LAKE COUNTRY

Life. The Okanagan Way.

Water Operations

2021 Annual Report

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Contents

Water Operations

2021 Overview

The following is intended to inform and summarize 2021 data collections, observations, and work completed by District of Lake Country staff with regards to water operations and water quality.

Water operations highlights include:

- Hare Road Pressure Regulating Station
- Beaver Lake Watershed Environmental Releases
- Galvanized Water Main Replacements
- Hach WIMS (Water Information Management System)
- Okanagan Lake Pumphouse & UV Treatment Plant
-
- Upgrades to District SCADA Network
- Reservoir Repair to Cell 3 at Upper Lakes
- Dam Repairs at Crooked Lake

System Descriptions and Classification

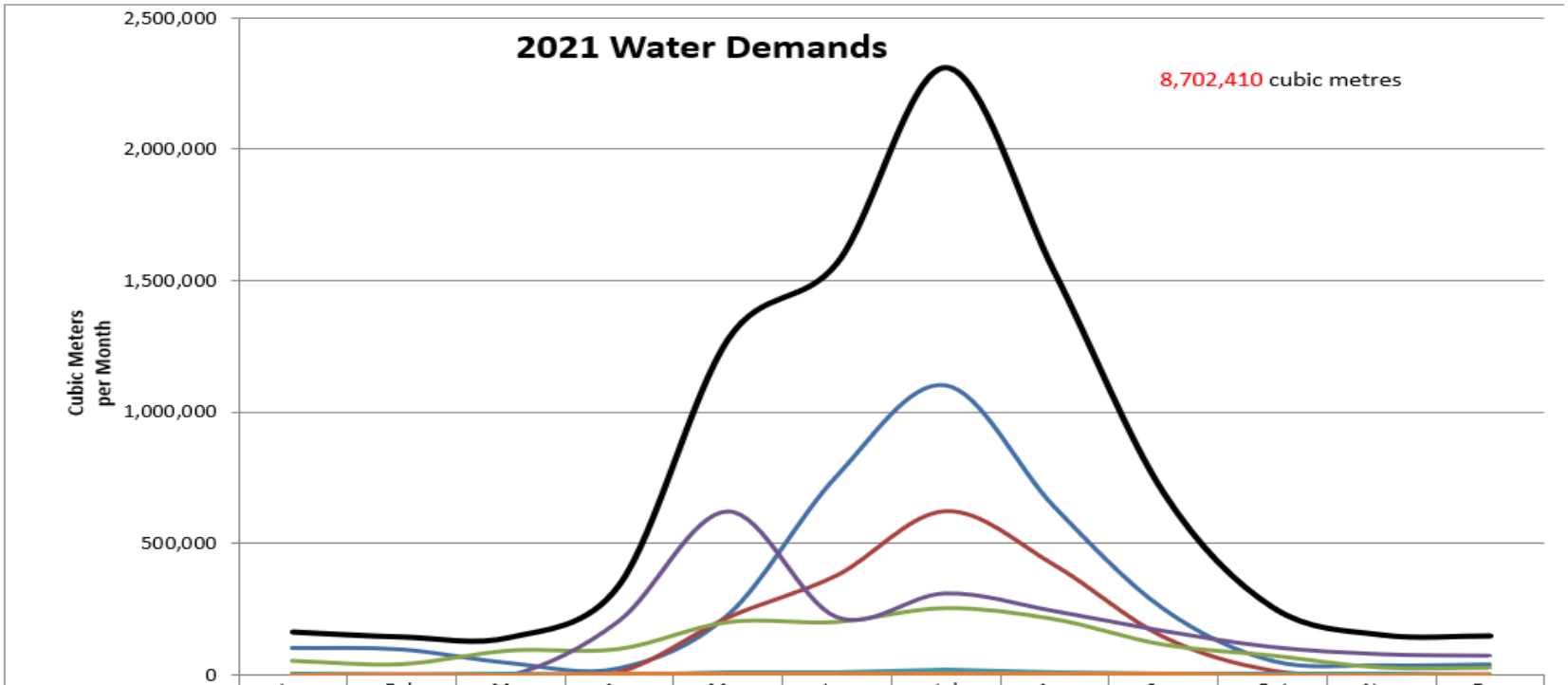
The District of Lake Country (DLC) is a growing municipality with an approximate population of 15,000 people. Not all 15,000 residents are connected to the DLC's public water systems. The primary upland sources used by the DLC include Beaver Lake, Crooked Lake, Oyama Lake, and Damer Lake. The lower elevation water sources are Okanagan Lake (3 separate intakes) and Kalamalka Lake.

Infrastructure within the DLC owned water systems includes 6 storage dams, 10 reservoirs, 6 chlorine injection systems, 9 pump houses, two UV disinfection systems, 4 pressure boosting stations, 38 pressure reducing stations, 83 pressure reducing valves, more than 508 hydrants, and approximately 200 km of water distribution mains.

Water Demands

Each water source within the DLC has varying levels of consumption demand. Factors that impact demand are the total number of connections to the water system and the type of water connection. Residential, commercial, industrial, institutional, seasonal irrigation and agricultural connections are all different types of customers connected to the different water systems. Total water usage among the sources and water systems in 2021 was 8,702,410 cubic meters (see Figure 1 for water consumption by source). Water demands in 2021 were the highest since 2015, which were likely a result of a drier than normal spring followed by an unprecedented heat dome that settled over the province in mid-June.

Each spring, Beaver and Oyama Lake have increased turbidity in the water from spring freshet. Due to the increased turbidity, DLC will supplement the Beaver and Oyama Lake sources with Okanagan and Kalamalka Lake water. This operational change can lead to increased demands on these sources.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total	159,821	141,138	139,983	340,915	1,277,333	1,566,522	2,310,859	1,528,081	689,682	254,108	149,035	144,933
Beaver Lake	103,059	97,337	45,089	25,416	227,337	756,320	1,102,997	640,852	253,085	54,195	36,751	40,183
Oyama Creek	0	0	0	7,894	215,709	376,386	621,683	416,984	143,366	14,342	73	0
Kalamalka Lake	54,180	41,790	92,726	98,551	198,900	199,499	251,307	210,069	115,134	74,213	29,268	28,242
Okanagan Lake	0	0	0	205,632	621,432	221246	310,731	243,719	168,685	107,426	80,165	74,455
Lake Pine	2,060	1,503	1,778	1,565	10,866	8,645	17,897	11,354	6,500	2,799	2,211	1,549
Coral Beach	522	508	390	1,857	3,089	4,426	6,244	5,103	2,912	1,133	567	504

Figure 1 . *2021 DLC water demands from each source reported as cubic meters per month.*

- *Zero demand months on the Oyama Lake source is due to the DLC supplementing the Oyama lake source with the Kalamalka lake source in low consumption periods .*
- *Zero demand months on Okanagan Lake occurred when this source was switched to the Beaver Lake source for upgrades to the Okanagan chlorination facility and construction of a new UV treatment facility.*

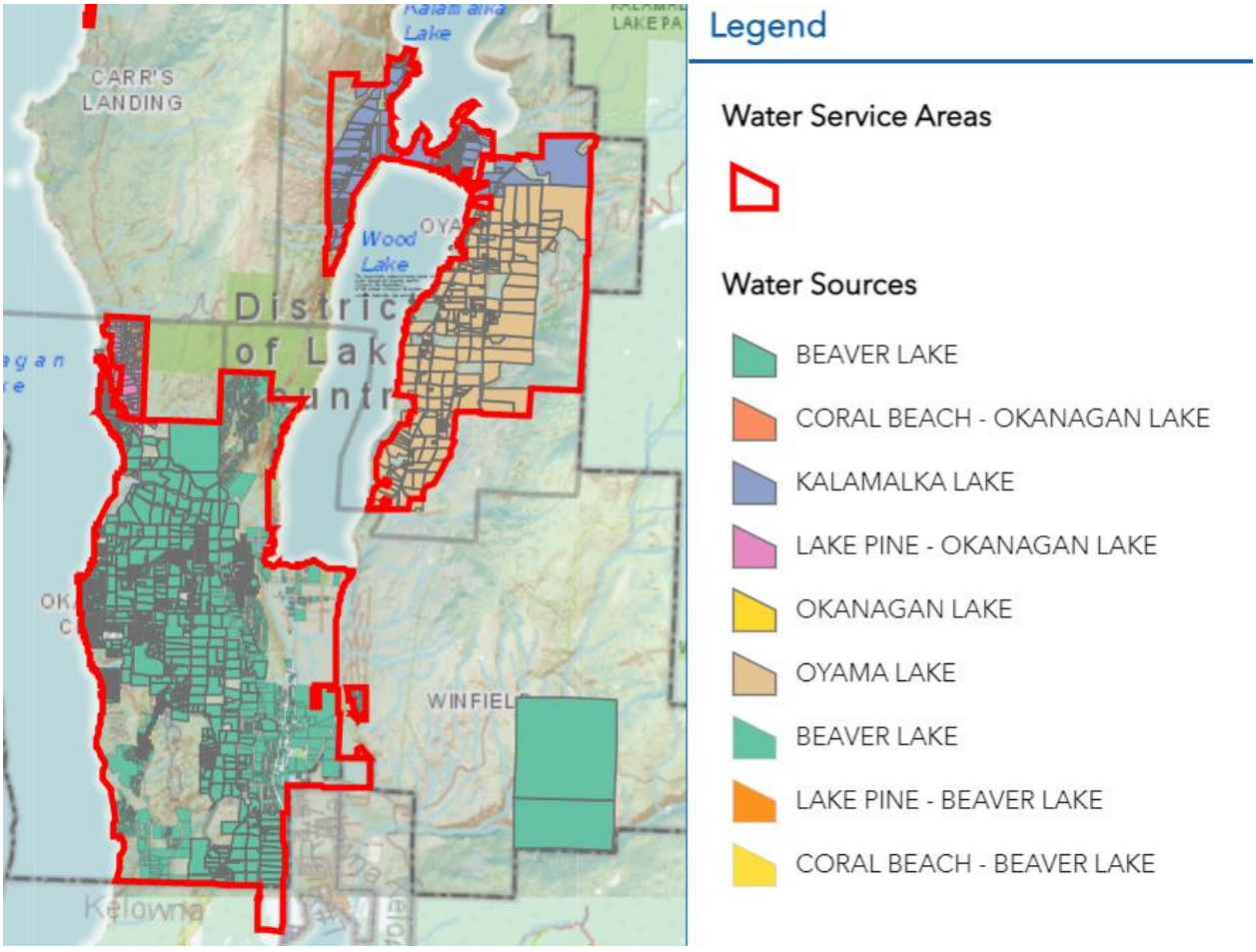
Water Sources

The DLC uses and monitors four separate water sources:

1. Beaver Lake (Crooked Lake chain flows into Beaver Lake)
2. Oyama Lake (Damer Lake flows into Oyama Creek)
3. Okanagan Lake
4. Kalamalka Lake

To review a water source area map, go to:

www.lakecountry.bc.ca/utilities → Click Water → then Water Source Map → Type in your address in the search bar to see which water source.



Crooked Lake Concrete Repairs Fall 2021

Oyama Lake Dam Structure after Pressure Wash

Okanagan Lake UV Facility

Vernon Creek Intake

Refer to Appendix E for the 2021 Oyama and Beaver Lake Level and Discharge and Drought Management Graphs

2021 Snowpack

The Oyama Lake snowpack for 2021 was slightly below average at the end of March, as seen in Figure 2. To see the historical snow survey data for Oyama Lake please visit the *BC River Forecast Centers website*, under the "*2021 (PDF)*", station ID "*2F19P*".

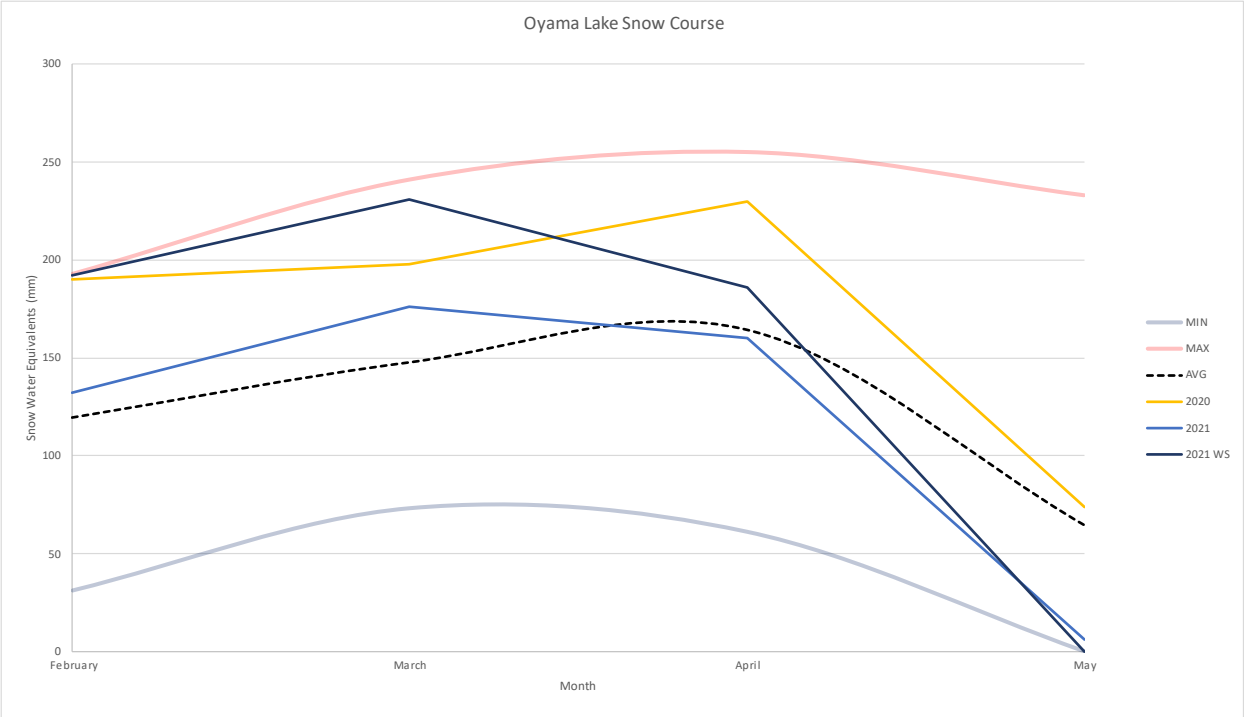


Figure 2. *2021 Oyama Lake Snowpack*

- *"2021" data points are collected in person by water operators*
- *"2021 WS" data points are automatically collected through the snow course located beside Oyama Lake*

2021 was the second year the automated snow course was operational. The real time data that is collected from the automated weather station will be verified manually until 2023. The weather station will record humidity, ambient temperature, snow depth, and snow water equivalents required for proper watershed management. Once manual verification confirms accuracy, the automated snow course will reduce the need for District staff to travel to the upper elevation watershed during winter months, thereby reducing safety concerns.

2021 Freshet

Using the information from the snow course we were able to monitor and anticipate an average yield from the snowpack. District staff released water from the upland lakes to accommodate the increase of runoff from the spring freshet. This allowed the lakes to fill over a longer period of time, which reduced the risk of flooding. A mild freshet was observed at Beaver and Oyama Lakes.

Cross Connection Control Program (CCCP)

Testing of known or required backflow prevention devices occurs in compliance with CSA Standard B64.10-11/B64.10.1-11 and amendments thereto. All new construction and businesses are required to meet or exceed DLC regulations related to Cross-Connection Control. Bylaw 984 (Water Rates & Regulations Bylaw) allows staff to inspect and enforce cross-connection control requirements in the BC Building Code and CSA Group standards. The program has become an integral part of the District's multi-barrier approach to protecting our community's drinking water. Existing facility assessments continue to take place on a rotating scheduled basis to ensure that any changes in ownership/usage are captured by the CCC program and protection devices are installed where required. As of 2021 the District tracks over 200 residential properties and nearly 200 Industrial/Commercial/Institutional (ICI) properties.

