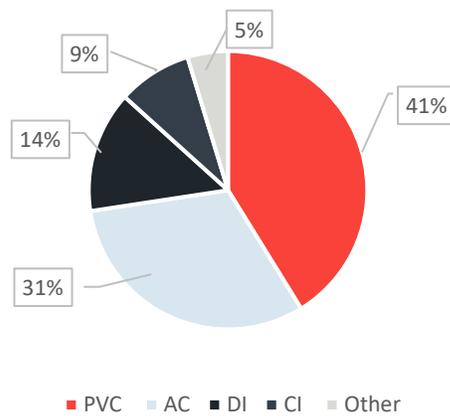


Figure 2: Distribution Network by Pipe Material

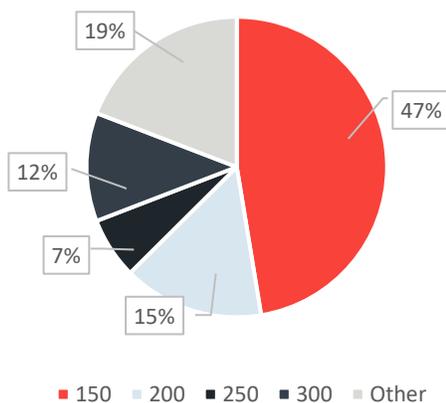


Figure 3: Distribution Network by Pipe Diameter

The LiDAR data provided by the City was cross referenced with the GIS data supplied to re-assign elevations to all nodes in the model.

The previous water model did not accurately reflect the correct number of nodes to reflect the actual number of hydrants in the field. The City's hydrant shapefile was referenced into the water model for updates. Using the GIS data, land use designations correlating to the City's Zoning Bylaw 1264 for all land parcels were obtained and reviewed against hydrant node fire flow requirements. Land use zones corresponding to the City's Subdivision, Development & Servicing Bylaw were assigned to each of the land use designations obtained from the GIS data. This allowed for allocation of fire flows to hydrants (nodes) based on development user types as described in Section 3. This was done by mapping the minimum required fire flow of each parcel to the nearest node in the model using ArcGIS. In the case where different fire flow requirements were allocated to the same node, the maximum (conservative) value was taken as the required fire flow for that specific node.

## 6 CALIBRATION METHODOLOGY

Calibration of a water model is an iterative review process encompassing the details of each component of the water system including: the length, diameter, material, and roughness factors of the watermains; node demands and elevations; and pump configurations and operational settings. The calibration process allows for confirmation and, where appropriate, revisions to the assumptions and/or estimates made in the development of the model.

Calibration requires confirmation of the model predictions by comparison to field measurements. Therefore, a hydrant flow testing program was developed such that static and residual pressures with the actual water network could be recorded during a simulation of fire flows, as well as any special operational changes to the system (such as main closures, valve closures, etc.) from the days of hydrant flow testing are also collected. The recorded field results are then compared to the computer water model's predicted results through the calibration process.

A program for multi-pressure and C-factor hydrant flow testing was developed for the purpose of collecting field data from which to calibrate the constructed hydraulic water models. In July 2020 WSP worked with the City's operations team to complete the testing. The testing program and results have been included as Appendix C of this report, which show the locations of each of these tests.

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### 6.1 CENTRAL REVELSTOKE C-FACTOR FIELD CALIBRATION RESULTS

Watermain materials and years of installation are based on the GIS information provided by the City. The field measurements were reviewed in detail and cross-referenced to the multi-pressure tests and adjusted accordingly to ensure field information suitability. On average, the model has been calibrated to 0.5% and 3.0% accuracy for 7 of the 10 tests completed, whereas 3 locations were identified as having field information collected appeared to be significantly inaccurate, likely due to logger reading error. This was confirmed and the calibration was updated in subsequent calibration efforts in spring 2022.

The Central Revelstoke model was reviewed based on 10 subsections/neighbourhoods to update the C-Factors for the piping. The GIS data for the water network provided by the City was reviewed as this includes estimated installation years, and the c-factors for each pipe material per section was set as follows:

- AC, CI, DI, GI – base of 110
- PVC, HDPE – base of 130
- -2.5 for every decade of service
- +10 for any main  $\geq 300$ mm in diameter
- Any calculated C-factor  $< 95$  increased to 95

These subsections have been incorporated into the water model as selection sets.

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### 6.2 CENTRAL REVELSTOKE MULTI-PRESSURE FIELD CALIBRATION RESULTS

The results of the calibration process indicate generally a good correlation between the field pressure measurements and computer predicted results. The complete calibration and validation results are provided in Appendix C.

Field investigation by City staff is recommended near hydrants which are not well calibrated, these hydrants are summarized in Appendix C:

The acceptable tolerance between field and computer predicted results is within 15% for pressures. Based on the calibration activities and the system information available at this time, WSP considers the majority of the hydraulic water model to be sufficiently calibrated to assess the capacity of the existing water system. It is recommended to complete more testing in the area of Multi-Pressure Set 3 to help determine the cause of the larger pressure drops

experienced during field testing. Results of the hydrant testing, and calibrated values of the water model are summarized in Appendix C.

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### 6.3 BIG EDDY C-FACTOR FIELD CALIBRATION RESULTS

The field measurements were reviewed in to ensure field information suitability. On average, the model has been calibrated to between 5.6% and 12.8% accuracy for 3 of the 5 tests completed, whereas 2 locations were identified as having field information collected with appeared to be significantly inaccurate, likely due to a network understanding error. As the Big Eddy water system is fairly simple with the distribution system all being fed from the same reservoirs it is likely these large variations are from incorrect pipe sizes within the model, unknown valve closures, or valves not being fully closed during the testing. It is our understanding that the City recently took over the Big Eddy water system and received minimal record documents from the previous operators.

As a result, more investigation is likely needed to improve model confidence. One way to develop an increased confidence in the watermain assumptions is to find and check more historical record drawings if possible, or alternatively, complete more directed hydrant testing is carried out.

As the C-factor test results did not provide enough data to use to calibrate the Hazen-Williams coefficients in the model, the same evaluation as completed for the Central Revelstoke water model was used to update the Big Eddy water model coefficients.

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### 6.4 BIG EDDY MULTI-PRESSURE FIELD CALIBRATION RESULTS

Although the c-factor testing was not as successful as anticipated for Big Eddy either, the results of the multi-pressure tests completed in Big Eddy led to the conclusion that the majority of the model has been successfully calibrated, with only 1 out of 26 of the field measurements for these tests showing a variance of >15% when compared to the model results.

# 7 EXISTING POPULATIONS AND WATER DEMANDS

## 7.1 EXISTING WATER DEMAND ESTIMATES

A total of three demand scenarios were calculated: Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD). ADD is the average water demand over the course of a year. MDD is an estimation of the maximum water usage per capita for one day in a year. PHD is an estimation of the maximum water usage of the system in one hour during a day in a certain year. The PHD usually occurs on or around the day when MDD occurs.

Two data sources were analysed to determine historical total system demands i.e., Big Eddy wells and Greeley Creek WTP/Golf Course well.

Flow meter data for the outlet of the Greeley Creek WTP and the pump run time data for the Golf Course well for 2017 to 2019, was used to calculate the water network ADD and MDD. To calculate the City’s PHD, the outlet flow rates for the TCH Reservoir and the AH Reservoir were reviewed independently to find the highest hourly outflows for 2017 to 2019. Hourly reservoir outflows were combined with hourly records at the Greeley Creek WTP and the Golf Course wells. The highest values from each year were averaged to calculate the PHD for each.

Flow data for the wells in Big Eddy region was provided by the City for 2019 to 2021. WSP analyzed the data to determine the ADD, MDD and PHD. The ADD and MDD values for Big Eddy were derived from the historical flow data. To be conservative, WSP has used a peaking factor of 4.44\*ADD (in line with the existing peaking factor in the current design standards) in estimating the PHD for Big Eddy region.

Table 5 summarizes the water demands for each pressure zone. Demand allocation for the existing conditions was not reassessed and were copied over the from the latest model. Demand totals have been cross-referenced and validated with the existing data to date.

**Table 5: Existing Water Demand Estimates by Pressure Zone**

<b>PRESSURE ZONE</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
Zone 0 – Greeley Creek WTP	2.95	3.47	6.18
Zone 0A – Cedar Street PRV	0.23	0.31	0.56
Zone 1 – Central Revelstoke and Lower AH	39.82	102.35	183.1
Zone 2 – Lower RMR	1.69	1.45	2.58
Zone 2A – Mid AH	5.19	5.22	9.3
Zone 3A – Mackenzie Landing	0.41	0.78	1.24
Zone 3B – Monashee	0.70	0.70	1.24
<b>Total Demand</b>	<b>55.14</b>	<b>114.28</b>	<b>204.19</b>
Zone 4 – Big Eddy	5.12	13.91	22.8

Note that demand allocations as described in the table above show some discrepancies in comparison between ADD and MDD in some pressure zones. The discrepancies are caused because the demand allocations were inherited from the previous City of Revelstoke Water Model Update project (WSP, 2021), where they may have been populated using a different approach. Review and re-distribution of water demands were not completed as it was determined that the demand allocation discrepancies are not large enough to negatively impact model results, and also the task is beyond the scope of this WMP project. Therefore, WSP advanced to the system assessment and system improvement development stage with the demand allocation as is. However, WSP recommends that the City to review demand allocation and revise as necessary prior to undertaking planning and design works in the future.

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## 7.2 FUTURE POPULATIONS AND WATER DEMANDS

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### *FUTURE POPULATION ESTIMATES*

Future population was estimated by adding up individual populations for a long list of future developments, confirmed by emails with the City. This includes significant developments in Johnson Heights, South Revelstoke, RMR, Hotels along the Trans Canada Highway, and a number of other smaller developments scattered in the City. This results in a total baseline population of 12,882 and seasonal population of 21,522 people in 2040. Estimated populations in each of the future developments is presented in Table 7 below.

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### *FUTURE WATER DEMANDS*

Future added residential and ICI population has been estimated based on the future development area and population densities from the City's Subdivision, Development & Servicing Bylaw 1846 as shown in Table 6. Future demand associated with this added population have been estimated assuming water demand rates (L/capita/day) from the water bylaw review carried out in Section 4. A MDD value of 1000 L/cap/day has been used for baseline population and a MDD value of 600 L/BU/day has been used for seasonal/tourist population.

**Table 6: Population Density**

ZONING	POPULATION DENSITY
<b>Baseline Population</b>	
Single-Family	3.0 people/unit
Multi-Family/Mobile Home	2.0 people/unit
Industrial	50.0 people/ha
Commercial	75.0 people/ha
<b>Seasonal Population</b>	
Bed Units	2.0 bed units per room

Each development's future build-out demands are summarized in Table 7. Populations, dwelling unit estimates, and demands for anticipated developments have been coordinated and confirmed with the City by email dated September 23, 2021. The ADD, MDD and PHD values were calculated using the per capita demands, peaking factors, and Bed Units (BU) demands listed in Table 4.

**Table 7: Future Buildout Demand Estimates**

DEVELOPMENT	EQUIVALENT POPULATION	ADD (L/S)	MDD (L/S)	PHD (L/S)
Along Trans Canada Highway	660 people and 480 BU	6.58	10.97	12.24
Johnson Heights	1996 people	13.87	23.11	40.09
Mackenzie Village	4,068 BU	17.14	28.62	34.23
Stoked Living	393 people	2.73	4.55	9.17
RMR*	8890 people	32.45	53.87	61.41
Upper Arrow Heights	615 people	4.89	8.16	20.21
Selkirk	24 people	0.17	0.28	0.74
Park Drive East Parcel	90 people	0.63	1.04	2.78
Newlands Development	70 people	1.15	1.91	3.56
Future Growth (West of Airport Way and South of Nichol)	24 people	0.17	0.28	0.74
RMR Golf Course Development	200 people	1.39	2.31	2.78
JS Park	30 people	0.21	0.35	0.93
Arrow Heights Road Parcel	87 people	0.60	1.01	2.68
Arrow Drive Parcel	39 people	0.27	0.45	1.20
Park Drive Parcel #1	120 people	0.83	1.39	3.70
Old Drive in Parcel	262 people	1.82	3.03	3.64

\* Pending final development approval process

Upon review of the above, the reader may pose a question in regard to future development with more population having lower PHD compared to future development with similar or less population. WSP notes that PHD peaking factor plays a major role in driving this “apparent” discrepancy. For example, developments along Trans Canada Highway has more future equivalent population but lower PHD than Upper Arrow Heights development, this is because developments along Trans Canada Highway consist of mostly commercial type development with a PHD peaking factor of 1.8, which is lower when compared to developments in Upper Arrow Heights single family residential areas with a PHD peaking factor of 4.44. Consequently, despite the anticipated future population is similar between the two development areas, larger PHD from area with more single family residential development is expected.

Appendix A contains a breakdown of these demands. With the addition of future population growth and developments, Table 8 summarizes the future water demands for each pressure zone.

**Table 8: Future Water Demands by Pressure Zone (2040)**

ZONE	ADD (L/S)	MDD (L/S)	PHD (L/S)
Zone 0 – Greeley Creek WTP	3.10	3.46	7.39
Zone 0A – Cedar Street PRV	0.23	0.31	0.56
Zone 0B – Johnson Heights	13.70	23.09	38.87
Zone 1 – Central Revelstoke and Lower AH	59.5	134.86	243.34
Zone 2 – Lower RMR	1.18	1.73	3.32
Zone 2A – Mid AH	10.40	14.27	30.34
Zone 2B – Mackenzie Village	17.89	28.97	35.16

ZONE	ADD (L/S)	MDD (L/S)	PHD (L/S)
Zone 5 – RMR*	34.66	56.32	69.53
<b>Total Demand</b>	<b>140.71</b>	<b>263.01</b>	<b>428.51</b>
Zone 4 – Big Eddy	5.12	13.91	22.8

\* RMR contains 5 sub pressure zones, shown on Figure 5. For simplicity, total demands of all RMR pressure zone are shown.

WSP notes that the total future MDD estimation in Table 8 (approximately 277 L/s) is different from that described in Section 4.1, where a best-case scenario and a conservative-case scenario are calculated based on design parameters. The 277 L/s was derived from more accurate information including population, land development types, and consultation with City staff, and was therefore used for hydraulic modeling purpose. Thus, the future MDD of 277 L/s was used in modeling and water distribution system analysis, and the future MDD of 274 L/s was used in water treatment and storage system analysis.

### 7.3 SCENARIO DEVELOPMENT

The hydraulic model was used to assess the existing and future hydraulic performance of the water network under ADD, MDD, and PHD. In addition, fire flows coincident to MDD were also assessed. A total of 17 scenarios were analysed, details of which are as follows:

- **2020 Scenario without Improvements (4 scenarios):** The City’s water distribution model was analysed for the existing conditions i.e., existing demands and populations as determined by the historical flows MDD (+FF) and PHD scenario. The purpose of these scenarios was to identify deficiencies in the existing system based on existing water demand.
- **2040 Scenario without Improvements (4 scenarios):** The City’s water distribution model was analysed for the future ADD, MDD (+FF) and PHD conditions i.e., future demands corresponding to the anticipated developments as outlined in Section 0. The purpose of this scenario was to identify deficiencies in the existing system based on future water demand.
- **2020 Scenario with Improvements (4 scenarios):** Using an iterative approach, the model was run several times to determine the infrastructure projects required to rectify the servicing deficiencies noted in the base 2020 scenarios (i.e., without Improvements)
- **2040 Scenario with Improvements (4 scenarios):** Using an iterative approach, the model was run several times to determine the infrastructure projects required to accommodate the anticipated future growth in the City while addressing deficiencies noted in the base 2040 scenarios (i.e., without Improvements).
- WSP created an additional scenario to review the hydraulic level of service of the Greeley Creek transmission main from the Greeley Creek Water Treatment Plant (WTP) to the TCH reservoir. An EPS simulation was created to determine the demand and time required to fill the TCH reservoir to the TWL before the start of the next day.

The upgrades recommended herein are based on all 17 scenarios noted in this section.

## 8 WATER SYSTEM ASSESSMENT

This section covers the hydraulic analysis of the water system under the existing and future demand conditions. The objective of the analysis is to assess the system's performance with respect to compliance with the design criteria outlined in Section 3 and to highlight existing deficiencies in the system followed by recommendations. Analysis covered in this section includes a review of the available storage capacity, available system pressures, fire flows in the distribution system, and pumping capacities.

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### 8.1 WATER SOURCE SUPPLY

Currently, in terms of available water supply to the City, the existing Greeley Creek Treatment Plant has a capacity of 175 L/s, with an additional potential additional capacity of 70 L/s (based on present pumping capacity) from golf course well No. 1.

The Golf Course well is potentially capable of providing 105 L/s (the existing capacity of the well screen), with pumping upgrades. The installation report states that the well could have a long-term capacity of "significantly greater than 140 L/s" but is limited by the well screen capacity of 105 L/s (Golder, 2002). Further, if a pumping rate in excess of 74 L/s is used an Environmental Assessment may be required. Golf Course Wellhead protection plan stipulates continuous use of Well No.1 would incur GARP, GWUDI consideration; double barrier disinfection would be required, with the addition of UV disinfection to the existing chlorination system.

If the Golf Course well pump is upgraded, the total potential available water supply capacity would be 280 L/s, without requiring Greeley Creek Treatment Plant expansion. It is noted that the capacity exceeds the model estimate (excluding Big Eddy demands) in Section 7 (277 L/s) and the best-case scenario in Section 4.1 (260 L/s). The difference is within the reasonable error of the model and can be mitigated with greater water conservation expected in the future (addition of higher efficiency appliances, capital distribution projects, etc.).

The Greeley Creek WTP at present has five trains and is expandable to seven. Expansion would add an additional 70 L/s but would require the Greeley Creek water license to be increased. The water treatment building also does not have space for expansion, so the additional trains would require considerable construction. These upgrades are feasible but would incur significant costs; it is not recommended to pursue this option.

A summary of demand and treatment upgrades is summarized in Table 9. It is recommended that an investigation occurs to support the increased the discharge of the Golf Course Well, while it is currently assumed feasible with an environmental assessment and would be sufficient to 2040 demand without expanding Greeley Creek TP.

The Big Eddy system has sufficient capacity based on the build-out scenario in Section 7. The system currently has an excess capacity of 5 L/s (above MDD), which would support 1.5% annual growth to the Big Eddy Service area for the next 20 years.

**Table 9: Treatment Upgrades Triggered by Demand**

SOURCE	TRIGGER	UPGRADES COMPLETED	CAPACITY AFTER UPGRADE (L/S)
Greeley Creek	MDD < 175 L/s	None	175
Greeley Creek + Golf Course Well	MDD > 175 L/s	— Manganese and Iron removal of Golf Course Well	245
	ADD > 175 L/s GARP, GWUDI consideration	— UV Disinfection at Golf Course Well	245
	MDD > 245 L/s	— Environmental assessment for 105 L/s discharge from Golf Course Well — Upgrade well pump to 105 L/s	280
	MDD > 280 L/s	— Increase Greeley Creek water license from 210 L/s to 245 L/s — Add two membrane trains at Greeley WTP, including building expansion	350

## 8.2 STORAGE CAPACITY ANALYSIS

An assessment of the storage capacities of the City’s reservoirs is conducted to determine if they meet the storage requirements. The fire storage required is governed by the highest fire flow demand required within the serviced area for each reservoir. The fire (A), balancing (B), and emergency (C) storage volumes have been calculated based on the design criteria noted in Section 3.

Table 10 summarizes the storage reservoir volumes and compares the total required storage to the available storage under existing and future demand conditions. The cells highlighted in red indicate deficiencies and the cells highlighted in green indicate surplus volume. Appendix B contains detailed breakdown of how these values were obtained.

By 2040, two additional reservoirs will be introduced into the system, Johnson Heights reservoir and Revelstoke Mountain Resort (RMR) reservoir, as part of the proposed upgrades. The available volume for both of these additional reservoirs have been coordinated to the same values used in ongoing projects for the City by WSP.

**Table 10: Existing Reservoir Contributions**

RESERVOIR	A – FIRE STORAGE (ML)	B – BALANCING STORAGE (ML/D)	C – EMERGENCY STORAGE (ML)	A+B+C REQUIRED STORAGE (ML)	AVAILABLE STORAGE (ML)	DEFICIENT/SURPLUS (ML)
<b>2020 Scenario</b>						
TCH*	2.43	2.54	0*	4.97	4.5	-0.47
Arrow Heights	1.08	0.35	0.36	1.79	2.3	0.51
<b>2040 Scenario</b>						
Johnson Heights	1.08	0.50	0.39	1.97	2.0 <sup>3</sup>	0.03
TCH <sup>1</sup>	2.43	3.04	0 <sup>1</sup>	5.47	4.5	-0.97

RESERVOIR	A – FIRE STORAGE (ML)	B – BALANCING STORAGE (ML/D)	C – EMERGENCY STORAGE (ML)	A+B+C REQUIRED STORAGE (ML)	AVAILABLE STORAGE (ML)	DEFICIENT/SURPLUS (ML)
RMR <sup>2</sup>	1.08	0.47	0.39	1.94	2.3	0.36
Arrow Heights	1.08	1.59	0.67	3.34	2.3	-1.04

1. TCH reservoir is directly connected on a major transmission main. Emergency storage may be deemed as not required (MMCD, 2014).
2. The RMR Reservoir design is currently underway as part of a separate project. The reservoir sizing listed herein is based on the limited data available at the time of this report. RMR reservoir sizing to be confirmed as more information becomes available.
3. The Johnson Heights Reservoir design is currently underway as part of a separate project. The reservoir sizing listed herein is based on the limited data available at the time of this report. Johnson Heights reservoir sizing to be confirmed as more information becomes available.

TCH reservoir has a deficient volume of 0.47 ML under existing conditions and 0.85 ML in 2040.

The available storage volume for the Johnson Heights and RMR reservoir is sufficient, however, the remaining two reservoirs require additional volume. Cascading analysis was done to determine if the surplus volume from associated reservoirs can be used to mitigate the storage deficiencies. The available cascading volume was determined by subtracting the balancing (B) and emergency (C) storage from the available storage. Table 11 summarizes the cascading volume analysis performed and its implications for each reservoir. The cells highlighted in green indicate surplus volume.

**Table 11: Future Cascading Volume Analysis**

RESERVOIR	DEFICIENT/SURPLUS (ML) BEFORE CASCADING	AVAILABLE CASCADING VOLUME (ML)	DEFICIENT/SURPLUS (ML)
Johnson Heights	0.03		0.03
TCH		1.11 (from JH Reservoir)	0.14
RMR	0.36		0.36
Arrow Heights		1.45 (from RMR Reservoir)	0.41

Through cascading of Johnson Heights reservoir into the TCH reservoir, this deficiency can be resolved. Similarly, the deficiency in the Arrow Heights reservoir can be rectified through cascading of the RMR reservoir into the Arrow Heights reservoir.

### 8.3 BIG EDDY STORAGE CAPACITY ANALYSIS

An assessment of the storage capacities of the existing 1.4ML reservoir in Big Eddy was conducted by WSP in 2017 to determine if they meet the storage requirements. The fire storage required is governed by the highest fire flow demand required within the serviced area for each reservoir. The storage volumes have been calculated based on the City of Kelowna design criteria. This considered the supply capacity of the well sites since they can reduce the need for reservoirs to provide emergency storage if certain supply requirements are met.

The City of Kelowna Bylaw No. 7900 – Subdivision, Development, and Servicing Bylaw, Schedule 4 reservoirs can be sized to the greater of the following criteria:

- One day average annual consumption for the service area (i.e., 825 m3)
- Total storage requirements = A + B – C, where:

A = Fire Storage

B = PHD flow sustained for 6 hours

C = Pump supply capacity with the largest capacity pump out of service

Table 12 summarizes the storage volume of the Big Eddy reservoir and compares the total required storage to the available storage under future (2037) demand conditions.

**Table 12: Big Eddy Storage Capacity Analysis**

RESERVOIR	A – FIRE STORAGE (m <sup>3</sup> )	B – PEAK HOURLY DEMAND (m <sup>3</sup> )	C – PUMP CAPACITY (m <sup>3</sup> )	A+B-C REQUIRED STORAGE (m <sup>3</sup> )	AVAILABLE STORAGE (m <sup>3</sup> )	DEFICIENT/ SURPLUS (m <sup>3</sup> )
Reservoir 1 (1980)	2,430	918	-544	2,804	1,400	-1,404

Based on the storage available with one reservoir, an additional 1,400 m<sup>3</sup> of storage was required to meet the City of Kelowna design standards. In 2018, a new reservoir was constructed to resolve the deficiency of 1,400 m<sup>3</sup>. The Big Eddy water system based upon the growth scenarios is deemed adequate for the next 20 years.

## 8.4 PRESSURES DURING AVERAGE DAY DEMAND CONDITIONS

### WITHOUT IMPROVEMENTS

The City allows for a minimum service pressure of 40 psi under ADD conditions. The maximum service pressure within each zone occurs at the properties with the lowest elevations compared to the HGL of the zone set by a reservoir, under ADD conditions.

Table 13 summarizes the maximum service pressures experienced under ADD conditions for the future system without improvements.

**Table 13: Future Demand Nodes Not in Compliance with Service Pressure Requirements (ADD)**

PRESSURE ZONE	NO. NODES EXCEEDING 120 PSI	NO. NODES EXCEEDING 130 PSI
<b>2040 Scenario</b>		
Zone 0 – Greeley Creek WTP	1	1
Zone 0A – Cedar Street PRV	0	0
Zone 0B – Johnson Heights	0	0
Zone 1 – Central Revelstoke and Lower AH	117	4
Zone 2 – Lower RMR	7	2
Zone 2A – Lower AH/MacKenzie Village	22	22
Zone 4 – Big Eddy	0	0
Zone 5 – RMR	9	6
<b>Total - 2040 Scenario</b>	<b>161</b>	<b>40</b>

A significant number of nodes within the system experience pressure exceedances under ADD conditions. Most of these are within the range of 120-130 psi which are not considered to be excessively above the standards.

## 8.5 PRESSURES DURING EXISTING AND FUTURE PEAK HOUR DEMAND CONDITIONS

The City allows a maximum service pressure under PHD conditions of 120 psi as outlined in Section 3. The minimum pressure within each pressure zone typically occurs either at the properties at the highest elevation compared to the HGL of the pressure zone set by either a reservoir, PRV, or pump, or under high demand conditions.

### WITHOUT IMPROVEMENTS

Figure 4 and Figure 5 illustrates the minimum and maximum service pressures experienced under PHD conditions (without improvements) for the existing and 2040 system respectively. Table 14 summarizes the number of demand nodes with less than 40 psi and demand nodes exceeding 120 and 130 psi in each pressure zone.

**Table 14: Existing Nodes Not in Compliance with Service Pressure Requirements (PHD)**

PRESSURE ZONE	NO. NODES UNDER 40 PSI
<b>2020 Scenario</b>	
Zone 0 – Greeley Creek WTP	0
Zone 0A – Cedar Street PRV	0
Zone 1 – Central Revelstoke and Lower AH	1
Zone 2 – Lower RMR	0
Zone 2A – Mid AH	0
Zone 3A – Mackenzie Landing	0
Zone 3B – Monashee	0
Zone 4 – Big Eddy	0
<b>Total - 2020 Scenario</b>	<b>1</b>
<b>2040 Scenario</b>	
Zone 0 – Greeley Creek WTP	16
Zone 0A – Cedar Street PRV	0
Zone 0B – Johnson Heights	3
Zone 1 – Central Revelstoke and Lower AH	1
Zone 2 – Lower RMR	0
Zone 2A – Lower AH/MacKenzie Village	0
Zone 4 – Big Eddy	0
Zone 5 – RMR	1
<b>Total - 2040 Scenario</b>	<b>21</b>

Only one of the existing nodes are under 40 psi, which occurs within Pressure Zone 1, at the dead-end node at Ninth Street. Existing conditions are acceptable, with only one node experiencing pressure lower than 40 psi.

For the 2040 scenario, a total of 21 nodes are under 40 psi. A majority of these low-pressure nodes are within Pressure Zone 0, along the Greeley Creek transmission main. The Greeley Creek transmission main supplies water from the Greeley Creek WTP Clearwell to the TCH reservoir and ultimately provides water to Central Revelstoke, including Johnson Heights. The low-pressure nodes along the Greeley Creek transmission main account for the majority of the nodes within Pressure Zone 0, and improvements to address these deficiencies are discussed in Section 8.9. The remaining low-pressure nodes are located within Pressure Zone 1 at the dead-end node at Ninth Street, and in Pressure Zone 5.

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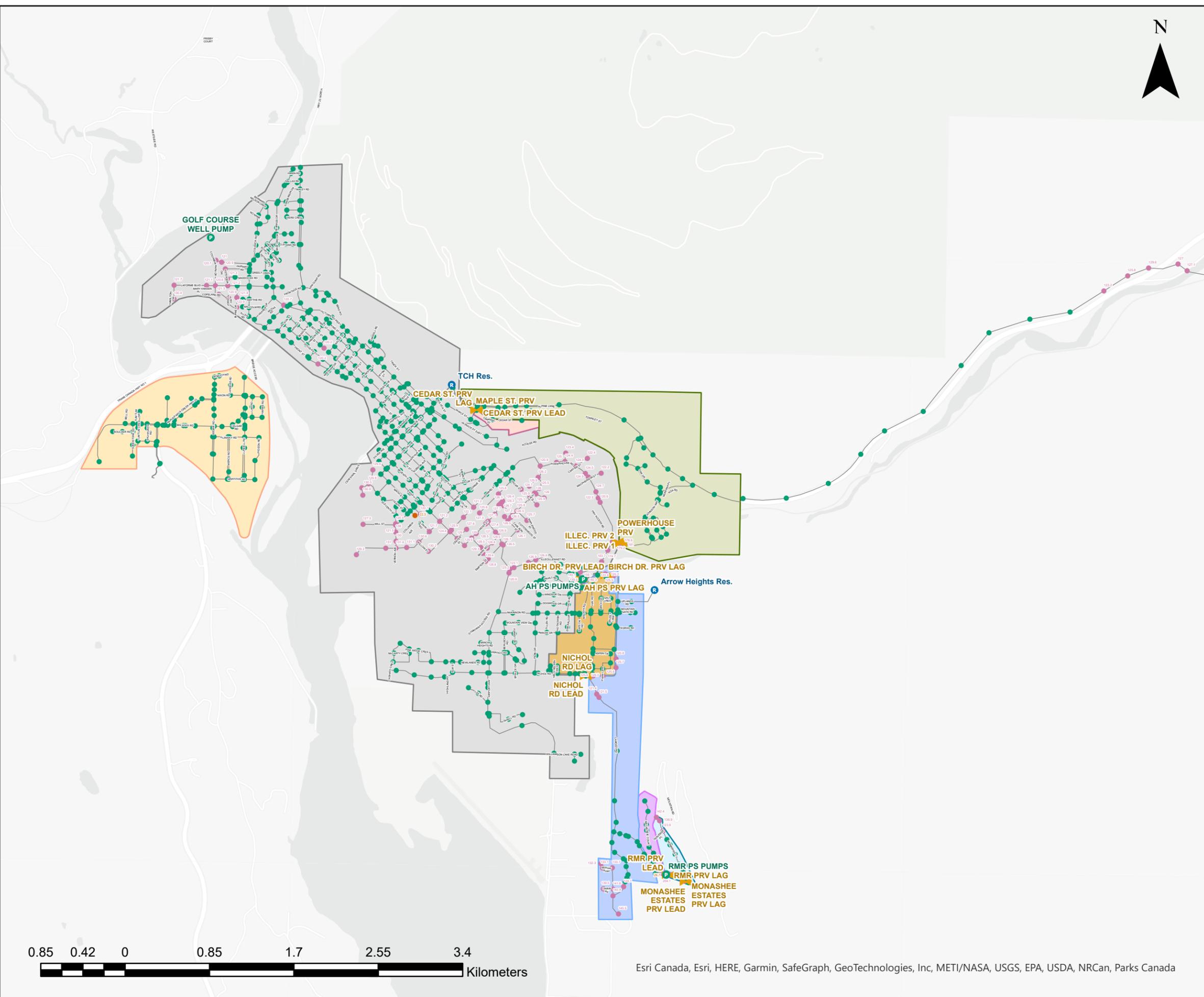
### WITH IMPROVEMENTS

Figure 6 illustrates the minimum and maximum service pressures experienced under PHD conditions (with improvements) for the 2040 system. The deficient nodes are identified as exceeding a difference of more than 5% from the 40 psi standard. Table 15 summarizes the number of demand nodes with pressure less than 40 psi.

**Table 15: Future Nodes Not in Compliance with Service Pressure Requirements (PHD)**

PRESSURE ZONE	NO. NODES UNDER 40 PSI
Zone 0 – Greeley Creek WTP	0
Zone 0A – Cedar Street PRV	0
Zone 0B – Johnson Heights	0
Zone 1 – Central Revelstoke and Lower AH	1
Zone 2 – Lower RMR	0
Zone 2A – Lower AH/MacKenzie Village	0
Zone 4 – Big Eddy	0
Zone 5 – RMR	1
<b>Total - 2040 Scenario with Improvements</b>	<b>2</b>

Nodes experiencing pressures under 40 psi are addressed with the improvements recommend, reducing the number of pressures deficient nodes from 21 to 2. The number of nodes experiencing pressure between 120 psi and 130 psi are not considered to be excessively above the standards outlined in Section 3. As such, the pressures at these nodes were kept consistent with the 2040 scenario without improvements.



