Water Operations
2018 Annual Report

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DISTRICT OF LAKE COUNTRY

Water Operations Annual Report - 2018

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LAKE COUNTRY
Life. The Okanagan Way.

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Water Operations

2018 Overview

The following is intended to inform and summarize 2018 data collections, observations, and work completed by District of Lake Country staff with regards to water operations and water quality.

Water operations highlights include:

- Eldorado Treated Reservoir Construction
- Glenmore Booster Station Construction
- Flooding restoration Works and Repair – Vernon Creek Intake
- Reimche Road Bridge Replacement and Water Line Extension

Systems Descriptions and Classification

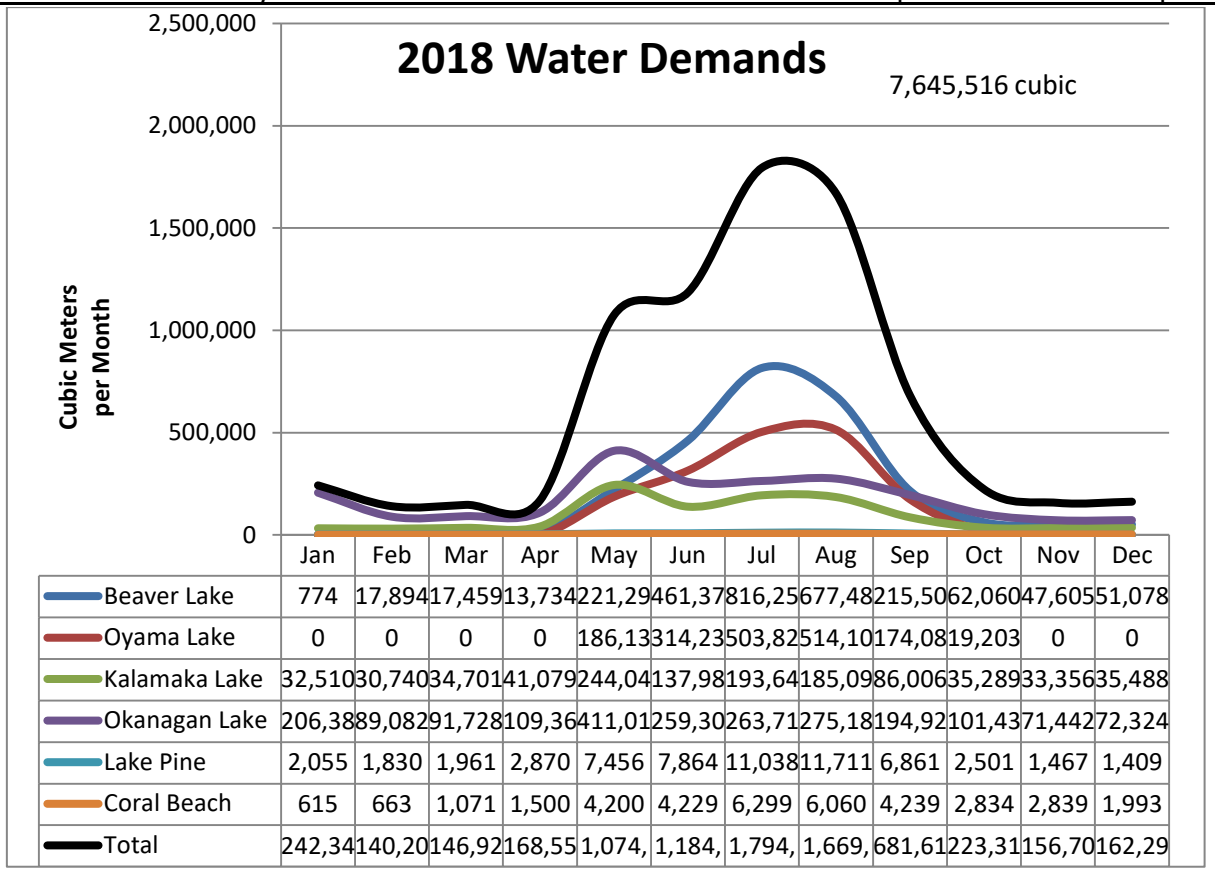
The District of Lake Country is a growing municipality with an approximate population of 14,000 people. Not all 14,000 residents are connected to the District's public water systems. The primary upland sources used by the District include Beaver Lake, Crooked Lake, Oyama Lake, and Damer Lake. The lower elevation water sources are Okanagan Lake (3 separate intakes) and Kalamalka Lake.

Infrastructure within the District owned water systems includes 6 storage dams, 10 reservoirs, 6 chlorine injection systems, 9 pump houses, 4 pressure boosting stations, 36 pressure reducing stations, 79 pressure reducing valves, more than 400 hydrants, and approximately 200 km of water distribution mains.

Water Demands

Each water source within the District 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 use among the sources and water systems in 2018 was 7,645,516 cubic meters (see Figure 1 for water consumption by source). Water demands in 2018 were the lowest in the previous decade. The District largely attributes this to the universal metering program, which was fully implemented by 2017.

Each spring Beaver and Oyama Lake have increased particulates in the water from spring freshet. Most spring the particulate in the water gets to a level that if used, the District would need to issue a boil water advisory. During these times the water operations staff will supplement the Beaver and Oyama Lake sources Okanagan or Kalamalka Lake water. This operational change leads to increased demands on those sources.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Beaver Lake	774	17,894	17,459	13,734	221,29	461,37	816,25	677,48	215,50	62,060	47,605	51,078
Oyama Lake	0	0	0	0	186,13	314,23	503,82	514,10	174,08	19,203	0	0
Kalamaka Lake	32,510	30,740	34,701	41,079	244,04	137,98	193,64	185,09	86,006	35,289	33,356	35,488
Okanagan Lake	206,38	89,082	91,728	109,36	411,01	259,30	263,71	275,18	194,92	101,43	71,442	72,324
Lake Pine	2,055	1,830	1,961	2,870	7,456	7,864	11,038	11,711	6,861	2,501	1,467	1,409
Coral Beach	615	663	1,071	1,500	4,200	4,229	6,299	6,060	4,239	2,834	2,839	1,993
Total	242,34	140,20	146,92	168,55	1,074,	1,184,	1,794,	1,669,	681,61	223,31	156,70	162,29

Figure 1. *2018 DLC water demands from each source reported as cubic meters per month. Zero demand on the Oyama lake source is due to the District supplementing the Oyama lake source with the Kalamalka lake source in low consumption months.*

Water Sources

The District 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


Left: Crooked Lake dam spillway Right: Oyama Lake dam spillway.


Left: Eldorado drinking water reservoir Right: Vernon Creek Intake

See Appendix F & G for 2018 Oyama and Beaver Lake level and Discharge **and Drought Management Graphs**

2018 Snow Pack

The Oyama Lake snow pack for 2018 was an abnormally high. The end of March measurement was 146% above average. To see the historical snow survey data for Oyama Lake please visit the *BC River Forecast Centers website*, under manual snow survey data, number 2F19.

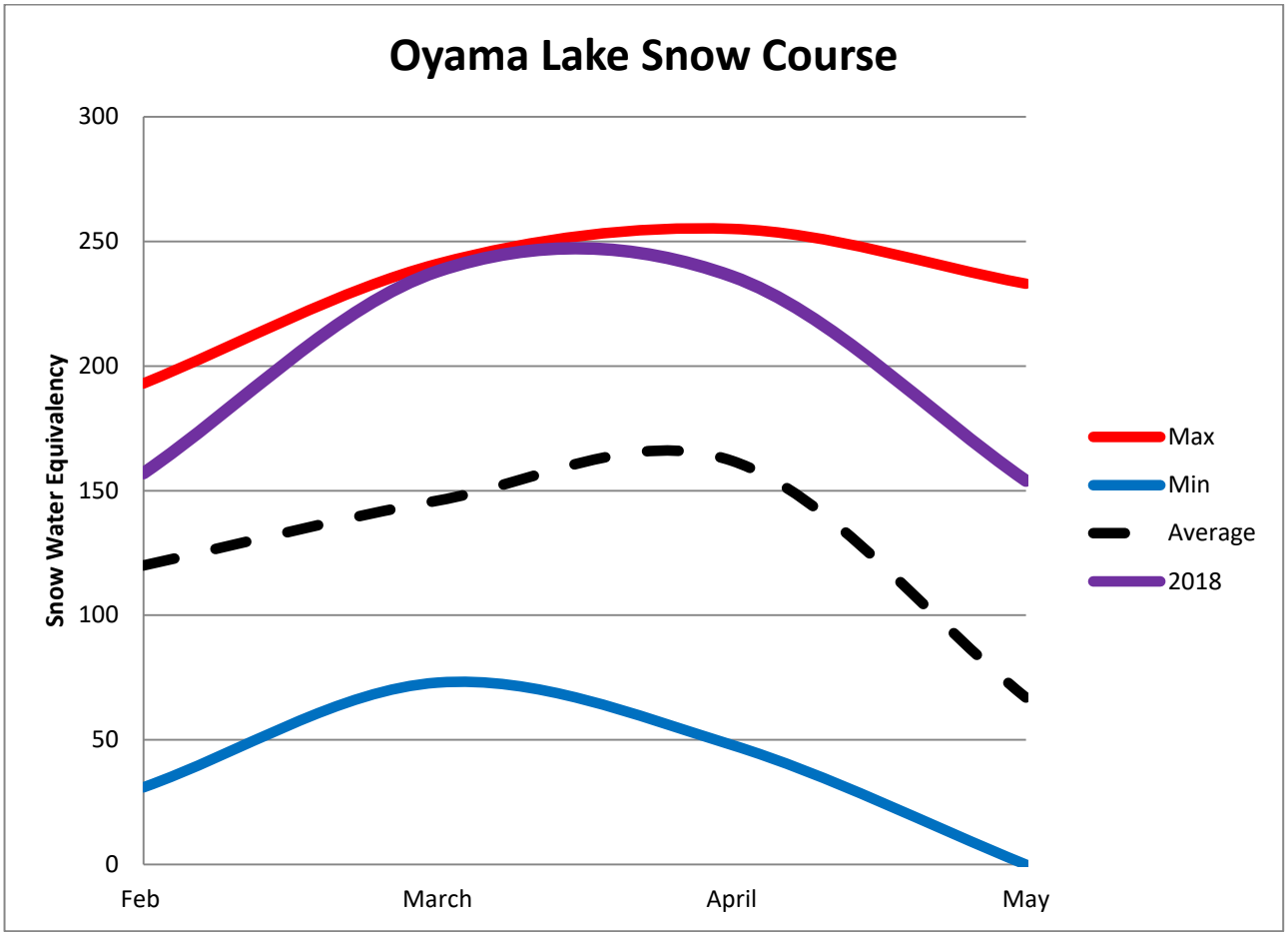


Figure 2. *2018 Oyama Lake Snow Pack*

2018 Flooding

Due to the abnormally high snow pack the 2018 freshet had the potential to cause serious flooding issues for the District. The District water operations staff began releasing water from the upland reservoirs in early March to make room for the large snow pack. When the snow freshet did occur, it did not create the same creek flooding issues that were experienced in 2017. The District largely attributes this to the lowering the upland reservoir and favorable weather conditions.

A State of Local Emergency still did go into effect on May 15th. This State of Local Emergency was instated through the Regional District of Central Okanagan as the Province predicted high flows and potentially high lake levels similar to 2017. Protective sandbag dams were constructed around vulnerable District water intakes on Okanagan Lake. Okanagan Lake reached 0.2 meters above full pool but did not flood to the same levels as 2017. The State of Local Emergency was rescinded June 5th.

Vernon Creek Intake 2017 Flood Repair

During the 2017 floods, rapid snow melt and heavy rain caused abnormally high creek flows which carried large amounts of debris and sediment into the Vernon Creek intake pond. This resulted in the pond being limited to approximately 50% capacity.

In January of 2018 restoration of the intake began. During this work, it was determined that the creek bypass pipe was damaged beyond repair. Over the month of January the intake was cleared of over 22,000 cubic metres (1,500 dump truck loads) of material, and the bypass pipe was replaced.

2017 Flooding of the Vernon Creek Intake Pond

Left: Pumps de-watering the intake pond ***Right: Hydro-vac excavation of the intake drain box***

Cross Connection Control Program (CCCP)

From 2014 to 2016 all seasonal and agricultural irrigation connections were equipped with backflow prevention valves (over 500 backflow prevention valves). The number of residential customers with backflow prevention valves has increased drastically since 2015 due to an increase in the number of residential fire suppression sprinkler systems installed in new construction.

All new construction and new business are required to meet or exceed District regulations related to Cross Connection Control. In 2019 a review of all existing businesses will be conducted and on-site inspections will take place if warranted.

Table 1. *Status of cross connection control program noting the severity of hazards and the number of those that were surveyed as being compliant*.

Hazards	Quantity	Not Surveyed	Surveyed	Vacant	Compliant
High	33	0	33	0	33
Medium	88	12	76	0	69
Low	61	7	54	0	43
None	8	8	0	5	0
Totals	190	27	163	5	145

**Note this table is only representative of industrial, intuitional, and commercial customers. The table does not include residential, seasonal irrigation, and agricultural irrigation customers.*

Annual Operations Summary

Annual operational duties that are completed by District 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
- Respond to customer complaints and inquiries

Dam Inspections

Inspections of Upland Dams (Beaver, Crooked, Oyama, and Damer) are completed by the District daily when the water levels are high. Weekly inspections occur when water levels return to normal. Inspection reports are filled out at the time of each inspection.

Recently it has been brought to our attention that the outlet control structure at Beaver Lake dam is in need of repair. District staff is working with different engineering firms to determine a solution.

Reservoir Cleaning

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

In 2018 Kalamalka Lake Reservoir, Okanagan Lake Reservoir, the Upper and Lower Lakes Reservoirs, and the Upper and Lower Lake Pine Reservoirs were inspected. District staff drained, cleaned, and inspected the Coral Beach reservoir. There were no issues of note for any inspection or cleaning.

2018 Capital Project Highlights

Reimche Rd Bridge

In August 2018 the District of Lake Country built an arched culvert bridge over Middle Vernon Creek on Reimche Rd. The original bridge was failing and in need of replacement. When the old bridge structure was removed, the District took this opportunity to extend the water main on Reimche Road. The District extended the 200mm PVC water main on to the east side of Middle Vernon Creek, using 200mm HDPE pipe for the creek crossing.

Eldorado Treated Reservoir and Glenmore Booster

In 2018 the District completed construction of the Eldorado Treated Water Reservoir and Glenmore Booster Station Project. This project consists of three new key infrastructure components:

1. 6,000 Cubic Metre Treated Water Reservoir that:
    - Provides greater time for chlorine to react and disinfect water prior to entering the distribution system
    - Provides greater storage for fire protection
    - Provides a clear water storage tank for future water treatment facility

2. Low Lift Booster Station that:
    - Conveys water from the raw water balancing reservoir to the new treated water reservoir

Piping being installed to new Treated Water Reservoir

3. Glenmore Booster Station that:
    - Replaces an existing undersized booster station
    - Interconnects the Beaver Lake water source and the Okanagan Lake water source, allowing District staff to use either source in both systems as needed

Kalamalka Lake Pump House Backup Power Installation

In 2018 the District installed a 200kW backup power generator at the Kalamalka Lake pump house in Oyama. In the event of a long term power outage, this project ensures that water is available to approximately 600 Oyama area customers for normal use and fire protection.

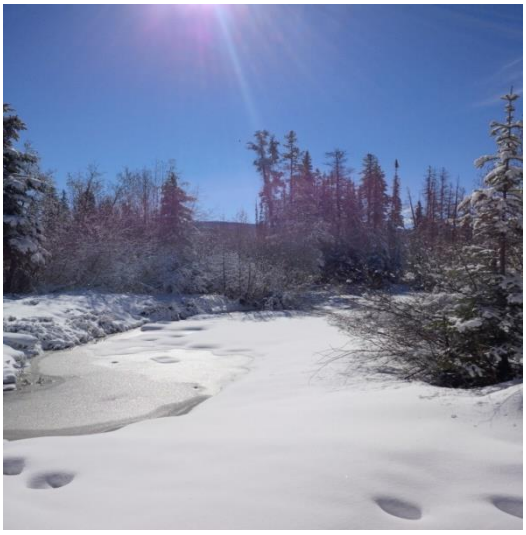
Emergency Response Plan

The DLC has an Emergency Response Plan that is updated annually (or more often as required). This report is seperate from the Annual Water Operations Report. Both the Emergeny Response Plan and Annual Water Operations Report are provided to IHA annually.

WATER QUALITY

Water Chemistry background

This section provides a review of the water quality testing performed in 2017 for the District of Lake Country's (DLC) water sources. Overall bacteriological and water chemistry results show that the majority of samples meet the *Guidelines for Canadian Drinking Water Quality* (GCDWQ); however, some parameters exceeded the maximum acceptable concentrations. The District'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 GCDWQ for colour and turbidity. Both Beaver and Oyama sources exceeded the THM guidelines. Such results are common throughout the Okanagan wherever water is sourced from highland watersheds.



Vernon Creek covered in snow.

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 DLC is working towards treatment (as outlined in our Water Master Plan) and at present our primary form of disinfection is chlorination.

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 BC Drinking water objectives provide an overview of the *framework towards achieving goals for drinking water treatment of pathogens in surface water supply systems in BC and for a general reference for assessing progress towards updating or improving existing water supply systems*. This general overview was developed using the BC's Drinking Water Protection Act, the Drinking Water Protection Regulation, and objectives in the GCDWQ. It will be used as a general reference for assessing progress towards updating or improving existing water supply systems. 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 until (NTU) of turbidity
- No detectable E.coli, fecal coliform and total coliforms

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

The District has addressed these concerns in our Water Master Plan and we remain in discussions with IHA regarding the implementation and challenges of meeting these requirements; further details page 12 Capital Works.

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).

Chlorine is the disinfectant used for all of the District sources. Free and total chlorine are measured to ensure a residual is maintained throughout the distribution systems. The Kalamalka Lake source also utilizes ultraviolet water treatment radiation as a secondary form of disinfection. Ultraviolet operations log sheets are contained in Appendix H.

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.

Temperature and pH affect the strength of the disinfectant. 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 CDWQG .

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.

Bacteriological Background

The District of Lake Country (DLC) in cooperation with the Interior Health Authority, Okanagan Service Area (IHA) has developed a Water Quality Monitoring and Reporting Plan. It includes the criteria set by the Province to ensure standards for the monitoring the delivery of safe drinking water are being met. 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).* 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 2) and the District of Lake Country Water Quality and Monitoring Plan; Frequency of Monthly bacteriological tests (Table 3). 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, Coral Beach and Lake Pine water systems. Results that do not meet the water quality standards in the DWPR, Schedule A **(Table 4)** are immediately reported to the Drinking Water Officer.

Table 2: *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 3: *Frequency of Monthly bacteriological tests: Membrane Filtration (MF) and Presence-Absence (P/A)*

System/Source	MF Distribution # samples required per mo.	MF Raw Water # samples recommended per mo.	P/A	Total MF Distribution and Raw	Distribution Bacteriological/ Chlorine test sites:
DLC Water System: Beaver Lake source : Est. Population 4,000	4	4	2	8	15*
DLC Water System: Okanagan Lake source : Est. Population: 4,000	4	4	2	8	11**
DLC Water System: Oyama Lake source: Est. Population 636	4	4	2	8	6
DLC Water System: Kalamalka Lake source: Est Population 614	4	4	2	8	5
Coral Beach Water System: Okanagan Lake source Est Population 124	4	4	2	8	2
Lake Pine Water System: Okanagan Lake source Est Population 173	4	4	2	8	4**
***includes Camp Rd. Reservoir (offline until required) ****includes at least 2 reservoirs					

Table 4: *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. The maximum acceptable concentration (MAC) of *E.coli* in public, semi-public, and private drinking water systems is zero 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. Initial counts are not reportable under our Permit to Operate. However, in order 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 2018 237 MF bacteriological samples were collected and analyzed at Caro Environmental Labs in Kelowna for total coliforms and E.coli. Additionally 142 P/A tests were analyzed (in-house). The P/A tests determine if total coliforms are present or absent from the sample but do not provide counts should the test be positive. P/A tests are collected on alternate weeks from the MF samples. The P/A tests provide quick feedback on the bacteriological quality of the water during the week that MF samples are not collected. 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 2018 no samples were positive for Total Coliforms or E.coli. Appendix A contains a summary of the total bacteriological tests collected in each water system and overall.

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 quality results are in tables 5 -10 below for District of Lake Country Water System. The list of sample sites for each distribution system is located in Appendix B.