Annual Operations Summary

Annual operational duties that are completed by DLC staff:

- Service installation and repairs
- Collection and analysis of water sampling
- Upland dam inspections
- Maintain and clean all reservoir, chlorination, and pumping facilities.
- Water main flushing
- Air valve maintenance
- Pressure reducing valve maintenance
- Hydrant maintenance
- Line valve maintenance
- Main line leak repairs
- Seasonal irrigation turn on & off
- Responding to customer complaints and inquiries
- Cross connection control assembly testing

Dam Inspection and Maintenance

Inspections of the upland dams (Beaver, Crooked, Oyama, and Damer) are completed by DLC staff weekly when the water levels are normal. Increased inspections occur when water levels increase. District staff are addressing the deficiencies noted in the 2020 Dam Audit Report issued by the Provincial Government.

Damer Lake Dam

Beaver Lake Dam

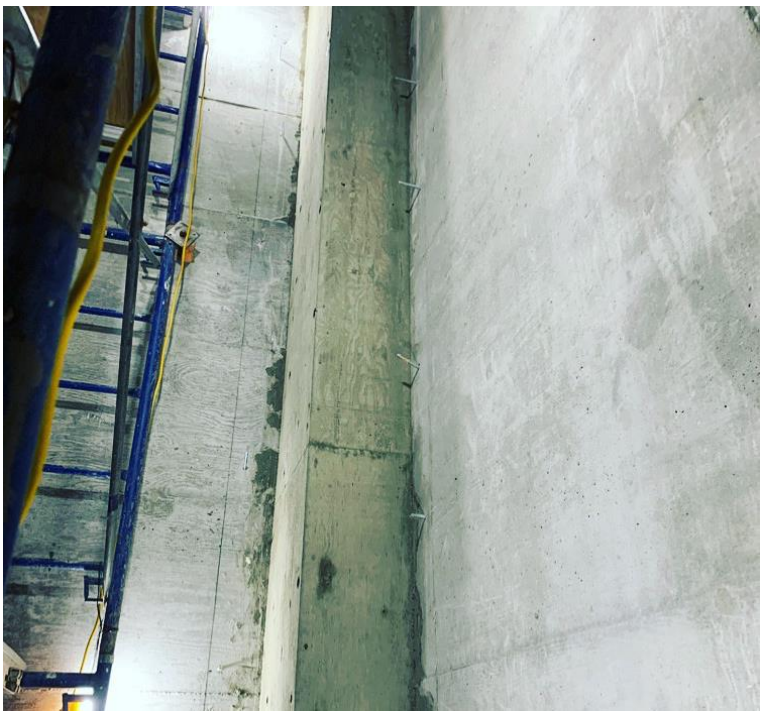
Reservoir Cleaning, Inspection, & Repair

The DLC uses a diving company to conduct reservoir inspections with an ROV unit as needed. In some instances, the DLC also uses divers to clean the reservoirs. When using a diver is not possible, the DLC operations crew will drain and clean the reservoir.

DLC staff drained, cleaned, and inspected the Coral Beach reservoir, Cell 3 at the Upper Lakes Reservoir, and one cell at the Upper Lake Pine Reservoir.

Upper Lake Pine Reservoir

A leak on the east wall of the Lakes Upper Reservoir was discovered in December 2020 where Cells 2 and 3 join. Working with a structural engineer, District staff conducted the repairs with the aid of an external contractor. Once the repairs were completed the reservoir was cleaned and put back into service.



Potable Water Emergency Response Plan

The DLC has a Potable Water Emergency Response Plan that is updated annually (or more often as required). The plan outlines operational response and communication procedures that are to be undertaken in an emergency event that may present health threats to people using the water system. Emergency events include, but are not limited to power outages, loss of supply, watermain breaks, and algae blooms. Both the Emergeny Response Plan and Annual Water Operations Report are provided to IHA annually.

2021 Operations Project Highlights

Upgrades to District SCADA Network

The existing District of Lake Country Water Distribution Supervisory Control and Data Acquisition (SCADA) system relies on a combination of communication technologies to gather, record, and communicate data from the District's water facilities.

In 2018 a number of facilities were noted to have either outdated or obsolete equipment both in the water and wastewater departments. In 2019 upgrades to the SCADA system were initiated and are expected to be complete by 2022.

Okanagan Lake Pumphouse & UV Treatment Plant

In March 2021 upgrades to the Okanagan Lake Pump Station were completed along with the new UV treatment facility. This facility is located on Okanagan Centre Road West and was commissioned in late April 2021. Completion of this project provided the Okanagan Lake source with improved disinfection and treatment process, and supply capacity increases.

Inside New UV building

New Hare Road PRV Station

Hare Road Pressure Regulating Station

A new PRV station was constructed on the south end of Hare Road that connects watermains on Nighthawk Road and Hare Road. This was the initial step in a three phase process to increase fire flows to the lower Okanagan Centre area. The PRV station also provided Hare Road and lower Okanagan Centre with an alternate supply feed, which increases redundancy and overall reliability of the distribution system.

Galvanized Pipe Replacement

Aging galvanized infrastructure nearing end of life rusts due to chemical reactions with the water it contains and its surrounding environment. When left too long, galvanized pipe fails and causes breaks in the distribution system.

Approximately 240 meters of 50mm galvanized watermain was replaced with 200mm PVC watermain along Chase Road near the Monte Bella and Monte Carlo intersections. All existing services were renewed, and a new hydrant and a water quality sampling station were also added as part of the project.

100 meters of galvanized watermain was abandoned on Eyles Road. Services connected to the abandoned watermain were reconnected to an existing adjacent watermain.

Five existing services were reconfigured and renewed to be serviced from a 150mm PVC watermain on Oyama Road.

Galvanized Watermain on Chase Road

Hach WIMS (Water Information Management System)

Hach Water Information Management System (WIMS) is a cloud-based database that allows for more efficient data collection and analysis in one central place. Hach WIMS provides streamlined data collection, reporting, graphing, and operational alerts for the entire water system. Using Hach WIMS to manage water quality and operational data will help staff analyze information more efficiently.

In 2021, staff developed databases for various water infrastructure locations and water quality parameters for each of the six District operated distribution systems. The databases are used to store information collected manually by water operators or automatically through SCADA systems. Staff created various reports that can be automatically generated through information inputted in the databases. Reports include monthly reports to IHA, components of the annual report, and analysis of distribution byproducts. Staff attended training sessions on the implementation, use, and analyses of Hach WIMS software.

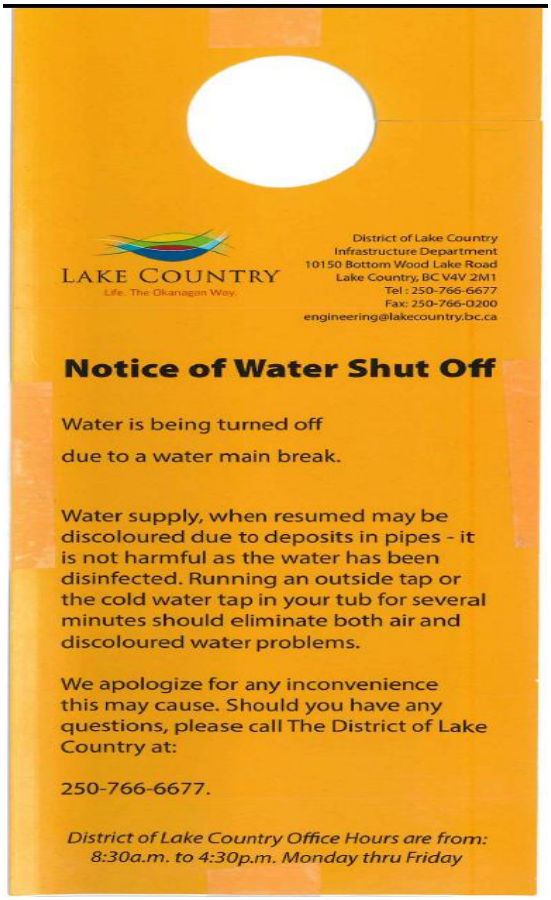
Service Disruptions

Under normal operating conditions many water utilities frequently experience minor disruptions for various reasons, such as leak repairs, water main breaks, seized valves, or installation of new infrastructure. In 2021 the water operations crew responded to 8 service repairs and 9 water main breaks.

Most repairs were completed with little disruption and as quickly as possible. Regular service was restored within the day and public health and safety was not compromised. In circumstances where public health and safety are at risk due to an interruption in water distribution services, the DLC reports the event to the Interior Health Authority (IHA), the appropriate corrective actions are taken to protect public health, and the event is documented in the monthly Water Quality Reports under "*Notable Events*". Two notable watermain breaks that resulted in significant service disruptions occurred on Hare Road and Middle Bench Road.

In January 2021 a major windstorm caused a large tree on Hare Road to sway, which shifted the roots and caused the 150mm watermain to break. As the tree was located overtop of the watermain, the utilities crew had to wait for professional arborists to fall the tree before repairs could be made. This resulted in a long water outage to residents along Hare Road and down in Okanagan Centre.

In July 2021 water crews responded to a leak on Middle Bench Road. The leak location was from a small valve coming out of a large 500mm transmission main. The leak location was unable to be isolated, which resulted in a water shutdown for the majority of the East bench of Oyama. A boil water notice was issued due to the size of the shutdown area, as adequate flushing was unattainable.



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Notice of Water Shut Off

Water is being turned off

due to a water main break.

Water supply, when resumed may be discoloured due to deposits in pipes - it is not harmful as the water has been disinfected. Running an outside tap or the cold water tap in your tub for several minutes should eliminate both air and discoloured water problems.

We apologize for any inconvenience this may cause. Should you have any questions, please call The District of Lake Country at:

250-766-6677.

District of Lake Country Office Hours are from: 8:30a.m. to 4:30p.m. Monday thru Friday

Whenever possible, customers in areas where service is disrupted are advised with notifications. In some emergency circumstances, notifications are not provided due to the size of the outage or the repairs urgent nature. In these circumstances efforts are made to notify customers using the District's website and various social media outlets.

Beaver Lake Watershed Environmental Releases

On September 13th, 2021, the Department of Fisheries and Oceans (DFO), in consultation with the Ministry of Forests, Lands, Natural Resource Operations (FLNRO), ordered the District to release water from the Beaver Lake watershed. The Order was given to preserve Kokanee salmon spawning habitats and requested approximately 20% of the available watershed storage. Water was released from Beaver Lake to Duck Lake, which spilled into Middle Vernon Creek and into Wood Lake. The Order was given in a time of drought and left the District extremely vulnerable if multi year droughts were to occur. While the fish habitat preservation is an important component of the community, long-term water availability requirements of the entire community must also be considered.

Water Quality

Regulatory and Resources

Water purveyors are responsible for providing potable water to their users under the BC's Drinking Water Protection Act. In November 2012 the Province released version 1.1 for Drinking Water Treatment Objective (microbiological) for surface water supplies in British Columbia (BC Drinking water objectives). The treatment objectives ensure the provision of microbiologically-safe drinking water. It provides minimum performance target for water suppliers to treat water to produce microbiologically-safe drinking water addressing enteric viruses, pathogenic bacteria, Giardia cysts and Cryptosporidium oocysts. This continues to follow the 4-3-2-1-0 treatment objectives:

- 4-log (99.99 percent) inactivation and/or removal of viruses,
- 3-log (99.9 percent) inactivation and/or removal of Giardia and *Cryptosporidia*,
- Two treatment processes for surface water
- Less than or equal to one nephelometric turbidity unit (NTU) of turbidity
- No detectable E.coli, fecal coliform and total coliforms

*Water **Master Plan** concept promotional marketing (above)*

Water suppliers serving populations greater than 500 people should have an implementation plan to meet this as a standard. Risk to human health is substantially reduced when water suppliers meet this objective. Water suppliers in British Columbia are required to clearly identify the risks associated with these water supplies that do not meet the standards so the public can make an informed decision regarding additional steps they may need to take to protect themselves, their family and their visitors.

The Oyama and Beaver Lake water treatment facilities at this time are chlorination only and do not have 3-log (99.9 percent) inactivation and/or removal of Cryptosporidium. The health effects associated with exposure to some Protozoa such as Giardia and Cryptosporidium depends on the immune system of the individual ingesting. For this reason the Oyama and Beaver Lake source are on a year round water quality advisory which recommends individuals with compromised immune systems boil the water for a minimum of 1 minute prior to drinking. These risks and concerns are addressed in our 2012 Water Master Plan (WMP) and we remain in discussions with IHA regarding the implementation and challenges of meeting these requirements. Customers that are immune compromised or potentially serve water to individuals that are immune compromised are encouraged to register for the sensitive customer list can connect with the DLC: Engineering@lakecountry.bc.ca. This will ensure that they are contacted when changes in water quality occur.

The DLC will continue our work towards compliance with the drinking water treatment objectives.

Water Quality Testing

This section provides a review of the water quality testing performed in 2021 for the District of Lake Country's (DLC) water sources. The DLC's distribution sites are monitored throughout the year for water chemistry (free and total chlorine, turbidity, temperature, pH and conductivity), and for the presence of bacteria (total coliforms and E.coli).

Vernon Creek covered in snow.

Overall the majority of water chemistry and bacteriological results show that the majority of samples meet the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) with some parameters exceeding the maximum acceptable concentrations.

Water Chemistry

The DLC's two main upland drinking water reservoirs (Beaver and Oyama Lake) and their creek sources where our intakes are located (Vernon and Oyama Creek) exceeded the Guidelines for Canadian Drinking Water Quality GCDWQ for colour and turbidity. The Oyama and Beaver Lake sources had total annual disinfectant by-product averages (Trihalomethanes (THM) and Haloacetic Acids (HAA)) that exceeded the GCDWQ. The Lake Pine Water system exceeded the GCDWQ for THM's for the second year.

Turbidity is naturally occurring in some areas and can be compounded by anthropogenic activities that occur above our intakes, such as recreation, cattle ranching and logging. Turbidity (a measure of the amount of particulate matter suspended in water) can harbour microorganisms, protecting them from disinfection, therefore increasing the chlorine demand. In the Canadian Drinking Water Guideline (GCDWQ) the maximum allowable concentration for turbidity in water distribution systems has been set at 1 NTU.

Chlorine is the disinfectant used for all DLC water sources. Free and total chlorine are measured to ensure adequate disinfection process is occurring, and a residual is maintained throughout the distribution systems.

Ultraviolet (UV) water treatment works by inactivating pathogens in surface water (such as cryptosporidium, giardia lamblia and more) with UV radiation. The UV light radiation, disrupts their DNA and disables their ability to replicate. UV disinfection provides no residual to prevent system regrowth. The Kalamalka and Okanagan Lake sources utilize ultraviolet water treatment as a secondary form of disinfection. Ultraviolet operations log sheets are contained in Appendix F.

Temperature and pH can impact odour and taste and can also has an affect the disinfection process. The potable water temperature should be less than 15 °C for palatability and to inhibit growth of nuisance organisms. GCDWQ for pH ranges between 7.0 and 10.5.

The pH is the measure of acidity or basicity of an aqueous solution. It is an Operational Guideline (OG) now set at 7.0- 10.5 in finished water (prior to 2017 was 6.5-8.5). pH is important to maximize treatment effectiveness, control corrosion and reduce leaching from distribution system and plumbing components GCDWQ .

Conductivity (the ability of an aqueous solution to carry an electrical current) is used as a quick indicator of changes occurring in the natural waters.

Colour creates high disinfectant demands and is an indicator of potential increased dissolved organic matter which, when combined with chlorine, forms disinfectant by-products. There is no GCDWQ for apparent colour however the aesthetic objective in the GCDWQ for true colour is <15 TCU.

