

2024

Greater Vernon Water Water Quality Monitoring Program

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1. INTRODUCTION

1.1 Acronyms and Definitions

Aesthetic Objectives (AO) – Guidelines for Canadian Drinking Water Quality (GCDWQ) applies these objectives to different substances in water that may affect the acceptance by the customer.

CARO - a full service environmental laboratory that provides analytical services.

Accredited Lab – a lab with formal recognition by an authoritative body and the Provincial Health Officer of the competence to work to specified standards.

Colilert™ - a product used to detect total coliforms and *E.coli* in water. It is based on IDEXX's patented Defined Substrate Technology (DST). When total coliforms metabolize Colilert's nutrient-indicator, ONPG, the sample turns yellow. When *E.coli* metabolize Colilert's nutrient-indicator MUG, which fluoresces when exposed to UV light.

CoV – City of Vernon.

DAF – Dissolved Air Flootation.

DCWTP – Duteau Creek Water Treatment Plant.

DoC – District of Coldstream.

DWPA – *Drinking Water Protection Act*.

DWPR – *Drinking Water Protection Regulation*.

DWTP - Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies

E.coli – *Escherichia coli* is a gram negative rod of the family Enterobacteriaceae. Most strains of *E.coli* do not produce debilitating toxins but there are a few strains that do, one being the *E.coli* O157:H7 strain.

ENKI – internet based data software system with centralized information management.

ERA – Environmental Resource Associates – company who provides Certified Reference Materials (CRMs) and Proficiency Testing (PT) products.

GCDWQ – Guidelines for Canadian Drinking Water Quality.

GVW – Greater Vernon Water.

HPC – Heterotrophic Plate Count.

IMAC – Interim Maximum Concentrations – GCDWQ has established these concentrations which estimates lifetime risks of cancer associated with the guideline.

MAC – Maximum Acceptable Concentrations – GCDWQ has established these concentrations for different substances which may have adverse effects on health.

MF – Membrane Filtration – testing method that theoretically detects a single bacterium in a 100/mL sample.

MHWTP – Mission Hill Water Treatment Plant.

MPN – Most Probable Number– quantification of coliforms and *E.coli*.

PHO – Provincial Health Officer.

Quanti-Tray® Enumeration Procedure – used to numerate Colilert™ procedures by counting the number of positive wells and referring to the MPN table.

RDNO – Regional District of North Okanagan.

RPD - Relative Percent Difference.

SCADA – Supervisory Control and Data Acquisition – is a system for remote monitoring and control that operates with coded signals over communication channels.

Source Water – untreated water before treatment or disinfection.

TC – Total Coliform group is a gram negative, non-spore forming rod-shaped bacteria. A group of specific bacteria called indicator bacteria which indicate a probable presence of pathogenic bacteria.

UV – Ultraviolet.

Water Distribution System – RDNO owned and administrated by GVW. The operations and maintenance is contracted to the CoV and DoC.

1.2 Background

As guidance for the Greater Vernon Water (GVW) Water Quality (WQ) Monitoring Program, the Guidelines for Canadian Drinking Water Quality (GCDWQ), the British Columbia *Drinking Water Protection Act and Regulation* (DWPA and DWPR) and the Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies (DWTO); have been drawn on to develop this “Monitoring Program”. The program is designed to monitor water at the source, treatment plants and the distribution system for variations and trending.

GVW uses the multi-barrier approach in the monitoring program. Staff monitor the source water in the watersheds, at the intakes and the wellheads before treatment or disinfection. GVW has two surface water sources used for domestic purposes, two surface water sources and two groundwater wells used for agriculture purposes and two groundwater wells that may be used as an emergency backup. The source water monitoring is discussed in section 2.

The treatment facilities are monitored by the Regional District of North Okanagan (RDNO) operators and WQ staff. The treatment monitoring is discussed in section 3.

The transmission and distribution system incorporates certified operators from the City of Vernon (CoV), District of Coldstream (DoC), and WQ staff to sample at designated sample sites. WQ staff sample for disinfection by-products quarterly and comprehensive analysis bi-annually. During normal operations, there are two potable water systems (Duteau Creek and Kalamalka Lake). The distribution monitoring is discussed in in section 4. The system has multiple interconnections within the distribution that are used when necessary. Either Duteau Creek or Kalamalka Lake can provide water to the whole water system

There are three irrigation systems; Goose Lake, Deer Creek (King Edward Lake) and untreated Duteau Creek water. These systems have limited monitoring, discussed in section 2.

1.3 Quality Assurance and Quality Control Program

To ensure good data is collected, a sampling program should include a Quality Assurance (QA) plan. QA is a system of activities designed to make sure the data meets defined standards of quality. It pertains to the overall management of the sampling program, and includes; planning, documentation, training, consistency in collecting and handling samples and analysis, validation and reporting. An important part of QA is *Quality Control* (QC). QC refers to the technical activities used to reduce errors throughout the sampling program. These activities measure the performance of a process against defined standards to verify the data meets the expected quality. Errors can occur in the field, laboratory or while handling the data. QC should include both internal and external measures. Internal QC is a set of measures undertaken by the project’s own samplers and analysts. External QC involves people and laboratories outside of the project utility (USEPA 1996).

The following steps have been employed by GVW to ensure reliable information from the WQ Monitoring Program:

1. As directed in the *DWPA and DWPR*, a water supplier is required to have their bacteriological analysis completed by a certified laboratory approved by the Provincial Health Officer (PHO). GVW uses CARO Analytical Services (CARO) to analyze bacteriological samples plus a multitude of other parameters.
2. Due to the nature of the water system there are a number of operators taking WQ samples and performing field measurements. Training through GVW for WQ sampling and emergency response is provided annually to operators to ensure collection and responses are correct. This refresher is used to reduce errors in the sampling program.

3. To assess the quality of the sampling and analytical results, field duplicates are analyzed for the program at a rate of approximately 10% of the total number of samples collected. A duplicate sample is defined as a field sample of water collected from the same location, split into two equal parts, and submitted to the analytical laboratory under a separate label so the laboratory has no knowledge of the samples site location. The collection and analysis of the duplicate samples provide information on the combined (field and analytical) precision of the sampling and analytical program. The individual analytical results in each of the samples of the duplicate pair are compared and the Relative Percent Difference (RPD) is calculated for each analyte pair. RPDs are calculated using the following formula, where “a” and “b” are duplicate pair values in identical units.

$$RPD = \left(\frac{a-b}{\left(\frac{a+b}{2} \right)} \right) \times 100$$

4. A RPD of 30% or less is generally considered acceptable while a RPD of greater than 30% may indicate a problem in either sampling or analysis (MoE 1998b). This limit may vary somewhat depending on the analysis involved and the concentration of the analyte.
5. The RPD also tends to increase as the result approaches the detection limit. Therefore, use of this threshold is restricted to values five times over their detection limit.

In 2024, GVW WQ staff will take 4 field blanks, 4 travel blanks and 50 duplicate samples. Three sample sites have been selected for field blanks which including a water watershed, a source and a treatment facility. Duplicates will be taken within the Duteau Creek watershed, on Coldstream Creek, water sources, and treatment facilities. DoC and CoV operators will take duplicates weekly at distribution sites.

Field instruments, including handheld conductivity and pH meters, turbidimeters and colorimeters are brought to the RDNO laboratory for regular maintenance. Handheld conductivity and pH meters are scheduled once a month, turbidimeters are scheduled once every three months. Colorimeters are brought in annually for a secondary check. Operators have been instructed to calibrate pH and conductivity meters before each sampling routine.

In addition to the samples sent to an external lab, the RDNO laboratory uses the Quanti-Tray® Enumeration Procedure to perform Most Probable Number (MPN) for Total Coliform and *E.coli*. These analyses are used to supplement the program. There is a QC procedure for these tests. This is completed by running IDEXX-QC test weekly when samples are analyzed. The IDEXX-QC meets standards for maintaining accreditation. This is completed by running three sterile vessels with:

- *Escherichia coli*,
- *Klebsiella variicola*, and
- *Pseudomonas aeruginosa*.

All samples are collected and shipped in accordance with the 2005 21st Edition Standard Methods for the Examination of Water and Wastewater (APHA, AWWA, and WEF). A sample confirmation or requisition and chain of custody form accompany all samples sent to an accredited laboratory.

GVW WQ staff have developed laboratory procedures that are updated when required.

2. SOURCE WATER

2.1 Source WQ Monitoring

Source WQ monitoring is designed to compare source water with guidelines, criteria and regulations that have been set for both health and aesthetic reasons. It is also designed to observe seasonal trends that may affect treatment and chlorine demand, and to monitor for potential threats from watershed land use practices. It is an important component of the multi-barrier approach and drinking water management.

It is important for monitoring programs to be as comprehensive as possible. (Source to Tap: Guidance on the Multi-Barrier Approach to Safe Drinking Water; Canadian Council of Ministers of the Environment, 2004).

Parameters include; turbidity, temperature, pH, conductivity, and bacteria (Total Coliform and *E.coli*). Some of these parameters are also incorporated in the “GVW Water Quality Deviation Response and Notification Program”. Source monitoring includes the Duteau Creek Watershed and the Kalamalka Lake / Coldstream Creek Watershed. The results are reported as part of the GVW Annual Report, source WQ information and watershed response plans.

GVW is committed to long-term monitoring for all sources.

2.2 Sampling Locations

GVW uses two surface water intakes for domestic/potable purposes; Kalamalka Lake and Duteau Creek which are routinely monitored. Two groundwater sources are available for emergency purposes; Coldstream Ranch Well 3 and Antwerp Springs PH 2, which are monitored before and when in use. A comprehensive water analysis is completed annually on Kalamalka Lake and Duteau Creek.

Non-potable water sources; Deer Creek (King Edward), Coldstream Ranch Well 2, Goose Lake, and untreated Duteau Creek are separated from the domestic water system and are used for irrigation water only. The following tables outline the sources, sampling point location and a descriptor of the site. Sampling location maps are located in Appendix A.

The irrigation sites are not monitored extensively, with the exception of Goose Lake. Goose Lake is monitored weekly during the irrigation season due to the chemistry of the lake. A comprehensive water analysis is completed every 5 years on Coldstream Ranch Well 2, Coldstream Ranch Well 3, Goose Lake Intake and Deer Creek Intake Pond.

Table 1 Domestic Potable Water Sources – Raw Water (untreated)

Intake / Source Year Round	Location	Sample Site Comment
Kalamalka Lake Intake	13204 West Kal Road, Coldstream	Sample station is located outside on the south side of the Kalamalka Pump Station (PS)
Duteau Creek Intake	95 Lewis Road, RDNO, Electoral Area “D”	Sample site inside building at Duteau Creek Intake
Antwerp Springs PH 2	6282 Highway 6, Coldstream	Pre-chlorination (emergency Well only)
Coldstream Ranch Well 3	Well located on Coldstream Ranch	Pre-chlorination (emergency Well only)

★ An annual sampling program for Kalamalka Lake is completed by Larratt Aquatic Consulting.