**Legend**

<b>2020 Zones</b>	<b>Reservoirs &amp; Pumps</b>
Zone 0 - Greeley WTP (594.6m)	Existing Reservoir
Zone 0A - Cedar Street PRV (565.3m)	Existing Pump
Zone 1 - Central Revelstoke & Lower AH (569.6m)	<b>PRVs</b>
Zone 2 - Lower RMR (584.6m)	PRVs (2020)
Zone 2A - Mid AH (561.2m)	<b>Pipes</b>
Zone 3A - Mackenzie Landing (613.5m)	All other pipes (2020)
Zone 3B - Monashee (638.1m)	<b>Pressures</b>
Zone 4 - Big Eddy (491.6 m)	<40 psi
	40 psi to 120 psi
	>120 psi

Client:

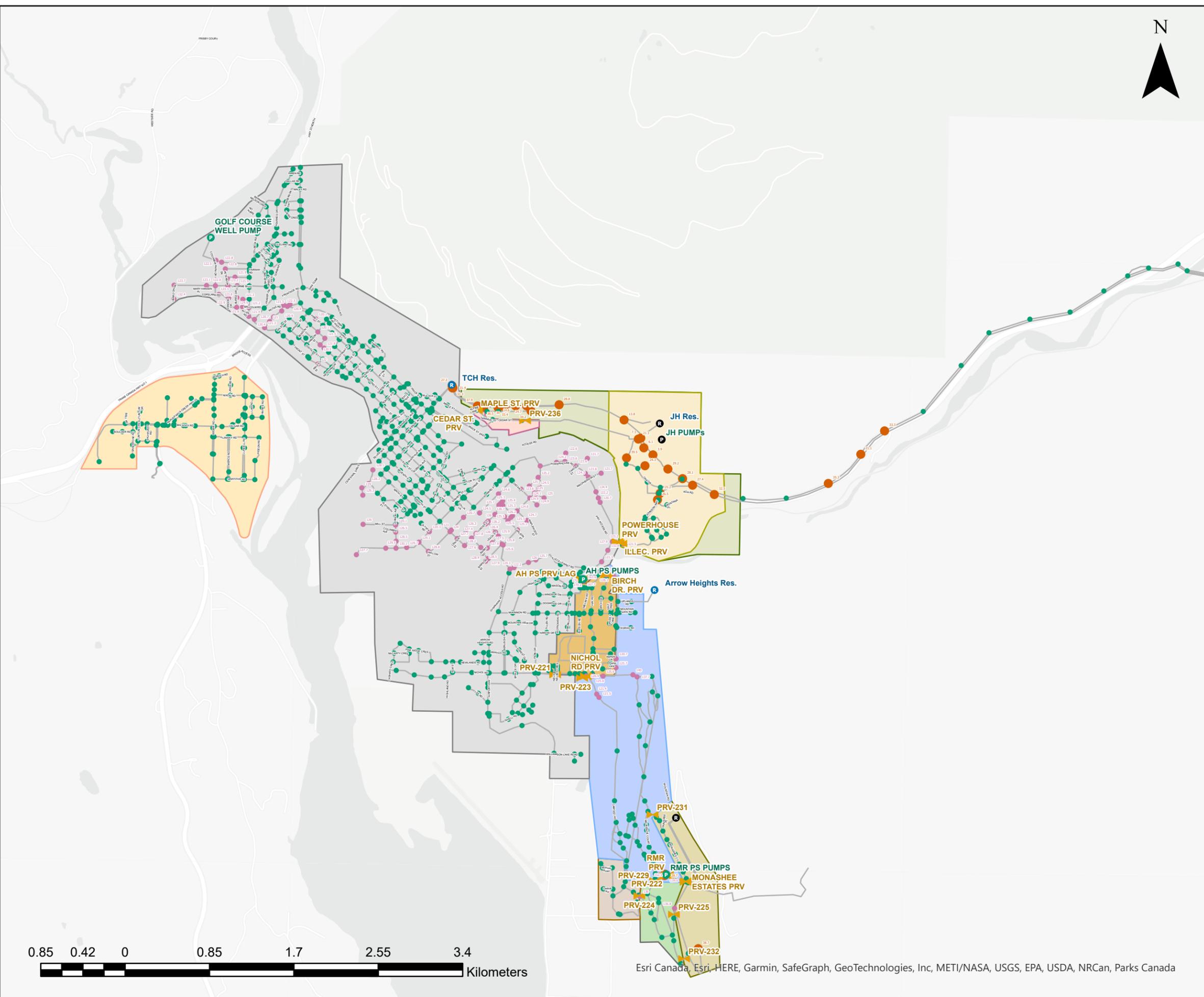


**wsp** Vancouver, BC

Figure 4:  
**2020 PHD Pressures**

Drawn: S. Gilani  
Approved: C. Leung  
Project: 211-09492-00





Esri, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada

**Legend**

- Zone 0B - JH (595.0m)
  - Zone 0A - Cedar Street PRV (565.3m)
  - Zone 0 - Greeley WTP (594.6m)
  - Zone 1 - Central Revelstoke & Lower AH (569.6m)
  - Zone 2A - Lower AH/MacKenzie Village (548 m)
  - Zone 2 - Lower RMR (584.6m)
  - Zone 4 - Big Eddy (491.6m)
  - Zone 5 - RMR1 (561.5m)
  - Zone 5 - RMR2 (682.0m)
  - Zone 5 - RMR3 (611.5m)
- Existing Reservoir
  - Proposed Reservoir
  - Existing Pump
  - Proposed Pump
- PRVs**
- PRVs (2040)
- Pipes**
- All other pipes (2040)
- Pressures**
- <40 Psi
  - 40 Psi to 120 Psi
  - >120 Psi

Client:



Vancouver, BC

Figure 5:

**2040 PHD Pressures**

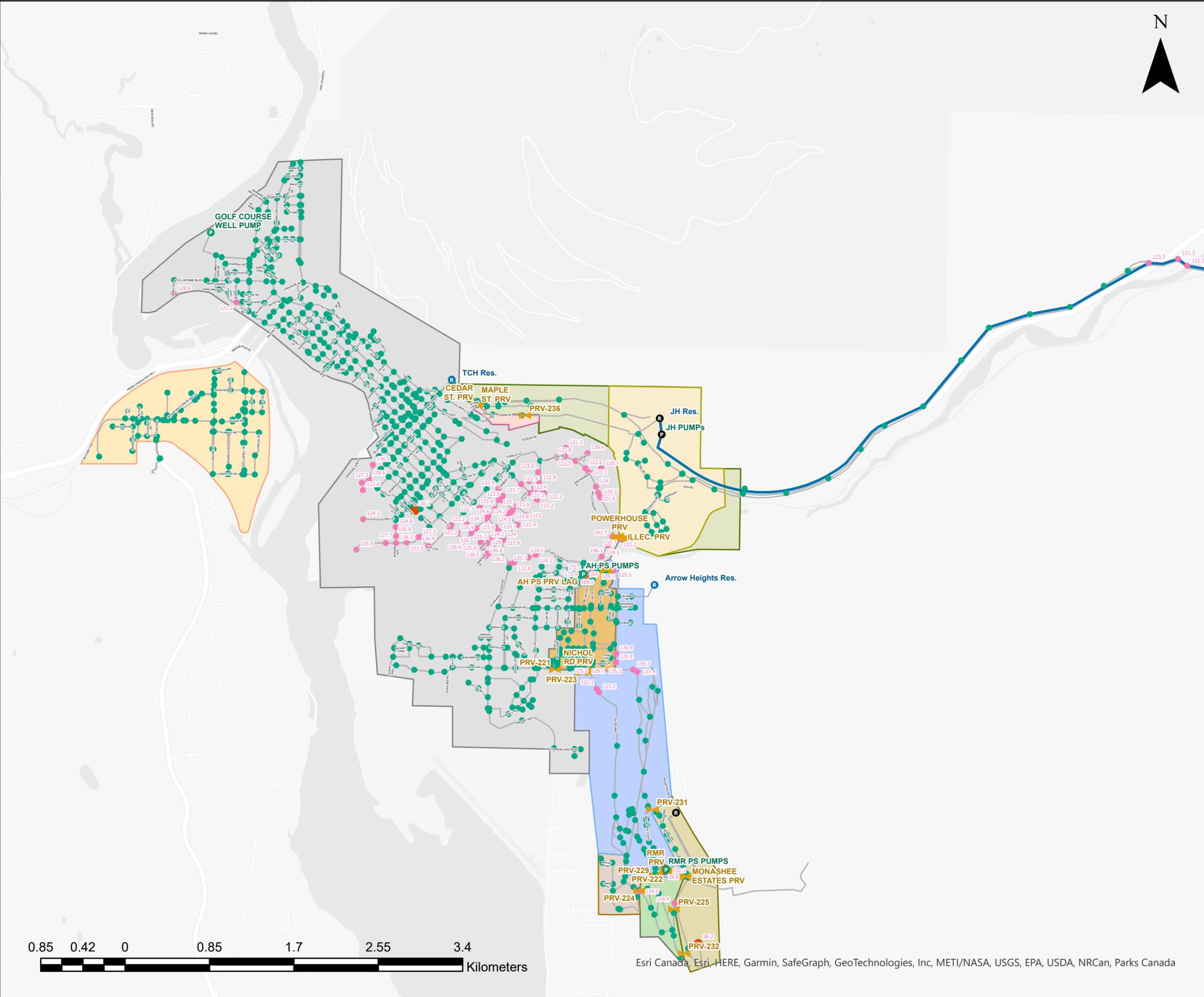
Drawn: L. Che

Approved: C. Leung

Project: 211-09492-00



Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, USDA, NRCAN, Parks Canada



**Legend**

Zone 0B - JH (595.0m)	Existing Reservoir
Zone 0A - Cedar Street PRV (565.3m)	Proposed Reservoir
Zone 0 - Greeley WTP (594.6m)	Existing Pump
Zone 1 - Central Revelstoke & Lower AH (569.6m)	Proposed Pump
Zone 2A - Lower AH/MacKenzie Village (548 m)	<b>PRVs</b>
Zone 2 - Lower RMR (584.6m)	PRVs (2040)
Zone 4 - Big Eddy (491.6m)	<b>Pipes</b>
Zone 5 - RMR1 (561.5m)	All other pipes (2040)
Zone 5 - RMR2 (682.0m)	Transmission main
Zone 5 - RMR3 (611.5m)	<b>P</b>
	< 40 psi
	40 - 120 psi
	> 120 psi

Client:



 Vancouver, BC

Figure 6:  
**2040 PHD Pressures with Improvements**

Drawn: L. Che  
Approved: C. Leung  
Project: 211-09492-00



## 8.6 FIRE FLOWS DURING MDD + FF

### WITHOUT IMPROVEMENTS

Fire flow analysis was conducted under MDD conditions, after assigning fire flow to hydrants as described in Section 3. The results on the fire flow analysis under existing and future conditions are summarized on Figure 7 and Figure 8 respectively, which illustrates fire flow requirements throughout the system and identifies where deficiencies are occurring. The deficient nodes are identified as those with available fire flows more than 5% less than the required fire flow.

Results from the fire flow analysis coincident to MDD are broken down by zone and deficiencies are summarized in Table 16.

**Table 16: Existing Nodes with Deficient Fire Flow**

PRESSURE ZONE	NO. OF DEFICIENT NODES	% OF ZONE
<b>2020 Scenario</b>		
Zone 0 – Greeley Creek Clearwell	3	8.1%
Zone 0A – Cedar Street PRV	0	0%
Zone 1 – Central Revelstoke and Lower AH	61	11.3%
Zone 2 – Lower RMR	6	16.7%
Zone 2A – Mid AH	0	0%
Zone 3A – Mackenzie Landing	9	37.5%
Zone 3B – Monashee	0	0%
Zone 4 – Big Eddy	7	7.3%
<b>Total – 2020 Scenario</b>	<b>86</b>	<b>10.0%</b>
<b>2040 Scenario</b>		
Zone 0 – Greeley Creek Clearwell	13	34.2%
Zone 0A – Cedar Street PRV	0	0%
Zone 1 – Central Revelstoke and Lower AH	73	13.5%
Zone 2 – Lower RMR	0	0%
Zone 2A – Lower AH/MacKenzie Village	1	1.4%
Zone 4 – Big Eddy	7	7.3%
Zone 5 – RMR	6	6.3%
<b>Total – 2040 Scenario</b>	<b>100</b>	<b>11.3%</b>

For the existing conditions, approximately 10% of all the nodes within the system do not meet the fire flow requirements as outlined in Section 3. A majority of these are within Pressure Zones 1, 2, and 3A. These deficiencies are a result of dead-end nodes and low flow to mid block hydrants. Section 6.3 provides a list of improvements required to address these nodes of concern, through looping, adding new pipes, or other upgrades as required.

Comparatively, in the 2040 scenario, a number of deficient nodes within Pressure Zone 2 and 3A are eliminated under the assumption that RMR will be fully developed in the future scenario, and a majority of the nodes in Pressure Zone 2 will ultimately be encompassed within the RMR development. However, the number of deficient nodes with Pressure Zone 0, 1, 2A, and 5 increases due to higher background demands. Approximately 11% of the all the nodes within the system do not meet the fire flow requirements in the 2040 scenario. A majority of these are within Pressure Zone 0, 1, 4, and 5. Many of these deficiencies are a result of dead-end nodes and low flow to mid block hydrants. Section 9 provides a list of improvements required to address these nodes of concern, through looping, upsizing watermains, or other upgrades as required.

### WITH IMPROVEMENTS

Fire flow analysis was conducted under MDD conditions, after assigning fire flow to hydrants as described in Section 3. The results on the fire flow analysis under future conditions with improvements are summarized on Figure 9, which illustrates fire flow requirements throughout the system and identifies where deficiencies are occurring. The deficient nodes are identified as those with available fire flows more than 5% less than the required fire flow.

Results from the fire flow analysis coincident to MDD are broken down by pressure zones and deficiencies are summarized in Table 17.

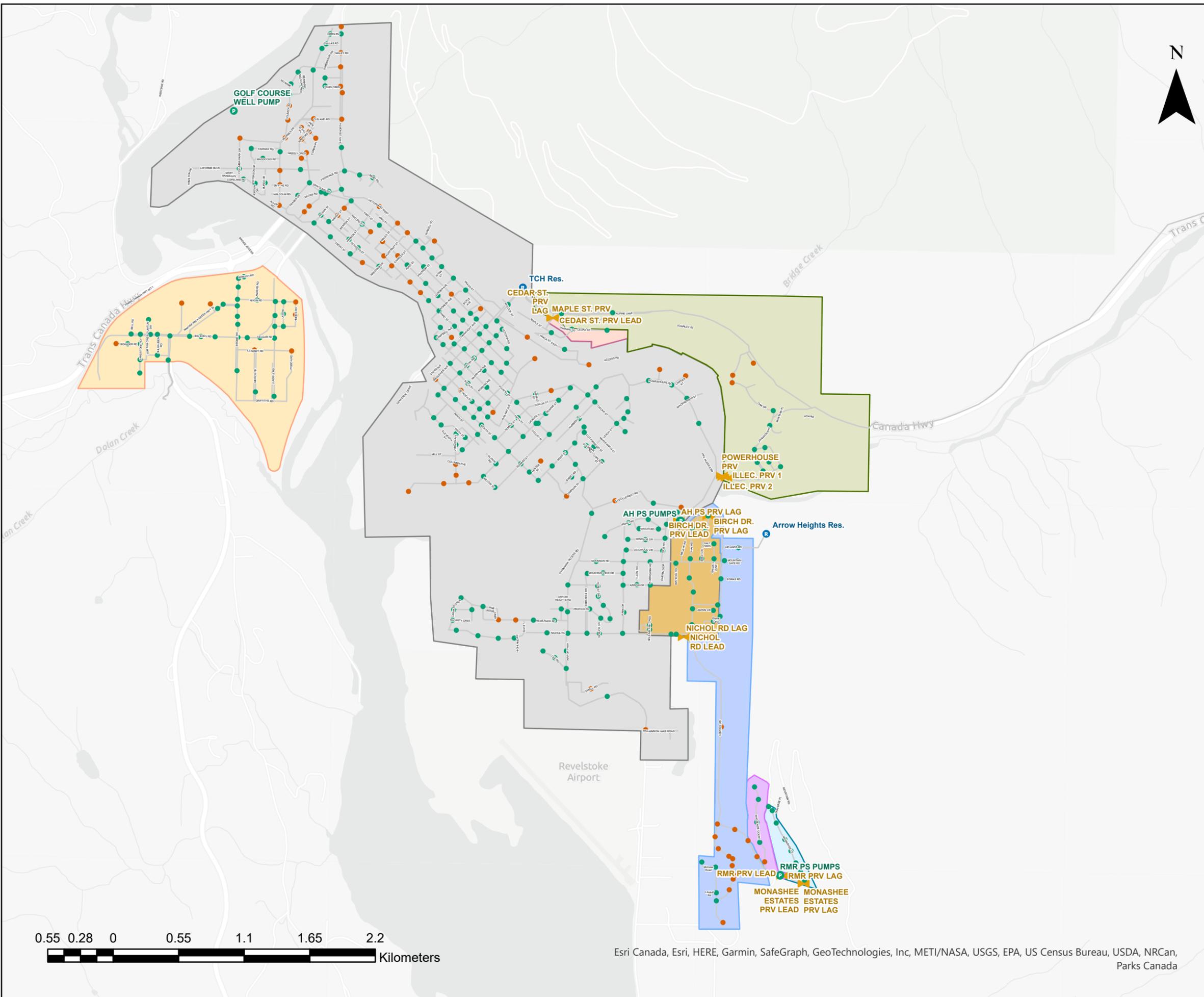
**Table 17: Future Nodes with Deficient Fire Flow**

PRESSURE ZONE	NO. OF DEFICIENT NODES	% OF ZONE
Zone 0 – Greeley Creek Clearwell	0	0%
Zone 0A – Cedar Street PRV	0	0%
Zone 0B – Johnson Heights	0	0%
Zone 1 – Central Revelstoke and Lower AH	2	0.1%
Zone 2 – Lower RMR	0	0%
Zone 2A – Lower AH/MacKenzie Village	0	0%
Zone 4 – Big Eddy	0	0%
Zone 5 – RMR	4	4.7%
<b>Total – 2040 Scenario with Improvements</b>	<b>6</b>	<b>0.7%</b>

The 2040 fire flow conditions with improvements are acceptable, as only six remaining nodes within the entire system have fire flows that do not meet the requirements.

The CPR area is in the northern portion of Pressure Zone 1 and based on the land use shapefiles provided by the City, this area was identified as industrial. However, during discussions with the City, it was noted that this area consists of mainly commercial properties. As a result, the assigned fire flows have been reduced to 150 L/s.

The sawmill area is in the southwestern region of Pressure Zone 1. Several pipes within this area were noted to have lower than required fire flows. These nodes are located on Columbia Avenue and west of Downie Street and Willow Street, and are illustrated on Figure 10. WSP has identified several upgrades (discussed in Section 9) to rectify those deficiencies. The City should discuss a cost sharing model with the lumberyard to implement the recommended improvements (ST/LT-M-13, ST/LT-S-42, and ST/LT-S-43) listed in Table 19.



**Legend**

**2020 Zones**

- Zone 0 - Greeley WTP (594.6m)
- Zone 0A - Cedar Street PRV (565.3m)
- Zone 2A - Mid AH (561.2m)
- Zone 3A - Mackenzie Landing (613.5m)
- Zone 3B - Monashee (638.1m)
- Zone 1 - Central Revelstoke & Lower AH (569.6m)
- Zone 2 - Lower RMR (584.6m)
- Zone 4 - Big Eddy (491.6m)

**Reservoirs & Pumps**

- Existing Reservoir
- Existing Pump

**PRVs**

- PRVs (2020)

**Pipes**

- All other pipes (2020)

**Satisfies fireflow constraints?**

- No
- Yes

Client:

Vancouver, BC

Figure 7:

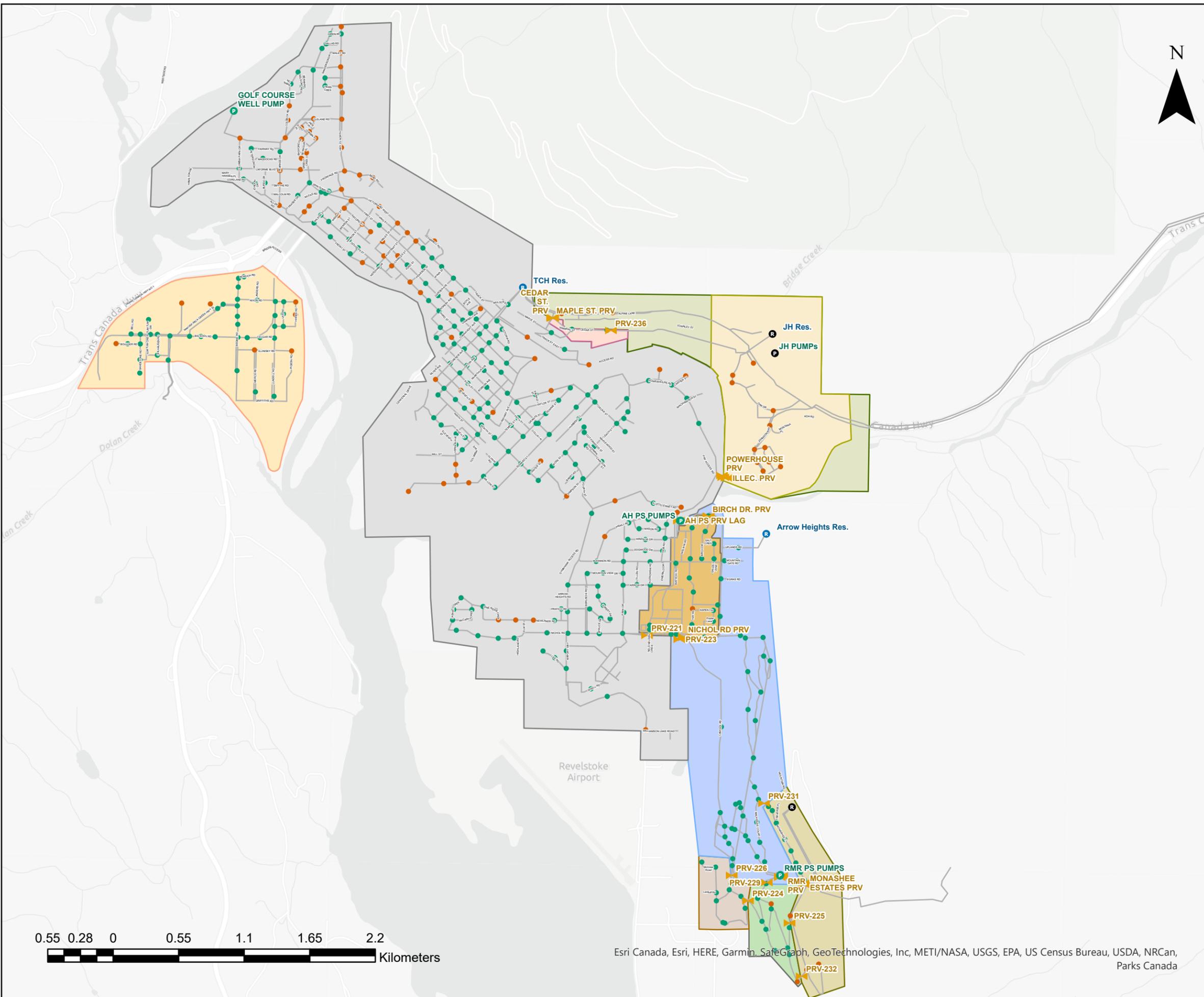
## 2020 Fireflows

Drawn: S. Gilani

Approved: C. Leung

Project: 211-09492-00





**Legend**

- Zone 0 - Greeley WTP (594.6m)
- Zone 0A - Cedar Street PRV (565.3m)
- Zone 0B - JH (595.0m)
- Zone 1 - Central Revelstoke & Lower AH (569.6m)
- Zone 2 - Lower RMR (584.6m)
- Zone 2A - Lower AH/MacKenzie Village (548m)
- Zone 4 - Big Eddy (491.6m)
- Zone 5 - RMR1 (561.5m)
- Zone 5 - RMR2 (682.0m)
- Zone 5 - RMR3 (611.5m)

**Reservoirs & Pumps**

- Existing Reservoir
- Proposed Reservoir
- Existing Pump
- Proposed Pump

**PRVs**

- PRVs (2040)

**Satisfies fireflow constraints?**

- No
- Yes
- All other pipes (2040)

Client:

Vancouver, BC

Figure 8:

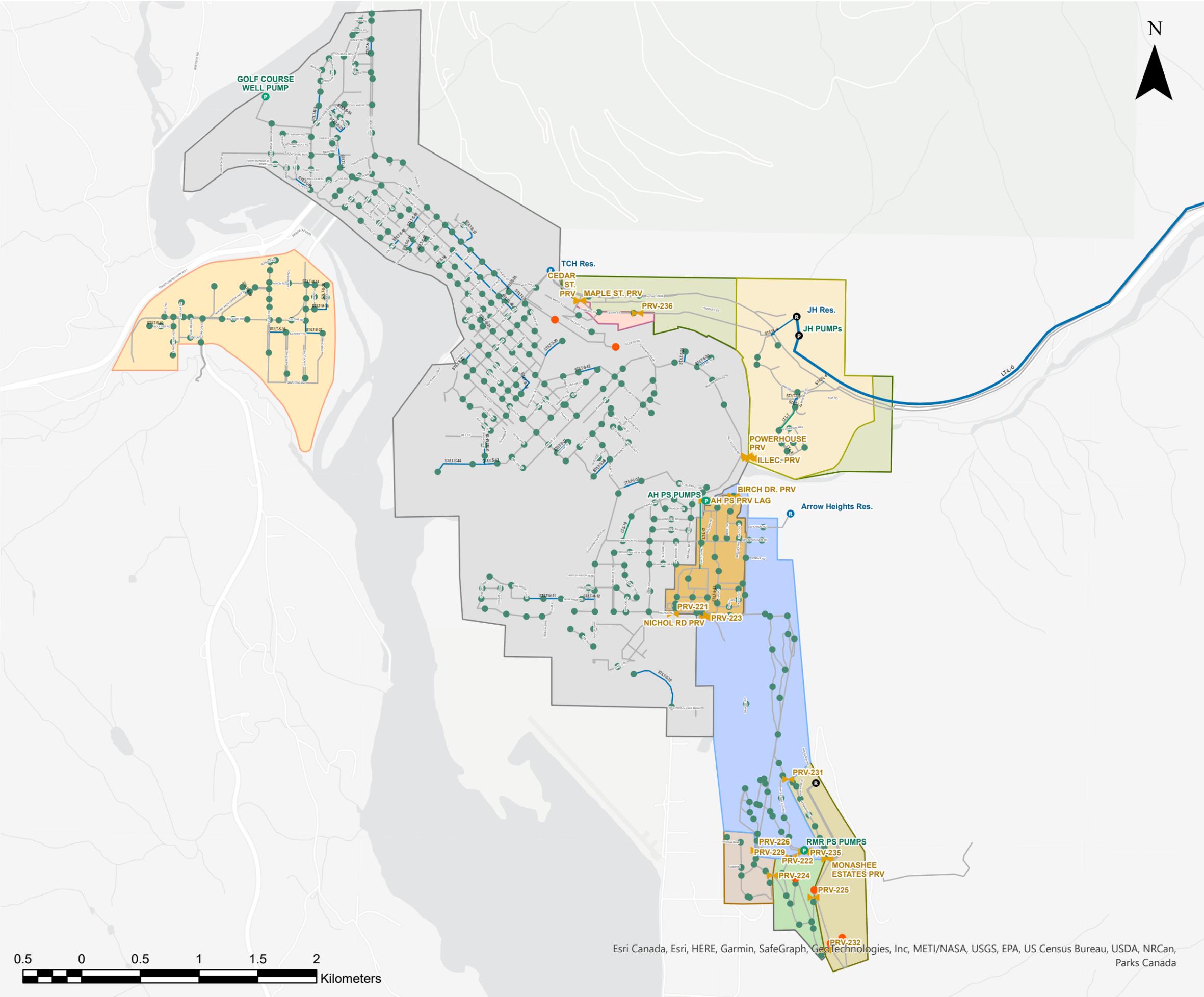
## 2040 Fire Flow

Drawn: L. Che

Approved: C. Leung

Project: 211-09492-00





**Legend**

**2040 Zones**

- Zone 0 - Greeley WTP (594.6m)
- Zone 0A - Cedar Street PRV (565.3m)
- Zone 0B - JH (595.0m)
- Zone 1 - Central Revelstoke & Lower AH (569.6m)
- Zone 2 - Lower RMR (584.6m)
- Zone 2A - Lower AH/Mackenzie Village (548m)
- Zone 4 - Big Eddy (491.6m)
- Zone 5 - RMR1 (561.5m)
- Zone 5 - RMR2 (682.0m)
- Zone 5 - RMR3 (611.5m)

**Reservoirs & Pumps**

- Existing Reservoir (R in blue circle)
- Proposed Reservoir (R in black circle)
- Existing Pump (P in green circle)
- Proposed Pump (P in black circle)

**PRVs**

- PRVs (2040) (Yellow arrow symbol)

**Pipes & Horizons**

- 2020 and 2040 (Blue line)
- 2040 (Green line)
- All other Pipes (2040) (Grey line)
- Transmission main (Thick blue line)

**Meet Fire Flow Requirement?**

- No (Red dot)
- Yes (Green dot)

Client:




Vancouver, BC

Figure 9:  
**2040 Fire Flow with Improvements**

Drawn: L. Che

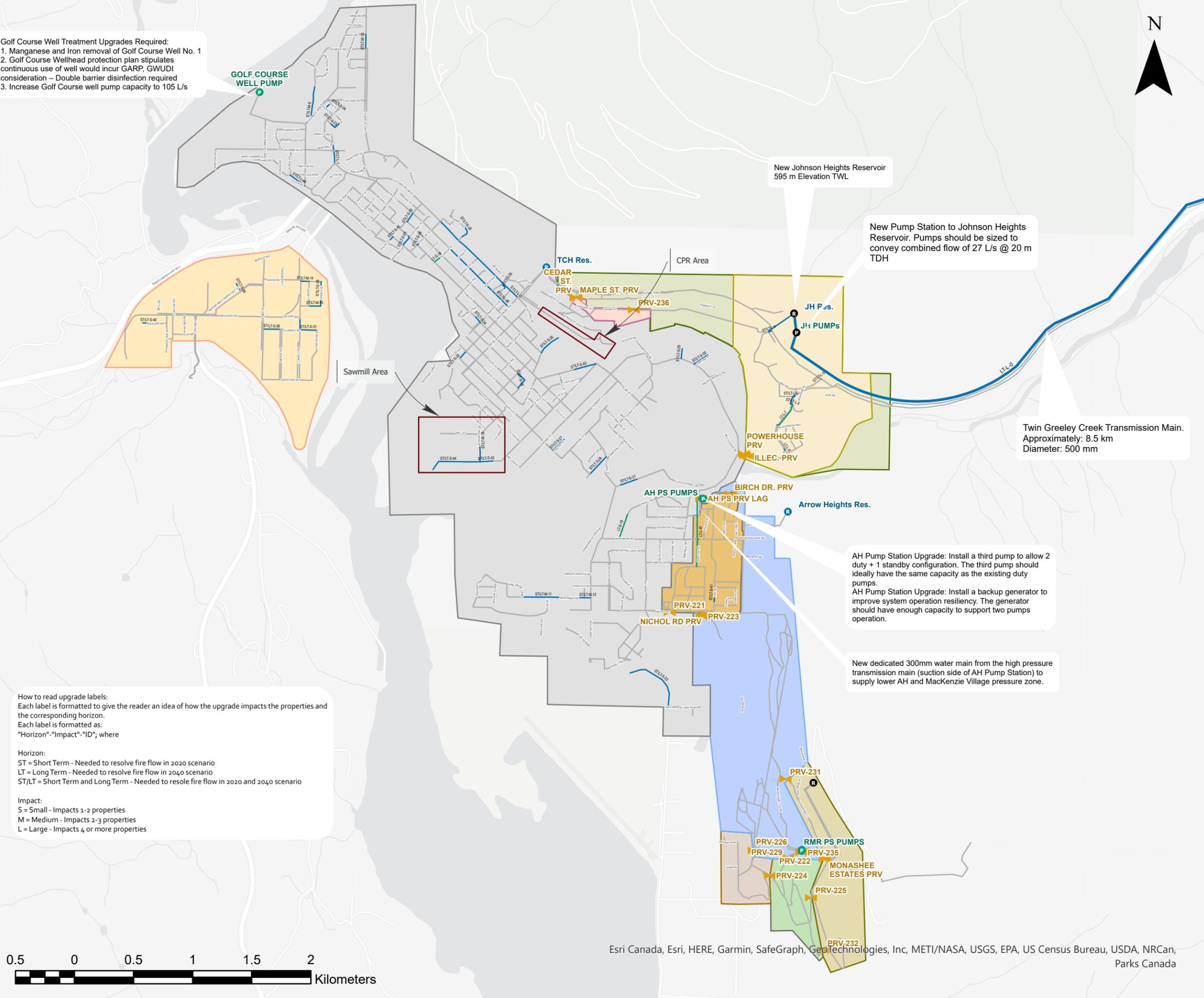
Approved: C. Leung

Project: 211-09492-00

Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCAN, Parks Canada

0.5 0 0.5 1 1.5 2  
 Kilometers

Golf Course Well Treatment Upgrades Required:  
 1. Manganese and Iron removal of Golf Course Well No. 1  
 2. Golf Course Wellhead protection plan stipulates continuous use of well would incur GARP, GWUDI consideration – Double barrier disinfection required  
 3. Increase Golf Course well pump capacity to 105 L/s



Esri, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada

**Legend**

- 2040 Zones**
- Zone 0 - Greeley WTP (594.6m)
  - Zone 0A - Cedar Street PRV (565.3m)
  - Zone 0B - JH (595.0m)
  - Zone 1 - Central Revelstoke & Lower AH (569.6m)
  - Zone 2 - Lower RMR (584.6m)
  - Zone 2A - Lower AH/Mackenzie Village (548m)
  - Zone 4 - Big Eddy (491.6m)
  - Zone 5 - RMR1 (561.5m)
  - Zone 5 - RMR2 (682.0m)
  - Zone 5 - RMR3 (611.5m)
- Reservoirs & Pumps**
- Existing Reservoir
  - Proposed Reservoir
  - Existing Pump
  - Proposed Pump
- PRVs**
- PRVs (2040)
- Pipes & Horizons**
- 2020 and 2040
  - 2040
  - All other Pipes (2040)
  - Transmission main

How to read upgrade labels:  
 Each label is formatted to give the reader an idea of how the upgrade impacts the properties and the corresponding horizon.  
 Each label is formatted as:  
 "Horizon"- "Impact"- "ID"; where

Horizon:  
 ST = Short Term - Needed to resolve fire flow in 2020 scenario  
 LT = Long Term - Needed to resolve fire flow in 2040 scenario  
 ST/LT = Short Term and Long Term - Needed to resolve fire flow in 2020 and 2040 scenario

Impact:  
 S = Small - Impacts 1-2 properties  
 M = Medium - Impacts 2-3 properties  
 L = Large - Impacts 4 or more properties

AH Pump Station Upgrade: Install a third pump to allow 2 duty + 1 standby configuration. The third pump should ideally have the same capacity as the existing duty pumps.  
 AH Pump Station Upgrade: Install a backup generator to improve system operation resiliency. The generator should have enough capacity to support two pumps operation.

New dedicated 300mm water main from the high pressure transmission main (suction side of AH Pump Station) to supply lower AH and MacKenzie Village pressure zone.

Twin Greeley Creek Transmission Main. Approximately: 8.5 km Diameter: 500 mm

New Johnson Heights Reservoir 595 m Elevation TWL

New Pump Station to Johnson Heights Reservoir. Pumps should be sized to convey combined flow of 27 L/s @ 20 m TDH



Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCAN, Parks Canada

Client:

Vancouver, BC

Figure 10:  
**System Improvements List**

Drawn: L. Che  
 Approved: C. Leung  
 Project: 211-09492-00

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## 8.7 PUMP CAPACITY ANALYSIS

There are currently four pump stations in the City, namely the Arrow Heights Pump Station, Monashee Booster Pump Station, the Golf Course Well Pump Station, and Big Eddy Well Pump Station

Golf course pumps provide redundancy to the overall water distribution system with an additional capacity of 70 L/s. The AH pump station's main purpose is to fill the AH reservoir when the reservoir water drops below a pre-determined level, it could also act as a backup supply in cases when the AH reservoir cannot provide sufficient flow to the system. RMR pump station supplies Pressure Zone 3A (RMR Booster Station) and Pressure Zone 3B (Monashee Estates). In the existing conditions no concerns (regarding the pump stations) were noted during the analysis.

Per the City's Subdivision, Development and Servicing Bylaw No. 1846 Schedule 4 Design Standards, the pump station must be designed to meet MDD with the largest pump out of service with balanced storage downstream online. If balancing storage downstream is not online, the pump station capacity must meet peak hour demands with the largest pump out of service. The station's capacity when all pumps operate is referred to as total capacity, and the station's capacity when the largest pump is out of service is referred to as firm capacity.

For the 2040 scenario, the RMR development is anticipated to include a new RMR reservoir which will be fed by the AH pump station and reservoir system. Once the RMR has undergone development and assuming all the proposed system improvements shown in Figure 10 are implemented, the existing AH pump station, currently houses two pumps, can provide a firm capacity of 58 L/s and a total capacity of approximately 96 L/s. The pressure zones downstream of AH pump station (Pressure Zones 2 and 5) are estimated to have an MDD of approximately 60 L/s, which is larger than the firm capacity of the station and thus requiring both pumps to operate to supply the required flow.

To accommodate its downstream service area, the AH pump station needs to operate in 2 duty + 0 standby mode, with no system operation redundancy. Therefore, it is recommended that a third pump to be installed in the AH pump station to allow the station to operate in 2 duty + 1 standby mode and provide redundancy in system operation in case of a pump failure. The additional pump can also help extend service life of all the pumps as they can operate in alternation which ensures balance wear on all pumps.

It is WSP's understanding that there is currently a spare pump bay in the AH pump station so that the addition of a third pump will not require significant building structure modification. However, it is recommended that the City to conduct a detailed review of the pump and existing pump station to examine suitability and spacing requirements in the detailed design stage.

A backup generator should also be provided in the AH pump station to improve resiliency in system operation within the southeast portion of the City as well as leading towards the RMR areas. The backup generator should have sufficient capacity to operate two duty pumps so that the firm capacity of the station can be maintained during power outage. Based on review of the pump curve, the generator would need to provide approximately 90 hp (67 kW). The required generator capacity was estimated based on a pump efficiency of 70%, thus the City should confirm the generator's capacity requirement in more detail in later design stage.

A new pump station is proposed adjacent to the new Johnson Heights Reservoir. This pump station will fill the downstream JH reservoir. Per the analysis, the JH pump station should be able to supply 27L/s @ 20m Total Dynamic Head (TDH).

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## 8.8 DISTRIBUTION SYSTEM COST ESTIMATE BASIS

Cost estimates provided in the Capital Projects List have been prepared based on unit cost rates from WSP's relevant past projects and from unit rates provided by the City based on previous projects, adjusted to 2022 dollars based on *ENR Construction Cost Index*.

Table 18 provides a summary for the basis for cost estimation of each of the projects in the Capital Works Plan.

**Table 18: Unit Rates**

ASSET	UPGRADE	UNIT COST (\$2022)	UNIT
Watermains	Upsize or install 150 mm watermain	\$490	lin.m
	Upsize or install 200 mm watermain	\$630	lin.m
	Upsize or install 250 mm watermain	\$770	lin.m
	Upsize or install 300 mm watermain	\$910	lin.m
	Upsize or install 350 mm watermain	\$1,050	lin.m
	Upsize or install 400 mm watermain	\$1,250	lin.m
	Upsize or install 500 mm watermain	\$1,470	lin.m
Water Valves	Valve Closure	\$1,000	Each
Reservoirs	Construct a new reservoir	\$3,360	m <sup>3</sup>
JH Pump Station	Construct a new pump station	\$1,500,000	Lump Sum
AH Pump Station	Supply and install an additional pump	\$125,000	Each
	Supply and install a backup generator	\$55,000	Each

The unit rates above will include an additional 15% for engineering fees and another 25% for contingency. Table 22 provides the anticipated Capital budget based on the project prioritization.

## 8.9 DISTRIBUTION SYSTEM RECOMMENDATIONS

In addition to the new JH pressure zone (and the associated JH pump station); several other improvements were made to the distribution system through upsizing and proposing new watermains throughout the system. These improvements address most of the system deficiencies pertaining to fire flows.

Table 19 summarizes the recommended upgrade works required to overcome the distribution system deficiencies. Each label is formatted as “Horizon” – “Impact” – “ID”. Horizon refers to the time frame as follows:

- Short Term: “ST” – Needed to resolve fire flow in 2020 scenario
- Long Term: “LT” – Needed to resolve fire flow in 2040 scenario
- Short/Long Term: “ST/LT” – Needed to resolve fire flow in 2020 and 2040

Impact refers to the effect of the upgrade on the surrounding properties as follows:

- Small: “S” – Impacts 1-2 properties.
- Medium: “M” – Impacts 2-3 properties.
- Large: “L” – Impacts 4 or more properties.

The ID is included as a naming convention to allow for reference between Table 19 and Figure 10.

