



GLENMORE-ELLISON IMPROVEMENT DISTRICT

## 2020 Annual Water Quality Report



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## INTRODUCTION

The Glenmore Ellison Improvement District continually strives to provide high quality drinking water to its rate payers through responsible operation, monitoring, evaluation and management of its water system.

As required by the British Columbia Drinking Water Protection Act and Regulation, the Glenmore Ellison Improvement District (GEID) provides the following Annual Report that includes:

- System Description
- Source Assessment Synopsis
- Annual consumption data
- Water Quality Results
- Updates to Water System Assessment and Capital Works Plan
- Updates to Water Monitoring Plan
- Updates to Emergency Response Plan
- Provide Environmental Operators Certification Program updates

This report also describes where your water comes from, how it is distributed, and how we ensure it is safe to drink. The information in this report will allow people, especially those with special health needs to be better informed about their drinking water. Please contact GEID (250)-763-6506 or email [dwilliams@geid.org](mailto:dwilliams@geid.org) if you have any questions.

This report discusses water quality parameter with potential health effects. For more information on drinking water health effects, the following websites are suggested.

Health Canada

<https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water.html>

US EPA

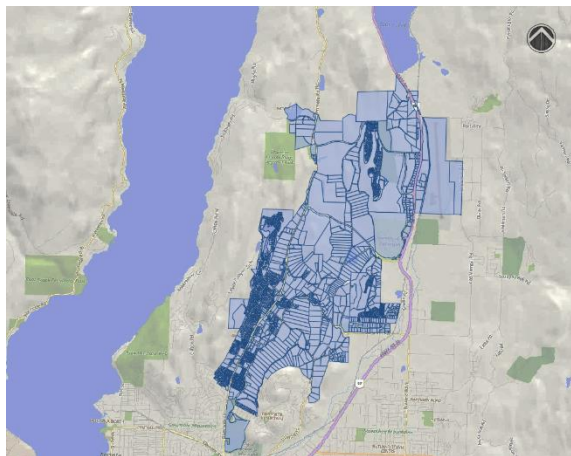
<http://www.epa.gov/safewater/mcl.html>

World Health Organization

[http://www.who.int/water\\_sanitation\\_health/publications/2011/dwg\\_guidelines/en/index.html](http://www.who.int/water_sanitation_health/publications/2011/dwg_guidelines/en/index.html)

The annual report covers the period from January 1<sup>st</sup>, 2020 to December 31<sup>st</sup>, 2020.

## GLENMORE ELLISON IMPROVEMENT DISTRICT - DRINKING WATER SYSTEM



The Glenmore-Ellison Improvement District (GEID) is one of four main water purveyors in Kelowna, British Columbia. The District boundaries extend across an area of approximately 3,694 hectares (36.85 km<sup>2</sup>, or 9,105 acres). Of the 1,861 hectares (4,600 acres) serviced with water, 1,041 hectares are bonafide agricultural land. GEID supplies water to approximately 9,068 residential service connections, serving an estimated population of 22,670 people. GEID operates and maintains two water distribution systems - The Glenmore

Distribution System, and the Ellison Distribution System.

### Glenmore Distribution System

The Glenmore Distribution system is sourced by Okanagan Lake from which water is pumped directly to the McKinley UV Treatment Plant where the water is treated with UltraViolet (UV) light to achieve a minimum 3 log removal (99.9%) of Cryptosporidium and Giardia Lamblia cysts. After UV treatment, the water is chlorinated to kill any bacteria or viruses that may be present and stored the 9 million-liter (ML) Rojem Reservoir (Clearwell). From the Clearwell, water is allowed to flow via gravity into the distribution system. The Glenmore Distribution System includes eight additional storage reservoirs and eleven pump/booster stations.



*Okanagan Lake*

### Ellison Distribution System

The Ellison Distribution System is sourced by Mill Creek. The water flows by gravity from an intake pond on the creek through coarse screens to Postill Pump Station then pumped into the 2ML Postill Reservoir. From the reservoir, water flows by gravity into the distribution system. There are no additional storage reservoirs or pump stations in the Ellison System.



*Mill Creek Intake*

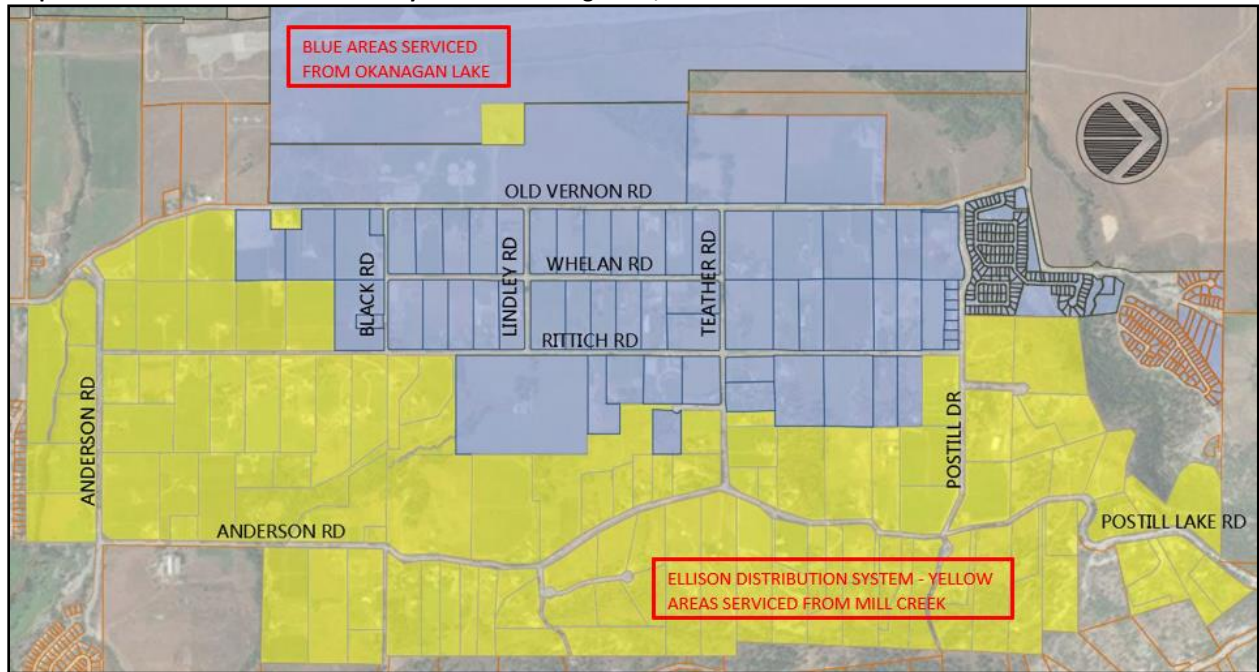
The Ellison Distribution System was transitioned into an agricultural-only water system through the Ellison Separation Project. For a portion of 2020, only 113 properties remained on the Mill Creek sourced system as the final phase of the project was being completed. The majority of properties in the Ellison area (Map 1.0) received domestic water from the Glenmore Distribution System (properties shown in blue).