Table 2 Duteau Creek Watershed Sample Sites

Duteau Creek Watershed	Sample Site Comment
Haddo Weir	Sample on south side of weir. Outflow of Haddo Lake
Duteau Creek Bridge	Downstream of bridge at 12km on Haddo main
16 km Aberdeen Road Tributary	Off Aberdeen main – used to monitor impacts of increasing logging in Flyfish subbasin
18 km Aberdeen Road Tributary	Aberdeen main – downstream of culvert – Flyfish Creek

Table 3 Kalamalka Lake Watershed Sample Sites

Kalamalka Lake Watershed★ Coldstream Creek	Sample Site Comment
Coldstream Creek at Howe Drive	Downstream of the bridge
Coldstream Creek at Kirkland Drive	Upstream of the bridge
Coldstream Creek at Brewer Road	Downstream of bridge and the culvert
Coldstream Creek at School Road	Downstream of the bridge

Table 4 Irrigation Water Sources - Watershed and Sample Stations

Intake / Watershed Irrigation	Sample Site Comment
Deer Creek Intake Pond	Intake pond
King Edward Outflow	Dam structure outlet
Coldstream Ranch Well 3	Well located on Coldstream Ranch
Coldstream Ranch Well 2	Well located on Coldstream Ranch
Goose Lake Intake	Raw water copper line at intake building

2.3 Source Monitoring Schedule and Parameters

Samples for source water are collected weekly. The 2024 sampling schedule for chemical and physical parameters is outlined in Appendix B. The analysis is completed in the field, at the RDNO laboratory and at CARO Analytical Services. Further information on some WQ parameters in the following sections.

2.3.1 Bacteriological

Samples of untreated water for domestic/potable purposes are collected weekly at water supply intakes and analyzed for Total Coliform and *E.coli*. Iron related bacteria and Sulfate reducing bacteria are collected monthly at Kalamalka Lake intake and annually at Coldstream Ranch Well 3 or before being brought online and after any operational maintenance work as an indicator of microbial changes in the aquifer.

Bacterial levels at the source are indicators of contamination. Historical data has assisted in developing trends for each source and therefore a deviation from “normal” initiates a response.

The response includes a second bacterial sample for confirmation, a site visit to investigate and possibly determine the contamination source. *E.coli* levels that rise above and remain high over an extended period of time will undergo further evaluation.

2.3.2 Adenosine Triphosphate

Adenosine Triphosphate (ATP) measures the biological activity within the water. There are two types of ATP, intracellular and extracellular. Extracellular ATP is outside of the cell which is released from dead or stressed microorganisms, while intracellular ATP is contained within the living cell. The ATP tests used, measure *free* ATP, which is also referred to as *extracellular* ATP and *total* ATP, which is the sum of *free* ATP and intracellular ATP.

Untreated water for domestic/potable purposes are tested for Adenosine Triphosphate (ATP) weekly at water supply intakes.

Table 5 Adenosine Triphosphate Sample Sites

Sample Sites	Type	Frequency
Kalamalka Lake Intake	source water	weekly
Duteau Creek Intake	source water	weekly

2.3.3 Turbidity

Kalamalka Lake Intake and Duteau Creek Intake, have online turbidimeters and are monitored by SCADA. Operations have a maintenance schedule for all online analyzers.

The turbidity is reported from the Mission Hill Water Treatment Plant (MHWTP) before chlorination and Ultraviolet (UV) disinfection and at the Duteau Creek Water Treatment Plant (DCWTP) after the Dissolved Air Floatation (DAF), chlorination and UV disinfection. The provincial guidance “Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water, April 2013” and the “GVW Water Quality Deviation Response and Notification Plan” which provides details on turbidity events and/or trigger levels used for response and notification.

2.3.4 Chemical, Biological and Physical

Comprehensive samples are taken annually for each water source as well as at two distribution sites; Allenby PS for the Kalamalka distribution and PRV 2 for the Duteau Creek distribution. Allenby PS and PRV 2 are completed biannually to identify seasonal changes in flow and quality. The comprehensive list of parameters is outlined below.

Table 6 Comprehensive Water Analysis

Parameters		
Alkalinity (Total)	Cyanide (Total)	Selenium (Total)
Aluminum (Dissolved) ¹	Dissolved Solids (Total)	Sodium (Total)
Aluminum (Total)	Fluoride	Strontium (Total)
Antimony (Total)	Hardness (Total)	Sulfate
Arsenic (Total)	Iron (Total)	Turbidity
Barium (Total)	Lead (Total)	Temperature
Boron (Total)	Magnesium (Total)	Uranium (Total)
Cadmium (Total)	Manganese (Total)	Zinc (Total)
Calcium (Total)	Mercury (Total)	Dissolved Organic Carbon*
Chloride	Molybdenum (Total)	UV ₂₅₄ *
Chromium (Total)	Nickel (Total)	Phosphorus (Total)*
Cobalt (Total)	Nitrate	Total Dissolved Phosphorous*
Color (True)	Nitrite	Total Kjeldahl Nitrogen*
Conductance @ 25 C	pH	Total Organic Carbon*
Copper (Total)	Potassium (Total)	Chlorophyll a*

¹ The Duteau Creek source.

* Sampled at surface water sources only.

Parameters checked routinely at surface sources are in Appendix B with more detail below:

- **Total Organic and Dissolved Organic Carbon** relate to Trihalomethane's production and UV disinfection effectiveness. Organic loading is also an indicator of pollutants in the water.
- **Aluminum** is monitored at the Duteau Creek source as the natural level is part of the cumulative value after treatment (Poly-Aluminum-Chloride, the flocculants used in the treatment process) in the Duteau Creek system.
- **Chlorophyll a, Algae density, Total Phosphorous, Total Nitrogen** is monitored at sources during the "growing" season, algae growth period and during lake turnovers (fall and spring).
- **Total Phosphorous, Total Nitrogen and Ammonia** are monitored at the Coldstream Creek locations monthly with increased monitoring during early snow melt, freshet, and flooding. Phosphorous and ammonia loading is an indicator of fertilizers and biological degradation.
- **Herbicides, pesticides and fuel scans** are completed every two years for the Kalamalka Lake Intake (scheduled for 2023). Every five years for the groundwater wells: Coldstream Ranch Well 2 and 3, and Antwerp Springs PH 2 (scheduled for 2023).
- **Volatile Organic Compounds (VOC)** are scheduled annually for the Kalamalka Lake Intake.

An emergency sampling kit is available in the RDNO laboratory to be used in the case of a spill, possible cross connection or other emergency testing.

3. TREATMENT AND DISINFECTION FACILITIES

3.1 DCWTP

The DCWTP has flocculation, DAF, chlorine (generated on site) and UV treatment. The DCWTP operators complete the following sampling and analysis:

Table 7 DCWTP Samples and Analysis

Raw	Online – Real Time	Grab Sample Frequency
Turbidity	Online	Daily
Temperature	Online	Daily
pH	Online	Daily
Conductivity	Online	Daily
Alkalinity	N/A	Daily
True Color	N/A	Daily
Apparent Color	N/A	Daily
Dissolved Organic Carbon	Online	N/A
Total Aluminum	N/A	Weekly
Mid-Process	Online – Real Time	Grab Sample Frequency
pH - each train	Online	Monday, Wednesday, Friday
Streaming Current - each train	Online	N/A
Turbidity - each DAF	Online	Daily
DAF Effluent	Online – Real Time	Grab Sample Frequency
Turbidity	Online	Daily
Alkalinity	N/A	Daily
Dissolved Aluminum	N/A	Tuesday, Friday
True Colour	N/A	Daily
UVT	Online	Daily
Pre-UV (Reservoir Outlet)	Online - Real Time	Grab Sample Frequency
Free Chlorine residual	Online	Daily
UVT (2)	Online	Daily
pH	Online	Daily
Post-UV	Online - Real Time	Grab Sample Frequency
Free Chlorine residual	Online	Daily
Alkalinity	N/A	Monday, Wednesday, Friday
Reactive phosphate ¹	N/A	Monday, Wednesday, Friday
Post-UV	Online - Real Time	Grab Sample Frequency
Temperature	N/A	Daily
pH	N/A	Daily
Turbidity	Online	Daily

¹Reactive phosphate is analyzed from September through April.

WQ staff will also sample and analyze bacteria and conductivity at the UV outlet.

The monthly and quarterly sampling schedules are outlined in the Appendices. The Chlorine Contact Time (CT) is applied at the DCWTP reservoir and dosage can be adjusted if required. Bacteria samples are taken after contact time which are analyzed at: CARO and the RDNO Lab.

3.2 MHWTP

The MHWTP consists of UV disinfection and chlorination generated on site.

Table 8 MHWTP Samples and Analysis

MHWTP	Online – Real Time	Grab Sample Frequency (excluding holidays)
Free Chlorine residual (before contact chamber)	Online	Monday to Friday
Free Chlorine residual (after contact chamber)	Online	Monday to Friday
Turbidity	Online	Monday to Friday
UVT	Online	Monday to Friday
Conductivity	Online	Monday to Friday
Temperature	Online	Monday to Friday
pH	Online	Monday to Friday
Total Organic Carbon	Online (calculated number using UV254)	N/A
MHWTP	Grab Samples	Grab Sample Frequency (excluding holidays)
Conductivity	Grab Sample	Monday to Friday
Temperature	Grab Sample	Monday to Friday

A chlorine residual analyzer monitors free chlorine levels after 20 minutes of contact time. The UVT is monitored online before the reactors. Both instruments are alarmed for low levels.

WQ staff will also sample at the point where chlorine contact time should be achieved.

The sampling schedules are outlined in the Appendices. Bacteria samples are taken after contact time which are analyzed at: CARO and the RDNO Lab.

3.3 Coldstream Ranch Well 3, Antwerp Springs PH 2

Coldstream Ranch Well 3 and Antwerp Springs PH 2 are both chlorinated when used as an emergency potable source. Both are equipped with chlorine residual analyzers and turbidity meters tracked through SCADA.

4. TRANSMISSION / DISTRIBUTION SYSTEM

4.1 Distribution WQ Monitoring

This portion of the WQ program is designed to meet the community water system regulations prescribed by the *DWPA and DWPR*, Schedules A and B. Supporting this design is also in the *Canadian Drinking Water Guidelines* which provide levels set for health reasons, Maximum Acceptable Concentrations (MAC), aesthetic values and Aesthetic Objectives (AO). Other parameters may be monitored if they are known to create problems within water distribution systems.

4.2 Sampling Stations – Type, Location and Number

GVW has a long and somewhat complex distribution system. Sample sites (as per DWPA and the DWO Guidebook 2022) testing must include representative samples within a distribution system.

Type - the locations for distribution sampling have been determined by the Manager, WQ, GVW staff operations, and IH. The monitoring regime is designed to capture the changes in WQ as it flows through the pipeline (i.e. flow patterns in the water distribution system). The site locations are broken down into flow ratings of high, medium and low or dead ends. The ideal combination is:

- 10% high flows/ main transmission/ Entry Point (H or EP),
- 40% medium flow (M),
- 40% low flow (L), and
- 10% dead-ends, un-looped lines and stagnant areas (DE).

The following is based under normal operations, as operational changes are often required at times. After the annual review of the sampling sites, each water system is broken down as follows:

Duteau Creek supplied system has a total of 41 sample sites:

- 12 % (5 sites) high flows/ main transmission/ entry point,
- 32% (13 sites) medium flow,
- 34 % (14 sites) low flow, and
- 22 % (9 sites) dead-ends, un-looped lines and stagnant areas.

Kalamalka Lake supplied system has a total of 33 sites:

- 9 % (3 Sites) high flows/ main transmission/ entry point,
- 52 % (17 Sites) medium flow,
- 27 % (9 Sites) low flow, and
- 12 % (4 sites) dead-ends, un-looped lines and stagnant areas.

Number - at this time there are 74 sampling sites regularly sampled throughout the GVW distribution system.