**Table 19: Distribution System Upgrade Recommendations**

LABEL	LENGTH (m)	UPGRADE	COST (\$2022)	COMMENTS
LT-L-0	8500	Twin Greeley Creek Transmission Main with 500 mm pipe	\$12,495,000	
ST/LT-L-1	180	Upsize existing 150 mm pipe to 250 mm	\$138,600	
ST/LT-L-2	-	Valve closure	\$1,000	

LABEL	LENGTH (m)	UPGRADE	COST (\$2022)	COMMENTS
ST/LT-L-3	916.5	Upsize existing 250 mm pipe to 500 mm .	\$1,347,255	
ST/LT-L-4	269.5	Construct new 400 mm pipe	\$336,875	
ST/LT-L-4	-	Valve closure	\$1,000	
ST/LT-L-5	-	Valve closure	\$1,000	
ST/LT-L-6	-	Valve closure	\$1,000	
ST/LT-L-6	-	Valve closure	\$1,000	
ST/LT-L-6	106.5	Construct new 200 mm pipe	\$67,095	
LT-L-7	230	Construct new 200 mm pipe	\$144,900	
LT-L-8	19	Construct new 200 mm pipe	\$11,970	
LT-L-8	-	Valve closure	\$1,000	
ST/LT-M-9	271	Upsize existing 150 mm pipe to 200 mm	\$170,730	
ST/LT-M-10	118.5	Upsize existing 200 mm pipe to 300 mm	\$107,835	
ST/LT-M-11	145	Upsize existing 150 mm pipe to 250 mm	\$111,650	
ST/LT-M-11	70	Replace existing 200 mm pipe with 200 mm	\$44,100	Replacement with same pipe diameter due to pipe age.
ST/LT-M-12	311	Upsize existing 100 mm pipe to 200 mm	\$196,245	
ST/LT-M-13	71	Upsize existing 150 mm pipe to 250 mm	\$54,670	City to discuss cost sharing with lumberyard to implement this
ST/LT-M-13	91.5	Upsize existing 100 mm pipe to 250 mm	\$70,455	City to discuss cost sharing with lumberyard to implement this
ST/LT-M-14	70	Upsize existing 150 mm pipe to 200 mm	\$44,100	
ST/LT-M-15	100	Upsize existing 50 mm pipe to 300 mm	\$91,000	
ST/LT-S-16	85	Construct new 200 mm pipe	\$53,550	
LT-S-17	85.5	Construct new 150 mm pipe	\$41,895	
LT-S-18	220	Construct new 200 mm pipe	\$138,600	
ST/LT-S-19	171	Upsize existing 50 mm pipe to 200 mm	\$107,730	
ST/LT-S-20	194	Upsize existing 150 mm pipe to 200 mm	\$122,220	
LT-S-21	81	Upsize existing 150 mm pipe to 200 mm	\$51,030	
ST/LT-S-22	137.5	Construct new 200 mm pipe	\$86,625	
ST/LT-S-23	71	Construct new 200 mm pipe	\$44,730	

LABEL	LENGTH (m)	UPGRADE	COST (\$2022)	COMMENTS
ST/LT-S-24	109	Construct new 200 mm pipe	\$68,670	
ST/LT-S-25	107.5	Construct new 200 mm pipe	\$67,725	
ST/LT-S-26	132.5	Upsize existing 150 mm pipe to 200 mm	\$83,475	
ST/LT-S-27	200	Upsize existing 150 mm pipe to 200 mm	\$126,000	
ST/LT-S-28	84.5	Upsize existing 150 mm pipe to 200 mm	\$53,235	
ST/LT-S-29	140.5	Upsize existing 150 mm pipe to 250 mm	\$108,185	
ST/LT-S-30	155	Upsize existing 150 mm pipe to 200 mm	\$97,650	
ST/LT-S-31	179.5	Upsize existing 100 mm pipe to 250 mm	\$138,215	
ST/LT-S-32	64	Construct new 200 mm pipe	\$40,320	
ST/LT-S-33	43	Construct new 200 mm pipe	\$27,090	
ST/LT-S-34	106.5	Upsize existing 200 mm pipe to 250 mm	\$82,005	
ST/LT-S-35	99.5	Upsize existing 50 mm pipe to 250 mm	\$76,615	
ST/LT-S-36	85	Upsize existing 150 mm pipe to 300 mm	\$77,350	
ST/LT-S-36	144.5	Upsize existing 150 mm pipe to 350 mm	\$151,725	
ST/LT-S-37	141.5	Upsize existing 150 mm pipe to 200 mm	\$89,145	
ST/LT-S-38	65	Upsize existing 150 mm pipe to 300 mm	\$59,150	
ST/LT-S-39	97.5	Upsize existing 150 mm pipe to 300 mm	\$88,725	
LT-S-40	123	Upsize existing 150 mm pipe to 200 mm	\$77,490	
ST/LT-S-41	194	Upsize existing 150 mm pipe to 200 mm	\$122,220	
ST/LT-S-42	108	Upsize existing 150 mm pipe to 200 mm	\$68,040	City to discuss cost sharing with lumberyard to implement this
ST/LT-S-42	103	Upsize existing 150 mm pipe to 350 mm	\$108,150	City to discuss cost sharing with lumberyard to implement this
ST/LT-S-43	332	Upsize existing 150 mm pipe to 300 mm	\$302,120	City to discuss cost sharing with lumberyard to implement this
ST/LT-S-44	68.5	Construct new 150 mm pipe	\$33,565	
ST/LT-L-45	703.5	Upsize existing 150mm pipe to 250mm	\$541,695	
ST/LT-L-46	150	Construct new 150 mm pipe	\$73,500	

LABEL	LENGTH (m)	UPGRADE	COST (\$2022)	COMMENTS
LT-L-47	700	Construct new 300 mm pipe	\$637,000	
<b>Total Cost</b>			<b>\$19,647,000</b>	

The improvements recommended in the table above have been chosen and designed to address the fire flow deficiencies in the City’s water distribution network while providing the best cost-benefit for their construction. The resulting fire flow deficiencies decrease from 11% to 0.23% under the 2040 MDD scenario once all the watermain improvements are completed.

Of note, a new Johnson Heights Pressure Zone (at 595 m) is proposed. The new pressure zone would be supplied by a new Johnson Heights (JH) reservoir via a new Johnson Heights pump station. The Johnson Heights reservoir would be supplied via the new Pump Station and draw from a twinned 500 mm Greeley Creek Transmission main.

## 8.10 TREATMENT RECOMMENDATIONS AND COSTS

The treatment upgrades required to meet water build-out MDD are summarized in Table 20. Treatment upgrades to the Gold Course well were costed in the *Revelstoke Water Risk Assessment Report* (2018). These costs were escalated using the *ENR Construction Cost Index*, from the report Date February 2018 to September 2022. An additional 25% contingency and 15% engineering was added to the costs.

The well pump upgrade for the Golf Course well was budgeted as a 250 HP MagForce™ pump, to supply a flow of 105 L/s at 140 m TDH.

The anticipated year the upgrade is required is shown as “estimated timeline” in Table 20. The estimates are based on a constant exponential increase from present population to build-out scenario for both residential and shadow population. This does not accurately capture shadow population growth which is based on developments.

**Table 20: Water Treatment Upgrades and Capital Costs**

TRIGGER	UPGRADE	ESTIMATED TIMELINE <sup>1</sup>	COST (\$2022)
MDD > 175 L/s	Manganese and Iron removal of Golf Course Well No. 1	2025	\$3,670,000
ADD > 175 L/s	Golf Course Wellhead protection plan stipulates continuous use of well would incur GARP, GWUDI consideration – Double barrier disinfection required	2035	\$3,855,000
MDD > 245 L/s	Increase Golf Course well pump capacity to 105 L/s	2035	\$210,000
<b>Total Cost</b>			<b>\$7,735,000</b>
1. Timeline based on constant exponential increase from present population to build-out scenario. May not accurately capture development timelines.			

# 9 IMPROVEMENT PROJECTS SUMMARY

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## 9.1 OVERVIEW

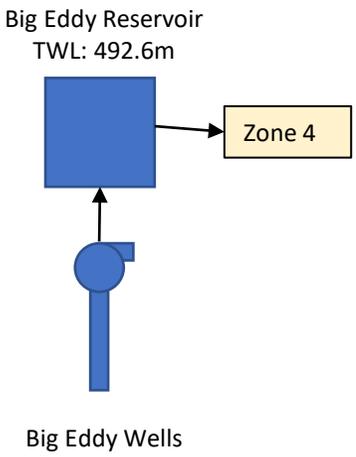
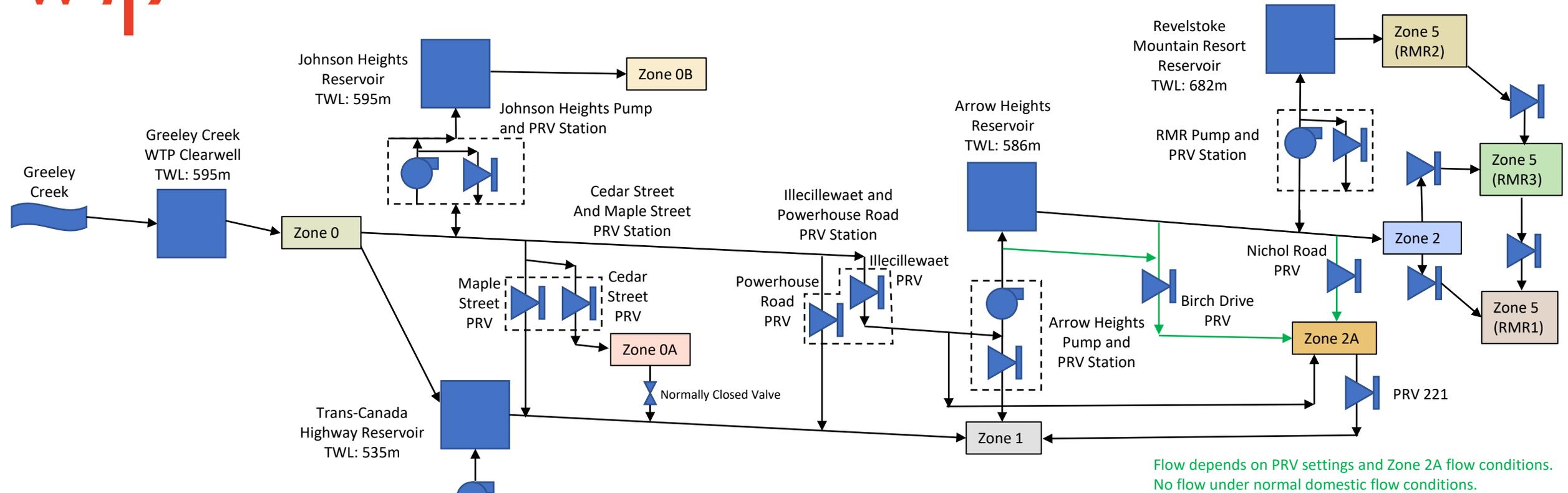
This section provides the City with a Capital Projects List which summaries recommended water infrastructure improvements over the next 18 years (from 2022 to the end of the study period in 2040). Projects from the hydraulic model review in Section 8.9 have been prioritized. All proposed improvements include but are not limited to the following design considerations:

- Upsizing of existing watermains.
- Construction of new watermains, reservoirs, pump stations and PRVs.
- Opportunity for pressure zone transfer.

A hydraulic schematic of the City's distribution system with the proposed improvements is shown in Figure 11.



# Revelstoke Future Water System Schematic



Zone	Fed Via	Areas Served	HGL (m)
Zone 0	Greeley Clearwell	Properties along Greeley transmission main	594.6
Zone 0A	Cedar Street PRV	Properties on Cedar Street	565.3
Zone 0B	Greeley Clearwell	Johnson Heights	595.0
Zone 1	TCH Reservoir and Arrow Heights PRV and Pump Station, Powerhouse Road PRV, Maple Street PRV, Nichol Road PRV	Central Revelstoke, Lower Arrow Heights	569.6
Zone 2	Arrow Heights Reservoir	Lower RMR (RMR Village)	584.6
Zone 2A	Dedicated Watermain from Transmission Main	Mid-level Arrow Heights and MacKenzie Village	548
Zone 4	Big Eddy Wells	Big Eddy	491.6
Zone 5 (RMR1-RMR3)	Monashee Booster Station PRV	Mackenzie Landing, Monashee, new RMR development	RMR1 (561.5), RMR2 (682.0), RMR3 (611.5)

Figure no. 11  
Date: Nov 29, 2022

## 9.2 PROJECTS PRIORITIZATION AND CAPITAL IMPROVEMENT PROJECTS

Projects have been prioritized based on their impact. The highest priority projects focus on addressing multiple system deficiencies with a single project. For instance, watermain upgrades address fire flow deficiencies and replace old watermains, and reservoir construction projects which provide improvements to existing storage but also address growth.

The methodology for implementation is as follows:

**High priority projects** will have the greatest impact in addressing fire flow deficiencies and pressure exceedances. This will include the creation of the proposed Johnson Heights pressure zone (at 595 m). There is a set of projects associated with the development of the new pressure zone include the construction of a new Johnson Heights reservoir and a pump station. The new pump station will be sized to convey a peak flow of 23.1 L/s.

Another high priority project is the twinning of the existing 450 mm Greeley Creek Transmission main with 500 mm for approximately 8.5 km.

Additionally, projects that have a large impact (4 or more properties) in the long and short term to address distribution system deficiencies will be highly prioritized as well. These projects are shown in Figure 9: 2040 Fire Flows with Improvements

Figure 10 with upgrade labels “ST-L-ID”, “LT-L-ID”, and “ST/LT-L-ID”. These consist of upsizing, constructing, and closing watermains within Pressure Zones 0 and 1.

**Medium priority projects** are proposed to address system deficiencies which will impact 2-3 properties. These are recommended to resolve fire flow deficiencies for both 2020 and 2040 scenarios. These projects are shown in with upgrade labels “ST/LT-M-ID”. These consist of upsizing and replacing watermains within Pressure Zones 1 and 4.

**Low priority projects** are proposed to address system deficiencies which will impact 1-2 properties. These are recommended to resolve fire flow deficiencies for both or either 2020 and 2040 scenarios. These projects are shown in Figure 7 with upgrade labels “ST-S-ID”, “LT-S-ID”, and “ST/LT-S-ID”. These consist of upsizing and constructing watermains, as well as valve closures within all the pressure zones.

Table 21 provides a summary of the type of upgrade required for the capital projects required based on their prioritization.

**Table 21: Type of Upgrades Required by Priority**

PROJECT PRIORITY	UPSIZING WATERMAIN	CONSTRUCTING NEW WATERMAIN	REPLACING WATERMAIN
High (ST-L-ID, LT-L-ID, and ST/LT-L-ID)	63.6%	23.1%	0.0%
Medium (ST/LT-M-ID)	92.9%	0.0%	7.1%
Low (ST-S-ID, LT-S-ID, and ST/LT-S-ID)	69.7%	30.3%	0.0%

## 9.3 SUMMARY AND RECOMMENDATIONS

Most of the existing system deficiencies can be addressed through the addition of a new pressure zone in the area south of the Trans Canada Highway and North of the Illecillewaet River. The new pressure zone would include a new Johnson Heights reservoir and the associated pump station to convey water to the Johnson Heights reservoir which ultimately feeds the JH pressure zone by gravity.

Twinning of the 500 mm Greeley Creek Transmission main which would run approximately 8.5 km is also a major high priority project that should be implemented at the same time.

Additionally, localized upgrades ranging from high priority (impacts more than 4 properties), medium priority (impacts 2-3 properties), and low priority (impacts 1-2 properties) are recommended. These include closing valves, upsizing, replacing, and installing new watermains across all pressure zones.

Following these upgrades, the system will satisfy the fire flow requirements by zoning as well as achieve adequate pressures as outlined in Section 8.6. Table 22 provides the anticipated Capital Budget based on the project prioritization.

**Table 22: Total Capital Costs**

<b>PROJECT PRIORTIZATION</b>	<b>NO. OF PROJECTS</b>	<b>TOTAL COST (\$2022)</b>
JH Reservoir	1	\$6,720,000
JH Pump Station	1	\$1,500,000
AH Pump Station	2	\$180,000
Treatment Upgrades	4	\$7,735,000
High (ST-L-ID, LT-L-ID, and ST/LT-L-ID)	10	\$15,362,000
Medium (ST/LT-M-ID)	7	\$980,000
Low (ST-S-ID, LT-S-ID, and ST/LT-S-ID)	28	\$3,305,000
<b>TOTAL</b>	<b>53</b>	<b>\$35,782,000</b>

# 10 INDUSTRIAL, COMMERCIAL, INSTITUTIONAL WATER METERING STRATEGY

A water balance was conducted as part of the Revelstoke Water Loss and Metering Report in 2011 by Veritec Consulting. Based on this, the industrial, commercial, and institutional (ICI) consumption within the City was found to be 9% of the gross water supplied. Currently, there are approximately 310 ICI connections to the City’s water system. Of this, only four of the ICI properties are metered. Only one of these, the Sutton Place Hotel, is billed based on its usage (Veritec Consulting Inc, 2013).

There are a variety of meters available on the market; the type and size of meter depends on the flow of water being read. Generally, ICI facilities use more water and have higher flows than residential, and so a larger meter would be required to achieve accurate readings. The City should require meters to be installed within an accessible insulated chamber for all ICI connections and requires positive displacement meters for connections less than 50mm.

For the purposes of the cursory review provided within this master plan, it is assumed that all ICI connections will be 38mm positive displacement meters installed in meter boxes. The cost of excavation and installation of meter boxes is estimated to be \$1,800 (2022 dollars) each, including supply and labour for installation based on discussions with vendors, review of installation costs in the City of Richmond, City of Mission and recent related studies. The T-10 meter offered by the Neptune Technology Group is a positive displacement meter that is assumed to be sufficient for all ICI applications in the City. The cost of a 38mm T-10 meter is \$1,135 (2022 dollars).

Under the assumption that the City will install meters in all unmetered connections, the capital costs for meter and meter box installations for all ICI properties remaining (i.e., 306 connections) is estimated to be in the range of \$898,110 (2022 dollars). These costs can be deferred to the ICI customer.

Typically for municipalities, water savings are more difficult to achieve for ICI customers as compared to residential. This is primarily due to fixed volume processes such as those found in factories and unconfined water usage in hotels. Based on research conducted by Environment Canada, water metering in combination with volumetric pay structures can reduce overall water consumption by 15% - 30% (2001). Similarly, based on USEPA’s Water Conservation Plan Guidelines significant water reductions are experienced based on increases in billing rates. Table 23 contains typical water conservation measures and the respective water use reduction experienced. Appendix D contains a comprehensive list of benchmarks used in conversation planning as outlined by the USEPA.

**Table 23: ICI Water Conservation Measures and Associated Water Use Reductions (USEPA, 1998)**

CATEGORY	MEASURE	REDUCTION IN END USE (%)
Water accounting and loss control	System audits and leak detection	Based on system
Costing and Pricing	10% increase in ICI prices	5 – 8
	Increasing block rate	5
Information and education	Public education	2 – 5
End-use audits	General industrial water conservation	10 – 20
Retrofits	Governmental buildings (indoors)	5

All of the measures listed above can be implemented for the City as part of an ICI metering strategy.

Specifically for the City of Revelstoke, increases in prices and block rates will provide ICI consumers with an incentive to control and limit their water usage and as such is assumed to reduce water use by 10% (5% for each measure). The City has implemented seasonal and temporal water restrictions and public education for its residential users, these could be enforced on the ICI lots as well to further reduce an estimated 3% of water usage.

End-use water audits can significantly lower water use. For instance, within the Resort Municipality of Whistler, an estimated 25% of water savings were achieved from ICI audits over the course of ten years (Resort Municipality of Whistler, 2015). From this, water savings of 15% can be conservatively estimated as a result of ICI audits for the City. Finally retrofits of government buildings can also lead to major use reductions at an estimate of 5%.

Table 24 summarizes the assumed water usage reductions for the recommended water conservation strategies reliant on metering.

**Table 24: Estimated Water Use Reductions**

CATEGORY	MEASURE	ESTIMATED REDUCTION IN END USE (%)
Water accounting and loss control	System audits and leak detection	Based on system
Costing and Pricing	10% increase in ICI prices	5
	Increasing block rate	5
Information and education	Public education	3
End-use audits	General industrial water conservation	15
Retrofits	Governmental buildings (indoors)	5
<b>Total</b>		<b>33%</b>

An estimated 33% water savings could be potentially achieved on the 310 ICI connections. These connections represent approximately 9% of the City’s annual water use, resulting in an overall water savings of 3% for the City.

# APPENDIX

# A WATER DEMANDS



2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
36	0.05	0.15	0.24	Zone - Big Eddy
40	0.05	0.15	0.24	Zone - Big Eddy
44	0.19	0.51	0.84	Zone - Big Eddy
60	0.04	0.11	0.18	Zone - Big Eddy
73	0.03	0.07	0.12	Zone - Big Eddy
75	0.04	0.11	0.18	Zone - Big Eddy
89	0.11	0.29	0.48	Zone - Big Eddy
94	0.05	0.15	0.24	Zone - Big Eddy
116	0.04	0.11	0.18	Zone - Big Eddy
123	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
124	0.07	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
125	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
126	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
129	0.16	0.44	0.72	Zone - Big Eddy
132	0.1	0.22	0.39	Zone 0A - Cedar Street PRV
134	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
135	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
137	0.3	0.8	1.31	Zone - Big Eddy
138	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
139	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
140	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
141	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
144	0.34	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
144	0	0.91	1.49	Zone - Big Eddy
146	0.31	0.84	1.37	Zone - Big Eddy
148	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
149	0.15	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
150	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
153	0.38	1.02	1.67	Zone - Big Eddy
154	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
155	0.23	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
155	0	0.62	1.02	Zone - Big Eddy
156	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
157	0.2	0.55	0.9	Zone - Big Eddy
159	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
160	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
161	0.46	1.24	2.03	Zone - Big Eddy
162	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
163	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2020 Demands</b>				
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>	<b>Pressure Zone</b>
165	0.03	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
166	0.11	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
170	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
172	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
173	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
176	0.3	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
177	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
178	0	0	0	Zone - Big Eddy
183	0.02	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
184	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
185	0.15	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
189	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
190	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
191	0.07	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
192	0.15	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
197	0.1	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
199	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
200	0.07	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
201	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
202	0.16	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
203	0.13	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
205	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
207	0.11	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
209	0	0	0	Zone - Big Eddy
212	0	0	0	Zone - Big Eddy
214	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
215	0.11	0	0	Zone 0 - Greeley WTP Zone
218	0	0	0	Zone - Big Eddy
222	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
225	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
231	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
233	0.1	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
234	0.18	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
241	0.21	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
242	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
243	0.1	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
244	0.25	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
246	0.05	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
249	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
257	0.1	0	0	Zone 0 - Greeley WTP Zone
257	0	0	0	Zone - Big Eddy
274	0	0	0	Zone - Big Eddy
279	0	0	0	Zone - Big Eddy
281	0	0	0	Zone - Big Eddy
283	0	0	0	Zone - Big Eddy
293	0.07	0.35	0.62	Zone 0 - Greeley WTP Zone
293	0	0	0	Zone - Big Eddy
295	0	0.47	0.84	Zone 0 - Greeley WTP Zone
297	0.31	0.25	0.45	Zone 0 - Greeley WTP Zone
298	0	0	0	Zone 2 - Lower RMR Zone
300	0	0	0	Zone - Big Eddy
302	0.2	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
303	0	0	0	Zone - Big Eddy
304	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
305	0	0	0	Zone - Big Eddy
307	0	0	0	Zone - Big Eddy
309	0.02	1.1	1.97	Zone 1 - Central Revelstoke and Lower Arrow Heights
310	0.03	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
310	0	0	0	Zone - Big Eddy
311	0.07	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
312	0	0	0	Zone - Big Eddy
314	0	0	0	Zone - Big Eddy
317	0.26	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
320	0.08	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
321	0	0	0	Zone - Big Eddy
323	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
323	0	0	0	Zone - Big Eddy
325	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
325	0	0	0	Zone - Big Eddy
327	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
327	0	0	0	Zone - Big Eddy
328	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
329	0	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
332	0	0	0	Zone - Big Eddy
333	0.03	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
335	0.03	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
336	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
339	0	0	0	Zone - Big Eddy

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
341	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
342	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
344	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
345	0.13	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
345	0	0	0	Zone - Big Eddy
348	0.18	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
348	0	0	0	Zone - Big Eddy
350	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
351	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
354	0	0	0	Zone - Big Eddy
356	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
357	0	0	0	Zone - Big Eddy
358	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
359	0.25	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
360	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
360	0	0	0	Zone - Big Eddy
361	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
363	0.05	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
363	0	0	0	Zone - Big Eddy
364	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
366	0	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
366	0	0	0	Zone - Big Eddy
367	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
369	0.13	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
369	0	0	0	Zone - Big Eddy
370	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
371	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
372	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
372	0	0	0	Zone - Big Eddy
374	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
375	0.02	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
375	0	0	0	Zone - Big Eddy
379	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
380	0.03	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
382	0.13	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
383	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
384	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
385	0.07	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
386	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
387	0.2	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
388	0.07	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
389	0.03	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
390	0.25	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
391	0.18	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
392	0.43	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
393	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
394	0.15	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
395	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
398	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
400	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
401	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
402	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
403	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
404	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
407	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
409	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
410	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
411	0	0	0	Zone - Big Eddy
412	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
413	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
414	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
416	0.3	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
417	0.13	0.09	0.17	Zone 0A - Cedar Street PRV
418	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
419	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
421	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
422	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
423	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
424	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
425	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
426	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
427	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
428	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
429	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
432	0	0.94	1.69	Zone 1 - Central Revelstoke and Lower Arrow Heights
433	0.05	0.91	1.63	Zone 1 - Central Revelstoke and Lower Arrow Heights
434	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
435	0.08	1	1.8	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
436	0.07	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
437	0.03	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
438	0.16	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
441	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
442	0.07	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
443	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
445	0.16	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
446	0.07	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
447	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
450	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
451	0.03	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
452	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
454	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
455	0.2	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
456	0.1	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
457	0.1	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
458	0.13	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
462	0.11	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
463	0.13	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
464	0.05	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
467	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
470	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
472	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
473	0.05	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
474	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
478	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
479	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
482	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
484	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
486	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
488	0.1	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
489	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
492	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
494	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
495	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
496	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
497	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
498	0.03	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
500	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
501	0.08	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
502	0.28	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
503	0.18	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
504	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
505	0.2	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
510	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
511	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
513	0.1	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
514	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
515	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
516	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
517	0.03	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
518	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
519	0.13	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
520	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
521	0.15	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
524	0.13	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
525	0.25	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
526	0.2	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
529	0.18	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
530	0.08	0.38	0.67	Zone 2A - Mid Arrow Heights Zone
531	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
532	0.18	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
533	0.08	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
534	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
535	0.11	0.38	0.67	Zone 2A - Mid Arrow Heights Zone
536	0.13	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
537	0	0.09	0.17	Zone 2A - Mid Arrow Heights Zone
538	0.08	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
539	0.16	0.31	0.56	Zone 2A - Mid Arrow Heights Zone
544	0.16	0.41	0.73	Zone 0 - Greeley WTP Zone
545	0.07	0.47	0.84	Zone 0 - Greeley WTP Zone
546	0	0.35	0.62	Zone 0 - Greeley WTP Zone
547	0.15	0.41	0.73	Zone 0 - Greeley WTP Zone
548	0.08	0	0	Zone 0 - Greeley WTP Zone
549	0.07	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
555	0.08	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
556	0.11	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
557	0.03	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
558	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
559	0.21	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
560	0.11	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
562	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
563	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
564	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
565	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
567	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
568	0.13	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1170	0.31	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
1178	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
1181	0.03	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
1183	0.08	0.56	1.01	Zone 2A - Mid Arrow Heights Zone
1202	0.21	0.28	0.51	Zone 2A - Mid Arrow Heights Zone
1204	0	0	0	Zone 2 - Lower RMR Zone
1213	0	0	0	Zone 2 - Lower RMR Zone
1217	0	0	0	Zone 2 - Lower RMR Zone
1219	0.1	0	0	Zone 2 - Lower RMR Zone
1223	0	0.19	0.34	Zone 3A - Mackenzie Landing Zone
1236	0.13	0.25	0.45	Zone 3A - Mackenzie Landing Zone
1238	0.13	0.16	0.28	Zone 3A - Mackenzie Landing Zone
1247	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
1285	0.1	0	0	Zone 0 - Greeley WTP Zone
1316	0.15	0	0	Zone 0 - Greeley WTP Zone
1325	0	0	0	Zone 2A - Mid Arrow Heights Zone
1362	0.16	0	0	Zone 2A - Mid Arrow Heights Zone
1374	0.2	0	0	Zone 2A - Mid Arrow Heights Zone
1375	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
1505	0.02	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1514	0.38	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1516	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
1528	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
1582	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
1587	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
1620	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1656	0.15	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
1677	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1682	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1697	0.2	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
1709	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1711	0.15	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
1722	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
1747	0.3	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1761	0.25	0	0	Zone 2 - Lower RMR Zone
1797	0	0	0	Zone 2 - Lower RMR Zone
1801	0.07	0	0	Zone 2 - Lower RMR Zone
1803	0.25	0	0	Zone 3A - Mackenzie Landing Zone
1815	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1822	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1826	0.05	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1833	0	0	0	Zone 2 - Lower RMR Zone
1878	0.1	0.03	0.06	Zone 3A - Mackenzie Landing Zone
1991	0.03	0.35	0.62	Zone 3A - Mackenzie Landing Zone
2020	(N/A)	0	0	Zone 2 - Lower RMR Zone
2020	(N/A)	(N/A)	(N/A)	RMR - BN
2020	0	(N/A)	(N/A)	RMR - BN
2025	0	0	0	Zone 2 - Lower RMR Zone
2035	(N/A)	0	0	Zone 2 - Lower RMR Zone
2035	0	(N/A)	(N/A)	RMR - BN
2054	0	0.28	0.51	Zone 2 - Lower RMR Zone
2057	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2206	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2209	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2212	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2215	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2218	(N/A)	(N/A)	(N/A)	RMR - BN
2349	(N/A)	(N/A)	(N/A)	RMR - BN
2350	(N/A)	(N/A)	(N/A)	RMR - BN
2351	(N/A)	(N/A)	(N/A)	RMR - BN
2352	0	0.09	0	Zone 3A - Mackenzie Landing Zone
2353	(N/A)	(N/A)	(N/A)	RMR - BN
2355	(N/A)	(N/A)	(N/A)	RMR - BN
2356	0	0	0	Zone 2 - Lower RMR Zone
2357	(N/A)	(N/A)	(N/A)	RMR - BN
2358	(N/A)	(N/A)	(N/A)	RMR - BN
2359	(N/A)	(N/A)	(N/A)	RMR - BN
2360	(N/A)	(N/A)	(N/A)	RMR - BN
2361	(N/A)	(N/A)	(N/A)	RMR - BN

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
2362	(N/A)	(N/A)	(N/A)	RMR - BN
2363	(N/A)	(N/A)	(N/A)	RMR - BN
2364	(N/A)	(N/A)	(N/A)	RMR - BN
2365	(N/A)	(N/A)	(N/A)	RMR - BN
2366	(N/A)	(N/A)	(N/A)	RMR - BN
2367	(N/A)	(N/A)	(N/A)	RMR - BN
2368	0	0	0	Zone 2 - Lower RMR Zone
2369	(N/A)	(N/A)	(N/A)	RMR - BN
2370	(N/A)	(N/A)	(N/A)	RMR - BN
2444	(N/A)	(N/A)	(N/A)	RMR - BN
2447	(N/A)	(N/A)	(N/A)	RMR - BN
2456	0	0	0	Zone 2 - Lower RMR Zone
2462	(N/A)	(N/A)	(N/A)	RMR - BN
2465	0	0	0	Zone 2 - Lower RMR Zone
2521	(N/A)	(N/A)	(N/A)	RMR - BN
2535	(N/A)	(N/A)	(N/A)	RMR - BN
2538	(N/A)	(N/A)	(N/A)	RMR - BN
2543	(N/A)	(N/A)	(N/A)	RMR - BN
2556	(N/A)	(N/A)	(N/A)	RMR - BN
2559	(N/A)	(N/A)	(N/A)	RMR - BN
2642	(N/A)	(N/A)	(N/A)	<None>
2654	0	0	0	Zone - Big Eddy
2699	0	0	0	Zone - Big Eddy
2700	0.2	0.55	0.9	Zone - Big Eddy
2703	0.12	0.33	0.54	Zone - Big Eddy
2705	0.28	0.76	1.25	Zone - Big Eddy
2706	0.08	0.22	0.36	Zone - Big Eddy
2707	0.07	0.18	0.3	Zone - Big Eddy
2708	0	0	0	Zone - Big Eddy
2709	0.05	0.15	0.24	Zone - Big Eddy
2710	0.07	0.18	0.3	Zone - Big Eddy
2712	0.07	0.18	0.3	Zone - Big Eddy
2713	0.05	0.15	0.24	Zone - Big Eddy
2714	0.01	0.04	0.06	Zone - Big Eddy
2717	0.16	0.44	0.72	Zone - Big Eddy
2718	0.01	0.04	0.06	Zone - Big Eddy
2719	0.16	0.44	0.72	Zone - Big Eddy
2720	0.17	0.47	0.78	Zone - Big Eddy
2722	0.27	0.73	1.2	Zone - Big Eddy

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
2724	0.08	0.22	0.36	Zone - Big Eddy
2725	0.03	0.07	0.12	Zone - Big Eddy
2726	0.03	0.07	0.12	Zone - Big Eddy
2728	0.2	0.55	0.9	Zone - Big Eddy
2736	0.03	0.07	0.12	Zone - Big Eddy
2738	0	0	0	Zone - Big Eddy
2740	0	0	0	Zone - Big Eddy
2744	0	0	0	Zone - Big Eddy
2746	0	0	0	Zone - Big Eddy
2747	0	0	0	Zone - Big Eddy
2748	0	0	0	Zone - Big Eddy
2749	0	0	0	Zone - Big Eddy
2755	0	0	0	Zone - Big Eddy
2763	0	0	0	Zone - Big Eddy
2768	0	0	0	Zone - Big Eddy
2770	0	0	0	Zone - Big Eddy
2772	0	0	0	Zone - Big Eddy
2775	0	0	0	Zone - Big Eddy
2784	0	0	0	Zone - Big Eddy
2785	0	0	0	Zone - Big Eddy
2786	0	0	0	Zone - Big Eddy
2787	0	0	0	Zone - Big Eddy
2789	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2937	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2940	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2943	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2946	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2949	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2952	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2955	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2958	0	0	0	Zone 0 - Greeley WTP Zone
2961	0	0	0	Zone 2 - Lower RMR Zone
2964	0	0	0	Zone 2 - Lower RMR Zone
2967	0	0	0	Zone 2A - Mid Arrow Heights Zone
2970	0	0	0	Zone 2A - Mid Arrow Heights Zone
2973	0	0	0	Zone 2A - Mid Arrow Heights Zone
2976	0	0	0	Zone 2A - Mid Arrow Heights Zone
2979	0	0	0	Zone 2 - Lower RMR Zone
2982	0	0	0	Zone 2A - Mid Arrow Heights Zone

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
2985	0	0	0	Zone 2A - Mid Arrow Heights Zone
2988	0	0	0	Zone 3A - Mackenzie Landing Zone
2991	0	0	0	Zone 3A - Mackenzie Landing Zone
2994	0	0	0	Zone 3A - Mackenzie Landing Zone
2997	0	0	0	Zone 3A - Mackenzie Landing Zone
3000	0	0	0	Zone 3A - Mackenzie Landing Zone
3003	0	0	0	Zone 3A - Mackenzie Landing Zone
3006	0	0	0	Zone 3A - Mackenzie Landing Zone
3009	0	0	0	Zone 3A - Mackenzie Landing Zone
3012	0	0	0	Zone 3A - Mackenzie Landing Zone
3015	0	0	0	Zone 3A - Mackenzie Landing Zone
3018	0	0	0	Zone 3A - Mackenzie Landing Zone
3021	0	0	0	Zone 3A - Mackenzie Landing Zone
3024	0	0	0	Zone 3A - Mackenzie Landing Zone
3027	0	0	0	Zone 3A - Mackenzie Landing Zone
3030	0	0	0	Zone 0 - Greeley WTP Zone
3033	0	0	0	Zone 0 - Greeley WTP Zone
3036	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3039	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3042	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3045	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3048	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3051	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3054	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3057	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3060	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3063	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3066	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3069	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3072	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3076	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3079	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3082	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3085	0	0	0	Zone - Big Eddy
3091	0	0	0	Zone - Big Eddy
3094	0	0	0	Zone - Big Eddy
3097	0	0	0	Zone - Big Eddy
3100	0	0	0	Zone - Big Eddy
AH-1	0.03	0	0	Zone 0 - Greeley WTP Zone