The project was completed on August 11, 2020. After this date, all customers within GEID boundaries received potable water sourced from Okanagan Lake. The Ellison system sourced by Mill Creek is non potable and will only be used for irrigation and fire protection.

The Ellison Distribution System also has the ability to use Ellison Well as a water source to the potable or non potable zones as required. When utilized, Ellison Well water is treated with sodium hypochlorite, a liquid form of chlorine.

Ellison Well was utilized from May 25<sup>th</sup> through August 11<sup>th</sup>, providing water for customers as the final stages of separation were underway.

**Map 1.0 - Modified Ellison Distribution System Prior to August 11, 2020**



### Alternate Sources

In the event of an emergency, GEID has two inactive wells (Airport Wells #1 and #2) that can be brought online. A total of 5 potable interconnects with adjacent water suppliers are available. The only permanent interconnection is with the Black Mountain Irrigation District water system. The remaining four are with the City of Kelowna water system and require manual connection.

## SOURCE ASSESSMENT SYNOPSIS

### Okanagan Lake

In October 2017, the McKinley open bodied reservoir was taken off line and completely bypassed. With the bypass in place, the District began pumping Okanagan Lake water directly to the McKinley UV Plant to supply the Glenmore Distribution System. The Okanagan Lake intake is currently the deepest intake on Okanagan Lake, providing consistently high-quality water with

low turbidity. The intake is situated in a desirable location, far from creek inlets making it less susceptible to seasonal fluctuations.

By utilizing low turbidity water from deep within Okanagan Lake, along with the state-of-the-art UV disinfection facility, GEID is providing safe, cost effective, high quality drinking water that meets both, Canadian Drinking Water Guidelines and the Drinking Water Treatment Objectives for Surface Water Supplies in BC.

### Mill (Kelowna) Creek

Mill Creek originates in the Kelowna Creek Watershed and is sourced mainly from Postill Lake, with the outlets Bulman Lake and South Lake also tributary. GEID operates earthfill dams on each of these lakes to ensure adequate water is available in the creek.

Being a watershed sourced creek with a small intake pond, the water quality of Mill Creek can be highly variable depending on various factors such as weather and seasonal changes.

In addition, General Potability analysis from an accredited lab in November 2019, showed that several other parameters exceeded the standards set in the Guidelines for Canadian Drinking Water Quality (GCDWQ); True Colour, Total Aluminum, and Total Iron.

## UPDATES TO WATER MONITORING PLAN

In 2020, GEID continued to monitor its water supply with a Water Quality Sampling Program that was developed with Interior Health (IH) approval. The program includes monthly reports submitted to IH contain information on sampling locations, sampling frequency, bacteriological testing results, turbidity levels, chlorine residuals, operational activities, treatment objectives achieved, customer complaints and response, variances of normal operation and monthly laboratory results.



The goals of the sampling program are to:

- meet or exceed the minimum sampling frequency for microbiological parameters set out in the BC Drinking Water Protection Regulation.
- update general water quality parameters such as dissolved iron and manganese on a periodic basis
- assess source water quality. This includes an assessment of lake conditions which will be completed by a consultant. The consultant conducts ongoing sampling to identify microorganisms such as algae in the lakes, and nutrient conditions that can affect water quality; and



- assess quality of water delivered to customers. This includes measurement of parameters that directly impact water quality, such as disinfection by-products, and measurement for parameters that are indirectly related to water system maintenance.

GEID continued to work on improving the reliability of online instrumentation and real-time monitoring in 2020.

## REGULATORY REQUIREMENTS

Several projects GEID has implemented over the past 5 years include those that are related to water quality improvements. Interior Health (IH) requires all water suppliers meet Drinking Water Objectives for Surface Water Supplies in BC. This means providing drinking water that, at minimum, meets the following objectives:

- 4 log inactivation of viruses;
- 3 log removal or inactivation of *Giardia lamblia* and *Cryptosporidium*;
- 2 treatment processes for all surface drinking water systems;
- 1 refers to less than 1 NTU of turbidity with a target of 0.1 NTU;
- 0 Total Coliforms and E coli.

GEID was able to meet these treatment requirements for the Glenmore System by effectively operating the McKinley UV Plant.

GEID was unable to meet the treatment requirements for the Ellison System due to turbidity levels >1.0NTU and because chlorination was the sole treatment process. Due to these conditions, the Ellison System was operated under a Water Quality or Boil Water Advisory. After the completion of the Ellison Separation Project in August 2020, GEID was able to provide water that meets treatment objectives to all ratepayers.

## WATER QUALITY MONITORING

Water sampling and testing is carried out regularly at each source and throughout the distribution systems to ensure the drinking water remains safe and meets legislated drinking water requirements.

According to the Guidelines for Canadian Drinking Water Quality parameters are either health based and listed as *Maximum Acceptable Concentrations (MAC)*, based on aesthetic

considerations and listed as *Aesthetic Objectives (AO)* or established based on operational considerations and listed as *Operational Guidance Values (OG)*.

The Guidelines for Canadian drinking water quality are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and the availability of treatment and analytical techniques. Operational considerations are factored in when the presence of a substance may interfere with or impair a treatment process or technology (e.g. turbidity interfering with chlorination) or adversely affect drinking water infrastructure (e.g. corrosion in pipes).



In general, the highest priority guidelines are those dealing with microbiological contaminants such as bacteria, protozoa and viruses. Any measures taken to reduce concentrations of chemical contaminants should not compromise the effectiveness of disinfection.

The GEID's water quality sampling and testing program has been set up in conjunction with Interior Health. The program outlines the collection of samples for water quality at source, reservoirs, test stations, dead end/low use zones, and various pressure zones. GEID operations staff as well as outside consultants are utilized to collect the samples.

For samples requiring third party analysis, collected water samples are uniquely identified and sent to a provincially approved laboratory for testing. Once completed, test results are uploaded by the lab into a data management system for GEID staff to review.