Beaver Lake Source

Table 5. *2018 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.*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.08	0.25	0.46	4	6.3	46
MAX	7.20	3.34	1.7	18	7.7	133
AVERAGE	1.51	1.60	0.91	13	6.9	85
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU AO**	***15*** ***AO***	***7.0-10.5*** ***AO***	

Water chemistry equipment (residual chlorine and turbidity meters) at Eldorado Balancing Reservoir

Okanagan Lake Source

Table 6. *2018 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). It should be noted that there was one occasion where the distribution water sampled is a mixture of both sources (Beaver (Vernon Creek) source water) in the Okanagan Lake lines due to the June 25th power outage at Okanagan Lake Pump house. On June 26th Okanagan Lake Source water was again restored through the lines and normal operations resumed.*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.32	0.49	0.22	3	7.2	142
MAX	2.88	2.16	3.50	18	8.3	329
AVERAGE	1.09	1.27	0.51	8	8.0	293
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** ***≤ 5 NTU*** ***AO***	***15*** ***AO***	***7.0-10.5*** ***AO***	

Oyama Lake Source

Table 7. *2018 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 off line approximately May 12 – October 15th (mixing of sources in the Oyama reservoir occurs for a short time following the switch).*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.23	0.43	0.40	7	5.5	50
MAX	5.30	4.20	3.70	21	7.0	199
AVERAGE	2.33	2.42	0.85	14	6.5	64
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***AO***	

Kalamalka Lake Source

Table 8. *2018 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). 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 (i.e. Kalamalka Lake water in Oyama distribution lines and not the reverse).*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.02	0.14	0.30	3	7.2	234
MAX	3.00	3.26	1.2	16	8.4	432
AVERAGE	1.24	1.46	0.71	9	8.1	402
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***AO***	

Coral Beach Water System

Table 9. *2018 Annual Distribution Water Chemistry Results: Coral Beach Water System; Okanagan Lake Source (All data reported from weekly water quality monitoring using hand-held equipment).*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.50	0.65	0.21	5	7.8	283
MAX	3.60	3.82	3.10	14	8.4	543
AVERAGE	1.45	1.64	0.73	9	8.0	320
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** **≤ 5 NTU** **AO**	***15*** ***AO***	***7.0-10.5*** ***AO***	

Lake Pine Water System

Table 10. *2018 Annual Distribution Water Chemistry Results: Lake Pine Water System; Okanagan Lake Source (All data reported from weekly water quality monitoring using hand-held equipment).*

	Chlorine mg/L	Chlorine mg/L	NTU	Temp °C	pH	Conductivity µS/cm
MIN	0.15	0.29	0.23	3.8	7.7	300
MAX	2.60	3.10	0.94	16	8.5	450
AVERAGE	1.33	1.53	0.42	9	7.9	345
WQ Guidelines ***Aesthetic objective (AO)***			***1 (max)*** ***≤ 5 NTU*** ***AO***	***15*** ***AO***	***7.0-10.5*** ***AO***	

Distribution water quality can vary for numerous reasons. These include: seasonal changes to water demand, timing of sampling following system flushing or use of hydrant, or mixing of water sources. The last circumstance is only applicable to Beaver/Okanagan Lake customers and Oyama/Kalamalka Lake customers. Under normal operating procedures Beaver Lake and Okanagan Lake sources do not mix. However, should Beaver Lake source water experience an undesirable water quality event (i.e. high turbidity that occurs during freshet), and if the system demands are within an operational range, we will supplement or switch Beaver Lake source customers with Okanagan Lake water. For customers on the Oyama source this is now year four that Kalamalka Lake source has been the primary supply during the non-irrigation season (approximately October through May). Under normal daily operating conditions, at no time are the Beaver or Oyama sources mixed into Okanagan or Kalamalka source distribution systems. If this were ever to occur it would be under a water emergency situation with the appropriate Water Quality Advisory Notification issued.

It is not unusual in any of the distribution systems for free chlorine to read trace levels at dead ends or through low use areas. The Beaver, Okanagan and Lake Pine distributions all had samples of less than 0.20 ppm free chlorine. The free and total chlorine levels are closely monitored and if chlorine levels are low or turbidity is elevated, chlorine dosing may be increased and/or flushing of distribution lines may occur. Follow-up sampling confirms residuals and turbidity levels.

In 2017 the GCDWQ changed and the Aesthetic Objectives of pH were changed from 6.5-8.5 to 7.0-10.5. The Beaver and Oyama sources regularly did not meet these objectives whereas the deep water intakes on Okanagan and Kalamalka were generally within this range. Temperature on all systems fluctuates with weather and raw water conditions. All systems (other than Coral Beach) at some point had at least one sample that was at or above the aesthetic temperature guidelines. Overall averages on all systems were well under the 15 degrees guidelines.

Water Quality Advisory and Boil Water Notice

The following sources throughout 2018 were on a **Water Quality Advisory (WQA**):

- Beaver Lake (District of Lake Country Water System)
- Oyama Lake (District of Lake Country Water System) (Oyama source Off-line May 12 – October 15)
- Okanagan Lake Source (On June 25th and rescinded June 26th) due to power outage and emergency temporary switch to Beaver Lake Source

The advisories on Beaver and Oyama Sources will remain in effect until infrastructure upgrades are made to improve water quality and reliability.

Notice to customers on the Oyama and Beaver sources as to when their water supplies will be switched over or supplemented with an alternate water source of better water quality does not occur. The DLC will continue to supply customers with the best water quality possible and normal operations includes the switching and supplementation of alternate sources to optimize water quality. WQA Reminder notifications are sent to customers on their water bills, it is permanently posted on our web and is publicized on various occasions in our local newspaper paper (The View) and DLC social media. In a situation where there is a higher water quality event, such as a Boil Water Notice, customers would be notified as per the IHA approved Potable Water Supply Emergency Response Plan for the DLC.

On June 25th a power outage occurred at the Okanagan Lake Pumphouse following an intense storm event. Until Fortis was able to restore power, an emergency and temporary water supply from the Beaver Lake was supplied to the Okanagan Lake customers. Customers on the Okanagan Lake water supply were then on an immediate Water Quality Advisory. The power was returned late that night; however, prior to removing the WQA, the reservoir went through numerous cycles using the Okanagan Lake water. System checks the following day also showed Okanagan Lake was through the distribution and water quality was good. On June 26th morning customers normally receiving the Okanagan Lake source were back to normal service.

In June 2017, IHA released a report as part of public awareness campaign called Drinking Water in Interior Health. It is an "Assessment of Drinking Water Systems, Risks to Public Health, and Recommendations for Improvement." (January 2017). The Chief Medical Health officer, Dr. Corneil, advises that "This report should be viewed as an opportunity to renew and rejuvenate conversations between drinking water officers, water supply managers, municipal leaders, and members of the community," and is "An opportunity to ensure we are moving forward, together, towards a common goal: access to clean, safe, and reliable tap water for all people at all times."

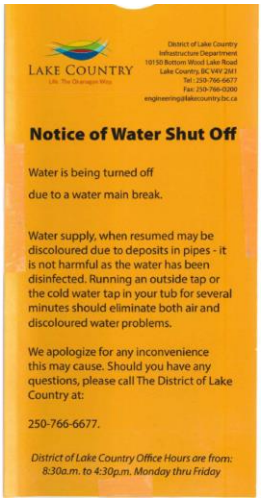
For the DLC we will continue our communications with IHA as we work towards achieving goals in our Water Master Plan and look forward to learning more about IHA's public awareness campaign. Currently IHA has developed a series of educational videos providing information on how the water systems work, how water is treated, and what safety issues the community should be aware of.

As with the 2006 Turbidity Notification Campaign, 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). Reminder notifications are sent to customers annually 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.

Service Disruptions

Under normal operating conditions many water utilities frequently experience minor disruptions due to various reasons such as repairs to leaks, water main breaks, seized valves or installation of new infrastructure. In 2018 water operations crew responded to approximately 5 service repairs and 6 water main breaks. 1 additional Water Quality Advisory was in effect for less than 24 hours on the Okanagan Lake Source from June 25 – 26th as detailed above.

Repairs in 2018 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 an interruption in water distribution services, the District reports the event to Interior Health Authority (IHA) and it is documented in the Monthly Water Quality Reports under *Notable Events*.


LAKE COUNTRY

District of Lake Country
Infrastructure Department
10150 Bottom Wood Lake Road
Lake Country, BC V4V 2M1
Tel: 250-766-6677
Fax: 250-766-0200
engineering@lakecountry.bc.ca

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

With the exception of an emergency repair or break, customers are provided advanced notice. When this is not possible, customers in the affected area are advised and notifications are left on the doors of the residents.

Trihalomethanes (THM's)

Trihalomethanes (THM's) are a by-product of the water disinfection process. They form when natural organic matter (i.e. decaying vegetation commonly found in lakes and reservoirs) reacts with the chlorine used to treat the water. This reaction produces organic chlorites that include suspected carcinogenic "disinfection by-products," the most common of which are 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. (*GCDWQ*)

2018 trihalomethane analysis in the DLC Water System showed Oyama and Beaver Lake sources had total THM averages that exceeding the Guidelines for Canadian Drinking Water Quality (GCDWQ). This may be

due to the higher levels of organics in the upland lakes. All THM results displayed as a running average are detailed in Figures 2-7.

Figure 2. DLC Beaver lake source trihalomethane (THM) data collected 2002 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ). *2002 and 2003 data limited to one sample date.

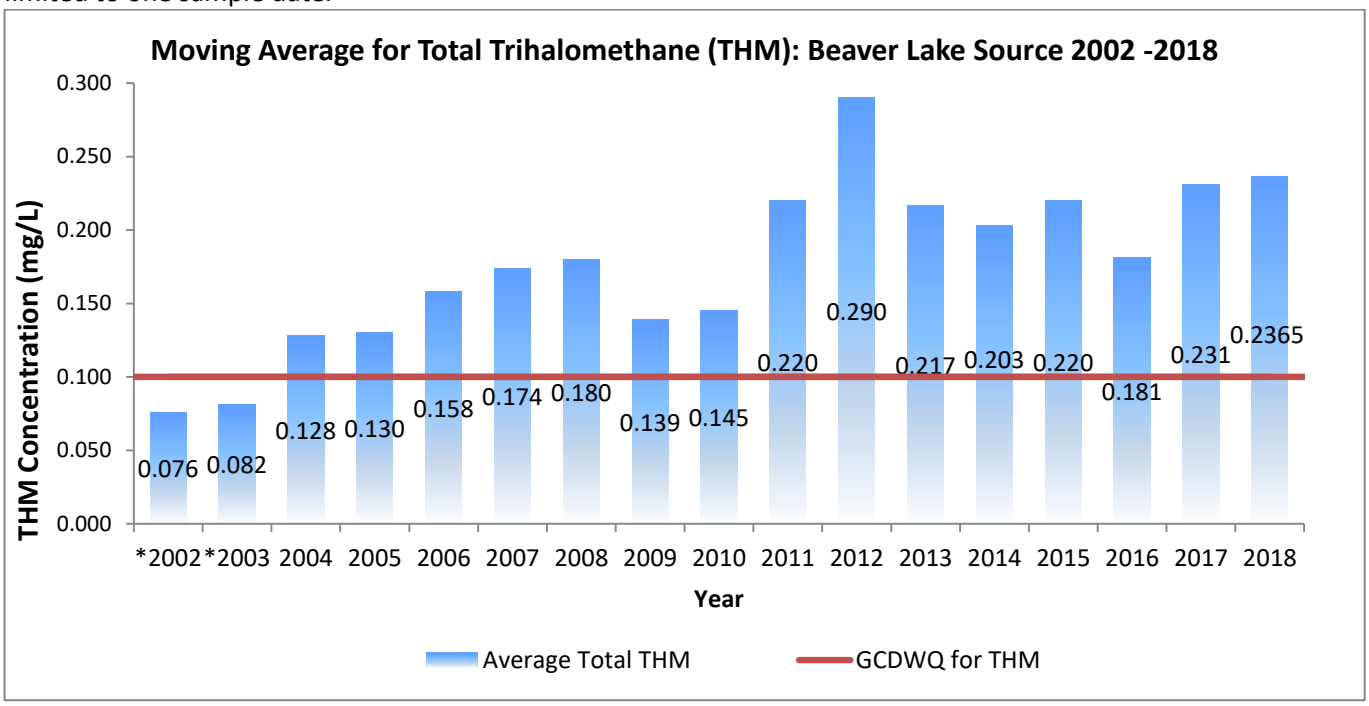


Figure 3. DLC Oyama lake source trihalomethane (THM) data collected 2004 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ). Sampling of Oyama source occurs only during irrigation season (approximately May – October) due to Kalamalka source in distribution lines during non-irrigation season. *2016 and 2017 limited to one sample date.

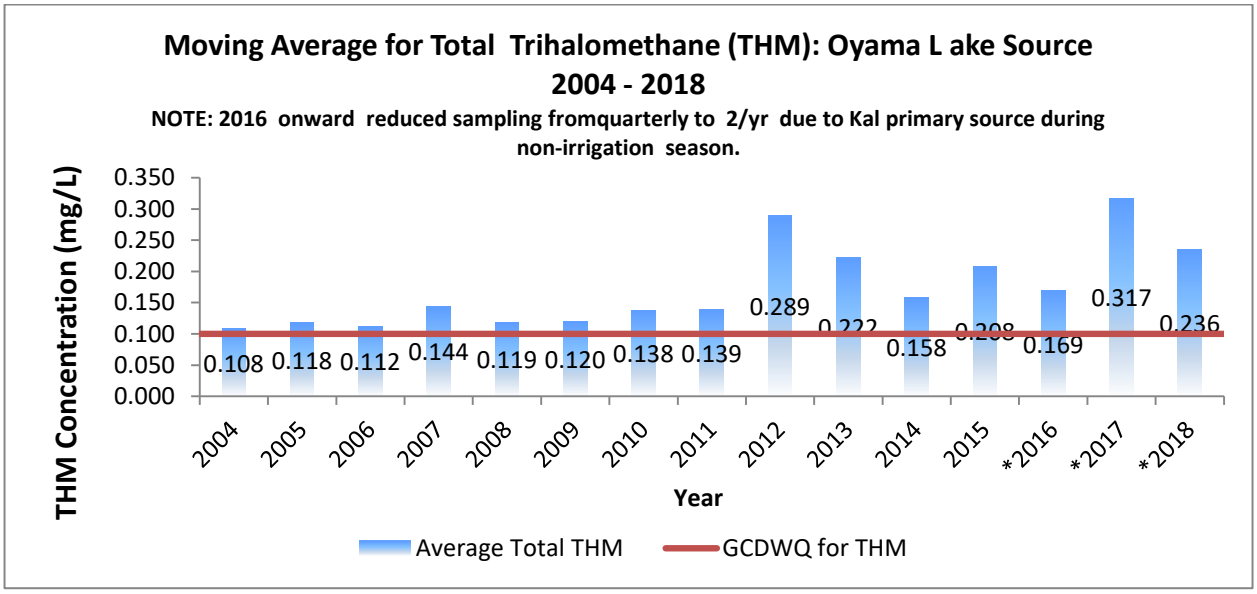


Figure 4. DLC Kalamalka lake source trihalomethane (THM) data collected 2006 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ). Kalamalka sampling includes sites within Oyama distribution lines during non-irrigation season (approximately October – May).

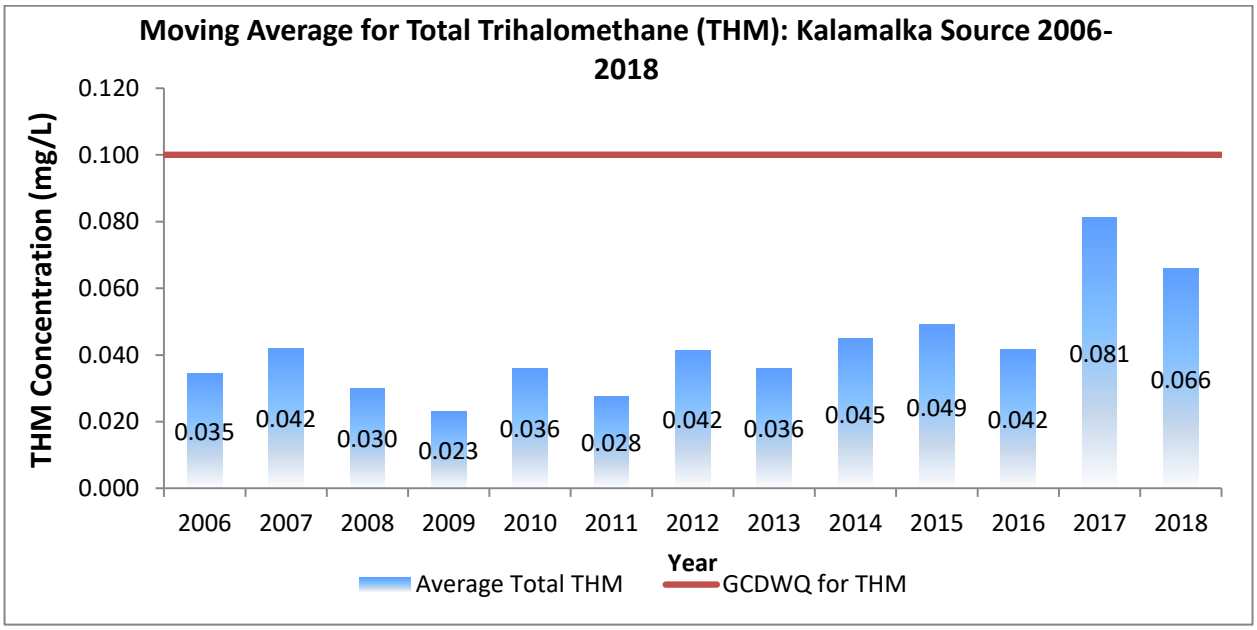


Figure 5. DLC Okanagan Lake source trihalomethane (THM) data collected 2006 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

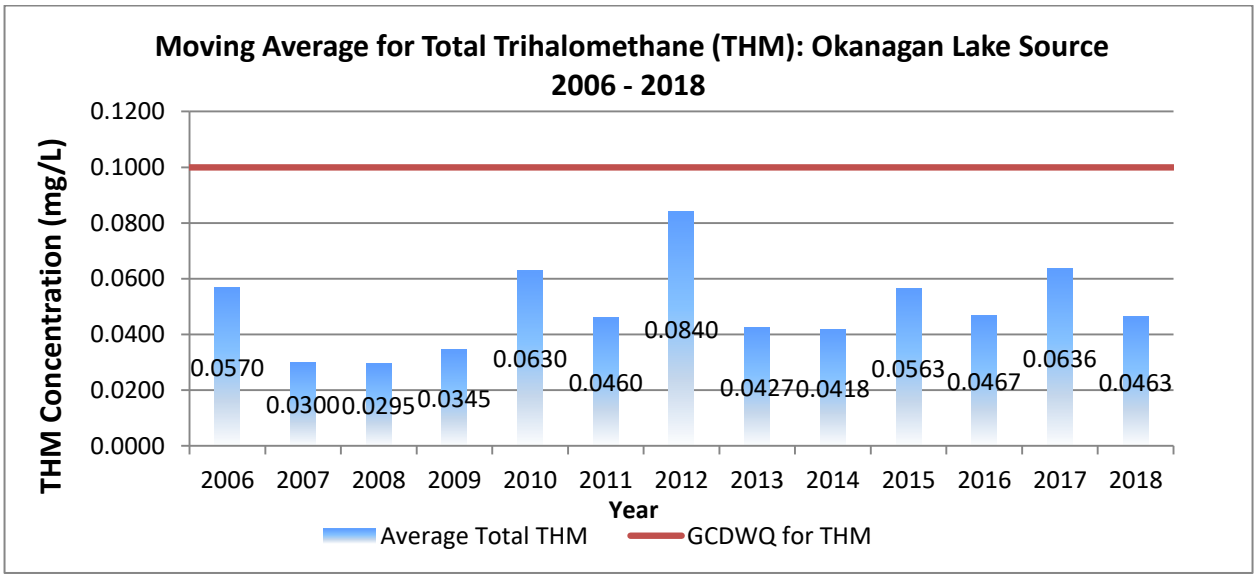


Figure 6. DLC Coral Beach System (Okanagan lake source) trihalomethane (THM) data collected 2009 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