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
AH-10	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-11	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-14	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-5	0.25	0	0	<None>
AH-6	0.28	0	0	<None>
AH-7	0.13	0	0	<None>
AH-9	0.33	0	0	<None>
ARR-BER	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
BER-SPR	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
Booster Stn	0.15	0	0	<None>
CAM-McKI	0.02	0	0	Zone 2A - Mid Arrow Heights Zone
CASHATO	0.21	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
CHA-1	0	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
CHA-3	0.08	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
CLE-PER	0.05	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
COL-23N	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
COL-SAN	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-4	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-5	0.16	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-TAY	0.15	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-TOW	0.02	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
FAI-PER	0	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
FRA-TCH	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
G-2+170	0	0	0	<None>
G-2+250	0.05	0	0	<None>
G-2+545	0.03	0	0	<None>
GAR-1	0.1	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
Greeley	0.05	0	0	<None>
GRIZZLY	0.05	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
Ham?	(N/A)	(N/A)	(N/A)	<None>
HAN-1	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
HAN-3	0.1	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
HAY	0.08	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
HILLTOP	0.03	0	0	Zone 0 - Greeley WTP Zone
HUM-4	0.1	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
ID	0.16	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
ILL-1	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
ILL-AIR	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-172	0.08	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2020 Demands</b>				
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>	<b>Pressure Zone</b>
J-179	0.2	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-181	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-182	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-196	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-197	0.15	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-199	0.02	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-200	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-202	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-204	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-208	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-209	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-210	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-212	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-215	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-216	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-217	0.25	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-218	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-221	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-224	0.02	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-225	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-227	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-230	0.03	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-232	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-233	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-235	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-243	0.1	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-246	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-253	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-254	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-255	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-258	0.1	0.72	1.29	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-273	0.2	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-274	0.15	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-276	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-282	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-283	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-285	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-288	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-292	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-297	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-307	0.03	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-308	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-316	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-317	0.03	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-321	0.08	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-325	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-326	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-330	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-336	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-337	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-338	0.08	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-342	0.11	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-343	0.11	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-345	0.03	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-346	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-348	0.08	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-352	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-353	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-354	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-357	0.02	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-358	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-360	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-362	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-364	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-367	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-368	0.16	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-370	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-376	0.26	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-386	0.03	0	0	Zone 2A - Mid Arrow Heights Zone
J-389	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-399	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-400	0.13	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-404	0.48	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-405	0.53	0.03	0.06	Zone 2A - Mid Arrow Heights Zone
J-417	0.07	0	0	Zone 2A - Mid Arrow Heights Zone
J-418	0.18	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
J-419	0.23	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-420	0.13	0.25	0.45	Zone 2A - Mid Arrow Heights Zone

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-427	0.25	0.13	0.22	Zone 2 - Lower RMR Zone
J-429	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-430	0.13	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-438	0.11	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-445	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-446	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-447	0.05	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-449	0.38	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-454	0.28	0.06	0.11	Zone 2 - Lower RMR Zone
J-455	0	0.16	0.28	Zone 2 - Lower RMR Zone
J-456	0.15	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-457	0.11	0.25	0.45	Zone 2A - Mid Arrow Heights Zone
J-460	0	0.22	0.39	Zone 2 - Lower RMR Zone
J-468	0.13	0	0	Zone 2 - Lower RMR Zone
J-470	0.05	0.06	0.11	Zone 3A - Mackenzie Landing Zone
J-478	0.13	0	0	Zone 0 - Greeley WTP Zone
J-481	0.11	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-482	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-485	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-486	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-487	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-492	0.08	0	0	Zone 0 - Greeley WTP Zone
J-494	0.05	0	0	Zone 0 - Greeley WTP Zone
J-499	0.07	0	0	<None>
J-500	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-501	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-502	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-503	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-505	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-510	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-511	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-513	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-515	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-516	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-517	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-519	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-520	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-522	0.18	0	0	Zone 2A - Mid Arrow Heights Zone
J-523	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-524	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-525	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-526	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-527	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-528	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-529	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-530	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-533	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-534	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-535	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-536	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-543	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-545	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-546	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-547	0.18	0	0	Zone 2A - Mid Arrow Heights Zone
J-548	0.18	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-549	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-551	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-552	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-556	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-557	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-558	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-559	0.34	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-561	0.07	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-562	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-563	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-564	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-565	0.31	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-566	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-567	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-568	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-569	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-570	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-571	0.16	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-572	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-573	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-574	0.1	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-575	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-576	0.07	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-577	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-578	0.13	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-579	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-58	0	0	0	Zone 2 - Lower RMR Zone
J-581	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-583	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-584	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-585	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-586	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-587	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-588	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-589	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-590	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-591	0.15	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-592	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-593	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-594	0.1	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-595	0.25	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-599	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-600	0.02	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-601	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-602	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-603	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-604	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-605	0.11	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-606	0.05	0	0	Zone 0 - Greeley WTP Zone
J-607	0.1	0.13	0.22	Zone 0 - Greeley WTP Zone
J-608	0.11	0.09	0.17	Zone 0 - Greeley WTP Zone
J-609	0.13	0.16	0.28	Zone 0 - Greeley WTP Zone
J-610	0.08	0	0	Zone 0 - Greeley WTP Zone
J-611	0.1	0	0	Zone 0 - Greeley WTP Zone
J-613	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-614	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-615	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-617	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-618	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-619	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-620	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-622	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-624	0.08	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-625	0.15	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-626	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-627	0.02	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-629	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-630	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-631	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-632	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-635	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-636	0.16	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-637	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-639	0.34	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-640	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-641	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-642	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-643	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-644	0.15	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-645	0.23	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-647	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-648	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-649	0.1	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-650	0.1	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-652	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-653	0.08	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-654	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-657	0.49	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-659	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-660	0.1	0	0	Zone 2A - Mid Arrow Heights Zone
J-661	0.18	0	0	Zone 2A - Mid Arrow Heights Zone
J-662	0.1	0	0	Zone 2A - Mid Arrow Heights Zone
J-664	0.15	0.35	0.62	Zone 2 - Lower RMR Zone
J-665	0	0.06	0.11	Zone 2A - Mid Arrow Heights Zone
J-666	0.28	0.09	0.17	Zone 2 - Lower RMR Zone
J-668	0.13	0	0	Zone 2 - Lower RMR Zone
J-671	0	0	0	Zone 2 - Lower RMR Zone
J-672	0	0	0	<None>
J-673	0.13	0.13	0.22	Zone 3A - Mackenzie Landing Zone
J-674	0.03	0.22	0.39	Zone 3A - Mackenzie Landing Zone
J-676	0.2	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-677	0.3	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-680	0.18	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-682	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-683	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-684	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-685	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-686	0.02	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-687	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-688	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-689	0	0	0	<None>
J-690	0.57	0	0	<None>
J-692	0.25	0	0	<None>
J-694	0.03	0	0	<None>
J-697	0.03	0	0	<None>
J-698	0	0	0	<None>
J-699	0.05	0	0	<None>
J-700	0.05	0	0	<None>
J-701	0.07	0	0	<None>
J-702	0.08	0	0	<None>
J-703	0.13	0	0	<None>
J-704	0	0	0	<None>
J-705	0.21	0	0	<None>
J-706	0	0	0	Zone 2 - Lower RMR Zone
J-707	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-709	0.1	0	0	<None>
J-710	0.1	0	0	<None>
J-711	0.1	0	0	<None>
J-712	0.08	0	0	<None>
J-713	0.15	0	0	<None>
J-714	0.26	0	0	<None>
J-715	0	0	0	<None>
J-718	0.26	0	0	<None>
J-719	0.26	0	0	<None>
J-720	0	0	0	<None>
J-721	0.05	0	0	<None>
J-722	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-723	0.21	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-727	0.05	0.16	0.28	Zone 2 - Lower RMR Zone
J-731	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-732	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-733	0.07	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-734	0	0	0	<None>
J-735	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-736	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-737	0	0	0	Zone 2 - Lower RMR Zone
J-738	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-741	0	0	0	<None>
J-742	0	0	0	<None>
J-743	0	0	0	<None>
J-744	0	0	0	<None>
J-745	0	0	0	<None>
J-746	0	0	0	<None>
J-747	0	0	0	<None>
J-748	0	0	0	<None>
J-749	0	0	0	<None>
J-750	0	0	0	<None>
J-751	0	0	0	Zone 0 - Greeley WTP Zone
J-752	0	0	0	Zone 0 - Greeley WTP Zone
J-753	0	0	0	<None>
J-754	0	0	0	<None>
J-757	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-758	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-759	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-76	0	0	0	Zone 2 - Lower RMR Zone
J-760	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-762	0	0	0	Zone 0A - Cedar Street PRV
J-763	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-764	0	0	0	Zone 2B - Mackenzie Village
J-765	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-766	0	0	0	<None>
J-767	0	0	0	<None>
J-77	0	0	0	Zone 2 - Lower RMR Zone
J-78	(N/A)	(N/A)	(N/A)	RMR - BN
J-79	(N/A)	(N/A)	(N/A)	RMR - BN
J-793	0	0	0	<None>
J-80	(N/A)	(N/A)	(N/A)	RMR - BN
J-803	0	0	0	<None>
J-804	0	0	0	<None>

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
J-810	(N/A)	(N/A)	(N/A)	RMR - BN
J-811	(N/A)	(N/A)	(N/A)	RMR - BN
J-812	0	0	0	<None>
J-82	(N/A)	(N/A)	(N/A)	RMR - BN
J-822	(N/A)	(N/A)	(N/A)	<None>
J-825	(N/A)	(N/A)	(N/A)	RMR - BN
J-83	0	0	0	Zone 2 - Lower RMR Zone
J-84	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-86	(N/A)	(N/A)	(N/A)	RMR - BN
J-87	(N/A)	(N/A)	(N/A)	RMR - BN
J-878	0	0	0	<None>
J-88	(N/A)	(N/A)	(N/A)	RMR - BN
J-884	0	0	0	<None>
J-886	(N/A)	(N/A)	(N/A)	<None>
J-887	(N/A)	(N/A)	(N/A)	<None>
J-888	0	0	0	<None>
J-889	0	0	0	<None>
J-89	(N/A)	(N/A)	(N/A)	RMR - BN
J-890	0	0	0	<None>
J-891	0	0	0	<None>
J-892	0	0	0	<None>
J-893	(N/A)	(N/A)	(N/A)	<None>
J-894	(N/A)	(N/A)	(N/A)	<None>
J-90	(N/A)	(N/A)	(N/A)	RMR - BN
J-91	(N/A)	(N/A)	(N/A)	RMR - BN
J-92	(N/A)	(N/A)	(N/A)	RMR - BN
J-93	(N/A)	(N/A)	(N/A)	RMR - BN
J-95	(N/A)	(N/A)	(N/A)	RMR - BN
JON-1	0.16	0	0	Zone 0 - Greeley WTP Zone
JON-4	0.18	0.19	0.34	Zone 0 - Greeley WTP Zone
LAF-PER	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LAF-PET	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LAF-VIC	0.15	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
LEA-CAR	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LEA-COT	0.08	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-1	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-2	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-3	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-4	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
MAC-5	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-6	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-7	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-TRACK	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-VIC	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAD-PER	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAD-PET	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAPLE	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
McA-9	0.15	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
McK-HIO	0.33	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
McKI-BIR	0.13	0.09	0.17	Zone 2A - Mid Arrow Heights Zone
McKI-GAL	0.21	0.06	0.11	Zone 2A - Mid Arrow Heights Zone
McKI-HAY	0	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
McKI-MEL	0.07	0.16	0.28	Zone 2A - Mid Arrow Heights Zone
MEL-HAY	0.07	0.25	0.45	Zone 2A - Mid Arrow Heights Zone
MONTANA	0	0.19	0.34	Zone 0 - Greeley WTP Zone
MOS-4	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
NEW-AIR	0.16	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
NEW-ELM	0.03	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
NIC-ELM	0.11	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
NIC-J+J	0.21	0	0	Zone 2A - Mid Arrow Heights Zone
OAK2	0	0	0	Zone 0 - Greeley WTP Zone
OAK3	0.03	0	0	Zone 0 - Greeley WTP Zone
ORT-1	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-2	0	0.72	1.29	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-3	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-4	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-5	0	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-6	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-7	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-8	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
PEA-1	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
PEA-2	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
PER-COL	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
POW	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
POW-STP	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
PRAT-AIR	0.33	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
ROB-VIC	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights

2020 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Pressure Zone
ROK-2	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
SHE-AIR	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
SHEIL	0	0.19	0.34	<None>
SIM-4	0.02	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
TCH-10+435	0.11	0	0	<None>
TCH-2+770	0.16	0	0	<None>
TCH-7+970	0.07	0	0	Zone 0 - Greeley WTP Zone
TCH-8+240	0.11	0	0	Zone 0 - Greeley WTP Zone
TCH-9+185	0.18	0	0	Zone 0 - Greeley WTP Zone
TCH-9+642	0.03	0	0	Zone 0 - Greeley WTP Zone
TEM-4	0.21	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
TEM-8	0.25	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
TOW-4	0.15	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
TRACK-CP	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-10	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-3	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-4	0	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-5	0.1	0.78	1.41	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-6	0.08	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-8	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-10	0.11	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-2	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-3	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-4	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-VER	0.02	0.75	1.35	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIE-23N	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
WAL-1	0.1	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
WAL-3	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-1	0.07	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-2	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-VIC	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
36	0.05	0.15	0.24	Zone - Big Eddy
40	0.05	0.15	0.24	Zone - Big Eddy
44	0.19	0.51	0.84	Zone - Big Eddy
60	0.04	0.11	0.18	Zone - Big Eddy
73	0.03	0.07	0.12	Zone - Big Eddy
75	0.04	0.11	0.18	Zone - Big Eddy
89	0.11	0.29	0.48	Zone - Big Eddy
94	0.05	0.15	0.24	Zone - Big Eddy
116	0.04	0.11	0.18	Zone - Big Eddy
123	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
124	0.07	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
125	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
126	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
129	0.16	0.44	0.72	Zone - Big Eddy
132	0.1	0.22	0.39	Zone 0A - Cedar Street PRV
134	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
135	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
137	0.3	0.8	1.31	Zone - Big Eddy
138	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
139	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
140	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
141	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
144	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
144	0.34	0.91	1.49	Zone - Big Eddy
146	0.31	0.84	1.37	Zone - Big Eddy
148	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
149	0.15	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
150	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
153	0.38	1.02	1.67	Zone - Big Eddy
154	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
155	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
155	0.23	0.62	1.02	Zone - Big Eddy
156	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
157	0.2	0.55	0.9	Zone - Big Eddy
159	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
160	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
161	0.46	1.24	2.03	Zone - Big Eddy
162	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
163	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2040 Demands</b>				
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>	<b>Zone</b>
165	0.03	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
166	0.11	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
170	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
172	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
173	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
176	0.3	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
177	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
178	0	0	0	Zone - Big Eddy
183	0.02	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
184	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
185	0.15	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
189	0.72	1.23	1.59	Zone 1 - Central Revelstoke and Lower Arrow Heights
190	0.63	0.87	2.31	Zone 1 - Central Revelstoke and Lower Arrow Heights
191	0.07	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
192	0.15	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
197	0.1	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
199	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
200	0.07	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
201	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
202	0.78	1.17	3	Zone 1 - Central Revelstoke and Lower Arrow Heights
203	0.13	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
205	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
207	0.11	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
209	0	0	0	Zone - Big Eddy
212	0	0	0	Zone - Big Eddy
214	1.93	3.22	3.98	Zone 1 - Central Revelstoke and Lower Arrow Heights
215	1.13	1.7	4.53	Zone 0 - Greeley WTP Zone
218	0	0	0	Zone - Big Eddy
222	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
225	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
231	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
233	0.1	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
234	0.18	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
241	0.21	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
242	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
243	0.1	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
244	0.25	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
246	0.05	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
249	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
257	1.69	2.66	2.87	Zone 0 - Greeley WTP Zone
257	0	0	0	Zone - Big Eddy
274	0	0	0	Zone - Big Eddy
279	0	0	0	Zone - Big Eddy
281	0	0	0	Zone - Big Eddy
283	0	0	0	Zone - Big Eddy
293	0.24	0.63	0.96	Zone 0 - Greeley WTP Zone
293	0	0	0	Zone - Big Eddy
295	0.17	0.75	1.18	Zone 0 - Greeley WTP Zone
297	0.48	0.53	0.79	Zone 0 - Greeley WTP Zone
298	0	0	0	Zone 2 - Lower RMR Zone
300	0	0	0	Zone - Big Eddy
302	0.2	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
303	0	0	0	Zone - Big Eddy
304	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
305	0	0	0	Zone - Big Eddy
307	0	0	0	Zone - Big Eddy
309	0.02	1.1	1.97	Zone 1 - Central Revelstoke and Lower Arrow Heights
310	0.03	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
310	0	0	0	Zone - Big Eddy
311	0.07	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
312	0	0	0	Zone - Big Eddy
314	0	0	0	Zone - Big Eddy
317	0.26	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
320	0.08	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
321	0	0	0	Zone - Big Eddy
323	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
323	0	0	0	Zone - Big Eddy
325	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
325	0	0	0	Zone - Big Eddy
327	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
327	0	0	0	Zone - Big Eddy
328	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
329	0	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
332	0	0	0	Zone - Big Eddy
333	0.03	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
335	0.03	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
336	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
339	0	0	0	Zone - Big Eddy

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
341	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
342	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
344	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
345	0.13	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
345	0	0	0	Zone - Big Eddy
348	0.18	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
348	0	0	0	Zone - Big Eddy
350	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
351	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
354	0	0	0	Zone - Big Eddy
356	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
357	0	0	0	Zone - Big Eddy
358	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
359	2.79	3.82	4.13	Zone 1 - Central Revelstoke and Lower Arrow Heights
360	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
360	0	0	0	Zone - Big Eddy
361	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
363	0.05	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
363	0	0	0	Zone - Big Eddy
364	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
366	0	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
366	0	0	0	Zone - Big Eddy
367	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
369	0.13	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
369	0	0	0	Zone - Big Eddy
370	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
371	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
372	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
372	0	0	0	Zone - Big Eddy
374	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
375	0.02	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
375	0	0	0	Zone - Big Eddy
379	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
380	0.03	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
382	0.13	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
383	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
384	0.1	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
385	0.07	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
386	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
387	0.2	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
388	0.07	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
389	0.03	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
390	0.25	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
391	0.18	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
392	0.43	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
393	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
394	0.15	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
395	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
398	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
400	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
401	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
402	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
403	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
404	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
407	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
409	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
410	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
411	0	0	0	Zone - Big Eddy
412	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
413	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
414	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
416	0.3	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
417	0.13	0.09	0.17	Zone 0A - Cedar Street PRV
418	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
419	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
421	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
422	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
423	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
424	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
425	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
426	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
427	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
428	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
429	0	0.63	1.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
432	0	0.94	1.69	Zone 1 - Central Revelstoke and Lower Arrow Heights
433	0.05	0.91	1.63	Zone 1 - Central Revelstoke and Lower Arrow Heights
434	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
435	0.08	1	1.8	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
436	0.07	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
437	0.03	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
438	0.16	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
441	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
442	0.07	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
443	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
445	0.16	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
446	0.07	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
447	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
450	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
451	0.03	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
452	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
454	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
455	0.2	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
456	0.1	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
457	0.1	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
458	0.13	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
462	2.53	4.25	11.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
463	0.13	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
464	0.05	0.53	0.96	Zone 1 - Central Revelstoke and Lower Arrow Heights
467	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
470	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
472	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
473	0.05	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
474	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
478	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
479	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
482	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
484	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
486	0.4	0.65	1.65	Zone 1 - Central Revelstoke and Lower Arrow Heights
488	0.1	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
489	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
492	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
494	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
495	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
496	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
497	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
498	0.2	0.56	1.25	Zone 1 - Central Revelstoke and Lower Arrow Heights
500	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
501	0.08	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
502	0.28	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
503	0.18	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
504	0.08	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
505	0.2	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
510	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
511	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
513	0.93	1.64	4.15	Zone 1 - Central Revelstoke and Lower Arrow Heights
514	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
515	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
516	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
517	0.03	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
518	0.32	0.67	1.59	Zone 1 - Central Revelstoke and Lower Arrow Heights
519	0.13	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
520	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
521	0.15	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
524	0.13	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
525	0.25	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
526	0.2	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
529	0.18	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
530	0.08	0.38	0.67	Zone 2A - Mid Arrow Heights Zone
531	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
532	0.18	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
533	0.08	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
534	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
535	0.11	0.38	0.67	Zone 2A - Mid Arrow Heights Zone
536	0.13	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
537	0	0.09	0.17	Zone 2A - Mid Arrow Heights Zone
538	0.08	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
539	0.16	0.31	0.56	Zone 2A - Mid Arrow Heights Zone
544	0.33	0.69	1.07	Zone 0 - Greeley WTP Zone
545	0.24	0.75	1.18	Zone 0 - Greeley WTP Zone
546	0.17	0.63	0.96	Zone 0 - Greeley WTP Zone
547	0.32	0.69	1.07	Zone 0 - Greeley WTP Zone
548	0.08	0	0	Zone 0 - Greeley WTP Zone
549	0.07	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
555	0.08	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
556	0.11	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
557	0.03	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
558	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
559	0.21	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
560	0.11	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
562	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
563	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
564	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
565	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
567	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
568	0.13	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1170	0.31	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
1178	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
1181	0.03	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
1183	0.08	0.56	1.01	Zone 2A - Mid Arrow Heights Zone
1202	0.21	0.28	0.51	Zone 2A - Mid Arrow Heights Zone
1204	0	0	0	PZ-RMR1
1213	0	0	0	PZ-RMR2
1217	0.52	0.87	2.31	PZ-RMR2
1219	(N/A)	(N/A)	(N/A)	Zone 2 - Lower RMR Zone
1223	0	0.19	0.34	PZ-RMR1
1236	0.13	0.25	0.45	PZ-RMR1
1238	0.13	0.16	0.28	PZ-RMR1
1247	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
1285	0.24	0.23	0.28	Zone 0 - Greeley WTP Zone
1316	0.63	0.8	0.86	Zone 0 - Greeley WTP Zone
1325	0	0	0	Zone 2A - Mid Arrow Heights Zone
1362	0.16	0	0	Zone 2A - Mid Arrow Heights Zone
1374	0.2	0	0	Zone 2A - Mid Arrow Heights Zone
1375	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
1505	0.02	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1514	2.67	3.82	4.12	Zone 1 - Central Revelstoke and Lower Arrow Heights
1516	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
1528	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
1582	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
1587	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
1620	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1656	0.15	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
1677	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1682	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1697	0.2	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
1709	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1711	0.15	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
1722	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
1747	0.3	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1761	0.25	0	0	PZ-RMR2
1797	0	0	0	PZ-RMR2
1801	0.07	0	0	PZ-RMR2
1803	0.82	0.96	1.15	PZ-RMR3
1815	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
1822	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
1826	0.05	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
1833	0	0	0	Zone 2 - Lower RMR Zone
1878	0.1	0.03	0.06	PZ-RMR1
1991	0.03	0.35	0.62	PZ-RMR3
2020	(N/A)	(N/A)	(N/A)	RMR - BN
2020	0.68	1.14	1.37	PZ-RMR1
2020	1.86	3.1	3.71	PZ-RMR1
2025	2.72	4.54	5.44	PZ-RMR1
2035	1.93	3.22	3.86	PZ-RMR1
2035	3.52	5.88	7.04	PZ-RMR5
2054	0.17	0.56	1.25	Zone 2 - Lower RMR Zone
2057	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2206	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2209	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2212	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2215	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2218	0.77	1.29	1.54	PZ-RMR1
2349	0	0	0	PZ-RMR1
2350	0	0	0	PZ-RMR1
2351	0	0	0	PZ-RMR1
2352	0.37	0.71	0.74	PZ-RMR1
2353	0	0	0	PZ-RMR1
2355	0	0	0	PZ-RMR1
2356	0	0	0	PZ-RMR2
2357	0	0	0	PZ-RMR4
2358	0.74	1.23	1.47	PZ-RMR4
2359	0.38	0.64	0.77	PZ-RMR4
2360	0.51	0.86	1.03	PZ-RMR4
2361	0.74	1.23	1.47	PZ-RMR4

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
2362	0.78	1.3	1.56	PZ-RMR4
2363	1.28	2.14	2.56	PZ-RMR4
2364	0	0	0	PZ-RMR4
2365	0	0	0	PZ-RMR4
2366	0	0	0	PZ-RMR2
2367	0.71	1.19	1.43	PZ-RMR2
2368	0	0	0	PZ-RMR1
2369	0	0	0	PZ-RMR1
2370	0.47	0.78	0.93	PZ-RMR1
2444	0.91	1.52	1.82	PZ-RMR1
2447	2.8	4.68	5.6	PZ-RMR1
2456	4.17	6.97	8.35	PZ-RMR1
2462	1.96	3.28	3.93	PZ-RMR2
2465	2.48	4.14	4.96	PZ-RMR2
2521	0	0	0	PZ-RMR4
2535	1.84	3.07	3.68	PZ-RMR3
2538	0	0	0	PZ-RMR3
2543	0	0	0	PZ-RMR1
2556	0	0	0	PZ-RMR1
2559	0	0	0	PZ-RMR3
2642	0	0	0	PZ-RMR4
2654	0	0	0	Zone - Big Eddy
2699	0	0	0	Zone - Big Eddy
2700	0.2	0.55	0.9	Zone - Big Eddy
2703	0.12	0.33	0.54	Zone - Big Eddy
2705	0.28	0.76	1.25	Zone - Big Eddy
2706	0.08	0.22	0.36	Zone - Big Eddy
2707	0.07	0.18	0.3	Zone - Big Eddy
2708	0	0	0	Zone - Big Eddy
2709	0.05	0.15	0.24	Zone - Big Eddy
2710	0.07	0.18	0.3	Zone - Big Eddy
2712	0.07	0.18	0.3	Zone - Big Eddy
2713	0.05	0.15	0.24	Zone - Big Eddy
2714	0.01	0.04	0.06	Zone - Big Eddy
2717	0.16	0.44	0.72	Zone - Big Eddy
2718	0.01	0.04	0.06	Zone - Big Eddy
2719	0.16	0.44	0.72	Zone - Big Eddy
2720	0.17	0.47	0.78	Zone - Big Eddy
2722	0.27	0.73	1.2	Zone - Big Eddy

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
2724	0.08	0.22	0.36	Zone - Big Eddy
2725	0.03	0.07	0.12	Zone - Big Eddy
2726	0.03	0.07	0.12	Zone - Big Eddy
2728	0.2	0.55	0.9	Zone - Big Eddy
2736	0.03	0.07	0.12	Zone - Big Eddy
2738	0	0	0	Zone - Big Eddy
2740	0	0	0	Zone - Big Eddy
2744	0	0	0	Zone - Big Eddy
2746	0	0	0	Zone - Big Eddy
2747	0	0	0	Zone - Big Eddy
2748	0	0	0	Zone - Big Eddy
2749	0	0	0	Zone - Big Eddy
2755	0	0	0	Zone - Big Eddy
2763	0	0	0	Zone - Big Eddy
2768	0	0	0	Zone - Big Eddy
2770	0	0	0	Zone - Big Eddy
2772	0	0	0	Zone - Big Eddy
2775	0	0	0	Zone - Big Eddy
2784	0	0	0	Zone - Big Eddy
2785	0	0	0	Zone - Big Eddy
2786	0	0	0	Zone - Big Eddy
2787	0	0	0	Zone - Big Eddy
2789	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2937	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2940	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2943	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2946	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2949	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2952	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2955	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
2958	0	0	0	Zone 0 - Greeley WTP Zone
2961	0	0	0	Zone 2 - Lower RMR Zone
2964	0	0	0	Zone 2 - Lower RMR Zone
2967	0	0	0	Zone 2A - Mid Arrow Heights Zone
2970	0	0	0	Zone 2A - Mid Arrow Heights Zone
2973	0	0	0	Zone 2A - Mid Arrow Heights Zone
2976	3.74	6.25	16.65	Zone 2A - Mid Arrow Heights Zone
2979	0	0	0	Zone 2 - Lower RMR Zone
2982	0	0	0	Zone 2A - Mid Arrow Heights Zone

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
2985	0	0	0	Zone 2A - Mid Arrow Heights Zone
2988	(N/A)	(N/A)	(N/A)	Zone 3A - Mackenzie Landing Zone
2991	(N/A)	(N/A)	(N/A)	Zone 3A - Mackenzie Landing Zone
2994	(N/A)	(N/A)	(N/A)	Zone 3A - Mackenzie Landing Zone
2997	(N/A)	(N/A)	(N/A)	Zone 3A - Mackenzie Landing Zone
3000	(N/A)	(N/A)	(N/A)	Zone 3A - Mackenzie Landing Zone
3003	0	0	0	PZ-RMR1
3006	0	0	0	PZ-RMR1
3009	0	0	0	PZ-RMR1
3012	0	0	0	PZ-RMR3
3015	0	0	0	PZ-RMR3
3018	0	0	0	PZ-RMR3
3021	0	0	0	PZ-RMR3
3024	0	0	0	PZ-RMR3
3027	0	0	0	PZ-RMR3
3030	0.24	0.4	0.43	Zone 0 - Greeley WTP Zone
3033	0	0	0	Zone 0 - Greeley WTP Zone
3036	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3039	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3042	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3045	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3048	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3051	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3054	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3057	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3060	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3063	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3066	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3069	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3072	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3076	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3079	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3082	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
3085	0	0	0	Zone - Big Eddy
3091	0	0	0	Zone - Big Eddy
3094	0	0	0	Zone - Big Eddy
3097	0	0	0	Zone - Big Eddy
3100	0	0	0	Zone - Big Eddy
AH-1	0.18	0.24	0.65	Zone 0 - Greeley WTP Zone

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
AH-10	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-11	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-14	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
AH-5	0.25	0	0	<None>
AH-6	0.28	0	0	<None>
AH-7	0.13	0	0	<None>
AH-9	0.33	0	0	<None>
ARR-BER	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
BER-SPR	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
Booster Stn	0.15	0	0	<None>
CAM-McKI	0.02	0	0	Zone 2A - Mid Arrow Heights Zone
CASHATO	0.21	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
CHA-1	0	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
CHA-3	0.08	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
CLE-PER	0.05	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
COL-23N	0.11	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
COL-SAN	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-4	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-5	0.16	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-TAY	0.21	0.37	0.76	Zone 1 - Central Revelstoke and Lower Arrow Heights
DOW-TOW	0.02	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
FAI-PER	0	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
FRA-TCH	0.07	0.12	0.31	Zone 1 - Central Revelstoke and Lower Arrow Heights
G-2+170	0	0	0	<None>
G-2+250	0.05	0	0	<None>
G-2+545	0.03	0	0	<None>
GAR-1	0.1	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
Greeley	0.05	0	0	<None>
GRIZZLY	1.7	2.93	4.61	Zone 2A - Mid Arrow Heights Zone
Ham?	(N/A)	(N/A)	(N/A)	<None>
HAN-1	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
HAN-3	0.1	0.44	0.79	Zone 1 - Central Revelstoke and Lower Arrow Heights
HAY	0.08	0.22	0.39	Zone 2A - Mid Arrow Heights Zone
HILLTOP	0.27	0.4	0.43	Zone 0 - Greeley WTP Zone
HUM-4	0.1	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
ID	0.16	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
ILL-1	0.44	0.35	0.93	Zone 1 - Central Revelstoke and Lower Arrow Heights
ILL-AIR	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-172	0.08	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-179	0.2	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-181	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-182	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-196	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-197	0.15	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-199	0.02	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-200	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-202	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-204	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-208	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-209	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-210	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-212	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-215	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-216	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-217	0.25	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-218	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-221	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-224	0.02	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-225	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-227	0.2	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-230	0.03	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-232	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-233	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-235	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-243	0.1	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-246	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-253	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-254	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-255	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-258	0.1	0.72	1.29	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-273	0.2	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-274	0.15	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-276	0.29	0.49	1.3	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-282	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-283	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-285	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-288	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-292	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2040 Demands</b>				
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>	<b>Zone</b>
J-297	0.03	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-307	0.03	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-308	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-316	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-317	0.03	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-321	0.08	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-325	0.11	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-326	0.18	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-330	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-336	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-337	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-338	0.08	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-342	0.11	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-343	0.11	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-345	0.03	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-346	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-348	0.08	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-352	0.16	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-353	0.07	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-354	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-357	0.02	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-358	0.05	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-360	0.08	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-362	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-364	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-367	0.05	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-368	0.16	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-370	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-376	0.86	1.2	3.02	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-386	0.03	0	0	Zone 2A - Mid Arrow Heights Zone
J-389	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-399	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-400	0.13	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-404	0.48	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-405	0.53	0.03	0.06	Zone 2A - Mid Arrow Heights Zone
J-417	0.07	0	0	Zone 2A - Mid Arrow Heights Zone
J-418	0.18	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
J-419	0.23	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-420	0.13	0.25	0.45	Zone 2A - Mid Arrow Heights Zone

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-427	0.25	0.13	0.22	Zone 2 - Lower RMR Zone
J-429	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-430	0.13	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-438	0.11	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-445	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-446	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-447	0.05	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-449	0.38	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-454	0.28	0.06	0.11	Zone 2 - Lower RMR Zone
J-455	0	0.16	0.28	Zone 2 - Lower RMR Zone
J-456	0.15	0.19	0.34	Zone 2A - Mid Arrow Heights Zone
J-457	0.11	0.25	0.45	Zone 2A - Mid Arrow Heights Zone
J-460	0	0.22	0.39	Zone 2 - Lower RMR Zone
J-468	0.13	0	0	PZ-RMR1
J-470	0.05	0.06	0.11	PZ-RMR1
J-478	0.13	0	0	Zone 0 - Greeley WTP Zone
J-481	0.11	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-482	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-485	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-486	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-487	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-492	0.25	0.28	0.74	Zone 0 - Greeley WTP Zone
J-494	0.05	0	0	Zone 0 - Greeley WTP Zone
J-499	0.07	0	0	<None>
J-500	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-501	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-502	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-503	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-505	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-510	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-511	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-513	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-515	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-516	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-517	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-519	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-520	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-522	17.89	28.97	35.16	Zone 2A - Mid Arrow Heights Zone
J-523	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-524	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-525	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-526	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-527	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-528	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-529	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-530	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-533	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-534	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-535	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-536	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-543	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-545	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-546	(N/A)	(N/A)	(N/A)	Zone 2A - Mid Arrow Heights Zone
J-547	0.18	0	0	Zone 2A - Mid Arrow Heights Zone
J-548	0.18	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-549	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-551	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-552	0.1	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-556	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-557	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-558	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-559	0.34	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-561	0.07	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-562	0.02	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-563	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-564	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-565	0.31	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-566	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-567	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-568	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-569	0	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-570	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-571	0.16	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-572	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-573	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-574	0.1	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-575	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-576	0.07	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2040 Demands</b>				
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>	<b>Zone</b>
J-577	0.2	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-578	0.13	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-579	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-58	0	0	0	PZ-RMR1
J-581	0.1	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-583	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-584	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-585	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-586	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-587	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-588	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-589	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-590	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-591	0.15	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-592	0.03	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-593	0	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-594	0.1	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-595	0.25	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-599	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-600	0.02	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-601	0.13	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-602	0.07	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-603	0.07	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-604	0.15	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-605	0.11	0.56	1.01	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-606	0.05	0	0	Zone 0 - Greeley WTP Zone
J-607	0.1	0.13	0.22	Zone 0 - Greeley WTP Zone
J-608	0.11	0.09	0.17	Zone 0 - Greeley WTP Zone
J-609	0.13	0.16	0.28	Zone 0 - Greeley WTP Zone
J-610	0.08	0	0	Zone 0 - Greeley WTP Zone
J-611	0.1	0	0	Zone 0 - Greeley WTP Zone
J-613	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-614	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-615	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-617	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-618	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-619	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-620	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-622	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-624	0.08	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-625	0.15	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-626	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-627	0.02	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-629	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-630	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-631	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-632	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-635	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-636	0.16	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-637	0.08	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-639	0.34	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-640	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-641	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-642	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-643	0.18	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-644	0.15	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-645	1.62	2.44	3	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-647	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-648	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-649	0.1	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-650	0.1	0.5	0.9	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-652	1.12	1.88	4.99	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-653	0.08	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-654	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-657	0.49	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-659	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-660	0.1	0	0	Zone 2A - Mid Arrow Heights Zone
J-661	0.18	0	0	Zone 2A - Mid Arrow Heights Zone
J-662	0.1	0	0	Zone 2A - Mid Arrow Heights Zone
J-664	0.15	0.35	0.62	Zone 2 - Lower RMR Zone
J-665	0	0.06	0.11	Zone 2A - Mid Arrow Heights Zone
J-666	0.28	0.09	0.17	Zone 2 - Lower RMR Zone
J-668	0.13	0	0	PZ-RMR2
J-671	0	0	0	PZ-RMR2
J-672	0	0	0	<None>
J-673	0.13	0.13	0.22	PZ-RMR3
J-674	0.03	0.22	0.39	PZ-RMR3
J-676	0.2	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-677	0.3	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-680	0.18	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-682	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-683	0.05	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-684	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-685	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-686	0.02	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-687	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-688	0	0.03	0.06	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-689	0	0	0	<None>
J-690	0.57	0	0	<None>
J-692	0.25	0	0	<None>
J-694	0.03	0	0	<None>
J-697	0.03	0	0	<None>
J-698	0	0	0	<None>
J-699	0.05	0	0	<None>
J-700	0.05	0	0	<None>
J-701	0.07	0	0	<None>
J-702	0.08	0	0	<None>
J-703	0.13	0	0	<None>
J-704	0	0	0	<None>
J-705	0.21	0	0	<None>
J-706	0	0	0	Zone 2 - Lower RMR Zone
J-707	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-709	0.1	0	0	<None>
J-710	0.1	0	0	<None>
J-711	0.1	0	0	<None>
J-712	0.08	0	0	<None>
J-713	0.15	0	0	<None>
J-714	0.26	0	0	<None>
J-715	0	0	0	<None>
J-718	0.26	0	0	PZ-RMR3
J-719	0.26	0	0	PZ-RMR3
J-720	0	0	0	<None>
J-721	0.05	0	0	<None>
J-722	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-723	0.21	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-727	0.05	0.16	0.28	Zone 2 - Lower RMR Zone
J-731	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-732	0.05	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-733	0.07	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-734	0	0	0	<None>
J-735	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-736	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-737	0	0	0	Zone 2 - Lower RMR Zone
J-738	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-741	0	0	0	<None>
J-742	0	0	0	<None>
J-743	0	0	0	<None>
J-744	0	0	0	<None>
J-745	0	0	0	<None>
J-746	0	0	0	<None>
J-747	0	0	0	<None>
J-748	0	0	0	<None>
J-749	0	0	0	<None>
J-750	0	0	0	<None>
J-751	0	0	0	Zone 0 - Greeley WTP Zone
J-752	0	0	0	Zone 0 - Greeley WTP Zone
J-753	0	0	0	<None>
J-754	0	0	0	<None>
J-757	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-758	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-759	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-76	0	0	0	PZ-RMR1
J-760	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-762	0	0	0	Zone 0A - Cedar Street PRV
J-763	0	0	0	Zone 2A - Mid Arrow Heights Zone
J-764	0	0	0	Zone 2B - Mackenzie Village
J-765	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-766	0	0	0	<None>
J-767	0	0	0	<None>
J-77	0	0	0	PZ-RMR1
J-78	0	0	0	PZ-RMR1
J-79	0	0	0	PZ-RMR1
J-793	0	0	0	PZ-RMR1
J-80	0	0	0	PZ-RMR1
J-803	0	0	0	PZ-RMR1
J-804	0	0	0	PZ-RMR1