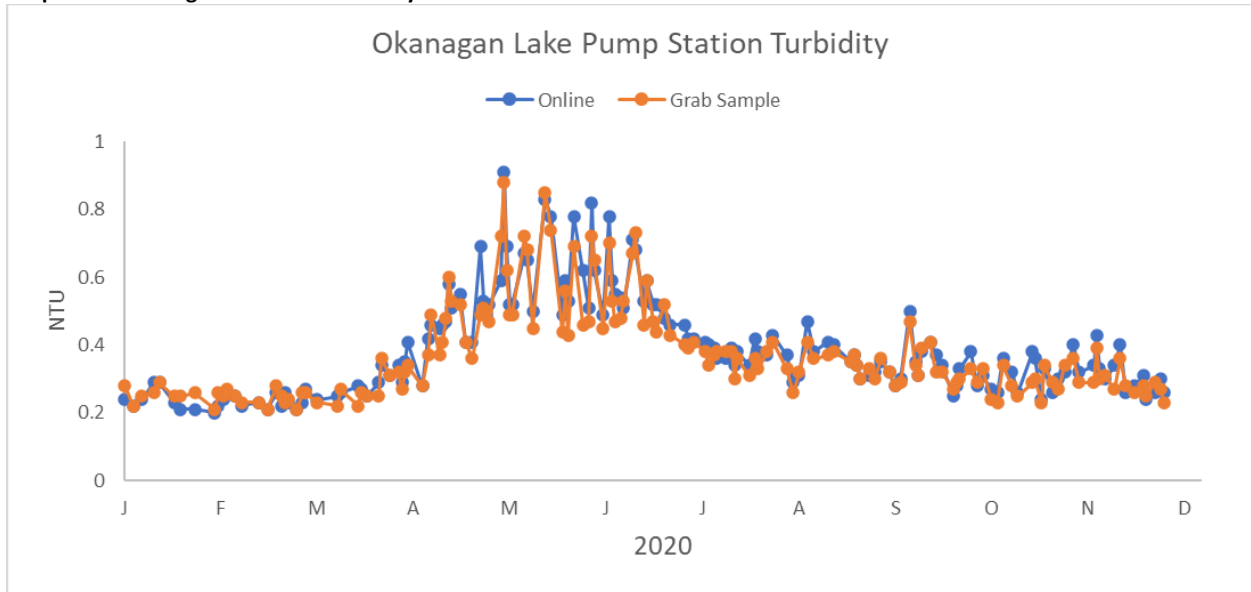
Key water quality parameters such as turbidity, free chlorine residual and %UVT are continuously monitored with online analyzers. The data from these analyzers is viewable remotely on the GEID SCADA system and is also stored in the SCADA Database. To ensure the analyzers are providing reliable and accurate data, samples are collected and analyzed in-house and compared to the online values.

### Source Water Turbidity

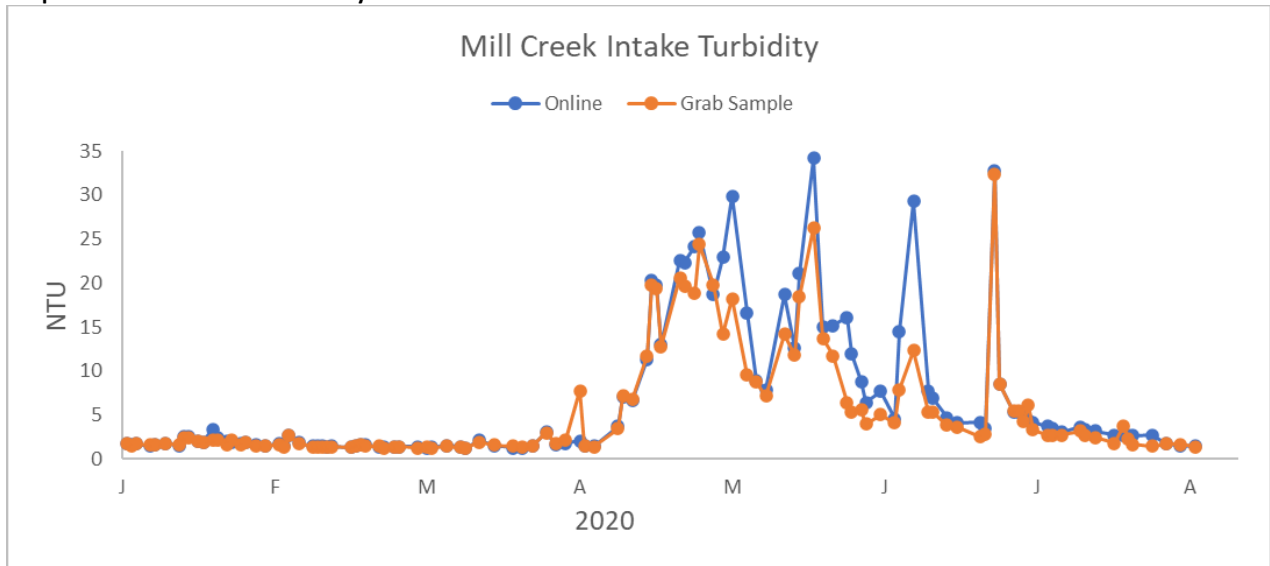
The Guidelines for Canadian Drinking Water Quality recommend a maximum acceptable concentration (MAC) of 1.0 Nephelometric Turbidity unit (NTU) for water entering the distribution system. Turbidity can harbour microorganisms, protecting them from disinfection. If turbidity exceeds 1.0NTU on average for 24 hours, GEID, in consultation with IH will call a Water Quality Advisory or a Boil Water Notice (>5.0NTU) for the affected water system.

The following graphs illustrate turbidity grab sample results and online analyzer values at Okanagan Lake Pump Station (Graph 1.0) and at the Mill Creek Intake Pond (Graph 2.0)

**Graph 1.0 - Okanagan Lake Raw Turbidity**



**Graph 2.0 - Mill Creek Raw Turbidity**



Water Quality Advisory upgrade to Boil Water Notice (BWN) on April 12, BWN remained in place until completion of system separation project on August 11

## Source Water Bacteriological

### Okanagan Lake

Okanagan Lake is sampled weekly for Total Coliforms and Escherichia Coli (E. Coli). There are two sample sites, (one at Okanagan Lake Pump station, the other at the McKinley UV plant) that are drawn from on a bi-weekly rotation. In 2020 a total of 55 samples were collected. The results of these samples are summarized below.

Table 2.0 - Okanagan Lake Source Bacteriological Summary

2020 Okanagan Lake Source Raw Bacteriological Data (MPN/100mL)					
	# of Samples	Detects	Min	Max	Avg
E. Coli	55	8	<1.0	2	1
<b>Total Coliforms</b>	55	34	<1.0	178	2.9

### Mill Creek

Mill Creek is sampled on a bi-weekly basis for Total Coliforms and E. Coli. In 2020 26 samples were collected with a wide range of results. The results of these samples are summarized below.