Water Chemistry Results

Water Chemistry Results For all sources, any water chemistry parameters that are recorded daily through supervisory control and data acquisition (SCADA) and are not included in the data below. SCADA information is reported monthly to IHA in the web posted Monthly Water Quality reports. The monitoring of source and distribution water is conducted weekly, rotating sampling through all sites as set out in the District of Lake Country Water Quality Monitoring and Reporting Plan.

Distribution water chemistry can vary for numerous reasons. Some of these changes can be attributed to seasonal changes to water demand, timing of sampling following system flushing or use of hydrant or mixing of water sources. It is not unusual within a distribution system to detect trace levels of free chlorine at dead ends or through low use areas. The free and total chlorine levels are closely monitored and if chlorine levels are low, turbidity and colour is elevated, or various other possible circumstances, steps are taken as per our Interior Health approved, Potable Water Quality Emergency Response protocols.

In 2017 the GCDWQ the Aesthetic Objectives of pH were changed from 6.5-8.5 to 7.0-10.5 as operational objectives for finished water. The Beaver and Oyama sources regularly did not meet these objectives whereas the lower elevation sources on Okanagan and Kalamalka were generally within this range. Temperature on all systems fluctuates with changing outdoor ambient temperature and raw water

conditions. Although annual averages on all systems were well under the 15 degrees guidelines summer maximum temperatures exceeding the guideline.

Distribution water quality results are in tables 1 -6 below for District of Lake Country Water Systems. The list of sample sites for each distribution system is in Appendix B.

Beaver Lake Source

Table 1. *2021 Annual Distribution Water Chemistry Results: District of Lake Country Water System; Beaver Lake Source (All data reported from weekly water quality monitoring using hand-held equipment). It should be noted that occasionally the distribution water sampled is a mixture of both sources (Okanagan Lake mixed into Beaver distribution) and variation from the norm occurs within the data. Note the Max turbidity of 11.90 is an isolated event post water main flushing.*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	**0.05**	**0.11**	**0.20**	**2.80**	**5.84**	**64**
MAX	**3.52**	**3.66**	**11.90**	**23.20**	**8.20**	**184**
AVERAGE	**1.13**	**1.33**	**0.88**	**9.30**	**6.89**	**86**
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Okanagan Lake Source

Table 2. *2021 Annual Distribution Water Chemistry Results: District of Lake Country Water System; Okanagan Lake Source (All data reported from weekly water quality monitoring using hand-held equipment). Note: until March 26, 2021 this source was offline and Beaver Lake was the primary Source.*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.12	0.26	0.16	5	7.2	180
MAX	4.30	4.50	1.16	18	8.4	295
AVERAGE	0.84	0.97	0.38	10	7.9	278
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Oyama Lake Source

Table 3. *2021 Annual Distribution Water Chemistry Results: District of Lake Country Water System; Oyama Lake Source (All data reported from weekly water quality monitoring using hand-held equipment). Occasionally the distribution water sampled is a mixture of both sources (Oyama Lake and Kalamalka Lake) and variation from the norm occurs within the data. Oyama water source is typically online mid-May through mid-October (mixing of sources in the Oyama reservoir occurs for a short time following the switch).*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	1.31	1.56	0.49	6	5.3	49
MAX	7.90	8.80	4.28	22	7.2	194
AVERAGE	2.51	2.80	1.25	14	6.4	68
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Kalamalka Lake Source

Table 4*. 2021 Annual Distribution Water Chemistry Results: District of Lake Country Water System; Kalamalka Lake Source (All data reported from weekly water quality monitoring using hand-held equipment).*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.16	0.37	0.25	4	6.9	287
MAX	3.44	3.92	1.50	17	8.5	425
AVERAGE	1.35	1.54	0.57	8	8.1	400
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Coral Beach Water System

Table 5. *2021 Annual Distribution Water Chemistry Results: Coral Beach Water System; Okanagan Lake Source (All data reported from weekly water quality monitoring using hand-held equipment).*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.26	0.42	0.18	4	7.1	208
MAX	2.36	2.58	0.87	21	8.3	579
AVERAGE	1.05	1.21	0.37	10	7.8	333
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Lake Pine Water System

Table 6. *2021 Annual Distribution Water Chemistry Results: Lake Pine Water System; Okanagan Lake Source (All data reported from weekly water quality monitoring using hand-held equipment).*

	Free Chlorine mg/L	Total Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.02	0.13	0.16	4	7.4	223
MAX	2.40	2.50	0.51	19	8.4	352
AVERAGE	1.00	1.18	0.32	10	8.0	312
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***OG***	

Bacteriological Regulations and Results

The bacteriological water quality monitoring requirements that DLC follows measure against the Guidelines for Canadian Drinking Water Quality (GCDWQ) and the *Drinking Water Protection Act (DWPA) and Regulations (DWPR).* To disinfect for waterborne pathogens, all DLC water sources use Chlorine (either gas or hypochlorite) and chlorine residuals are measured in the distribution lines. On the Kalamalka and Okanagan Lake sources an additional measure of ultraviolet (UV) disinfection is used. See Appendix F for UV system off spec water.

Drinking water samples are collected on a weekly basis within each DLC Water System. Each water source is monitored for physical, chemical, and biological parameters. All membrane filtration microbiological samples are sent to an accredited and licensed laboratory for analysis. Additionally, samples are analyzed 'in-house' with Presence-Absence tests (P/A) for further measurement against the GCDWQ and for use in assessing trends, standards and emerging issues. The required numbers of monthly samples are detailed in the DWPR Schedule B (Table 7) and the District of Lake Country Water Quality and Monitoring Plan; Frequency of Monthly bacteriological tests (Table 8). All weekly Total coliform and E.coli results from raw water sources and throughout the distribution system (this includes both membrane filtration and Presence-Absence) are compiled and submitted to the Drinking Water Officer assigned to DLC. Results that do not meet the water quality standards in the DWPR, Schedule A **(Table 9)** are immediately reported to the Drinking Water Officer and corrective actions are implemented as per the Districts Potable Water Emergency Response Plan.

Table 7: *Schedule B – Frequency of Monitoring Samples for Prescribed Water Supply Systems* (*section 8).*

Population Served by the Prescribed Water Supply System:	**# Samples per month:**
less than 5,000	4
5,000 to 90,000	1 per 1,000 of population
more than 90,000	90 plus 1 per 10,000 of population in excess of 90,000

Table 8: *Frequency of Monthly bacteriological tests: Membrane Filtration (MF) and Presence-Absence (P/A)*

System/Source	MF Distribution # samples required per mo.	P/A	Total MF Distribution and Raw	Distribution Bacteriological/Chlorine test sites:
DLC Water System: Beaver Lake source : Est. Population 3,000	4	2	8	15*
DLC Water System: Okanagan Lake source : Est. Population: 6,000	6	2	8	14**
DLC Water System: Oyama Lake source: Est. Population 625	4	2	8	5
DLC Water System: Kalamalka Lake source: Est Population 750	4	2	8	5
Coral Beach Water System: Okanagan Lake source Est Population 130	4	2	8	2
Lake Pine Water System: Okanagan Lake source Est Population 198	4	2	8	3**

- * Includes Camp Rd. Reservoir (Offline unless required)
- ** Includes 2 reservoirs

Table 9: *Schedule A - Water Quality Standards for Potable Water (sections 2 and 9) DWPR*

Parameter:	Standard:
Escherichia coli (*E.coli*)	No detectable Escherichia coli (*E.coli*) per 100 ml
Total coliform bacteria:	
(a) 1 sample in a 30 day period	No detectable total coliform bacteria per 100 ml
(b) more than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacteria per 100 ml

Coliform bacteria are naturally occurring in the environment and generally are not harmful. However, their presence is an indicator for the presence of other types of disease-causing organisms. The presence of these bacteria is a sign that there may be problems with the water treatment, or the water distribution system.

Escherichia coli, (E.coli) are a bacterium that is always present in the intestines of humans and other animals and whose presence in drinking water would indicate fecal contamination of the water. Most strains of E.coli do not cause illness in healthy humans, although some strains do cause cramps and diarrhea. One particular strain named O157:H7 produces a powerful toxin that can cause severe illness. Under BC's Drinking Water Protection Regulations the maximum acceptable concentration (MAC) of *E.coli* in public, semi-public, and private drinking water systems is none detectable per 100 mL. At the time the samples are analyzed, the lab estimates the general bacterial population from background colony counts. Background bacteria are used as a general measure of the bacterial population present in a drinking water system or in the raw source water. Under ideal growth conditions, the background bacteria may increase

and are indicators of the potential growth of coliforms. BC's Drinking Water Protection Regulations further state that no sample may contain more than 10 total coliforms per 100 ml, and that at least 90% of samples must have no detectable total coliform bacteria in a sample over a 30-day period. To identify problem areas and in aiming to provide good water quality within the distribution systems, all events are recorded and reported with follow-up sampling and, when necessary, flushing to provide fresh water to the site.

In 2021, 308 MF bacteriological samples were collected and analyzed at Caro Environmental Labs in Kelowna for total coliforms and E.coli. Additionally, 120 P/A tests were analyzed in-house. The summary of the bacteriological results is in Appendix A. The P/A tests determine if total coliforms are present or absent from the sample but do not provide coliform counts should the test be positive. P/A tests are collected on alternate weeks from the MF samples. Should a P/A be positive, additional bacteriological testing and further water chemistry testing occurs. At no time was E.coli detected in any DLC distribution systems.

In 2021 Three Total Coliform samples were detected. On the Beaver Lake source and two samples were positive and on the Coral Beach water system two sites (South end and Coral Beach Pumphouse) were positive for total Coliforms.

On the Beaver Lake Source, January 11, 2021 77 CFU/100mL were detected and on July 6th 2 total coliforms were detected both at the south end sample site and at the pumphouse sample site.

Results were unusual and unexplained. All sites were re-sampled immediately following receipt of results and no further detection of coliforms occurred.

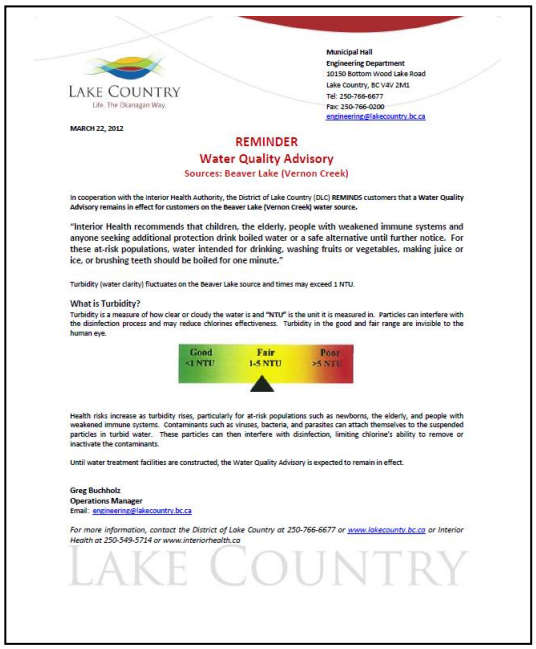
Water Quality Advisories and Boil Water Notices

IHA maintains the requirement of purveyors to issue a Water Quality Advisory when turbidity exceeds 1 NTU and to contact Interior Health as the turbidity approaches 5 NTU to discuss enhanced notification (i.e. a Boil Water Notice). Two of the DLC sources are on a Water Quality Advisory (WQA). Reminder notifications are sent to customers quarterly through water bill inserts as well as posted on the DLC web page and through our social media and local paper as required. Regardless whether a source is on an Advisory or not, the distribution systems on all sources are regularly monitored as per the IHA approved Water Quality Monitoring and Reporting Plan.

The following sources throughout 2021 were on a **Water Quality Advisory (WQA**):

- Beaver Lake Water Source
- Oyama Lake Water Source

The advisories on Beaver and Oyama Sources are on WQA's due to fluctuating turbidity and lack of multibarrier treatment. Both WQA's will remain in effect until infrastructure upgrades are made to improve water quality and reliability.



LAKE COUNTRY
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Municipal Hall
Engineering Department
10150 Bottom Wood Lake Road
Lake Country, BC V4V 2M1
Tel: 250-766-6677
Fax: 250-766-0200
engineering@lakecountry.bc.ca

MARCH 22, 2012

REMINDER
Water Quality Advisory
Sources: Beaver Lake (Vernon Creek)

In cooperation with the Interior Health Authority, the District of Lake Country (DLC) **REMINDS** customers that a **Water Quality Advisory remains in effect for customers on the Beaver Lake (Vernon Creek) water source.**

"Interior Health recommends that children, the elderly, people with weakened immune systems and anyone seeking additional protection drink boiled water or a safe alternative until further notice. For these at-risk populations, water intended for drinking, washing fruits or vegetables, making juice or ice, or brushing teeth should be boiled for one minute."

Turbidity (water clarity) fluctuates on the Beaver Lake source and times may exceed 1 NTU.

What is Turbidity?
Turbidity is a measure of how clear or cloudy the water is and "NTU" is the unit it is measured in. Particles can interfere with the disinfection process and may reduce chlorines effectiveness. Turbidity in the good and fair range are invisible to the human eye.

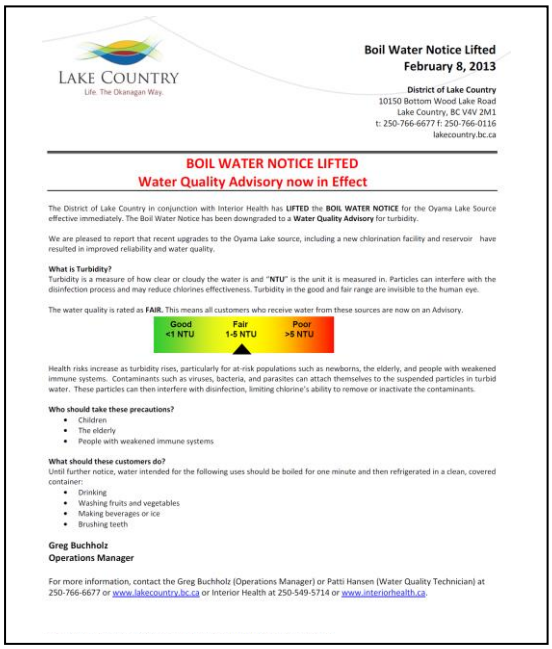
Good	Fair	Poor
<1 NTU	1-5 NTU	>5 NTU

Health risks increase as turbidity rises, particularly for at-risk populations such as newborns, the elderly, and people with weakened immune systems. Contaminants such as viruses, bacteria, and parasites can attach themselves to the suspended particles in turbid water. These particles can then interfere with disinfection, limiting chlorine's ability to remove or inactivate the contaminants.

Until water treatment facilities are constructed, the Water Quality Advisory is expected to remain in effect.

Greg Buchholz
Operations Manager
Email: engineering@lakecountry.bc.ca

For more information, contact the District of Lake Country at 250-766-6677 or www.lakecountry.bc.ca or Interior Health at 250-549-5714 or www.interiorhealth.ca



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Boil Water Notice Lifted
February 8, 2013

District of Lake Country
10150 Bottom Wood Lake Road
Lake Country, BC V4V 2M1
t: 250-766-6677 f: 250-766-0116
lakecountry.bc.ca

BOIL WATER NOTICE LIFTED
Water Quality Advisory now in Effect

The District of Lake Country in conjunction with Interior Health has **LIFTED** the **BOIL WATER NOTICE** for the Oyama Lake Source effective immediately. The Boil Water Notice has been downgraded to a **Water Quality Advisory** for turbidity.

We are pleased to report that recent upgrades to the Oyama Lake source, including a new chlorination facility and reservoir have resulted in improved reliability and water quality.

What is Turbidity?
Turbidity is a measure of how clear or cloudy the water is and "**NTU**" is the unit it is measured in. Particles can interfere with the disinfection process and may reduce chlorines effectiveness. Turbidity in the good and fair range are invisible to the human eye.

The water quality is rated as **FAIR.** This means all customers who receive water from these sources are now on an Advisory.