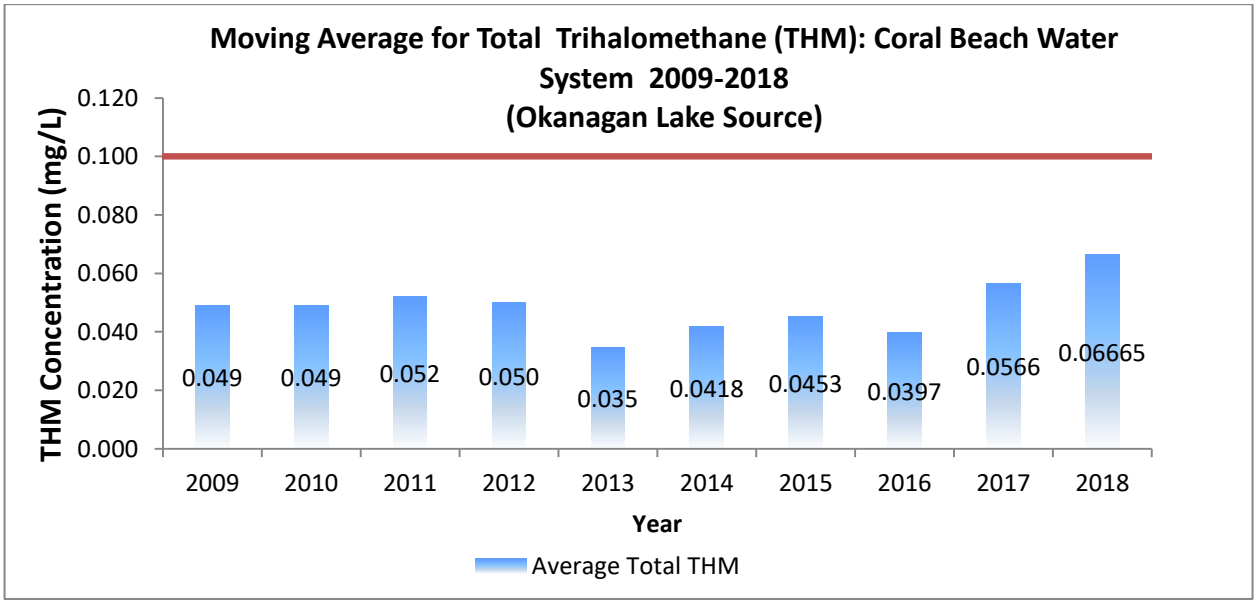
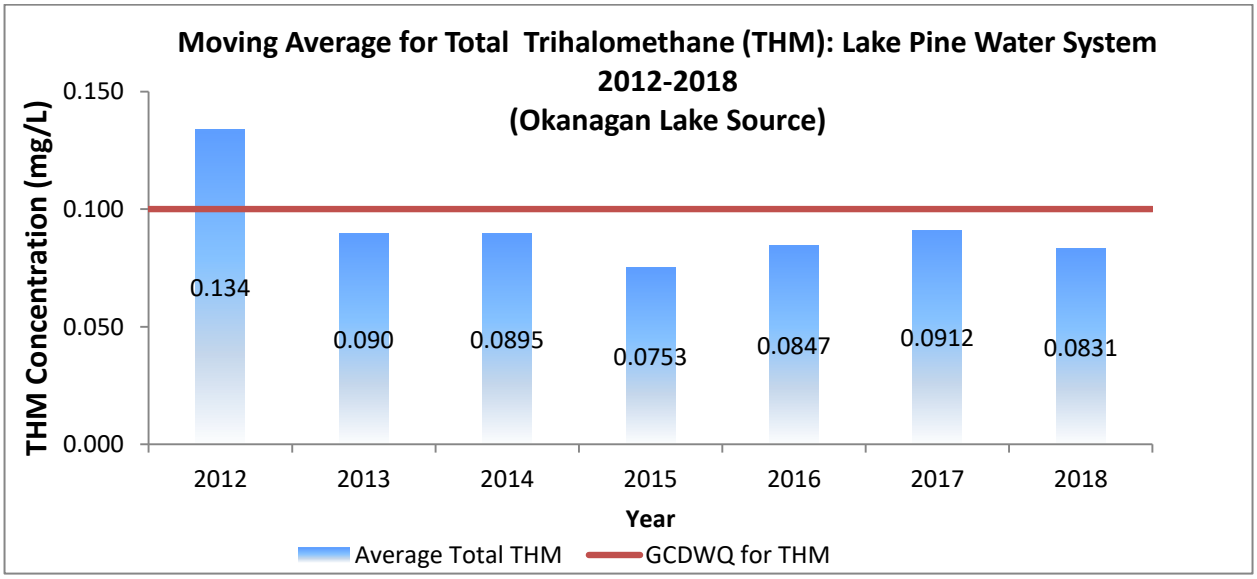


Figure 7. DLC Lake Pine System (Okanagan lake source) trihalomethane (THM) data collected 2012 – 2018. Average Total THM values relative to the Guidelines for Canadian Drinking Water Quality (GCDWQ).



Instrument Calibration and Quality Control

Prior to sampling, field instruments are checked against standards to ensure accuracy. All equipment is regularly maintained and calibrated as required prior to use in the field. Annually, a representative from Hach Services personally attends the DLC to inspect, recalibrate and re-certify water quality hand-held equipment. 2018 certification was obtained for all water quality monitoring field equipment. On-line Water Quality monitoring equipment is verified weekly using the hand-held water quality equipment,

maintained, and calibrated as per manufacture directions and certified by an outside agency as scheduled in the automated operational maintenance program.

Giardia Performance Monitoring: CT calculations

Beaver Lake Source

Chlorine is the primary disinfectant used on the Beaver Lake source and in order to be effective, it must have adequate contact time (CT) with microorganism to inactivate them. Various factors can affect CT values, such as pH, temperature, strength of disinfectants and types of organisms. The CT table that the DLC uses was developed by IHA specifically for the Beaver Lake source at the Glenmore pressure reducing Station (PR6), with the assumption that we are aiming to inactivate both Giardia lamblia (a single-celled parasite that causes intestinal infection) and viruses. Therefore the objective of giardia performance monitoring is to achieve a 3 log inactivation of giardia which is 99.9% deactivation which also provides the required 4 log inactivation of viruses. This PR station on Seaton Road has been working relatively well for collecting CT data. However, due to confined space and inadequate set up within the PR station, this dedicated sample site was instead installed outside of the station and is subject to freezing in winter. This site was only sampled in January 2018 and all CT requirements were achieved with 99.9% -100% deactivation. The CT spreadsheet is located in Appendix C. From February through April Beaver source was either off-line or mixed source water (with Okanagan Lake) and from May through the fall of 2018 this station was then a construction site to bring this PR station above ground. Details of this project are described earlier in this report (page 11) under the Eldorado Treated Reservoir and Glenmore Booster section within the 2018 Capital Works Update. The CT is now met through the new reservoir located on the Eldorado chlorination facility and balancing reservoir grounds and this site is no longer required. On-line water quality monitoring equipment for chlorine, pH and temperature have been installed inside the new Glenmore Booster Station and connected to SCADA for both the Vernon Creek and Okanagan Lake source.

Source Sampling (Raw Water)

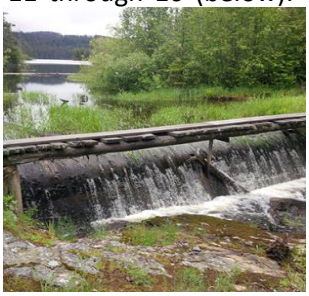
Raw Water Sampling occurs at intakes, upland drinking water reservoirs, and at deep water intake pump stations.

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. These data is compared against the CDWG as per Conditions on Permit and recommendations in Oyama and Vernon Creek Watersheds Source Water Assessment. Annually, comprehensive tests are collected at all intakes and nutrient testing occurs as budget permits during high and low flow seasons or as required. The DLC continually modifies parameters sampled to provide sufficient baseline data for future water treatment.

Raw Water Data from intakes and pump stations are located 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

Results are stored electronically and undergo verification prior to monthly and annual reporting to ensure quality controlled data. These data are used to characterize the quality of raw water intakes, monitor levels of physical, chemical and biological changes occurring in raw drinking water, establish trends in drinking water quality, identify and track the occurrence of concerns such as increased turbidity, positive bacteriological results or changes in nutrient loading. As well provide background data for future additional forms of disinfection and water treatment plant(s), assess and report on the state of the DLC's distribution and raw water quality.

Table 11. *District of Lake Country Water System, 2018 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=43)
MIN	40	0.32	1	7.1	48	19	<1	<1	
MAX	80	4.90	18	8.0	105	91	480	94	87%
AVERAGE	56	1.37	9	7.5	75	38	44 samples		
WQ Guidelines			*15*	*7.0-10.5*			*<1*	*<1*	
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	*acceptable*	*1 (max) ≤ 5 NTU AO*	*AO*	*AO*		*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 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Table 12. *District of Lake Country Water System, 2018 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 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=41)
MIN	120	0.22	4	7.9	261	<5	<1	<1	85	
MAX	220	0.93	8	8.3	318	7.3	110	2	87	100%
AVERAGE	150	0.43	6	8.0	277	n/a	41 SAMPLES		86	
WQ Guidelines			***15***	***7-10.5***			***<1***	**<1**		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***AO***		***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: nine sample results <5 and four results <5.3- 7.3

4 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Table 13. *District of Lake Country Water System, 2018 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).*

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=23)
MIN	40	0.43	5.6	7.0	46	38	<1	<1	
MAX	40	0.85	18	8.0	92	66	1100	280	55%
AVERAGE	40	0.58	12	7.4	54	46	22 samples		
WQ Guidelines			***15***	***7.0-10.5***			***<1***	***<1***	
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	***acceptable***	***1 (max) ≤ 5 NTU AO***	***AO***	***AO***		***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 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Table 14. *District of Lake Country Water System, 2018 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=52)
MIN	160	0.31	4	7.8	378	<5	<1	<1	90	100%
MAX	220	1.20	11	8.6	419	<5	33	7	92	
AVERAGE	189	0.61	7	8.1	396		52 Samples		90	
WQ Guidelines			*15*	*7-10.5*			*<1*	<1		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	*acceptable*	*1 (max) ≤ 5 NTU AO*	*AO*	*AO*		*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: nine sample results <5 and four results <5.3- 7.3

4 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Table 15. *Coral Beach Water System, 2018 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 µS/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=48)
MIN	120	0.27	4	7.3	261	<5	<1	<1	83	100%
MAX	160	2.24	12	8.4	299	6.8	5	<1	91	
AVERAGE	143	0.56	7	8.0	275	n/a	48 Samples		86	
WQ Guidelines			*15*	*7-10.5*			*<1*	<1		
Maximum Allowable	*acceptable*	≤ 5 NTU	*AO*	*AO*		*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: Nine sample results <5 and four results 5.5 - 6.8.

4 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Table 16. *Lake Pine Water System, 2018 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=41)
MIN	120	0.21	5	7.8	256	<5	<1	<1	84	100%
MAX	160	0.98	14	8.3	311	14	7	2	87	
AVERAGE	144	0.45	11	8	286		49 Samples		85	
WQ Guidelines			*15*	*7.0-10.5*			*<1*	*<1*		
Aesthetic objective (AO) Maximum Allowable Concentation (MAC)	*acceptable*	*1 (max) ≤ 5 NTU AO*	*AO*	*AO*		*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.

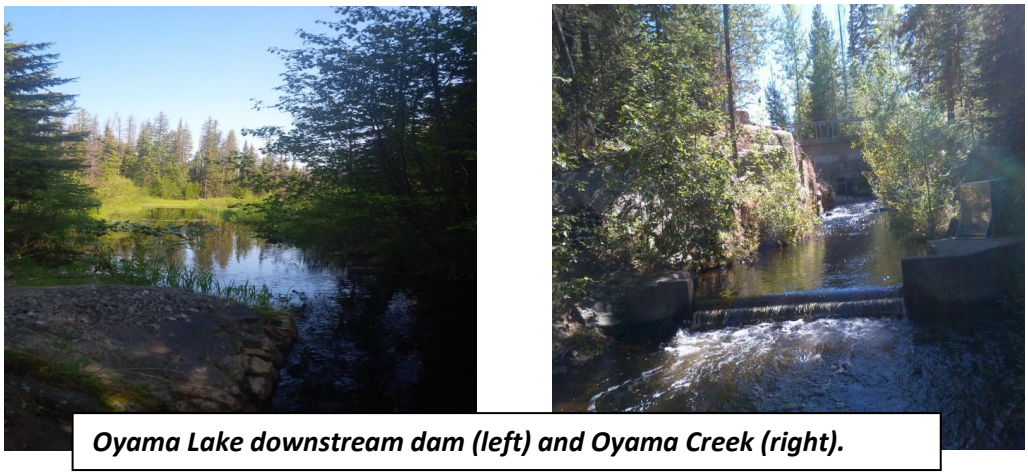
3 Average unavaliable: Nine sample results <5 and four results 5.5 - 6.8.

4 According to the criteria set out by the BC Water Quality Guidelines (BCWCG) for a system using disinfection only to treat drinking water, "90% of samples should have less than 10 E.coli per 100mL" (BCWQG (Criteria) 2006). Results are % of samples less than 10 E.coli/100mL

Raw Water Reservoirs/Intakes

The District 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 intake
4. Kalamalka Lake (1) deep water intake



Oyama Lake downstream dam (left) and Oyama Creek (right).

The Oyama and Vernon Creek watersheds together encompass approximately 141.1 km2. Together, the two community watersheds supply the DLC with approximately 65% of their source water. Both watersheds are dependent on upland storage reservoirs that rely on snow pack 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 located in Appendix D and the result for nutrient sampling (upland drinking water reservoirs (Beaver and Oyama)) is contained in Appendix E

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

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. Results are stored electronically and undergo verification prior to monthly and annual reporting to ensure quality controlled data. The data is used to characterize the raw water quality from our upland drinking water reservoirs, monitor levels of physical, chemical and biological changes occurring in raw drinking water, establish trends in drinking water quality, identify and track the occurrence of concerns such as increased turbidity, positive bacteriological results or changes in nutrient loading, provide background data for future additional forms of disinfection and water treatment plant(s) and to assess and report on the state of the DLC's distribution and raw water quality.

Beaver Lake at Dam outflow

Algal blooms and other aquatic growth in our drinking water reservoirs can occur at various times throughout the year. Aquatic anomalies are assessed, under the direction of an aquatic biologist; samples are collected and sent for analysis.

The Eldorado balancing reservoir is monitored regularly and operations staff continued with on-going measures to control aquatic organism growth which includes the operation of the water as a balancing reservoir and the periodic removal of accumulated sediments. In 2018 this worked well however, there was one event that required additional analysis. Near the end of June a sample collected from the Eldorado balancing reservoir (Beaver Lake source) was determined to be filamentous green algae. The taxa were identified as nontoxic adding only nutrient components to the water. The balancing reservoir was managed accordingly and the chlorine was maintained with no complications in disinfection or delivery. There were no observed algae incidents on Oyama Lake or Oyama Creek.

Eldorado balancing reservoir (Beaver Lake source) sample collected was determined to be filamentous green algae. The taxa were identified as nontoxic adding only nutrient components to the water.

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.

In mid-July Kalamalka Lake began to marl and although it was less intense than previous years, the beautiful blue and turquoise green colours (picture above submitted as Jewels of Lake Country through DLC photo contest, V.Gouliquer) were still present. With this crystallization of calcium carbonate we also see a slight increase with this inorganic turbidity source. With very low bacterial counts and our chlorine maintained at adequate levels this did not cause additional problems other than regular cleaning and maintenance of equipment at our chlorination and UV facility. IHA was aware of this increased turbidity trending and a water quality advisory was not required.

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 Vernon Creek watersheds.

Infrastructure within these watersheds was constructed approximately 100 years ago for irrigation, but in the 1970's the systems were updated, and evolved to become a major domestic water supply. As the service population continues to expand, there has been a significant increase on the demands of these watersheds. Both the Oyama and Vernon Creek 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.

In 2010 the DLC secured an Okanagan Basin Water Board Water Quality and Conservation Grant that provided us with the substantial financial support to complete Watershed Source Water Assessment Plans. The DLC meets annually with stakeholders to review the plan, the intentions and recommendations/action items that were completed and other actions that have occurred or are required. The DLC also continues to collaborate with stakeholders (Forestry, Ranchers etc.) on other various occasions throughout the year to address matters as they arise. In 2015, the DLC fulfilled the second watershed related requirement of condition on permit to produce an implementation plan.

Watershed Source Water Assessment Plans:

2010 Oyama and Vernon Creek Source Water Assessment (Watershed Protection Plan)]

2010 Source to Tap Assessment South Kalamalka Lake Intake (DLC water system)

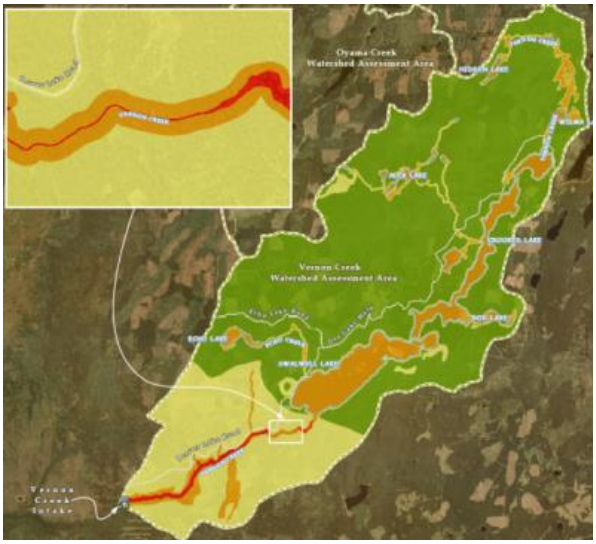
2010 Source to Tap Assessment of the Okanagan lake Intake (DLC water system)

2015 Source Water Assessment and implementation Plan: Oyama and Vernon Creek

Damer Lake (above).

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.

The Watershed Protection plan 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 Oyama and Vernon Creek Source Water Assessment (SWA) was completed in 2010 as a condition on permit and prepared by Ecoscape Environmental Consultants Ltd. with input from all stakeholders.

Follow up meetings are for stakeholders to share their past accomplishments and current activities in the watershed. Overall, there is an appreciation and recognition our watersheds are multipurpose and it takes and overall effort to help protect the water while also sustainably maintaining resources for all users. Stakeholders are encouraged to bring forward their questions with an understanding that we want to maintain trust in this environment. As we continue to understand more of each stakeholder's processes and various regulations involved in their activities, recommendations can more often be dealt with through regular communication and collaborative efforts. We recognize water is vitally important; however, we are all impacting the watershed regardless of what our activities are, we all have rights to be in the watersheds and we all have room for improvement.

The Source Water Assessment continues to play an important role in the management and planning in our community watersheds. In 2018 a specific stakeholder meeting to follow up on identified risks and actions in the SWA was not held. However, throughout 2018 there were various meetings (and continuous communications) either on a one-to one basis or in group settings with the Ministry of Agriculture, Ministry of Forest Lands and Natural Resource Operations, forestry licensees, range tenure holders, private lease lot cabin and resort owners, Okanagan Basin Water Board, Central Okanagan Regional District and the Ministry of Transportation and Infrastructure are among some of the parties the DLC worked with in 2018 respecting watershed activities. DLC staff also maintains other connections through involvement with several of the above-mentioned in various watershed related organizations some of which are the Okanagan Basin Water Board (OBWB), Okanagan Water Stewardship Council, BC Water Supply Association, Public Advisory Group for Sustainable Forest Management, OBWB and source protection and wetland committee.

In 2019 scheduled meetings are planned to resume. Major licencees in our watershed have opted out of public advisory group planning and the DLC is no longer a participant in their sustainable forest management process. As such, there is now reduced information sharing between the forestry stakeholders and local government water purveyors. We continue to develop our collaboration efforts and maintain and improve relationships with the SWA stakeholders group, striving to implement recommendations and recognize improvements as we move forward. Our watersheds are multipurpose, multijurisdictional 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.

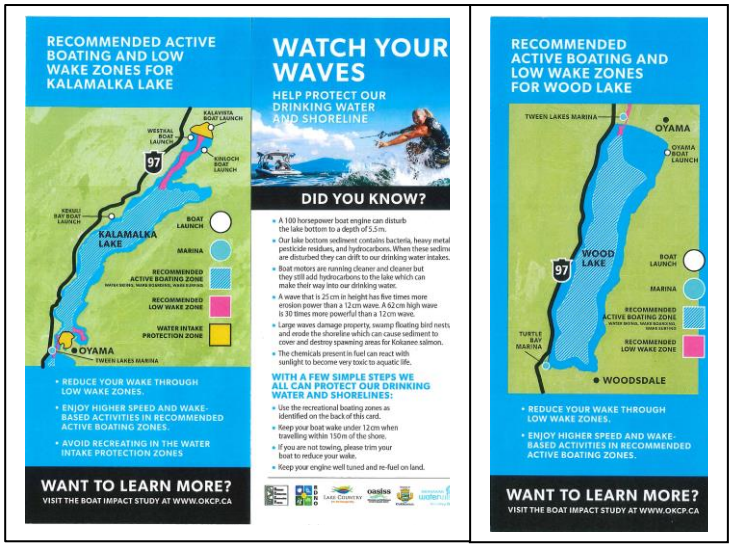
Even without the annual stakeholder meeting, the DLC endeavors to maintain connection with stakeholders in our community watersheds and network at various professional functions to learn of other's successes, share information and seek potential partnerships. Recent partnerships have been with UBCO (various studies in our watersheds), Ministry of Agriculture, FLNRORD, Tolko and Ranchers (Silvopasture), and RDNO (ongoing Lake monitoring program). The DLC at times acts as a liaison for stakeholders in assisting with providing connections, record and reporting of events and providing information. We are now more aware of situations in the watershed when these relationships are sustained.