Table 2.1 - Mill Creek Source Bacteriological Summary

2020 Mill Creek Source Raw Bacteriological Data (MPN/100mL)					
	# of Samples	Detects	Min	Max	Avg
E. Coli	26	26	1	59.4	4.5
<b>Total Coliforms</b>	26	26	>8	2490	219.3

## Comprehensive Water Quality Results

**Table 3.0 - Raw Water Quality for Glenmore and Ellison Water Systems**

		Glenmore System	Ellison System		
		Okanagan Lake P/S	Mill Creek	Ellison Well	
	Date	2020-11-12	2020-11-12	2020-11-19	
Parameter	Units				Std (GCDWQ)
<b>Anions</b>					
Chloride	mg/L	4.97	1.17	10.5	AO<=250
Fluoride	mg/L	0.13	<0.10	0.55	MAC=1.5
Nitrate (as N)	mg/L	0.037	0.052	0.021	MAC=10
Nitrite (as N)	mg/L	<0.010	<0.010	<0.010	MAC=1
Sulfate	mg/L	29.3	2	96.1	AO<=500
<b>Calculated Parameters</b>					
Langelier Index	-	0.08	-1.7	0.9	N/A
Hardness, Total (as CaCO3)	mg/L	129	31.3	353	None Required
Solids, Total Dissolved (calc)	mg/L	164	36.2	442	AO<=500
<b>General Parameters</b>					
Temperature, at pH	°C	22.1	22.5	-	N/A
Colour, True	CU	<5.0	65	<5.0	AO<=15
Alkalinity, Total (as CaCO3)	mg/L	114	30.7	298	N/A
Alkalinity, Phenolphthalein (as CaCO3)	mg/L	<1.0	<1.0	-	N/A
Alkalinity, Bicarbonate (as CaCO3)	mg/L	114	30.7	-	N/A
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.0	<1.0	-	N/A
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.0	<1.0	-	N/A
Cyanide, Total	mg/L	<0.0020	<0.0020	<0.0020	MAC=0.2
Turbidity	NTU	0.32	3.06	3.77	OG<1
pH	pH units	7.92	7.32	8.07	7.0-10.5
Conductivity (EC)	uS/cm	279	67	715	N/A
<b>Total Metals</b>					
Aluminum, total	mg/L	<0.0050	0.0939	<0.0050	OG<0.1
Antimony, total	mg/L	<0.00020	<0.00020	<0.00020	MAC=0.006
Arsenic, total	mg/L	0.00055	<0.00050	0.00193	MAC=0.01
Barium, total	mg/L	0.0234	0.0051	0.624	MAC=2
Boron, total	mg/L	0.503	0.0195	<0.0500	MAC=5
Cadmium, total	mg/L	<0.000010	<0.000010	<0.000010	MAC=0.005
Calcium, total	mg/L	34.5	8.01	69.3	None Required
Chromium, total	mg/L	<0.00050	<0.00050	<0.00050	MAC=0.05
Cobalt, total	mg/L	<0.00010	<0.00010	<0.00010	N/A
Copper, total	mg/L	0.00302	0.00145	0.00091	MAC=2
Iron, total	mg/L	<0.010	0.392	0.366	AO<=0.3
Lead, total	mg/L	<0.00020	<0.00020	<0.00020	MAC=0.005
Magnesium, total	mg/L	10.4	2.74	43.7	None Required
Manganese, total	mg/L	0.0011	0.013	0.18	MAC=0.12
Mercury, total	mg/L	<0.000010	<0.000010	<0.000010	MAC=0.001
Molybdenum, total	mg/L	0.00392	0.00032	0.0215	N/A
Nickel, total	mg/L	0.00054	0.00093	0.00087	N/A
Potassium, total	mg/L	2.42	0.73	4.21	N/A
Selenium, total	mg/L	<0.00050	<0.00050	0.00152	MAC=0.05
Sodium, total	mg/L	12.4	2.6	36.5	AO<=200
Strontium, total	mg/L	0.301	0.495	0.522	7
Uranium, total	mg/L	0.00263	0.000115	0.00957	MAC=0.02
Zinc, total	mg/L	<0.0040	<0.0040	<0.0040	AO<=5

AO: Aesthetic Objective, MAC: Maximum Acceptable Concentration as per Canadian Drinking Water Guidelines.  
OG: Operational Guideline

Parameters that exceed the CGDWQ are highlighted in red.

The Mill Creek source for the Ellison exceeds the Aesthetic Guideline standard values for True Colour, and Total Iron. It should be noted that these values refer to the aesthetic condition of the water and do not have health issues directly associated with them.

The exceedance of the Turbidity standard caused GEID to operate the Ellison System under a WQA (>1.0 NTU) or a BWN (>5.0) NTU until completion of the Ellison Separation Project on August 11, 2020.

Ellison Well exceeds the Aesthetic Objective for Iron as well as the Maximum Acceptable Concentration (MAC) for manganese as is common for groundwater sources in the region. The MAC for manganese was revised in 2019 and according to the GCDWQ, manganese has 'effects on neurological development and behaviour; deficits in memory, attention, and motor skills'<sup>1</sup> at levels above the MAC. Additionally, the manganese, as well as the iron in the water precipitates out of solution over time causing increased turbidity level. For these reasons, Ellison Well is only used when required for maintenance projects and emergency situations.

Ellison Well was utilized as the source water for the parts Ellison System from May 25 through August 11 as the final stages of the Ellison Separation Project were completed.

## Hardness

A parameter commonly inquired upon by ratepayers is Hardness. Water in the Glenmore system is classified as hard (~130mg/L). In Okanagan Lake there is natural calcium and magnesium as well as natural limestone in the Okanagan valley that contributes to the hardness of our source water.

Ellison Well, while used for only a small portion of the year, has very hard water (almost 300m/L). Very hard water is typical of groundwater sources due to high concentrations of dissolved minerals.

An indicator of hard water is taking more soap to form a lather and a slight scum will appear while washing. Hard water can also form a limescale on the inside of kettles and water fittings. Hard water is not a health concern and is perfectly safe for consumption.

**Table 4.0 - Water Hardness Classification**

<b>Classification</b>	<b>Hardness (mg/L)</b>
Soft	0-60
Moderately Hard	61-120
Hard	121-180
Very Hard	>180

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<sup>1</sup> Guidelines for Canadian Drinking Water Quality Summary Table, June 2019

## Trihalomethanes (THM's) / Halo Acetic Acids (HAAs)

South Lake Reservoir

GEID, like most water purveyors, uses chlorine as the primary disinfection agent. While chlorine has proven to be effective for ensuring potable water systems are safe for consumption, it can also produce disinfection by-products when organic matter is present in the source water.