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
J-810	0	0	0	PZ-RMR2
J-811	0	0	0	PZ-RMR4
J-812	0	0	0	PZ-RMR1
J-82	0	0	0	PZ-RMR1
J-822	0	0	0	PZ-RMR1
J-825	(N/A)	(N/A)	(N/A)	RMR - BN
J-83	0	0	0	PZ-RMR1
J-84	0	0	0	PZ-RMR5
J-86	0	0	0	PZ-RMR5
J-87	0	0	0	PZ-RMR5
J-878	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
J-88	0	0	0	PZ-RMR5
J-884	0	0	0	Zone 0 - Greeley WTP Zone
J-886	0	0	0	<None>
J-887	0	0	0	<None>
J-888	0	0	0	<None>
J-889	0	0	0	<None>
J-89	0	0	0	PZ-RMR5
J-890	0	0	0	<None>
J-891	0	0	0	<None>
J-892	0	0	0	<None>
J-893	(N/A)	(N/A)	(N/A)	<None>
J-894	(N/A)	(N/A)	(N/A)	<None>
J-90	0	0	0	PZ-RMR5
J-91	0	0	0	PZ-RMR5
J-92	0	0	0	PZ-RMR5
J-93	0	0	0	PZ-RMR5
J-95	0	0	0	PZ-RMR5
JON-1	0.16	0	0	Zone 0 - Greeley WTP Zone
JON-4	0.35	0.47	0.68	Zone 0 - Greeley WTP Zone
LAF-PER	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LAF-PET	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LAF-VIC	0.15	0.06	0.11	Zone 1 - Central Revelstoke and Lower Arrow Heights
LEA-CAR	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
LEA-COT	0.08	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-1	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-2	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-3	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-4	0.06	0.35	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
MAC-5	0	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-6	0	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-7	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-TRACK	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAC-VIC	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAD-PER	0	0.41	0.73	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAD-PET	0	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
MAPLE	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
McA-9	0.15	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
McK-HIO	0.33	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
McKI-BIR	0.13	0.09	0.17	Zone 2A - Mid Arrow Heights Zone
McKI-GAL	0.21	0.06	0.11	Zone 2A - Mid Arrow Heights Zone
McKI-HAY	0	0.13	0.22	Zone 2A - Mid Arrow Heights Zone
McKI-MEL	0.07	0.16	0.28	Zone 2A - Mid Arrow Heights Zone
MEL-HAY	0.07	0.25	0.45	Zone 2A - Mid Arrow Heights Zone
MONTANA	3.97	6.82	18.01	Zone 0 - Greeley WTP Zone
MOS-4	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
NEW-AIR	0.16	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
NEW-ELM	0.03	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
NIC-ELM	0.11	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
NIC-J+J	0.21	0	0	Zone 2A - Mid Arrow Heights Zone
OAK2	2.05	3.42	4.07	Zone 0 - Greeley WTP Zone
OAK3	2.15	3.54	4.25	Zone 0 - Greeley WTP Zone
ORT-1	0	0.6	1.07	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-2	0	0.72	1.29	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-3	0.11	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-4	0	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-5	0	0.66	1.18	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-6	0	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-7	0.11	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
ORT-8	0.16	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
PEA-1	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
PEA-2	0.05	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
PER-COL	0.08	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
POW	0.15	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
POW-STP	0.11	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
PRAT-AIR	0.33	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
ROB-VIC	0.13	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights

2040 Demands				
Label	ADD (L/s)	MDD (L/s)	PHD (L/s)	Zone
ROK-2	0.18	0.47	0.84	Zone 1 - Central Revelstoke and Lower Arrow Heights
SHE-AIR	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
SHEIL	0	0.19	0.34	PZ-RMR5
SIM-4	0.02	0.25	0.45	Zone 1 - Central Revelstoke and Lower Arrow Heights
TCH-10+435	0.11	0	0	<None>
TCH-2+770	0.16	0	0	<None>
TCH-7+970	0.39	0.54	0.58	Zone 0 - Greeley WTP Zone
TCH-8+240	0.11	0	0	Zone 0 - Greeley WTP Zone
TCH-9+185	0.18	0	0	Zone 0 - Greeley WTP Zone
TCH-9+642	0.03	0	0	Zone 0 - Greeley WTP Zone
TEM-4	0.21	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
TEM-8	0.25	0.22	0.39	Zone 1 - Central Revelstoke and Lower Arrow Heights
TOW-4	0.15	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
TRACK-CP	0	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-10	0.15	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-3	0	0.31	0.56	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-4	0	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-5	0.1	0.78	1.41	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-6	0.08	0.38	0.67	Zone 1 - Central Revelstoke and Lower Arrow Heights
VER-8	0	0.28	0.51	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-10	0.11	0.82	1.46	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-2	0	0.16	0.28	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-3	0	0.19	0.34	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-4	0.23	0	0	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIC-VER	0.02	0.75	1.35	Zone 1 - Central Revelstoke and Lower Arrow Heights
VIE-23N	0	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
WAL-1	0.1	0.35	0.62	Zone 1 - Central Revelstoke and Lower Arrow Heights
WAL-3	0.1	0.09	0.17	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-1	1.57	2.53	6.71	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-2	0.13	0.13	0.22	Zone 1 - Central Revelstoke and Lower Arrow Heights
WRI-VIC	2.11	3.33	3.99	Zone 1 - Central Revelstoke and Lower Arrow Heights

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
<b>Big Eddy</b>			
36.000	0.054	0.145	0.239
40.000	0.054	0.145	0.239
42.000	0.202	0.545	0.896
44.000	0.188	0.509	0.837
48.000	0.121	0.327	0.538
50.000	0.283	0.763	1.255
52.000	0.081	0.218	0.359
54.000	0.067	0.182	0.299
58.000	0.054	0.145	0.239
60.000	0.040	0.109	0.179
62.000	0.067	0.182	0.299
66.000	0.067	0.182	0.299
68.000	0.054	0.145	0.239
73.000	0.027	0.073	0.120
75.000	0.040	0.109	0.179
79.000	0.013	0.036	0.060
81.000	0.161	0.436	0.717
83.000	0.013	0.036	0.060
87.000	0.161	0.436	0.717
89.000	0.108	0.291	0.478
91.000	0.175	0.472	0.777
94.000	0.054	0.145	0.239
99.000	0.269	0.727	1.195
112.000	0.081	0.218	0.359
114.000	0.027	0.073	0.120
116.000	0.040	0.109	0.179
118.000	0.027	0.073	0.120
129.000	0.161	0.436	0.717
137.000	0.296	0.799	1.315
144.000	0.336	0.908	1.494
146.000	0.310	0.836	1.374
153.000	0.377	1.017	1.673
155.000	0.229	0.618	1.016

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
157.000	0.202	0.545	0.896
159.000	0.202	0.545	0.896
161.000	0.458	1.235	2.032
168.000	0.027	0.073	0.120
<b>Central Revelstoke</b>			
CASHATO	0.210	0.090	0.170
McARTY	0.160	0.410	0.730
McA-CAS	0.160	0.220	0.390
CAS-McA	0.070	0.310	0.560
OSC-MHP	0.050	0.000	0.000
NIC-J+J	0.210	0.000	0.000
MAC-TRACK	0.110	0.000	0.000
HAY	0.080	0.220	0.390
CPR-STN	0.160	0.000	0.000
TRACK-CP	0.000	0.000	0.000
CEDAR	0.100	0.220	0.390
MAP-MUL	0.000	0.630	1.120
MAPLE	0.000	0.380	0.670
COP-JOR	0.000	0.380	0.670
LAF-CPD	0.000	0.630	1.120
FAI-PET	0.000	0.380	0.670
MADD	0.000	0.250	0.450
MAD-PET	0.000	0.220	0.390
LAF-PET	0.000	0.280	0.510
ALL-PER	0.000	0.030	0.060
LAF-PER	0.000	0.280	0.510
MAD-PER	0.000	0.410	0.730
FAI-PER	0.000	0.440	0.790
COL-BNC	0.000	0.310	0.560
BNC-COL	0.000	0.220	0.390
COL-PER	0.150	0.220	0.390
CLE-PER	0.050	0.060	0.110
COL-SAN	0.000	0.350	0.620
PER-COL	0.080	0.220	0.390

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
DAL-PER	0.000	0.130	0.220
HIR-23N	0.150	0.160	0.280
MAL-23N	0.000	0.310	0.560
COL-23N	0.110	0.060	0.110
VIE-23N	0.000	0.090	0.170
CLE-23N	0.070	0.090	0.170
CLE-BAS	0.000	0.000	0.000
LAF-VIC	0.150	0.060	0.110
FRA-VIC	0.000	0.060	0.110
OLD-BEND	0.000	0.060	0.110
WILS-FRO	0.100	0.190	0.340
WILS-DOU	0.030	0.310	0.560
HAN-1	0.000	0.470	0.840
HAN-2	0.110	0.530	0.960
HAN-3	0.100	0.440	0.790
HAN-DOU	0.000	0.310	0.560
KIN-DOU	0.050	0.380	0.670
WAL-3	0.100	0.090	0.170
WAL-1	0.100	0.350	0.620
WAL-VIC	0.000	0.000	0.000
CHA-VIC	0.300	0.160	0.280
CHA-1	0.000	0.440	0.790
CHA-3	0.080	0.470	0.840
PEA-2	0.050	0.380	0.670
PEA-1	0.080	0.220	0.390
GAR-1	0.100	0.380	0.670
GAR-VIC	0.110	0.060	0.110
CAMP-5	0.020	0.470	0.840
CAMP-3	0.000	0.160	0.280
SHEIL	0.000	0.190	0.340
SHE-AIR	0.000	0.000	0.000
PRC	0.150	0.440	0.790
NICHOL	0.070	0.350	0.620
NEW-ELM	0.030	0.350	0.620

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
NIC-ELM	0.110	0.350	0.620
PRAT-AIR	0.330	0.000	0.000
NEW-AIR	0.160	0.160	0.280
NIC-AIR	0.150	0.060	0.110
BER-SPR	0.200	0.000	0.000
NIC-BER	0.100	0.160	0.280
FOR-SPR	0.000	0.130	0.220
NIC-SPR	0.070	0.190	0.340
NIC-PARK	0.110	0.160	0.280
ARR-BER	0.100	0.190	0.340
PARK-1	0.130	0.310	0.560
AH-14	0.000	0.090	0.170
AH-13	0.200	0.130	0.220
MEL-HAY	0.070	0.250	0.450
McKI-GAL	0.210	0.060	0.110
McKI-BIR	0.130	0.090	0.170
McKI-HAY	0.000	0.130	0.220
McKI-MEL	0.070	0.160	0.280
McK-HIO	0.330	0.130	0.220
AH-12	0.110	0.280	0.510
AH-11	0.080	0.220	0.390
AH-10	0.200	0.000	0.000
ILL-AIR	0.000	0.060	0.110
AH-9	0.330	0.000	0.000
AH-7	0.130	0.000	0.000
POW	0.150	0.000	0.000
POW-STP	0.110	0.090	0.170
LEA-OSC	0.100	0.190	0.340
LEA-COT	0.080	0.250	0.450
LEA-CAR	0.000	0.280	0.510
SIM-4	0.020	0.250	0.450
MOS-4	0.000	0.190	0.340
HUM-OSC	0.110	0.160	0.280
HUM-4	0.100	0.280	0.510

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
EDW-4	0.070	0.090	0.170
EDW-OSC	0.100	0.130	0.220
DOW-TOW	0.020	0.000	0.000
DOW-4	0.150	0.000	0.000
TEM-4	0.210	0.000	0.000
TOW-4	0.150	0.310	0.560
DOW-5	0.160	0.380	0.670
TEM-5	0.180	0.380	0.670
TEM-6	0.210	0.380	0.670
EDW-8	0.050	0.250	0.450
DOW-8	0.100	0.560	1.010
TEM-8	0.250	0.220	0.390
VIC-8	0.250	0.220	0.390
VIC-10	0.110	0.820	1.460
VIC-VER	0.020	0.750	1.350
VER-7	0.050	0.350	0.620
VER-6	0.080	0.380	0.670
VER-5	0.100	0.780	1.410
VIC-4	0.230	0.000	0.000
VER-4	0.000	0.820	1.460
VIC-3	0.000	0.190	0.340
VER-3	0.000	0.310	0.560
VIC-2	0.000	0.160	0.280
ROB-2	0.100	0.310	0.560
ROB-VIC	0.130	0.190	0.340
VER-10	0.150	0.380	0.670
McA-9	0.150	0.310	0.560
ORT-8	0.160	0.000	0.000
ORT-7	0.110	0.000	0.000
ORT-6	0.000	0.380	0.670
ORT-5	0.000	0.660	1.180
ORT-4	0.000	0.350	0.620
ORT-3	0.110	0.190	0.340
ORT-2	0.000	0.720	1.290

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
ORT-1	0.000	0.600	1.070
MAC-7	0.000	0.310	0.560
MAC-6	0.000	0.130	0.220
MAC-5	0.000	0.470	0.840
MAC-3	0.000	0.130	0.220
MAC-2	0.000	0.090	0.170
MAC-1	0.000	0.160	0.280
MAC-VIC	0.000	0.190	0.340
TCH-10+435	0.110	0.000	0.000
TCH-9+642	0.030	0.000	0.000
TCH-9+185	0.180	0.000	0.000
TCH-8+240	0.110	0.000	0.000
TCH-2+770	0.160	0.000	0.000
G-2+545	0.030	0.000	0.000
G-2+250	0.050	0.000	0.000
Greeley	0.050	0.000	0.000
G-2+170	0.000	0.000	0.000
JON-1	0.160	0.000	0.000
CAM-McKI	0.020	0.000	0.000
CAM-EGR	0.000	0.000	0.000
ROK-2	0.180	0.470	0.840
ROK-3	0.200	0.350	0.620
AH-5	0.250	0.000	0.000
AH-6	0.280	0.000	0.000
J-172	0.080	0.030	0.060
MAC-MUL	0.160	0.000	0.000
McAR-6	0.020	1.100	1.970
McAR-7	0.030	0.470	0.840
J-179	0.200	0.060	0.110
J-181	0.200	0.000	0.000
J-195	0.070	0.060	0.110
J-196	0.050	0.000	0.000
J-197	0.150	0.090	0.170
J-198	0.260	0.090	0.170

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-199	0.020	0.130	0.220
J-200	0.030	0.160	0.280
J-201	0.080	0.250	0.450
J-202	0.180	0.000	0.000
J-203	0.000	0.410	0.730
J-204	0.000	0.000	0.000
J-205	0.000	0.280	0.510
J-206	0.000	0.190	0.340
J-207	0.000	0.190	0.340
J-208	0.000	0.190	0.340
J-209	0.000	0.160	0.280
J-210	0.000	0.280	0.510
J-211	0.000	0.500	0.900
J-212	0.080	0.000	0.000
J-213	0.030	0.500	0.900
J-214	0.030	0.500	0.900
J-215	0.230	0.000	0.000
J-216	0.070	0.090	0.170
J-217	0.250	0.000	0.000
J-218	0.000	0.410	0.730
J-219	0.200	0.000	0.000
J-220	0.000	0.600	1.070
J-221	0.110	0.000	0.000
J-222	0.100	0.310	0.560
J-223	0.000	0.130	0.220
J-224	0.020	0.350	0.620
J-225	0.130	0.130	0.220
J-226	0.130	0.280	0.510
J-227	0.200	0.000	0.000
J-228	0.180	0.190	0.340
J-229	0.080	0.090	0.170
J-230	0.030	0.000	0.000
J-232	0.000	0.250	0.450
J-233	0.000	0.190	0.340

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-234	0.000	0.250	0.450
J-235	0.000	0.060	0.110
J-236	0.000	0.060	0.110
J-237	0.000	0.060	0.110
J-239	0.080	0.000	0.000
J-241	0.000	0.160	0.280
J-242	0.050	0.090	0.170
J-243	0.100	0.250	0.450
J-244	0.000	0.600	1.070
J-245	0.000	0.530	0.960
J-246	0.180	0.130	0.220
J-247	0.000	0.310	0.560
J-248	0.130	0.350	0.620
J-249	0.000	0.410	0.730
J-250	0.000	0.310	0.560
WRI-2	0.130	0.130	0.220
J-251	0.000	0.280	0.510
J-252	0.000	0.190	0.340
J-253	0.030	0.160	0.280
J-254	0.000	0.130	0.220
J-255	0.000	0.220	0.390
J-256	0.020	0.060	0.110
J-257	0.000	0.060	0.110
J-258	0.100	0.720	1.290
J-259	0.030	0.660	1.180
J-260	0.130	0.500	0.900
J-261	0.000	0.280	0.510
J-262	0.100	0.310	0.560
J-263	0.070	0.280	0.510
J-264	0.050	0.380	0.670
J-265	0.200	0.380	0.670
J-266	0.070	0.560	1.010
J-267	0.030	0.440	0.790
J-268	0.250	0.280	0.510

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-269	0.180	0.350	0.620
J-270	0.430	0.060	0.110
J-271	0.000	0.190	0.340
J-272	0.150	0.130	0.220
J-273	0.200	0.220	0.390
J-274	0.150	0.090	0.170
J-275	0.100	0.000	0.000
J-277	0.230	0.000	0.000
J-278	0.080	0.190	0.340
J-279	0.110	0.090	0.170
J-280	0.050	0.190	0.340
J-281	0.100	0.000	0.000
J-282	0.000	0.000	0.000
J-283	0.110	0.090	0.170
J-284	0.000	0.250	0.450
J-285	0.000	0.060	0.110
J-286	0.000	0.380	0.670
J-287	0.000	0.250	0.450
J-288	0.000	0.310	0.560
J-289	0.000	0.380	0.670
J-290	0.000	0.220	0.390
J-291	0.000	0.190	0.340
J-292	0.180	0.000	0.000
J-293	0.130	0.190	0.340
J-294	0.300	0.560	1.010
J-295	0.130	0.090	0.170
J-296	0.180	0.000	0.000
J-297	0.030	0.160	0.280
J-298	0.000	0.280	0.510
J-299	0.000	0.160	0.280
J-300	0.030	0.160	0.280
J-301	0.000	0.220	0.390
J-302	0.000	0.280	0.510
J-303	0.000	0.350	0.620

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-304	0.000	0.220	0.390
J-305	0.000	0.250	0.450
J-306	0.000	0.280	0.510
J-307	0.030	0.250	0.450
J-308	0.000	0.470	0.840
J-309	0.000	0.630	1.120
J-310	0.000	0.940	1.690
J-311	0.050	0.910	1.630
J-312	0.000	0.380	0.670
J-313	0.080	1.000	1.800
J-314	0.070	0.130	0.220
J-315	0.030	0.130	0.220
J-316	0.000	0.220	0.390
J-317	0.030	0.350	0.620
J-318	0.160	0.530	0.960
J-319	0.180	0.470	0.840
J-320	0.070	0.440	0.790
J-321	0.080	0.310	0.560
J-322	0.080	0.220	0.390
J-323	0.160	0.250	0.450
J-324	0.070	0.250	0.450
J-325	0.110	0.160	0.280
J-326	0.180	0.000	0.000
J-327	0.000	0.000	0.000
J-328	0.080	0.000	0.000
J-329	0.030	0.000	0.000
J-330	0.000	0.000	0.000
J-331	0.020	0.280	0.510
J-332	0.080	0.000	0.000
J-333	0.200	0.160	0.280
J-334	0.100	0.250	0.450
J-335	0.100	0.410	0.730
J-336	0.070	0.090	0.170
J-337	0.070	0.000	0.000

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-338	0.080	0.160	0.280
J-339	0.130	0.350	0.620
J-341	0.130	0.160	0.280
J-342	0.110	0.410	0.730
J-343	0.110	0.280	0.510
J-344	0.050	0.530	0.960
J-345	0.030	0.090	0.170
J-346	0.110	0.190	0.340
J-347	0.100	0.000	0.000
J-348	0.080	0.160	0.280
J-349	0.050	0.220	0.390
J-350	0.000	0.310	0.560
J-351	0.050	0.160	0.280
J-352	0.160	0.220	0.390
J-353	0.070	0.090	0.170
J-354	0.000	0.060	0.110
J-355	0.000	0.030	0.060
J-356	0.000	0.190	0.340
J-357	0.020	0.160	0.280
J-358	0.050	0.220	0.390
J-359	0.000	0.190	0.340
J-360	0.080	0.000	0.000
J-361	0.070	0.000	0.000
J-362	0.100	0.000	0.000
J-363	0.100	0.090	0.170
J-364	0.160	0.000	0.000
J-366	0.100	0.030	0.060
J-367	0.050	0.000	0.000
J-368	0.160	0.060	0.110
J-369	0.110	0.160	0.280
J-370	0.180	0.130	0.220
J-371	0.070	0.000	0.000
J-372	0.130	0.000	0.000
J-373	0.080	0.190	0.340

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-374	0.110	0.190	0.340
J-375	0.160	0.220	0.390
J-378	0.070	0.220	0.390
J-379	0.080	0.350	0.620
J-380	0.280	0.310	0.560
J-381	0.180	0.160	0.280
J-382	0.080	0.190	0.340
J-386	0.030	0.000	0.000
J-387	0.200	0.090	0.170
J-388	0.050	0.220	0.390
J-389	0.000	0.220	0.390
J-390	0.000	0.280	0.510
J-392	0.000	0.220	0.390
J-393	0.050	0.220	0.390
J-394	0.100	0.190	0.340
J-395	0.030	0.090	0.170
J-397	0.130	0.310	0.560
J-398	0.050	0.000	0.000
J-399	0.200	0.130	0.220
J-400	0.130	0.220	0.390
J-401	0.150	0.190	0.340
J-402	0.130	0.250	0.450
J-403	0.250	0.250	0.450
J-404	0.480	0.190	0.340
J-405	0.530	0.030	0.060
J-406	0.200	0.190	0.340
J-407	0.180	0.220	0.390
J-408	0.080	0.380	0.670
J-409	0.150	0.160	0.280
J-410	0.180	0.310	0.560
J-411	0.080	0.310	0.560
J-412	0.150	0.160	0.280
J-413	0.110	0.380	0.670
J-414	0.130	0.130	0.220

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-415	0.000	0.090	0.170
J-416	0.080	0.220	0.390
J-417	0.070	0.000	0.000
J-418	0.180	0.130	0.220
J-419	0.230	0.190	0.340
J-420	0.130	0.250	0.450
J-421	0.160	0.310	0.560
J-426	0.080	0.000	0.000
J-427	0.250	0.130	0.220
J-182	0.070	0.000	0.000
J-429	0.000	0.130	0.220
J-430	0.130	0.160	0.280
J-431	0.070	0.280	0.510
J-433	0.080	0.030	0.060
J-434	0.110	0.220	0.390
J-435	0.030	0.030	0.060
J-436	0.150	0.000	0.000
J-437	0.210	0.160	0.280
J-438	0.110	0.350	0.620
J-439	0.110	0.130	0.220
J-161	0.100	0.000	0.000
J-441	0.000	0.250	0.450
J-442	0.180	0.470	0.840
VER-8	0.000	0.280	0.510
J-443	0.000	0.280	0.510
J-444	0.070	0.090	0.170
J-445	0.110	0.000	0.000
J-446	0.000	0.000	0.000
J-447	0.050	0.090	0.170
J-448	0.130	0.280	0.510
J-449	0.380	0.130	0.220
J-450	0.310	0.350	0.620
J-451	0.000	0.310	0.560
J-452	0.030	0.130	0.220

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-454	0.280	0.060	0.110
J-455	0.000	0.160	0.280
J-456	0.150	0.190	0.340
J-457	0.110	0.250	0.450
J-458	0.080	0.560	1.010
J-459	0.210	0.280	0.510
J-460	0.000	0.220	0.390
J-462	0.000	0.000	0.000
J-464	0.000	0.000	0.000
J-467	0.100	0.000	0.000
J-468	0.130	0.000	0.000
J-470	0.050	0.060	0.110
J-471	0.000	0.190	0.340
J-472	0.130	0.250	0.450
Booster Stn	0.150	0.000	0.000
J-476	0.130	0.160	0.280
J-478	0.130	0.000	0.000
J-481	0.110	0.030	0.060
J-482	0.000	0.060	0.110
J-484	0.000	0.060	0.110
J-485	0.000	0.060	0.110
J-486	0.130	0.000	0.000
J-487	0.000	0.160	0.280
J-494	0.050	0.000	0.000
J-499	0.070	0.000	0.000
J-500	0.000	0.000	0.000
J-501	0.000	0.060	0.110
J-502	0.150	0.000	0.000
J-503	0.030	0.220	0.390
J-505	0.000	0.000	0.000
J-506	0.000	0.000	0.000
J-508	0.160	0.000	0.000
J-509	0.200	0.000	0.000
J-543	0.000	0.000	0.000

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-547	0.180	0.000	0.000
J-548	0.180	0.060	0.110
J-549	0.000	0.160	0.280
J-550	0.000	0.030	0.060
J-551	0.000	0.190	0.340
J-552	0.100	0.000	0.000
J-554	0.020	0.090	0.170
J-556	0.000	0.030	0.060
J-557	0.020	0.280	0.510
J-558	0.050	0.250	0.450
J-559	0.340	0.190	0.340
J-560	0.050	0.380	0.670
J-561	0.070	0.190	0.340
J-562	0.020	0.280	0.510
J-563	0.000	0.380	0.670
J-564	0.000	0.280	0.510
J-565	0.310	0.000	0.000
J-566	0.160	0.000	0.000
J-567	0.000	0.130	0.220
J-568	0.000	0.060	0.110
J-569	0.000	0.060	0.110
J-570	0.070	0.000	0.000
J-571	0.160	0.280	0.510
J-572	0.130	0.130	0.220
J-573	0.150	0.380	0.670
J-574	0.100	0.060	0.110
J-575	0.130	0.190	0.340
J-576	0.070	0.350	0.620
J-577	0.200	0.130	0.220
J-578	0.130	0.820	1.460
J-579	0.000	0.250	0.450
J-580	0.150	0.380	0.670
J-581	0.100	0.190	0.340
J-582	0.050	0.220	0.390

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-583	0.100	0.090	0.170
J-584	0.000	0.160	0.280
J-585	0.030	0.220	0.390
J-586	0.080	0.090	0.170
J-587	0.000	0.310	0.560
J-588	0.000	0.250	0.450
J-589	0.000	0.190	0.340
J-590	0.000	0.280	0.510
J-591	0.150	0.350	0.620
J-592	0.030	0.220	0.390
J-593	0.000	0.250	0.450
J-594	0.100	0.060	0.110
J-595	0.250	0.000	0.000
J-596	0.070	0.220	0.390
J-599	0.000	0.130	0.220
J-600	0.020	0.030	0.060
J-601	0.130	0.000	0.000
J-602	0.070	0.220	0.390
J-603	0.070	0.000	0.000
J-604	0.150	0.160	0.280
J-605	0.110	0.560	1.010
J-606	0.050	0.000	0.000
J-607	0.100	0.130	0.220
J-608	0.110	0.090	0.170
J-609	0.130	0.160	0.280
J-610	0.080	0.000	0.000
J-611	0.100	0.000	0.000
J-612	0.000	0.000	0.000
J-613	0.000	0.000	0.000
J-614	0.000	0.000	0.000
J-615	0.000	0.000	0.000
J-617	0.000	0.000	0.000
J-618	0.000	0.190	0.340
J-619	0.050	0.190	0.340

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-620	0.000	0.190	0.340
J-621	0.150	0.030	0.060
J-622	0.000	0.350	0.620
J-623	0.000	0.090	0.170
J-624	0.080	0.060	0.110
J-625	0.150	0.660	1.180
J-626	0.000	0.090	0.170
J-627	0.020	0.470	0.840
J-628	0.000	0.000	0.000
J-629	0.000	0.130	0.220
J-630	0.000	0.000	0.000
J-631	0.000	0.000	0.000
J-632	0.110	0.190	0.340
J-633	0.200	0.220	0.390
J-634	0.000	0.000	0.000
J-635	0.000	0.000	0.000
J-636	0.160	0.030	0.060
J-637	0.080	0.090	0.170
J-638	0.150	0.190	0.340
J-639	0.340	0.250	0.450
J-640	0.000	0.000	0.000
J-641	0.000	0.000	0.000
J-642	0.000	0.000	0.000
J-643	0.180	0.130	0.220
J-644	0.150	0.250	0.450
J-646	0.110	0.060	0.110
J-647	0.050	0.190	0.340
J-648	0.000	0.130	0.220
J-649	0.100	0.280	0.510
J-650	0.100	0.500	0.900
J-651	0.300	0.280	0.510
J-653	0.080	0.060	0.110
J-654	0.000	0.030	0.060
J-657	0.490	0.160	0.280

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-659	0.000	0.000	0.000
J-660	0.100	0.000	0.000
J-661	0.180	0.000	0.000
J-662	0.100	0.000	0.000
J-664	0.150	0.350	0.620
J-665	0.000	0.060	0.110
J-666	0.280	0.090	0.170
J-667	0.250	0.000	0.000
J-668	0.130	0.000	0.000
J-669	0.000	0.000	0.000
J-670	0.070	0.000	0.000
J-671	0.000	0.000	0.000
J-672	0.000	0.000	0.000
J-673	0.130	0.130	0.220
J-674	0.030	0.220	0.390
J-676	0.200	0.090	0.170
J-677	0.300	0.130	0.220
J-678	0.180	0.000	0.000
J-679	0.000	0.090	0.170
J-680	0.180	0.380	0.670
J-681	0.050	0.280	0.510
J-682	0.000	0.000	0.000
J-683	0.050	0.190	0.340
J-684	0.000	0.000	0.000
J-685	0.110	0.090	0.170
J-686	0.020	0.000	0.000
J-687	0.000	0.000	0.000
J-688	0.000	0.030	0.060
J-689	0.000	0.000	0.000
J-690	0.570	0.000	0.000
J-692	0.250	0.000	0.000
J-694	0.030	0.000	0.000
J-696	0.000	0.000	0.000
J-697	0.030	0.000	0.000

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
J-698	0.000	0.000	0.000
J-699	0.050	0.000	0.000
J-700	0.050	0.000	0.000
J-701	0.070	0.000	0.000
J-702	0.080	0.000	0.000
J-703	0.130	0.000	0.000
J-704	0.000	0.000	0.000
J-705	0.210	0.000	0.000
J-706	0.000	0.000	0.000
J-707	0.150	0.000	0.000
J-709	0.100	0.000	0.000
J-710	0.100	0.000	0.000
J-711	0.100	0.000	0.000
J-712	0.080	0.000	0.000
J-713	0.150	0.000	0.000
J-714	0.260	0.000	0.000
J-715	0.000	0.000	0.000
J-716	0.100	0.030	0.060
J-718	0.260	0.000	0.000
J-719	0.260	0.000	0.000
J-720	0.000	0.000	0.000
J-721	0.050	0.000	0.000
J-722	0.000	0.000	0.000
J-723	0.210	0.000	0.000
J-725	0.030	0.350	0.620
J-727	0.050	0.160	0.280
J-731	0.000	0.350	0.620
J-732	0.050	0.250	0.450
J-733	0.070	0.250	0.450
RMR			
2020.000	0.825	0.960	1.150
2035.000	0.772	1.290	1.545
2030.000	0.371	0.710	0.743
2020.000	0.737	1.230	1.473

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
2025.000	0.383	0.640	0.766
2020.000	0.515	0.860	1.030
2025.000	0.737	1.230	1.473
2035.000	0.778	1.300	1.557
2025.000	1.281	2.140	2.563
2020.000	0.713	1.190	1.425
2020.000	0.683	1.140	1.365
2035.000	3.521	5.880	7.042
2035.000	0.467	0.780	0.934
2035.000	0.910	1.520	1.820
2025.000	2.719	4.540	5.437
2020.000	2.802	4.680	5.605
2035.000	1.928	3.220	3.856
2020.000	4.174	6.970	8.347
2020.000	1.964	3.280	3.928
2025.000	2.479	4.140	4.958
2020.000	1.856	3.100	3.713
2035.000	1.838	3.070	3.677
<b>Hotels along Highway</b>			
	2.106	3.333	3.992
	2.665	3.817	4.122
	0.793	0.908	0.980
	1.994	2.912	3.145
	2.787	3.820	4.125
<b>Johnson Heights</b>			
	0.628	0.799	0.863
	0.239	0.399	0.431
	0.269	0.399	0.431
	0.176	0.243	0.648
	0.240	0.634	0.960
	0.350	0.474	0.680
	0.170	0.754	1.180
	0.480	0.534	0.790
	0.330	0.694	1.070

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
	0.240	0.754	1.180
	0.170	0.634	0.960
	0.320	0.694	1.070
	3.971	6.822	18.008
	0.239	0.231	0.278
	0.392	0.538	0.581
	1.691	2.656	2.869
	0.749	1.250	1.500
	1.123	1.875	2.250
	0.179	0.299	0.323
	2.051	3.424	4.073
	0.246	0.278	0.740
	1.129	1.701	4.533
	2.151	3.542	4.250
<b>Mackenzie Village</b>			
	0.402	0.371	0.400
	17.096	28.250	33.832
	17.886	28.968	35.158
<b>Stocked Living</b>			
	0.445	0.790	1.978
	1.256	2.144	2.637
	1.701	2.934	4.614
	1.123	1.875	4.995
<b>Upper Arrow Heights Zone</b>			
	3.743	6.250	16.650
	0.520	0.868	2.313
	0.624	1.042	1.248
<b>TCH Reservoir</b>			
	0.166	0.558	1.250
	0.784	1.172	2.995
	0.630	0.868	2.313
	0.724	1.232	1.590
	0.196	0.558	1.250
	1.616	2.445	2.998

<b>2040 Demands by Development</b>			
<b>Label</b>	<b>ADD (L/s)</b>	<b>MDD (L/s)</b>	<b>PHD (L/s)</b>
	0.388	0.347	0.925
	0.863	1.197	3.023
	0.320	0.671	1.593
	0.932	1.639	4.150
	1.926	3.222	3.979
<b>Urban Systems</b>			
	0.069	0.116	0.308
WRI-1	0.070	0.030	0.060
	0.761	1.269	3.381
	0.736	1.227	3.270
	1.568	2.526	6.710
DOW-TAY	0.150	0.280	0.510
	0.056	0.093	0.247
	0.206	0.373	0.757
MAC-4	0.000	0.250	0.450
	0.063	0.104	0.278
	0.063	0.354	0.728
ILL-1	0.230	0.000	0.000
	0.208	0.347	0.925
	0.438	0.347	0.925
	0.292	0.486	1.295
J-340	0.110	0.220	0.390
	2.417	4.028	10.730
	2.527	4.248	11.120
J-365	0.070	0.090	0.170
	0.333	0.556	1.480
	0.403	0.646	1.650
	150.467	277.909	452.518



# APPENDIX

## **B** RESERVOIR VOLUMES



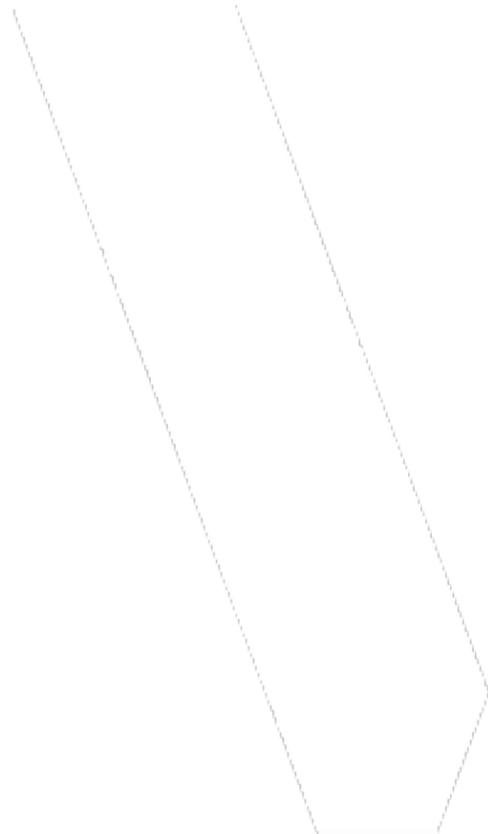
Reservoirs - 2020			A		25% of MDD		B	C	Required (A+B+C)	Available	Deficient/Surplus
	Fireflow (L/s)	Duration (hr)	Fire Storage (ML)	MDD (L/s)	(L/s)	L/d	ML/d		ML	ML	ML
TCH	225	3	2.43	117.79	29.4475	2544264	2.544264	0	5.35	4.5	-0.47
Arrow Heights	150	2	1.08	16.27	4.0675	351432	0.351432	0.357858	1.78929	2.3	0.51071

Reservoirs - 2040			A		25% of MDD		B	C	Required (A+B+C)	Available	Deficient/Surplus	Available Cascading Volume	Total Available Volume after Cascading	Deficient / Surplus
	Fireflow (L/s)	Duration (hr)	Fire Storage (ML)	MDD (L/s)	(L/s)	L/d	ML/d		ML	ML	ML	ML	ML	ML
Johnson Heights	150	2	1.08	23.06	5.765	498096	0.498096	0.394524	1.97262	2	0.02738	1.10738		0.02738
TCH	225	3	2.43	140.93	35.2325	3044088	3.044088	0	5.474088	4.5	-0.974088	1.455912	5.60738	0.133292
RMR	150	2	1.08	21.61	5.4025	466776	0.466776	0.386694	1.93347	2.3	0.36653	1.44653		0.36653
Arrow Heights	150	150	1.08	73.61	18.4025	1589976	1.589976	0.667494	3.33747	2.3	-1.03747	0.04253	3.74653	0.40906

= Surplus (Available - Required > 0)

= Deficient (Available - Required < 0)

Available Cascading Volume = Available Volume (ML) - B - C



# APPENDIX

## C HYDRANT TESTING



CITY OF REVELSTOKE

# REVELSTOKE AND BIG EDDY WATER MODEL CALIBRATIONS

JANUARY 11, 2021

CONFIDENTIAL





# CITY OF REVELSTOKE REVELSTOKE AND BIG EDDY WATER MODEL CALIBRATIONS

FINAL REPORT  
CONFIDENTIAL

PROJECT NO.: 5114-019-03  
DATE: JANUARY 2021

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# 1 INTRODUCTION

The City of Revelstoke owns and operates two separate potable water distribution systems. The first, the larger of the two systems, is for the central City of Revelstoke located on the east side of the Columbia River, and the second is for the Big Eddy neighbourhood on the west side of the Columbia River. For the purposes of this report these will be referred to as the Central Revelstoke and Big Eddy water systems respectively.