Location - the preferred location for dedicated sampling sites are sites connected directly to a water main. Public buildings or residential are the least preferred sampling sites as they may not be accessible at all times and results may not always be reliable. If a sample line cannot be run continuously, it should be a suitable size to allow water from the main to reach the tap after a brief flushing. Sampling sites are being re-evaluated as the GVW program evolves.

Every year, the RDNO discusses sample site locations with CoV and DoC operators. Some sample stations are moved to better locations and approximately three new sample stations are installed annually. In 2024, the sample station site locations will be reviewed to determine any changes required.

4.3 Distribution Monitoring Schedule

During regular operations, GVW has two main water sources with two treatment plants supplying the distribution systems:

- Duteau Creek Water Treatment Plant (DCWTP) - Duteau Creek Water Distribution system (gravity fed system), and
- Mission Hill Water Treatment Plant (MHWTP) - Kalamalka Lake Water Distribution system (pumped system).

As mentioned above, the two water systems have many interconnections which allow some blending of treated water. The water distribution system can also run on one source (treatment plant) if an emergency arises or a planned shutdown is required. There are some obstacles if this happens during peak demand periods (i.e.: summer flows) but GVW could include seasonal source Coldstream Ranch Well 3 and Antwerp Springs PH 2 to provide extra volume.

The distribution monitoring schedule is prepared by management and WQ staff. Operators and staff from the DoC, CoV and the RDNO have routes covered on a rotating four week schedule.

Appendix A has a map of all the distribution sampling sites. This schedule rotates the sampling sites from week to week to assist in a weekly overview of the entire water system.

The distribution sites are listed in the following Tables which include:

- Sample Site Name
- Site Description/Location, and
- Flow Rating:
 - o Entry Point (EP): where the water enters the distribution system (treatment plants);
 - o High (H): in the distribution system where disinfectant residual is expected to be higher than typical (after entering the distribution system or after re-chlorination);
 - o Medium (M): midpoint in the distribution system where disinfectant residual is expected to be typical;
 - o Low (L): where disinfectant residual is the lowest; and
 - o Dead ends (DE): where disinfectant residual is the lowest.

Table 9 Duteau Water Distribution Sites

ENKI Sample Site Name	Site Description / Location	Flow Rating
43rd Avenue SS	2001 43 Street	DE
6015 Highway 6	6015 Highway 6	L
7900 McClounie Road	7900 McClounie Road – Kalamalka Secondary School	L
Aberdeen Road SS	9007 Aberdeen Road	DE
Boss Creek 1 PS Return	Boss Creek PH 1 (Lower) Return/Inlet	DE
Boss Creek 2 PS Return	Boss Creek PH 2 (Upper) Return/Inlet	DE
Braeburn Drive SS	8835 Braeburn Drive (PRV 270)	L
Brewer Road SS	6815 Brewer Road	L
Coldstream Creek Road SS	12408 Coldstream Creek Road	L
Cosens Bay Road SS	Cosens Bay Road and Grieves Drive	L
Cunliffe Reservoir SS	6910 Cunliffe Road	M
DCWTP Post Treatment	1014 Whitevale Road	EP
East Dedecker Road SS	East Dedecker Road at the park	M
Foothills Booster	6805 Foothills Drive	M
Golfview Place SS	466 Golfview Place	L
Goose Lake Road PS	6604 Goose Lake Road	L
Haney Road SS	located near SPCA	DE

ENKI Sample Site Name	Site Description / Location	Flow Rating
Highway 6 SS	7446 Highway 6	L
Husband Road PS	11701 Husband Road	M
Kosmina Road SS	1701 Kosmina Road	M
Marmot Court SS	364 Marmot Court	DE
McMechan Booster	901 39 Avenue	M
Mt Grady Road SS	corner of Mt. Grady Court and Mt. Grady Road	L
Noble Canyon Road Hydrant	Noble Canyon	DE
North BX 2 PS	6302 Apple Lane	H
Old Kamloops Road SS	Highway 97 and Old Kamloops Road	M
Palfrey Drive SS	Cunliffe Road and Palfrey Drive	M
Pine Road SS	Pine Road and Coldstream Creek Road SS	M
Pleasant Valley Road SS	6522 PV Road	M
Ponderosa Way SS	13900 Ponderosa Way	L
PRV 076	8101 Highland Place	DE
PRV 1	8798 Buchanan Road	H
PRV 2	4714 Pleasant Valley Road	H
Ravine Drive PS	35 Ravine Drive	M
Rugg Road SS	6926 Rugg Road	DE
South BX 1 PS	3600 East Vernon Road	H
South BX 2 PS	5121 Dixon Dam	H
Springfield Road SS	5608 Petworth/Springfield	L
Sunpeaks Reservoir SS	7444 Sun Peaks Drive	L
Upland Drive SS	488 Upland Drive	L
Total Duteau Sites	EP = 1 / H = 4 / M = 13 / L = 14 / DE = 9	

Table 10 Kalamalka Lake Distribution Sites

Sample Site Names	Site Description / Location	Type
15th Street SS	2702 15 Street	M
21st Avenue SS	2101 32 Street	M
25 Street SS	4404 25 St SS	M
30th Street SS	3402 - 30 Street	M
35 Street SS	2806 35 Street	M
43rd Street SS	2001 43rd Street SS	M
4714 Pleasant Valley SS	City Yard fill station at 4714 Pleasant Valley Road	M

Sample Site Names	Site Description / Location	Type
Allenby PS	5715 Bella Vista Road	M
Amber Drive SS	7095 Amber Drive	DE
Anderson Way SS	5100 Anderson Way	M
Balsam Reservoir SS	558 Balsam Court	M
Brassy Place SS	803 Brassy Place	DE
College Way SS	Highway 97 and College Way	M
Dunsmuir Road SS	3025 Dunsmuir SS	L
Kidston Road SS	12101 Kidston Road	DE
Kirkland Drive SS	7906 Kirkland Drive	L
Kokanee Booster	9320 Kokanee Road	M
Longacre Drive SS	6532 Longacre Drive	L
Longspoon Court SS	595 Longspoon Court	L
McMechan Reservoir SS	39 Avenue	H
MHWTP Post Treatment	3350 Reservoir Road	EP
Mission Road SS	1400 Mission Road	L
Mt Grady Court SS	Mt Grady Court and Mt Grady Road	L
Okanagan Landing 1 PS	7864 Okanagan Landing Road	M
Okanagan Landing 2 PS	8979 Okanagan Landing Road	M
Okanagan Landing Road SS	5871 Okanagan Landing Road	M
Pottery Road SS	1802 Pottery Road	H
Tavistock Reservoir SS	9033 Tavistock Road	L
Tronson Road SS	Beachcomber Bay Road & Tronson Road	M
Turtle Mountain PS	3600 Turtle Mountain Blvd	M
Upper Commonage Booster	461 Commonage Road	L
Weeks Road SS	7540 Weeks Road	L
West Kal Road SS	7603 West Kal Road	DE
Total Kal Sites	EP = 1 / H = 2 / M = 17 / L = 9 / DE = 4	

4.4 Bacteriological

The frequency and number of samples for microbiological control monitoring is based on recommendations from the *DWPA and DWPR*.

Schedule A - WQ Standards for Potable Water Fecal Coliform bacteria – no detectable fecal Coliform bacteria per 100mLs.

Escherichia coli (*E.coli*) – no detectable *E.coli* per 100mLs.

Total Coliform Bacteria:

(a) one sample in a 30 day period - no detectable Total Coliform per 100 mls.

(b) more than one sample in a 30 day period - at least 90% of samples have no detectable total bacteria per 100 mls.

Schedule B – Frequency of Monitoring Samples

Population served by the prescribed water supply system: 5,000 to 90,000.

Number of samples per month: 1 per 1,000 populations.

Other considerations when developing a WQ monitoring program:

- quality of the source water
- number of water sources
- past frequency of unsatisfactory samples
- adequacy of treatment and capacity of the treatment plant
- size and complexity of the distribution system
- practice of disinfection; and
- size of population served.

The following table summarizes the population sizes and number of sources, which help determine the number of bacterial samples to be completed each month for GVW's WQ program. A minimum of **67** bacteriological samples are sent to CARO for analysis each month for the Kalamalka Lake and Duteau Creek systems, based on normal operations. A minimum of **50** bacterial samples are completed at the RDNO laboratory using the Colilert® methods for MPN. A total of **118** bacterial samples are analyzed monthly for the water distribution system. The schedule for the water systems is shown below.

Note: Staff and operators are asked to collect an extra bacterial sample if the free chlorine is lower than 0.20 mg/L and to deliver it to the RDNO laboratory for analysis.

Table 11 Distribution Bacteria Sampling Frequency

System	Population (approx.)	Sources/ Intakes	Sample Sites	Samples per month to Caro	Minimum Bacterial Samples per Month
Kalamalka Lake	45,000	1	33	42	41
Duteau Creek	22,000	1	41	26	17
Total 2023	67,000	2	74	68	58

4.5 Adenosine Triphosphate

Adenosine Triphosphate (ATP) is samples at sources, treatment plants and within the distribution. The sample sites and frequency are found in the following table.

Table 12 ATP Sample Sites

Sample Sites	Type	Frequency
MHWTP Post Treatment	treatment	weekly
DCWTP Post Treatment	treatment	weekly

4.6 Low Chlorine Monitoring

Chlorine is used as a disinfectant for the GVW system. As required in the DWPA, Section 6(b) and Section 5.2(a) of the DWPR. All sampling sites are monitored for free and total chlorine by operators or GVW WQ staff.

A more in-depth look at chlorine management will continue in 2024. Additional chlorine checks will be added to provide operators and the WQ team with more data for chlorine residual and optimization. The sites are as follows:

Table 13 Low Chlorine Sample Sites

Chlorine Sites	Description
Galiano Road BO	water pumped from South BX #1
Brookside Road BO	small road off Dixon Dam Road
Longspoon Court SS	Predator Ridge - chlorination
Golfview Place SS	north west - Swan Lake
Tavistock Reservoir SS	Adventure Bay
Aberdeen Road SS	Aberdeen Road

4.7 Chemical and Physical Parameters

The chemical and physical testing within the distribution system includes conductivity, temperature, turbidity, free and total chlorine and pH. Parameters chosen for the weekly analysis help identify WQ issues before they become problematic or where source blending is occurring in some areas of the distribution system.

Further examination of WQ in the distribution system is completed quarterly at two sampling sites, which are:

1. Allenby PS (Kalamalka Lake supply), and
2. PRV 2 (Duteau Creek supply).

These sites help determine if there are WQ issues due to changes in alkalinity, pH, flow (high/low), chlorine levels or the type of water mains. The schedule and parameters for these sites are located in Appendix B.

Further WQ information on the following parameters:

4.7.1 Aluminum

Dissolved and total Aluminum are monitored monthly before and after treatment on the Duteau water source. Total aluminum values can reflect on the flocculation process carried through to the treated water. Elevated dissolved aluminum can be an indicator of over application of Poly

Aluminum Chloride (PAC), the plant's primary coagulant. Aluminum is a treatment related parameter; with an Operational Guideline, developed in 1998, (OG) of < 0.2 mg/L (other treatment type, not conventional). The OG applies to treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum. OGs are based on a running annual average of monthly samples. The naturally occurring Aluminum in the Duteau Creek source averages around 0.12 mg/L.