THMs and HAAs are the most commonly monitored disinfection by-products (DBPs). The level of THMs and HAAs in treated water will depend on numerous factors including: total organic carbon, temperature, pH, chlorine dose and water age within the distribution system.

In the Glenmore System, GEID monitors for THMs and HAAs at three locations of the distribution system, representing beginning (Clearwell Outflow), middle (GEID Office) and far/end points (Shayler Rd. South T/S and Ellison Well Domestic T/S) of the system. Ellison Well Domestic T/S was added as an end of line sample point upon completion of the Ellison Separation Project.



When supplied by Mill Creek, the Ellison System is monitored at the point of distribution and at the far end of the distribution system.

Table 5.0 - THM and HAA Summary

Total Trihalomethane Summary							
Sample Date	Distribution System THM Results (mg/L Total Trihalomethanes)						Standard Guideline
	Ellison	Ellison	Glenmore	Glenmore	Glenmore	Glenmore	
	Postill T/S	Ellison Well T/S	Ellison Well Domestic T/S	GEID Office/Lab	Shayler Rd. T/S South	Clearwell Outflow	
21-Apr-20	0.358	0.419	-	0.0668	0.0802	0.0500	MAC = 0.1
24-Jun-20	0.399	0.00634*	-	0.0685	0.0917	0.0531	MAC = 0.1
3-Sep-20	-	-	0.0668	0.0512	0.0633	0.0401	MAC = 0.1
20-Nov-20	-	-	0.105	0.0881	0.0755	0.0702	MAC = 0.1
<b>Annual Average</b>	<b>0.379</b>	<b>0.213</b>	<b>0.0859</b>	<b>0.0687</b>	<b>0.0777</b>	<b>0.0534</b>	MAC = 0.1
Haloacetic Acids Summary							
Sample Date	Distribution System HAA Results (mg/L HAA5)						Standard Guideline
	Ellison	Ellison	Glenmore	Glenmore	Glenmore	Glenmore	
	Postill T/S	Ellison Well T/S	Ellison Well Domestic T/S	GEID Office/Lab	Shayler Rd. T/S South	Clearwell Outflow	
21-Apr-20	0.461	0.554	-	0.0704	0.0817	0.0558	MAC = 0.08
24-Jun-20	0.427	<0.002*	-	0.0438	0.0517	0.0344	MAC = 0.08
3-Sep-20	-	-	0.0556	0.0407	0.0531	0.0303	MAC = 0.08
20-Nov-20	-	-	0.0511	0.0514	0.0459	0.0393	MAC = 0.08
<b>Annual Average</b>	<b>0.444</b>	<b>0.277</b>	<b>0.0534</b>	<b>0.0516</b>	<b>0.0581</b>	<b>0.0400</b>	MAC = 0.08

\*Ellison Well in service during time of sampling

According to The Guidelines for Canadian Drinking Water Quality, the Glenmore Distribution meets the DBP standards based on the yearly running average.

The Ellison Distribution System greatly exceeded the GCDWQ for each sample set. As the water source has relatively high levels of organics and elevated turbidity, a high chlorine dose is required to achieve acceptable free chlorine residuals throughout the system. The combination of these variables produces elevated levels of DBPs.

### Distribution System Bacteriological Results

Tables 6.0 and 6.1 illustrate how GEID’s distribution systems met the bacteriological standards for potable water as set out in Schedule A of the Drinking Water Protection Regulation. Positive results for Total Coliforms occurred on three occasions. A new sample from the same location was collected following laboratory confirmation and each time, the result came back with no detectable total coliforms.

**Table 6.0 - Glenmore System Microbiological Results**

Parameter	Number of Samples	Number of Exceedances	Drinking Water Regulations
Total Coliforms	460	3*	No detectable CFU/100 (ml)
E. coli	460	0	No detectable CFU/100 (ml)

\* maximum count 4 CFU/100ml. Each location resampled, showing <1 CFU/100mL

**Table 6.1 - Ellison System Microbiological Results**

Parameter	Number of Samples	Number of Exceedances	Drinking Water Regulations
Total Coliforms	56	0	No detectable CFU/100 (ml)
E. coli	56	0	No detectable CFU/100 (ml)

**Table 6.2 - Microbiological Standards for Potable Water**

Parameter	Standard
Escherichia Coli	No detectable Escherichia Coli per 100 ml
Total Coliform Bacteria	At least 90% of samples have no detectable total coliform bacteria per 100ml and no sample has more than 10 total coliform bacteria per 100 ml



## Postill Pump Station Log Removal

The Ellison Water System is treated only with chlorine and therefore relies on chlorine dosage to achieve 3log inactivation Cryptosporidium and Giardia Lamblia cysts. Field data is collected on a weekly basis and Concentration Time (CT) is calculated to ensure that the 3log treatment objectives are being met. Table 7.0 summarizes the weekly calculations.