The DLC continued the joint work with Greater Vernon Water/North Okanagan Regional District (RDNO) and the Ministry of Environment to acquire water quality data on Kalamalka Lake. Data collected from 2018 sampling season was compiled and updated into the Kalamalka Lake Water Quality Study, Microflora, Water Chemistry & Thermal Profiles Report. The 2018 sampling season began in May during freshet and continued monthly into the fall; this marks the 20th year of collaboration on this comprehensive study.

In June 2018, DLC council officially received the Kalamalka and Wood Lake Boat Impact Study (March 2018) and it was requested that this report be referred to staff to develop a committee to devise implementation strategies and public consultation initiatives to review the recommendations of the report.

Under this direction, DLC staff (Strategic & Support Services Manager and Water Quality Technician) collaborated with the RDNO, District of Coldstream and RDCO with an initial step of further public engagement. An OBWB grant was awarded and the Okanagan Collaborative Conservation Program retained to help lead this project. The Boat Impact Study was undertaken to investigate the long-term potential threats of boating activity on the water quality in Wood Lake and Kalamalka Lake, as well as determine potential impacts from boating on environmental values. The study also recorded the number of boats on the lake during the summer at peak times to determine if the lakes were reaching maximum recreational capacity. This grant will cover the costs for developing the public education materials, disseminating information on the awareness of the importance to protect our drinking water intakes and shorelines.
It is anticipated that this report will be a major driver in our drafting of a comprehensive plan for source water protection as we also work towards Council's directive to further engage with the public and to craft a comprehensive source water protection plan for Kalamalka Lake and Okanagan Lake intakes including an implementation plan.

This project designed and distributed (rack cards), created a booth display to engage with boaters and the public. This process consisted of sharing information, conducting surveys, and having discussions with the public on a variety of topics including: waves and erosion, safety, drinking water quality, and regulations. Rack cards are being distributed through local government offices and through Tourism Information Centers, municipal halls and at OCCP and OBWB outreach events and conferences. Inform was provided at various events to evaluate the level of support for the Boat Impact Study recommendations. Feedback from this outreach will help local government with further outreach programs and other potential strategies to protect water quality and environmental values. The partners in this project will meet again in early 2019 to receive the updated results and establish next steps.



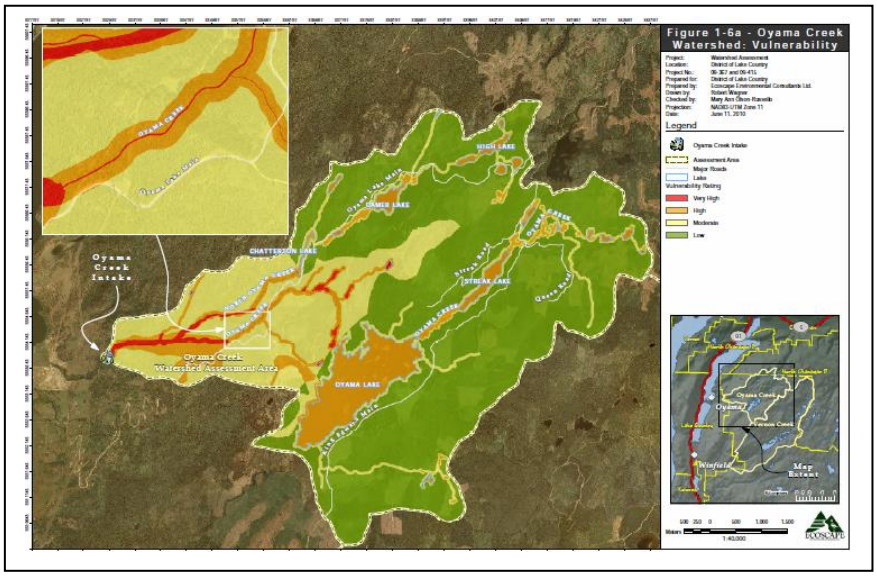
In 2018, the DLC continued to respond and investigate complaints of unsanctioned off road activities in high vulnerability areas directly along creeks and Beaver Lake Road, below our drinking water reservoirs and above drinking water intakes. Motorized vehicle activity in the drainage of our intakes 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 particulate loading into our drinking water source.

If you notice questionable activities in our Community Watersheds report the incident to:
1-844-676-8477.

Range Management

The Okanagan Shuswap District Range Program's annual meeting took place in the spring at the District of Lake Country. The 2017 range summary at the 2018 planning meeting was smaller than the previous years with only the RDNO and the DLC watersheds: Duteau, Oyama and Beaver. This setting works much better for individual discussions and specific updates with range use permit holders in our community watersheds. Outside of this meeting, the DLC connects with ranchers (and others) throughout the year working to maintain open lines of communication with updates on projects, opportunities or situations that either party should be aware of.

Overall, the discussions this year focused on collaboration among local Government, ranchers, Ministries within FLNRORD), BMP's, UBCO research projects, debris stream protection, Provincial updates regarding groundwater and wildfire, watershed fire risk planning and recreational development. Again concern remained of the impact from (non-sanctioned and unknown but authorized) recreational activities in our watershed and forestry development.



All major licencees and the SSSP have agreed to use the DLC vulnerability zone mapping in their planning and development process.

Shown left is the Oyama Creek Vulnerability zone map.

DLC staff also actively participated and presented updates at various educational workshops for range, water stewardship, watershed protection and forestry planning committees throughout 2018. These presentations, workshops and associations are important for conveying and gaining further understanding the complexity of integrated watershed land use. Science based research and collaborative partnerships have been the key to identifying and developing solutions for resolving water quality and quantity issues.

Forestry

Harvest activities in our community watershed continued in 2018. There are two major licencees in our watersheds: Tolko and BC Timber Sales, both of which had harvest operations in 2018. The DLC makes an ongoing effort to maintain communications through staff involvement with the Sustainable Forest Management Plans (SFMP) Public Advisory Group and direct contact as necessary. However, as mentioned under the watershed section, both Tolko and BCTS have opted out of public advisory group planning. Both Tolko and BCTS are now obtaining their certification through the Sustainable Forestry Initiative (SFI) that is not open to public input or consultation in the development and reporting of targets and indicators in the open consultation process as the DLC had previously participated in with the SFMP.

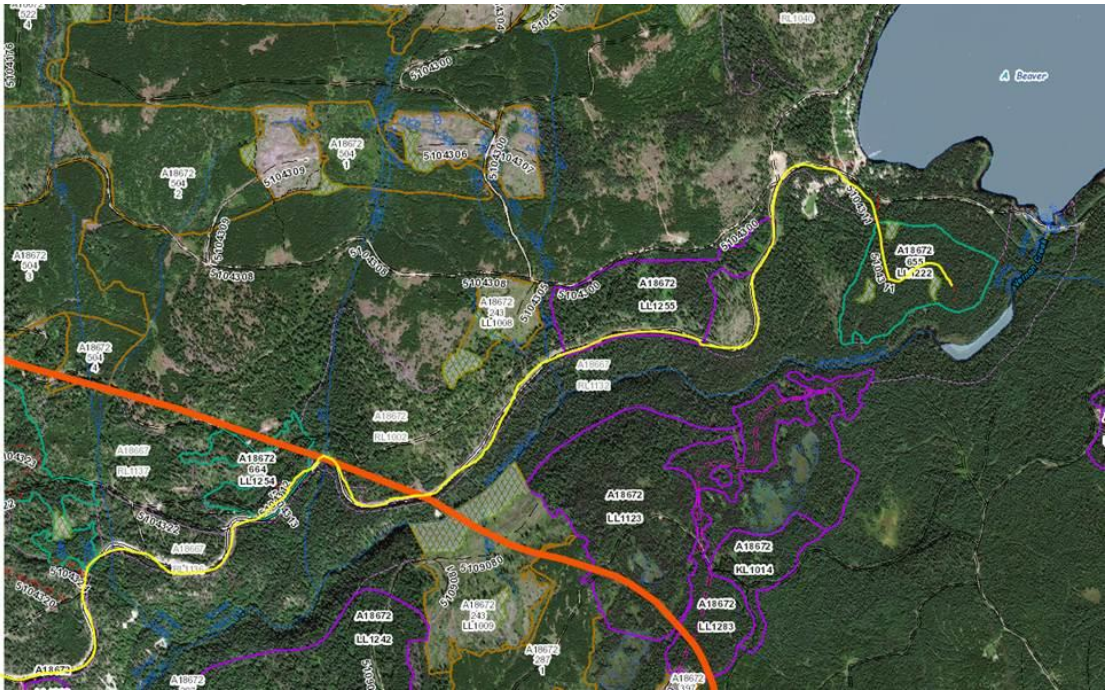
Major Licencees in our community watersheds are well aware of our Watershed Protection Plan and the DLC has requested it be used as a planning tool when developing harvest plans. Harvest/site plans are reviewed by DLC staff and recommendations are provided as needed to address issues such as access (cattle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

Small Scale Salvage is a program that is regulated and operates through the Province. Private companies can apply for a small scale salvage licencee 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 such as the SFMP or SFI. These FSP plans are to include a set of values/principles, objectives, indicators and target/performance measures that promotes sustainable forestry practices through addressing environmental, economic and social aspects of forest management. Major Licencees acquire certification to show they are sustainably managing their forestry activities and products. It is the responsibility of the small scale salvage operator and the Province to ensure that best management practices are being followed. The DLC as requested to be given the opportunity to provide comments and recommendations on our two major licencees FSP's so that high vulnerabilities, risks and other important concerns in protecting water quality and quantity are addressed. However, in 2017 Tolko did not advise of when they posted their FSP for public input and we were unaware of this until after the public comment period was closed. The DLC has made requests that all future FSP's be referred for comment.

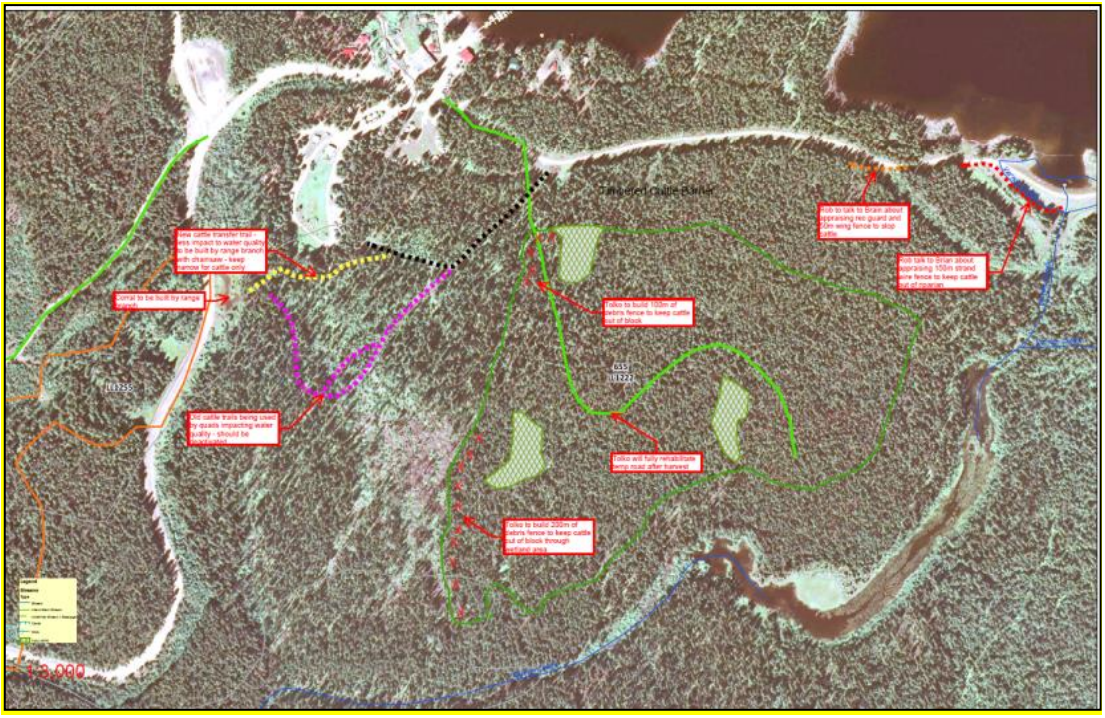
As with major licencees, when small scale salvage operations occur in DLC'S watersheds, DLC staff review the referral for comment/recommendations and remind or provide the applicant a copy of our Watershed Protection Plan highlighting the importance of recognizing our vulnerability zones and properly planning and working within these zones. The DLC's highest concerns are within high vulnerability zones regardless of type of the proposed activity. The DLC continues to express concern with the Province authorizing approval for small scale salvage logging in high vulnerability zones (commonly within a major licensee's Lakeshore protection).

The Okanagan Shuswap District advises they do not regularly track ECA (equivalent Clear Cut Area) and rely on the comments from Major Licensee's to identify related issues in their feedback. The ECA can have hydrologic impact influencing water quantity (timing and volume) which also impacts water quality. The DLC will continue requesting updates and address this information gap in our watershed implementation plans as the cumulative hydrometric impacts were apparent in the 2017 flooding.

For background, in 2017, Tolko proposed logging along Beaver Lake Road and near the Beaver Lake dam. Prior to logging the DLC, Ranchers, (FLNRORD – Range) and Beaver Lodge were in various discussions and block-walks to make Tolko aware of the water quality, quantity, access and other concerns with harvesting in this area through their referral process. The DLC made requests for special consideration in the areas of access management into the high vulnerability areas off Beaver Lake Road, restricted motorized vehicle access from the campground, cattle management areas, road deactivations and rehabilitation all to reduce cumulative impact sources of sediment that contribute to high turbidly in our drinking water source. In 2018 and following the harvest in this area, reduced access fencing was installed at the Beaver Lake dam and on-going discussion of works are in process for works off Beaver Lake Road to maintain cattle access and restrict motorized vehicle activities into this area. The DLC staff does need to walk this area again to confirm other works were completed for reducing and/or eliminating motorized access into this area.



Section of map of Tolko's proposed logging off Beaver Lake Road and more specifically (below), the sites below the Beaver Lake resort and Dam.



Blocks that started harvest in 2018 were: LL1251, LL1252, and LL1253 – Located along Beaver Lake road. Block walks and recommendations for risk to water quality, quantity and access have been completed. DLC concerns focused on culverts and drainage especially following the flooding and road wash outs during the 2017 freshet and high 2018 flows. The Ministry of Transportation and Highways is well aware of the drainage from these new sites as well as the devastation to the drainage corridor (their section of Beaver Lake Road) from the 2017 flooding and made substantial repairs and improvements to ditching and culverts

The primary concern to the DLC remains the blocks above the Vernon Creek Intake as it is our community water supply. In 2017 the DLC hired a specialized hydrologist with forestry expertise to specifically address our apprehension with these sites. Concerns were with the Licensee's terrain assessment, the steep slopes above the community's drinking water intake and that DLC's specific water management prescriptions were being addressed in Tolko's plans. Tolko is fully aware of this high vulnerability area and sensitivities of this block; they are committed to continue discussions and a further block walk in 2018 did take place. This year no harvest commenced however, the drainage was addressed in addition to fixing problems caused by off-road vehicle activities in this sensitive area. This is be discussed again in 2019.

Wildfire Planning:

The DLC is partnering with FLNRORD and the RDNO in an upcoming Forest Enhancement Society funding, integrating and collaborative fire risk management planning. There is potential for the local governments in the neighboring watershed 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 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. If the wildfire reduction plans and operations grant is awarded in 2019 there would potentially be five community watersheds on the Aberdeen Plateau (from Vernon through to Highway 33 that would be under one massive landscape management plan. This is a

remarkably large area and the plan and operations would 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.

This year and last were the worst wildfire seasons on record (over 2 million Ha lost to wildfires) with a provincial state of emergency being declared each year. The possibility of a catastrophic wildfire occurring in our community watershed is very high. A devastating fire in the Beaver or Oyama watersheds would not only degrade water quality but post-fire floods and landslides are expected impacts seen directly following the first storm event (or freshet) and for years 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. This is identified in our Potable Water Emergency Response Plan (Section 3.10 provided to IHA July 2018). Currently (throughout the wildfire season) the DLC maintains contact weekly with the BCWS to obtain information for the Zone Wildfire Commanding Officer should a strike occur in our community watersheds. This officer would then provide direct communication with our primary contact for information on our infrastructure and provide progress reports. This protocol was extended in 2018 as the extreme dry season went well into the fall. We will continue to work with BCWS to have the DLC updated in their BCWS Pre-Organization book (i.e. for primary contact if wildfire occurs in Beaver or Oyama Watersheds). Should the DLC be awarded the funding for Wildfire reduction planning and mitigation this method of contact with BCWS will also be addressed to ensure communication is managed in the most efficient and effective process.

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)	**none detected in distribution system**					**36**	**18**
Okanagan Lake Source	**none detected in distribution system**					**31**	**34**
Oyama Lake Source (WQA)	**none detected in distribution system**					**24**	**12**
Kalamalka Lake Source	**none detected in distribution system**					**57**	**30**
Coral Beach Water System: Okanagan Lake Source	**none detected in distribution system**					**52**	**27**
Lake Pine Water System: Okanagan Lake Source	**none detected in distribution system**					**37**	**21**
					TOTAL:	***237***	***142***

* Background Colonies > 200 CFU/100 mL

1 Overgrown with visible Total Coliforms detected however due to interference from high concentration of background bacteria the total coliforms cannot be determined.

2 Overgrown without visible E.coli. Due to interference from high concentrations of background bacteria the presence or absence of E.coli cannot be determined.