Currently, Health Canada has developed a technical guideline document to solicit comments on the proposed guideline and OG values. The document proposed a MAC of 2.9 mg/L for total aluminum and a OG value of 0.050 mg/L is proposed for total aluminum to optimize water treatment and distribution systems.

4.7.2 Orthophosphate Corrosion Inhibitor

Orthophosphates are used primarily as a corrosion inhibitor with its ability to create passivity film on the surface of distribution pipes. In this project, WQ staff have investigated the effectiveness of the zinc orthophosphate addition to the water distribution system. Zinc orthophosphate is injected into the treated water at the DCWTP in the fall until spring to reduce issues arising from cast and ductile iron waterlines in the distribution system. The Zinc orthophosphate has the ability to create an inert and resilient protective, microscopic layer on metal surfaces. This film acts as a barrier between the oxygenated and corrosive potable water and the metal pipe surface which minimizes the release of iron, lead, copper, and other metals that indicate corrosion is occurring and can produce harmful effects in the system. If properly applied, all the Zinc orthophosphate reacts with the pipe surface and there is no active residual left in the water. Samples are routinely collected at the sites listed in the following table, then brought to the RDNO laboratory for analysis. Operators at the DCWTP grab and analyze samples from the reservoir three times per week to analyze reactive phosphate.

Table 14 Corrosion Inhibitor Monitoring Sites

Sample Sites	Parameters Apply to All Sample Sites
DCWTP Post Treatment	Reactive Phosphate, Iron
Aberdeen Road SS	
Sunpeaks Reservoir SS	
Golfview Place SS	
Noble Canyon Road Hydrant	

4.7.3 Disinfection By-Products

Disinfection By-products (DBP) are monitored as per the GCDWQ. The distribution systems are monitored quarterly for Trihalomethanes (THM's) and Haloacetic acids (HAA's) have been designed to look at the following conditions:

- first customer or point of entry - water treatment plants,
- at points in the distribution system with the longest disinfectant retention time,
- the worst case scenario (longest contact time), and
- the effect of different sources blending in the distribution system.

The maximum acceptable concentration (MAC) for the distribution system is based on a locational running annual average of the quarterly samples taken at the sample sites with the longest disinfectant retention time. The following sample sites will be monitored in March, June, September and November of annually.

Table 15 Disinfection By-Products Monitoring Sites

Sample Sites	Location in Distribution	Most Common Source	Parameters
DCWTP Post Treatment	first customer – entry point	Duteau Creek	THM, HAA, Bacterial, TOC
Palfrey Drive SS	mid-point - after re-chlorination at PRV#1	Duteau Creek	THM, HAA, Bacterial
Sunpeaks Reservoir SS	longest disinfectant retention time	Duteau Creek	THM, HAA, Bacterial
Golfview Place SS	longest disinfectant retention time	Duteau Creek	THM, HAA, Bacterial
MHWTP Post Treatment	first customer - entry point	Kalamalka Lake	THM, HAA, Bacterial, TOC
Tavistock Reservoir SS	longest disinfectant retention time	Kalamalka Lake	THM, HAA, Bacterial
Allenby PS	mid-point	Kalamalka Lake	THM, HAA, Bacterial
Longspoon Reservoir SS	longest disinfectant retention time	Kalamalka Lake	THM, HAA, Bacterial

5. REPORTING

RDNO uses ENKI, an internet based data software system with centralized information management. The ENKI database is accessible to all who have been registered as “users” by the administrator (GVW Manager, WQ).

At this time, WQ notification and maintenance activities such as flushing can be found on the RDNO website at www.rdno.ca. Customers can subscribe to receive announcements, media releases, and updates by email at <https://www.rdno.ca/subscribe>.

Weekly reports are generated by GVW WQ staff for Operations Supervisors by Friday of each week. This allows an overview of chlorine residuals, turbidity and bacterial results within the distribution system and some source water information.

Monthly WQ reports are generated by GVW WQ staff for Interior Health each month. All reports are sent to the Drinking Water Officer, Operations Supervisors and the WQ Manager by the 15 day of the following month. Following review, the reports are posted on the RDNO website.

An annual WQ report is due on June 30 for the previous year. The report includes microbiological, inorganic and organic parameters for the sources and the distribution system plus recommendations to improve WQ where standards and aesthetic issues are not met.

6. REFERENCES

Decision Tree for Responding to a Turbidity Event in Unfiltered Drinking Water, Ministry of Health, BC, April 2013.

Drinking Water Protection Act [SBC 2001] Chapter 9, *Assented to April 11, 2001*.

Drinking Water Protection Regulation, B.C. Reg. 200/2003 [includes amendments up to B.C. Reg. 87/2011, May 19, 2011].

Guidelines for Canadian Drinking Water Quality, Health Canada, *February 2017*.

WQG-01 Source Drinking Water Quality Guidelines, Ministry of Environment & Climate Change Strategy, Water Protection & Sustainability Branch , 2017.

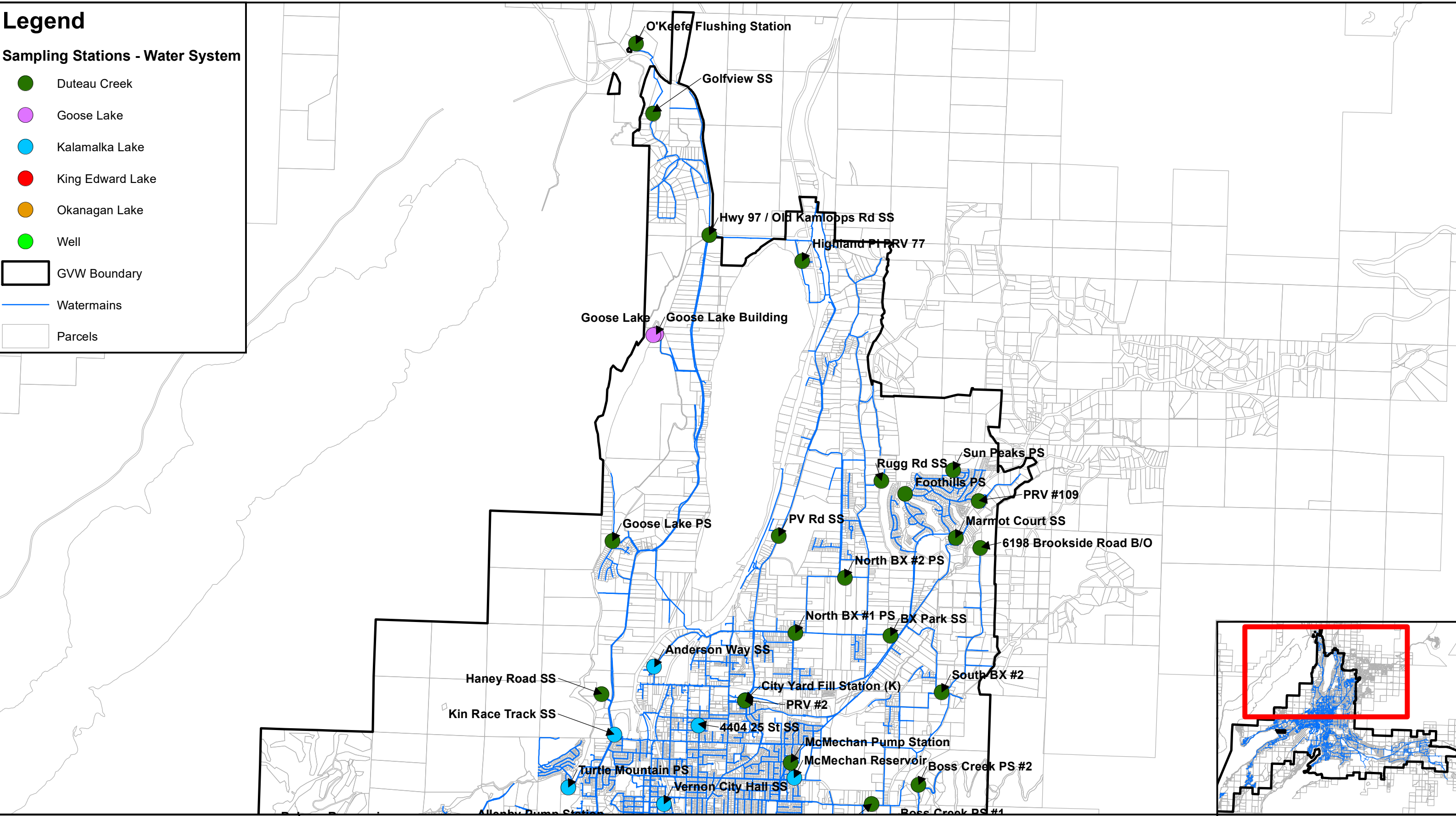
APPENDICES

APPENDIX A - WQ Maps of Sample Sites

Legend

Sampling Stations - Water System

- Duteau Creek
- Goose Lake
- Kalamalka Lake
- King Edward Lake
- Okanagan Lake
- Well
- GVW Boundary
- Watermains
- Parcels



This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

GVW Sampling Stations - North

Plot Date: Apr 27, 2022

Scale: 1:50,000

0 2 4 8 Kilometers

Plot Size: 17" x 11"