WSP recently completed a full update to the Central Revelstoke water model. This included reviewing the City's GIS database and available as-builts to update the watermain geometry, sizing, and materials, updating the demands of the models based on recorded flow rates, and updating PRV settings, pump settings, and reservoir details. Scenarios were created in the model for Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD). It should be noted that the City of Revelstoke Subdivision Bylaw No. 1846 uses the terms Average Daily Flow, Peak Daily Flow, and Peak Hour Flow. As ADD, MDD, and PHD, are the industry standard terms these will continue to be used in this analysis.

As the Big Eddy water system is much smaller and less complex than the Central Revelstoke water system a less intensive update was also completed by WSP on the Big Eddy water model. The goal of this update was mainly to ensure that the recent upgrades completed to the system were included within the model. Along with reviewing and updating the pipe network MDD and PHD scenarios were added to the model. The demand values used for these scenarios were based off of the existing ADD values that were already in the model, and the ADD:MDD ( $MDD = 2.67 \times ADD$ ) and ADD:PHD ( $PHD = 4.44 \times ADD$ ) ratios from the City of Revelstoke Subdivision Servicing Bylaw No. 1846.

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## 1.1 CENTRAL REVELSTOKE WATER SYSTEM SUMMARY

The existing Central Revelstoke water system consists of approximately 100km of watermain. The primary raw water source is from the water treatment plant at Greeley Creek which has a clearwell that feeds through a transmission main for approximately 5km to the City. There is also a small backup groundwater well at the golf course on the northwest corner of the City that is used in the summer during high demand periods.

There are currently two reservoirs within the water service area, one on the Trans-Canada Highway near the center of the City and one in the Arrow Heights neighbourhood in the south side of the City. There are also several PRV and pump stations throughout the service area that provide separation between the system's seven (7) pressure zones.

Figure A1 included in Appendix A provides an overview of the potable water system including the different pressure zones. The following two tables provide the breakdown of the sizing and materials of the piping within the Central Revelstoke water network.

**Table 1: Central Revelstoke Water Network Pipe Materials**

Material	Percentage of Total Pipe Length
Asbestos Cement	38.5%
Ductile Iron, Galvanized Iron, Cast Iron	20.6%
PVC	39.7%
HDPE	1.2%

**Table 2: Central Revelstoke Water Network Pipe Diameters**

Diameter (mm)	Percentage of Total Pipe Length
<100	6.6%
100	5.0%
150	44.1%
200	11.4%
250	9.0%
300	12.0%
350	2.9%
400	6.6%
450	2.2%
500	0.3%

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## 1.2 BIG EDDY WATER SYSTEM SUMMARY

The existing Big Eddy water system consists of approximately 12km of watermain operating as one pressure zone. The primary raw water source is from the three wells on the west side of the water network. These wells pump via a dedicated main up to the Big Eddy Reservoir on the south west side of the water network. A large portion of the water system has been upgraded in the past 4 years. These upgrades included a large portion of the watermains, the addition of a third well, and most recently the addition of a second reservoir at the Big Eddy Reservoir site. The following two tables provide the breakdown of the sizing and materials of the piping within the water network.

**Table 3: Big Eddy Network Pipe Materials**

Material	Percentage of Total Pipe Length
Asbestos Cement	30.0%
Ductile Iron and Galvanized Iron	1.6%
PVC	51.1%
HDPE	17.2%

**Table 4: Big Eddy Water Network Pipe Diameters**

Diameter (mm)	Percentage of Total Pipe Length
50	15.0%
100	2.2%
150	37.8%
200	15.3%
300	26.1%
350	3.7%

## 2 HYDRANT TESTING APPROACH

WSP was retained by the City to develop and implement a hydrant testing plan to assist with calibration of the two water models. In July 2020 WSP worked with the City’s operations team to complete the testing. The testing included three (3) multi-pressure hydrant tests and ten (10) c-factor tests for the Central Revelstoke water system, and two (2) multi-pressure hydrant tests and five (5) c-factor tests for the Big Eddy water system.

## 3 MODEL CALIBRATION

*“Water-distribution-model calibration consists of comparing model results with field measurements, making adjustments to a model, and reviewing field data to improve agreement between the two. The calibration process should result in a more accurate model as well as a better understanding of the strengths and weakness of the model – and in many cases a better understanding of the distribution system itself”.*

*(Committee Report: Defining Model Calibration, AWWA, 2013)*

A water model is a decision-support tool. Although a water model can be calibrated to accurately perform an analysis of fire flows, water quality, and/or energy requirements, a model that is calibrated for one of these analyses may not be well calibrated for another. It is how the water model will be used as a decision support tool that will dictate the type and extent of model calibration.

The hydraulic calibration of a water model for fire flow analysis provides a model that is well suited to assess other demands on the system such as Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD) and how these demands impact the sizing of reservoirs, sizing of transmission and distribution watermains, pumping capacity, PRV settings, etc. The calibration of the hydraulic water model for a fire flow analysis therefore provides the City with a tool to develop a cost-effective strategy to manage and upgrade its potable water infrastructure to meet the demands of the current population as well as anticipated growth.

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### 3.1 CALIBRATION METHODOLOGY

Calibration of a water model is an iterative review process encompassing the details of each component of the water system including: the length, diameter, material, and roughness factors of the watermains; node

demands and elevations; and pump configurations and operational settings. The calibration process allows for confirmation and, where appropriate, revisions to the assumptions and/or estimates made in the development of the model.

Calibration requires confirmation of the model predictions by comparison to field measurements. Therefore, a hydrant flow testing program was developed such that static and residual pressures with the actual water network could be recorded during a simulation of fire flows, as well as any special operational changes to the system (such as main closures, valve closures, etc.) from the days of hydrant flow testing are also collected. The recorded field results are then compared to the computer water model's predicted results through the calibration process.

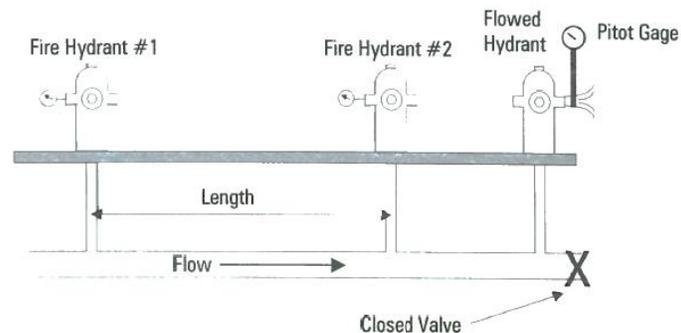
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### 3.1.1 HYDRANT FLOW TEST PROGRAM

A program for multi-pressure and C-factor hydrant flow testing was developed for the purpose of collecting field data from which to calibrate the constructed hydraulic water models. In July 2020 WSP worked with the City's operations team to complete the testing. Figures 1 to 7 for Central Revelstoke and 1 to 5 for Big Eddy have been included as Appendix B of this report, which show the locations of each of these tests.

#### C-FACTOR TEST

The c-factor process includes fully opening a pre-determined hydrant and measuring flow from it, while simultaneously recording pressures at two other hydrants. Because the purpose of this test is to determine the pressure drop between these two hydrants, the two hydrants must be in a straight, homogenous section of pipe. To create these straight sections of pipe, valves may need to be closed. Ten (10) c-factor tests were completed in the Central Revelstoke water system, and five (5) c-factor tests were completed in the Big Eddy water system.



**Figure 1: C-Factor Test Schematic**

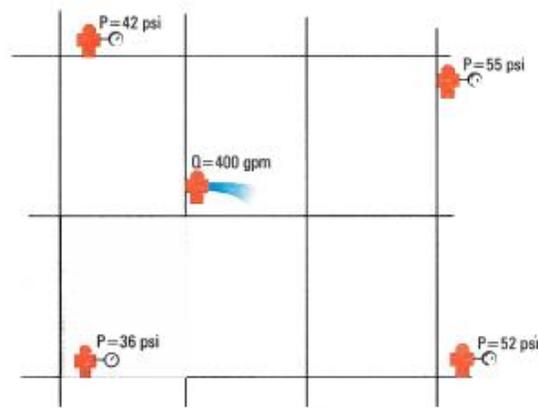
Reproduced from "A Reference Guide for Utilities"

The following were considered in the selection of the C-factor hydrant flow test and pressure locations to obtain representative coverage of the system's watermains:

- All hydrants are in the same pressure zone;
- Range of pipe diameters;
- Range of pipe ages and,
- Range of pipe materials.

## MULTI-PRESSURE TEST

A multi-pressure test set includes setting up four static hydrants that will measure changes in pressure over the course of the test set. Then, another pressure monitor is set up on a residual hydrant and an adjacent flow hydrant is opened. The residual pressure and flow hydrant are moved to different locations within the same pressure zone during a single set.



**Figure 2: Multi-Pressure Test Schematic**

Reproduced from "A Reference Guide for Utilities"

Three (3) sets of multi-pressure hydrant flow tests for a total of 12 flow tests were completed for Central Revelstoke, and two (2) sets of multi-pressure hydrant flow tests for a total of 6 flow tests were completed for Big Eddy.

The following were considered in the selection of the multi-pressure hydrant flow and pressure locations to obtain representative coverage of the zone:

- All hydrants are in the same pressure zone;
- Low and high elevations to capture maximum and minimum pressures;
- General location and populated areas; and,
- Land use.

### BIG EDDY MULTI-PRESSURE TEST SET #2

As the Big Eddy water system was fairly recently taken over by the City of Revelstoke there are some areas within the network with unknown pipe size, material, and/or age. One of these larger unknown locations is the south east corner of the water network. Due to the number, and locations, of fire hydrants and in-line valves, the type of testing available in this area is limited. Because of this, the two traditional test methods previously presented are not able to be used in this area. In order to get useful results for this area WSP and the City completed a scaled down multi-pressure test. This test is shown in Big Eddy Figure 5 included in Appendix B of this memo.

One at a time, flows were pulled from the two hydrants in the extremities of the network, with pressure loggers recording the pressure at the remaining three hydrants in the area. The goal of this was to determine the approximate available fire flows within this area, and this data along with the water model results, was used to help confirm the actual pipe sizes within this area.

### MULTI-PRESSURE TEST METHODOLOGY

The procedure used to collect data for model calibration is multi-pressure monitoring, and is outlined as follows:

- 1 Four high resolution pressure loggers ( $\pm 0.2\%$  of full scale) were installed on predetermined pressure hydrants, and one additional logger was installed on a hydrant adjacent to the flow hydrant. After bleeding the air, the flow hydrant was opened completely.
- 2 A pitot gauge was installed on the flow hydrants and the velocity pressures were recorded. These pressures were later converted into hydrant flow.
- 3 The type of hydrant orifice or nozzle on the flow hydrant was recorded, as this information affects flow characteristics.
- 4 Operations staff assisted with monitoring flows, supervising drainage and providing de-chlorination as required. Each hydrant flow period took around **five minutes**.
- 5 Pressure loggers were then removed and downloaded into a computer program. The recorded data in the pressure loggers provided the static and residual pressures needed to calibrate the model.

### 3.1.2 CENTRAL REVELSTOKE CALIBRATION PARAMETERS

Flow meter records were provided by the City’s operations staff to determine the approximate water usage during the days the hydrant flow tests were carried out. Table 5 summarizes the recorded demands for the calibration scenarios and compares the values to the previously calculated average day demands based on the City of Revelstoke Subdivision Servicing Bylaw.

The City of Revelstoke provided relevant SCADA data to be used to complete the calibration. The following information was checked and updated in the model when required:

- Valve closures
- Golf Course well status
- PRV settings
- Pump settings
- Reservoir water levels
- WTP flow rates

**Table 5: Central Revelstoke Recorded Daily Demands during Hydrant Flow Testing**

FLOW TEST DATE	MODEL ADD (L/S)	CALIBRATION DEMAND (L/S)	RATIO TO MODELED ADD
July 2, 2020	59.9 L/s	42.1 L/s	70%
July 3, 2020	59.9 L/s	67.6 L/s	113%

### 3.1.3 BIG EDDY CALIBRATION PARAMETERS

Recorded system demands were provided by the City’s operations staff to determine the actual water usage during the days the hydrant flow tests were carried out. Table 6 summarizes the recorded demands for the calibration scenario and compares the values to the previously calculated average day demands based on the City of Revelstoke Subdivision Servicing Bylaw.

The City of Revelstoke provided relevant SCADA data to be used to complete the calibration. The following information was double checked and updated in the model when required:

- Valve closures
- Well pump flow rates
- Reservoir water levels

**Table 6: Recorded Daily Demands during Hydrant Flow Testing**

FLOW TEST DATE	MODEL ADD (L/S)	CALIBRATION DEMAND (L/S)	RATIO TO MODELED ADD
July 2, 2020	38.1 L/s	28.6 L/s	75%

## 3.2 RESULTS AND DISCUSSION

### 3.2.1 CENTRAL REVELSTOKE C-FACTOR FIELD CALIBRATION RESULTS

Watermain materials and years of installation are based on the GIS information provided by the City. Results of the C-factor hydrant testing are summarized in Table 7. The static pressure difference and residual pressure difference fields contain the percent variance between the field recorded results and the modeled results.

**Table 7: Central Revelstoke C-Factor Calibration Results**

FLOW TEST NO.	PIPE MATERIAL	PIPE DIAMETER (MM)	PIPE INSTALL YEAR	STATIC PRESSURE DIFFERENCE (%)	RESIDUAL PRESSURE DIFFERENCE (%)	NOTES
1	AC	200	1976	0.0	-14.2	
2	AC	150	1965	0.4	5.2	
3	CI	150	1940	1.7	6.0	
4	AC	250	1974	2.4	1.5	
5	HDPE	216	2016	n/a	n/a	Field measurements appear inaccurate. Recommendation to revisit testing for 2021.
6	AC	200	1938	-1.1	21.1	
7	PVC	150	1992	2.6	-14.2	
8	PVC	150	1986	-2.3	15.5	
9	PVC	150	2008	n/a	n/a	Field measurements appear inaccurate. Recommendation to revisit testing for 2021.
10	PVC	150	1974	n/a	n/a	Field measurements appear inaccurate. Confirmed from multi-hydrant pressure testing. Recommendation to revisit testing for 2021.
<b>Avg</b>				<b>0.5%</b>	<b>3.0%</b>	

Note: Residual Pressure Difference between model and field results: Excellent (<5%), Good (<10%), Satisfactory (<20%)

The field measurements were reviewed in detail and cross-referenced to the multi-pressure tests and adjusted accordingly to ensure field information suitability. On average, the model has been calibrated to 0.5% and 3.0% accuracy for 7 of the 10 tests completed, whereas 3 locations were identified as having field information collected with appeared to be significantly inaccurate, likely due to logger reading error. These 3 locations are recommended for retesting in 2021. Meanwhile the following illustrates the approach to adjustment of c-factors to complete calibration.

The existing Central Revelstoke water model does not include estimated pipe installation years. The Central Revelstoke model was reviewed based on 10 subsections/neighbourhoods to update the C-Factors for the piping. The GIS data for the water network provided by the City was reviewed as this includes estimated installation years, and the c-factors for each pipe material per section was set as follows:

- AC, CI, DI, GI – base of 110
- PVC, HDPE – base of 130
- -2.5 for every decade of service
- +10 for any main  $\geq 300\text{mm}$  in diameter
- Any calculated c-factor  $< 95$  increased to 95

These subsections have been incorporated into the water model as selection sets. In some areas, such as where it was clear that there were areas of the neighbourhood that had separate areas with significantly different ages of the same pipe materials (i.e. a new subdivision in an older neighbourhood, or an area of significant water improvements in an older neighbourhood), we attempted to capture this as well. These C-factors are summarized in Table 8.

**Table 8: Revelstoke Updated C-Factors**

SUBSECTION/ NEIGHBOURHOOD	WATERMAIN MATERIALS	ESTIMATED DECADE OF MAJORITY OF MAINS	C-FACTOR USED (+10 FOR $\geq 300\text{MM}$ DIAMETER)
1 – Columbia Heights	AC	1970's	97.5
	PVC	1970's/1980's/2000's/2010's	117.5/120/127.5/130
	DI	2000's	105
2 – Central City/ Downtown	AC	1960's	95
	PVC	1980's	120
	GI	1980's	120
	CI	1940's	95
3 – TCH Reservoir Surroundings	PVC	1980's	120
	GI	1960's	95
4 – Johnson Heights	AC	1970's	95
	PVC	1990's	122.5
	DI	1970's	97.5
5 – Greeley Creek Transmission Main	AC	1970's	97.5
	PVC	1990's	97.5
	DI	1970's	117.5
6 – Queen Victoria Hospital and Surroundings	AC	1980's	102.5
	PVC	1990's	120
7 – Arrow Heights	AC	1970's	97.5
	PVC	1980's	120
	DI	1970's	97.5
	GI	1970's	97.5
8 – Revelstoke Mountain Resort	PVC	2000's	127.5
	HDPE	2010's	130
9 – Illecillewaet River Crossing	HDPE	2010's	130
	DI	1970's	97.5
10 – Southside/ Industrial Area	AC	1970's	97.5

SUBSECTION/ NEIGHBOURHOOD	WATERMAIN MATERIALS	ESTIMATED DECADE OF MAJORITY OF MAINS	C-FACTOR USED (+10 FOR ≥ 300MM DIAMETER)
	PVC	1980's	120
	CI	1950's	95
	GI	1950's	95

### 3.2.2 BIG EDDY C-FACTOR FIELD CALIBRATION RESULTS

Watermain materials and years of installation were based on the GIS information provided by the City. Results of the C-factor hydrant testing are summarized in Table 9. The static pressure difference and residual pressure difference fields contain the percent variance between the field results and the modeled results.

**Table 9: C-Factor Calibration Results**

FLOW TEST NO.	PIPE MATERIAL	PIPE DIAMETER (MM)	PIPE INSTALL YEAR	STATIC PRESSURE DIFFERENCE (%)	RESIDUAL PRESSURE DIFFERENCE (%)	NOTES
1	PVC	300	2017	8.9%	14.8%	
2	AC	100	1975	n/a	n/a	Field measurements appear inaccurate. Recommendation to revisit testing for 2021.
3	PVC	300	2017	5.1%	17.2%	
4	PVC	300	2018	2.8%	6.4%	
5	PVC	300	2018	n/a	n/a	Field measurements appear inaccurate. Recommendation to revisit testing for 2021.
<b>avg</b>				<b>5.6%</b>	<b>12.8%</b>	

Note: Residual Pressure Difference between model and field results: Excellent (<5%), Good (<10%), Satisfactory (<20%)

The field measurements were reviewed in to ensure field information suitability. On average, the model has been calibrated to 5.6% and 12.8% accuracy for 3 of the 5 tests completed, whereas 2 locations were identified as having field information collected with appeared to be significantly inaccurate, likely due to a network understanding error. As the Big Eddy water system is fairly simple with the distribution system all being fed from the same reservoirs it is likely these large variations are from incorrect pipe sizes within the model, unknown valve closures, or valves not being fully closed during the testing. It is our understanding that the City recently took over the Big Eddy water system and received minimal record documents from the previous operators.

As a result, more investigation is likely needed to improve model confidence. One way to develop an increased confidence in the watermain assumptions is to find and check more historical record drawings if possible, or alternatively, complete more testing in the spring of 2021 in these two areas.

As the c-factor test results didn't provide enough data to use to calibrate the Hazen-Williams coefficients in the model, the same evaluation as completed for the Central Revelstoke water model was used to update the Big Eddy water model coefficients. Due to the smaller size and simplicity of the model, the GIS data provided by the City was used to input the estimated installation years for each pipe in the water model and these install years were used to set the c-factors based on the following criteria.

- AC, CI, DI, GI – base of 110
- PVC, HDPE – base of 130
- -2.5 for every decade of service
- +10 for any main  $\geq 300$ mm in diameter
- Any calculated c-factor < 95 increased to 95

---

### 3.2.3 CENTRAL REVELSTOKE MULTI-PRESSURE FIELD CALIBRATION RESULTS

The results of the calibration process indicate generally a good correlation between the field pressure measurements and computer predicted results. The complete calibration and validation results are provided in Appendix C.

Field investigation by City staff is recommended near hydrants which are not well calibrated, these hydrants are summarized below, the locations of these hydrants are available to be viewed in the figures in Appendix B:

- Hydrant Flow Test No. 1 – Hydrants S1S1 and S1S2 were measured in the field with static pressures quite a bit lower than the other hydrants in this test set, with the HGL of these two generally around 4m lower than the other hydrants measured. This could be to an equipment error or could be related to an incorrect elevation of these hydrants within the model. Overall this is not a significant concern for the model calibration, but this hydrant elevation could be picked up from a survey shot and updated within the model.
- Hydrant Flow Test No. 1, Set 3 – Residual hydrant S1R3 and Static hydrant S1S3 experienced much less of a pressure drop in the field than expected based on the model when fire flows were pulled from S1F3. This would suggest that a watermain in this area is larger than expected based on the water model, possibly on Laforme Blvd. between Peakes Dr. and Columbia Park Dr., the available engineering drawings for this area do match up with the current watermain sizing within the model.
- Hydrant Flow Test Set 2 – Field measured static pressures for S2S4 were inconsistent with the other hydrants in this test set. This is assumed to be due to equipment/human error and the results from this hydrant were removed from this calibration set.
- Hydrant Flow Test Set 3 – Field measured static pressures for S3S4 were inconsistent with the other hydrants in this test set. This is assumed to be due to equipment/human error and the results from this hydrant were removed from this calibration set.

The remaining residual pressure field results varied significantly from the expected model results, with much greater pressure drops being experienced in the field than as expected from the model. This could be due to a closed or partially closed valve within the west side of the Arrow Heights neighbourhood, or possibly a critical watermain being of a smaller size than expected. WSP did review the available GIS data for this area to ensure the model watermain sizing was accurate as possible based on the available records.

The City crew went to this area and checked all the valves on the largest 350mm main that feeds this area, from the testing area back to the Arrow Heights Pump/PRV Station. A partially closed valve on this line was originally assumed to be the most likely cause of the large pressure drops seen in the field tests. The crew did not find any valve closures or partial valve closures on the 350mm main but did find a valve on a smaller main nearby that was around 25% closed. This 25% closure was modeled but had no significant effect on the results obtained in the model.

The acceptable tolerance between field and computer predicted results is within 15% for pressures. Based on the calibration activities and the system information available at this time, WSP considers the majority

of the hydraulic water model to be sufficiently calibrated to assess the capacity of the existing water system. It is recommended to complete more testing in the area of Multi-Pressure Set 3 to help determine the cause of the larger pressure drops experienced during field testing. Results of the hydrant testing and calibrated values of the water model are summarized in Appendix C.

---

### **3.2.4 CENTRAL REVELSTOKE CALIBRATION SUMMARY AND RECOMMENDATIONS**

Although the c-factor testing was not as successful as anticipated, the results of multi-pressure tests 1 and 2 lead to the conclusion that the majority of the model has been successfully calibrated, with a large majority of the field results for these tests showing a variance of <15% when compared to the model results. The complete calibration and validation results are provided in Appendix D.

As previously mentioned, we recommend:

1. Completing further field testing and monitoring in the spring of 2021, particularly in the area where multi-pressure test 3 was completed, to determine why fire flows available in this area are much lower than would be expected. This is an especially critical area due to the proximity to the Queen Victoria Hospital.
  2. At the same time as above, also complete field testing in the areas where the c-factor tests had a large variance from the expected results (Tests 5, 9, 10).
- 

### **3.2.5 BIG EDDY MULTI-PRESSURE FIELD CALIBRATION RESULTS**

Although the c-factor testing was not as successful as anticipated for Big Eddy either, the results of the multi-pressure tests completed in Big Eddy lead to the conclusion that the majority of the model has been successfully calibrated, with only 1 out of 26 of the field measurements for these tests showing a variance of >15% when compared to the model results.

---

### **3.2.6 BIG EDDY CALIBRATION SUMMARY AND RECOMMENDATIONS**

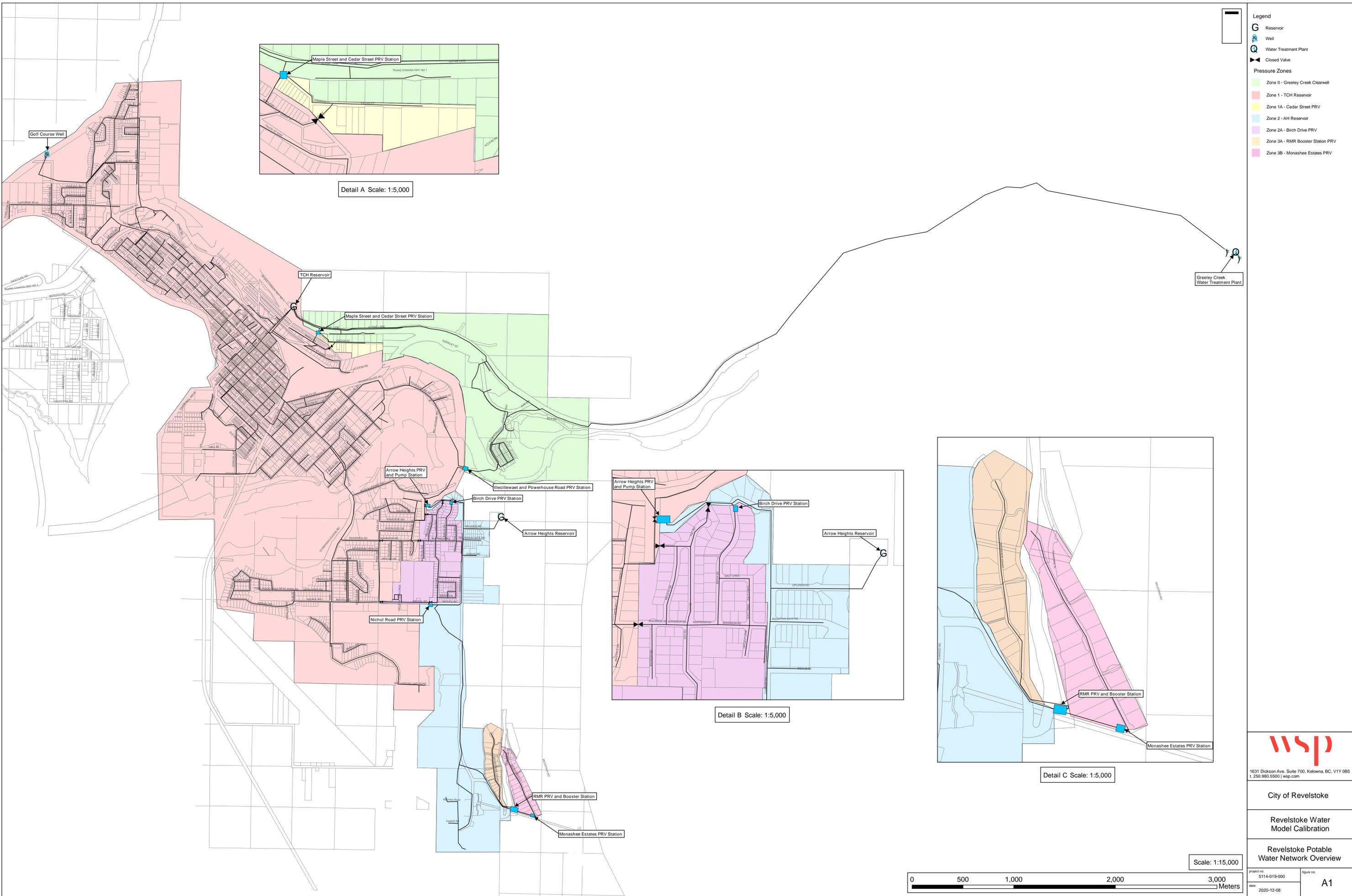
The results of the multi-pressure testing lead us to believe that the model, overall, has been calibrated to provide useful system capacity information for the City.

As previously mentioned, we have observed:

3. Locations of c-factor tests 2 and 5 gave indication that the network is still very new to the City and there could be significant unknowns for the watermain materials and sizes. One way to develop an increased confidence in the watermain assumptions is to find and check more historical record drawings if possible, or alternatively, complete more testing in the spring of 2021 in these two areas.

# APPENDIX

# A CENTRAL REVELSTOKE WATER SYSTEM SUMMARY



- Legend**
- Reservoir
  - Well
  - Water Treatment Plant
  - Closed Valve
- Pressure Zones**
- Zone 0 - Greeley Creek Clearwell
  - Zone 1 - TCH Reservoir
  - Zone 1A - Cedar Street PRV
  - Zone 2 - AH Reservoir
  - Zone 2A - Birch Drive PRV
  - Zone 3A - RMR Booster Station PRV
  - Zone 3B - Monashee Estates PRV

Detail A Scale: 1:5,000

Detail B Scale: 1:5,000

Detail C Scale: 1:5,000

Scale: 1:15,000



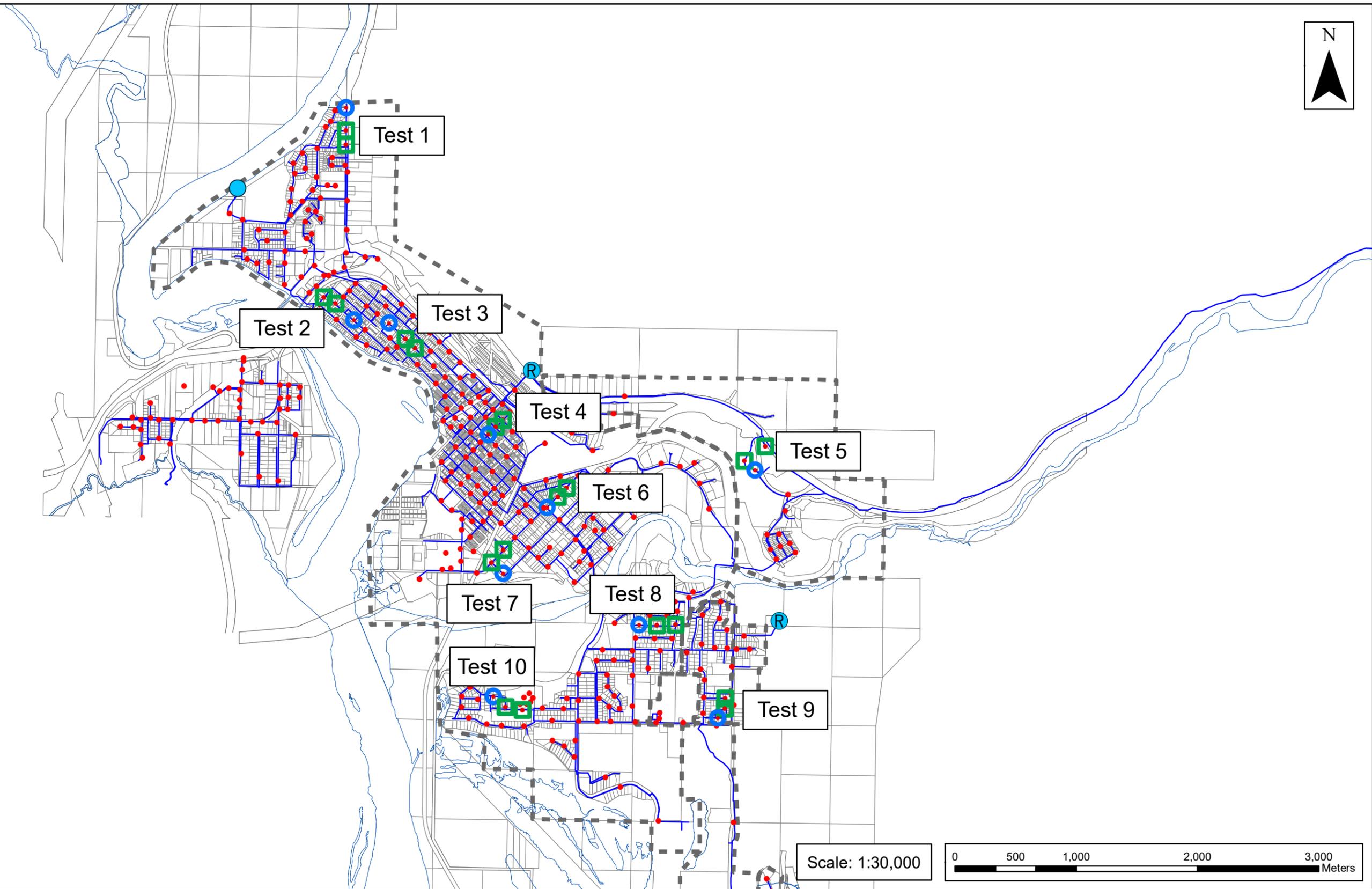
**wsp**  
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City of Revelstoke  
 Revelstoke Water Model Calibration  
 Revelstoke Potable Water Network Overview

project no. 5114-019-000  
 date: 2020-12-08  
 figure no. **A1**

# APPENDIX

## **B** HYDRANT TESTING LOCATION FIGURES



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City of Revelstoke

Legend

-  Flow Hydrant
-  Residual Hydrant
-  Pressure Zone Boundary

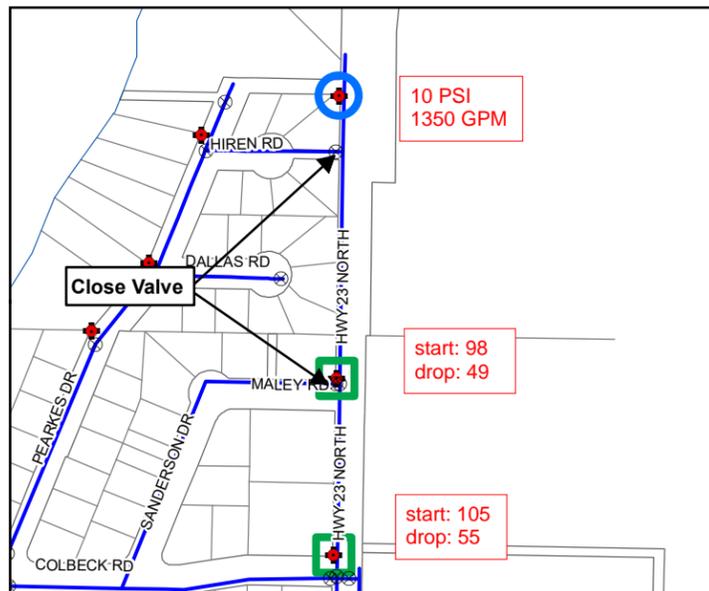
### Hydrant Testing Plan C-Factor Tests Overview

project no.  
5114-019-000

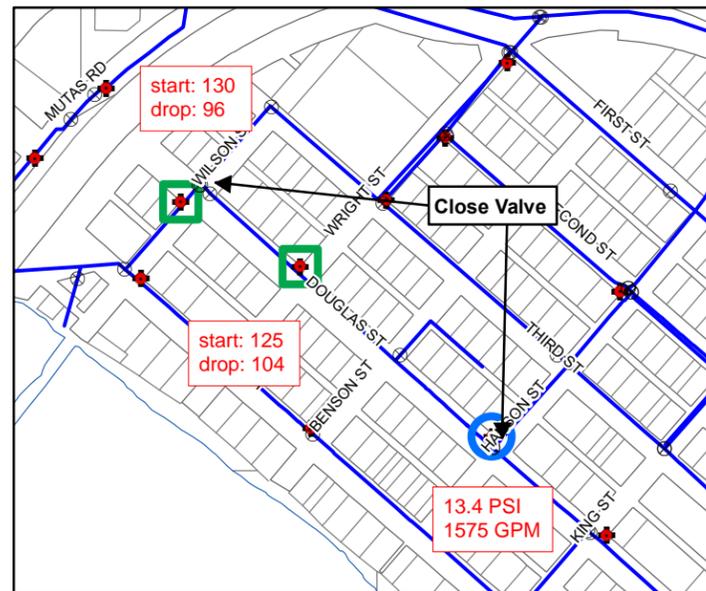
figure no.