**Table 7.0 - Weekly CT Calculation Data for the Ellison Water System**

Date	pH (from Intake)	Water Temp (°C) (at T/S)	Max. Postill Outflow (GPM)	Min Res. Level %	Effective Res. Vol. (US Gal)	Effective Tot. Vol. (US gal)	Contact Time (mins)	Chlorine Residual at T/S	CT achieved	CT required	CT Ratio (must be > 1)
Jan 02/20	7.36	2.1	162.60	45	71334	110291	678	2.31	1566.9	252.6	6.2
Jan 06/20	7.44	2.3	166.6	45	71334	110291	662	2.25	1489.5	255.4	5.8
Jan 13/20	7.44	2.0	420.4	45	71334	110291	262	2.16	566.7	259.2	2.2
Jan 20/20	7.2	1.4	185.0	45	71334	110291	596	2.45	1460.6	252.1	5.8
Jan 27/20	7.47	2.2	178.3	45	71334	110291	619	2.43	1503.1	263.0	5.7
Feb 03/20	7.55	2.5	185.5	45	71334	110291	595	1.90	1129.7	255.5	4.4
Feb 10/20	7.21	1.7	163.0	45	71334	110291	677	2.00	1353.3	240.4	5.6
Feb 18/20	7.37	2.0	150.8	45	71334	110291	731	2.18	1594.4	253.1	6.3
Feb 24/20	7.52	1.9	164.5	45	71334	110291	670	2.04	1367.7	266.3	5.1
Mar 03/20	7.46	2.4	171.2	45	71334	110291	644	2.07	1333.5	252.3	5.3
Mar 10/20	7.85	2.6	173.3	45	71334	110291	636	2.22	1412.8	288.4	4.9
Mar 17/20	7.76	1.5	179.6	45	71334	110291	614	2.19	1344.9	301.2	4.5
Mar 23/20	7.8	2.0	171.6	45	71334	110291	643	1.98	1272.6	290.5	4.4
Mar 30/20	7.94	2.7	178.5	45	71334	110291	618	2.67	1649.7	303.6	5.4
Apr 06/20	7.98	2.5	174.1	45	71334	110291	633	2.86	1811.8	315.3	5.7
Apr 14/20	7.93	2.4	485.1	45	71334	110291	227	2.56	582.0	307.0	1.9
Apr 20/20	7.82	3.0	939.7	50	79260	118217	126	2.01	252.9	273.6	0.9
Apr 27/20	7.24	2.9	658	55	87186	126143	192	2.40	460.1	229.9	2.0
May 04/20	7.56	3.7	651	59	93527	132484	204	2.69	547.4	248.6	2.2
May 11/20	7.39	6.6	1781	59	93527	132484	74	2.73	203.1	191.6	1.1
May 19/20	7.16	9.0	595	59	93527	132484	223	1.48	329.5	136.0	2.4
May 25/20	7.55	9.1	210	59	93527	132484	631	1.21	763.4	151.1	5.1
June 01/20	7.46	11.8	402	59	93527	132484	330	0.69	227.4	111.5	2.0
June 8/20	7.82	10.7	836	59	93527	132484	158	1.01	160.1	144.6	1.1
June 15/20	7.24	12.7	125	62	98283	137240	1098	1.02	1119.9	102.5	10.9
June 22/20	7.93	12.4	929	57	90357	129314	139	3.74	520.6	162.4	3.2
June 29/20	7.84	11.8	1095	57	90357	129314	118	2.83	334.2	157.5	2.1
July 06/20	8.08	12.8	1076	58	91942	130899	122	2.3	279.8	154.5	1.8
July 13/20	7.93	10.8	1336	58	91942	130899	98	4.05	396.8	183.7	2.2
July 20/20	7.82	12.8	2219	82	129987	168944	76	2.36	179.7	142.0	1.3
July 27/20	7.9	13.3	1518	82	129987	168944	111	1.83	203.7	135.7	1.5
Aug 04/20	7.44	14.1	1774	82	129987	168944	95	2.21	210.5	112.4	1.9
Aug 10/20	7.89	12.7	1519	67	106209	145166	96	2.12	202.6	144.1	1.4

\*See page 17 for results after Aug. 11, 2020 due to the change in source water supply to Okanagan Lake (Glenmore Distribution System)

## WATER QUALITY CONCERNS

Occasionally the GEID receives concerns from the rate payers regarding the quality of their drinking water. During the course of 2020, the district received minimal enquiries with most common issue of concern related to water color and odour. Every individual enquiry was investigated by the districts water supply and distribution operations staff and the appropriate action was taken to resolve the appropriate water quality concern.

Typical examples of water quality concerns such as colored water arise as a result of the following:

- Freshet
- Water main flushing
- Fire fighting
- Water main breaks
- Local construction/development
- Lake turnover/algae blooms
- Changes in flows and system dynamics

## McKINLEY UV TREATMENT PLANT PERFORMANCE

McKinley UV Treatment Plant receives raw water directly from Okangan Lake via the Okangan Lake Pump Station. The water comes from a deep intake structure and provides GEID with a consistent water source in terms of organics, turbidity, % UltraViolet Transmittance (%UVT) and temperature.

The UV Plant is operated to provide 3 Log (99.9%) inactivation of *Cryptosporidium* and *Giardia Lamblia* cysts. The plant has two UV Reactors, with one reactor able to provide adequate treatment during regular operation, while the other acts as a stand-by reactor to provide redundancy if an issue arises. If the reactors fail to adequately treat the water (<3.0 Log), Off-spec water is produced. The Off-spec water volumes and event durations are logged and recorded. A minimum of 95% of the water flowing through the reactors must meet the validated treatment criteria<sup>2</sup>. GEID strives to ensure that 100% of water provided is treated with adequate UV dosage. In 2020, only 0.003% of water produced failed to meet 3Log inactivation requirements, an improvement from 0.01% in 2019.

Additionally, log inactivation for viruses (4log inactivation is required) is calculated on a daily basis. The calculation uses data collected by online chlorine analyzers, temperature and pH

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<sup>2</sup> US EPA UV Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule

probes, level transmitters and flow meters to calculate the required Concentration Time (CT value) that must be maintained in order to achieve the treatment goal.

The following tables show the 2020 raw water Ultra Violet Transmittance (%UVT), reactor log inactivation performance, 4log summary for viruses, and treatment performance of the two UV Reactors. Overall, the UV Plant operated within the required parameters as set by IH.



*McKinley Reservoir, future agricultural water source.*

**Table 8.0 - McKinley UV Treatment Plant Raw Water %UVT**

Month	Raw UV T%		
	Min	Max	Avg
January	84.2	87.4	86.7
February	85.2	87.5	86.7
March	85.3	86.4	86.3
April	85.1	87.2	86.5
May	83.6	86.7	85.5
June	83.5	86.6	85.6
July	83.4	86.8	85.4
August	84.6	86.6	85.7
September	83.8	86.6	85.8
October	82.2	86.7	85.8
November	83.7	87.0	85.5
December	83.5	86.5	85.7

Values taken hourly from the GEID SCADA Database and averaged on a monthly basis

**Table 8.1 - Glenmore Distribution System 4-Log Virus Summary**

Month	Daily 4-Log-i Achieved
January	Yes
February	Yes
March	Yes
April	Yes
May	Yes
June	Yes
July	Yes
August	Yes
September	Yes
October	Yes
November	Yes
December	Yes

**Table 8.2 - UV Reactor 110 Performance Summary**

McKinley UV Water Treatment Plant - Train 110							
Month	OFF-SPEC % Time	OFF-SPEC % Volume	OFF-SPEC Time Minutes	Total Run Time Minutes	OFF-SPEC Volume (ML)	Total Treated Volume (ML)	Avg. Log Inactivation
January	0	0	0	7232	0	95.81	3.16
February	0	0	0	6263	0	88.83	3.18
March	0	0	0	6273	0	92.80	3.25
April	0	0	0	9800	0	143.30	3.58
May	0	0	0	14966	0	223.25	3.60
June	0	0	0	13380	0	202.47	3.60
July	0	0	1	23679	0.02769	487.32	3.61
August	0	0	0	25914	0	559.56	3.62
September	0	0	2	19099	0.00850	302.56	3.6
October	0	0	1	11376	0.00837	146.69	3.58
November	0	0	0	7816	0.00000	101.87	3.58
December	0	0	2	7378	0.00346	96.07	3.58
<b>Totals</b>			<b>6</b>	<b>153176</b>	<b>0.04802</b>	<b>2540.54</b>	