Good	Fair	Poor
<1 NTU	1-5 NTU	>5 NTU

Health risks increase as turbidity rises, particularly for at-risk populations such as newborns, the elderly, and people with weakened immune systems. Contaminants such as viruses, bacteria, and parasites can attach themselves to the suspended particles in turbid water. These particles can then interfere with disinfection, limiting chlorine's ability to remove or inactivate the contaminants.

Who should take these precautions?
- Children
- The elderly
- People with weakened immune systems

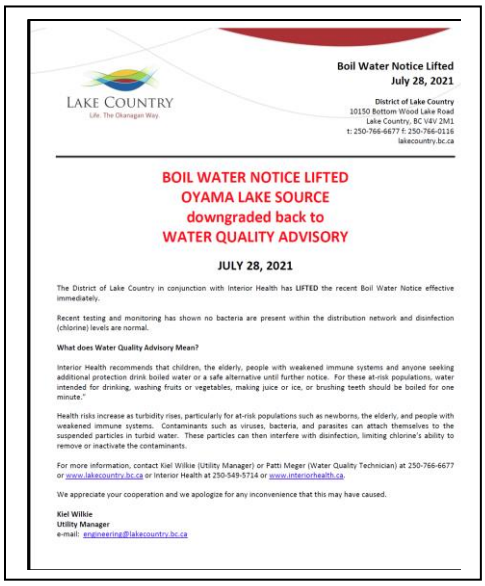
What should these customers do?
Until further notice, water intended for the following uses should be boiled for one minute and then refrigerated in a clean, covered container:
- Drinking
- Washing fruits and vegetables
- Making beverages or ice
- Brushing teeth

Greg Buchholz
Operations Manager

For more information, contact the Greg Buchholz (Operations Manager) or Patti Hansen (Water Quality Technician) at 250-766-6677 or www.lakecountry.bc.ca or Interior Health at 250-549-5714 or www.interiorhealth.ca.

Notable Water Quality Events

Oyama Lake Source Boil Water Notice-



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Boil Water Notice Lifted
July 28, 2021

District of Lake Country
10150 Bottom Wood Lake Road
Lake Country, BC V4V 2M1
t: 250-766-6677 f: 250-766-0116
lakecountry.bc.ca

BOIL WATER NOTICE LIFTED
OYAMA LAKE SOURCE
downgraded back to
WATER QUALITY ADVISORY

JULY 28, 2021

The District of Lake Country in conjunction with Interior Health has **LIFTED** the recent Boil Water Notice effective immediately.

Recent testing and monitoring has shown no bacteria are present within the distribution network and disinfection (chlorine) levels are normal.

What does Water Quality Advisory Mean?

Interior Health recommends that children, the elderly, people with weakened immune systems and anyone seeking additional protection drink boiled water or a safe alternative until further notice. For these at-risk populations, water intended for drinking, washing fruits or vegetables, making juice or ice, or brushing teeth should be boiled for one minute."

Health risks increase as turbidity rises, particularly for at-risk populations such as newborns, the elderly, and people with weakened immune systems. Contaminants such as viruses, bacteria, and parasites can attach themselves to the suspended particles in turbid water. These particles can then interfere with disinfection, limiting chlorine's ability to remove or inactivate the contaminants.

For more information, contact Kiel Wilkie (Utility Manager) or Patti Meger (Water Quality Technician) at 250-766-6677 or www.lakecountry.bc.ca or Interior Health at 250-549-5714 or www.interiorhealth.ca.

We appreciate your cooperation and we apologize for any inconvenience that this may have caused.

Kiel Wilkie
Utility Manager
e-mail: engineering@lakecountry.bc.ca

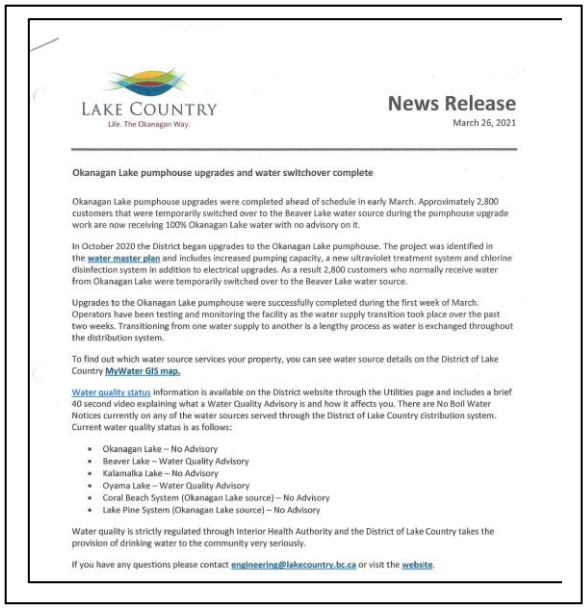
One Boil Water Notice was issued July 24, 2021 due to a main break on the Oyama Lake source. The BWN was rescinded on July 28th

In the afternoon of Saturday July 24th on the Oyama Water Source, South End Middle Bench Road a water leak was discovered. A Boil Water Notice was issued as per the DLC Potable Water Quality Emergency Response Plan. The repair occurred during the day, water was restored, flushed and back on-line early evening. Bacteriological sampling and water chemistry testing followed and on Wednesday July 28th the Boil Water Notice (BWN) was rescinded and the Water Quality Advisory was reinstated. All procedures

were followed as outlined in DLC Potable Water Quality Emergency Response Plan. This includes notification to all sensitive customers.

Okanagan Lake Source Water Quality Advisory -

From October 14th, 2020 to March 26th, 2021 customers that receive Okanagan Lake water from the District's Okanagan Lake pump house were switched to the Beaver Lake source and placed on a water quality advisory. This was to facilitate the improvements already discussed prior in this report. The District used emails on file, mailed letters, social media, local news papers, and the Districts website to advise and communicate with this customer base. The same methods of communications was used when the Okanagan Lake source was returned to these customers and the water quality advisory was rescinded.



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News Release
March 26, 2021

Okanagan Lake pumphouse upgrades and water switchover complete

Okanagan Lake pumphouse upgrades were completed ahead of schedule in early March. Approximately 2,800 customers that were temporarily switched over to the Beaver Lake water source during the pumphouse upgrade work are now receiving 100% Okanagan Lake water with no advisory on it.

In October 2020 the District began upgrades to the Okanagan Lake pumphouse. The project was identified in the water master plan and includes increased pumping capacity, a new ultraviolet treatment system and chlorine disinfection system in addition to electrical upgrades. As a result 2,800 customers who normally receive water from Okanagan Lake were temporarily switched over to the Beaver Lake water source.

Upgrades to the Okanagan Lake pumphouse were successfully completed during the first week of March. Operators have been testing and monitoring the facility as the water supply transition took place over the past two weeks. Transitioning from one water supply to another is a lengthy process as water is exchanged throughout the distribution system.

To find out which water source services your property, you can see water source details on the District of Lake Country MyWater GIS map.

Water quality status information is available on the District website through the Utilities page and includes a brief 40 second video explaining what a Water Quality Advisory is and how it affects you. There are No Boil Water Notices currently on any of the water sources served through the District of Lake Country distribution system. Current water quality status is as follows:

- Okanagan Lake – No Advisory
- Beaver Lake – Water Quality Advisory
- Kalamalka Lake – No Advisory
- Oyama Lake – Water Quality Advisory
- Coral Beach System (Okanagan Lake source) – No Advisory
- Lake Pine System (Okanagan Lake source) – No Advisory

Water quality is strictly regulated through Interior Health Authority and the District of Lake Country takes the provision of drinking water to the community very seriously.

If you have any questions please contact engineering@lakecountry.bc.ca or visit the website.

Wood Lake Algae Bloom-

Although the District does not have any water intakes on Wood Lake, the District Kalamalka Lake intake was impacted by the spring algae bloom on Wood Lake. Frequent sample were taken at the District Kalamalka Lake intake, and no samples indicated that the source should not be used for drinking water. Monitoring for algae is a year-round process as algae blooms can occur in winter months.

In Mid May 2021, the Province launched an Algae Watch Website (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/algae-watch) . Algae Watch is an educational program for citizen science data gathering. The goal is to help people recognize and identify algae blooms in B.C. lakes. IHA is in the process of updating their web site and it should be available for the 2022 season.

Disinfectant By-Products:

Under the Guidelines for Canadian Drinking Water Quality: Haloacetic acids (HAAs) and Trihalomethanes (THM's)are disinfectant by-products and are a group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation). The use of chlorine in the treatment of drinking water has virtually eliminated waterborne diseases, because chlorine can kill or inactivate most microorganisms commonly found in water. The majority of drinking water treatment plants in Canada use some form of chlorine to disinfect drinking water: to treat the water directly in the treatment plant and/or to maintain a chlorine residual in the distribution system to prevent bacterial regrowth. Disinfection is an essential component of public drinking water treatment; the health risks from disinfection by-products, including Trihalomethanes and haloacetic acids, are much less than the risks from consuming water that has not been appropriately disinfected. (GCDWQ)

Water quality results with high HAA's and THM's such as those from our upper elevation drinking water reservoirs are common throughout the Okanagan when untreated then chlorinated water is sourced from lakes with elevated natural organic matter. It is less common on our lower elevation lakes (Okanagan and Kalamalka) to see higher disinfectant by-products and turbidity. Water quality at our deep-water intakes is carefully being monitored for possible deviations following flooding years. It is common to have more than one season pass following a flooding event prior to detecting variations in water chemistry

Haloacetic acids (HAAs)

Total haloacetic acids refers to the total of monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid and dibromoacetic acid. The maximum acceptable concentration (MAC) for total haloacetic acids in drinking water is 0.08 mg/L (80 µg/L) based on a locational running annual average of a minimum of quarterly samples taken in the distribution system.

2021 haloacetic acids analysis in the DLC Water System showed Oyama and Beaver lake sources had total annual HAA averages that exceeded the Guidelines for Canadian Drinking Water Quality (GCDWQ).

Table 10. Beaver Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ).

HAA mg/L Vernon Creek (Beaver Lake)Source **guideline <0.080 mg/L**	**Cooney** End of Line mg/L	**Pow** intermediary (towards N end of line) mg/L
2021-01-25	**0.240**	**0.196**
2021-06-14	**0.154**	**0.132**
2021-09-14	**0.177**	**0.179**
2021-12-01	**0.164**	**0.177**
Quarterly Annual Average by site	**0.184**	**0.171**
System Total Annual Quarterly HAA Average mg/L		**0.177**

Table 11. Okanagan Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ). Note: Okanagan Lake offline the first quarter of this year (offline October 14, 2020 – March 31, 2021).

HAA mg/L Okanagan Lake Source guideline <0.0.080 mg/L	**Glenmore Booster** intermediary post reservoir mg/L	**Lakes Upper Reservoir** post 3 reservoirs and re-chlorination (hypochlorite) mg/L	**Lakes cell 1 Lakes Lower Reservoir** mg/L
2021-01-27	0.0252	0.0518	
2021-06-14	0.0257	0.0394	0.0266
2021-09-17	0.0400	0.0502	0.0436
2021-11-29	0.0400	0.0502	0.0436
Quarterly Annual Average by site	0.030	0.047	0.035
Total Annual Quarterly HAA Average mg/L			0.038

Table 12. Oyama Water System, Kal Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ).

HAA mg/L Kalamalka Lake Source guideline <0.080 mg/L	**Cornwall mg/L** Intermediary/end of line	**Evans Road** (End of Line & one time sample) mg/L	**Ribbleworth** (Oyama Distribution Kal Source) mg/L
2021-01-26	0.0315		0.0191
2021-06-15	0.0161	0.0413	
2021-09-20	0.0318		
2021-12-06	0.0268		
Quarterly Annual Average by site	0.0270	0.041	0.019
Total Annual Quarterly HAA Average mg/L			0.029

Table 13. Oyama Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ). Note: Oyama Source only on-line during the irrigation season and quarterly annual samples are not possible

HAA mg/L Oyama Lake Source guideline <0.080 mg/L	**East Hill** (intermediary) mg/L	**Ribbleworth** (Intermediary) mg/L
2021-06-16	0.145	0.168
2021-09-20	Source switched to Kal Early, no Fall Sample	
Quarterly Annual Average by site	0.145	0.168
Total Annual Quarterly HAA Average mg/L		0.029

Table 14. Coral Beach Water System, Okanagan Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ).

HAA mg/L Coral Beach South End Ok Lake Source guideline <0.100 mg/L	**HAA mg/L**
2021-01-27	0.0350
2021-06-16	0.0360
2021-09-15	0.0268
2021-12-07	0.0515
Annual Quarterly Average mg/L	**0.0373**

Table 15. Lake Pine Water System, Okanagan Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total HAA data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ).

HAA mg/L Lake Pine Ok Lake Source PR Stn. guideline <0.080 mg/L	**HAA**
2021-01-27	0.0833
2021-06-16	0.0527
2021-09-15	0.0337
2021-12-01	0.0508
2021-12-07	0.0641
Annual Quarterly Average HAA mg/L	**0.0569**

Trihalomethanes (THM's)

The maximum acceptable concentration (MAC) for trihalomethanes (*includes the total of chloroform, bromodichloromethane, dibromochloromethane and bromoform*) in drinking water is 0.100 mg/L (100 µg/L). This is based on a locational running annual average of a minimum of quarterly samples taken at the point in the distribution system with the highest potential THM levels.

The DLC follows the GCDWQ for HAA's and THM's with a minimum quarterly monitoring samples taken at intermediary sites as well as on large water systems (Oyama, Beaver and Okanagan), at a point in the distribution system with the highest THM formation potential. These sites are represented in areas of the distribution system with the longest disinfectant retention time, which are located at the far end of the distribution system.

2021 trihalomethane analysis in the DLC Water System showed Oyama and Beaver Lake sources as well as the Lake Pine water system had total annual THM averages that exceeded the Guidelines for Canadian Drinking Water Quality (GCDWQ). All THM results displayed as a running average for each site and as a distribution total are detailed in Figures 3-8 **.**

Table 16. Beaver Lake Source trihalomethane (THM) data collected 2021. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

THM mg/L Vernon Creek (Beaver Lake) Source **guideline <1.000 mg/L**	**Cooney** End of Line mg/L	**Pow** intermediary (towards N end of line) mg/L
2021-01-25	**0.265**	**0.243**
2021-06-14	**0.316**	**0.287**
2021-09-14	**0.421**	**0.250**
2021-12-01	**0.439**	**0.324**
Quarterly Annual Average by site	**0.360**	**0.276**
Total Annual Quarterly THM Average		**0.318**

Table 17. DLC Okanagan Lake source trihalomethane (THM) data collected 2021. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ). Note: Okanagan Lake offline the first quarter of this year (offline October 14, 2020 – March 31 2021).

THM mg/L Okanagan Lake Source guideline <0.100 mg/L	**Glenmore Booster** intermediary post reservoir mg/L	**Lakes Upper Reservoi**r post 3 reservoirs and re-chlorination (hypochlorite) mg/L	**Jardine** intermediary mg/L	**cell 1 Lakes Lower Reservoir mg/L**
2021-01-27		0.0518		0.0252
2021-06-14	0.0645	**0.103**	0.0266	0.0257
2021-09-17		0.0502	0.0436	0.040
Quarterly Annual Average by site	0.065	0.068	0.035	0.030
Total Annual Quarterly THM Average				0.050

Sampling of Oyama source occurs only during irrigation season (approximately May – October) due to Kalamalka source in distribution lines during non-irrigation season.

Table 18. Oyama Lake Source Haloacetic Acid (HAA) data collected 2021. Average Total THM data collected and calculated as per the Guidelines for Canadian Drinking Water Quality (GCDWQ). Note: Oyama Source only on-line during the irrigation season and quarterly annual samples are not possible.