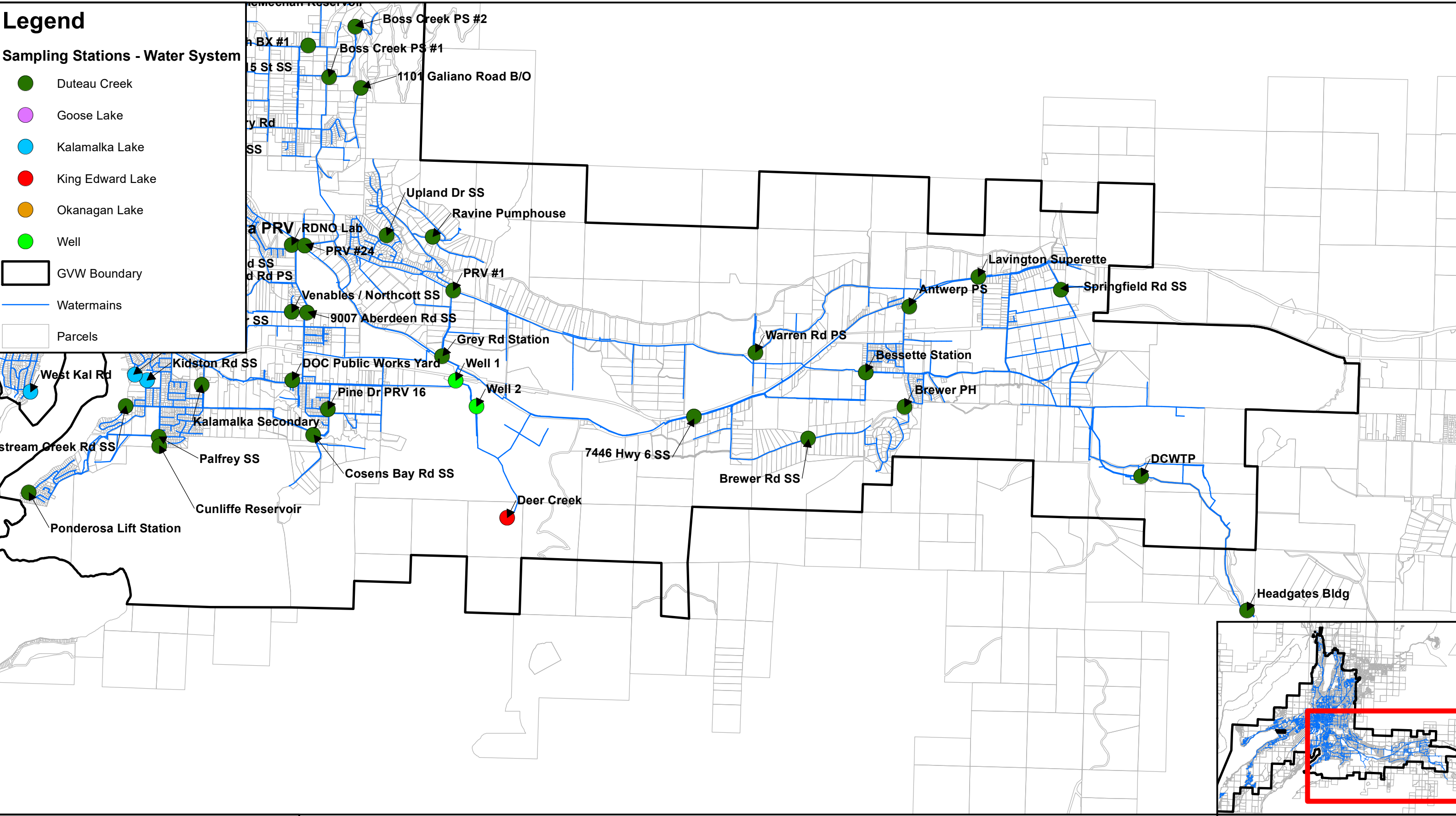
REGIONAL
DISTRICT
NORTH
OKANAGAN

RD NO

Legend

Sampling Stations - Water System

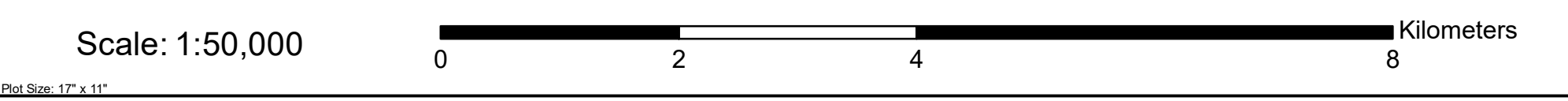
- Duteau Creek
- Goose Lake
- Kalamalka Lake
- King Edward Lake
- Okanagan Lake
- Well
- GVW Boundary
- Watermains
- Parcels



This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

GVW Sampling Stations - East

Plot Date: Apr 27, 2022












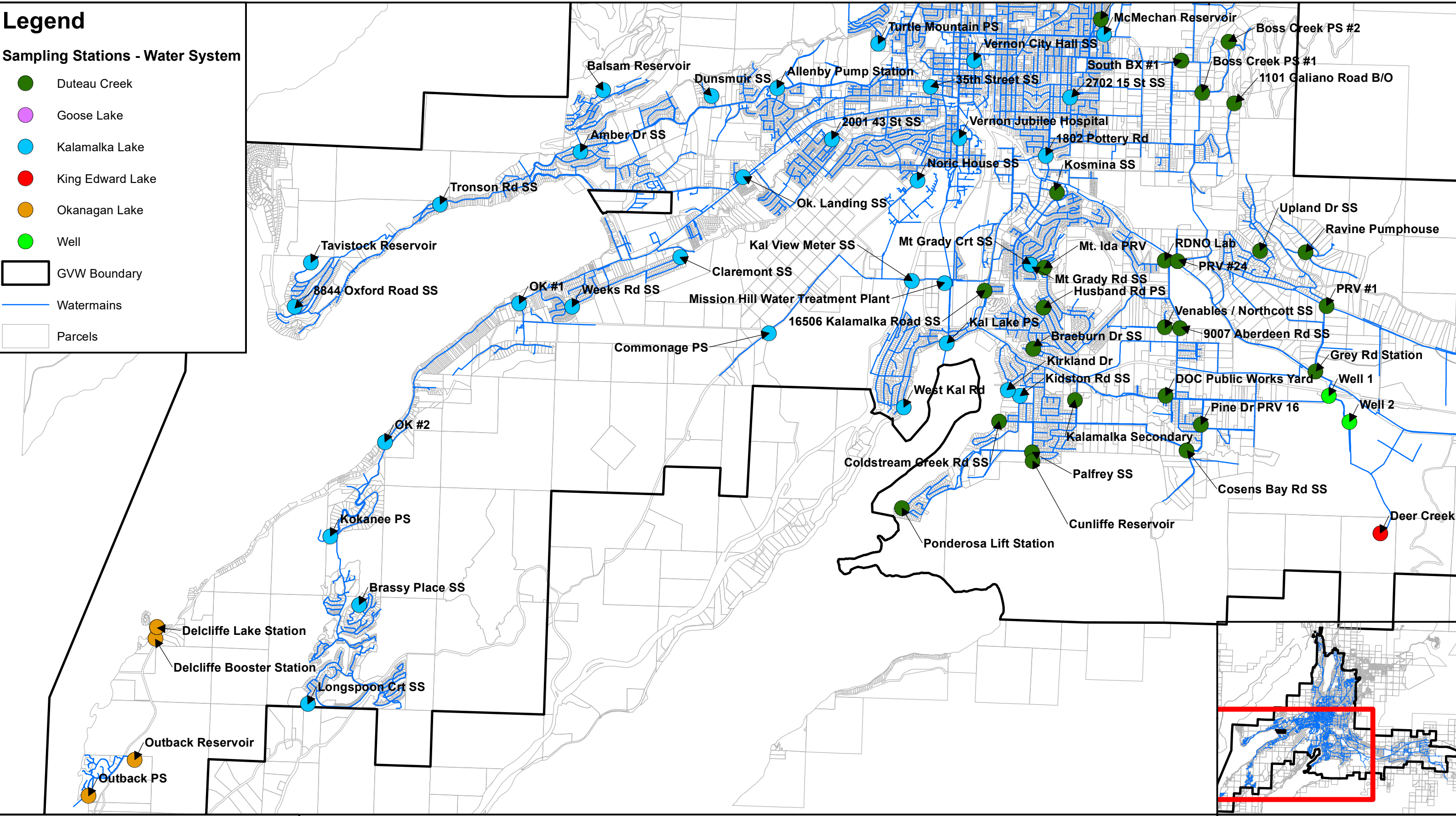
REGIONAL
DISTRICT
NORTH
OKANAGAN

RDNO

Legend

Sampling Stations - Water System

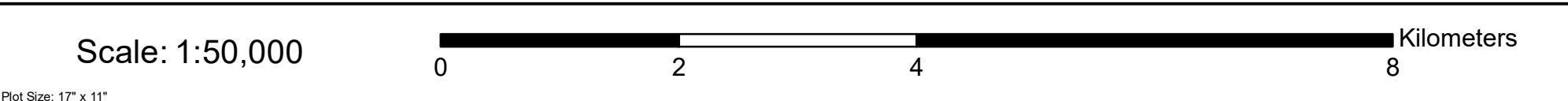
-  Duteau Creek
-  Goose Lake
-  Kalamalka Lake
-  King Edward Lake
-  Okanagan Lake
-  Well
-  GVW Boundary
-  Watermains
-  Parcels



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GVW Sampling Stations - West

Plot Date: Apr 27, 2022





REGIONAL
DISTRICT
NORTH
OKANAGAN



RDNO

APPENDIX B - Parameters and Schedule

Weekly Sampling

1st, 2nd, 4th (5th) Tuesdays

SOURCES	Kalamalka Lake Intake	Freshet (Feb/March - June)
	Duteau Creek Intake	Summer (May - Nov)
TREATMENT PLANTS	DCWTP Post Treatment	Winter (October to April)
	MHWTP Post Treatment	Irrigation (April 15 to September 30)
KALAMALKA WATERSHED	Coldstream Creek	Marl (mid June - ??)
IRRIGATION	Goose Lake	
SEASONAL / POTABLE	Coldstream Ranch Well 1 (Prechlorination)	

***NOTE: take algae density sample if distinct odor to the water (fishy, septic, skunky and grassy)**

SOURCES

SAMPLE SITE	BOTTLES	PARAMETERS
Kalamalka Lake Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 250 mL Caro	DOC (1st week of Month)
	1 - TOC (2 bottles)	TOC (1st week of Month)
Kalamalka Lake Intake Extra Sampling	1 - 125 ml Caro (Yellow Lid)	TP
	1 - 250 mL Caro	TN

Freshet and Lake flips (Feb/March and May/June) and (October/November)- Take TP and TN when lake flips (Turbidity <1)

NOTE: if Kalamalka Lake Source is turned off, there is a pump running to take source samples at the sample line and run the online turbidimeter

NOTE: Marl increases Turbidity

SAMPLE SITES	BOTTLES	PARAMETERS
Duteau Creek Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
Duteau Creek Intake Extra Sampling	1 - 125 ml Caro (Yellow Lid)	TP
	1 - 250 mL Caro	TN

Duteau Creek Intake during freshet and if turbidity or flows pick up take extra samples: TP, TN

Weekly Sampling

TREATMENT PLANTS

SAMPLE SITES	BOTTLES	PARAMETERS
DCWTP Post Treatment	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - Caro Bacterial	Total Coliform, E.Coli
MHWTP Post Treatment	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - Caro Bacterial	Total Coliform, E.Coli

KALAMALKA WATERSHED

COLDSTREAM CREEK

WEEKLY: February/March to June (Freshet) sampled every Tuesday and during major rain events.

MONTHLY: July to January/February: Coldstream Creek will be sampled one per month (fourth Tuesday) and during any major rain events

Freshet: during the snow melt; water level, turbidity will be higher in creek

Monthly - Fourth or Fifth Tuesday of month
(and during events)

COLDSTREAM CREEK SAMPLING

SAMPLE SITES	BOTTLES	PARAMETERS
Coldstream Creek at Kirkland Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Howe Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Brewer Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at School Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC

Weekly Sampling

Coldstream Creek Sampling

1st, 2nd and 3rd & 5th Tuesday of month during freshet (March until June)

SAMPLE SITES	BOTTLES	PARAMETERS
Coldstream Creek at Kirkland Drive	1 - Caro Bacterial	Total Coliform, E.coli
Coldstream Creek at Howe Drive	1 - Caro Bacterial	Total Coliform, E.coli
Coldstream Creek at Brewer Road	1 - Caro Bacterial	Total Coliform, E.coli
Coldstream Creek at School Road	1 - Caro Bacterial	Total Coliform, E.coli

IRRIGATION

every week during irrigation season: April 15 to September 30

SAMPLE SITES	BOTTLES	PARAMETERS
Goose Lake Intake	1 - 1 L Algae Density	
Goose Lake Shore	1 - 1 L Algae Density	Approximately start Mid June until September 30
	* Lake Observation visual / odor comments	

SEASONAL SOURCE sample if being used for potable water

Annual to be completed prior to Well turn on for the season

SAMPLE SITES	BOTTLES	PARAMETERS
Coldstream Ranch Well 3 Prechlorination	1 - 100 mL PA	Bacterial (Most Probable Number)

3rd Tuesday of every month

Monthly Sampling

SOURCES	Kalamalka Lake Intake	Freshet (Feb/March - June)
	Duteau Creek Intake	Summer (May - Nov)
TREATMENT PLANTS	DCWTP Post Treatment	Winter (October to April)
	MHWTP Post Treatment	Irrigation (April 15 to September 30)
SOURCES	Outback Intake	
	Delcliffe Intake	
TREATED	Outback Reservoir SS	
KALAMALKA LAKE WATERSHED	Coldstream Creek	
IRRIGATION	Goose Lake	
SEASONAL / POTABLE	Coldstream Ranch Well 1 (Prechlorination)	