**Table 8.3 - UV Reactor 120 Performance Summary**

McKinley UV Water Treatment Plant - Train 120							
Month	OFF-SPEC % Time	OFF-SPEC % Volume	OFF-SPEC by Time Minutes	Total Run Time Minutes	OFF-SPEC Volume (ML)	Total Treated Volume ML	Avg. Log Inactivation
January	0	0	0	5212	0	72.15	3.24
February	0.1	0.1	3	4812	0.03582	67.68	3.14
March	0	0	0	5131	0	74.94	3.21
April	0	0	0	10747	0.00055	158.84	3.55
May	0	0	0	13540	0.00075	200.80	3.61
June	0	0	1	12527	0.00850	193.46	3.60
July	0	0	0	15327	0.00048	292.17	3.61
August	0	0	0	18621	0	384.41	3.64
September	0	0	0	17162	0	274.82	3.62
October	0	0.1	3	6033	0.03979	79.17	3.62
November	0	0	0	6003	0.00026	78.77	3.58
December	0	0	0	5363	0	70.20	3.60
<b>Totals</b>			<b>7</b>	<b>120478</b>	<b>0.08615</b>	<b>1947.42</b>	

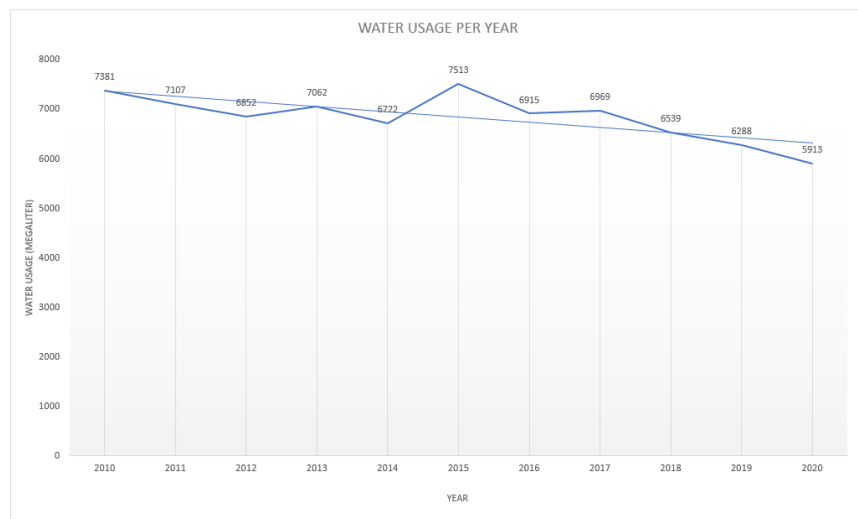
## ANNUAL WATER CONSUMPTION STATISTICS

Table 9.0 shows the historic GEID water consumption over the past ten years in MegaLiters (ML). Of note, the McKinley Landing Water Works system was switched over to the Glenmore distribution system in 2017.

In 2020, the combined total water usage for GEID was 6920ML. The Glenmore System accounts for approximately 4936ML (71%), while the Ellison System accounts for the remaining 1984ML, with Mill Creek Intake supplying 879ML and Ellison Well supplying 1105ML.

**Table 9.0 – Combined Annual Water Usage**

GEID WATER USAGE		
Year	Usage (Megaliter)	Usage ( Acre foot)
2010	7381	5984
2011	7107	5762
2012	6852	5555
2013	7062	5725
2014	6722	5450
2015	7513	6091
2016	6915	5606
2017	6969	5606
2018	6539	5302
2019	6288	5078
2020	5913	4794



## MAINTENANCE AND FLUSHING PROGRAM



*Flushing in Progress*

Regular inspections, maintenance and water quality testing is performed by certified operators to ensure optimal operation of the GEID water systems. The district performed uni-directional flushing of each system in the fall of 2020 and conducted isolated area flushing as required due to maintenance, repair activities, and to maintain water quality.

## EMERGENCY RESPONSE PLAN

The emergency response plan is updated annually, and copies of the updated plan were provided to IH in 2020. Updates include changes to contact numbers (including GEID staff, consultants, contractors and regulatory agencies), as well as changes to the plans that may be required including the addition of new facilities.

## CROSS CONNECTION CONTROL PROGRAM

The cross-connection control program for GEID and the Kelowna Joint Water Committee is administered by the City of Kelowna and results are reported annually to IH in order to protect the quality of the water in our distribution systems.

The City of Kelowna employs a full time Cross Connection Control Coordinator to develop, implement and maintain a program which focuses on all Industrial, Commercial, Institutional, and Agricultural water customers in our water utility.

The Cross-Connection Control Coordinator checks connections (industrial, commercial, institutional and agricultural) to determine whether pipes, vessels or other devices exist that would allow fluid contaminants to enter the water system by backflow. Potentially hazardous cross connections are eliminated or backflow prevention assemblies (testable) or devices (non-testable) are installed. All installations are subject to yearly testing and inspection programs administered by the Cross-Connection Control Coordinator.

## OPERATOR CERTIFICATION

GEID's water distribution system (Facility 497) is classified as a Level IV system by the Environmental Operators Certification Program (EOCP). Additionally, the McKinley UV Treatment Plant (Facility 2276) is classified as a Level II Facility by the EOCP.

Water system operators are the first line of defense for water quality issues, as they identify, manage, and remedy risks to the water supply. The tasks completed by GEID's operators are essential in ensuring safe, reliable, water supply, including:

- Regular system checks of critical infrastructure such as pump stations and chlorinators
- Daily monitoring of SCADA system to assess system performance
- Response to system alarms 24 hours a day, seven days a week
- Water main flushing as needed to enhance water quality
- Completion of water system maintenance, repair and renewal works
- Instrument testing and calibration
- Water Quality Sampling
- Watershed monitoring and protection

Four of the operators are graduates of Okanagan College's Water Quality and Environmental Engineering Technology program. The two-year water engineering technology diploma program is designed for the water and wastewater industry and provides instruction in areas such as water system design, maintenance, water treatment, and water quality testing and analysis.

Table 10.0 shows the certification levels of GEID employees as of the end of 2020.

