THE VILLAGE OF
NAKUSP

ANNUAL WATER REPORT 2019

VILLAGE OF NAKUSP

Abstract

Nakusp Water System, Facility # 0211995

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1.0 Introduction:

Under the terms of the Village of Nakusp Operating Permit for the Nakusp Water System, Facility #0211995, as per Section 8 of the *Drinking Water Protection Act*, the Village is required to provide an annual report to the public and users of the water system. This report is to provide a summary of the water system operation, maintenance, upgrades, and testing procedures and is submitted to Interior Health.

Please note that Sections 2, 3, 4 and 10 are taken directly from the Village of Nakusp Emergency Response Plan, as prepared by Austin Engineering, 2016.

Inquiries relating to the water system should be directed to the Public Works Department:

1325 Hot Springs Rd
Nakusp, BC, V0G 1R0
Office: 250-265-3556

2.0 CUSTOMER DEMOGRAPHICS:

2019 annual invoiced customers are as follows[1]:

Rate Code	Rate Description	Customer Count	Strata Units
01 W01	Water Single Family Dwelling	727	744
01 W02	Water Duplex, Triplex or Apartment - first unit	27	27
01 W03	Water Retail and Other Business	62	81
01 W04	Water Hotel/motel - owner/manager residence	2	2
01 W05	Water Cafe, Restaurant, Drive-in	8	8
01 W08	Water Large Grocer	1	1
01 W09	Church or Church Hall	8	8
01 W10	WATER HALL OR AMUSEMENT PLACE	3	3
01 W11	Water Licenced Lounge	4	4
01 W12	Water Car Wash - per wash unit	2	3
01 W13	Water bottling plant - $0.13464/cubic meter based on 2013 usage	3	3
01 W14	Water Hospital, Intermediate Care Facility - per bed	2	43
01 W17	WATER SPORTS COMPLEX	1	1
01 W18	WATER CONCRETE PLANT	1	1
01 W19	WATER CEMETERY	1	3
01 W20	WATER MOBILE HOME - each pad	5	64
01 W21	WATER Drive In Restaurant (no indoor seating)	2	2
01 W24	WATER LAUNDROMAT PER WASHER	1	12
01 W25	WATER BEACH PARK WASHROOMS	1	2
01 W26	WATER BEACH PARK SPRINKLING	1	5
01 W30	Water Campground - per site	2	41
01 W40	WATER FARM WITH LIVESTOCK	7	7
01 W41	Water Garage, Service Station or Body Shop	12	12
01 W52	Water - Apartment - each additional unit	24	78
01 W84	Water Hotel/motel - per room	8	122
01 W99	WATER Vacant lot with service available	2	2
01 WES	WATER NAKUSP ELEMENTARY SCHOOL	1	1
01 WSS	WATER NAKUSP SECONDARY SCHOOL	1	1
		919	**1,281.00**

Table 1: 2019 Invoiced Water Consumers

[1] A number of these connections are located outside of the Village of Nakusp's municipal boundary.

3.0 WATER COLLECTION, TREATMENT & DISTRIBUTION SYSTEM:

The Village of Nakusp's water system is supplied by both surface and groundwater sources. Typical system operation can be described as operating in two zones:

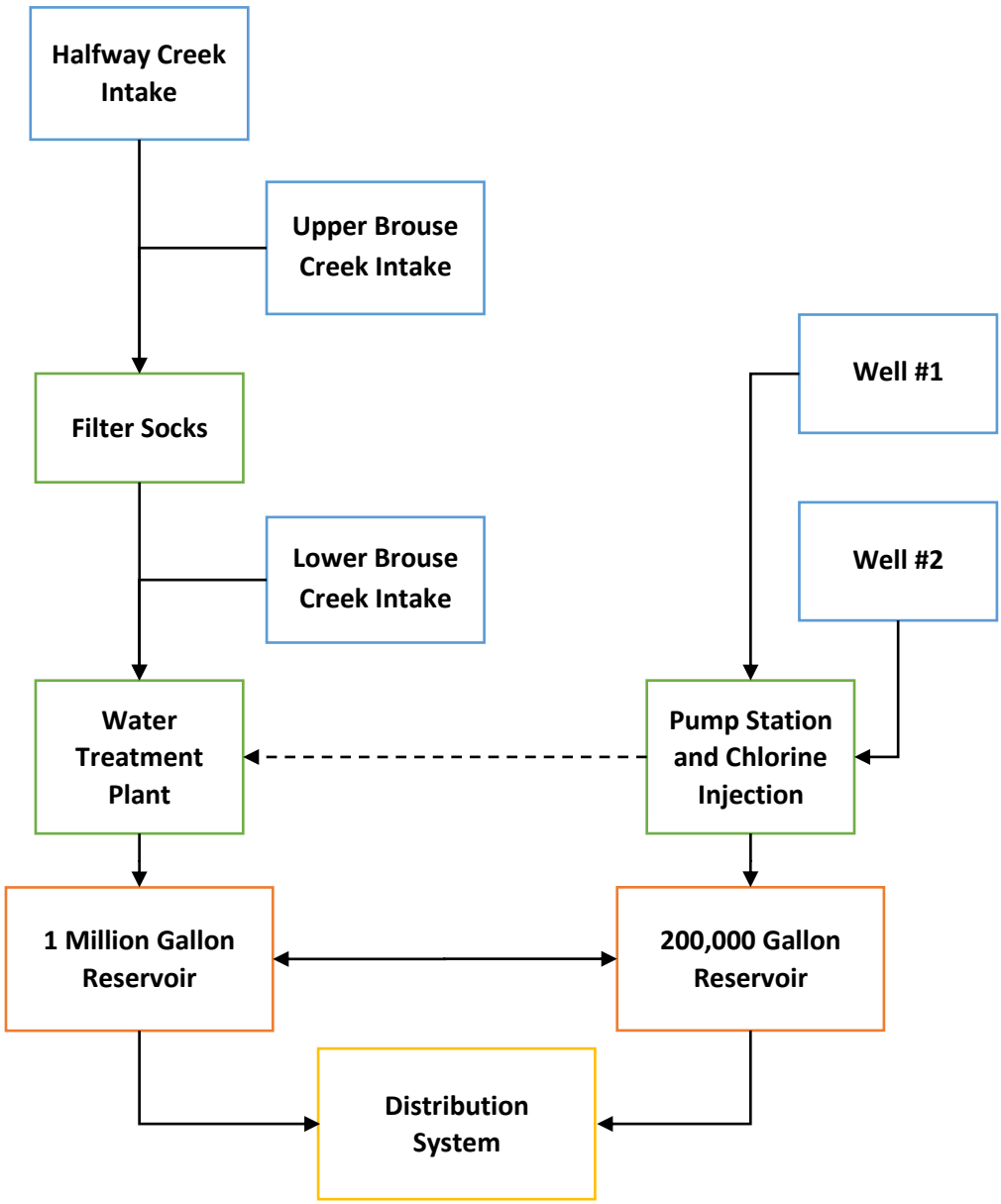


Figure 1: Nakusp Water System Schematic

Upper Distribution Zone

Raw water is supplied by surface water intakes on Halfway Creek, Upper Brouse Creek and Lower Brouse Creek. The surface water then undergoes membrane ultrafiltration, ultraviolet (UV) light, and chlorine injection treatment at the water treatment plant. The water treatment plant directly supplies the 1,000,000 gallons (3,785,000 L) upper reservoir which subsequently services the upper distribution zone.