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 Ci2/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										
Artella	Beaver Lk				x	x											x							x
Breakwater	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		
Glenmore Booster Station	Beaver Lk		x	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(Contractor to install in 2019 - yard hydrant broke summer 2018))	Beaver Lk			x				x									x							x
Middleton Rd (Future)	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								
PR2	Beaver Lk			x	x	x										x								
Williams	Beaver Lk			x		x		x									x	x	x					x

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 Ci2/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	
Clement	Ok Lk			x					x								x			x		x	x	
Copper Hill	Ok Lk			x		x											x					x		
Glenmore Booster Station	Ok Lk		x	x			x				x				x									
Jardine Pump Stn	Ok Lk			x						x						x								
Kelwin	Ok Lk				x						x						x							
Lower Lakes Reservoir (cell 1)	Ok Lk			x			x				x					x								
McCoubrey	Ok Lk			x				x								x								
Ok Bio Fuels (Jim Bailey Rd)	Ok Lk			x		x																		
Ponderosa pumphouse	Ok Lk			x							x		x				x							
Ponderosa PRV stn	Ok Lk			x							x					x								
Ottley Rd (off Stubbs)	Ok Lk			x				x							x						x			
Upper Lakes Reservoir	Ok Lk			x					x															
Upper Zone (Future)	Ok Lk			x																		x		

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 Ci2/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			
Sawmill Rd Booster (Future)	Kal			x												x	x							
Oyama Creek Chlorination Facility (distribtuion water fromKal Source (Sawmill) to Oyama reservoir)	Kal						x						x	x										
Old Oyama Pumphouse	Kal				x						x		x			x								x
Teddy Bear (seasonal)	Kal			x							x						x			x				x

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 – 2018 Giardia Performance Monitoring

DATE Jan	pH (highest)	TEMP C (low est)	FLOW L/s	Free Cl PR6	CT achieved	CT Req'd	CTa/CTr	Free Cl Req'd	% Inactivation	TOT. VOL. USGAL	FLOW Usgpm	TIME (hrs)
1	7.00	3.80	10.00	3.00	7742.7	204.0	38.0	0.08	100.00	409124	159	43.0
2	7.00	3.80	10.00	2.20	5678.0	194.7	29.2	0.08	100.00	409125	159	43.0

Appendix D – Comprehensive Test Results

2018 Comprehensive Results							
Distribution Source		Beaver	Okanagan	Lake Pine	Coral Beach Source	Oyama	Kalamalka
Site		VERNON CREEK Intake	OK Pump House	LAKEPINE Pump House	CORAL BEACH Pump House	OYAMA CREEK	KALAMALKA Pump House
Date		June 18 2018	June 19 2018	June 19 2018	June 19 2018	June 19 2018	June 19 2018
Anions	units						
Alkalinity (total)	mg/L	29.6	113.0	115.0	113.0	35.4	158.0
Alkalinity (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Alkalinity (AO)	mg/L						
Chloride	mg/L	1.71	4.98	6.77	5.09	0.62	7.36
Chloride (MAC)	mg/L						
Chloride (AO)	mg/L	≤250	≤250	≤250	≤250	≤250	≤250
Fluoride	mg/L	<0.10	0.17	0.19	0.15	0.11	0.25
Fluoride (MAC)	mg/L	1.5	1.5	1.5	1.5	1.5	1.5
Fluoride (AO)	mg/L						
Nitrogen, Nitrate as N	mg/L	0.028	0.074	0.216	0.065	0.078	<0.010
Nitrate (MAC)	mg/L	10	10	10	10	10	10
Nitrate (AO)	mg/L						
Nitrogen, Nitrite as N	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrite (MAC)	mg/L	1	1	1	1	1	1
Nitrite (AO)	mg/L						
Sulphate	mg/L	3.6	29.5	32.8	29.5	10.5	52.9
Sulphate (MAC)	mg/L						
Sulphate (AO)	mg/L	≤500	≤500	≤500	≤500	≤500	≤500
General Parameters							
True Colour*	TCU	**44**	<5	<5.0	<5.0	**46**	<5
True Colour (MAC)	TCU						
True Colour (AO)	TCU	≤15	≤15	≤15	≤15	≤15	≤15
Conductivity	uS/cm	72.1	287	303	287	105	400
Cond. (MAC)	uS/cm	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Cond. (AO)							
Cyanide	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.010
Cyanide (MAC)	mg/L	0.2	0.2	0.2	0.2	0.2	0.2
Cyanide (AO)							
pH	pH unit	6.75	7.25	7.22	7.20	6.75	8.15
pH (MAC)	pH unit						
pH (AO)	pH unit	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Turbidity*	NTU	**0.78**	0.36	0.44	0.39	**0.51**	0.60
Turbidity (MAC)	NTU	(1 -<5 NTU) See Guideline	(1 -<5 NTU) See Guideline	(1 -<5 NTU) See Guideline	(1 -<5 NTU) See Guideline	(1 -<5 NTU) See Guideline	(1 -<5 NTU) See Guideline
Turbidity (AO)	NTU						

Appendix D continued– Comprehensive Test Results

2018 Comprehensive Results							
Distribution Source		Beaver	Okanagan	Lake Pine	Coral Beach Source	Oyama	Kalamalka
Site		VERNON CREEK Intake	OK Pump House	LAKEPINE Pump House	CORAL BEACH Pump House	OYAMA CREEK	KALAMALKA Pump House
Date			June 19 2018	June 19 2018	June 19 2018	June 19 2018	June 19 2018
Calculated Parameter	**units**						
Hardness (mg/L as $CaCO_3$)	mg/L	33.4	125	131	131	46.7	194
Hardness (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Hardness (AO)	mg/L						
Total Dissolved Solids/TDS	mg/L	38.6	162	173.0	165	54.5	246
TDS (MAC)	mg/L						
TDS (AO)	mg/L	≤500	≤500	≤500	≤500	≤500	≤500
Total Recoverable Metals							
Aluminum (total)	mg/L	0.0763	0.0118	0.02	0.0156	**0.0793**	<0.05
Aluminum (MAC)	mg/L						
Aluminum (AO)	mg/L	0	0	0	0	0	<0.2
Antimony (total)	mg/L	0.003	<0.001	<0.001	<0.001	<0.001	0.002
Antimony (MAC)	mg/L	0.006	0.006	0.006	0.006	0.006	0.006
Antimony (AO)	mg/L						
Arsenic (total)	mg/L	<0.00050	0.00050	0.00055	0.00059	<0.00050	<0.005
Arsenic (MAC)	mg/L	0.01	0.01	0.01	0.01	0.01	0.01
Arsenic (AO)	mg/L						
Barium (total)	mg/L	<0.0050	0.0204	0.0210	0.0235	0.0154	<0.05
Barium (MAC)	mg/L	1.0	1.0	1.0	1.0	1.0	1.0
Barium (AO)	mg/L						
Beryllium (total)	mg/L	<0.00010	0	0	0	<0.00010	<0.001
Beryllium (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Beryllium (AO)	mg/L						
Boron (total)	mg/L	0.0057	0.0130	0.0131	0.0126	0.0054	<0.04
Boron (MAC)	mg/L	5	5	5	5	5	5
Boron (AO)	mg/L						
Cadmium (total)	mg/L	<00000010	<0.000010	0.000010	<0.000010	<0.000010	<0.0001
Cadmium (MAC)	mg/L	0.005	0.005	0.005	0.005	0.005	0.005
Cadmium (AO)	mg/L						
Calcium (total)	mg/L	8.05	33.6	34.5	34.1	11.6	43.5
Calcium (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Calcium (AO)	mg/L						
Chromium (total)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.005
(MAC) Chromium	mg/L	0.05	0.05	0.05	0.05	0.05	0.05
(AO) Chromium	mg/L						
Cobalt (total)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.0005
Cobalt (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Cobalt (AO)	mg/L						
Copper (total)	mg/L	0.00142	0.00079	0.0595	0.00093	0.0108	<0.002
Copper (MAC)	mg/L						
Copper (AO)	mg/L	≤1	≤1	≤1	≤1	≤1	≤1

Appendix D continued – Comprehensive Test Results

2018 Comprehensive Results							
Distribution Source		Beaver	Okanagan	Lake Pine	Coral Beach Source	Oyama	Kalamalka
Site		VERNON CREEK Intake	OK Pump House	LAKEPINE Pump House	CORAL BEACH Pump House	OYAMA CREEK	KALAMALKA Pump House
Date			June 19 2018	June 19 2018	June 19 2018	June 19 2018	June 19 2018
Total Recoverable Metals cont.							
Iron (total)	mg/L	0.122	0.013	0.022	0.016	0.121	<0.10
Iron (MAC)	mg/L						
Iron (AO)	mg/L	≤0.3	≤0.3	≤0.3	≤0.3	≤0.3	≤0.3
Lead (total)	mg/L	<0.00020	<0.00020	0.00213	<0.00020	0.00045	<0.001
Lead (MAC)	mg/L	0.01	0.01	0.01	0.01	0.01	0.01
Lead (AO)	mg/L						
Magnesium (diss.)	mg/L	3.23	10.0	10.8	11.0	4.26	20.7
Magnesium (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Magnesium (AO)	mg/L						
Manganese (total)	mg/L	0.0064	0.00104	0.00146	0.00120	0.009	0.002
Manganese (MAC)	mg/L						
Manganese (AO)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	≤0.05
Mercury (total)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00002
Mercury (MAC)	mg/L	0.001	0.001	0.001	0.001	0.001	0.001
Mercury (AO)	mg/L						
Molybdenum (total)	mg/L	0.00032	0.00344	0.00410	0.00382	0.00052	0.006
Molybdenum (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Molybdenum (AO)	mg/L						
Nickel	mg/L	0.00081	0.00044	0.00103	0.00047	0.00143	<0.002
Nickel (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Nickel (AO)	mg/L						
Phosphorus	mg/L	<0.050	0	0	0	<0.050	<0.2
Phosphorus (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Phosphorus (AO)	mg/L						
Potassium (total)	mg/L	1.09	2.53	2.6	2.81	1.63	5.1
Potassium (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Potassium (AO)	mg/L						
Selenium (total)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.005
Selenium (MAC)	mg/L	0.05	0.01	0.01	0.01	0.01	0.01
Selenium (AO)	mg/L						

Appendix D continued– Comprehensive Test Results

2018 Comprehensive Results							
Distribution Source		Beaver	Okanagan	Lake Pine	Coral Beach Source	Oyama	Kalamalka
Site		VERNON CREEK Intake	OK Pump House	LAKEPINE Pump House	CORAL BEACH Pump House	OYAMA CREEK	KALAMALKA Pump House
Date			June 19 2018	June 19 2018	June 19 2018		
Silicon	mg/L	6.0	0	0	0	5.7	<5
Silicon (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Silicon (AO)	mg/L						
Silver	mg/L	<0.0005	0	0	0	<0.000050	<0.0005
Silver (MAC)	mg/L	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline	No current guideline
Silver (AO)	mg/L						
Sodium T-Na	mg/L	2.82	12.1	14.2	13.4	3.85	20.1
Sodium (MAC)	mg/L						
Sodium (AO)	mg/L	≤200	≤200	≤200	≤200	≤200	≤200
Uranium (total)	mg/L	0.000078	0.00249	0.00584	0.00256	0.000273	0.0032
Uranium (MAC)	mg/L	0.02	0.02	0.02	0.02	0.02	0.02
Uranium (AO)	mg/L						
Vanadium	mg/L	<0.0010	0	0	0	<0.0010	<0.01
Vanadium (MAC)	mg/L						
Vanadium (AO)	mg/L						
Zinc (total)	mg/L	<0.0040	<0.0040	0.0411	<0.0040	0.0107	<0.04
Zinc (MAC)	mg/L						
Zinc (AO)	mg/L	≤5.0	≤5.0	≤5.0	≤5.0	≤5.0	≤5.0

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
MAC	Maximum acceptable concentration. 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

Appendix E – Nutrient Sampling Upland Drinking Water Reservoirs

2018 Nutrients				
Site		BEAVER	OYAMA	DAMER
Date		7-Jun-2018	7-Jun-2018	7-Jun-2018
Anions				
Phosphate (as P)	mg/L	<0.0050	0.0062	<0.0050
No current guidelines				
Sulfate	mg/L	1.4	<1.0	1.6
Sulfate (AO)	mg/L	<500	<500	≤ 500
General Parameters				
Alkalinity, Total (as CaCO3)	mg/L	22.7	13.2	15.9
No current guidelines				
Alkalinity,Phenolphthalein (as CaCO3)	mg/L	<1.0	<1.0	<1.0
No current guidelines				
Alkalinity, Bicarbonate (as CaCO3)	mg/L	22.7	13.2	15.9
No current guidelines				
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.0	<1.0	<1.0
No current guidelines				
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.0	<1.0	<1.0
No current guideline				
Total Organic Carbon	mg/L	9.75	10.5	17.7
No current guidelines				
Dissolved Organic Carbon	mg/L	8.87	10	15.7
No current guidelines				
Chlorophyll-a	ug/L	0.68	2.9	1.8
No current guidelines				
Colour, True	CU	51	49	110
Colour(AO)	CU	< 15	≤15	≤15
Phosphorus, Total (as P)	mg/L	0.0119	0.0115	0.0213
No current guidelines				
Calculated Parameters				
Hardness, Total (as CaCO3)	mg/L	18.4	15.3	20.4
No current guidelines see definition below				
Total Dissolved Aluminium	mg/L	0.0485	0.0488	0.143
Total Recoverable Aluminium	mg/L	0.0874	0.0659	0.256
Aluminium (OG)	mg/L	<0.1	<0.1	<0.01
Total Dissolved Antimony	mg/L	<0.00020	<0.00020	<0.00020
Total Recoverable Antimony	mg/L	<0.00020	<0.00020	<0.00020
Antimony (MAC)	mg/L	0.006	0.006	0.006
Total Dissolved Arsenic	mg/L	<0.00050	<0.00050	<0.00050
Total Recoverable Arsenic	mg/L	<0.00050	<0.00050	<0.00050
Arsenic (MAC)	mg/L	0.01	0.01	0.01
Total Dissolved Barium	mg/L	0.0053	0.0066	0.008
Total Recoverable Barium	mg/L	0.0059	0.0071	0.0093
Barium (MAC)	mg/L	1	1	1
Total Dissolved Beryllium	mg/L	<0.00010	<0.00010	<0.00010
Total Recoverable Beryllium	mg/L	<0.00010	<0.00010	<0.00010
No current guidelines				

Appendix E continued – Nutrient Sampling Upland Drinking Water Reservoirs

2018 Nutrients				
Site		BEAVER	OYAMA	DAMER
Date		7-Jun-2018	7-Jun-2018	7-Jun-2018
Metals				
Total Dissolved Bismuth	mg/L	<0.00010	<0.00010	<0.00010
Total Recoverable Bismuth	mg/L	<0.00010	<0.00010	<0.00010
No current guidelines				
Total Dissolved Boron	mg/L	0.0054	<0.0050	<0.0050
Total Recoverable Boron	mg/L	0.0059	<0.0050	<0.0050
Boron (MAC)	mg/L	5	5	5
Total Dissolved Cadmium	mg/L	<0.000010	<0.000010	<0.000010
Total Recoverable Cadmium	mg/L	<0.000010	<0.000010	<0.000010
Cadmium (MAC)	mg/L	0.005	0.005	0.005
Total Dissolved Calcium	mg/L	4.91	3.82	4.62
Total Recoverable Calcium	mg/L	5.54	4.17	4.99
No current guidelines				
Total Dissolved Chromium	mg/L	<0.00050	<0.00050	<0.00050
Total Recoverable Chromium	mg/L	<0.00050	<0.00050	0.0007
Chromium (MAC)	mg/L	0.05	0.05	0.05
Total Dissolved Cobalt	mg/L	<0.00010	<0.00010	<0.00010
Total Recoverable Cobalt	mg/L	<0.00010	<0.00010	0.00011
No current guidelines				
Total Dissolved Copper	mg/L	0.00097	0.00124	0.00231
Total Recoverable Copper	mg/L	0.00128	0.00141	0.0094
Copper (AO)	mg/L	<1	<1	≤ 1
Total Dissolved Iron	mg/L	0.093	0.07	0.124
Total Recoverable Iron	mg/L	0.169	0.139	0.247
Iron (AO)	mg/L	≤ 0.3	≤ 0.3	≤ 0.3
Total Dissolved Lead	mg/L	<0.00020	<0.00020	<0.00020
Total Recoverable Lead	mg/L	<0.00020	<0.00020	0.00029
Lead (MAC)	mg/L	0.01	0.01	0.01
Total Dissolved Lithium	mg/L	0.00043	0.00058	0.00125
Total Recoverable Lithium	mg/L	0.0006	0.00068	0.00150
No current guidelines'				
Total Dissolved Magnesium	mg/L	1.49	1.39	2.15
Total Recoverable Magnesium	mg/L	1.71	1.58	2.48
No current guidelines				

Appendix E continued – Nutrient Sampling Upland Drinking Water Reservoirs

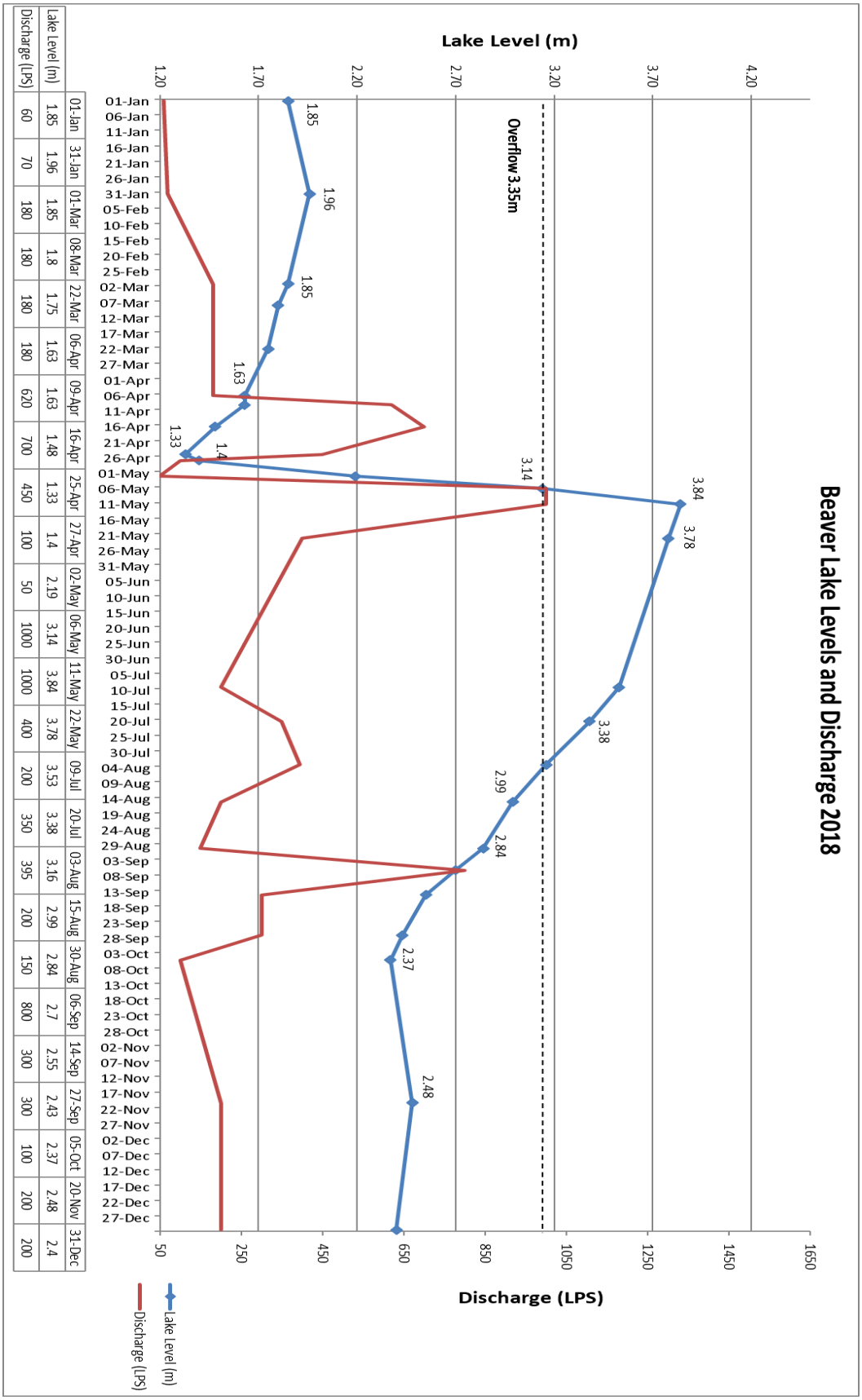
2018 Nutrients				
Site		BEAVER	OYAMA	DAMER
Date		7-Jun-2018	7-Jun-2018	7-Jun-2018
Metals Continued				
Total Dissolved Manganese	mg/L	0.00251	0.00179	0.00496
Total Recoverable Manganese	mg/L	0.00553	0.00599	0.00706
Manganese (AO)	mg/L	<0.05	<0.05	<0.05
Total Dissolved Mercury	mg/L	<0.000010	<0.000010	<0.000010
Total Recoverable Mercury	mg/L	<0.000010	<0.000010	<0.000010
Mercury (MAC)	mg/L	0.001	0.001	0.001
Total Dissolved Molybdenum	mg/L	0.00017	0.00013	0.00023
Total Recoverable Molybdenum	mg/L	0.0022	0.00014	0.00025
No current guidelines				
Total Dissolved Nickel	mg/L	0.00066	0.00105	0.00198
Total Recoverable Nickel	mg/L	0.00007	0.00113	0.00232
No current guidelines				
Total Dissolved Phosphorus	mg/L	<0.050	<0.050	<0.050
Total Recoverable Phosphorus	mg/L	<0.050	<0.050	<0.050
No current guidelines				
Total Dissolved Potassium	mg/L	0.86	0.92	1.37
Total Recoverable Potassium	mg/L	0.93	1.01	1.49
No current guidelines				
Total Dissolved Selenium	mg/L	<0.00050	<0.00050	<0.00050
Total Recoverable Selenium	mg/L	<0.00050	<0.00050	<0.00050
Selenium (MAC)	mg/L	0.05	0.05	0.05
Total Dissolved Silicon	mg/L	4.5	4.4	6.9
Total Recoverable Silicon	mg/L	4.5	4.3	6.9
No current guidelines				
Total Dissolved Silver	mg/L	<0.000050	<0.000050	<0.000050
Total Recoverable Silver	mg/L	<0.000050	<0.000050	<0.000050
No current guidelines				
Total Dissolved Sodium	mg/L	1.86	1.82	2.11
Total Reocoverable Sodium	mg/L	2.07	2.09	2.37
Sodium (AO)	mg/L	≤ 200	≤ 200	≤ 200
Total Dissolved Strontium	mg/L	0.0294	0.0270	0.0288
Total Recoverable Strontium	mg/L	0.0320	0.0286	0.0311
No current guidelines				
Total Dissolved Sulfur	mg/L	3.3	<3.0	<3.0
Total Recoverable Sulfur	mg/L	<3.0	<3.0	<3.0
No current guidelines				
Total Dissolved Tellurium	mg/L	<0.00050	<0.00050	<0.00050
Total Recoverable Tellerium	mg/L	<0.00050	<0.00050	<0.00050
No current guidelines				
Total Dissolved Thallium	mg/L	<0.000020	<0.000020	<0.000020
Total Recoverable Thallium	mg/L	<0.000020	<0.000020	<0.000020
No current guidelines				