THM mg/L Oyama Lake Source guideline <0.100 mg/L	**East Hill** (intermediary) mg/L	**Ribbleworth** (intermediary-end of line) mg/L
2021-06-16	0.285	0.356
2021-09-20	Source switched to Kal Early, no Fall Sample	
Quarterly Annual Average by site mg/L	0.285	0.356
Total Annual Quarterly HAA Average mg/L		0.029

Table 19. DLC Kalamalka lake source trihalomethane (THM) data collected 2021. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ). Kalamalka sampling includes sites within Oyama distribution lines during non-irrigation season (approximately October – May).

THM mg/L Kalamalka Lake Source guideline <0.100 mg/L	**Cornwall** mg/L	**Evans Road** (End of Line ONE time sample) mg/L	**Ribbleworth** (Oyama Distribution Kal Source) mg/L
2021-01-26	0.0514		0.0437
2021-06-15	0.0553	0.0543	
2021-09-20	0.0729		
2021-12-06	0.103		
Quarterly Annual Average by site	0.071	0.054	0.044
Total Annual Quarterly THM Average			0.056

Table 20 . DLC Coral Beach System (Okanagan lake source) trihalomethane (THM) data collected 2021. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

THM mg/L Coral Beach Ok Lake Source guideline <0.100 mg/L	**South End** mg/L
2021-01-27	0.0583
2021-06-16	0.0842
2021-09-15	0.0714
2021-12-07	**0.160**
Annual Quarterly Average	**0.093**

Table 21. DLC Lake Pine System (Okanagan Lake source) trihalomethane (THM) data collected 2021. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

THM mg/L Lake Pine Ok Lake Source guideline <0.100 mg/L	**PR Stn.** mg/L
2021-01-27	**0.104**
2021-06-16	**0.145**
2021-09-15	**0.140**
2021-12-01	**0.149**
2021-12-07	**0.177**
Annual Quarterly THM Average mg/L	0.143

Raw Water Reservoirs/Intakes

The DLC draws water from four main primary drinking water reservoirs:

1. Beaver Lake (Crooked Lake chain flows into Beaver Lake) - upland source with a downstream intake on Vernon Creek.
2. Oyama Lake (Damer Lake flows into Oyama Creek) - upland source with a downstream intake on Oyama creek
3. Okanagan Lake (3) deep water intakes
4. Kalamalka Lake (1) deep water intake

Oyama Lake near earthfill dam (left) and Oyama Creek (right).

The Oyama and Beaver Lake watersheds together encompass approximately 141.1 km^2. Together, the two community watersheds supply the DLC with approximately 60-65% of their source water. Both watersheds are dependent on upland storage reservoirs that rely on snowpack for annual water regeneration and supply needs.

The DLC draws water from intakes both on Vernon and Oyama Creeks. In addition to monitoring and sampling at these intakes, the DLC also analyzes raw water from our upland drinking water reservoirs. These reservoirs have samples collected for other water quality parameters that would provide adequate measurement of chemical and physical water quality against the CDWG as per Conditions on Permit and recommendations in 2010 Oyama and Vernon Creek Source Water Assessment. Comprehensive reports (parameters tested at the drinking water intakes) are in Appendix C and the result for nutrient sampling (upland drinking water reservoirs (Beaver and Oyama)) is contained in Appendix D.

Source water from these watersheds is high in organic matter which causes colour issues and elevated disinfectant by-products. Turbidity is naturally occurring in some areas and can be compounded by human activities that occur above our intakes, such as recreation, cattle ranching and logging.

The water quality monitoring of these reservoirs may increase or decrease in response to varying water quality conditions and to provide adequate baseline data for future water treatment.

Beaver Lake at Dam outflow

Source Sampling (Raw Water)

Raw Water Sampling occurs at intakes, upland drinking water reservoirs, and at deep water intake pump stations.

Crooked Lake (left) Beaver Lake Dam (middle) and Vernon Creek (right)

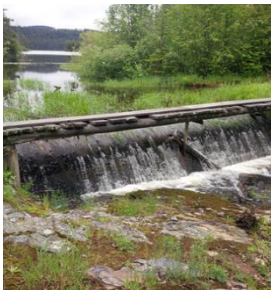
At raw water intakes we analyze water quality parameters that will provide adequate measurement of chemical and physical water quality. This data is compared against the GCDWQ and the recommendations in Oyama and Vernon Creek Watersheds Source Water Assessment. Annually, comprehensive tests are collected at all intakes and nutrient testing occurs as deemed necessary. The DLC continually modifies parameters sampled to provide sufficient baseline data for future water treatment.

The DLC's two main upland drinking water reservoirs (Beaver and Oyama Lakes) and creek sources (Vernon and Oyama Creeks) exceeded the physical parameters of the GCDWQ for colour and turbidity. Such results are common throughout the Okanagan wherever water is sourced from highland watersheds.

All results are tabulated in the comprehensive reports in Appendix D.

Raw Water Data from intakes and pump stations are in Tables 11 through 16 (below). Data is collected from each source from the following sites:

- Beaver Lake source: Vernon Creek Intake (Table 11)
- Okanagan Lake Source: Okanagan Lake Pump Station (Table 12)
- Oyama Lake source: Oyama Creek Intake (Table 13)
- Kalamalka Lake source: Kalamalka Pump Station (Table 14)
- Okanagan Lake Source: Coral Beach Pump House (Table 15)
- Okanagan Lake Source: Lake Pine Pump House (Table 16)



Oyama Lake Dam Spillway

Table 11. *District of Lake Country Water System, 2021 Raw Water, Beaver Lake Source: Vernon Creek Intake/Eldorado Reservoir. (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services).*

weekly sampling and on-line water quality eqiupment verification	[1] *Hardness* *mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond µS/cm	TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	[3] % of samples less than 10 E.coli/100mL (N=52)
MIN	40	0.48	0.5	7.0	53	24	<1	<1	77%
MAX	60	5.12	23	8.5	110	120	3650	64	
AVERAGE	47	1.21	9	7.5	71	44	52 samples		
WQ Guidelines			***15***	***7.0-10.5***			***<1***	***<1***	
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***OG***		***AO***	***MAC***	***MAC***	

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3 Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Table 12. *District of Lake Country Water System, 2021 Raw Water, Okanagan Lake Source: Okanagan Lake Intake. (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services).*

weekly sampling and on-line water quality eqiupment verification	[1] *Hardness mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond mS/cm	[3] TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	UV Transmittance @ 254 nm unflitered	[4] % of samples less than 10 E.coli/100mL (N=44)
MIN	140	0.22	6	7.3	244	<5	<1	<1	78	100%
MAX	160	0.90	14	8.9	284	6.7	35	1	86	
AVERAGE	150	0.40	9	7.9	274	n/a	44 Samples		84	
WQ Guidelines			***15***	***7-10.5***			***<1***	**<1**		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***OG***		***AO***	***MAC***	***MAC***		

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3 Average unavaliable: three of six sample results reported at <5

4 Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Okanagan Lake was Offline October 14th and Beaver Lake Source the Primary Supply. This was due to upgrades.

Table 13. *District of Lake Country Water System, 2021 Raw Water Oyama Creek Intake. (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services). Oyama source on-line during irrigation season only.*

weekly sampling and on-line water quality eqiupment verification May-Sept.	[1] *Hardness mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond mS/cm	TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	[3] % of samples less than 10 E.coli/100mL (N=20)
MIN	40	0.34	9	7.1	47	24	71	<1	55%
MAX	40	2.07	24	8.0	63	130	9800	921	
AVERAGE	40	0.98	15	7.5	52	66	20 samples		
WQ Guidelines			***15***	***7.0-10.5***			***<1***	***<1***	
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***OG***		***AO***	***MAC***	***MAC***	

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3. Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Table 14. *District of Lake Country Water System, 2021 Raw Water Kalamalka Lake Intake. (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services).*

weekly sampling and on-line water quality eqiupment verification	[1] *Hardness mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond µS/cm	[3] TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	UV Transmittance @ 254 nm unflitered	[4] % of samples less than 10 E.coli/100mL (N=53)
MIN	180	0.26	5	7.6	386	<5	<1	<1	89	
MAX	200	0.93	14	8.4	400	5.3	517	4	90	100%
AVERAGE	190	0.47	9	8.1	394		53 Samples		90	
WQ Guidelines			***15***	***7-10.5***			***<1***	**<1**		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***OG***		***AO***	***MAC***	***MAC***		

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3 Average unavaliable: eight of nine sample results reported as <5

4 Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Table 15. *Coral Beach Water System, 2021 Raw Water Coral Beach Intake (Okanagan Lake source). (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services).*

weekly sampling and on-line water quality eqiupment verification	[1] *Hardness mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond mS/cm	[3] TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	UVTransmittance @ 254 nm unflitered	[4] % of samples less than 10 E.coli/100mL (N=51)
MIN	140	0.20	6	7.5	272	<5	<1	<1	85	
MAX	160	0.84	23	8.3	375	5.3	687	1	86	100%
AVERAGE	150	0.42	10	7.9	278	n/a	51 Samples		85	
WQ Guidelines			***15***	***7-10.5***			***<1***	**<1**		
Maximum Allowable	***acceptable***	**≤ 5 NTU**	***AO***	***OG***		***AO***	***MAC***	***MAC***		

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3 Average unavaliable: six of eight sample results reported as <5

4 Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Table 16. *Lake Pine Water System, 2021 Raw Water Lake Pine Intake (Okanagan Lake source). (All data reported from weekly water quality monitoring using hand-held equipment other than True colour and Bacteriological (Caro Analytical Services).*

weekly sampling and on-line water quality eqiupment verification	[1] *Hardness mg/L as CaCO3*	[2] Turbidity NTU	Temp °C	pH	Cond µS/cm	[3] TRUE color TCU	MF TOTAL CFU/100 ml	MF E.Coli CFU/100 ml	UV Transmittance @ 254 nm unflitered	[4] % of samples less than 10 E.coli/100mL (N=49)
MIN	140	0.19	7	7.5	267	<5	<1	<1	85	
MAX	160	0.69	21	8.5	378	7	93	5	86	100%
AVERAGE	150	0.37	12	8.1	284		49 Samples		86	
WQ Guidelines			***15***	***7.0-10.5***			***<1***	***<1***		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***OG***		***AO***	***MAC***	***MAC***		

1 According to the criteria set out by the Guidelines for Canadian Drinking Water Quality (GCDWQ) the degree of hardness of drinking water may be classified in terms of ts calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above

2 Turbidity is reported as weekly equipment verification and not SCADA.

3 Average unavaliable: five of eight sample results reported as <5

4. Criteria is set out in the 2020 Source Drinking Water Quality Guidelines SDWQG Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch British Columbia. The SDWQG of ≤ 10 E. coli /100 mL is a benchmark to protect current and future drinking water sources; it is the minimum performance target for water suppliers to treat water to produce microbiologically safe drinking water. Results are % of samples less than 10 E.coli/100mL

Instrument Calibration and Quality Control

Field instruments are checked against standards to ensure accuracy, are regularly maintained and calibrated as required prior to use in the field. 2021 Hach certification was obtained for all water quality monitoring field equipment.

On-line SCADA water quality monitoring equipment is verified weekly using the hand-held water quality equipment. The equipment is also maintained and calibrated as per manufacture directions.

Watershed Management

The DLC supplies domestic and irrigation water for the communities of Oyama, Winfield, Okanagan Centre, and Carr's Landing. Sixty-five (65%) percent of the water delivered to the Lake Country communities originates from the Oyama and Beaver Lake watersheds.

Infrastructure within these watersheds was constructed approximately 100 years ago for irrigation, but in the 1970's the systems were improved and evolved to become a major domestic and agricultural water supply. Both the Oyama and Beaver Lake watersheds are multi-use and have numerous ongoing activities (e.g. forestry, range, recreation, etc.). Under the BC Government's Action Plan for Safe Drinking Water, the primary responsibility for protecting drinking water from land-use activities lies with the agency responsible for approving those activities. This can create complex governance that makes addressing source water concerns a significant challenge.

For many years, including 2021, the District has worked closely with many stakeholders that work or have interests within our local watersheds. The DLC continues to collaborate and work with stakeholders (Forestry, Ranchers etc.) throughout the year to address matters as they arise and maintain working partnerships on various projects and/or action items from the various watershed protection plans and source to tap assessments.

Damer Lake

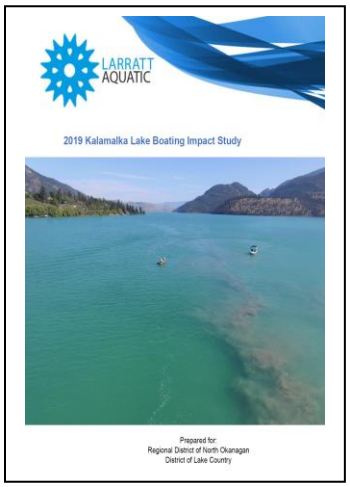
Source to Tap Assessments

The purpose of the Source to Tap Assessments on the DLC distribution systems Kalamalka and Okanagan Lake sources were to conduct research and compile known data for use in identifying the DLC'S intake strengths, liabilities and planning for water quality protection and improvement. One of the most important recommendations in these assessments was the identification of an Intake Protection Zone. This zone defines the area where the intake should take precedence over every other use of consideration. It also defines the areas of land and water where special care must be taken in the use and handling of potential contaminants to prevent them from accidently entering the lake and affecting the intake.

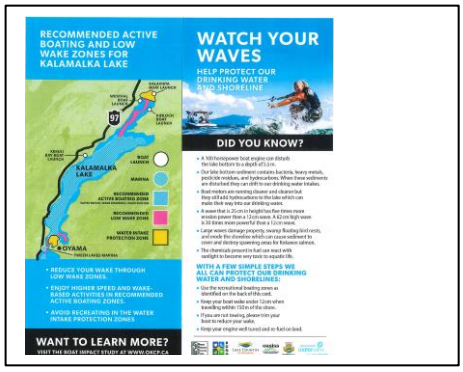
Kalamalka Lake

Since 1998, when a taste and odour complaint occurred on Kalamalka Lake, the DLC, Greater Vernon Water/North Okanagan Regional District and the Ministry of Environment have partnered to acquire water quality data on this source. The information obtained defines the physical and biological impact at the DLC'S existing intakes; accumulates baseline water chemistry for future additional water treatment; provides information on the ideal depth of intakes for the best water quality; shows fluctuations in nutrients and algae production; and the implications of changes for water resources. This research is evaluated and re-directed on an annual basis. This marks the 22nd year of this comprehensive and collaborative study.

In 2021 the Aquatic biologist focused on potential impacts from previous years' flooding and/or high water levels and other climate change impacts such as particulates from wildfires. It is common for a gap in response time to occur from previous years' events. This is due to the time for particulates and additional materials to accumulate and decompose at the deep-water depths.



The DLC, Regional District of North Okanagan and District of Coldstream partnered again in 2021 addressing recommendations of research projects completed between 2017-2019 that examined the impacts of motorized boating on water quality. This research identified; lake bottom sediments contain contaminates (hydrocarbons, bacteria and heavy metals), that wakeboard boats can disturb and re-suspend the lake bottom to a depth of 8 meters and the re-suspended sediments from motorized boating can drift to municipal and domestic intakes and negatively impact water quality. The research also identified erosion impacts on property and damage to fish spawning habitat and bird nesting areas on the shoreline. In 2021 the collaborative messaging campaign continued with the focus on minimizing the impacts of boat wakes on water quality, wildlife habitat and shoreline erosion. We continued to build upon previous works and develop a campaign that can be utilized and distributed by local governments and hopefully at some point be adopted by OBWB. This year two billboards were erected one in the RDCO and one in the RDNO showing our Wake Mascot and providing information on the Don't Make a Wake Campaign.



Watershed Protection Plans

The Source Water Assessments for the Oyama and Vernon Creek watersheds promotes sustainable management of our ecosystems through collaborative efforts of all stakeholders. The most valuable management tool from this plan is the identification of the various vulnerability zones that indicate the potential for risk to water quality. When considering any high-risk activities within our community watershed, these high-risk areas are the first to be evaluated for potential impacts of the activities along with the associated levels of risk. These activities may include forestry management, sports and/or recreational and mining activities.