Lower Distribution Zone

Raw water is supplied by two (2) groundwater wells located in the same aquifer. Groundwater undergoes chlorine injection prior to suppling the 200,000 gallons (757,000 L) lower reservoir which subsequently services the lower distribution zone.

Together these systems contain one (1) treatment plant, two (2) groundwater wells, three (3) surface water intakes, 26.7 km of water main, two (2) reservoirs, (1) pressure reducing station and one (1) booster pump station.

The upper reservoir is capable of supplying water to the lower reservoir (gravity) and the lower reservoir to the upper reservoir (by means of the booster station) therefore each source can indirectly supply water to any location within the system providing system redundancy under emergency circumstances. An overview schematic for the Nakusp water system can be found in **Error! Reference source not found.**.

Village of Nakusp Water Treatment Plant (WTP)

The Village of Nakusp Water Treatment Plant (WTP) is supplied with raw water from the surface water intakes located at Brouse Creek and Halfway Creek. Raw water is gravity fed through a coarse filter sock chamber and a micro hydro facility before reaching the WTP. At the plant water is treated using membrane ultrafiltration, ultraviolet (UV) light, and chlorine disinfection. The maximum capacity of the WTP is 25 L/s. A general process for the water treatment plant can be found below in Figure 2: General WTP Process.

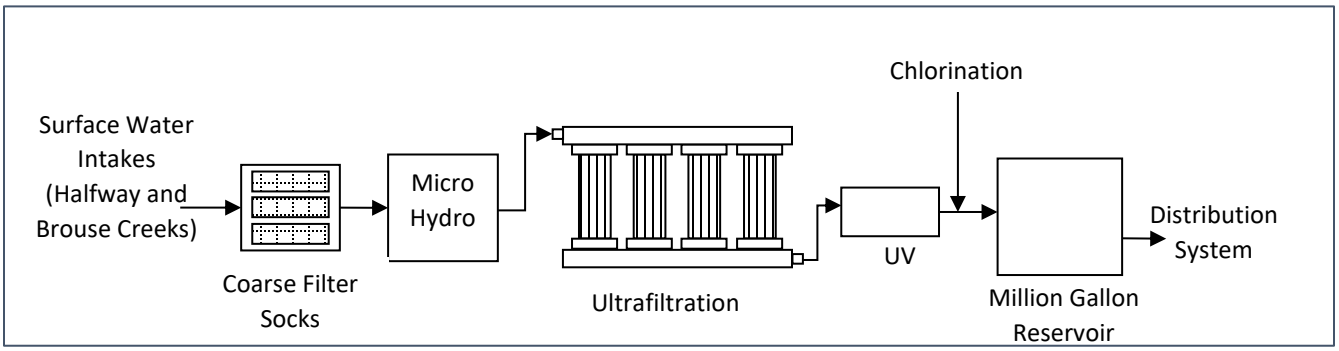


Figure 2: General WTP Process

Groundwater Wells

The Village of Nakusp water system contains two (2) groundwater wells (Well #1 and Well #2). Both wells are located in close proximity to each other, north of the arena in the Nakusp Recreation Park within a "confined to semi-confined aquifer comprised of coarse-grained alluvial fan sediments overlain by silt and clay" with a static water level of approximately 18 m below ground surface (Golder Associates, 2014).

Groundwater sourced from the wells undergoes chlorine injection prior to being routed directly into the 200,000 Gallon Reservoir and the rest of the distribution system. Connection between the WTP and the groundwater wells is available however this is typically bypassed.

Due to the proximity of the two groundwater wells, a groundwater contamination event is likely to impact both wells. The wells can therefore only be considered as redundant to each other for supply related emergency situations. Neither well should be utilized if the other has a contaminant related emergency as both are likely to be impacted.

A summary of well characteristics is outlined below in Table 2.

	Well #1 (Golder Associates, 2014)	Well #2 (Golder Associates, 2014 & Village of Nakusp)
BC Ministry of Environment Well Tag Number	88581	104165
Installation Year	2004	2015
Total Depth	84.0 m	124.4 m
Capacity[2] (Limited Based on Current Pump)	46.6 L/s (675 US gpm)	81 L/s[3] (1,270 US gpm)
Current Pump	50 hp	75 hp
Typical Pump Flowrate at Maximum Power	23 L/s (364 US gpm)	28 L/s (444 US gpm)

Table 2: Well Summary (Golder Associates, 2014 and the Village of Nakusp)

4.0 OPERATIONS & MAINTENANCE:

Operations and maintenance procedures are important safeguards for several potential emergency risks and can help to reduce the impact of unavoidable emergency situations. Notable operations and maintenance procedures that the Village of Nakusp employs, related to potential emergencies and their response, are outlined in Table 3 below.

O&M Procedure	Emergency Effects	Potential for Improvement
Locked buildings, fenced reservoir	Protection from tampering	Increased security measures (cameras/security company/better signage/lock gates providing vehicle access to intake locations.
SCADA system connected to all water system entities	Response time is reduced due to on-going/constant surveillance and effective notification system	
Recorded routine O&M checks performed and recorded	Likelihood of unexpected failure reduced	
Documented cross connection control program in place	Reduce likelihood of contamination	
Multiple water supply sources available for whole system (Groundwater wells and WTP)	Redundancy for potential loss/reduction of available water supply	Investigate options to increase supply from the surface water Halfway and Brouse Creeks intakes. Investigate options for a the third well to increase redundancy and water production.
Distribution system flushing program (annually in spring and fall)	Reduce potential of stagnation/ contamination	

Table 3: Operations and Maintenance Procedures

[2] **Capacity is limited due to the current pump installed in the wells**

[3] **Limited to a maximum of 63 L/s (1,000 US gpm) as an environmental assessment has not been completed under the *BC Environmental Assessment Act*.**

5.0 WATER QUALITY SAMPLING:

Water quality sampling frequency and procedures are important to the realization of a potential emergency event. The *BC Drinking Water Protection Regulation – Schedule B* outlines the required frequency of monitoring samples. The Village of Nakusp's Water System falls into the category for populations of less than 5,000 which requires four (4) samples per nth. The Village of Nakusp currently meets this sampling requirement by taking samples from seven (7) distinct locations within the system. Approximate sampling locations are outlined in Figure 3.

Samples for external analysis are taken by qualified Water Operators and sent monthly to qualified laboratories (CARO Analytical Services, or BC Centre for Disease Control Laboratory Services). All lab results are documented and kept on file. A summary of water system monitoring is outlined in Table 4.