Appendix E continued – Nutrient Sampling Upland Drinking Water Reservoirs

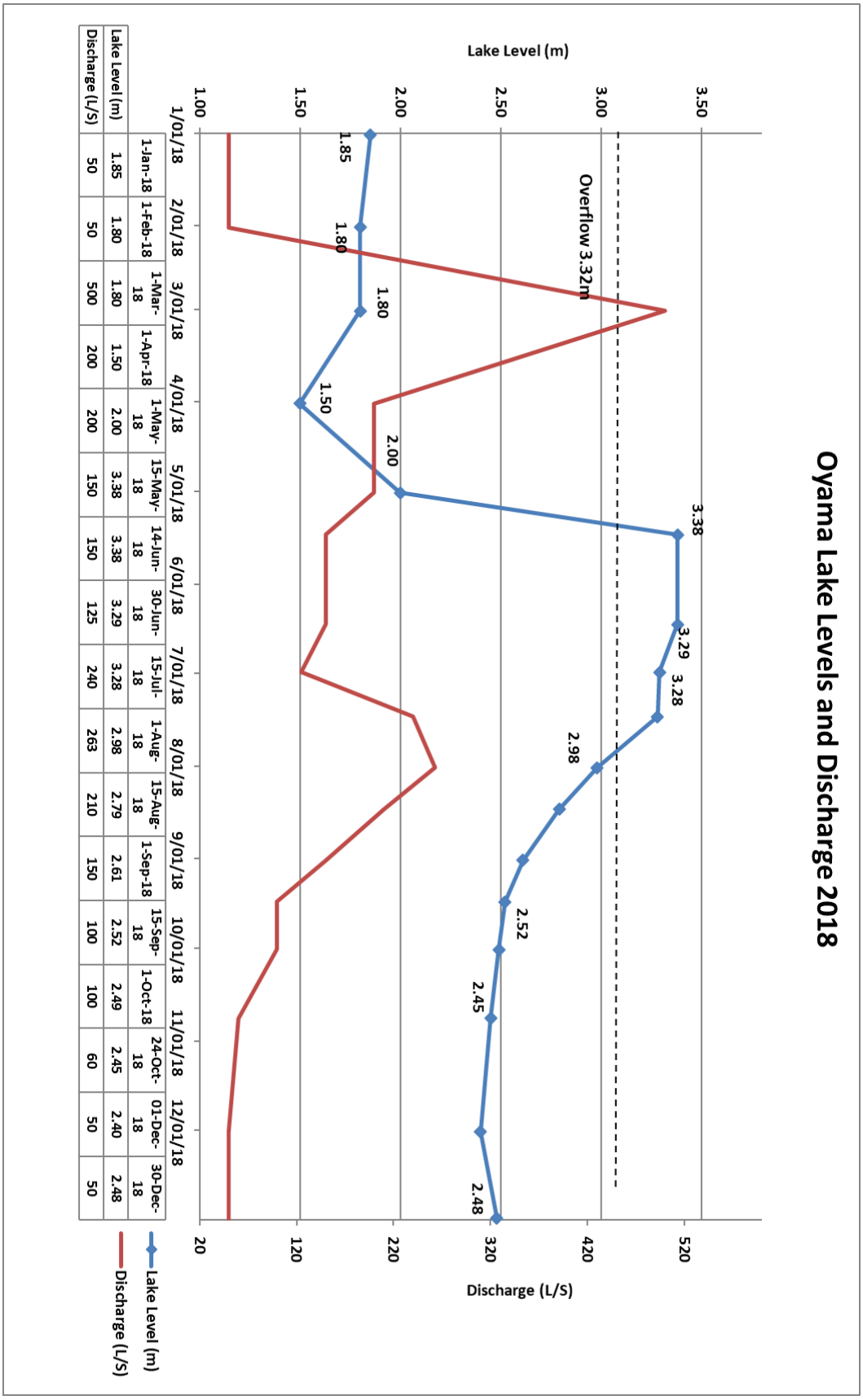
2018 Nutrients				
Site		0.0022	0.00014	0.00025
Date		0-Jan-1900	0-Jan-1900	0-Jan-1900
Metals Continued				
Total Dissolved Thorium	mg/L	<0.00010	<0.00010	<0.00010
Total Recoverable Thorium	mg/L	<0.00010	<0.00010	<0.00010
No current guidelines				
Total Dissolved Tin	mg/L	<0.00020	<0.00020	<0.00020
Total Recoverable Tin	mg/L	<0.00020	<0.00020	<0.00020
No current guidelines				
Total Dissolved Titanium	mg/L	<0.0050	<0.0050	<0.0050
Total Recoverable Titanium	mg/L	<0.0050	<0.0050	0.0069
No current guidelines				
Total Dissolved Uranium	mg/L	0.000033	0.000043	0.000128
Total Recoverable Uranium	mg/L	0.000059	0.000047	0.00014
Uranium (MAC)	mg/L	0.02	0.02	0.02
Total Dissolved Vanadium	mg/L	<0.0010	<0.0010	<0.0010
Total Recoverable Vanadium	mg/L	<0.0010	<0.0010	0.0011
No current guidelines				
Total Dissolved Zinc	mg/L	<0.0040	<0.0040	<0.0040
Total Recoverable Zinc	mg/L	<0.0040	<0.0040	0.0064
Zinc (AO)	mg/L	≤ 5	≤ 5	≤ 5
Total Dissolved Zirconium	mg/L	0.00050	0.00051	0.00156
Total Recoverable Zirconium	mg/L	0.00049	0.00057	0.00147
No current guidelines				

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 above.

Appendix F – Beaver Lake & Oyama Lake Levels and Discharge

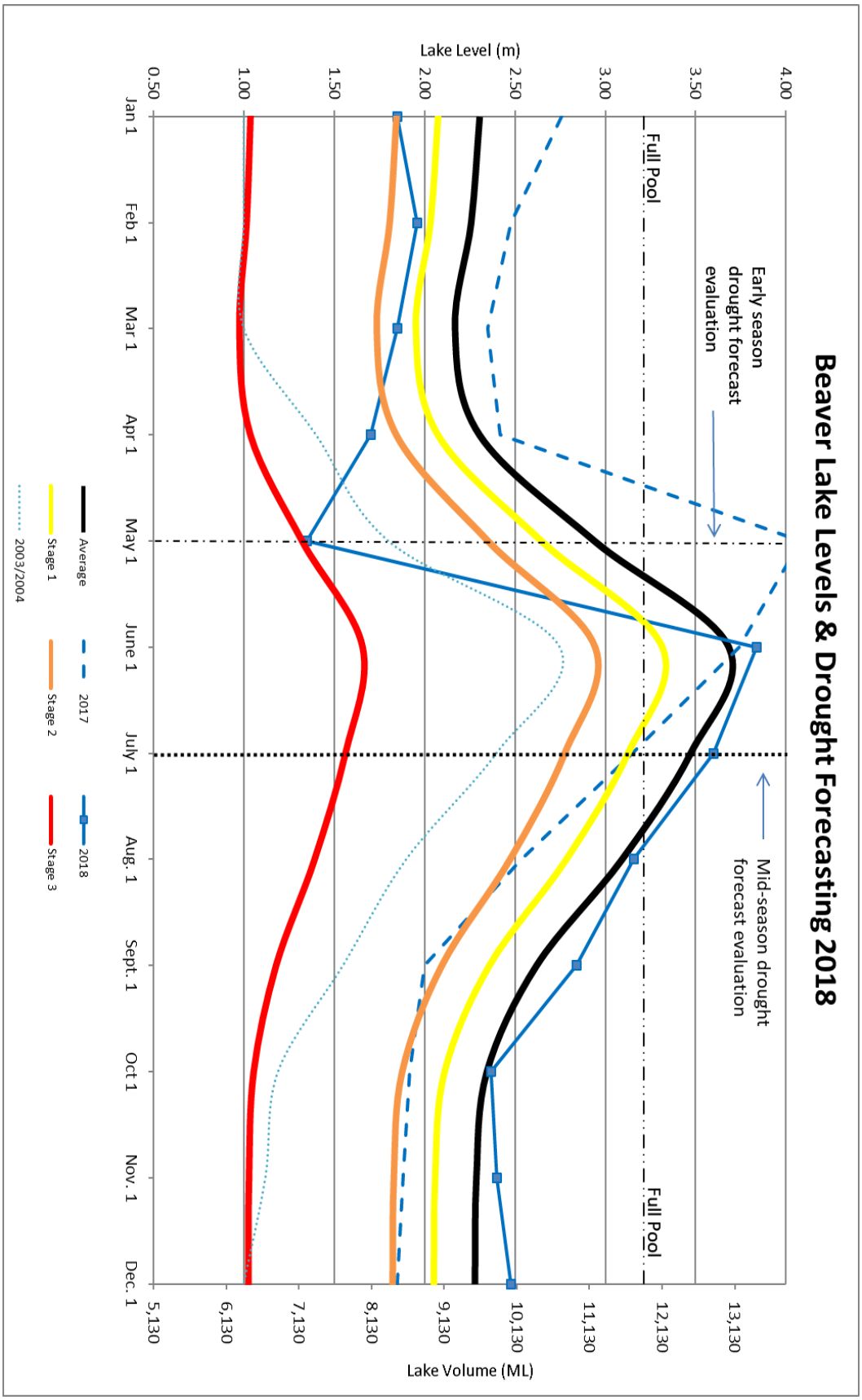


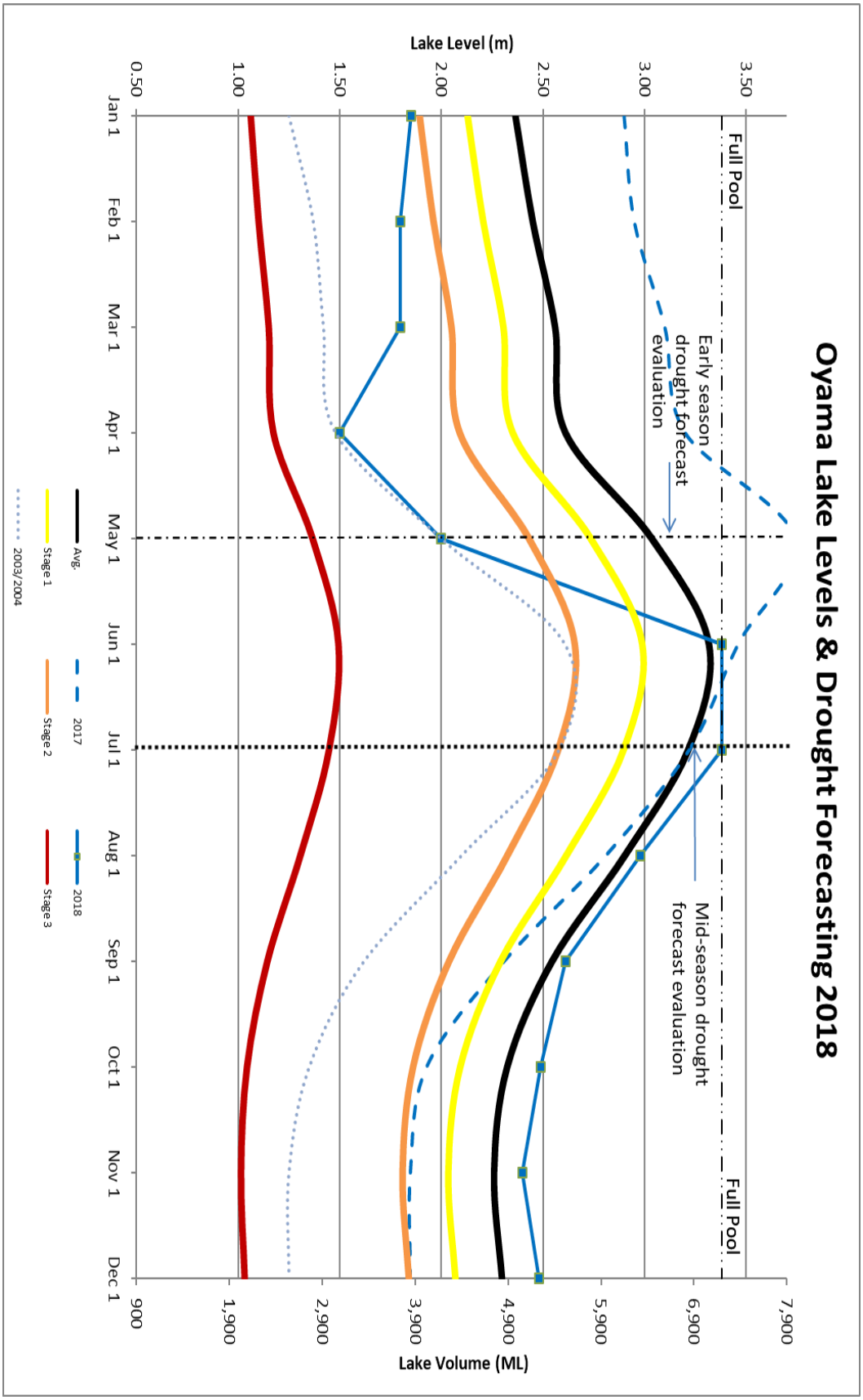
	01-Jan	31-Jan	01-Mar	08-Mar	22-Mar	06-Apr	09-Apr	16-Apr	25-Apr	27-Apr	02-May	06-May	11-May	22-May	09-Jul	20-Jul	03-Aug	15-Aug	30-Aug	06-Sep	14-Sep	27-Sep	05-Oct	20-Nov	31-Dec
Lake Level (m)	1.85	1.96	1.85	1.8	1.75	1.63	1.63	1.48	1.33	1.4	2.19	3.14	3.84	3.78	3.53	3.38	3.16	2.99	2.84	2.7	2.55	2.43	2.37	2.48	2.4
Discharge (LPS)	60	70	180	180	180	180	620	700	450	100	50	1000	1000	400	200	350	395	200	150	800	300	300	100	200	200



	1/01/18	2/01/18	3/01/18	4/01/18	5/01/18	6/01/18	7/01/18	8/01/18	9/01/18	10/01/18	11/01/18	12/01/18
	1-Jan-18	1-Feb-18	1-Mar-18	1-Apr-18	1-May-18	15-May-18	14-Jun-18	30-Jun-18	15-Jul-18	1-Aug-18	15-Aug-18	1-Sep-18	15-Sep-18	1-Oct-18	24-Oct-18	01-Dec-18	30-Dec-18
Lake Level (m)	1.85	1.80	1.80	1.50	2.00	3.38	3.38	3.29	3.28	2.98	2.79	2.61	2.52	2.49	2.45	2.40	2.48
Discharge (L/S)	50	50	500	200	200	150	150	125	240	263	210	150	100	100	60	50	50

Appendix G – Drought Forecast for Beaver Lake & Oyama Lake




Oyama Lake Levels & Drought Forecasting 2018
Lake Level (m)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
Lake Volume (ML)
7,900
6,900
5,900
4,900
3,900
2,900
1,900
900
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1
Nov 1
Dec 1
Full Pool
Full Pool
Early season drought forecast evaluation
Mid-season drought forecast evaluation
Avg.
2017
2018
Stage 1
Stage 2
Stage 3
2003/2004

Appendix H – Kalamalka UV Station log Sheets

January 2018

JANUARY			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	1311	J.R.	2889170	3315871	3270	12046	2484	3218	13392	2561	401/402	94.6	74.0	139.8	68.4	4.06	39	91.8	4.3	2.5
2	1100	Pm	2889397	3315180	3271	12048	2485	3218	13400	2562	401/402						-0-	92		
3	1200	RoB	2891064	3316216	3272	12060	2486	3219	13401	2563	401/402	95	132	164	80	4.48	37	91.9	5.8	3.0
4	1300	RoB	2891155	3316444	3273	12060	2487	3220	13403	2564	401/402	101	137	158	83	4.50	38	91.7	5.9	3.0
5											401/402									
6	1355	J.R.	2891291	3318726	3274	12069	2488	3222	13420	2566	401/402	99.3	74.3	141.1	67.4	4.13	39	91.6	4.3	2.5
7											401/402									
8	930	RoB	2893981	3319321	3276	12081	2490	3223	13424	2568	401/402	97	133	16						
9	1030	RoB	2894869	3319553	3277	12087	2491	3224	13426	2569	401/402	97	133	161	82	4.43	38	91.6	5.8	3.0
10											401/402									
11	1200	RoB	2897463	3319791	3278	12105	2493	3225	13427	2570	401/402			145						
12	1245	MK	2897829	3320307	3279	12105	2494	3227	13431	2522	401/402	96.5	73.9	[illegible]	67	4.15	40	91.9	4.3	2.5
13											401/402									
14										2573	401/402									
15	9:30	MK	2901076	3320957	3281	12131	2497	3228	13436	2573	401/402									
16	1050	MK	2901250	3322643	3282	12132	2498	3230	13448	2575	401/402									
17	0850	J.R.	2901491	3322663	3283	12134	2499	3230	13448	2575	401/402						0	91.4		
18	0915	J.R.	2902206	3323823	3284	12139	2500	3231	13457	2576	401/402						0	91.5		
19	0750	J.R.	2903298	3324056	3258	12142	2501	3232	13458	2577	401/402	66.1	86.0	128.5	68.4	3.98	39	91.5	4.0	2.6
20	848	MAA	2903951	3324284	3285	12151	2503	3233	13460	2578	401/402									
21	9:04	MAA	2905292	3324925	3286	12161	2504	3234	13463	2579	401/402									
22	1100	RoB	2905537	3325981	3287	12163	2505	3235	13472	2580	401/402	81	59	85	58	3.81	39	91.5	3.7	1.7
23	1100	RoB	2905766	3326453	3288	12164	2506	3235	13476	2581	401/402									
24		RoB	2907219	3326767	3289	12175	2507	3236	13478	2582	401/402									
25											401/402									
26											401/402									
27	7:00	TF	2909257	3328772	3291	12189	2510	3234	13492	2585	401/402							92.5		
28	9:00	TF	2909440	3329102	3292	12190	2511	3240	13495	2586	401/402	99	71	143	64	4.17	39	92.8	4.5	2.5
29	0940	J.R.	2909469	3330613	3293	12190	2512	3242	13506	2588	401/402	86	62.7	89.1	58.3	4.1	38	91.9	3.8	1.2
30	1200	J.R.	2911137	3330852	3294	12202	2512	3242	13508	2588	401/402						0	91.8		
31											401/402									
JANUARY											401/402									

February 2018

FEBRUARY			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	1000	ROB	2912330	3331710	3295	12211	2513	3244	13514	2590	401/402									
2	845	ROB	2912569	3333449	3296	12213	2514	3245	13524	2591	401/402	51	61	86	60	3.81	39	90.7	3.7	1.7
3											401/402									
4	900	ROB	2913425	3334567	3298	12219	2516	3246	13534	2593	401/402									
5	0810	J.R	2914372	3336808	3299	12220	2517	3247	13536	2594	401/402						0	91.6		
6											401/402									
7	9:15	2-5	2914601	3337129	3300	12227	2518	3249	13553	2596	401/402							91		
8											401/402									
9	9:30	2-5	2915403	3338566	3303	12238	2521	3251	13563	2598	401/402	73	88	133	68	4.00	39	89.8	4.2	2.6
10	1110	2-9	2917057	3338675	3303	12245	2521	3252	13564	2599	401/402	83.7	63.9	90.0	66.3	3.87	38	91.3	3.8	1.7
11											401/402									
12	0745	2-9	2918745	3339042	3304	12257	2522	3253	13567	2600	401/402						0	92.1		
13	0930	2-9	2919140	3340580	3305	12260	2523	3254	13578	2601	401/402	81.2	62.1	87.0	68.6	3.85	39.1	91.3	3.7	1.7
14	430	ROB	2919441	3341180	3306	12262	2524	3256	13582	2603	401/402									
15	0910	2-9	2921212	3341180	3307	12274	2526	3255	13582	2603	401/402						0	91.2		
16	1000	ROB	2923763	3341462	3310	12278	2528	3257	13584	2605	401/402	67	72	120	63	4.00	39	91.4	4.2	2.6
17	8:20	MKH	2923120	3341462	3310	12289	2529	3257	13584	2605	401/402									
18	8:30	MKH	2924762	3341708	3311	12295	2529	3258	13586	2606	401/402									
19											401/402									
20											401/402									
21	1330	J.R.	2926283	3344143	3316	12310	2530	3264	13604	2609	401/402	91.9	64.1	122.2	60.9	3.96	39.4	3.96	4.4	2.5
22	1330	ROB	2926546	3344659	3318	12313	2533	3265	13608	2610	401/402									
23	1500	TF	2926546	3346336	3318	12313	2533	3266	13620	2611	401/402							93		
24	9:00	TF	2926785	3346565	3319	12314	2534	3267	13624	2612	401/402	86	64	118	62	3.90	39	91	4.3	2.5
25	9:45	TF	2927032	3348195	3320	12316	2535	3267	13633	2613	401/402							91		
26	10:40	TF	2927032	3349852	3320	12316	2535	3268	13645	2614	401/402							92		
27	1100	ROB	2927276	3350561	3321	12318	2536	3269	13650	2615	401/402	84	66	116	62	3.96	39	91.3	4.3	2.5
28	1100	ROB	2927521	3351664	3322	12320	2537	3269	13658	2616	401/402									
29											401/402									
30											401/402									
31											401/402									
FEBRUARY											401/402									