***NOTE: take algae density sample if distinct odor to the water
(fishy, septic, skunky and grassy)**

SOURCES

SAMPLE SITE	BOTTLES	PARAMETERS
Kalamalka Lake Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria) IRB (Iron Related Bacteria)
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - TOC Caro (2 bottles)	TOC
	1 - 250 mL Caro	DOC
	1 - 1 L (in house)	Algae Density
	1 - 4 L Caro	chlorophyll a
	1 - 1 L Caro	Heather Larratt schedule →
Kalamalka Lake Intake Extra Sampling	1 - 125 ml Caro (Yellow lid)	TP
	1 - 250 mL Caro	TN

Kalamalka Lake Intake - Freshet and Lake flips (Feb/March and May/June) and (October/November)- Take TP and TN when lake flips (Turbidity <1)

NOTE: if Kalamalka Lake Source is turned off, there is a pump running to take source samples at the sample line and run the online turbidimeter

3rd Tuesday of every month

Monthly Sampling

Duteau Creek Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - Metals Caro	Al
	1 - TOC Caro (2 bottles)	TOC
	1 - 250 mL Caro	dissolved Al
	1 - 500 mL in house	Iron
	1 - 1 L in house	Algae Density (June - October)
	1 - 4 L Caro	chlorophyll a
Duteau Creek Intake Extra Sampling	1 - 125 ml Caro (Yellow lid)	TP
	1 - 250 mL Caro	TN

Duteau Creek Intake during freshet and if turbidity or flows pick up take extra samples: TP, TN

note: Marl increases Turbidity

TREATMENT PLANTS

SAMPLE SITES	BOTTLES	PARAMETERS
DCWTP Post Treatment	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - 500 mL Caro	dissolved Aluminum, UVT (Unfiltered)
	1 - Metals Caro	Aluminum
	1 - TOC Caro (2 bottles)	TOC
	1 - 500 mL in house	Iron
MHWTP Post Treatment	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria) IRB (Iron Related Bacteria)
	1 - PA	Bacterial (Most Probable Number)
	1 - TOC Caro (2 bottles)	TOC
	1 - 250 mL Caro	DOC

3rd Tuesday of every month

Monthly Sampling

SOURCES - OUTBACK AND DELCLIFFE

Outback (Monthly - Fourth Monday of every Month)

SAMPLE SITES	BOTTLES	PARAMETERS
Outback Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria), IRB (Iron Related Bacteria)
	1 - 200 mL PA (Duplicate)	Bacterial (Most Probable Number)
	1 - TOC Caro	TOC
	1 - 1 L in house	Algae Density (May to November)
	1 - 4 L Caro	Chlorophyll a (May to November)

Note: WQ samples raw water at Outback and Delcliff monthly
no distribution except quarterly THM's at Outback Reservoir

Delcliff (Monthly - Fourth Monday of every Month)

SAMPLE SITES	BOTTLES	PARAMETERS
Delcliff Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 mL PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 mL Caro (yellow lid)	TP
	1 - 250 mL Caro	DOC, TN
	1 - TOC (2 bottles)	TOC
	1 - 500 mL in house	UVT (UF)
	1 - 1 L in house	Algae Density (May to November)
	1 - 4 L Caro	Chlorophyll a (May to November)

NOTE: Delcliff Intake: call operator to meet so they can turn the raw water on

NOTE :Please take a Chlorine at the raw before taking a sample to ensure there is not chlorine

KALAMALKA WATERSHED

Coldstream Creek Sampling

WEEKLY: February/March to June (Freshet) sampled every Tuesday and during major rain events.

MONTHLY: July to January/February: Coldstream Creek will be sampled one per month (fourth Tuesday) and during any major rain events

Freshet: during the snow melt; water level, turbidity will be higher in creek

Monthly - Fourth or Fifth Tuesday of month
(and during events)

Coldstream Creek Sampling

SAMPLE SITES	BOTTLES	PARAMETERS
Coldstream Creek at Kirkland Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Howe Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Brewer Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at School Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC

IRRIGATION

SAMPLE SITES	BOTTLES	PARAMETERS
Goose Lake Intake	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - 1 L Algae Density	in house - algae
	1 - 125 ml Caro (Yellow lid)	TP
	1 - 500 mL Caro	TN, DOC
	1 - 4 L Caro	Chlorophyll A
Goose Lake Shore	1 - 1 L Algae Density	Approximately Mid June until September 30
	* Lake Observation visual / odor comments	

send out a voyent alert stating we are no longer monitoring Goose Lake

October 1st - Just sampling algae until the end of October due to high counts and we have learned that Goose Lake is never actually fully turned off.

SEASONAL SOURCE (sample if being used for potable water)

SAMPLE SITES	BOTTLES	PARAMETERS
Coldstream Ranch Well 3 Prechlorination	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	HPC
	1 - Caro Bacterial	Iron Related Bacteria
	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - Metals Caro	Manganese
	1 - 500 mL in house	Sulphate, Iron, Manganese

3rd Tuesday of every 3rd month

Quarterly Sampling

Quarterly (Feb, May, Aug, Nov)

SOURCES	Kalamalka Lake Intake	Freshet (Feb/March - June)
	Duteau Creek Intake	Summer (May - Nov)
TREATMENT PLANTS	DCWTP Post Treatment	Winter (October to April)
	MHWTP Post Treatment	Irrigation (April 15 to September 30)
DISTRIBUTION	PRV 2	Various Sample dates
	Allenby PS	
SOURCES	Outback Intake	
	Delcliffe Intake	
TREATED	Outback Reservoir SS	
KALAMALKA LAKE	Coldstream Creek	
WATERSHED	Goose Lake	
IRRIGATION	Coldstream Ranch Well 1	
SEASONAL / POTABLE	(Prechlorination)	

***NOTE: take algae density sample if distinct odor to the water (fishy, septic, skunky and grassy)**

SOURCES

SAMPLE SITE	BOTTLES	PARAMETERS
Kalamalka Lake intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria) IRB (Iron Related Bacteria)
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - TOC Caro (2 bottles)	TOC
	1 - 125 ml Caro (Yellow lid)	TP* (May & August only)
	1 - 500 mL Caro	DOC, Bromide TN* (May & August only)
	1 - 500 mL in house	Colour (true & apparent), Alkalinity, Hardness
	1 - 1 L (in house)	Algae Density (May to November)
	1 - 4 L Caro	chlorophyll a (May to November)
	1 - 1 L Caro	Heather Larratt schedule →

Kalamalka Lake Intake - Freshet and Lake flips (Feb/March and May/June) and (October/November)- Take TP and TN when lake flips (Turbidity <1)

NOTE: if Kalamalka Lake Source is turned off, there is a pump running to take source samples at the sample line and run the online turbidimeter

SAMPLE SITE	BOTTLES	PARAMETERS
Duteau Creek Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - Metals Caro	Aluminum
	1 - TOC Caro (2 bottles)	TOC
	1 - 125 ml Caro (Yellow lid)	TP
	1 - 500 mL Caro	DOC, TN, dissolved Aluminum, Chloride, Bromide
	1 - 500 mL in house	Iron
	1 - 1 L in house	Algae Density (June - October)
	1 - 4 L Caro	chlorophyll a

Duteau Creek Intake during freshet and if turbidity or flows pick up take extra samples: TP, TN

TREATMENT PLANTS

SAMPLE SITE	BOTTLES	PARAMETERS
DCWTP Post Treatment	1 - Caro Bacterial	Total Coliform, E. Coli
	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - 500 mL Caro	dissolved Aluminum, DOC
	1 - Metals Caro	Aluminum
	1 - TOC Caro (2 bottles)	TOC
	1 - 500 mL in house	Iron
MHWTP Post Treatment	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria) IRB (Iron Related Bacteria)
	1 - 100 mL PA	Bacterial (Most Probable Number)
	1 - 250 mL Caro	DOC
	1 - TOC Caro (2 bottles)	TOC
	1 - 500 mL in house	Colour (apparent), Sulfate

DISTRIBUTION

SAMPLE SITE	BOTTLES	PARAMETERS
PRV 2	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 100 mL PA	PA (MPN if $Cl_2 < 0.20$)
	1 - 125 mL Caro	Dissolved Aluminum
	1 - 125 mL Metals Caro	Aluminium
	1 - 1 L in house	Iron, Colour (apparent), Alkalinity, Hardness
Allenby PS	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 100 mL PA	PA (MPN if $Cl_2 < 0.20$)
	1 - 1 L in house	Sulfate, Colour (apparent), Alkalinity, Hardness

KALAMALKA WATERSHED

COLDSTREAM CREEK

WEEKLY: February/March to June (Freshet) sampled every Tuesday and during major rain events.

MONTHLY: July to January/February: Coldstream Creek will be sampled one per month (fourth Tuesday) and during any major rain events

Freshet: during the snow melt; water level, turbidity will be higher in creek

Fourth or Fifth Tuesday of month

COLDSTREAM CREEK SAMPLING

SAMPLE SITE	BOTTLES	PARAMETERS
Coldstream Creek at Kirkland Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Howe Drive	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at Brewer Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC
Coldstream Creek at School Road	1 - Caro Bacterial	Total Coliform, E.coli
	1 - 125 mL Caro (Yellow Lid)	TP, Ammonia
	1 - 250 mL Caro	TN, Chloride, Sulphate
	1 - TOC (2 bottles)	TOC

SOURCES - OUTBACK AND DELCLIFFE

Note: WQ samples raw water at Outback and Delcliff monthly
no distribution except quarterly THM's at Outback Reservoir

Outback - Quarterly - **Fourth Monday of (March, June, September, December)**

SAMPLE SITE	BOTTLES	PARAMETERS
Outback Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria), IRB (Iron Related Bacteria)
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - TOC Caro	TOC
	1 - 125 mL Caro (yellow lid)	TP
	1 - 250 ml Caro	TN
	Quarterly: 1 - 500 mL in house	sulfate, Apparent Colour, Total Alkalinity, Total Hardness
	1 - 1 L in house	Algae Density
	1 - 4 L Caro	Chlorophyll a
Outback Reservoir SS	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	Quarterly: 2 - THM bottles	THM's
	Quarterly: 2 - HAA bottles	HAA's

Delcliff - Monthly

NOTE: Delcliff Raw: call operator to meet so they can turn the raw water on

NOTE: Please take a Chlorine at the raw before taking a sample to ensure there is not chlorine

SAMPLE SITE	BOTTLES	PARAMETERS
Delcliff Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 mL Caro (yellow lid)	TP
	1 - 250 mL Caro	DOC, TN
	1 - 500 mL in house	UVT (UF)
	1 - TOC (2 bottles)	TOC
	1 - 1 L in house	Algae Density (May to November)
	1 - 4 L Caro	Chlorophyll a (May to November)

Irrigation

SAMPLE SITE	BOTTLES	PARAMETERS
Goose Lake Intake	1 - PA	Bacterial (Most Probable Number)
	1 - 1 L Algae Density	in house - algae
	1 - 125 ml Caro (Yellow lid)	TP
	1 - 500 mL Caro	TN, DOC
	1 - 4 L Caro	Chlorophyll A
Goose Lake Shore	1 - 1 L Algae Density	Approximately start Mid June until September 30
	* Lake Observation visual / odor comments	