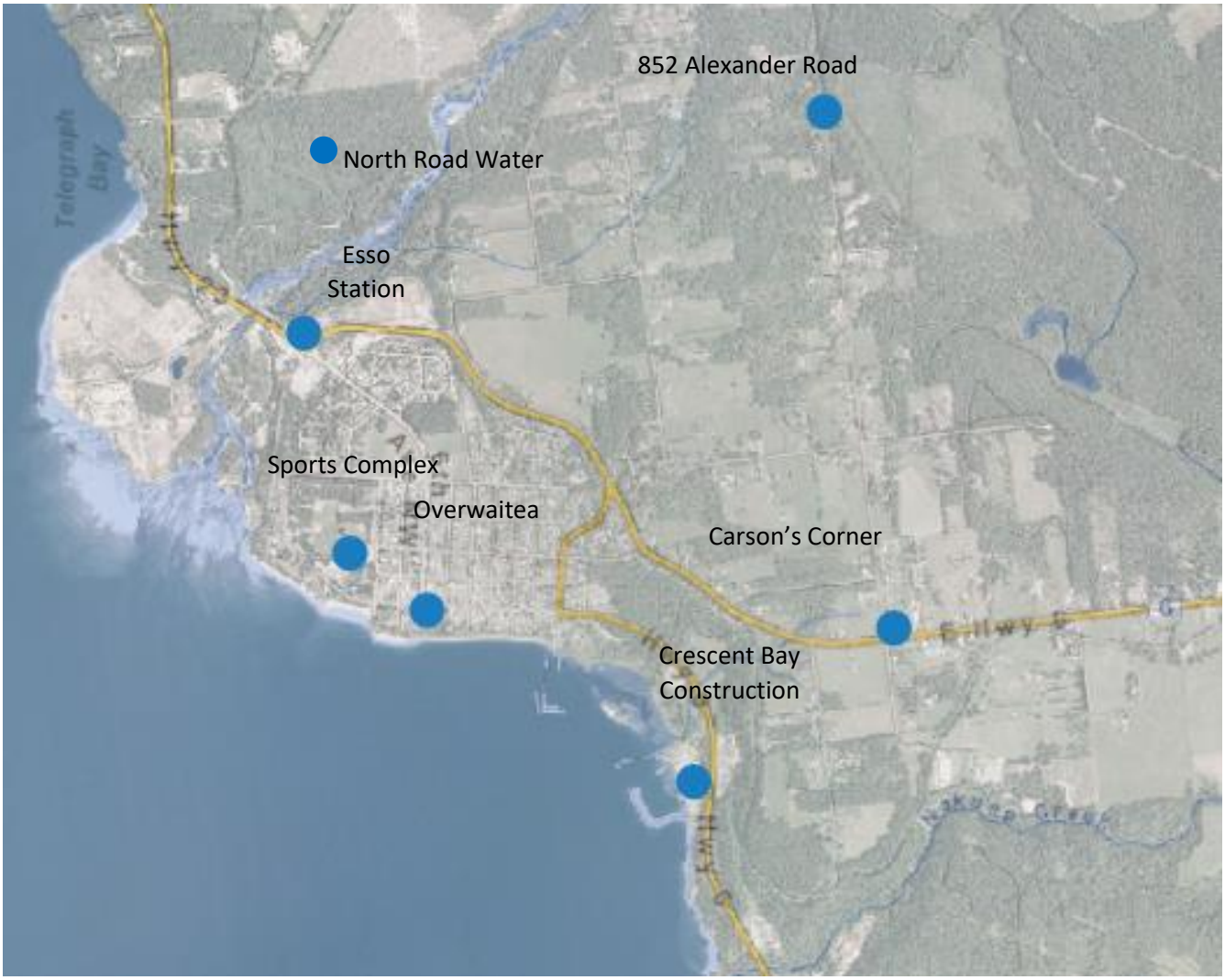


Figure 3: Approximate Sampling Locations

Contamination Events

In the event of suspected or realized contamination in the water system, further water quality sampling is a critical step in resolving the situation. Due to the time required for sampling, laboratory analysis, and results, it should occur as quickly as possible (notification of Interior Health and possible public notification are the priority).

Potential water contaminants that would need to be sampled for in an emergency event can be categorized as:

- Microbial Pathogens
- Chemical and Physical
- Radiological

In the event of a water quality emergency, both the relevance of a test and the turn-around time for result delivery required for decision making, should be considered on a case-by-case basis as required. Once results are available, a comparison should be made to the relevant *BC Water Quality Guideline*. Water sampling Standard Operating Procedures (SOPs) should be followed under all situations.

Frequency	Test
Weekly	Microbial (E.Coli and Total Coliform)
Monthly	Turbidity monitoring data UV and UV sensor data Chlorine monitoring data
Quarterly	Trihalomethane Holoacetic acids
Semi-Annually	Baseline analysis for potential contaminants of groundwater, including: hydrocarbons (benzene, toluene, ethylbenzene & xylene, light and heavy extractable petroleum hydrocarbons -including polyaromatic hydrocarbons, volatile organic compounds; herbicides and pesticides; metals, nitrates; nitrites and phosphorus; and/or microbiological parameters (coliforms, E. coli); Specific contaminants of concern
Annually	Full comprehensive raw water analysis for each source

Table 4: Sampling Overview (Adapted from Village of Nakusp 2015 Annual Water Report)

6.0 2019 WATER QUALITY ANALYSIS RESULTS

SITE	DATE	Residual Cl ppm	TC Count/100ML	EC Count /100 ML
Carson's Corner				
	5-Feb-19	0.83	L1	L1
	26-Mar-19	0.34	L1	L1
	14-May-19	0.81	L1	L1
	3-Jul-19	0.5	L1	L1
	20-Aug-19	0.8	L1	L1
	8-Oct-19	0.71	L1	L1
	26-Nov-19	0.65	L1	L1
NRW				
	20-Feb-19	0.25	L1	L1
	2-Apr-19	0.65	L1	L1
	22-May-19	0.35	L1	L1
	9-Jul-19	0.4	L1	L1
***OG- resampled Sept 3/19**	27-Aug-19	0.42	OG	OG
	5-Sep-19		L1	L1
	16-Oct-19	0.47	L1	L1
	3-Dec-19	0.45	L1	L1
***OG= Overgrown**				
852 Alexander Rd.				
	3-Jan-19	No courier		
	8-Jan-19	0.21	L1	L1
	20-Feb-19	0.31	L1	L1
	9-Apr-19	0.22	L1	L1
	28-May-19	0.42	L1	L1
	16-Jul-19	0.17	L1	L1
	5-Sep-19	0.5	L1	L1
	22-Oct-19	0.45	L1	L1
	10-Dec-19	0.72	L1	L1
Sports Complex				
	8-Jan-19	0.38	L1	L1
	26-Feb-19	0.47	L1	L1
	16-Apr-19	0.33	L1	L1
	4-Jun-19	0.39	L1	L1
	23-Jul-19	0.52	L1	L1
	10-Sep-19	0.33	L1	L1
	29-Oct-19	0.45	L1	L1
	17-Dec-19	0.48	L1	L1
Crescent Bay Const.				
	15-Jan-19	0.4	L1	L1
	5-Mar-19	0.33	L1	L1
	24-Apr-19	0.51	L1	L1
	11-Jun-19	0.42	L1	L1
	30-Jul-19	0.35	L1	L1
	17-Sep-19	0.43	L1	L1
Caro did not test samples had to resample	5-Nov-19	0.45		
	19-Nov-19		L1	L1
Overwaitea				
	22-Jan-19	0.4	L1	L1
	12-Mar-19	0.42	L1	L1
	30-Apr-19	0.41	L1	L1
	18-Jun-19	0.45	L1	L1
	7-Aug-19	0.42	L1	L1
	24-Sep-19	0.45	L1	L1
	13-Nov-19	0.49	L1	L1
Esso Station				
	29-Jan-19	0.34	L1	L1
	19-Mar-19	0.4	L1	L1
	7-May-19	0.38	L1	L1
	25-Jun-19	0.45	L1	L1
	13-Aug-19	0.31	L1	L1
	1-Oct-19	0.45	L1	L1
	19-Nov-19	0.3	L1	L1