March 2018

MARCH			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	930	RB	2927521	3353360	3321	12320	2537	3270	13670	2618	401/402									
2	945	RB	2927764	3353771	3322	12322	2538	3271	13673	2619	401/402	100	66	118	63	3.89	39	90.6	4.3	2.5
3	930	RB	2927860	3355144	3324	12323	2539	3271	13682	2620	401/402	67	71	119	63	4.02	37	90.7	4.2	2.6
4	900	RB	2928015	3356756	3324	12324	2539	3272	13694	2621	401/402									
5	830	RB	2928260	3357128	3325	12325	2540	3272	13697	2622	401/402	97	67	116	63	4.02	39	90.8	4.3	2.5
6	1000	RB	2928501	3358622	3326	12327	2541	3273	13707	2623	401/402									
7	930	RB	2928501	3360296	3326	12327	2541	3274	13719	2624	401/402									
8	815	RB	2928745	3360575	3327	12329	2542	3275	13721	2625	401/402	98	68	121	63	4.03	39	91.8	4.4	2.5
9	8:00	TF	2928785	3362024	3328	12329	2543	3275	13732	2626	401/402	68	73	124	62	4.08	39	91.6	4.3	2.6
10	0930	J.R	2928989	3363731	3326	12331	2544	3276	13744	2627	401/402						0	91.9		
11	1230	J.R	2929257	3364560	3330	12333	2546	3277	13749	2628	401/402	65.4	70.1	112.1	63	3.95	39	91.3	4.3	2.6
12	1240	PM	2930558	3364674	3330	12342	2546	3278	13750	2629	401/402	95.8	67.2	116.7	62.6	4.04	37.1	92.4	4.4	2.5
13	1330	RB	2932247	3364778	3331	12354	2547	3278	13751	2629	401/402						Ø	91.9		
14	0820	J.R	2932267	3365012	3331	12351	2547	3279	13753	2630	401/402						Ø	91.5		
15	800	RB	2934139	3365039	3333	12367	2549	3280	13753	2631	401/402	63	69	108	60	3.95	38	91.6	4.2	2.6
16	1350	MK	2934977	3365273	3334	12373	2551	3281	13755	2632	401/402									
17	8:00	MCM	2934977	3366794	3334	12373	2551	3282	13766	2633	401/402									
18	9:00	MRM	2935230	3367921	3335	12376	2552	3282	13774	2634	401/402	92.2	64.5	112	62.7	3.66	39	90.5	4.3	2.5
19	930	RB	2935458	3368321	3336	12377	2553	3283	13778	2635	401/402									
20	930	RB	2935458	3370291	3336	12377	2553	3284	13791	2637	401/402	[illegible]								
21	1130	RB	2936928	3370518	3336	12386	2555	3285	13792	2638	401/402	92	103	137	80	4.31	39	90.4	5.8	3.0
22	800	RB	2937276	3370743	3336	12390	2556	3286	13794	2639	401/402									
23	1130	RB	2939045	3370958	3339	12403	2557	3287	13796	2640	401/402									
24	900	RB	2939286	3371179	3340	12404	2558	3288	13802	2641	401/402	139	99	134	85	4.37	39	91	6.0	2.5
25	900	RB	2939517	3372658	3341	12406	2559	3288	13806	2641	401/402									
26	800	RB	2939552	3374445	3342	12406	2560	3289	13821	2643	401/402	90	111	140	80	4.30	38	90.8	5.9	3.0
27	1230	RB	2940945	3374652	3343	12416	2561	3290	13823	2644	401/402	89	106	136	79	4.21	39	90.1	5.8	3.0
28	1345	RB	2941133	3374907	3343	12420	2561	3291	13824	2645	401/402									
29	830	RB	2943191	3374907	3344	12432	2563	3291	13824	2645	401/402									
30	09:00										401/402	60	70	112	58	3.81	39	91.0	4.2	2.6
31											401/402									
MARCH											401/402									

April 2018

APRIL			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1											401/402	91.6	109.4	137.2	8.1	4.30	38	90.3	5.8	3.0
2	8:30	LW	2948114	3375624	3348	12467	2568	3298	13830	2648	401/402									
3	0835	J.R	2948831	3375869	3348	12472	2569	3299	13832	2649	401/402						∅	91.6		
4	930	ROB	2950644	3375849	3349	12485	2571	3299	13832	2649	401/402									
5	1044	J.R	2951876	3376166	3351	12493	2573	3301	13834	2651	401/402						∅	91.5		
6	0045	J.R	2952103	3376751	3352	12495	2574	3302	13838	2652	401/402						∅	91.7		
7	8:20	TF	2952103	3378540	3352	12495	2574	3303	13857	2654	401/402							92.1		
8	9:30	TF	2952346	3379742	3353	12497	2575	3304	13860	2655	401/402	70	61	112	59	8.83	39	91	4.3	2.5
9	0910	J.R	2952574	3380331	3354	12499	2576	3304	13861	2656	401/402						∅	91.7		
10	1000	ROB	2952574	3382173	3354	12499	2576	3305	13877	2658	401/402									
11	1000	ROB	2952817	3383664	3355	12501	2577	3306	13887	2659	401/402	86	61	113	58	3.93	39	92.2	4.3	2.5
12	8:20	TF	2953057	3383924	3356	12502	2578	3306	13888	2660	401/402							91.5		
13											401/402									
14	1030	T.R	2954613	3385824	3358	12516	2580	3309	13903	2662	401/402	60	66.2	111.5	57.9	3.89	36	91.9	4.2	2.6
15	1145	J.R	2955370	3386063	3359	12519	2582	3309	13905	2663	401/402	54.7	66.5	111.3	54.4	3.84	40	91.3	4.2	2.6
16	1100	ROB	2957084	3386148	3359	12531	2583	3310	13906	2664	401/402	91	63	114	60	3.95	38	91.5	4.4	2.5
17	1130	ROB	2958864	3386311	3360	12543	2585	3310	13907	2664	401/402									
18	0745	PiM	2959009	3386556	3361	12544	2586	3311	13909	2665	401/402	59.1	62.9	109	57.1	3.86	39	92.2		
19	900	ROB	2960842	3386757	3361	12557	2587	3312	13910	2666	401/402	89	62	114	57	4.07	37	93	4.4	2.5
20	1200	ROB	2962742	3386822	3362	12570	2589	3312	13910	2666	401/402									
21	7:50	MRM	2963553	3387071	3363	12576	2590	3313	13913	2667	401/402	84.2	72	186	92.3	4.37	38.4	93.1	5.8	3.0
22			2964674	3387895	3363	12584	2591	3314	13914	2668	401/402									
23	11:07	TF	2966706	3387296	3364	12598	2593	3314	13914	2668	401/402							93.5		
24	7146	TF	2967116	3388602	3365	12601	2594	3316	13924	2670	401/402	86	60	113	57	3.96	39	92.8	4.3	2.5
25	11:1	MRM	2967397	3390049	3366	12603	2595	3317	13934	2671	401/402	86.2	60.1	114	56.3	4.01	39.35	93.5	4.9	2.4
26	2:00	TF	2967657	3391964	3367	12605	2596	3317	13947	2672	401/402							94.7		
27	10:36	TF	2967657	3394868	3367	12605	2596	3318	13968	2674	401/402	87	61	114	57	3.98	39	92.9	4.3	2.5
28											401/402									
29	9:00	LW	2968402	3402151				3321	14002	2678	401/402	182	136	184	141	3.61	92	88.4	7.9	3.8
30			↓	↓	3370	12681	2599	3321	14002	2678	401/402									
31											401/402									
APRIL											401/402									

May 2018

MAY			FLOW		Reactor 401			Reactor 401		Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	1400	RoB	2969130	3403538	3372	12616	2601	12616	2601	3322	14009	2679	401/402									
2	1230	RoB	2974149	3405373	3373	12631	2602	12631	2602	3323	14017	2680	401/402	105	120	180	124	3.24	93	91.4	7.6	4.1
3	1130	TF	2976768	3405373	3373	12645	2604	12645	2604	3323	14017	2680	401/402	116	122	181	125	3.47	92	91.4	7.5	4.0
4	800	RoB	2980636	3405641	3373	12659	2605	12659	2605	3324	14019	2681	401/402	89	63	118	60	3.97	39	91.8	4.4	2.5
5	900	RoB	2987711	3405846	3374	12662	2607	12662	2607	3324	14020	2681	401/402	118	131	183	127	3.49	93	91.4	7.5	4.1
6		RoB	2996363	3406323	3374	12728	2610	12728	2610	3326	14022	2682	401/402	113	134	176	126	3.42	93	91.4	7.5	4.0
7	1030	RLS	3004256	3406621	3374	12731	2611	12731	2611	3327	14023	2683	401/402	117	137	179	127	3.46	93	91.7	7.5	4.0
8	1330	RoB	3009707	3410245	3374	12747	2613	12747	2613	3329	14039	2685	401/402	177	132	182	132	3.76	45	92.6	7.7	3.7
9	1100	RoB	3011773	3415030	3375	12754	2614	12754	2614	3330	14048	2687	401/402	176	132	181	136	3.64	95	91.3	7.7	3.7
10	7.45	RoB	3014894	3416718	3377	12763	2616	12763	2616	3331	14053	2688	401/402	121	141	185	124	3.07	93	92.5	7.6	4.1
11	1300	TF	3018619	3418481	3379	12774	2618	12774	2618	3333	14058	2690	401/402						93			
12	840	mk	3020397	3420455	3381	12780	2620	12780	2620	3335	14064	2691	401/402	115	133	175	127	3.40	94	91.2	7.6	4.1
13	11:45	mk	3026782	3421612	3382	12799	2621	12799	2621	3337	14068	2693	401/402	180	136	185	135	3.76	96	92.4	7.8	3.8
14	830	RoB	3028165	3427166	3383	12803	2622	12803	2622	3337	14084	2694	401/402	123	138	185	124	3.68	93	92.7	7.6	4.1
15	930	RoB	3036449	3428924	3383	12838	2624	12838	2624	3342	14091	2696	401/402	119	141	182	124	3.38	93	91.0	7.5	4.0
16	9:11	TF	3044106	3430879	3383	12851	2626	12851	2626	3348	14098	2698	401/402	185	138	188	129	4.07	83	91.5	7.8	3.8
17	1245	RoB	3052930	3435127	3383	12874	2628	12874	2628	3355	14113	2700	401/402	116	140	180	126	3.51	93	92.5	7.5	4.0
18		RoB	3060356	3437442	3383	12902	2630	12902	2630	3361	14123	2702	401/402	108	130	166	129	3.12	93	90.6	7.5	4.0
19	1030	RoB	3067681	3440380	3383	12925	2632	12925	2632	3367	14131	2704	401/402	119	143	183	136	3.54	94	91.9	7.5	4.0
20		RoB	3075542	3443627	3383	12949	2634	12949	2634	3374	14143	2705	401/402	106	127	162	133	3.20	94	91.4	7.5	4.0
21	1145	RoB	3083525	3446938	3383	12974	2636	12974	2636	3381	14155	2707	401/402	115	137	175	111	3.68	92	91.9	7.5	4.0
22	10:50	TF	3090998	3450301	3383	12997	2638	12997	2638	3387	14166	2709	401/402	118	147	180	126	3.48	97	91.7	7.5	4.0
23	10:40	TF	3093574	3454014	3385	13006	2639	13006	2639	3391	14178	2711	401/402	179	136	184	132	3.85	88	91.9	7.7	3.7
24	11:10	TF	3096654	3457042	3388	13015	2641	13015	2641	3394	14188	2713	401/402	181	137	188	130	3.95	90	92.9	7.7	3.8
25	9:05	TF	3101694	3458517	3389	13031	2643	13031	2643	3395	14193	2714	401/402	178	135	181	133	3.78	89	91.4	7.8	3.7
26	8:40	TF	3106011	3460898	3391	13045	2645	13045	2645	3396	14200	2715	401/402	118	145	181	120	3.71	88	91.4	7.5	4.0
27	10:45	TF	3110591	3464086	3392	13059	2647	13059	2647	3397	14210	2716	401/402							92.0		
28	1100	RoB	3113376	3468720	3394	13066	2648	13066	2648	3400	14229	2718	401/402	179	137	185	135	3.80	88	90.5	7.9	3.8
29	1400	RoB	3116449	3470994	3399	13079	2650	13079	2650	3407	14232	2720	401/402	124	155	198	128	3.77	82	91.4	7.7	4.1
30	10:45	TF	3117863	3472865	3403	13084	2652	13084	2652	3412	14239	2722	401/402	124	153	198	128	3.77	87	91.4	7.7	4.1
31	11:00	TF	3119880	3474608	3407	13091	2654	13091	2654	3417	14245	2724	401/402	117	144	182	118	3.74	82	92.0	7.7	4.1
MAY													401/402									

June 2018

JUNE			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	1730	RoB	3123543	3476861	3411	13100	2656	3421	14252	2726	401/402	119	145	186	3.74	3.71	84	91.7	7.6	4.1
2	7:	MK	3125718	3478202	3413	13110	2658	3423	14257	2727	401/402									
3	6:58	MK	3128705	3481341	3415	13119	2659	3427	14267	2729	401/402	183	137	187	134	3.91	89	91.3	7.9	3.8
4	900	RoB	3130831	3483756	3419	13127	2661	3431	14275	2732	401/402	182	137	188	130	3.94	84	91.5	7.9	3.8
5	1200	RoB	3132717	3485364	3424	13133	2664	3435	14280	2734	401/402	112	139	174	119	3.55	84	90.7	7.6	4.1
6	10:30	TF	3134838	3487438	3430	13141	2665	3441	14288	2736	401/402	125	153	180	125	3.68	85	90.7	7.6	4.1
7	930	RoB	3138249	3489285	3433	13152	2667	3444	14294	2737	401/402	114	157	178	118	3.65	85	91.5	7.6	4.1
8	8:30	TF	3140656	3492627	3436	13160	2669	3449	14304	2739	401/402	161	124	123	124	3.72	85	91.5	7.8	3.8
9	~~9:15~~	~~TF~~									401/402									
10											401/402									
11	9:15	TF	3145066	3497150	3447	13175	2674	3461	14320	2745	401/402							91.8		
12	12:00	TF	3146391	3498412	3451	13180	2676	3465	14325	2747	401/402							93.4		
13	15:20	TF	3147655	3499684	3455	13185	2678	3469	14329	2749	401/402							92.5		
14	1330	RoB	3148905	3500588	3459	13189	2680	3472	14332	2750	401/402									
15	8:20	TF	3150057	3501887	3462	13193	2682	3476	14337	2752	401/402	169	124	117	122	3.66	86	91.2	7.9	3.8
16	12 18	MK	3152689	3504152	3467	13202	2684	3480	14344	2754	401/402							92.6		
17	9:05	MK	3156115	3505847	3470	13213	2686	3483	14350	2756	401/402	113	145	171	123	3.42	88	90.8	7.6	4.1
18	900	RoB	3157836	3510606	3472	13219	2688	3485	14365	2758	401/402	117	147	177	127	3.40	91	90.6	7.7	4.1
19	8:25	TF	3159455	3516052	3473	13224	2689	3486	14387	2760	401/402	117	147	177	130	3.34	93	90.5	7.6	4.1
20	1130	RoB	3160897	3516552	3473	13231	2691	3486	14389	2760	401/402	111	144	172	124	3.38	88	90.4	7.5	4.0
21	14:12	TF	3171515	3520219	3475	13261	2693	3488	14396	2762	401/402	117	144	173	127	3.34	88	90.1	7.5	4.0
22	1000	RoB	3171775	3525923	3475	13361	2693	3489	14414	2764	401/402	168	137	109	131	3.36	86	90.2	7.7	3.7
23	8:20	MK	3174473	3526027	3477	13270	2695	3493	14421	2766	401/402									
24	709	MK	3176494	3530510	3483	13277	2696	3496	14430	2767	401/402									
25	9:30	TF	3178920	3534116	3486	13285	2699	3500	14442	2769	401/402	175	131	114	120	3.58	83	90.6	7.9	3.8
26	15:45	TF	3181579	3536688	3491	13294	2701	3505	14451	2772	401/402	173	129	112	117	3.60	83	91.2	7.9	3.8
27	11:50	TF	3183576	3538656	3494	13300	2702	3508	14457	2773	401/402	151	114	99	88.7	3.03	81	86	7.9	3.8
28	1030	RoB	3187083	3540707	3498	13311	2704	3512	14464	2776	401/402	161	116	114	87	353	87	90.1	7.8	3.8
29	1930	TF	3187499	3544862	3501	13319	2706	3516	14478	2778	401/402	159	114	109	122	3.34	85	90.3	7.8	3.8
30	11:30	TF	3191913	3547387	3504	13327	2708	3519	14486	2779	401/402	162	117	109	116	3.51	84	91.1	7.9	3.8
31											401/402									
JUNE											401/402									

July 2018

JULY			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	11:20	TF	3194417	3550027	3508	13335	2710	3522	14495	2781	401/402	108	161	166	127	3.20	86	89.0	7.6	4.1
2	10:00	TF	3196122	3552344	3511	13341	2711	3526	14503	2783	401/402							90.2		
3	11:15	TF	3197788	3554055	3517	13347	2714	3531	14510	2785	401/402							90.5		
4	9:00	TF	3199900	3556153	3520	13354	2715	3536	14516	2787	401/402	162	130	130	130	3.14	95	90.5	77.	4.1
5	11:41	TF	3204844	3559793	3524	13367	2718	3539	14528	2788	401/402							91.8		
6	2:16	MK	3207665	3562879	3527	13379	2719	3542	14538	2790	401/402	105	166	169	118	3.32	87	90.6	7.5	4.1
7	~~8:00~~	~~uw~~									401/402									
8	8:00	uw									401/402	167	140	129	135	3.62	87	89	8.0	3.8
9	13:00	TF	3212670	3568426	3538	13396	2725	3554	14556	2796	401/402	167	141	129	131	3.69	88	90.7	7.8	3.8
10	10:20	TF	3215409	3570948	3541	13405	2726	3558	14564	2798	401/402	104	166	172	121	3.22	84	89.8	7.6	4.1
11	9:00	TF	3217444	3573120	3545	13412	2728	3560	14571	2800	401/402	104	182	172	170	3.24	84	90.2	7.0	4.1
12	1000	RoB	3220470	3576257	3548	13421	2730	3563	14581	2802	401/402	104	169	171	125	3.13	87	89.6	7.6	4.1
13	8:40	TF	3223571	3579074	3550	13431	2732	3566	14590	2803	401/402	164	140	125	140	3.36	99	90.4	7.8	3.8
14	7:40	MKM	3226026	3583753	3554	13439	2733	3567	14604	2805	401/402	157	130	121	134	3.40	90	89.3	7.7	3.8
15	8:00	MKM	3228973	3587507	3556	13449	2735	3569	14616	2807	401/402									
16		RoB			3559	13460	2737	3571	14626	2809	401/402	102	162	[illegible]	[illegible]	3.16	88	91.5	7.6	4.1
17	9:30	TF	3236087	3594345	3560	13471	2739	3573	14637	2810	401/402	153	131	122	129	3.56	89	90.7	7.7	3.7
18	10:30	TF	3243354	3594958	3561	13494	2741	3573	14639	2810	401/402	101	165	165	122	3.12	86	90.0	7.5	4.0
19	1200	RoB	3251463	3595222	3561	13519	2744	3574	14640	2811	401/402	99	160	160	116	3.19	88	91.4	7.5	4.0
20	1100	RoB	3258928	3595222	3561	13549	2745	3574	14640	2811	401/402	101	164	164	115	3.32	8.7	92.6	7.5	4.0
21	8:20	MK	3262654	3597867	3562	13554	2747	3575	14648	2812	401/402	102	166	165	113	3.33	87	92	7.5	4.0
22	9:45	MK	3266657	3600909	3564	13567	2749	3579	14658	2814	401/402	153	131	124	127	3.66	90	91.6	7.7	3.8
23	1400	RoB	3270479	3604120	3568	13579	2751	3582	14668	2815	401/402	101	164	165	113	3.36	81	91.7	7.5	4.1
24											401/402									
25	10:30	TF	3279292	3608409	3570	13606	2754	3586	14681	2818	401/402	150	128	123	126	3.66	90	91.8	7.7	3.7
26	14:15	TF	3279404	3616730	3574	13607	2755	3587	14707	2820	401/402	105	173	170	112	3.54	90	93.0	7.7	4.1
27	7:40	TF	3282402	3619070	3574	13616	2755	3588	14715	2821	401/402							92.0		
28	9:45	TF	3285439	3624420	3576	13626	2757	3589	14732	2823	401/402	148	128	120	124	3.65	90	92.2	7.7	3.7
29	10:20	TF	3288786	3627990	3578	13636	2759	3591	14743	2824	401/402	152	134	130	130	3.75	89	91.9	7.9	3.8
30	1030	RoB	3292345	3631791	3579	13647	2760	3592	14755	2826	401/402	149	128	122	124	3.67	89	91.9	7.7	3.7
31	1145	RoB	3293234	3639910	3581	13661	2761	3592	14780	2828	401/402	148	127	121	129	3.51	92	91.4	7.7	3.7
JULY											401/402									