Throughout the process of completing these plans, stakeholder involvement was a key component to ensuring a broad range of aspects were considered. The goal for stakeholders is to be aware of the vulnerability zones and to recognize the recommendations specific to them when planning further watershed activities.

The Source Water Assessment continues to play an important role in the management and planning in our community watersheds. In 2021 a specific stakeholder meeting to follow up on identified risks and actions in the SWA was not held. DLC staff instead maintains communications and meetings with stakeholders. As well DLC staff maintains connections and direct involvement with several watershed related organizations some of which are the Okanagan Basin Water Board (OBWB), Okanagan Water Stewardship Council, BC Water Supply Association, OBWB and source protection committee.

Since Major licensees in our watershed have opted out of public advisory group for sustainable forest management process, there is now reduced information sharing between the forestry stakeholders and local government water purveyors. Considering this the DLC endeavors to maintain and improve relationships with major licensees as well as all SWA stakeholders' group, striving to implement recommendations and recognize improvements as we move forward. Our watersheds are multipurpose, multi-jurisdictional and cumulatively all activities are making an impact. All stakeholders have a responsibility to recognize this and use best practices maintaining sustainable resources for all users.

Off Road Vehicle

Again in 2021, with the ongoing increased Provincial orders and other measures to reduce the spread of the Covid19 Pandemic, a tremendous volume of motor vehicle traffic and unsanctioned activities occurred in our community watersheds. Of the thousands of cars venturing into these crown lands many were roadside parking/camping for days and weeks having illegal fires and dumping their garbage. The lease lot resorts reported an exceptional increase of activity and interest of people wanting to stay and access our drinking water reservoirs. As with the previous year, large amounts of garbage and other debris such as abandon and burnt vehicles were not only dumped into the forest but also left burnt on the roadside. Illegal activity in our community watershed including motorized vehicle activity in the drainage of our intakes could adversely impact our water quality through soil disturbance, creation of new drainage pathways among other concerns in these vulnerable areas adding to the cumulative impact, on the elevated particulates loading into our drinking water source. We were also very fortunate with our exceptionally hot and dry conditions that no forest fires were attributed to these roadside fires and other activities.

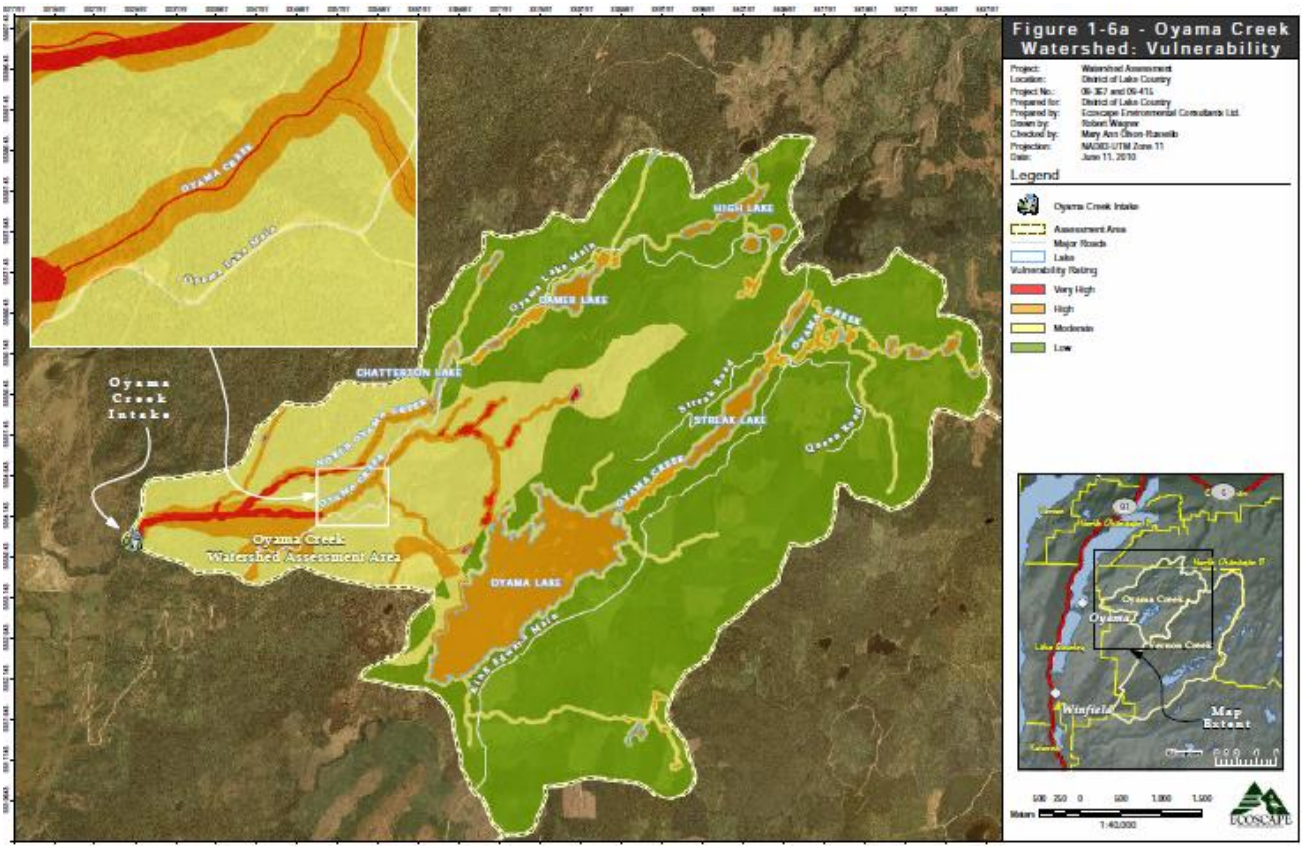
If you notice questionable activities in our Community Watersheds **Report All Poachers and Polluters** (RAPP)
Violations to the Conservation Officer Service 24-hour **hotline: 1-877-952-7277**. or #7277 on the TELUS Mobility Network

Additionally, you can register complaints online through RAPP

Range Management

The Okanagan Shuswap District Range Program's annual meeting took place in the spring at the DLC. The range meeting included only the RDNO and the DLC watersheds: Duteau, Oyama and Beaver. The stakeholders including ranchers, major licensees, IHA and others if necessary, regularly meet early in the new year to review the previous year and look at the new season. The Okanagan Shuswap District Range Program's annual meeting took place in the spring at the DLC and included the RDNO and the DLC watersheds. Discussions focused around key areas, targeted grazing and heard health to mitigate water quality concerns. Concern remains on the impact from increasing (non-sanctioned) recreation and off-road vehicle activities in our watershed as well as aggressive forestry development.

The DLC regularly connects with ranchers (and other stakeholders) throughout the year working to maintain open lines of communication with updates on projects, opportunities, or situations that either party should be aware of. A generous amount of time has been allocated over recent years to help some ranchers manage their reporting obligations. For next year's season, the DLC will be working closer with the Province to shift this leadership role over.



All Range use holders, major licensees and the Small-Scale Salvage Program (SSSP) have agreed to use the DLC vulnerability zone mapping in their planning and development process.

Forestry

Tolko and BC Timber Sales are the two major licensees in our watersheds.

As both Tolko and BCTS have opted out of public advisory group planning they are now obtaining their certification through the Sustainable Forestry Initiative (SFI). This process is not open to public input or consultation in the development and reporting of targets and indicators and there is no open consultation process as the DLC previously had when participating with them in with the former Sustainable Forest Management Public Advisory Group.

Major Licensees in our community watersheds are aware of our Watershed Protection Plan and the DLC has requested it be used as a planning tool when developing harvest plans. Harvest/site plans are reviewed by DLC staff and recommendations are provided as needed to address issues such as access (cattle and unsanctioned motorized vehicle activities), wildfire management, drainage concerns, and rehabilitation of roads to decrease the amount of non-status roads accumulating in our community watersheds.

In both the Beaver and Oyama watersheds there are various old and newly proposed Tolko and BCTS harvest blocks the DLC is closely monitoring and involved with on different levels. All proposed harvesting works in the Vernon Creek and Oyama watershed are within the high and very high vulnerability zones. These sites are all located directly below the outflow of our dam's and above our drinking water intakes. We are very interested in these activities, and we maintain active involvement to understand how Licensees will ensure access management will be maintained and importantly, immediate and long term water quality and quantity are not impacted.

In 2021 both Tolko and BCTS had proposed harvest sites directly below the outflow of Beaver and Oyama Lake Dams and above our drinking water intakes; these are the highest vulnerability zones in our community watersheds. The DLC has advised both licensees Tolko and BCTS of the risk and consequences of activities in these high vulnerability zones, our position regarding this sensitive area, that we require block walks with our subject matter experts. We have had block walks, many discussions and have even requested that our regulatory authority, Interior Health become familiar with the information provided and assist in providing feedback on these major licensee referrals and their sensitive watershed plans. This is a very active and on-going process.

Small Scale Salvage (SSSP) is a program that is regulated and operates through the Province. Private companies can apply for a small-scale salvage licensee through the Ministry of Forest Lands and Natural Resources Operations and Rural Development (FLNRORD). These smaller operations apply to the FLNRORD, harvest small volumes of timber that would otherwise not have been harvested and/or to

address forest health objectives. Small scale salvage operations do not follow Forest Stewardship Plans (FSP) or belong to a certification process. The DLC has requested referrals from the Province for all SSSP activities in our community watersheds. For over three years, the DLC has not received any referrals from the Province.

In July 2019 the Government of B.C. provided a public engagement opportunity to help The FRPA framework defines how legislation, regulations and policy work to get inform improvements to the Forest and Range Practices Act (FRPA) that will support the health and sustainability of B.C.'s forests and rangelands, while strengthening public confidence in how these vital resources are managed. her across the landscape. It governs on-the-ground forest and range activities on B.C.'s public forests and rangelands. The Province advised they are improving FRPA to ensure it will effectively manage and conserve our forests and rangelands in the face of change. At this time, the DLC had provided comments on all aspects of FRPA as many improvements are required for a more integrative management approach that will consider cumulative impacts within our community watersheds. The District hopes that improved legislation is required to protect water quality and quantity and effectively manage and conserve our forests and rangelands.

Wildfire Planning:

In 2021 the possibility of a catastrophic wildfire occurring in our community watershed was of high concern. A devastating fire in the Beaver or Oyama watersheds would not only degrade water quality, but post-fire floods and landslides are typical impacts seen directly following the first storm event (or freshet) and occur for decades following. The DLC has recognized Wildfire as a risk to our community and have identified a process for communication with the BC Wildfire Service (BCWS) during the wildfire season.

The DLC continued our collaborative partnerships with the Regional District of North Okanagan (RDNO), the Black Mountain Irrigation District (BMID) and Glenmore Ellison Improvement District (GEID) in the Forest Enhancement Society funding, integrating and collaborative fire risk management planning. These four water purveyors have neighboring watershed and aim to work together modifying each of our wildfire protection and mitigation plans to develop one that includes priorities of all stakeholders and to meet new expectations of the land manager and BC Wildfire Service. Wildfire reduction planning and mitigation measures are not directly managed by the Province. Provincial funding for wildfire reduction planning and operations is provided to the Forest Enhancement Society of BC (FESBC) and dispersed through process grants. These grants are dependent on a variety of factors including the collaboration and consent of major stakeholders. This is an extensive process with a small window of opportunity and requires input from many stakeholders.

On July 31, 2020 the DLC received a $142,860 grant for wildfire reduction planning and mitigation works in the Beaver and Oyama Community Watersheds. This funding provided by FESBC is in part to $663,910 granted to the three other water purveyors in this collaboration: the BMID, GEID, and the RDNO. December 2021 this project was completed by Frontline Operations Group and considering future provincial funding is ready for the next phase implementation.

Wildfire Planning Continued:

2019- 2021 project Summary

There are five community watersheds on the Aberdeen Plateau (from Vernon through to Highway 33 that undertook one massive wildfire reduction landscape management plan). This is a remarkably large area and the implementation plan for operations will need to extend over multiple years. The Planning, prescriptions and operations will require a unique team of specialized subject matter experts with extensive knowledge in wildfire behavior, planning and management, mapping, LiDAR proficiency, hydrogeology, forestry, and several other areas of expertise to establish a coordinated wildfire reduction plan and carry out prescriptions of this scale.

Figure 1. Project priority watersheds on the Aberdeen. Reducing Wildfire Risk to the Okanagan Basin Water Supply – Aberdeen Plateau John Davies, RPF 2019 -2021

To reiterate from the FESBC press release, the outcome for each project will be to produce management plans that are operationally feasible, ecologically appropriate, and account for all values and constraints within the watershed while ultimately protecting water quality and quantity as a resource. The long-term planning and prescription works will also include collaborative works with our indigenous neighbors, provincial ministry and key stakeholders to protect our communities and vital infrastructure from the potential devastation of wildfire in and around our water infrastructure. More details are provided through the FESBC press release https://www.fesbc.ca/wildfire-risk-reduction-projects-obtain-funding-to-protect-critical-okanagan-watersheds/.

Appendices

Appendix A – Summary of Positive Bacteriological Results in Distribution

	Total coliforms CFU/100 mL	E.coli CFU/100 mL	Presence Absence (total coliforms)	Presence Absence (E.coli)	Sample date	Number of TC/E.coli Samples	Number of P/A samples
District of Lake Country Water System:							
Beaver Lake Source (WQA)	77 CFU/100ml Total Coliforms and and NO E.coli detected in January at the Copper Hill site.				January 11/22	61	29
Okanagan Lake Source	none detected in distribution system					74	17
Oyama Lake Source (WQA)	none detected in distribution system					28	14
Kalamalka Lake Source	none detected in distribution system					42	17
Coral Beach Water System: Okanagan Lake Source	2 CFU/100ml Total Coliforms and 2 CFU/100ml Total Coliforms were detected at the Coral Beach South end and pumphouse in July and NO E.coli detected				July 6/22	54	21
Lake Pine Water System: Okanagan Lake Source	none detected in distribution system					49	22
					TOTAL:	***308***	***120***

Appendix B – District of Lake Country Sampling Sites

District of Lake Country Water System: Beaver Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	Sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
Vernon Creek Intake **RAW**	Beaver Lk			x									x											
Eldorado **RAW**	Beaver Lk			x			x		x															
Eldorado Balancing Reservoir	Beaver Lk			x			x				x													
Eldorado Reservoir chlorination facility (reservoir inlet & outlet)	Beaver Lk						x				x		x	x										
Camp Rd shop Yard hydrant	Beaver Lk			x												x				x		x		
Camp Rd shop inside building	Beaver Lk			x						x						x								
Camp Rd Reservoir (off line)	Beaver Lk			x	x						x					x			x					
Cooney Drain	Beaver Lk	x	x	x								x					x					x		
Glenmore Booster Station	Beaver Lk			x			x				x				x									
Mulbery	Beaver Lk			x				x								x								
Dewar Park	Beaver Lk			x		x											x							x
Fire Admin Building	Beaver Lk			x		x										x								
Jammery	Beaver Lk				x					x														x
Long	Beaver Lk			x				x									x							
McCreight	Beaver Lk			x		x											x	x				x		
Nighthawk	Beaver Lk			x		x											x	x	x					
North View/Chase	Beaver Lk			x				x									x	x						
Nygren	Beaver Lk			x				x									x							
Pow Rd PRV Stn	Beaver Lk	x	x	x								x				x								
PR2	Beaver Lk			x	x	x										x								
Williams	Beaver Lk			x		x		x									x	x	x					x
Lakestone Beacon Hill PRV	Beaver Lk			x							x													