2018 Annual Comprehensive Source Water Analysis (Untreated Water)

Well #1 Comprehensive - 2019-12-04

Anions	Results	Guideline	RL Units	Analyzed
Chloride	**5.26**	AO≤250	0.10 mg/L	2019-12-06
Fluoride	**0.18**	MAC = 1.5	0.10 mg/L	2019-12-06
Nitrate (as N)	**0.446**	MAC = 10	0.010mg/L	2019-12-06
Nitrite (as N)	< 0.010	MAC = 1	0.010,g/L	2019-12-06
Sulfate	**5.9**	AO≤500	1.0 mg/L	2019-12-06

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	149	None required	0.500 mg/L	N/A
Langelier Index	0.3	N/A	-5.0	2019-12-16
Nitrogen, Organic	<0.0500	N/A	0.0500 mg/L	N/A
Solids, Total Dissolved	164	AO≤250	1.00 mg/L	N/A

General Parameters	**Results**	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	147	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Bicarbonate (as CaCO3)	147	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Ammonia, Total (as N)	0.020	None Required	0.020 mg/L	2019-12-06	
Carbon, Total Organic	0.74	N/A	0.50 mg/L	2019-12-06	
Colour, True	< 5.0	AO≤15	5.0 CU	2019-12-07	
Conductivity (EC)	293	N/A	2.0 µS/cm	2019-12-06	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2019-12-06	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2019-12-07	
pH	7.96	7.0-10.5	0.10 pH units	2019-12-06	HT2
Phosphorus, Total (as P)	0.0043	N/A	0.0020 mg/L	2019-12-10	
Sulfide, Total	< 0.020	AO :5 0.05	0.020 mg/L	2019-12-06	
Temperature, at pH	21.5	N/A	°C	2019-12-06	HT2
Turbidity	< 0.10	OG < 1	0.10 NTU	2019-12-05	
UV Transmittance @ 254nm	90.4	N/A	0.10% T	2019-12-09	

Microbiological Parameters	**Results**	**Guidelines**	**RL Units**	**Analyzed**
Coliforms, Total	< 1	MAC = 0	1 CFU/100 mL	2019-12-05
E. coli	< 1	MAC = 0	1 CFU/100 mL	2019-12-05

Well #1 Comprehensive (untreated) - 2019-12-04, Continued

Total Metals	Results	Guideline	RL Unit	Analyzed
Aluminum, total	< 0.0050	OG < 0.1	0.0050	2019-12-14
Antimony, total	< 0.00020	MAC = 0.006	0.00020	2019-12-14
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	2019-12-14
Barium, total	0.390	MAC = 1	0.0050	2019-12-14
Boron, total	0.0193	MAC = 5	0.0050	2019-12-14
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2019-12-14
Calcium, total	47.2	None Required	0.20 mg/L	2019-12-14
Chromium, total	0.00285	MAC = 0.05	0.00050 mg/L	2019-12-14
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2019-12-14
Copper, total	0.00042	AO≤1	0.00040 mg/L	2019-12-14
Iron, total	< 0.010	AO≤ 0.3	0.010 mg/L	2019-12-14
Lead, total	< 0.00020	MAC = 0.01	0.00020 mg/L	2019-12-14
Magnesium, total	6.94	None Required	0.010 mg/L	2019-12-14
Manganese, total	< 0.00020	AO≤0.05	0.00020 mg/L	2019-12-14
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2019-12-14
Molybdenum, total	0.00022	N/A	0.00010 mg/L	2019-12-14
Nickel, total	< 0.00040	N/A	0.00040 mg/L	2019-12-14
Potassium, total	1.31	N/A	0.10 mg/L	2019-12-14
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2019-12-14
Sodium, total	4.29	AO≤200	0.10 mg/L	2019-12-14
Strontium, total	0.885	N/A	0.0010 mg/L	2019-12-14
Uranium, total	0.00168	MAC = 0.02	0.000020 mg/L	2019-12-14
Zinc, total	0.0043	AO≤5	0.0040 mg/L	2019-12-14

Well #2 Comprehensive (untreated) - 2018-12-04

Anions	Results	Guideline	RL Unit	Analyzed
Chloride	4.50	AO≤250	0.10 mg/L	2019-12-06
Fluoride	0.22	MAC = 1.5	0.10 mg/L	2019-12-06
Nitrate (as N)	0.474	MAC = 10	0.010 mg/L	2019-12-06
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2019-12-06
Sulfate	4.7	AO≤500	1.0 mg/L	2019-12-06

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	105	None required	0.500 mg/L	N/A
Langelier Index	-0.06	N/A	-5.0	2019-12-16
Nitrogen, Organic	<0.0500	N/A	0.0500 mg/L	N/A
Solids, Total Dissolved	119	AO≤250	1.00 mg/L	N/A

General Parameters	Results	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	104	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Bicarbonate (as CaCO3)	104	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Ammonia, Total (as N)	0.021	None	0.020 mg/L	2019-12-06	
Carbon, Total Organic	.74	N/A	0.50 mg/L	2019-12-10	
Colour, True	< 5.0	AO≤15	5.0 CU	2019-12-07	
Conductivity (EC)	216	N/A	2.0 µS/cm	2019-12-06	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2019-12-06	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2019-12-07	

pH	7.85	7.0-10.5	0.10 pH units	2019-12-06	HT2
Phosphorus, Total (as P)	0.0079	N/A	0.0020 mg/L	2019-12-10	
Sulfide, Total	< 0.020	AO≤ 0.05	0.020 mg/L	2019-12-06	
Temperature, at pH	21.6	N/A	°C	2019-12-06	HT2
Turbidity	0.50	OG < 1	0.10 NTU	2019-12-05	
UV Transmittance @ 254nm	89.9	N/A	0.10% T	2019-12-009	HT1

Well #2 Comprehensive (untreated)- 2018-12-04

Microbiological Parameters	**Results**	**Guidelines**	**RL Units**	**Analyzed**
Coliforms, Total	< 1	MAC = 0	1 CFU/100 mL	2019-12-05
E. coli	< 1	MAC = 0	1 CFU/100 mL	2019-12-05