date:  
2020-04-27

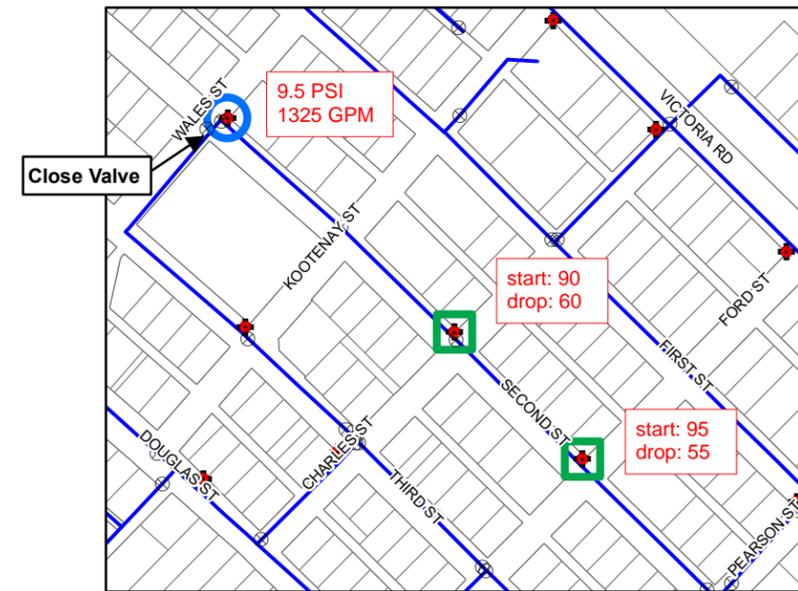
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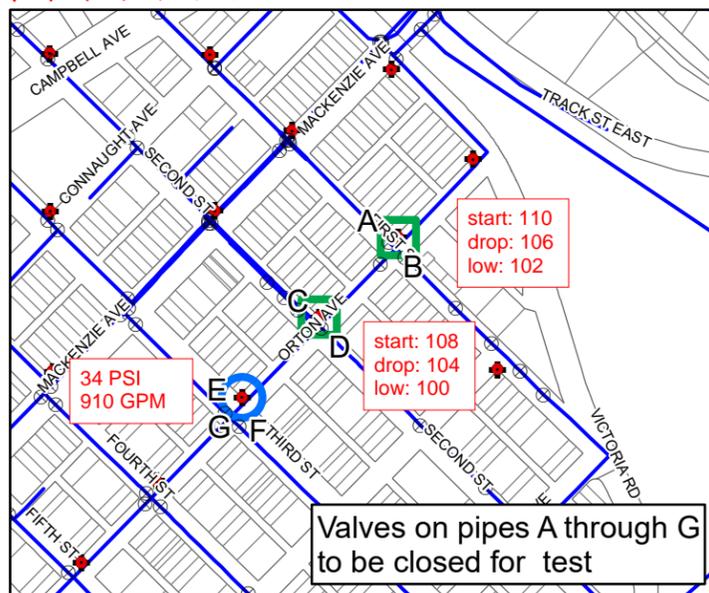
**Test 1** Pipe: 200mm AC  
Port: Large



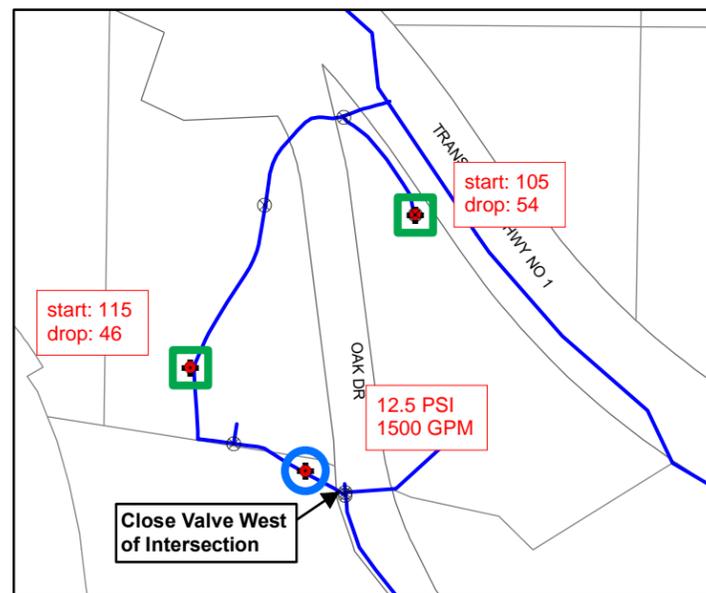
**Test 2** Pipe: 150mm AC  
Port: Large



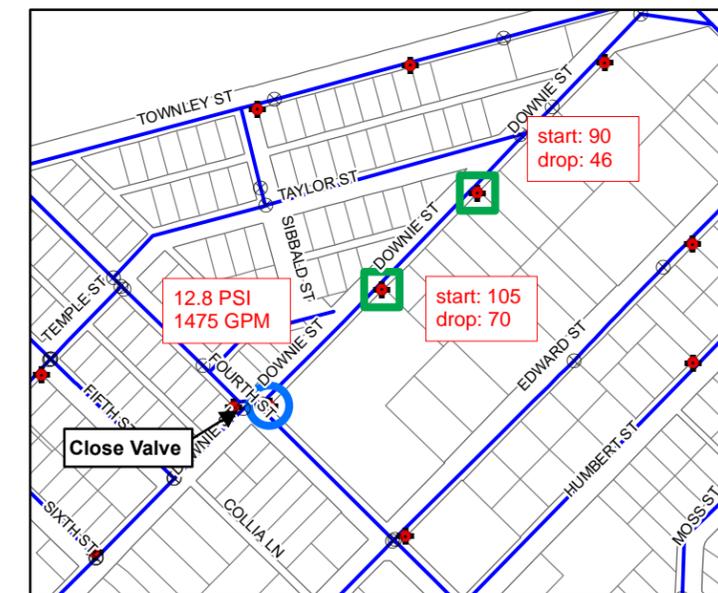
**Test 3** Pipe: 150mm CI  
Port: Large



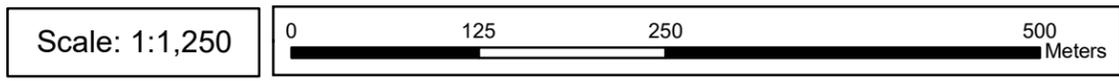
**Test 4** Pipe: 250mm AC  
Port: Small  
\*valve G is not there so shifted test up a block to 4th

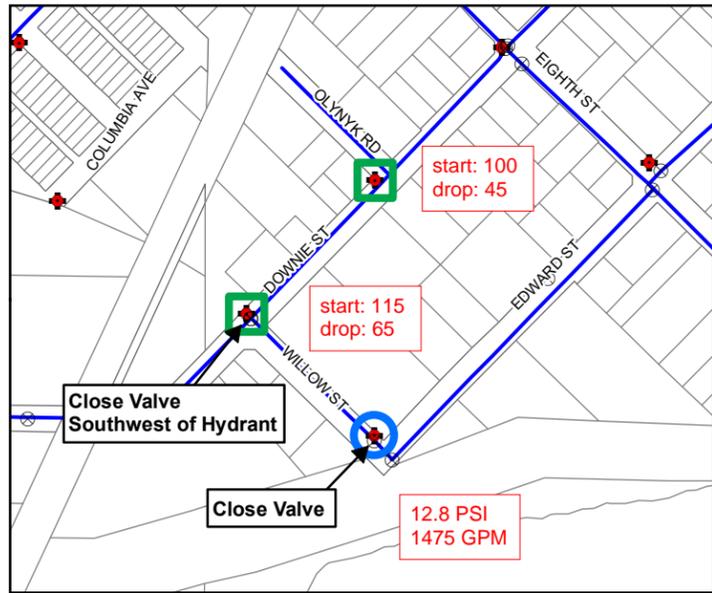


**Test 5** Pipe: 250mm HDPE  
Port: Large

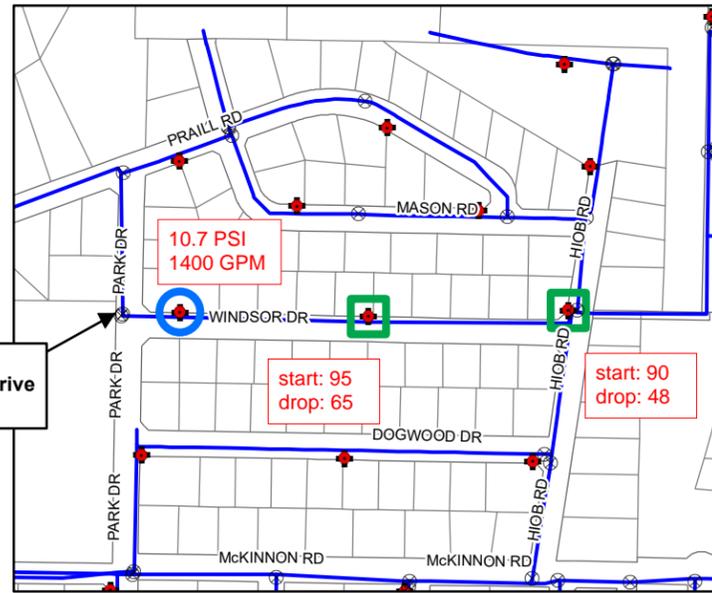


**Test 6** Pipe: 200mm AC  
Port: Large

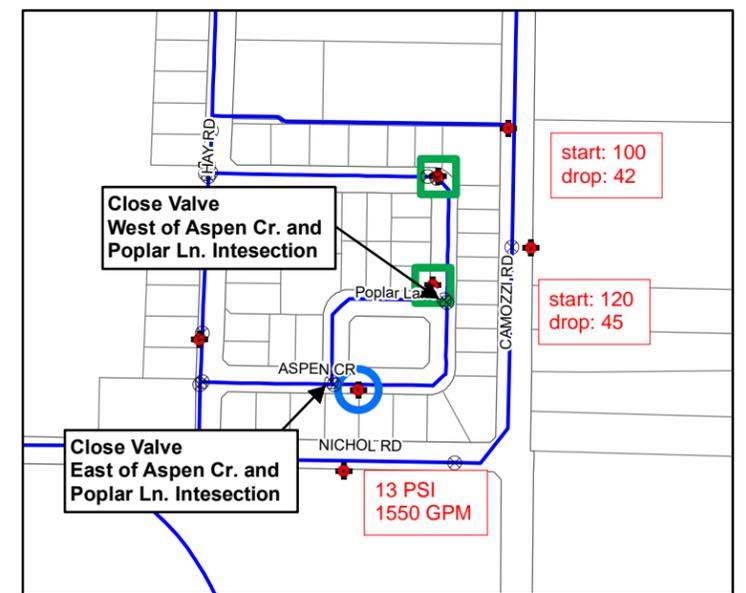




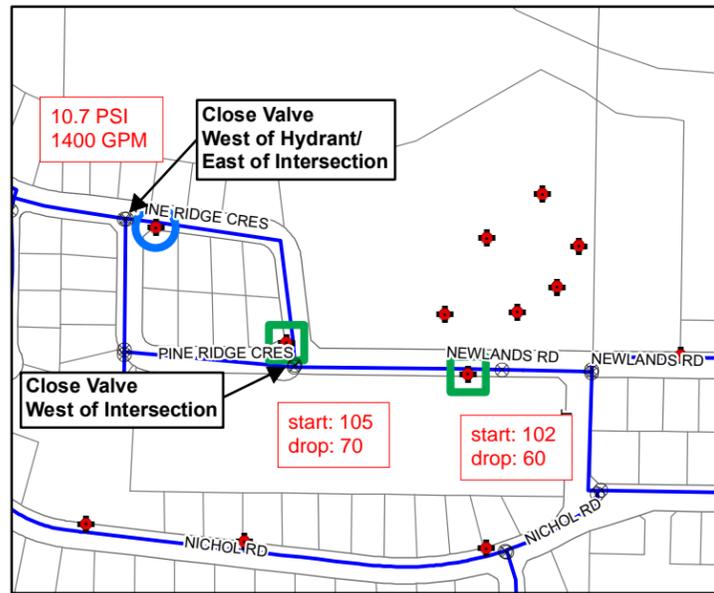
**Test 7** Pipe: 150mm PVC  
Port: Large



**Test 8** Pipe: 150mm PVC  
Port: Large

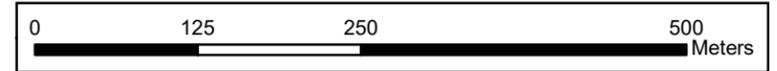


**Test 9** Pipe: 150mm PVC  
Port: Large



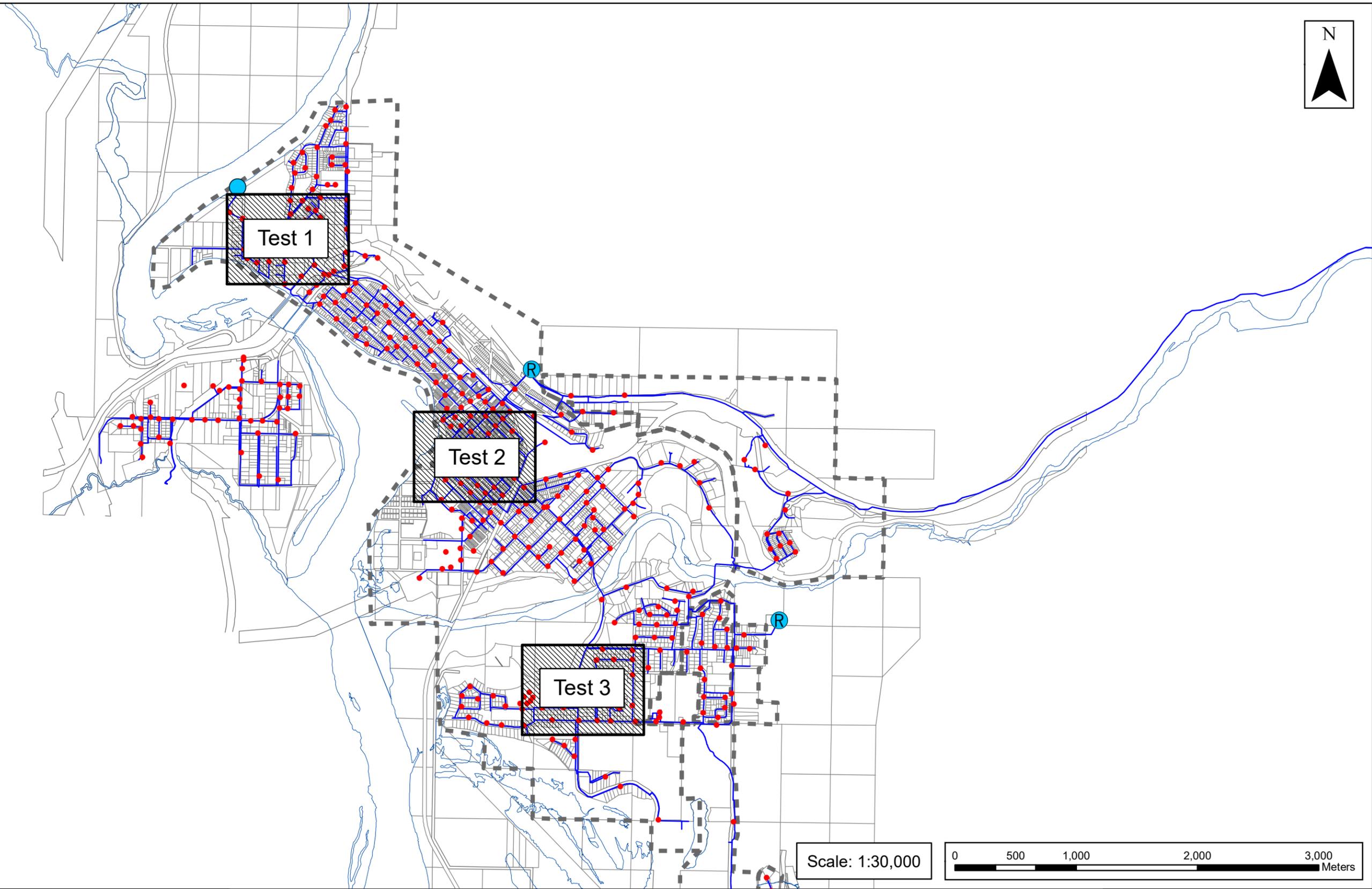
**Test 10** Pipe: 150mm PVC  
Port: Large

Scale: 1:1,250

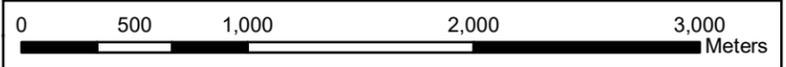


**Hydrant Teting Plan  
C-Factor Tests 7-10 Detail**

project no. 5114-019-000	figure no. <b>3</b>
date: 2020-04-26	



Scale: 1:30,000



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City of Revelstoke

Legend

 Pressure Zone Boundary

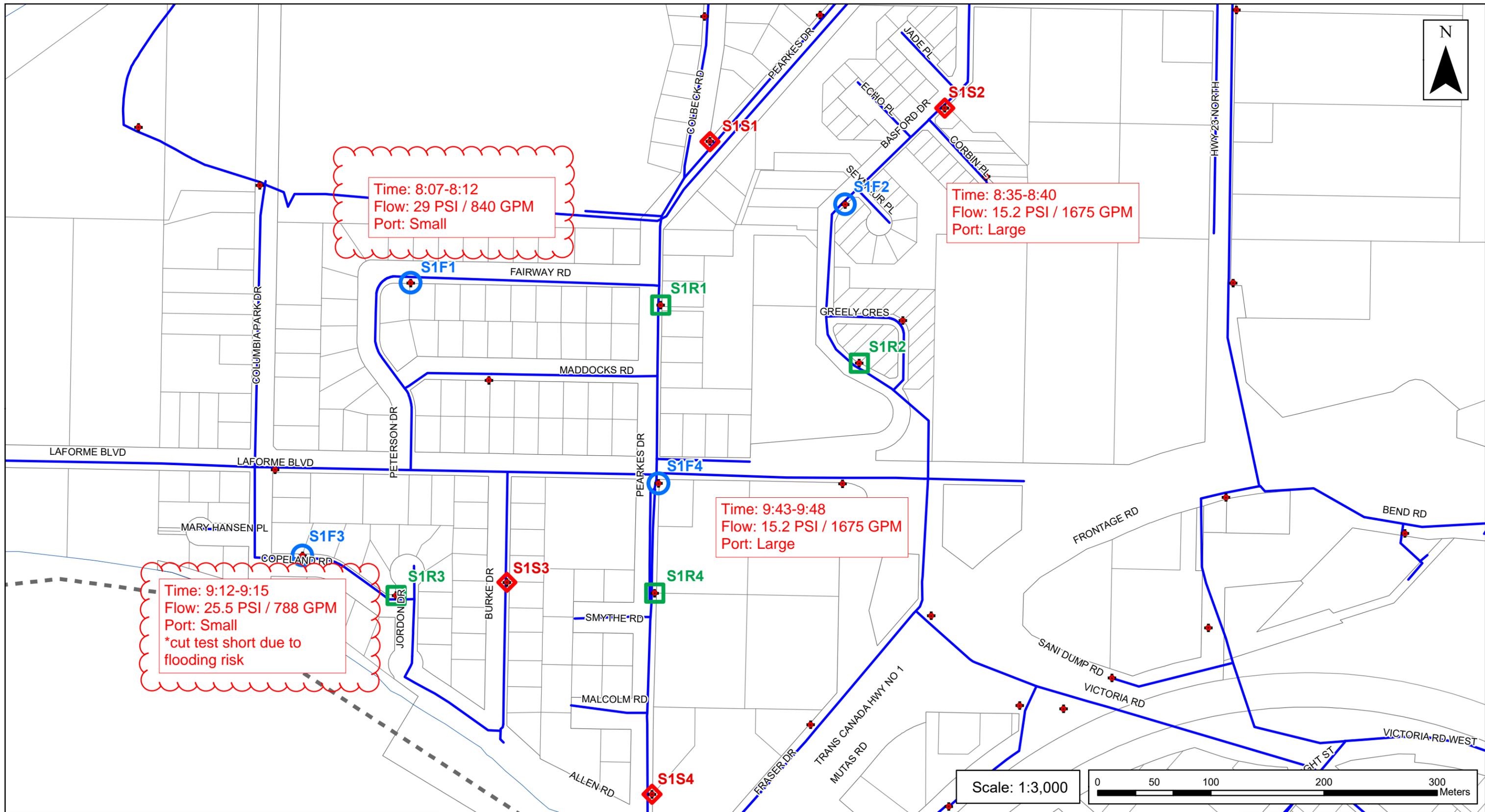
### Hydrant Tesing Plan Multi-Pressure Testing Overview

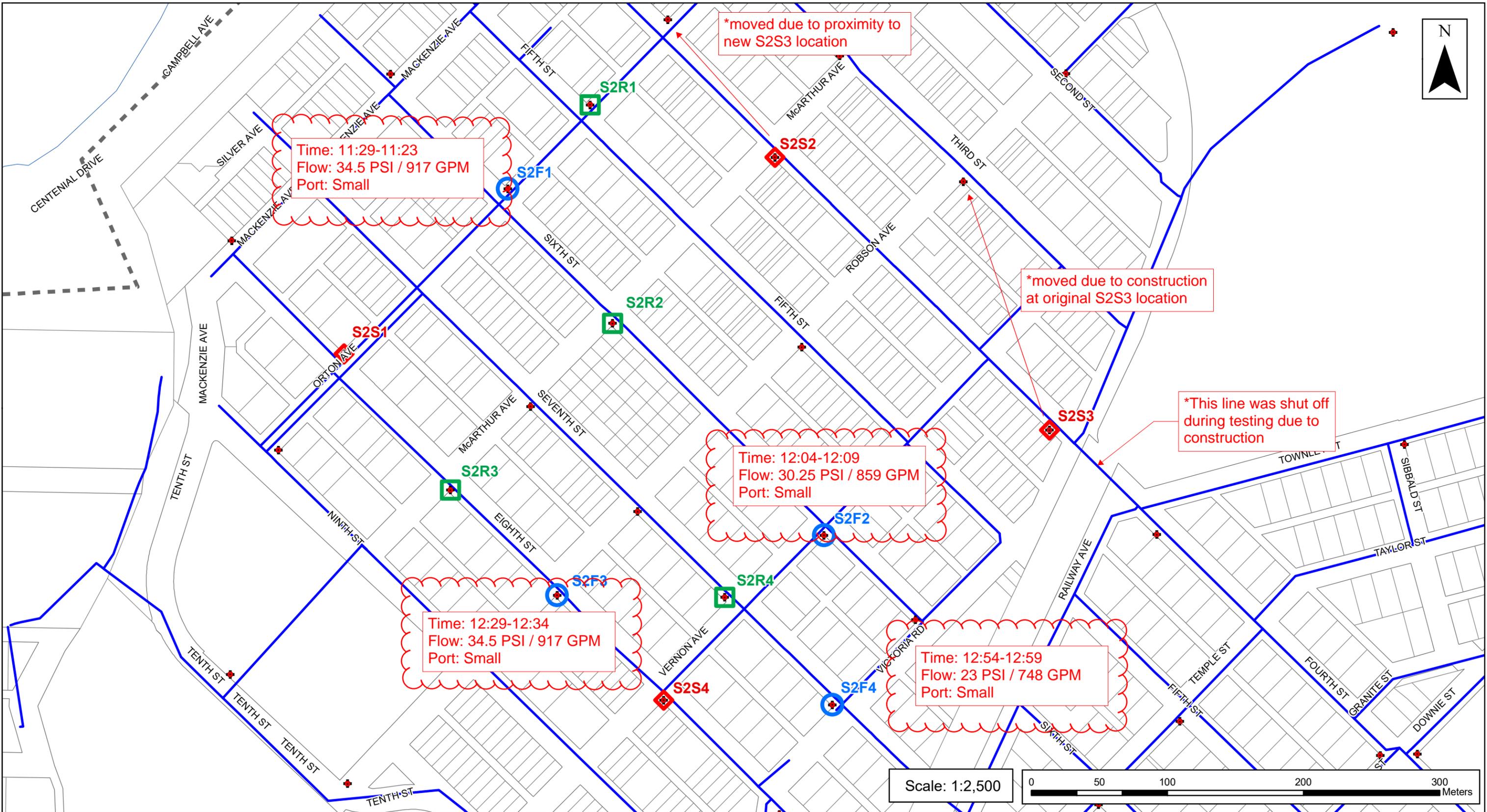
project no.  
5114-019-000

figure no.

date:  
2020-04-19

4





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City of Revelstoke

Legend

-  Flow Hydrant
-  Residual Hydrant
-  Static Hydrant
-  Pressure Zone Boundary

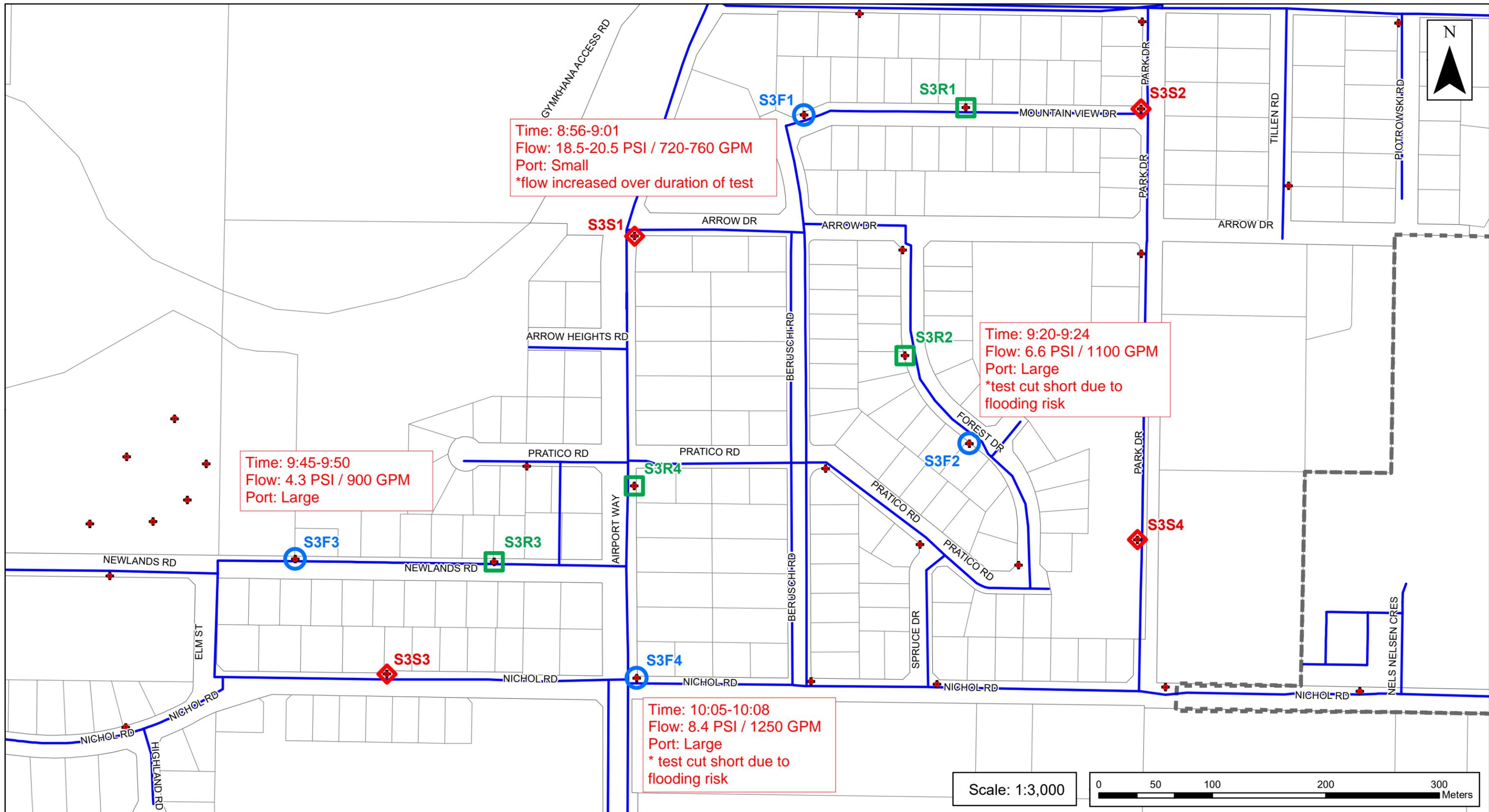
Hydrant Testing Plan  
Multi-Pressure Hydrant Tests 2

project no.  
5114-019-000

figure no.

date:  
2020-04-21

6



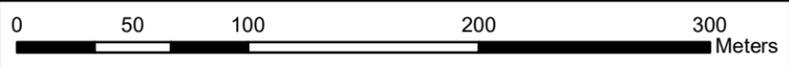
Time: 9:45-9:50  
 Flow: 4.3 PSI / 900 GPM  
 Port: Large

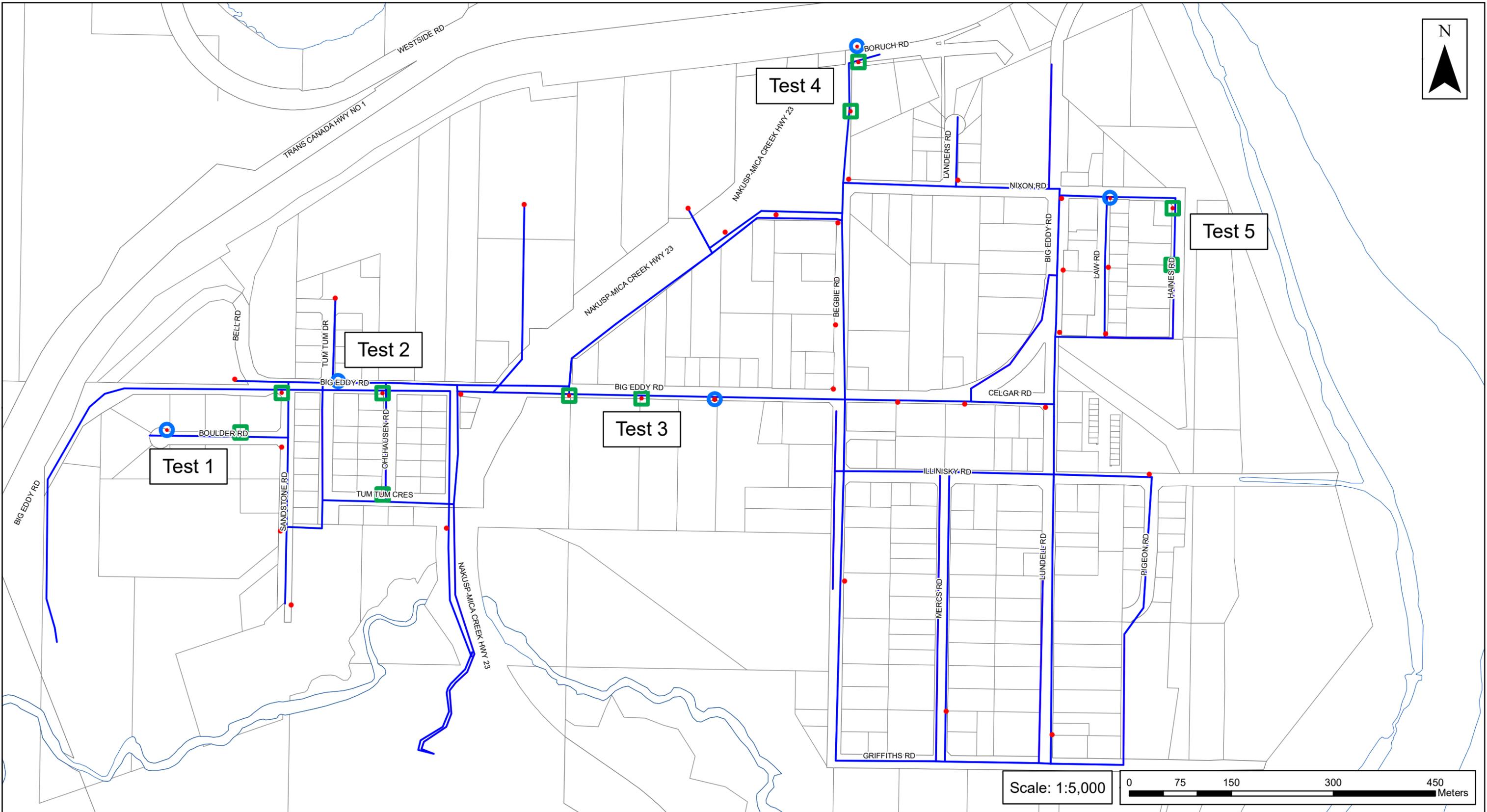
Time: 8:56-9:01  
 Flow: 18.5-20.5 PSI / 720-760 GPM  
 Port: Small  
 \*flow increased over duration of test

Time: 9:20-9:24  
 Flow: 6.6 PSI / 1100 GPM  
 Port: Large  
 \*test cut short due to flooding risk

Time: 10:05-10:08  
 Flow: 8.4 PSI / 1250 GPM  
 Port: Large  
 \* test cut short due to flooding risk

Scale: 1:3,000





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City of Revelstoke

Legend

-  Flow Hydrant
-  Residual Hydrant

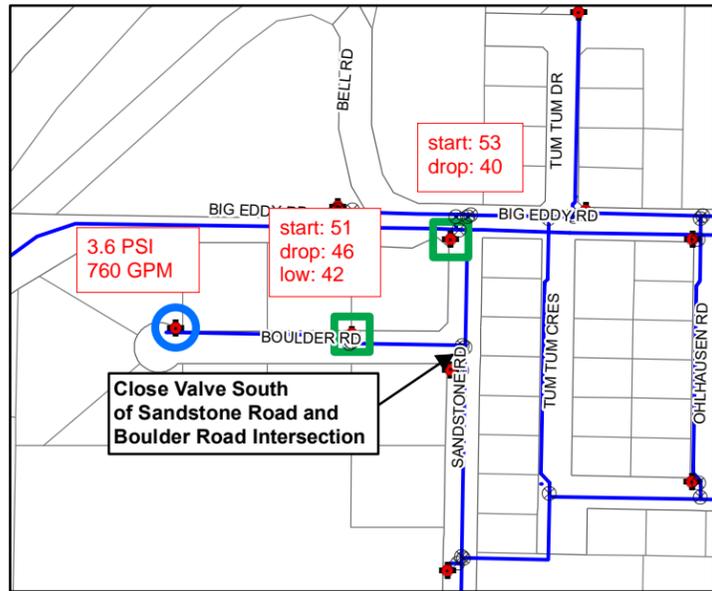
Big Eddy Hydrant Testing Plan  
C-Factor Tests Overview

project no.  
5114-019-000

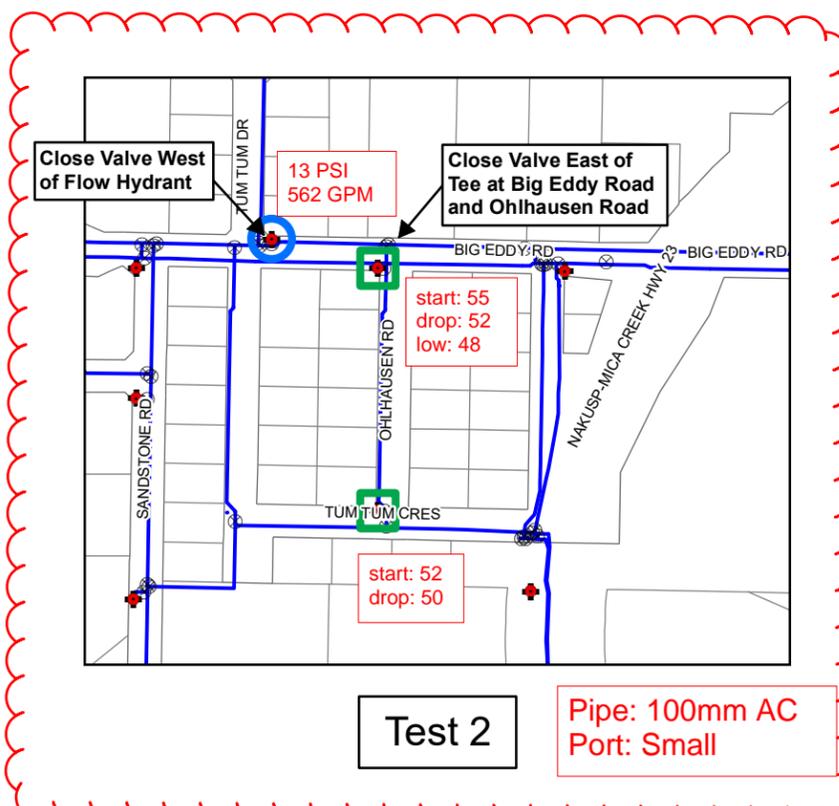
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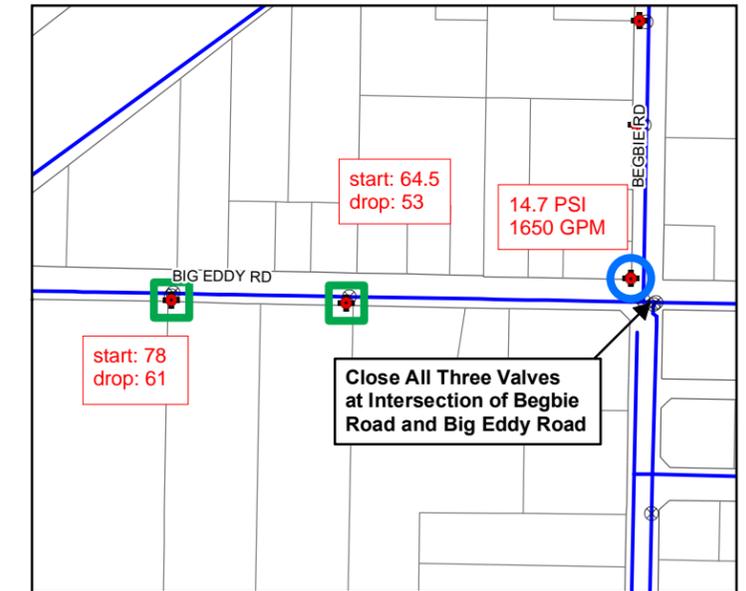
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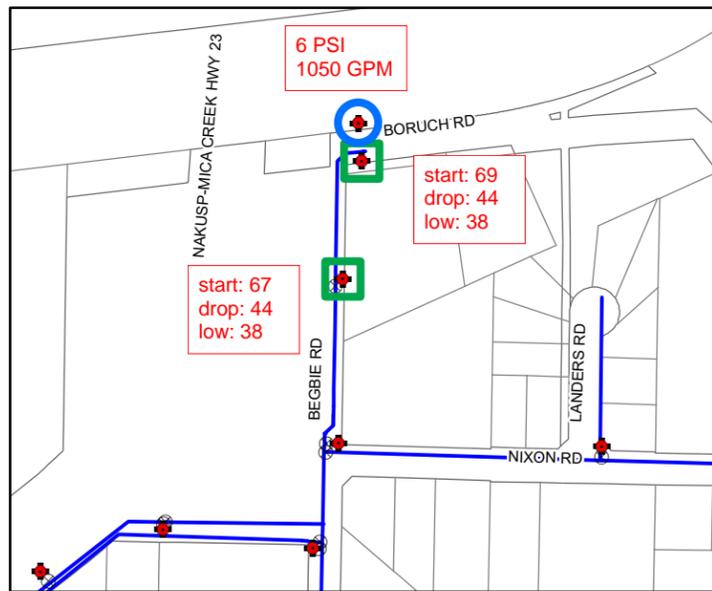
**Test 1** Pipe: 300mm PVC  
Port: Large