SEASONAL SOURCE sample if being used for potable water

SAMPLE SITE	BOTTLES	PARAMETERS
Coldstream Ranch Well 3 Prechlorination	1 - Caro Bacterial	Total Coliform, E.Coli
	<i>1 - Caro Bacterial</i>	<i>HPC</i>
	<i>1 - Caro Bacterial</i>	<i>Iron Related Bacteria (in house)</i>
	weekly	Bacterial (Most Probable Number)
	1 - Metals Caro	Manganese
	1 - 500 mL in house	Sulphate, Iron, Manganese

Annually

Sources Kalamalka Lake Intake
Duteau Creek Intake
Seasonal Source Coldstream Ranch Well 1
(Prechlorination)

Bi-Annually (January/July)

Distribution PRV 2
Allenby PS

Every 5 Years (2024, 2029 etc)

Irrigation Goose Lake Intake
Coldstream Ranch Well 3

Deer Creek Intake Pond

Emergency Source Antwerp Springs PH 2

Comprehensive Sampling

Kalamalka Lake:

every 2 years (2021, 2023 etc):

Herbicides & Pesticides: June

Fuels: August

Annually

VOC's : July

Groundwater:

every 5 years (2019, 2024 etc):

Herbicides & Pesticides, Fuels: July

VOC's : July (Annually)

SOURCES

SAMPLE SITE	BOTTLES	PARAMETERS
Kalamalka Lake Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	SRB (sulfur reducing bacteria) IRB (Iron Related Bacteria)
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - Cyanide	
	1 - 125 mL Caro (Yellow lid)	TP
	1 - TOC Caro (2 bottles)	TOC
	1 - VOC Caro (2 bottles)	VOC
	1 - 1 L Caro	
	1 - 4 L Caro	Chlorophyll a
	(June) 2 - 40 ml amber glass vials preserved with Na2S2O3 (THM Vials)	Herbicides (2023, 2025, 2027 etc)
	(June) 2 - 1 L amber Caro*	Pesticides (2023, 2025, 2027 etc)
	(August) 2 - 1 L amber Caro	Fuel Scan (HEPL/LEPL) (2023, 2025, 2027 etc)

Annually

Comprehensive Sampling

Duteau Creek Intake	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 500 mL in house	Iron
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - Cyanide	
	1 - 125 mL Caro (Yellow lid)	TP
	1 - TOC Caro (2 bottles)	TOC
	1 - 1 L Caro	
	1 - 4 L Caro	Chlorophyll a

Duteau Creek Intake: Ensure Dissolve Aluminum is on the CoC

Distribution

3rd Tuesday in January and July

Bi-Annually - January and July

Site and Water Trax #	Bottles	Parameters
PRV 2 Should reflect Duteau distribution water	1 - Caro Baterial	Total Coliform, E.Coli
	1 - PA	PA (MPN if CI2 <0.20)
	1 - 500 mL in house	Colour (true)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 125 mL Caro (Yellow lid)	TP
	1 - Cyanide	Cyanide
	1 - TOC (2 bottles)	TOC
	1 - 1 L Caro	
Allenby PS Note: Should reflect Kal distribution water	1 - Caro Baterial	Total Coliform, E.Coli
	1 - PA	PA (MPN if CI2 <0.20)
	1 - 500 mL in house	Colour (true)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 125 mL Caro (Yellow lid)	TP
	1 - Cyanide	Cyanide
	1 - TOC (2 bottles)	TOC
	1 - 1 L Caro	

Annually

Comprehensive Sampling

Outback - Annual (July)

Site and water trax #	Bottles	Parameters
Outback Intake	1 - Caro Baterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 125 mL Caro (Yellow lid)	TP
	1 - Cyanide	Cyanide
	1 - TOC	TOC
	1 - 1 L Caro	
	1 - 4 L Caro	chlorophyll a
	1 - 1 L in house	Algae Density

Delcliffe - Annual

NOTE: Delcliffe Intake: call operator to meet so they can turn the raw water on

NOTE: Please take a Chlorine at the raw before taking a sample to ensure there is not chlorine

Site and water trax #	Bottles	Parameters
Delcliffe Intake	1 - Caro Baterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 125 mL Caro (Yellow lid)	
	1 - Cyanide	Cyanide
	1 - TOC	TOC
	1 - 1 L Caro	
	1 - 500 mL in house	UVT (UF)
	1 - 4 L Caro	chlorophyll a
	1 - 1 L in house	Algae Density

Annually

Comprehensive Sampling

Seasonal Irrigation Source - annually (Well #3 can be used as an emergency potable source)

Coldstream Ranch Well 3 (Replace Well #1; drilled in Fall/Winter 2019)	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - Caro Bacterial	HPC
	1 - Caro Bacterial	Iron Reducing Bacteria
	1 - Caro Bacterial	Sulfur Reducing Bacteria
	1 - PA	Bacterial (Most Probable Number)
	1 - 500 mL in house	Sulphate and Iron
	1 - Cyanide	
	1 - 125 mL Caro (Yellow lid)	
	1 - 125 mL Metals Caro	
	1 - 40 mL mercury glass metals	
	1 - 1 L Caro	
	1 - VOC Caro (2 bottles)	VOC's
	1 - 250 mL amber bottles (NaHSO ₄)	Fuel Scan (HEPL/LEPL) (2021, 2023, 2028 etc)
	2 - 40 ml amber glass vials preserved with Na ₂ S ₂ O ₃ (THM Vials)	Herbicides (2021, 2023, 2028 etc)
	2 - 1 L amber Caro*	Pesticides (2021, 2023, 2028 etc)

Note: Palfrey is shut off during the winter. Please contact DoC a couple days prior to turn on for the December and March samples.
NOTE: Contact DCWTP a few days prior to sampling to let them

THM's, HAA's & TOCs
(Mar, Jun, Sept, Nov)

Site		WaterTrax #	Most common Source	March, June, September, Decemember
DCWTP Post Treatment	entry point	23E7C	Duteau	THM, HAA, PA, TOC
Palfrey Drive SS	mid point	5ED7	Duteau	THM, HAA, PA
Golfview SS	end point	358A8	Duteau	THM, HAA, PA
Sunpeaks Reservoir SS	end point	229C3	Duteau	THM, HAA, PA
MHWTP Post Treatment	entry point	2427B	Kal	THM, HAA, 200 ml PA (duplicate), TOC
Tavistock Reservoir SS	end point	264EB	Kal	THM, HAA, PA
Longspoon Reservoir SS	end point	270F1	Kal	THM, HAA, PA
Allenby PS	mid point	280F5	Kal	THM, HAA, PA

Each site:		1 - PA
		1 - PA (200 ml) duplicate (DCWTP Post Treatment)
		2 - THM Bottles
		2 - HAA's
	DCWTP & MHWTP	2 - TOC bottles

***Note - be sure Outback THM's are completed March, June, September and November**

Duplicates:

November 19th 2020

Dup 4A

MHWTP Post Treatment

January 2019	<p>Extra THM sampling Foothills Outflow, McMechanan PS, Sunpeaks This is to assist in determining if the mixer put into Foothills reservoir in December 2018 is helping reduce THMs</p>
January 2018	<p>Removed perchlorate because there were very few detectable results</p>
December 2017	<p>For 2018 switched from Longspoon PH to Longspoon Reservoir as reservoir has longer retention time and is after re-chlorination at Longspoon PS. The PS sample site was before re-chlorination.</p>
November 2017	<p>Extra sample at Brewer to check if the mixer in Antwerp is working. The mixer in Antwerp Reservoir was installed Aug/Sept 2017</p>
Nov/Dec 2017	<p>Removed Ravine and Middleton Reservoirs from site of interest sampling and added in Grey Rd after chlorination if possible (March and September). Sampling Grey Rd and Brewer Rd SS before and after UV at DCWTP to determine if improvement after UV. Added McMechan PS (up to Foothills) and Foothills outlet to determine THM and HAAs in Foothills area. These will be completed in March and September.</p>
January 2016	<p>Removed Brewer Rd SS from regular THM sampling and added it Site of Interest sampling dates instead (March and August). Also added Ravine Res and Middleton Res to Site of Interest sampling for 2017. These sites are not regular sample sites and will be relooked at the end of 2017. Perchlorate has been added for 2017 to the eight regular sites in March (low flow) and August (high flow) to investigate if there are any concerns regarding hypo by-products.</p>
December 2016	<p>Added Brewer Rd SS to THM sampling in September 2016. Will continue to monitor this site in 2017 for the chlorine management program. Re-look at this site at the end of 2017. Removed Stepping Stones SS and added Golf View SS for 2017. Stopped sampling for bromate, chlorate, chlorite in 2017</p>

Added Bromate, Chlorite, and Chlorite analysis to THM sampling for 2016. One bottle for each site that gets analyzed at AGAT. Review for 2017 if will continue.

February 2016

NOTE: these are sent to AGAT, therefore you must get the bottles and preservatives prior to sampling.

These samples must be dropped off at Purolator by 4:30.

January 26, 2015

Renee and Dale had a meeting
DCWTP, Palfrey or Ponderosa, Sunpeaks, Stepping Stones (Golf once in), Longspoon PS, Tavistock, MHTP, Allenby

Changes January 12, 2015

Duteau	sunpeaks instead of foothill Golfview (new site) or Steppingstones or O'Keefe
Kalamalka	Tavistock and Longspoon

removed HPC from all sites - have enough data 4 years of data (since 2011)

changed foothills to SunPeaks - Foothills can be either source or reservoir or distribution and right after chlorination

December 12, 2014

changed Stepping Stones to highland - stepping stones tends to freeze and will only run for 2 minutes at a time and can't turn down pressure

changed Kokanee to Longspoon PS

changed city hall to Tavistock

June 2014

removed BX Park (Foothills is Duteau now)
removed Old Kamloops Road (Duteau mainly)
added City Hall for Kalamalka
Did not add Anderson Way (on Kal only 60% of the time)

Reactive Phosphate and Iron Sampling Program

RDNO Operator Sampling	Frequency	Parameters	Comments
DCWTP Post Treatment	3X/Week	DCWTP Lab: Reactive Phosphate, Alkalinity	Reservoir

DCWTP operators analyze and enter these results to WaterTrax

DoC Sampling	Frequency	Parameters	Comments
Noble Canyon Road Hydrant	monthly	GVW Lab: Reactive Phosphate & Iron	Week 3 (added January 2021)
Aberdeen Road SS	weekly	GVW Lab: Reactive Phosphate & Iron	Week 1, 2, 3 & 4 (added March 5, 2019)

CoV Sampling	Frequency	Parameters	Comments
Golfview SS	Monthly	GVW Lab: Reactive Phosphate & Iron	Week 1 (added January 2021)
Sunpeaks Reservoir SS	Monthly	GVW Lab: Reactive Phosphate & Iron	Week 3 (added January 2021)

October 4th - Zinc orthophosphate online. It will be an odd year for sampling as with Duteau system is a lot smaller with the headgates project. Dosing will be somewhat intermittent depending how low the flows out of Duteau are the same as UV. RDNO ops will test for reactive phosphate downstream of injection as normal. (as per email fwd from Tricia from Dustin on October 5, 2022 at 2:37 pm)

Older information

Base Line Samples	Parameters: orthophosphate Zinc
Foothills	5-Dec-13
Ponderosa	5-Dec-13
PRV #2	19-Feb-13, 16-Jul-13, 4-Dec-13
Bessette	10-Dec-13

2019:

9007 Aberdeen Road will be sampled for two projects:

Chlorine Residual and Mangement Project

Orthophosphate Corrosion Inhibitor Project

Orthophosphate Notes:

October 14, 2020: Zinc orthophosphate dosing started at Duteau WTP for the season. Dosing at start will occur at 5.0mg/L and will be adjusted to achieve a 1.4-1.6mg/L reactive phosphate concentration in the water. There is a plan to fix a leak on Duteau reservoir outlet the UV plant will be bypassed in November for this. Dosing during this project will be moved to the front end of Duteau reservoir so that the switch to bypass will still have ortho injection. We do not expect to see any significant reactive phosphate in the system for a couple of days. Last year we were able to move towards optimizing dose working with Keiko with results from the distribution system, hopefully we can do that again.