Total Metals	**Results**	**Guideline**	**RL Unit**	**Analyzed**
Aluminum, total	< 0.0050	OG < 0.1	0.0050	2019-12-14
Antimony, total	< 0.00020	MAC = 0.006	0.00020	2019-12-14
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	2019-12-14
Barium, total	0.276	MAC = 1	0.0050	2019-12-14
Boron, total	0.0164	MAC = 5	0.0050	2019-12-14
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2019-12-14
Calcium, total	33.5	None Required	0.20 mg/L	2019-12-14
Chromium, total	0.00430	MAC = 0.05	0.00050 mg/L	2019-12-14
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2019-12-14
Copper, total	0.00032	AO≤1	0.00040 mg/L	2019-12-14
Iron, total	0.055	AO≤ 0.3	0.010 mg/L	2019-12-14
Lead, total	0.00021	MAC = 0.01	0.00020 mg/L	2019-12-14
Magnesium, total	5.15	None Required	0.010 mg/L	2019-12-14
Manganese, total	0.00131	AO≤0.05	0.00020 mg/L	2019-12-14
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2019-12-14
Molybdenum, total	0.00079	N/A	0.00010 mg/L	2019-12-14
Nickel, total	< 0.00041	N/A	0.00040 mg/L	2019-12-14
Potassium, total	1.50	N/A	0.10 mg/L	2019-12-14
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2019-12-14
Sodium, total	4.13	AO≤200	0.10 mg/L	2019-12-14
Strontium, total	0.567	N/A	0.0010 mg/L	2019-12-14
Uranium, total	0.000635	MAC = 0.02	0.000020 mg/L	2019-12-14
Zinc, total	0.0050	AO≤5	0.0040 mg/L	2019-12-14

Surface Comprehensive (untreated) - 2018-12-04

Anions	Results	Guideline	RL Unit	Analyzed
Chloride	0.12	AO≤250	0.10 mg/L	2019-12-06
Fluoride	0.35	MAC = 1.5	0.10 mg/L	2019-12-06
Nitrate (as N)	<0.010	MAC = 10	0.010 mg/L	2019-12-06
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2019-12-06
Sulfate	4.7	AO≤500	1.0 mg/L	2019-12-06

Calculated Parameters	Results	Guideline	RL Units	Analyzed
Hardness, Total (as CaCO3)	47.0	None required	0.500 mg/L	N/A
Langelier Index	-1.1	N/A	-5.0	2019-12-16
Nitrogen, Organic	<0.0500	N/A	0.0500 mg/L	N/A
Solids, Total Dissolved	54.6	AO≤250	1.00 mg/L	N/A

General Parameters	Results	Guideline	RL Units	Analyzed	Qualifier
Alkalinity, Total (as CaCO3)	39.2	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Bicarbonate (as CaCO3)	39.2	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0 mg/L	2019-12-06	
Ammonia, Total (as N)	0.042	None	0.020 mg/L	2019-12-06	
Carbon, Total Organic	1.17	N/A	0.50 mg/L	2019-12-10	
Colour, True	6.3	AO≤15	5.0 CU	2019-12-07	
Conductivity (EC)	103	N/A	2.0 µS/cm	2019-12-06	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020 mg/L	2019-12-06	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2019-12-07	
pH	7.60	7.0-10.5	0.10 pH units	2019-12-06	HT2
Phosphorus, Total (as P)	0.0095	N/A	0.0020 mg/L	2019-12-10	
Sulfide, Total	< 0.020	AO≤ 0.05	0.020 mg/L	2019-12-06	
Temperature, at pH	21.6	N/A	°C	2019-12-06	HT2
Turbidity	0.32	OG < 1	0.10 NTU	2019-12-05	
UV Transmittance @ 254nm	86.6	N/A	0.10% T	2019-12-009	HT1

Surface Comprehensive (untreated) - 2018-12-04, Continued

Microbiological Parameters	Results	Guidelines	RL Units	Analyzed
Coliforms, Total	5	MAC = 0	1 CFU/100 mL	2019-12-05
E. coli	< 1	MAC = 0	1 CFU/100 mL	2019-12-05

Total Metals	Results	Guideline	RL Unit	Analyzed
Aluminum, total	0.0154	OG < 0.1	0.0050	2019-12-14
Antimony, total	< 0.00020	MAC = 0.006	0.00020	2019-12-14
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	2019-12-14
Barium, total	0.0411	MAC = 1	0.0050	2019-12-14
Boron, total	0.0109	MAC = 5	0.0050	2019-12-14
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2019-12-14
Calcium, total	16.1	None Required	0.20 mg/L	2019-12-14
Chromium, total	0.00086	MAC = 0.05	0.00050 mg/L	2019-12-14
Cobalt, total	< 0.00010	N/A	0.00010 mg/L	2019-12-14
Copper, total	0.00040	AO≤1	0.00040 mg/L	2019-12-14
Iron, total	0.012	AO≤ 0.3	0.010 mg/L	2019-12-14
Lead, total	0.00020	MAC = 0.01	0.00020 mg/L	2019-12-14
Magnesium, total	1.65	None Required	0.010 mg/L	2019-12-14
Manganese, total	0.00120	AO≤0.05	0.00020 mg/L	2019-12-14
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2019-12-14
Molybdenum, total	0.00106	N/A	0.00010 mg/L	2019-12-14
Nickel, total	< 0.00040	N/A	0.00040 mg/L	2019-12-14
Potassium, total	0.66	N/A	0.10 mg/L	2019-12-14
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2019-12-14
Sodium, total	1.56	AO≤200	0.10 mg/L	2019-12-14
Strontium, total	0.626	N/A	0.0010 mg/L	2019-12-14
Uranium, total	0.000943	MAC = 0.02	0.000020 mg/L	2019-12-14
Zinc, total	0.0040	AO≤5	0.0040 mg/L	2019-12-14

2018 Trihalomethane (THM) Results

Each water sample is tested for: Bromodichloromethane; Bromoform; Chloroform; and Dibromochloromethane. Results are reported in mg/L. The method reporting limit for each compound is less than 0.001 mg/L. Only results exceeding 0.001 mg/L are shown below:

DATE	SITE	BROMODICHLOROMETHANE	BROMOFORM	CHLOROFORM	DIBROMO-CHLOROMETHANE	TOTAL THM
March 5, 2019	Crescent Bay	<0.0010	<0.0010	<0.0010	<0.0010	<0.00400
June 11, 2019	Crescent Bay	<0.0010	<0.0010	<0.0010	<0.0010	<0.00400
September 5, 2019	Alexander Road	<0.0010	<0.0010	0.0402	<0.0010	0.0402
December 3, 2019	North Road	0.0016	<0.0010	0.0026	0.0012	0.00546

2019 Haloacetic Acid (HAA) Results

Another major group of chlorinated disinfection by-products found in drinking water, besides Trihalomethanes, are Haloacetic Acids. Together they can be used as indicators for the presence of all chlorinated disinfection by-products. The Maximum Allowable Concentration of HAAs is 80 micrograms/Litre.

DATE	SITE	MONOCHLOROACETIC ACID (MCA)	DICHLOROACETIC ACID (DCA)	TRICHLOROACETIC ACID (TCA)	MONOBROMOACETIC ACID (MBA)	DIBROMOACETIC ACID (DBA)	TOTAL HAA5
March 5, 2019	Crescent Bay	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00200
June 11, 2019	Crescent Bay	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00200
September 5, 2019	Alexander Road	0.0027	0.0133	<0.0020	<0.0020	<0.0020	0.037
December 3, 2019	North Road	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.00200

7.0 OPERATOR CERTIFICATION:

Utilities and Utility Operators are certified through the Environmental Operators Certification Program (EOCP). Following an EOCP re-evaluation the Village WTP remains classified as a Water Treatment Level II and Water Distribution Level II Facility, which requires Level II Operators to run it.