**Table 10.0 - Current Operations Staff**

<b>Name</b>	<b>Certification Level</b>	<b>Position</b>
Kevin Burtch	Water Distribution Level 1	Operations Manager
Mike Rojem	Water Distribution Level 3 Water Treatment Level 1	Projects Coordinator
Brandon Fletcher	Water Distribution Level 4 Water Treatment Level 2	Projects Assistant
Chris MacKay	Water Distribution Level 3 Water Treatment Level 1	System Operator
Shaun McGaw	Water Distribution Level 3	System Operator
Kelvin Giesbrecht	Water Distribution Level 2 Water Treatment Level 1	System Operator
Julius Rideg	Water Distribution Level 2 Water Treatment Level 1	System Operator
Scott Smith	Water Distribution Level 2	System Operator
Brad Wallace	Water Distribution Level 1	Water Meter Technician
Brain Krause	Water Distribution Level 2 Water Treatment Level 1	Equipment Operator / System Operator
Chris Tucker	Water Treatment Level 4 Water Distribution Level 2	Water Quality Technician / System Operator

## STAFF CONTACTS

**Table 11.0 - Staff Contacts**

<b>Name</b>	<b>Title</b>	<b>Telephone</b>
Dawn Williams	Administrator	250-763-6506 ext. 102
Kevin Burtch	Operations Manager	250-763-6506 ext. 109
Garry Filafilo	Administrative Treasurer	250-763-6506 ext. 104
Mike Rojem	Projects Coordinator	250-763-6506 ext. 103
Chris Tucker	Water Quality Technician	250-763-6506

## COMPLETED PROJECTS 2020

The Glenmore Ellison Improvement District saw the completion of the Ellison Separation Project in 2020.

## AVAILABILITY OF THE REPORT

This report may be found on the district's website at [www.glenmoreellison.com](http://www.glenmoreellison.com) under the water quality tab.

## GLOSSARY

**Aesthetic Objective (AO)** – In terms of drinking water quality, refers standards above which, objectional taste, odour and/or appearance may occur.

**Bacteria** – many different types of bacterial organisms are found in drinking water. Most municipal treated water is essentially bacteria free due to the addition of chlorine. Some forms of cyst type bacteria have a degree of immunity to chlorine due to the cocoon-like shell around the organism, such as Giardia Lamblia, and Cryptosporidium.

**Chemical Parameter** – properties of water relating to the molecular composition, such as mineral or metal concentrations.

**Chlorine** – widely used in the disinfection of water available as a gas, a liquid in sodium hypochlorite, or as a solid in calcium hypochlorite.

**Coliform Bacteria** – a group of organisms primarily found in human and animal intestines and wastes, and thus widely used as an indicator organism to show the presence of such wastes in water and the possible presence of pathogenic bacteria.

**Color** (Apparent Color (PtCo) – to determine the color of water within a sample without turbidity removal.

**Contact Time** – the time from when the chlorine is added to the water, to when the water reaches the first customers.

**Corrosion** – the deterioration of a material, specifically metals in water, caused by reactions and affected by complex interactions between pH, hardness, alkalinity and temperature of the water.

**CT Values** – the product of contact time and free chlorine concentration. It is used to calculate the percent removal of viruses and bacteria.

**Disinfection by-products (DBP)** – are created when the chlorine added to water reacts with naturally occurring matter in the water.

**Disinfection** – a process used to eliminate any harmful substance or micro-organism in water.

**Drinking Water Protection Regulation (DWPR)** – defines regulatory standards under the Provincial Water Act that must be met to ensure water is safe to drink and fit for domestic purposes.



**Escherichia coli (E. Coli)** – are bacteria present in the intestine and feces of warm blooded animals. E. Coli are a member species of the fecal coliform group of indicator bacteria. Their concentrations are expressed as number of colonies per 100 mL of sample.

**Free Chlorine** – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as residual chlorine.

**Guidelines for Canadian Drinking Water Quality** – A document established by Health Canada that recommends standards for potable water. The standards include; Maximum Acceptable Concentrations (MAC), Aesthetic Objectives (AO) and Operational Guidance (OG) for physical, microbiological, chemical and radiological substances in drinking water.

**Haloacetic Acid (HAA)** - a type of disinfection by-product resulting from the reaction of chlorine and organic matter in the water. The MAC for HAAs in drinking water is 0.0800mg/L.

**Hardness** – a characteristic of natural water due to the presence of dissolved calcium and magnesium.

**Inactivation** – to destroy or ensure the loss of the ability to cause disease.

**Log Removal** – indicates how effective disinfection is in eliminating protozoa. For example, 4-log-i removal guarantees 99.99% disinfection of pathogenic organism, 3-log-i removal guarantees 99.9%, and 2-log-i removal guarantees 99% removal.

**Maximum Acceptable Concentration (MAC)** – defines the upper most limit of a parameter before it can become a health concern.

**NTU (Nephelometric Turbidity Units)** – the standard unit of measurement for turbidity (cloudiness) in water. It detects the amount of light that is scattered by fine suspended particles in water.

**Organic** – derived from plant or animal matter, as opposed to inorganic matter which is derived from rocks and minerals. Organic matter is characterized by its carbon-hydrogen structure.

**pH** – the expression of the acidity of a solution by the negative logarithm of the hydrogen ion concentration; pH of 1 is very acidic; pH of 14 is very basic (alkaline); pH of 7 is neutral. The neutral point of 7 indicates the presence of equal concentrations of free hydrogen and free hydroxide ions.

**Physical Parameters** – these are often observable properties such as color, taste and odour.

**Potable Water** – water which is considered safe and fit for human consumption, culinary

and domestic purposes and meets the requirements of the health authority having jurisdiction which is the Vancouver Island Health Authority in this region.

**Raw Water** – untreated water from wells, surface sources (i.e. lakes and rivers) or any water before it reaches a water treatment device or process.

**Reservoir** – a receptacle used for storing water within the water system.

**Residual Chlorine** – the quantity of chlorine remaining which has not been consumed in reactions with microorganisms or organic matter. Also referred to as free chlorine.

**Surface Water** – water collecting on the ground or in a stream, river, lake sea or ocean, as opposed to groundwater, which is contained in underground aquifers.

**Trihalomethanes (THMs)** – the major category of disinfection by-products in chlorinated drinking water. They are caused by the reaction of chlorine with organic matter present in the water. The MAC for THMs in drinking water is 0.100mg/L

**Total Coliform** – an indicator group of organisms mostly of intestinal origin used to appraise the microbiological risks to drinking water.

**Turbidity** – the cloudiness or haziness of water caused by suspended solids that are usually invisible to the naked eye. Its measurement relates to the optical property of water that causes light to be scattered, rather than transmitted through the sample in a straight line. Measured in NTU (Nephelometric Turbidity Units).

**Virus** – the smallest form of life known to be capable of producing disease or infection, usually considered to be of large molecular size. They multiply by assembly of component fragments in living cells, rather than by cell division as do most bacteria.