May 12, 2020: Zinc Orthophosphate dosing finished for the low flow 2019/2020 season

March 30, 2020: Zinc Orthophosphate sampling on additional Kal sites stopped with the exception of Longspoon Crt SS and Anderson Way SS. Ortho is no longer being detected in significant amounts at the discontinued sites and conductivity at these sites indicateds it is completely Kal water now. Longspoon and Anderson Way still have significant levels of ortho being detected and conductivity is showing a blend of Kal/Duteau still so these sites will continue to be sampled for Ortho.

November 19, 2019: Kalamalka Lake was shut down for flood midigation at Kal PH. Duteau has been throughout the whole system so it was decided to see how ortho/iron is through the Kal distrubtion. CoV started sampling in December 2019 and will continue in 2020 until it has been decided to end the sampling. The WQ team will re-asses every couple of months.

September 30, 2019: DCWTP started dosing Zinc Orthophosphate.

January 2, 2019: Zinc Orthophosphate is now being used again, new ortho was getting plugged. Removed zinc and alkalinity from sampling - Zinc was not detected throughout the system and alkalinity did not change throughout the system. Removed 2018 distribution sites - Golf View, PRV#1. Will continue sampling PRV#2 monthly during zinc ortho application to ensure it is getting through the system (190102 CH)

January 11, 2019 Duteau UV and Orthophosphate are back online as of 3pm. Free chlorine residual leaving the plant will be up approx. 0.2 ppm higher than it has been while UV was offline

Dustin Heidt email

January 2, 2019 We switched back to Zinc orthophosphate from the trial Orthophosphate we were using on Dec 31st. The trial product is proving difficult to inject consistently

Dustin Heidt email

January 2, 2019 As of 8am this morning we are bypassing the UV plant at Duteau for work in the UV outlet chamber. This means chlorine residual will be a bit low 1.6mg/l leaving the plant from 1.9mg/l but we are working on getting this back up to a target of 1.9 (this will take a day). Zinc Orthophosphate will be offline until the work is complete. Wildstone (onsite contractor) is hoping to finish by this Friday but it may push into next week.

Dustin Heidt email

December 13, 2018 Orthophosphate is back online as of this afternoon. It is now dosing from the UV building which means it does not need to make it through our reservoir before seeing it in the system. We will start testing for reactive phosphate again, but this is still the new trial product so there is no Zinc to test for.

Dustin Heidt email

December 4, 2018 We are making progress on the Ortho dosing skid in the new UV plant, right now we are going through a 5 day running exercise with water. Possibly next week if we can get the product through the mud and ice to the new plant we could start injecting again.

December 2018: Stopped sampling for Zinc. Testing new ortho product which is not zinc ortho. (181213 CH)

Dustin Heidt email

November 11, 2018 We have taken Orthophosphate offline as the new product is gelling in the injection line as it runs from Duteau Plant over to the reservoir. The new product has a high freezing point than the zinc orthophosphate but this should not be a problem when the new dosing location is up and running in the UV building.

Hopefully by early December we will be ready to go from that location where all of the injection system is within the building.

Dustin Heidt email

October 24, 2018 As of Oct 24th we are injecting Orthophosphate into the front end of Duteau Reservoir. It will be dosed at 5mg/l until we see reactive phosphate through the distribution system and then reduced to a dose to achieve a target of 1.5 mg/L reactive phosphate leaving the reservoir. We do not expect to see Ortho in the distribution system until early next week as it typically takes a week to fill the sample lines and get through the reservoir.

This year we are trialing a new product, ClearHIB-4 Orthophosphate rather than MCT 5071 Zinc Orthophosphate. Chemical supplier testing on our water and references from other systems using ClearHIB-4 suggest it should work well for our system. Once we see the reactive phosphate in the system it will be good to know if we are seeing any water quality changes from previous years. We can relatively easily switch back to the product we were using in previous years if necessary. The primary reason for this change is cost savings.

April 22, 2018 - DCWTP final day of Ortho injection. Reservoir outlet pH around 6.85 now but cannot dose caustic to back end of reservoir until dosing line re-established due to UV construction project. Probably at least 2 weeks away.

January 2018 - Added PRV #1 and PRV #2 to WQ monthly sampling for ortho and zinc project, coinciding with aluminum and monthly sampling.

- Removed Bessette from DOC Sampling

January 3, 2018 - Switched out Stepping Stones for Golf View SS, added Kal Secondary, added alkalinity and zinc to all distribution sites for 2018 to determine water chemistry (not DCWTP).

November 27, 2017 - added Alkalinity to all distribution sites for 2018 to determine water chemistry. Check about Kal Secondary; changing Stepping Stones to Golf View SS

Oct 6, 2017 - DCWTP started injecting zinc orthophosphate into the front end of reservoir at a dose of 6 mg/L, once ortho levels are detected in the distribution, dosage will be reduced to achieve a target of 1.5 mg/L going forward. This is similar to previous years. An early doseage date due to caustic addition offline due to UV construction.

March 23, 2017 - DCWTP final day of Ortho injection. Switching back to caustic injection on reservoir outlet for pH control over next few weeks. DCWTP reservoir pH currently 7.2 so not a huge concern at this time.

Oct 24, 2016 - DCWTP started injecting zinc orthophosphate into the front side of the reservoir. It was seen at the back side of the reservoir Oct 28, 2016.

November 16, 2015 - DCWTP started injecting zinc orthophosphate into the front side of the reservoir

April 13, 2015 - DCWTP - the last of the zinc orthophosphate was pushed through the injection lines. As of Wednesday (April 15th) still seeing a bit of residual at the sample point off the outlet of the reservoir. Typically run a few totes of water through the dosing system before bringing caustic back online. As a result pH could be lower than normal in the distribution system over the next few days

January 9, 2014 - DCWTP started injecting zinc orthophosphate into the front side of the reservoir

October 15, 2014 - DCWTP started to inject zinc orthophosphate into the front side of the Duteau reservoir at a Dose of 5.0 mg/L

May 5, 2014 - DCWTP ran the last bit of Zinc Orthophosphate; orthophosphate analysis will continue until the end of May.

2019 - Removed Zinc and Alkalinity because there are no changes within the system when Zinc ortho is on compared to when its not on.

Added Lead to DCWTP for base line; added to Cosens Bay and Kal Secondary

Added 9007 Aberdeen for Cl2 management project and ortho project

Removed PRV#2 and Northcott/Venables SS

Sites:**Duteau Watershed**

Haddo Weir
 18 km Aberdeen Road Tributary (dry
 ~July 15)
 Duteau Creek Bridge

Peizometers and moisture content probes - first week of the month

For Peizometers and moisture bring: SDI-12 Reader and Water Level Reader

For Duteau Bridge bring: pump, tubing and weight

Bi-weekly

Follow Watershed Schedule

Sites and water trax #	Bottles	Parameters
16 km Aberdeen Road Tributary	1 - PA	Bacterial (Most Probable Number)
18 km Aberdeen Road Tributary	1 - PA	Bacterial (Most Probable Number)
Haddo Weir	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
Duteau Creek Bridge	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)

Monthly

Follow Watershed Schedule

Sites and water trax #	Bottles	Parameters
16 km Aberdeen Road Tributary	1 - PA	Bacterial (Most Probable Number)
18 km Aberdeen Road Tributary	1 - PA	Bacterial (Most Probable Number)
Haddo Weir	1 - Caro Baterial	Total Coliform, E.Coli
	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)
	1 - 125 ml Caro (Yellow lid)	TP
	1 - 125 ml Caro	TN
	1 - TOC Caro	TOC
	1 - 500 mL in house	Iron, Colour (true and apparent)
	1 - 1 L Algae Density *if odor is present	Algae Density
	1 - 4 L Chlorophyll-a Caro	Chlorophyll a
Duteau Creek Bridge	1 - 200 ml PA (Duplicate)	Bacterial (Most Probable Number)

Annuaux - July

Sites and water track #	Bottles	Parameters
16 km Aberdeen Road Tributary	1 - PA	Bacterial (Most Probable Number)
18 km Aberdeen Road Tributary	1 - PA	MPN
Haddo Weir	1 - Caro Bacterial	Total Coliform, E.Coli
	1 - PA	Bacterial (Most Probable Number)
	1 - 500 mL in house	Iron, Colour (true and apparent)
	1 - Metals Caro	
	1 - Metals Caro (glass)	
	1 - Cyanide (Purple lid)	
	1 - 125 ml Caro (Yellow lid)	
	1 - TOC Caro	TOC
	1 - 1 L Caro	
	1 - 1 L Algae Density *if odor is present	Algae Density
	1 - 4 L Caro	Chlorophyll a
Duteau Creek Bridge	1 - PA	Bacterial (Most Probable Number)
	1 - TOC Caro	TOC

2024 Instrument Maintenance Schedule						
Date	Week	Instruments		Date	Week	Instruments
Jan 1 - 5	4			Jul 1 - 5	2	pH, Conductivity
Jan 8 - 12	1			Jul 8 - 12	3	
Jan 15 - 19	2	pH, Conductivity		Jul 15 - 19	4	
Jan 22 - 26	3			Jul 22 - 26	1	
Jan 29 - Feb 2	4			Jul 29 - Aug 2	2	
Feb 5 - 9	1	pH, Conductivity, Turbidity		Aug 5 - 9	3	pH, Conductivity, Turbidity
Feb 12 - 16	2			Aug 12 - 16	4	
Feb 19 - 23	3			Aug 19 - 23	1	
Feb 26 - Mar 1	4			Aug 26 - 30	2	
Mar 4 - 8	1	pH, Conductivity		Sep 2 - 6	3	pH, Conductivity
Mar 11 - 15	2			Sep 9 - 13	4	
Mar 18 - 22	3			Sep 16 - 20	1	
Mar 25 - 29	4			Sep 23 - 27	2	
Apr 1 - 5	1	pH, Conductivity		Sep 30 - Oct 4	3	
Apr 8 - 12	2			Oct 7 - 11	4	pH, Conductivity
Apr 15 - 19	3			Oct 14 - 18	1	
Apr 22 - 26	4			Oct 21 - 25	2	
Apr 29 - May 3	1			Oct 28 - Nov 1	3	
May 6 - 10	2	pH, Conductivity, Turbidity		Nov 4 - 8	4	pH, Conductivity, Turbidity
May 13 - 17	3			Nov 11 - 15	1	
May 20 - 24	4			Nov 18 - 22	2	
May 27 - 31	1			Nov 25 - 29	3	
Jun 3 - 7	2	pH, Conductivity, Pocket Colorimeter II		Dec 2 - 6	4	pH, Conductivity
Jun 10 - 14	3			Dec 9 - 13	1	
Jun 17 - 21	4			Dec 16 - 20	2	
Jun 24 - 28	1			Dec 23 - 27	3	
				Pocket Colorimeter II - secondary standard check annually		