At this time, our staff is certified to the following levels:

Employee	Water Treatment	Water Distribution
Gilbert Battersby	-	WD - II
Terry Flamond	WT-I	WD - I
Bob Gresiuk	WT-II	WD – III
Taylor Cooke	-	Multi-Utility

8.0 CHALLENGES & DIFFICULTIES:

The Village's greatest challenge water consumption. The Village of Nakusp's summer and annual water demand typically increases each year: Annual water demand is expected to increase by 6.9%, and summer demand is expected to increase by 7.6% in 2020, exceeding 2019 demand. The Village of Nakusp's water production systems, as they are currently operated, are estimated to be producing insufficient volumes of water to meet summer demand for domestic, fire protection and irrigation use.

Between May and September 2019, the creek sources produced a total water volume of 74,410m^3, and the well sources produced a total of 338,982m^3, providing a combined total of 413,392m^3 (See Figure 2). This equates to 2,730m^3 less water produced than was required to meet 2019 summer water demand (Note: Production must at least equal demand. This may have been a mechanical error caused by flow meters not recording data for a period of time. This data indicates that there was no redundancy). In 2019, the Village of Nakusp proactively engaged with Aqua Diversities Inc. and 9dot Engineering Inc. to address water demand challenges.

Figure 4 shows that water production during 2019 was insufficient to meet summer demand.

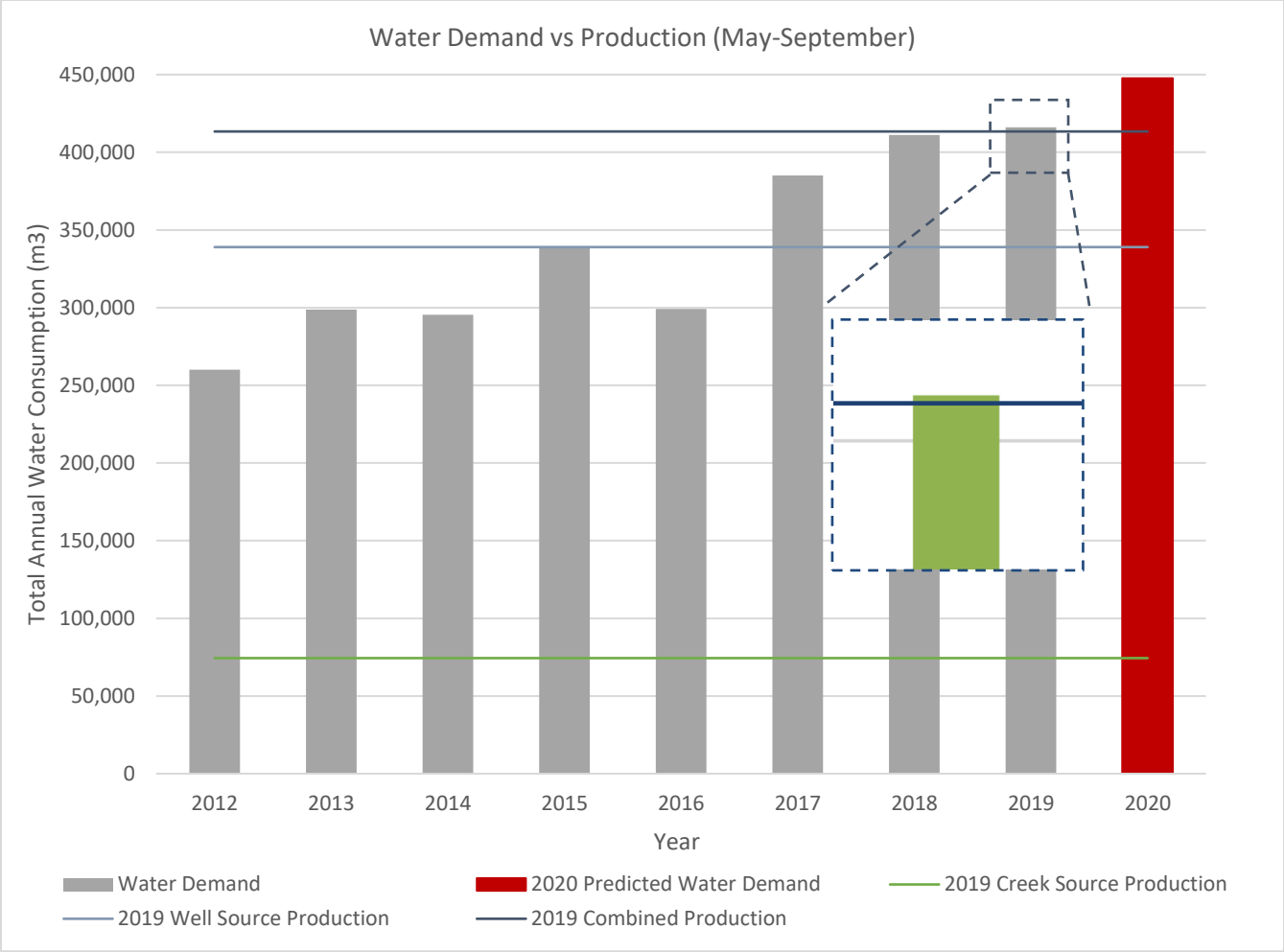


Figure 4: Summer production and demand comparison

(including 2020 summer demand prediction (2019 demand + 7.6% average summer growth)

Figure 5 compares water demand between January to April in 2019 and 2020.

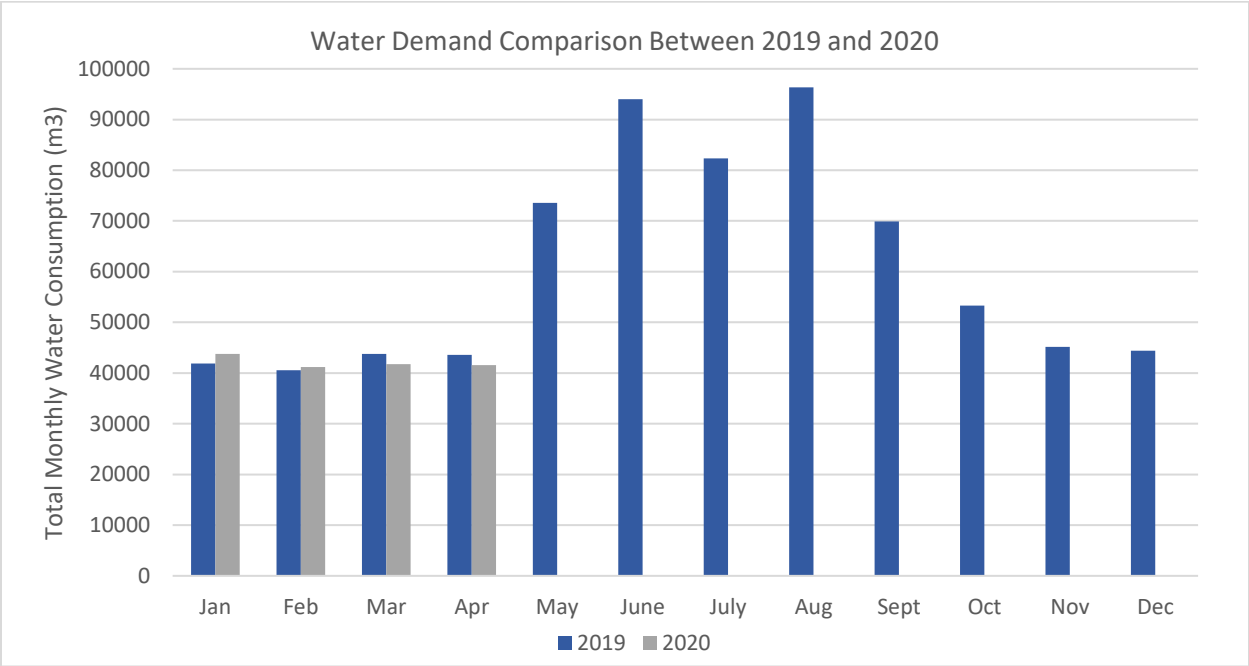
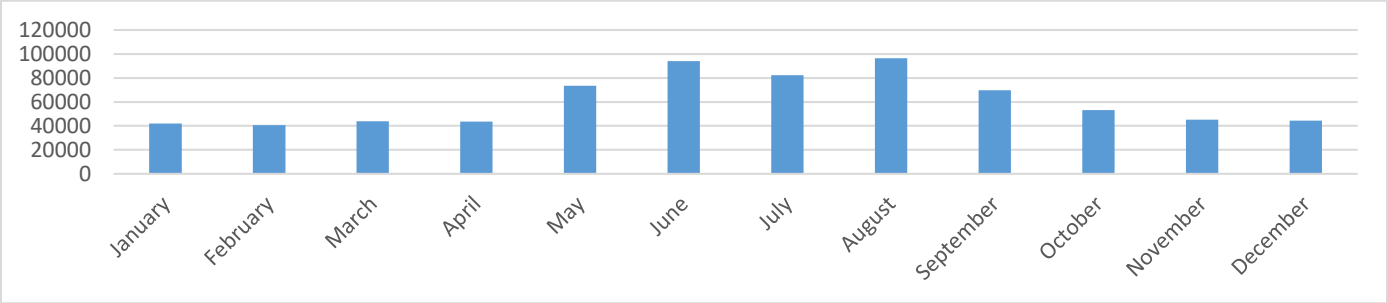