August 2018

AUGUST			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity				Dosage	Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	12:50	TF	3295608	3645101	3582	13658	2762	3593	14796	2830	401/402	146	127	124	123	3.77	89	91.4	7.7	3.7
2	1130	RoB	3298673	3648774	3584	13668	2763	3594	14808	2831	401/402	147	128	123	126	3.62	87	90.8	7.7	3.7
3	1115	RoB	3300656	3653203	3586	13675	2765	3596	14822	2833	401/402	151	132	132	128	3.84	86	91.6	7.9	3.8
4	1030	RoB	3304593	3655708	3588	13687	2766	3597	14836	2634	401/402	97	159	162	116	3.12	88	91.3	7.5	4.0
5	1206	RoB	3310023	3657929	3589	13704	2768	3598	14837	2835	401/402	95	165	159	115	3.10	89	91.7	7.5	4.0
6	1030	RoB	3310835	3664611	3589	13706	2769	3599	14857	2837	401/402	145	127	122	127	3.62	89	91.0	7.7	3.7
7	1230	RoB	3317471	3665944	3590	13727	2771	3600	14863	2838	401/402	95	164	161	118	3.06	88	90.8	7.5	4.0
8	1000	RoB	3324432	3665944	3590	13749	2773	3600	14863	2838	401/402	96	166	160	119	3.05	87	90.7	7.5	4.0
9	1430	RoB	3325709	3674161	3593	13753	2775	3601	14890	2841	401/402	97	164	161	116	3.17	88	91.5	7.6	4.1
10	1445	RoB	3332428	3674645	3593	13778	2777	3602	14891	2842	401/402	95	165	158	115	3.12	88	91.4	7.5	4.0
11	5:17	MRM	3334053	3679207	3593	13760	2777	3603	14906	2844	401/402	144	129	124	126	3.69	87	91.4	7.7	3.7
12	5:50	MRM	3337515	3681647	3596	13791	2776	3608	14914	2845	401/402	97.8	169	160	118	3.10	89	91.4	7.6	4.1
13	1300	RoB	3340663	3685687	3600	13801	2781	3615	14927	2847	401/402	147	134	128	126	3.78	85	91.4	7.8	3.8
14	1230	RoB	3343177	3688567	3605	13809	2782	3616	14937	2848	401/402									
15	1200	RoB	3346542	3690889	3608	13820	2784	3621	14944	2850	401/402	150	137	134	132	3.81	88	91.4	7.9	3.8
16	1236	RoB	3349498	3694853	3610	13830	2786	3622	14957	2851	401/402	94.8	163	159	110	3.21	89	91.4	7.6	4.1
17	815	RoB	3352860	3696431	3613	13841	2787	3624	14962	2852	401/402	97	168	164	112	3.23	84	91.4	7.5	4.1
18	646	mK	3355811	3700121	3615	13851	2789	3627	14974	2854	401/402	138	128	125	128	3.67	89	91.4	7.7	3.8
19	11:21	mK	3359181	3703292	3618	13862	2791	3630	14984	2856	401/402	139	131	132	129	3.81	86	91.4	7.8	3.8
20			?		3623	13882	2795	3635	15001	2859	401/402									
21	545	RoB	3365555	3708518							401/402									
22											401/402									
23	1030	RoB	3372078	3713797	3629	13904	2799	3641	15018	2862	401/402									
24											401/402									
25	10:45	TF	3378315	3718725	3636	13924	2802	3647	15034	2865	401/402	96	164	160	112	3.05	84/41	91.4	7.7	4.1
26	9:00	TF	3380574	3720562	3640	13937	2804	3652	15040	2867	401/402	100	169	167	109	3.41	81	91.4	7.7	4.1
27	1300	RoB	3383194	3722106	3644	13938	2806	3657	15047	2869	401/402	161	135	656?	131	3.92	82	91.4	8.0	3.8
28											401/402									
29	11:03	TL	3384908	3725385	3655	13947	2809	3666	15060	2872	401/402	89.4	135	150.7	108	3.20	81	91.4	7.7	4.2
30	13:15	TF	3386977	3727227	3660	13955	2811	3670	15066	2874	401/402							91.5		
31	1100	RoB	3388207	3729916	3664	13959	2813	3674	15072	2876	401/402	99.8	162	152	116	3.26	83	90.4	7.7	4.1
AUGUST											401/402									

September 2018

SEPTEMBER			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	MBM	5:20	3390078	3731403	3667	13965	2815	3677	15081	2877	401/402	95.1	146.6	134	115	3.10	83	90	7.6	4.1
2	MBM	5:30	3392306	3734025	3670	13973	2816	3681	15090	2879	401/402	125	116	153	123	3.54	83	87.9	7.8	3.8
3	MLW	8:0?	3394417	3736399	3674	13980	2818	3684	15098	2881	401/402									
4	RB	1200	3395781	3738176	3676	13985	2820	3689	15104	2883	401/402									
5	RB	1030	3398546	3739918	3682	13991	2822	3693	15111	2885	401/402									
6	RB	1400	3400503	3742358	3687	14001	2825	3697	15119	2887	401/402	94	164	137	107	3.29	81	91.4	7.6	4.1
7	RB	1245	3402741	3744570	3696	14009	2826	3701	15126	2889	401/402	134	120	160	125	3.62	84	90.1	7.9	3.8
8	RB	1000	3404222	3746190	3695	14014	2828	3707	15132	2890	401/402	131	120	155	123	3.68	81	90.2	7.9	3.8
9	RB	1630	3405883	3747934	3700	14020	2830	3711	15138	2892	401/402	95	165	147	113	3.19	85	91.4	7.7	4.1
10	MK	2:15	3407803	3750050	3705	14027	2831	3719	15146	2894	401/402	133	120	167	126	3.58	82	89.4	7.9	3.8
11	TL	9:00	3409222	3751757	3709	14031	2833	3723	15152	2896	401/402	137.6	169	156.5	131	3.96	82	91.4	7.7	4.1
12	TL	10:54	3411396	3753593	3713	14039	2835	3729	15159	2898	401/402	141.1	124.8	162.3	123	3.75	84	91.3	8.0	3.8
13	TL	8:10	3412761	3755115	3717	14044	2837	3732	15164	2899	401/402	135	161.5	160	126.7	3.99	78.7	91.4	7.6	4.1
14	TF	11:30	3413830	3756067	3720	14048	2838	3737	15168	2901	401/402	135	177	168	115	3.95	78	92.7	7.9	3.8
15	TF	1045	3414640	3756822	3723	14051	2840	3739	15170	2902	401/402							94.2		
16	TF	8:00	3415786	3757630	3725	14053	2841	3742	15173	2904	401/402							94.1		
17	TL	9:27	3416134	3758682	3729	14056	2843	3746	15177	2906	401/402							92.1		
18	RB	1200	3416966	3759581	3732	14059	2844	3752	15181	2907	401/402									
19	TL	9:30	3417030	3760893	3733	14060	2845	3758	15186	2909	401/402							92.2		
20	TL	2:00	3418318	3762412	3737	14064	2847	3763	15191	2911	401/402							92.8		
21	TL	8:23	3418917	3762954	3739	14066	2848	3765	15193	2912	401/402							94		
22											401/402									
23											401/402									
24	MK	2:36	3422769	3767151	3746	14091	2854	3772	15221	2917	401/402	95	121	109	79	4.44	38	92	5.8	3.0
25	TL	10:37	3423950	3767889	3748	14100	2855	3774	15226	2918	401/402	93.7	120.7	109.2	79.7	4.40	39.64	92.9	5.8	3.0
26	TL	1:32	3426130	3769364	3749	14112	2857	3776	15235	2920	401/402	124.2	112	153	123.8	3.38	87.85	90.4	7.8	3.8
27	TL	11:10	3426537	3771367	3751	14115	2858	3778	15247	2921	401/402	96.6	86.1	118.8	75	4.30	39.65	91.4	6.1	2.8
28	RB	1500	3427316	3772613	3754	14118	2860	3780	15252	2922	401/402									
29	MK	7:12	3427565	3773158	3755	14119	2860	3782	15254	2923	401/402									
30	MK	7:20	3428532	3773689	3758	14122	2862	3784	15256	2924	401/402									
31											401/402									
SEPTEMBER											401/402									

October 2018

OCTOBER			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	8:50	TF	3429163	3774575	3761	14125	2863	3787	15260	2926	401/402							92.1		
2	1030	RoB	3429914	3775298	3764	14125	2865	3790	15263	2927	401/402									
3	815	RoB	3430429	3771580	3766	14130	2866	3792	15265	2929	401/402									
4	1:15	TL	3430945	3776541	3768	14132	2867	3795	15267	2930	401/402							90.9		
5	9:00	TL	3431449	3776998	3770	14133	2869	3797	15269	2931	401/402	133.3	17.7	159.3	17.1	3.81	77.3	91.3	7.9	3.8
6	1100	RoB	3431855	3777234	3772	14135	2870	3798	15270	2932	401/402									
7											401/402									
8	945	RoB	3432551	3777921	3775	14138	2873	3801	15273	2935	401/402									
9	8:10	TL	3433088	3778840	3777	14139	2875	3803	15275	2937	401/402							91.1		
10	9:44	TL	3433311	3778882	3779	14140	2877	3805	15276	2938	401/402	111.7	140.6	139.1	118.2	3.48	83.3	90.1	7.7	4.1
11	1:30	TL	3433719	3779340	3780	14142	2878	3807	15278	2940	401/402							91.5		
12	9:45	TF	3433945	3779570	3781	14143	2879	3808	15279	2941	401/402							90.1		
13	11:10	TF	3434423	3779792	3783	14145	2881	3809	15280	2942	401/402							88.8		
14	9:45	TF	3434644	3780021	3784	14145	2882	3810	15281	2943	401/402							90.7		
15	8:28	TL	3434900	3780400	3785	1447	2883	3812	15284	2945	401/402	99.9	85.3	116	75.3	4.26	38.24	90.5	6.1	2.8
16	11:16	TL	3436035	3782800	3786	1455	2884	3814	15301	2946	401/402							90.6		
17	10:15	TL	3436290	3782233	3787	1457	2885	3815	15304	2947	401/402	96.2	84.6	114.8	75.5	4.19	37.66	90.3	6	2.8
18	630	RoB	3437730	3783494	3788	14169	2886	3815	15306	2947	401/402									
19	800	RoB	3437936	3784939	3791	14169	2886	3818	15316	2949	401/402	94	83	112	75	4.15	39	89.8	6.0	2.8
20											401/402									
21											401/402									
22	845	RoB	3440196	3787527	3794	14185	2890	3821	15335	2953	401/402	92	82	106	73	4.18	39	90.8	6.0	2.8
23	830	RoB	3440274	3788112	3795	14186	2891	3822	15339	2955	401/402									
24	9:15	RoB	3442185	3788184	3796	14199	2893	3823	15340	2956	401/402	100	87	112	75	4.33	38	91.1	6.1	2.8
25	930	RoB	3442436	3789942	3797	14201	2894	3824	15352	2957	401/402	94	83	107	71	4.38	38	92.7	6.0	2.8
26	9:20	TL	3442682	3790197	3798	14203	2896	3825	15354	2958	401/402							91.7		
27	1020	MK	3444389	3790323	3799	14215	2896	3826	15355	2959	401/402	66	56	95	55	3.80	38	91.7	4.4	2.5
28	10:07	MK	3445404	3791207	3800	14222	2597	3827	15362	2960	401/402									
29	11:15	TL	3446281	3791436	3802	14228	2899	3828	15363	2961	401/402	83.5	108.4	99.2	74.9	4.18	39.1	90.2	5.8	3
30	0840	PM	3447458	3791688	3802	14236	2900	3829	15365	2962	401/402						0	92.4		
31											401/402									
OCTOBER											401/402									

November 2018

NOVEMBER			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity			Dosage		Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1	1448	KOB	3499290	3793306	3804	14250	2902	3831	15377	2964	401/402	83	73	97	68	4.02	39	91	6.0	2.8
2	1055	EK	3499530	3793794	3805	14257	2903	3831	15380	2965	401/402	—	—	—	—	—	—	91.6	—	—
3	930	ROB	3449915	3795037	3806	14254	2904	3832	15389	2966	401/402									
4	1000	ROB	3450164	3796159	3807	14256	2905	3834	15397	2968	401/402	94	83	104	71	4.37	39	92.6	6.0	2.8
5	2:00	MK	3450501	3797304	3809	14259	2907	3835	15406	2970	401/402									
6	1500	ROB	3450748	3798484	3810	14260	2908	3836	15414	2971	401/402									
7	1100	ROB	3452252	3795724	3811	14271	2909	3837	15416	2972	401/402	67	101	93	63	4.03	37	90.7	5.8	3.0
8	1000	ROB	3452474	3798966	3812	14273	2910	3838	15418	2973	401/402	70	104	95	65	4.04	37	90.1	5.8	3.0
9	11:33	MK	3452577	3800673	3813	14274	2911	3839	15430	2975	401/402	74.9	111	100	67	4.18	37	91.6	5.9	3.0
10	8:06	MGY	3452807	3802003				3840	15439	2976	401/402	55.2	76.1	91.4	69.2	4.15	38	92.1	6.0	2.8
11	8:10	MGM	3453050	3802532	3814	14.277	2912	3840	154343	2977	401/402									
12	6:32	MGY	3454717	3802775	3815	14289	2913	3841	15445	2978	401/402									
13											401/402									
14		TL	3455613	3804550	3817	14295	2915	3844	15458	2981	401/402							90.2		
15	1230	EM	3455870	3806092	3816	14297	2916	3845	15464	2982	401/402	—	—	—	46.3	—	—	92.2	—	—
16	9:41	TL	3456290	3806332	3820	14300	2918	3847	15471	2983	401/402	84.5	118	106.3	73.4	4.35	39.32	92.8	5.9	3.0
17	10:06	TF	3457783	3806684	3820	14311	2918	3848	15473	2984	401/402							93.0		
18	9:10	TF	3458203	3807294	3821	14318	2919	3849	15478	2985	401/402							91.7		
19		ROB	3459063	3807591	3822	14320	2920	3850	15480	2986	401/402									
20	2:02	TL	3460693	3807783	3823	14331	2921	3851	15481	2987	401/402							92		
21	0915	EK	3462124	2807783	3825	14342	2922	3852	15481	2987	401/402	76.9	103.5	94.1	70.1	4.10	39.96	90.4	5.8	3.0
22	930	ROB	3462585	3808017	3825	14345	2923	3853	15833	2988	401/402									
23	9:15	TL	3462825	3809559	3826	14347	2924	3854	15494	2989	401/402							92.3		
24	10:10	MK	3463814	3809788	3828	14354	2926	3855	15496	2990	401/402	83.1	110.6	99.3	73	4.24	39.4	91.6	5.8	3.0
25	9:57	MK	3464711	3810017	3828	14360	2926	3856	15498	2991	401/402									
26	0805	EK	3466492	3810025	3830	14373	2928	3857	15498	2992	401/402							90.0		
27											401/402									
28	915	ROB	3468348	3810536	3833	14386	2930	3860	15502	2994	401/402									
29	0900	EK	3469992	3810557	3836	14398	2932	3863	15502	2995	401/402	91.3	84.7	130.2	74.5	4.24	37.95	96.1	6.1	2.8
30											401/402									
31											401/402									
NOVEMBER											401/402									

December 2018

DECEMBER			FLOW		Reactor 401			Reactor 402			Running Reactor	Lamp Intensity				Dosage	Flow	UVT	Power	
DAY	TIME	Chk'd	Totalizer 401 (m3)	Totalizer 402 (m3)	Starts #	Time (hrs)	Wipes #	Starts #	Time (hrs)	Wipes #		1 (W/m2)	2 (W/m2)	3 (W/m2)	UV SP (W/m2)	Validated Log	(LPS)	%	Bank 1 (KWH)	Bank 2 (KWH)
1											401/402									
2											401/402									
3	800	RoB	3472134	3813937	3839	11413	2935	3866	15519	2999	401/402									
4	800	RoB	3472381	3814531	3840	14415	2936	3867	15531	3000	401/402									
5	800	RoB	3473446	3814762	3842	14422	2938	3868	15532	3001	401/402	81	107	93	73	4.17	39	90.2	5.3	3.0
6											401/402									
7	800	RoB	3474779	3815658	3844	14432	2939	3871	15539	3004	401/402	80	73	101	69	3.98	39	89.1	6.0	2.8
8	855	MK	3475016	3817059	3845	14434	2940	3871	15549	3005	401/402									
9											401/402									
10	830	RoB	3476728	3817551	3847	14446	2942	3873	15553	3007	401/402									
11											401/402									
12	930	RoB	3476878	3821086	3848	14447	2943	3877	15557	3011	401/402									
13	800	RoB	3477126	3821163	3849	14449	2944	3878	15578	3012	401/402	88	86	120	76	4.24	38	90	6.1	2.8
14	8:23	TL	3478741	3821332	3850	14460	2945	3878	15579	3012	401/402							91.4		
15	8:00	TL	3478982	3822593	3851	14462	2946	3880	15588	3014	401/402	84.5	82.8	111	73.8	4.20	39.54	90.4	6	2.8
16	8:00	TL	3479225	3823114	3852	14464	2947	3880	15592	3014	401/402							90.7		
17	800	RoB	3480862	3823370	3853	14476	2948	3881	15594	3015	401/402									
18	9:31	TL	3481099	3824522	3854	14477	2949	3883	15602	3017	401/402	82	81.4	113.1	74	4.10	39.64	89.4	6	2.8
19											401/402									
20	8:19	MK	3481646	3826262	3857	14481	2951	3887	15615	3019	401/402	82	81	113	71	4.25	39.5	92	6	2.8
21	630	RoB	3481878	3827479	3858	14483	2952	3887	15623	3019	401/402									
22	1057	MK	3483435	3827720	3860	14494	2953	3888	15625	3020	401/402									
23											401/402									
24	1130	TF	3483917	3829673	3862	14498	2955	3890	15639	3023	401/402							92.0		
25	7:00	TF	3484846	3829919	3863	14504	2956	3891	15641	3024	401/402	84	113	100	75	4.17	39	89.5	5.8	3.0
26	10:00	TF	3485934	3830153	3863	14572	2957	3892	15643	3025	401/402							92.0		
27	12:00	TF	3486188	3831721	3864	14574	2958	3893	15654	3026	401/402							93.0		
28	11:45	TF	3487337	3831955	3866	14522	2960	3894	15656	3027	401/402	82	112	96	72	4.36	39	97.4	5.8	3.0
29	11:10	TF	3488179	3832188	3866	14527	2960	3895	15658	3028	401/402							93.1		
30	10:30	TF	3488369	3833744	3867	14529	2961	3896	15669	3029	401/402							97.2		
31	9:15	RoB	3488767	3835376	3869	14534	2963	3897	15670	3030	401/402	82	112	96	7.2	4.36	39	91.8	5.8	3.0
DECEMBER											401/402									

Appendix I – 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-I
Rob Witzke	1841	WD-II, CH
Patti Meger	4838	WT-I, CH, WD-I, T-I
Kiel Wilkie	6503	WD-III, CH
Tyler Friedrich	7697	WD-II, WT-I
Mike Kristensen	8344	WD-I, WT-I
Tessa Luison	1000130	WD-I, CH
Evan Kemp	8114	WWT-III, WWC-1, CH