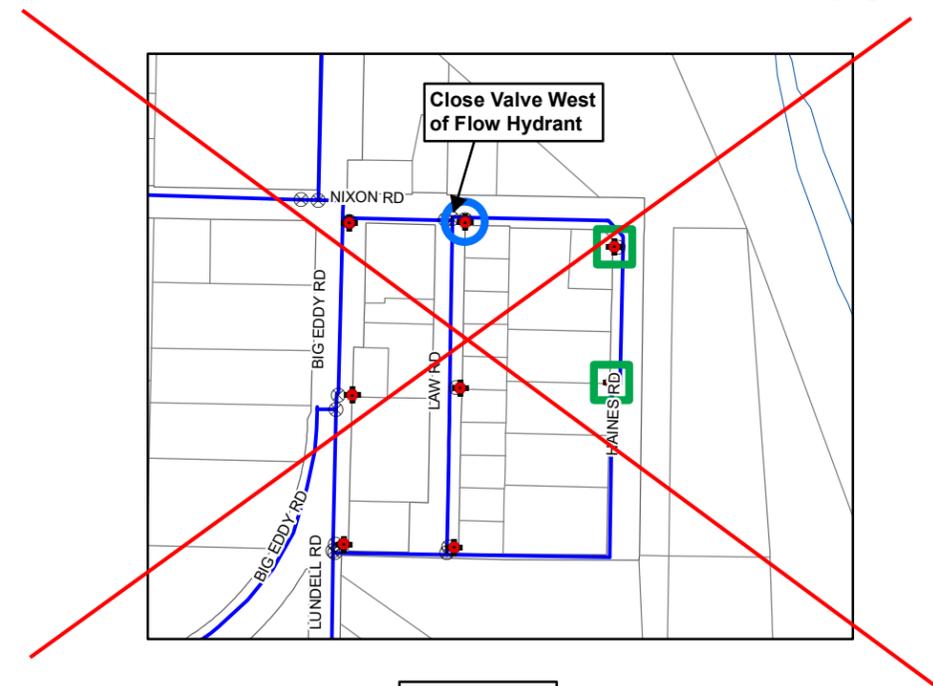
**Test 2** Pipe: 100mm AC  
Port: Small



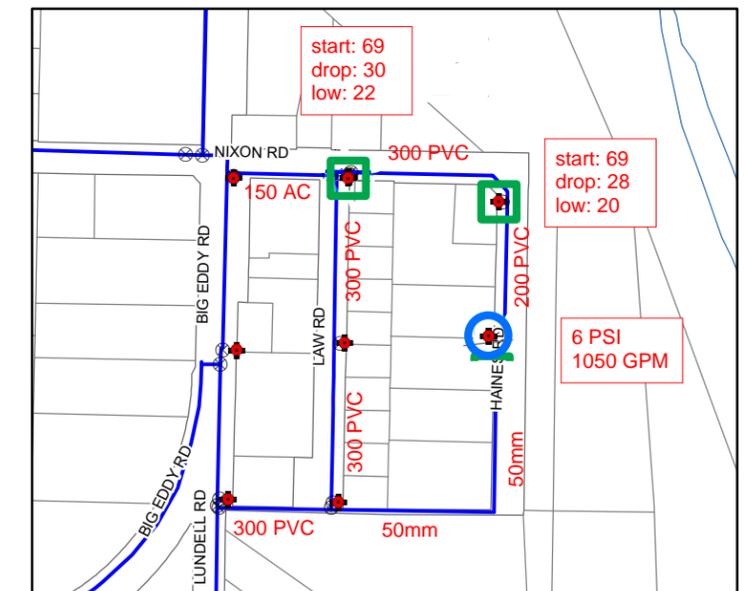
**Test 3** Pipe: 300mm PVC  
Port: Large



**Test 4** Pipe: 300mm PVC  
Port: Large

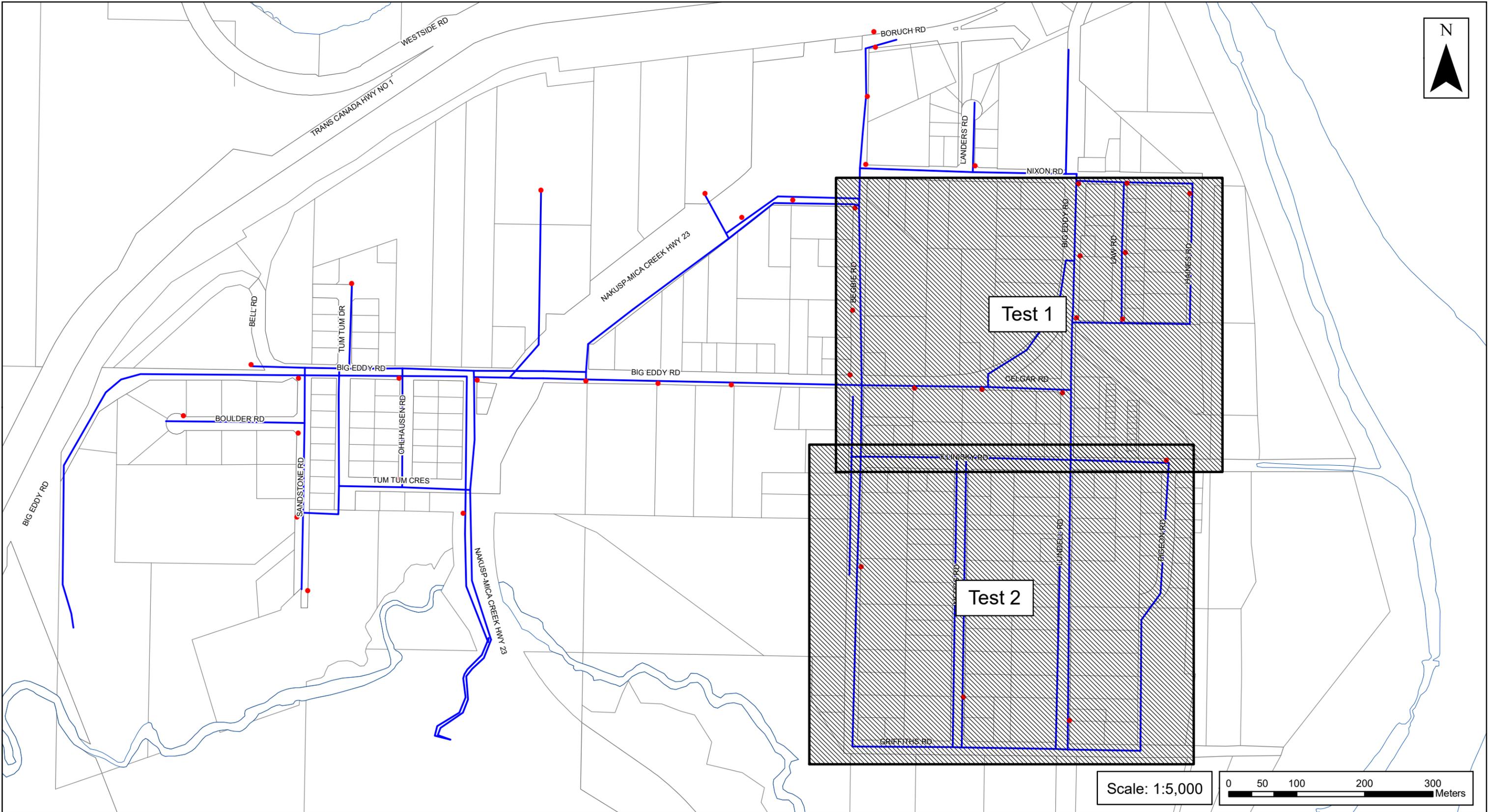


**Test 5**

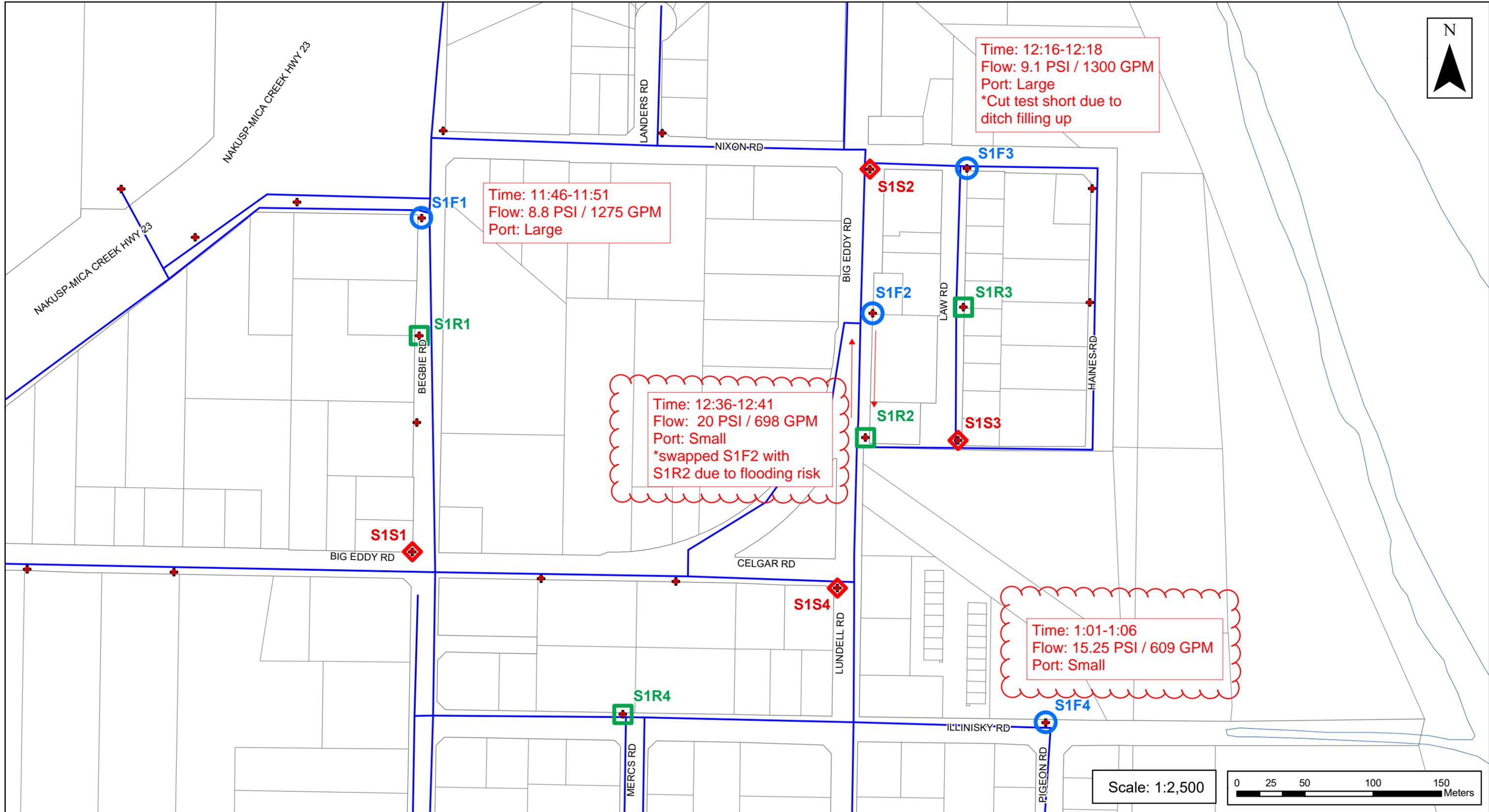


**Test 5** Pipe: 200/300mm PVC  
Port: Large





Scale: 1:5,000  
 0 50 100 200 300 Meters



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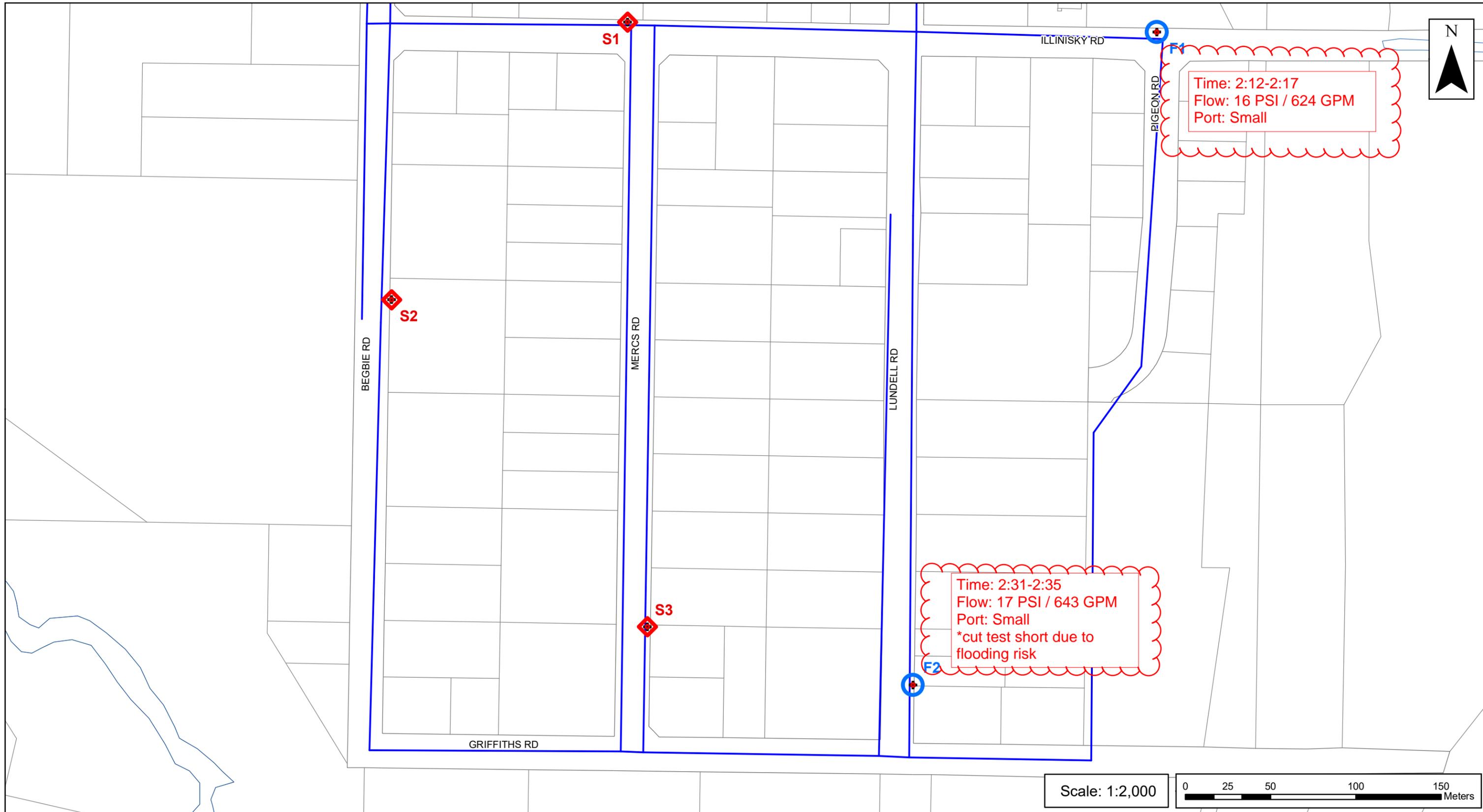
City of Revelstoke

Legend

-  Flow Hydrant
-  Residual Hydrant
-  Static Hydrant

Big Eddy Hydrant Testing Plan  
Multi-Pressure Test 1

project no. 5114-019-000	figure no. <b>4</b>
date: 2020-05-28	



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Legend

-  Flow Hydrant
-  Static Hydrant

Big Eddy Hydrant Testing Plan  
Multi-Pressure Test 2

project no.  
5114-019-000

figure no.

date:  
2020-05-28

5

# APPENDIX

## C CENTRAL REVELSTOKE CALIBRATION TABLES

**CENTRAL REVELSTOKE MULTI PRESSURE  
FIELD RESULTS VS. COMPUTER PREDICTED RESULTS**

Date	Flow set no.	Pressure Zone	Hydrant Test No. & Time	Flow (GPM)	Flow (L/s)	Test ID	WaterCAD Node	Hydrant Elev. (m)	Field Result					Computer Result				Static Pressure Diff (psi)	% diff Static Pressure	Residual Pressure Diff (psi)	% diff Residual Pressure	Demand Boundary Conditions	Comments	
									Static (psi)	Residual (psi)	Static HGL (m)	Residual HGL (m)	Pressure Drop (psi)	Static (psi)	Residual (psi)	Static HGL (m)	Residual HGL (m)							
2-Jul-20	1	1	F1			S1F1	FAI-PET	444.5													0.70 ADD	HGL of S1 and S2 does not match up, should be similar to three other locations. Potential incorrect elevation of these locations in the model. - ASC File from this MP Test area could not be geoprocesed		
			Start			S1R1	J-769	447.3	124.6	108.9	534.9	523.9	15.7	125.3	109.5	535.5	524.3	0.7	1%	0.6			1%	
				8:07:00 AM	840	52.98	S1S1	J-208	447.7	118.1	104.2	530.7	521.0	13.9	124.8	111.7	535.5	526.3	6.7	6%			7.5	7%
							S1S2	J-219	455.3	104.9	92.8	529.1	520.5	12.1	114.0	103.4	535.5	528.0	9.1	9%			10.6	11%
			End			S1S3	J-234	443.7	127.5	105.3	533.3	517.7	22.2	130.5	98.0	535.5	512.6	3.0	2%	-7.3			-7%	
				8:12:00 AM			S1S4	ALL-PER	446.5	125.8	113.9	534.9	526.6	11.9	126.5	115.9	535.5	528.0	0.7	1%			2.0	2%
			F2			S1F2	J-223	460.6																
			Start			S1R2	J-228	460.0	106.2	72.6	534.6	511.0	33.6	107.4	70.2	535.5	509.3	1.2	1%	-2.4			-3%	
				8:35:00 AM	1675	105.64	S1S1	J-208	447.7	116.1	85.5	529.3	507.8	30.6	124.8	88.5	535.5	509.9	8.7	7%			3.0	4%
							S1S2	J-219	455.3	103.8	70.2	528.3	504.7	33.6	114.0	76.1	535.5	508.8	10.2	10%			5.9	8%
			End			S1S3	J-234	443.7	128.3	96.4	533.9	511.5	31.9	130.5	94.5	535.5	510.1	2.2	2%	-1.9			-2%	
				8:40:00 AM			S1S4	ALL-PER	446.5	125.8	94.6	534.9	513.0	31.2	126.5	92.5	535.5	511.5	0.7	1%			-2.1	-2%
			F3			S1F3	J-770	444.9																
			Start			S1R3	COP-JOR	444.3	127.5	78.3	533.9	499.4	49.2	129.7	51.6	535.5	480.6	2.2	2%	-26.7			-34%	
				9:12:00 AM	788	49.70	S1S1	J-208	447.7	115.2	105.5	528.7	521.9	9.7	124.8	113.3	535.5	527.4	9.6	8%			7.8	7%
							S1S2	J-219	455.3	103.5	94.2	528.1	521.5	9.3	114.0	104.5	535.5	528.8	10.5	10%			10.3	11%
End			S1S3	J-234	443.7	127.9	97.5	533.6	512.2	30.4	130.5	73.5	535.5	495.4	2.6	2%	-24.0	-25%						
	9:15:00 AM			S1S4	ALL-PER	446.5	124.4	114.6	534.0	527.1	9.8	126.5	117.0	535.5	528.8	2.1	2%	2.4	2%					
F4			S1F4	J-771	447.1																			
Start			S1R4	J-550	445.8	124.9	74.5	533.6	498.2	50.4	127.5	80.2	535.5	502.2	2.6	2%	5.7	8%						
	9:43:00 AM	1675	105.64	S1S1	J-208	447.7	115.4	78.1	528.8	502.6	37.3	124.8	84.4	535.5	507.1	9.4	8%	6.3	8%					
				S1S2	J-219	455.3	103.6	68.4	528.1	503.4	35.2	114.0	78.6	535.5	510.6	10.4	10%	10.2	15%					
End			S1S3	J-234	443.7	129.4	80.6	534.7	500.4	48.8	130.5	80.9	535.5	500.6	1.1	1%	0.3	0%						
	9:48:00 AM			S1S4	ALL-PER	446.5	125.3	85.3	534.6	506.5	40.0	126.5	90.2	535.5	509.9	1.2	1%	4.9	6%					
3-Jul-20	2	1	F1			S2F1	J-298	458.6												1.13 ADD	S2S4 removed from test set due to inconsistent static HGL.			
			Start			S2R1	J-299	458.8	108.1	104.6	534.8	532.4	3.5	109.1	106.9	535.5	534.0	1.0	1%			2.3	2%	
				11:29:00 AM	917	57.84	S2S1	J-297	458.1	107.7	104.2	533.8	531.4	3.5	110.1	107.5	535.5	533.7	2.4			2%	3.3	3%
							S2S2	J-300	459.0	104.8	102.5	532.7	531.1	2.3	108.9	107.1	535.6	534.3	4.1			4%	4.6	4%
			End			S2S3	J-310	457.2	108.9	107.0	533.7	532.4	1.9	111.5	109.8	535.6	534.4	2.6	2%			2.8	3%	
				11:33:00 AM			S2S4	J-443	456.3	-	-	-	-	-	-	-	-	-	-			-	-	
			F2			S2F2	J-315	456.9																
			Start			S2R2	McAR-6	458.6	108.5	97.9	534.9	527.4	10.6	109.4	106.3	535.5	533.3	0.9	1%			8.4	9%	
				12:04:00 PM	859	54.18	S2S1	J-297	458.1	107.6	103.7	533.7	531.0	3.9	110.1	107.9	535.5	534.0	2.5			2%	4.2	4%
							S2S2	J-300	459.0	104.1	101.9	532.2	530.6	2.2	108.9	107.3	535.6	534.4	4.8			5%	5.4	5%
			End			S2S3	J-310	457.2	108.5	106.1	533.4	531.8	2.4	111.5	109.9	535.6	534.4	3.0	3%			3.8	4%	
				12:09:00 PM			S2S4	J-443	456.3	-	-	-	-	-	-	-	-	-	-			-	-	
			F3			S2F3	J-442	456.8																
			Start			S2R3	J-320	458.2	109.3	101.9	535.1	529.9	7.4	110.0	105.8	535.6	532.6	0.7	1%			3.9	4%	
				12:29:00 PM	917	57.84	S2S1	J-297	458.1	108.3	103.0	534.2	530.5	5.3	110.1	107.2	535.5	533.5	1.8			2%	4.2	4%
							S2S2	J-300	459.0	104.0	101.8	532.1	530.6	2.2	108.9	107.2	535.6	534.4	4.9			5%	5.4	5%
End			S2S3	J-310	457.2	108.6	105.9	533.5	531.6	2.7	111.5	109.8	535.6	534.4	2.9	3%	3.9	4%						
	12:34:00 PM			S2S4	J-443	456.3	-	-	-	-	-	-	-	-	-	-	-	-						
F4			S2F4	J-319	454.2																			
Start			S2R4	VER-7	456.9	108.3	100.2	533.0	527.3	8.1	111.9	108.6	535.6	533.3	3.6	3%	8.4	8%						
	12:54:00 PM	748	47.18	S2S1	J-297	458.1	107.9	104.2	534.0	531.4	3.7	110.1	108.3	535.5	534.3	2.2	2%	4.1	4%					
				S2S2	J-300	459.0	103.9	102.5	532.0	531.1	1.4	108.9	107.5	535.6	534.6	5.0	5%	5.0	5%					
End			S2S3	J-310	457.2	107.5	106.6	532.7	532.1	0.9	111.5	110.1	535.6	534.6	4.0	4%	3.5	3%						
	12:59:00 PM			S2S4	J-443	456.3	-	-	-	-	-	-	-	-	-	-	-	-						
3-Jul-20			F1			S3F1	J-396	472.3													Potential valve closure on larger main impacting tests 1, 2, 3, and 4. S2S4 removed from test set due to inconsistent static HGL.			
			Start			S3R1	J-397	472.5	87.8	65.8	534.3	518.8	22.0	89.1	81.4	535.2	529.8	1.3	1%			15.6	24%	
				8:56:00 AM	740	46.67	S3S1	J-395	470.8	90.3	69.5	534.3	519.7	20.8	91.5	86.0	535.2	531.3	1.2			1%	16.5	24%
							S3S2	PARK-1	475.0	83.1	64.7	533.4	520.5	18.4	85.7	82.0	535.2	532.6	2.6			3%	17.3	27%
			End			S3S3	J-377	473.7	84.5	64.7	533.1	519.2	19.8	87.4	82.4	535.2	531.7	2.9	3%			17.7	27%	



# APPENDIX

## D BIG EDDY CALIBRATION TABLES



# APPENDIX

## **D** USEPA BENCHMARKS USED IN CONSERVATION PLANNING

## APPENDIX B

### BENCHMARKS USED IN CONSERVATION PLANNING

**Table B-1: Recent Estimates of Indoor Water Use With and Without Conservation**

Type of Use	Without conservation		With conservation		Savings
	Amount (gpcd)	Percent of total	Amount (gpcd)	Percent of total	
Toilets	18.3	28.4%	10.4	23.2%	44%
Clothes washers	14.9	23.1%	10.5	23.4%	30%
Showers	12.2	18.8%	10.0	22.4%	18%
Faucets	10.3	16.0%	10.0	22.5%	2%
Leaks	6.6	10.2%	1.5	3.4%	77%
Baths	1.2	1.9%	1.2	2.7%	0%
Dish washers	1.1	1.6%	1.1	2.4%	0%
<b>Total indoor water use</b>	<b>64.6</b>	<b>100%</b>	<b>44.7</b>	<b>100%</b>	<b>31%</b>

Source: AWWA WaterWiser, "Household End Use of Water Without and With Conservation," 1997 *Residential Water Use Summary - Typical Single Family Home* (<http://www.waterwiser.org/wateruse/tables.html>).

gpcd = gallons per capita per day

Note: These data are provided for illustrative purposes only and may not be applicable to a given situation. To the extent practical, planners use system-specific assumptions and estimates.

## Table B-2: Benchmarks for Estimating Residential End Uses of Water

Type of use	Units	Likely range of average values
<b>INDOOR USES</b>		
Average household size	Persons	2.0-3.0
Frequency of toilet flushing	Flushes/person/day	4.0-6.0
Flushing volumes	Gallons/flush	1.6-8.0
Fraction of leaking toilets	Percent	0-30
Showering frequency	Showers/person/day	0-1.0
Duration of average shower	Minutes	5-15
Shower flow rates	Gallons/minute	1.5-5.0
Bathing frequency	Baths/person/day	0-0.2
Volume of water	Gallons/cycle	30-50
Washing machine use	Loads/person/day	0.2-0.5
Volume of water	Gallons/cycle	45-50
Dishwasher use	Loads/person/day	0.1-0.3
Volume of water	Gallons/cycle	10-15
Kitchen faucet use	Minutes/person/day	0.5-5.0
Faucet flow rates	Gallons/minute	2.0-3.0
Bathroom faucet use	Minutes/person/day	0.5-3.0
Faucet flow rates	Gallons/minute	2.0-3.0
<b>OUTDOOR USES</b>		
Average lot size[a]	Square feet	5000-8000
Average house size[a]	Square feet	1200-2500
Landscape area[a]	Square feet	4000-5000
Fraction of lot size in turf[a]	Percent	30-50
Water application rates[a]	Feet/year	1-5
Percent of homes with pools	Percent	10-25
Pool evaporation losses	Feet/year	3-7
Frequency of refilling pools	Times per year	1-2
Frequency of car washing	Times/month	1-2

Source: Duane D. Baumann, John J. Boland, and W. Michael Hanemann, *Urban Water Demand Management and Planning* (New York: McGraw Hill, 1998), 254.

[a] Reflects single-family averages.

Note: These data are provided for illustrative purposes only and may not be current or applicable. To the extent practical, planners should regionally appropriate or system-specific assumptions and estimates.

## Table B-3: Sample Calculation of Water Savings from Showerhead Replacement

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The following calculations represent the water savings expected as the result of a showerhead retrofit program. The savings rate represents a difference in average winter water use between homes with low-flow showerheads and homes without low-flow showerheads.

- Nonconserving showerhead flow rate = 3.4 gallons/minute
- Low-flow showerhead flow rate = 1.9 gallons/minute
- Estimated showering time = 4.8 minutes/person/day
- Average winter household water use = 200 gallons per household per day
- Average household size = 2.5 persons
- Water use with nonconserving showerhead = (3.4 gal/min) × (4.8 min/person/day) = 16.3 gpcd
- Water use with low-flow showerhead = (1.9 gal/min) × (4.8 min/person/day) = 9.1 gpcd
- Water savings = 16.3 gpcd – 9.1 gpcd = 7.2 gpcd

At an average household size of 2.5 persons, the savings rate would be 18.0 gallons per household per day (2.5 persons × 7.2 GPCD). The formula for calculating the reduction factors representing the fraction of, for example, single-family winter water use is

$$R = (18.0 \text{ GPHD}) / (200 \text{ GPHD during winter}) = 0.09 \text{ (or 9 percent)}$$

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Source: Duane D. Baumann, John J. Boland, and W. Michael Hanemann, *Urban Water Demand Management and Planning* (New York: McGraw Hill, 1998): 255.

Note: These data are provided for illustrative purposes only and may not be current or applicable. To the extent practical, planners should regionally appropriate or system-specific assumptions and estimates.

## Table B-4: Benchmarks for Savings from Selected Conservation Measures

Category	Measure	Reduction in end use	Life span (years)
<b>LEVEL 1 MEASURES</b>			
Universal metering	Connection metering	20 percent	8 to 20
	Submetering	20 to 40 percent	8 to 20
Water accounting and loss control	System audits and leak detection	Based on system	na
Costing and pricing	10% increase in residential prices	2 to 4 percent	na
	10% increase in nonresidential prices	5 to 8 percent	na
	Increasing-block rate	5 percent	na
Information and education	Public education and behavior changes	2 to 5 percent	na
<b>LEVEL 2 MEASURES</b>			
End-use audits	General industrial water conservation	10 to 20 percent	na
	Outdoor residential use	5 to 10 percent	na
	Large landscape water audits	10 to 20 percent	na
Retrofits	Toilet tank displacement devices (for toilets using > 3.5 gallons/flush)	2 to 3 gpcd	1.5
	Toilet retrofit	8 to 14 gpcd	1.5
	Showerhead retrofit (aerator)	4 gpcd	1 to 3
	Faucet retrofit (aerator)	5 gpcd	1 to 3
	Fixture leak repair	0.5 gpcd	1
	Governmental buildings (indoors)	5 percent	na
	Pressure management	Pressure reduction, system	3 to 6 percent of total production
Pressure-reducing valves, residential		5 to 30 percent	na
Outdoor water-use efficiency	Low water-use plants	7.5 percent	10
	Lawn watering guides	15 to 20 percent	na
	Large landscape management	10 to 25 percent	na
	Irrigation timer	10 gpcd	4
<b>LEVEL 3 MEASURES</b>			
Replacements and promotions	Toilet replacement, residential	16 to 20 gpcd	15 to 25
	Toilet replacement, commercial	16 to 20 gpcd	10 to 20
	Showerhead replacement	8.1 gpcd	2 to 10
	Faucet replacement	6.4 gpcd	10 to 20
	Clothes washers, residential	4 to 12 gpcd	12
	Dishwashers, residential	1 gpcd	12
	Hot water demand units	10 gpcd	na
Reuse and recycling	Cooling tower program	Up to 90 percent	na
Water-use regulation	Landscape requirements for new developments	10 to 20 percent in sector	na
	Graywater reuse, residential	20 to 30 gpcd	na
Integrated resource management	Planning and management	Energy, chemical, and wastewater treatment costs	na

Source: Compiled from various sources. Actual water savings can vary substantially according to a number of factors. These data are provided for illustrative purposes only and may not be current or applicable. To the extent practical, planners should regionally appropriate or system-specific assumptions and estimates. na = not available

## Table B-5: Water Efficiency Standards Established by The Energy Policy Act of 1992

**Faucets.** The maximum water use allowed by any of the following faucets manufactured after January 1, 1994, when measured at a flowing water pressure of 80 pounds per square inch, is as follows:

Faucet type	Maximum flow rate (gallons per minute or per cycle)
Lavatory faucets	2.5 gpm
Lavatory replacement aerators	2.5 gpm
Kitchen faucets	2.5 gpm
Kitchen replacement aerators	2.5 gpm
Metering faucets	0.25 gpc

**Showerheads.** The maximum water use allowed for any showerhead manufactured after January 1, 1994, is 2.5 gallons per minute when measured at a flowing pressure of 80 pounds per square inch.

**Water Closets.** (1) The maximum water use allowed in gallons per flush for any of the following water closets manufactured after January 1, 1994, is as follows:

Water closet type	Maximum flush rate (gallons per flush)
Gravity tank-type toilets	1.6 gpf
Flushometer tank toilets	1.6 gpf
Electromechanical hydraulic toilets	1.6 gpf
Blowout toilets	3.5 gpf

(2) The maximum water use allowed for any gravity tank-type white two-piece toilet which bears an adhesive label conspicuous upon installation of the words "Commercial Use Only" manufactured after January 1, 1994 and before January 1, 1997, is 3.5 gallons per flush.

(3) The maximum water use allowed for flushometer valve toilets, other than blowout toilets, manufactured after January 1, 1997, is 1.6 gallons per flush.

**Urinals.** The maximum water use allowed for any urinals manufactured after January 1, 1994, is 1.0 gallons per flush.

Note: These standards were developed in 1992. New and emerging technologies can increase the cost effectiveness of conservation measures, affect demand forecasts, and eventually lead to the establishment of new standards.

Table B-6: Potential Water Savings From Efficient Fixtures

Fixture [a]	Fixture capacity [b]	Water use (gpd)		Water savings (gpd)	
		Per capita	2.7-person household	Per capita	2.7-person household
<b>Toilets [c]</b>					
Efficient	1.5 gallons/flush	6.0	16.2	na	na
Low-flow	3.5 gallons/flush	14.0	37.8	8.0	21.6
Conventional	5.5 gallons/flush	22.0	59.4	16.0	43.2
Conventional	7.0 gallons/flush	28.0	75.6	22.0	59.4
<b>Showerheads [d]</b>					
Efficient	2.5 [1.7] gal/min	8.2	22.1	na	na
Low-flow	3.0 to 5.0 [2.6] gal/min	12.5	33.8	4.3	11.7
Conventional	5.0 to 8.0 [3.4] gal/min	16.3	44.0	8.1	22.0
<b>Faucets [e]</b>					
Efficient	2.5 [1.7] gal/min	6.8	18.4	na	na
Low-flow	3.0 [2.0] gal/min	8.0	21.6	1.2	3.2
Conventional	3.0 to 7.0 [3.3] gal/min	13.2	36.6	6.4	17.2
<b>Toilets, Showerheads, and Faucets Combined</b>					
Efficient	Not applicable	21.0	56.7	na	na
Low-flow	Not applicable	34.5	93.2	13.4	36.4
Conventional	Not applicable	54.5	147.2	33.5	90.4

Source: Amy Vickers, "Water Use Efficiency Standards for Plumbing Fixtures: Benefits of National Legislation," *American Water Works Association Journal*. Vol. 82 (May 1990): 53.

na = not applicable

[a] Efficient = post-1994

Low-flow = post-1980

Conventional = pre-1980

[b] For showerheads and faucets: maximum rated fixture capacity (measured fixture capacity). Measured fixture capacity equals about two-thirds the maximum.

[c] Assumes four flushes per person per day; does not include losses through leakage.

[d] Assumes 4.8 shower-use-minutes per person per day.

[e] Assumes 4.0 faucet-use-minutes per person per day.