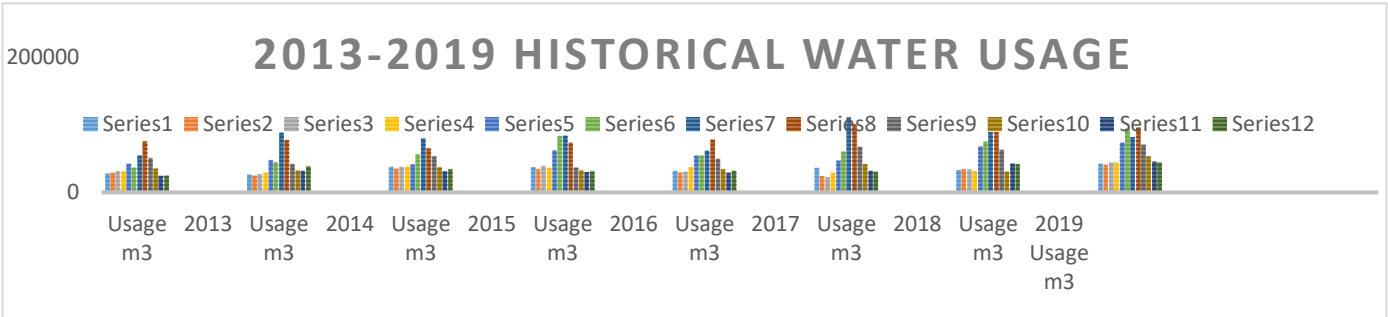
Figure 5: Water demand comparison between 2019 and 2020

8.0 WATER CONSUMPTION DATA:

2019 Monthly Consumption in Cubic Meters



2013-2019 Water Usage



2019

GRAVITY SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF MONTH	READING FOR MONTH M3	DAILY AVG
January	31	421	28	0	5	446,508	455,131	8,623	278
February	28	671	17	2	14	455,131	461,648	6,517	233
March	31	413	11	40	26	461,648	470,407	8,759	283
April	30	576	2	108	24	470,407	479,218	8,811	294
May	31	592	30	7	1	479,218	490,560	11,342	366
June	30	911	3	272	9	490,560	507,678	17,118	571
July	31	790	30	361	6	507,678	523,984	16,306	526
August	31	1,178	9	419	12	524,732	542,818	18,086	583
September	30	554	1	226	23	542,818	554,376	11,558	385
October	31	584	23	328	7	554,376	568,052	13,676	441
November	30	549	1	38	20	568,052	581,203	13,151	438
December	31	782	20	396	18	581,209	597,648	16,445	530

2019 WELL #1 SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF MONTH	READING FOR MONTH M3	DAILY AVG
January	28	1,556	4	770	1	1,132,782	1,166,023	33,241	1,187
February	23	2,986	13	1	9	1,166,023	1,192,482	26,459	1,150
March	3	129	31	6	14	1,192,482	1,192,739	257	86
April									
May	8	557	27	120	22	1,192,739	1,194,638	1,899	237
June	30	681	4	161	8	1,194,638	1,205,811	11,173	372
July	24	376	30	101	18	1,205,811	1,210,911	5,100	213
August	31	1,863	28	99	2	1,211,210	1,224,857	13,647	440
September	19	1,441	25	101	21	1,224,857	1,230,544	5,687	299
October	7	176	5	8	23	1,230,544	1,230,896	352	50
November	25	1,523	20	603	12	1,230,896	1,256,104	25,208	1,008
December	24	1,301	18	521	21	1,256,104	1,276,157	20,053	836

2019 WELL #2 SYSTEM									
MONTH	DAYS RUNNING	MAX. DAY WATER USED	DAY OF MONTH MAX.	MIN. DAY WATER USED	DAY OF MONTH MIN.	READING @ START OF MONTH	READING @ END OF NEXT MONTH	READING FOR MONTH M3	DAILY AVG.
January	1	8	16	0	1	1,290,148	1,290,156	8	8
February	13	1,335	9	105	3	1,290,156	1,129-7,723	7,567	582
March	31	1,785	8	692	31	1,297,723	1,332,496	34,773	1,122
April	30	2,931	23	701	8	1,332,496	1,367,282	34,786	1,160
May	30	3,614	7	1,068	25	1,367,282	1,427,593	60,311	2,010
June	30	2,903	14	1,515	28	1,427,593	1,493,306	65,713	2,190
July	30	2,603	1	1,438	2	1,493,306	1,554,222	60,916	2,031
August	31	2,903	5	624	27	1,556,280	1,618,179	61,899	1,997
September	30	2,447	1	139	25	1,618,179	1,670,816	52,637,	1,755
October	31	2,498	15	720	27	1,670,816	1,710,113	39,297	1,268
November	9	2,296	1	56	13	1,710,113	1,716,922	6,809	757
December	23	1,115	29	5	3	1,716,922	1,724,847	7,925	345

9.0 CROSS CONNECTION CONTROL PROGRAM:

The Village of Nakusp has developed a Cross Connection Control Program, as required by the Drinking Water Protection Act. The purpose of this program is to protect public health, by preventing potential non-potable water sources from cross contaminating the domestic water supply. This is achieved through the installation, maintenance, and inspection of back-flow prevention devices.