Appendix B continued– District of Lake Country Sampling Sites

District of Lake Country Water System: Okanagan Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	Sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
Ok Lk Intake **RAW**	Ok Lk			x							x		x										x	
Ok Lk Pump Stn/chlorination facility	Ok Lk						x				x		x	x										
Arena	Ok Lk				x											x				x			x	
New Station (replace Clement - Future)	Ok Lk																							
Copper Hill	Ok Lk			x		x											x					x		
Glenmore Booster Station	Ok Lk		x	x			x				x				x									
Jardine	Ok Lk			x						x						x								
Kelwin	Ok Lk				x						x						x							
Lakes Lower Reservoir (cell 1)	Ok Lk			x			x				x					x								
Lakes Upper Reservoir	Ok Lk			x					x															
Lakes Upper Zone (Shoreline Park)	Ok Lk			x																		x		
Lake Stone Benchlands	Ok Lk			x				x									x							
Future site: Lake Stone original development	Ok Lk			x					x															
McCoubrey	Ok Lk			x				x								x								
Middleton and Pretty Road PRV	Ok Lk			x												x						x		
Ok Bio Fuels (Jim Bailey Rd)	Ok Lk			x		x																		
Oceola PRV	Ok Lk			x							x						x							
Ottley Rd (off Stubbs)	Ok Lk			x				x							x						x			
Ponderosa pumphouse	Ok Lk			x				x									x							
Ponderosa PRV stn	Ok Lk			x							x					x								

Appendix B continued – District of Lake Country Sampling Sites

District of Lake Country Water System: Oyama Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	Sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
Easthill	Oyama Lk	x	x	x		x		x								x								
Oyama Rd S	Oyama Lk	x		x				x									x	x	x					
Oyama Rd N	Oyama Lk			x				x									x	x	x					
Oyama Lk/Hayton Rd	Oyama Lk				x												x	x		x				x
Oyama Creek Intake **RAW**	Oyama Lk			x									x											
Oyama Reservoir	Oyama Lk			x							x			x									x	
Ribbleworth	Oyama Lk			x				x								x							x	
Sawmill Rd at Middlebench (Future)	Oyama Lk				x							x				x							x	
Talbot Rd Booster Stn (future)	Oyama Lk				x				x								x							
5410 Todd Rd. (summer: First customer Fall (Sawmill online) could be either from Sawmill or from reservoir	Oyama Lk			x							x				x	x	x							
Oyama Creek intake/Chlorination Facility - Chlorinator post reservoir	Oyama Lk						x						x	x										

District of Lake Country Water System: Kalamalka Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	Sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
B-2 Reservoir	Kal				x				x							x								
Cornwall/ Sheldon	Kal	x	x	x				x								x		x						
Evans	Kal			x				x									x							
Kal Lk Intake **RAW**	Kal			x							x		x											
Kal Pump Stn	Kal			x			x				x			x	x						x			
Sawmillpump station	Kal			x							x					x								
Oyama Creek Chlorination Facility (distribtuion water fromKal Source (Sawmill) to Oyama reservoir)	Kal						x						x	x										

Appendix B continued – District of Lake Country Sampling Sites

Coral Beach Water System: Okanagan Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	Sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
Coral Beach Intake **RAW**	CB Ok Lk			x			x						x										x	
Coral Beach Pump Stn	CB Ok Lk						x				x			x	x						x			
Coral Beach Pump Stn (distrib sample site)	CB Ok Lk			x					x					x	x									
Coral Beach Reservoir (Future)	CB Ok Lk			x												x						x		
Coral Beach South End	CB Ok Lk	x	x	x		x											x					x		

Lake Pine Water System: Okanagan Lake Source

MATRIX: Water Quality Sampling Sites, Criteria,Purpose, Type of sample Station	Source	THM	HAA	BacT/Water Chemistry	Free Cl2/NTU when required	Yard Hydrant	Online WQ equipment verification	Eclipse #88	Hose bib	sink	Stainless port	Galvanised pipe	Continuous run	Point of Disinfection	First Customer	Intermediary	End of line	Chronic problem area	Stale water problem area	Seasonal only	Future Online CT monitoing site	Recommend install Eclipse #88	Sample Site Modification Required	Recommend not use
Lake Pine Intake RAW	LP Ok Lk			x					x														x	
Lake Pine chlorination facility	LP Ok Lk		x				x				x			x	x									
Lake Pine Booster/Lower Res	LP Ok Lk		x	x			x				x			x	x						x			
Lake Pine Lower Res	LP Ok Lk		x	x				x							x									
Lake Pine PR Stn.	LP Ok Lk	x		x													x					x		
Lake Pine Upper Reservoir	LP Ok Lk			x							x					x								
Moberly South (Future Site)	LP Ok Lk																x							

Appendix C – Comprehensive Test Results

2021 Water Potability Test (aka Comprehensive Results)							
Distribution Source		Beaver	Oyama	Kal lake	Coral Beach	Lake Pine	Okanagan Lake
Site		VERNON CREEK Intake	OYAMA CREEK Pump House	KALAMALKA Pump House	CORAL BEACH Pump House	LAKEPINE Pump House	OKANAGAN Lake Pump House
Date		14-Jun-21	15-Jun-21	15-Jun-21	16-Jun-21	16-Jun-21	16-Jun-21
Anions							
Chloride	mg/L	1.22	0.16	9.38	5.69	5.83	5.32
Chloride (AO)	mg/L	250	250	250	250	250	250
Fluoride	mg/L	0.17	<0.10	0.23	0.13	0.13	0.13
Fluoride (MAC)	mg/L	1.5	1.5	1.5	1.5	1.5	1.5
Nitrogen, Nitrate as N	mg/L	0.06	0.05	0.05	<0.01	0.07	0.04
Nitrate (MAC)	mg/L	10	10	10	10	10	10
Nitrogen, Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite (MAC)	mg/L	1.0	1.0	1.0	1.0	1.0	1.0
Sulphate	mg/L	3.30	2.60	50.20	30.30	31.60	30.40
Sulphate (AO)	mg/L	500	500	500	500	500	500
General Parameters							
Alkalinity (total)	mg/L	25.00	27.50	194.00	126.00	127.00	127.00
No current guidelines							
Total Organic Carbon	mg/L	7.68	10.10	3.52	3.82	3.80	3.83
No current guidelines							
Dissolved Organic Carbon	mg/L	6.99	9.89	3.52	3.78	3.46	3.43
No current guidelines							
True Colour	CU	40.00	52.00	<5.00	<5.00	<5.00	<5.00
True Colour (AO)	CU	<15	<15	<15	<15	<15	<15
Conductivity	uS/cm	79.00	54.90	55.50	273.00	278.00	271.00
No current guidelines							
Cyanide	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Cyanide (MAC)	mg/L	0.2	0.2	0.2	0.2	0.2	0.2
pH	pH units	6.40	7.61	7.61	8.15	8.14	8.10
pH (OG)	pH units	7 - 10.5	7 - 10.5	7 - 10.5	7 - 10.5	7 - 10.5	7 - 10.5
Turbidity	NTU	1.11	0.66	0.40	0.90	0.31	0.22
Turbidity Guideline	NTU	<1	<1	<1	<1	<1	<1
Trans. 254 nm (unfiltered)	% T		44.00	89.20	84.80	84.80	85.90
No current guidelines. Note the lab did not report for Beaver and Oyama Lake sources							
Trans. 254 nm (unfiltered)	nm		44.00	89.20	84.80	84.80	85.90
No current guidelines. Note the lab did not report for Beaver and Oyama Lake sources							
Calculated Parameters							
Hardness (mg/L as CaCO3)	mg/L	39.60	26.30	194.00	123.00	127.00	125.00
No current guidelines see glossary below							
Total Dissolved Solids/TDS	mg/L	37.90	32.60	166.00	170.00	175.00	171.00
TDS (AO)	mg/L	500	500	500	500	500	500

Appendix C continued – Comprehensive Test Results

2021 Water Potability Test (aka Comprehensive Results)							
Distribution Source		Beaver	Oyama	Kal lake	Coral Beach	Lake Pine	Okanagan Lake
Site		VERNON CREEK Intake	OYAMA CREEK Pump House	KALAMALKA Pump House	CORAL BEACH Pump House	LAKEPINE Pump House	OKANAGAN Lake Pump House
Date		14-Jun-21	15-Jun-21	15-Jun-21	16-Jun-21	16-Jun-21	16-Jun-21
Total Recoverable Metals							
Aluminium (total)	mg/L	0.10	0.08	<0.01	0.02	0.01	<0.01
Aluminium (OG)	mg/L	0.1	0.1	0.1	0.1	0.1	0.1
Antimony (total)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Antimony (MAC)	mg/L	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
Arsenic (total)	mg/L	<0.0005	<0.0005	0.0010	0.0005	0.0005	0.0005
Arsenic (MAC)	mg/L	0.010	0.010	0.010	0.010	0.010	0.010
Barium (total)	mg/L	0.01	0.01	0.03	0.02	0.02	0.02
Barium (MAC)	mg/L	2.0	2.0	2.0	2.0	2.0	2.0
Boron (total)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron (MAC)	mg/L	5.0	5.0	5.0	5.0	5.0	5.0
Cadmium (total)	mg/L	<0.000500	<0.000010	<0.000010	<0.000010	<0.000010	>0.000010
Cadmium (MAC)	mg/L	0.007	0.007	0.007	0.007	0.007	0.007
Calcium (total)	mg/L	9.47	6.39	40.50	33.60	34.50	33.70
No current guidelines							
Chromium (total)	mg/L	<0.00050	<0.00050	<0.00056	<0.00050	<0.00050	<0.00050
Chromium (MAC)	mg/L	0.050	0.050	0.050	0.050	0.050	0.050
Cobalt (total)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
No current guidelines							
Copper (total)	mg/L	0.0013	0.0014	0.0017	0.0009	0.0788	0.0009
Copper (MAC)	mg/L	2.000	2.000	2.000	2.000	2.000	2.000
Iron (total)	mg/L	0.18	0.13	<0.01	0.04	0.02	0.01
Iron (AO)	mg/L	0.3	0.3	0.3	0.3	0.3	0.3
Lead (total)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00251	<0.00020
Lead (MAC)	mg/L	0.005	0.005	0.005	0.005	0.005	0.005
Magnesium (diss.)	mg/L	3.87	2.50	22.60	9.52	9.92	9.89
No current guidelines							
Manganese (total)	mg/L	0.00815	0.00634	0.00081	0.00320	0.00177	0.00093
Manganese (MAC)	mg/L	0.12	0.12	0.12	0.12	0.12	0.12
Mercury (total)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Mercury (MAC)	mg/L	0.001	0.001	0.001	0.001	0.001	0.001
Molybdenum (total)	mg/L	0.00031	0.00021	0.00529	0.00328	0.00540	0.00341
No current guidelines							

Appendix C continued – Comprehensive Test Results

2021 Water Potability Test (aka Comprehensive Results)							
Distribution Source		Beaver	Oyama	Kal lake	Coral Beach	Lake Pine	Okanagan Lake
Site		VERNON CREEK Intake	OYAMA CREEK Pump House	KALAMALKA Pump House	CORAL BEACH Pump House	LAKEPINE Pump House	OKANAGAN Lake Pump House
Date		14-Jun-21	15-Jun-21	15-Jun-21	16-Jun-21	16-Jun-21	16-Jun-21
Total Recoverable Metals							
Nickel	mg/L	0.0011	0.0014	0.0048	0.0006	0.0007	0.0005
No current guidelines							
Potassium (total)	mg/L	1.28	1.37	5.61	2.40	2.45	2.45
No current guidelines							
Selenium (total)	mg/L	<0.0005	<0.0005	0.0010	<0.0005	<0.0005	<0.0005
Selenium (MAC)	mg/L	0.05	0.05	0.05	0.05	0.05	0.05
Sodium (total)	mg/L	3.24	2.60	21.40	11.90	12.60	12.10
Sodium (AO)	mg/L	200	200	200	200	200	200
Strontium (total)	mg/L	0.05	0.04	0.45	0.25	0.03	0.26
Strontium (MAC)	mg/L	7	7	7	7	7	7
Uranium (total)	mg/L	0.000057	0.000092	0.003360	0.002430	0.000365	0.002450
Uranium (MAC)	mg/L	0.020	0.020	0.020	0.020	0.020	0.020
Zinc (total)	mg/L	<0.004	<0.004	<0.004	<0.004	0.017	<0.004
Zinc (AO)	mg/L	3.000	3.000	3.000	3.000	3.000	3.000
Glossary of Terms, GCDWQ:							
<	Less than. Reported when result is less than the reported detection limit						
≤	Less than or equal to. Reported when result is less or equal to the reported detection limit						
AO	Aesthetic objective. Refer to GCDWQ						
MAC	Maximum acceptable concentration. Refer to GCDWQ						
OG	Operational guidance values. Refer to GCDWQ						
TCU	True color unit. Color referenced against a platinum cobalt standard						
NTU	Nephelometric turbidity unit						
uS/cm	Microsiemens per centimeter						
Hardness	The degree of hardness of drinking water may be classified in terms of its calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and						

Appendix D – Nutrient Sampling Upland Drinking Water Reservoirs

2021 Nutrients			
Site		OYAMA	BEAVER
Date		25-Oct-21	25-Oct-21
Anions			
Nitrogen (Nitrate as N)	mg/L	0.02	0.02
Nitrate (MAC)	mg/L	10	10
Nitrogen (Nitrite as N)	mg/L	<0.01	<0.01
Nitrite (MAC)	mg/L	1	1
Phosphate (as P)	mg/L	<0.01	<0.01
No current guidelines			
Sulfate	mg/L		
Sulfate (AO)	mg/L	500	500
General Parameters			
Alkalinity, Total (as CaCO3)	mg/L	20.80	28.60
No current guidlines			
Alkalinity,Phenolphthalein (as CaCO3)	mg/L	<1.00	<1.00
No current guidelines			
Alkalinity, Bicarbonate (as CaCO3)	mg/L	20.80	28.60
No current guidelines			
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.00	<1.00
No current guidelines			
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.00	<1.00
No current guidelines			
Ammonia (as N)	mg/L	0.06	0.05
No current guidelines			
Total Organic Carbon	mg/L	11.00	9.85
No current guidelines			
Chlorophyll-a	ug/L	2.65	1.41
No current guidelines			
Colour, True	CU	47.00	41.00
True Colour (AO)	CU	<15	<15
Nitrogen, Total Kjeldahl	mg/L	0.41	0.31
No current guidelines			
Phosphorus, Total (as P)	mg/L	0.02	0.01
No current guidelines			
TDS	mg/L		
TDS (AO)	mg/L	500	500
TSS	mg/L	<2.00	<2.00
No current guidelines			
Calculated Parameters			
Hardness, Total (as CaCO3)	mg/L	20.10	24.50
No current guidelines			
Nitrate+ Nitrite (as N)	mg/L	0.0219	0.0201
No current guidelines			
Total Nitrogen	mg/L	0.44	0.33
No current guidelines			
Organic Nitrogen	mg/L	0.36	0.26
No current guidelines			