10.0 EMERGENCY RESPONSE:

Notifications

Clear and timely communication to all stakeholders in an emergency situation is critical to the effective management and resolution for any situation. Internal, government and public notifications should be made in a timely manner as each situation necessitates.

In the event of water quality exceedances, the first point of contact is the local public health officer at Interior Health. Any laboratory drinking water sample with positive E. coli or fecal coliform bacteria results, or threat of unsafe drinking water must be reported to Interior Health as per the *BC Drinking Water Protection Act*:

- During regular Interior Health office hours (weekdays, 08:00 to 16:30) the local public health officer should be the first point of contact.
- Should the local public health officer be unavailable during office hours the Nelson Health Unit, Health Protection Office can be contacted as an alternate.
- The Medical Health Officer Emergency Contact Number should only be used for emergency situations that occur outside of regular office hours.

In the event that public notice is required, multiple methods should be utilized to ensure all effected parties are adequately informed. This may include the use of notices, public meetings, radio advertisements, newspaper advertisements, television advertisements or direct individual notice.

Public notices regarding water quality issues have been developed for distribution in the following scenarios:

- **Water Quality Advisory:** Addresses situations where “at risk populations” (such as the elderly, infants, and people with weakened immune systems) may be at risk due to increased turbidity and potentially higher bacterial, virus, and parasite risks.
- **Boil Water Notice:** Addresses situations with high turbidity and potential bacterial, virus and parasite contamination of the water.
- **Do Not Consume Notice:** Addresses situations where water is not safe and should not be consumed due to untreated chemical contaminants, or other extreme cases in which contaminants cannot be inactivated by boiling water.

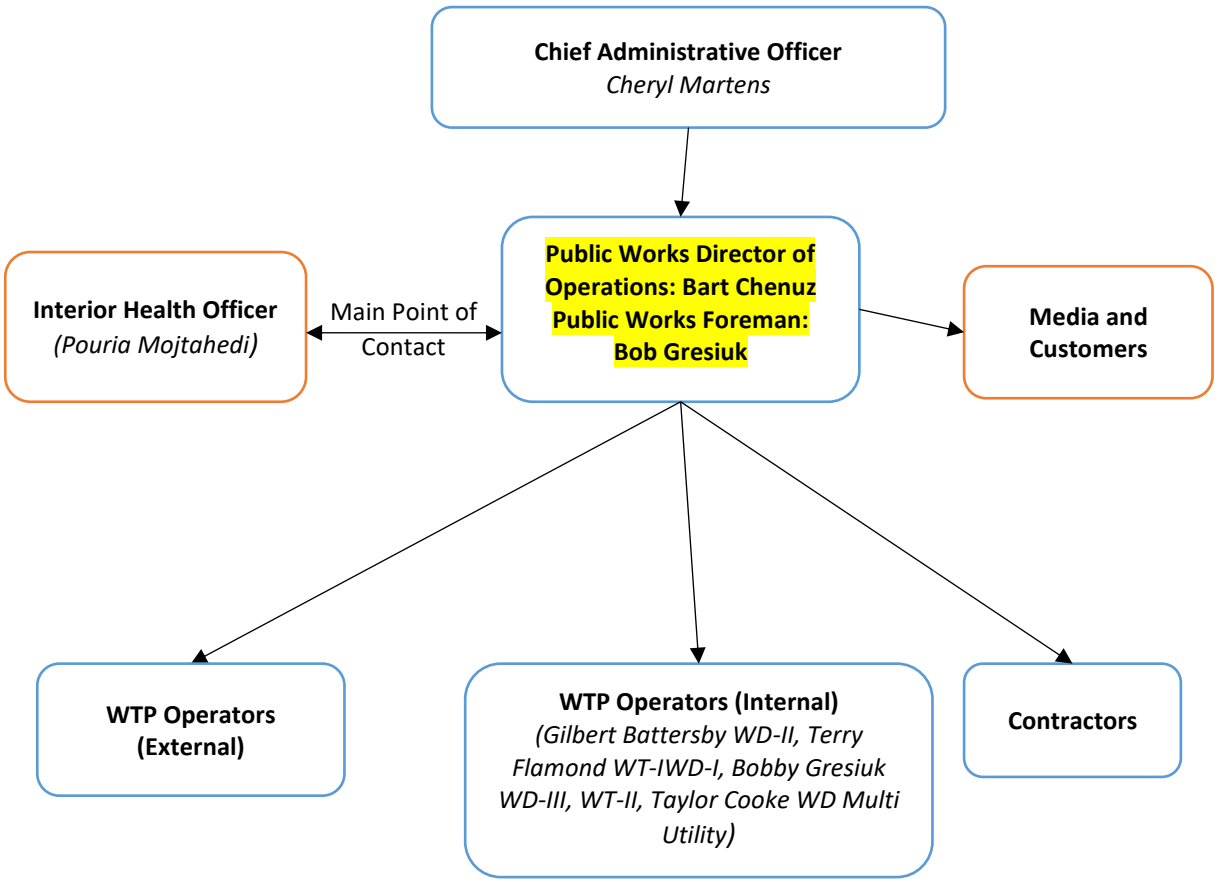
These notices should be tailored to each specific situation to provide the public with accurate and relevant information. Once the issues have been resolved, the public will also need to be informed that it is safe to resume with normal use of water. Notices for these situations can be found in Appendix A.

In the event that water use restrictions need to be implemented, it should be in accordance with the *Village of Nakusp Water Rates and Regulations Bylaw 656-2015.*

It is effective to designate a spokesperson to focus on communicating all relevant information to impacted parties. A summary of the ERP should be distributed and made available to all customers to alleviate questions and concerns in an emergency event.

Internal communication is also important in an emergency event, and a chain of command should be developed to ensure efficiency and that no information is lost.

The following is an example of a chain of command system for implementation.



NOTE:
**WT=Water Treatment Operator Certification*
**WD=Water Distribution Operator Certification*
**Village of Nakusp Requires Level II Distribution and Level II Treatment Operators*

11.0 PROJECTS & IMPROVEMENTS:

In cooperation with Village staff, 9dot Engineering Inc. (9dot) and Aqua Diversities Waterworks Inc. (Aqua) have developed a list of 2020 capital improvements and proposed engineering studies that will address the most pressing issues related to the Village of Nakusp water utility. The following table outlines projects currently underway (in –progress) and the forthcoming projects anticipated for the remainder of 2020 and beyond.

Project Summary & Timeline

Capital Improvements	
Project Title	**Estimated Completion Date**
Flow Meter Install Design	Completed
Flow Meter Plan and 2 New Flow Meter installation	June 2020
Water Line Replacement Design (Shakespeare Rd) Shelf Ready	May/June/July 2020
Flow Meter - SCADA System Integration Plan	August - December 2020

Engineering Studies/Plans &Technical Reports	
Flow Meter Assessment Memorandum	Completed
Water Treatment Systems Action Plan	Completed
Well Data Collection & Analysis (Aqua)	June 2020
Well Study Report (9dot)	June 2020
Water Treatment Plant Optimization Study	June 2020
Water Master Plan	January 2021
Operations & Maintenance	
Micro-Hydro Inspection	Completed
Ground Water (Well 1 and 2) Licensing Application	July 2020
Kuskanax Pipe Removal (including permitting)	TBD
1 Mil Reservoir Inspection	TBD
200K Reservoir Inspection (camera)	TBD