Appendix D continued– Nutrient Sampling Upland Drinking Water Reservoirs

2021 Nutrients			
Site		OYAMA	BEAVER
Date		25-Oct-21	25-Oct-21
Metals			
Total Dissolved Aluminium	mg/L	0.03	0.02
Total Recoverable Aluminium	mg/L	0.03	0.03
Aluminium (OG)	mg/L	0.1	0.1
Total Dissolved Antimony	mg/L	<0.0002	<0.0002
Total Recoverable Antimony	mg/L	<0.0002	<0.0002
Antimony (MAC)	mg/L	0.006	0.006
Total Dissolved Arsenic	mg/L	<0.0050	<0.0005
Total Recoverable Arsenic	mg/L	<0.0005	<0.0005
Arsenic (MAC)	mg/L	0.01	0.01
Total Dissolved Barium	mg/L	0.0067	0.0059
Total Recoverable Barium	mg/L	0.0073	0.0059
Barium (MAC)	mg/L	2	2
Total Dissolved Beryllium	mg/L	<0.00010	<0.00010
Total Recoverable Beryllium	mg/L	<0.00010	<0.00010
No current guidelines			
Total Dissolved Bismuth	mg/L	<0.00010	<0.00010
Total Recoverable Bismuth	mg/L	<0.00010	<0.00010
No current guidelines			
Total Dissolved Boron	mg/L	<0.05	<0.05
Total Recoverable Boron	mg/L	<0.05	<0.05
Boron (MAC)	mg/L	5	5
Total Dissolved Cadmium	mg/L	<0.000010	<0.000010
Total Recoverable Cadmium	mg/L	<0.000010	<0.000010
Cadmium (MAC)	mg/L	0.005	0.005
Total Dissolved Calcium	mg/L	5.28	6.90
Total Recoverable Calcium	mg/L	5.20	6.78
No current guidelines			
Total Dissolved Chromium	mg/L	<0.00050	0.00062
Total Recoverable Chromium	mg/L	<0.00050	<0.00050
Chromium (MAC)	mg/L	0.05	0.05
Total Dissolved Cobalt	mg/L	<0.00010	<0.00010
Total Recoverable Cobalt	mg/L	<0.00010	<0.00010
No current guidelines			
Total Dissolved Copper	mg/L	0.00102	0.00088
Total Recoverable Copper	mg/L	0.00083	0.00068
Copper (AO)	mg/L	2	2
Total Dissolved Iron	mg/L	0.17	0.13
Total Recoverable Iron	mg/L	0.23	0.19
Iron (AO)	mg/L	0.3	0.3
Total Dissolved Lead	mg/L	<0.00020	<0.00020
Total Recoverable Lead	mg/L	<0.00020	<0.00020
Lead (MAC)	mg/L	0.005	0.005
Total Dissolved Lithium	mg/L	0.00033	0.00014
Total Recoverable Lithium	mg/L	0.00064	0.00045
No current guidelines			
Total Dissolved Magnesium	mg/L	1.67	1.76
Total Recoverable Magnesium	mg/L	1.86	1.93
No current guidelines			

Appendix D continued– Nutrient Sampling Upland Drinking Water Reservoirs

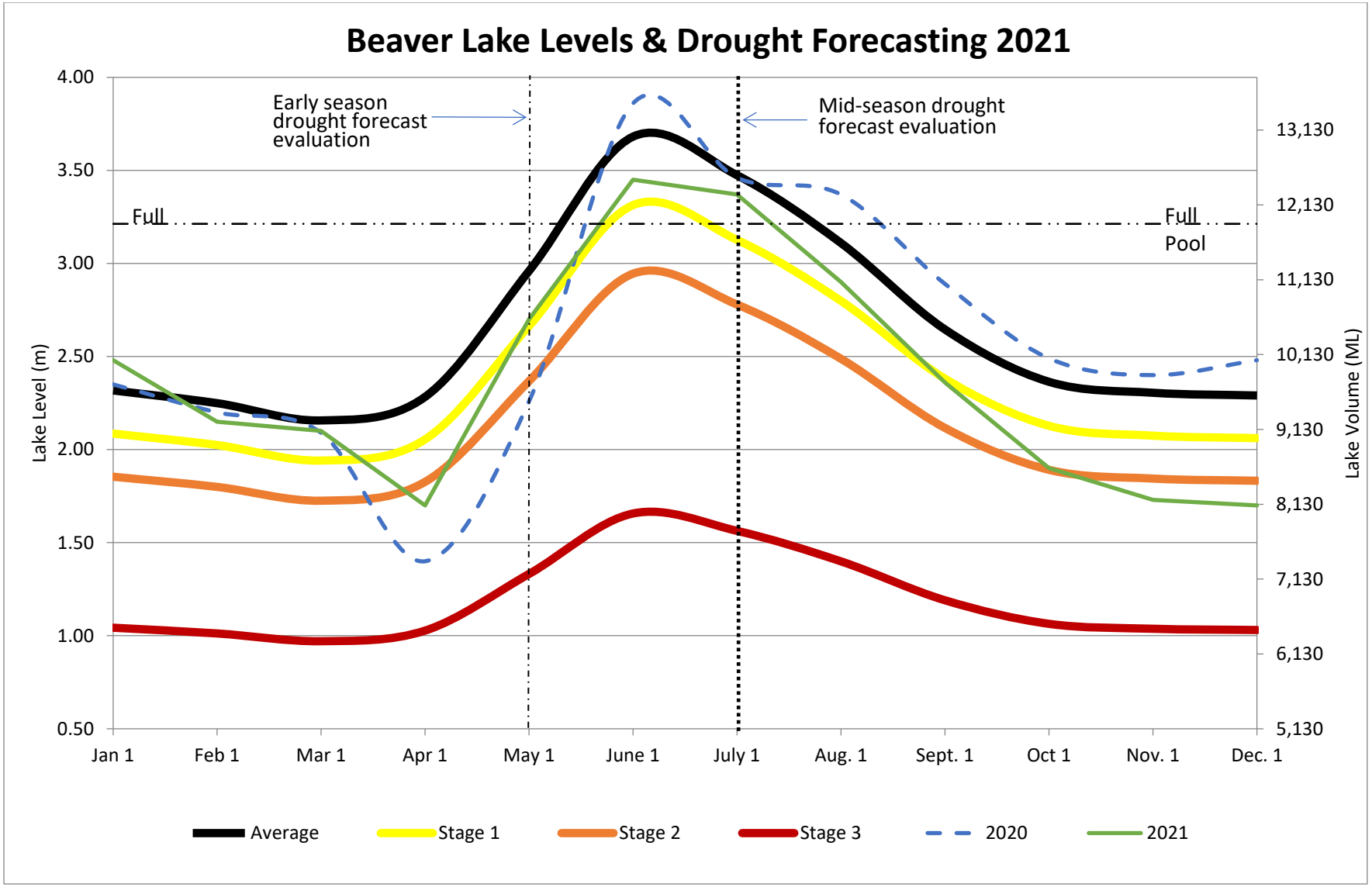
2021 Nutrients			
Site		OYAMA	BEAVER
Date		25-Oct-21	25-Oct-21
Metals Continued			
Total Dissolved Manganese	mg/L	0.03	0.01
Total Recoverable Manganese	mg/L	0.03	0.02
Manganese (MAC)	mg/L	0.12	0.12
Total Dissolved Mercury	mg/L	<0.000010	<0.000010
Total Recoverable Mercury	mg/L	<0.000010	<0.000010
Mercury (MAC)	mg/L	0.001	0.001
Total Dissolved Molybdenum	mg/L	0.00013	0.00017
Total Recoverable Molybdenum	mg/L	0.00017	0.00015
No current guidelines			
Total Dissolved Nickel	mg/L	0.00116	0.00055
Total Recoverable Nickel	mg/L	0.00092	0.00045
No current guidelines			
Total Dissolved Phosphorus	mg/L	<0.05	<0.05
Total Recoverable Phosphorus	mg/L	<0.05	<0.05
No current guidelines			
Total Dissolved Potassium	mg/L	1.21	1.03
Total Recoverable Potassium	mg/L	1.03	0.90
No current guidelines			
Total Dissolved Selenium	mg/L	<0.00050	<0.00050
Total Recoverable Selenium	mg/L	<0.00050	<0.00050
Selenium (MAC)	mg/L	0.05	0.05
Total Dissolved Silicon	mg/L	3.10	3.90
Total Recoverable Silicon	mg/L	3.70	4.00
No current guidelines			
Total Dissolved Silver	mg/L	<0.000050	<0.000050
Total Recoverable Silver	mg/L	<0.000050	<0.000050
No current guidelines			
Total Dissolved Sodium	mg/L	13.20	22.30
Total Reocoverable Sodium	mg/L	2.36	2.25
Sodium (AO)	mg/L	200	200
Total Dissolved Strontium	mg/L	0.03	0.04
Total Recoverable Strontium	mg/L	0.03	0.04
No current guidelines			
Total Dissolved Sulfur	mg/L	<3.00	<3.00
Total Recoverable Sulfur	mg/L	<3.00	<3.00
No current guidelines			
Total Dissolved Tellurium	mg/L	<0.00050	0.00050
Total Recoverable Tellerium	mg/L	<0.00050	<0.00050
No current guidelines			
Total Dissolved Thallium	mg/L	<0.000020	<0.000020
Total Recoverable Thallium	mg/L	<0.000020	<0.000020
No current guidelines			

Appendix D continued– Nutrient Sampling Upland Drinking Water Reservoirs

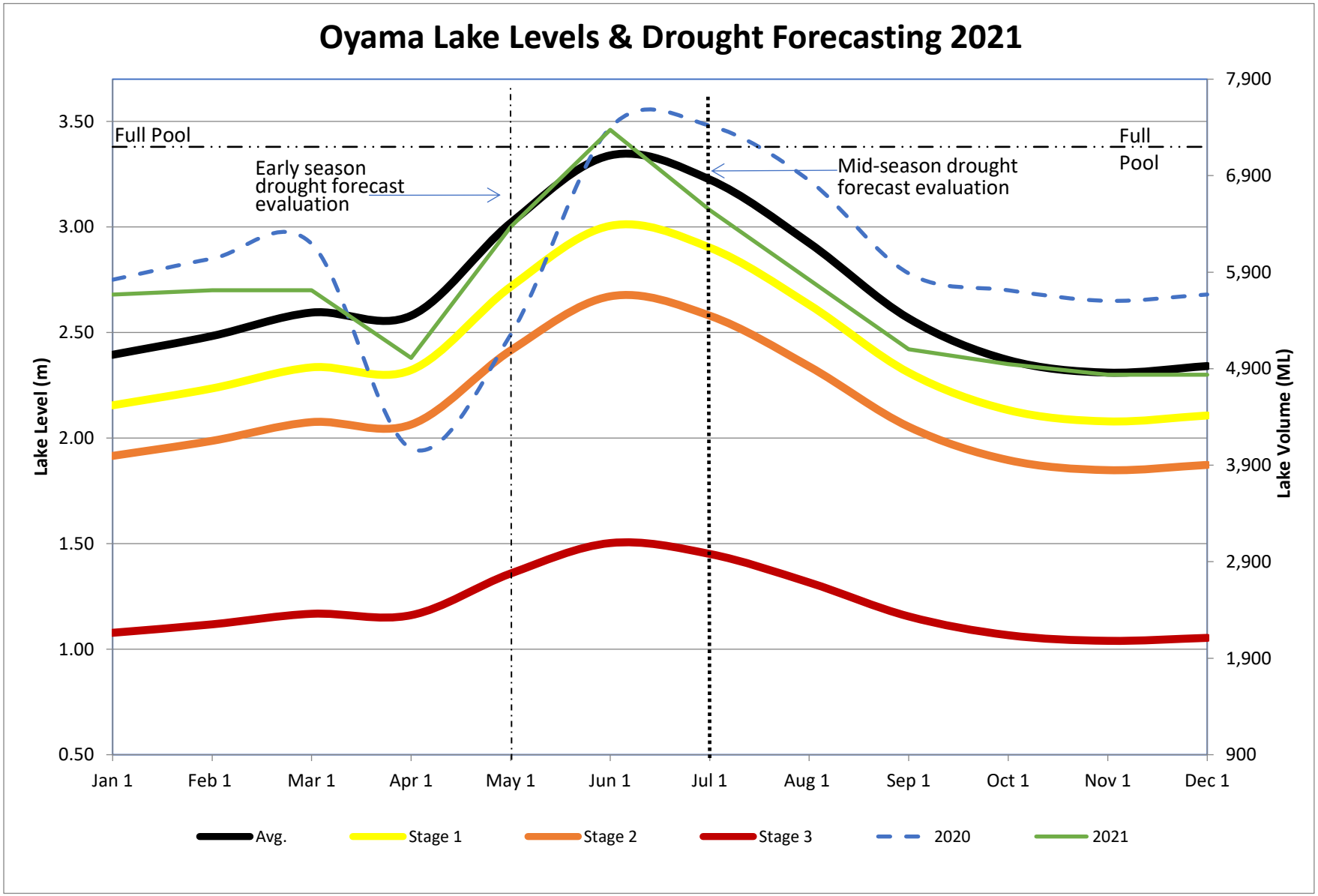
2021 Nutrients			
Site		OYAMA	BEAVER
Date		25-Oct-21	25-Oct-21
Metals Continued			
Total Dissolved Thorium	mg/L	<0.00010	<0.00010
Total Recoverable Thorium	mg/L	<0.00010	<0.00010
No current guidelines			
Total Dissolved Tin	mg/L	<0.00200	<0.00020
Total Recoverable Tin	mg/L	<0.00020	<0.00020
No current guidelines			
Total Dissolved Titanium	mg/L	<0.01	<0.01
Total Recoverable Titanium	mg/L	<0.01	<0.01
No current guidelines			
Total Dissolved Uranium	mg/L	0.000027	0.000025
Total Recoverable Uranium	mg/L	0.000031	0.000029
Uranium (MAC)	mg/L	0.02	0.02
Total Dissolved Vanadium	mg/L	<0.00100	<0.00100
Total Recoverable Vanadium	mg/L	0.00240	0.00230
No current guidelines			
Total Dissolved Zinc	mg/L	<0.0040	<0.0040
Total Recoverable Zinc	mg/L	<0.0040	<0.0040
Zinc (AO)	mg/L	5	5
Total Dissolved Zirconium	mg/L	0.00059	0.00052
Total Recoverable Zirconium	mg/L	0.00055	0.00054
Zirconium (MAC)	mg/L		

Glossary of Terms, GCDWQ:	
<	Less than. Reported when result is less than the reported detection limit
≤	Less than or equal to. Reported when result is less or equal to the reported detection limit
AO	Aesthetic objective. Refer to GCDWQ
MAC	Maximum acceptable concentration. Refer to GCDWQ
OG	Operational guidance values. Refer to GCDWQ
TCU	True color unit. Color referenced against a platinum cobalt standard
Hardness	The degree of hardness of drinking water may be classified in terms of its calcium carbonate concentration as follows: soft, 0 to <60 mg/L; medium hard, 60 to <120 mg/L; hard, 120 to < 180 mg/L; and very hard, 180 mg/L and above.
NTU	Nephelometric turbidity unit
uS/cm	Microsiemens per centimeter

Appendix E – Drought Forecast for Beaver Lake & Oyama Lake



Appendix E continued – Drought Forecast for Beaver Lake & Oyama Lake



Appendix F – UV system off spec water

The configuration and design of the UV system at Kalamalka Lake does not automatically permit off spec water to pass into the distribution system. In order for this facility to operate outside of validated conditions (i.e., 5% off spec) the system would need to be manually adjusted to bypass the UV reactor setting to operate outside of the spec conditions. This did not occur.

Appendix G – Environmental Operators Certification Program (EOCP)

The EOCP Board of Directors, with the approval of the Ministry of Health, recently changed the water treatment facility definition. As such, since our chlorination facilities are method of *primary disinfection*, to produce potable water, they are now classified as water treatment facilities.

According to the EOCP, primary disinfection can include chlorination and ultraviolet of which we utilize alone or combined in our facilities. With this new definition, Operators are now required to update their certification to include water treatment. With the EOCP and Ministry of Health changing our facility classifications to Water Treatment facilities, Section 12 of the BC Drinking Water Protection Regulation requires that our operators now must now also obtain Water Treatment Certification through the EOCP. All operators now are also required to accumulate operator experience toward Water Distribution and Water Treatment certification.

Name	Certification No.	Level
Mike Mitchell	1839	WD-IV, CH, WT-II
Patti Meger	4838	WT-I, CH, WD-II
Kiel Wilkie	6503	WD-III, CH
Tyler Friedrich	7697	WD-III, WT-I
Mike Kristensen	8344	WD-II, WT-I, CH
Krista Winram	1001349	WD-I, CH
Evan Kemp	8114	WWT-III, WWC-I, CH, WT-II
Kyle Barker	Pending	WD-I